GEOLOGICAL AND GEOPHYSICAL
EXPLORATION, 1964
CAPE TATNAM AREA, MANITOBA

Prepared For

SOGEPET LIMITED

by

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INTRODUCTION

This report is a summation of the work done by Sogepet Limited in the Hudson Bay lowlands during the summer of 1964. The work was performed in exploration of the Sogepet permits in the Cape Tatnam area, and was largely restricted to the permit areas. The report accompanies and covers three more formal reports on the geological and geophysical work:

(1) Devonian of the Northern Hudson Bay Lowland, Cape Tatnam Region, Manitoba and Ontario (S. J. Nelson)

(2) Report on a Refraction Seismic Survey of the Hudson Bay Lowlands, Manitoba (Heiland Exploration)

(3) Seismic Refraction Evaluation of a part of the Southern Shore of Hudson Bay in Manitoba (M. Aydin)

Various aspects of the work not emphasized by the separate reports are discussed. The significance of the findings of the individual pieces of work are related to the overall exploration program. To deal with the scattered subject matter, this report is divided into four parts: Part I - Geology, Geophysics, Geomorphology; Part II - Access Considerations; Part III - Random Notes on Pertinent Subjects; Part IV - Photographs.

This report covers only the work in the lowlands. Further work carried out on Southampton Island, while related, is dealt with as a unit in a separate report. The chronological schedule of field work for 1964 was as follows:

(1) Refraction Seismic Survey, Cape Tatnam Area, April
- Heiland Exploration.

(2) Geological Reconnaissance, Southampton Island, April and May
- L. Halladay.

(3) Geological Reconnaissance, Southampton Island, July and August
- S. J. Nelson

(4) Route and Access Study, Cape Tatnam Area, July
- R. D. Johnson and Heiland Exploration

(5) Coal Search, Churchill Area, August - S. J. Nelson

(6) Geology, Cape Tatnam Area, September - S. J. Nelson and R. D. Johnson

(7) Seismic Survey, Cape Tatnam Area, September - Heiland Exploration

In reading this and the accompanying reports, it should be remembered that throughout 1964 Sogepet was the only active explorer in the area. No other companies held any acreage until very late in the year. Further, the results of earlier government geophysical work in Ontario and on the Bay were not released until near the end of the year. These conditions have changed in 1965 with the publication of much of the government work, anticipated extensive new government surveys and the presence of other explorers. All these conditions will aid future exploration.

PART I

GEOLOGY, GEOPHYSICS, GEOMORPHOLOGY

Geology

The main geological work of 1964 was performed in the permit area in September. During this month, S. J. Nelson and R. D. Johnson carried out a geological reconnaissance of the Kaskattama River within the permit area and visited the lower reaches of the Black Duck and Niskibi rivers to the south and the lower Hayes River to the north. The entire coast was flown from the Niskibi River to Churchill. Efforts were made to find additional landing spots, particularly between the Niskibi and Hayes rivers, but none were found other than the mouths of the rivers mentioned. All the lakes in the coastal strip are too shallow. Considerable geological time was placed on the geomorphology of the coastal strip and its relation to the logistical aspects of exploration.

Despite the lack of outcrop in the area, a significant geological discovery was made. Sufficient Devonian rubble was found along the lower reaches of the Kaskattama River to be reasonably confident that parts of the Hudson Bay lowlands are underlain by Devonian strata. This is the first time, to my knowledge, that the presence of Devonian rocks has been established in the area north of James Bay. Abundant Devonian rubble and float was found on the lower reaches of the Hayes, Kaskattama, Black Duck and Niskibi rivers. This rubble is presumed sparse or not present on the Nelson, Severn and Winisk rivers, where earlier geological work was performed. Current data, while sketchy, suggests that Devonian rock is present at least in parts of the area from the Hayes to the Severn rivers. The actual on-shore distribution may well be limited to the lower areas between Cape Tatnam and the Niskibi River, perhaps an area of 30 x 120 miles, somewhat less than suggested in Nelson's report.

The lithologies of the rubble collected in the Kaska area vary considerably from that found along the Severn River and from those predominantly found along the Hayes River. The presence of reddish and brownish siltstones and sandstones are common. These colours and lithologies are in marked contrast to the greys and pale yellows of the Ordovician and Silurian carbonates.

Nelson's report describes the geological work in detail. He presents paleontological evidence that the clastic rocks are probably lower Upper Devonian or uppermost Middle Devonian in age. The less dramatic, but more predominant, light grey limestones of the rubble are also dated the same age. This age is agreeable to the overall condiderations; however, lithological similarities suggest that some of the reddish and greenish fine clastic rocks may belong to the northern equivalents of the Kenogami River formation and the Sextant formation. The Kenogami is the uppermost Silurian formation in James Bay and is Upper Silurian in age. The Sextant formation is the lowermost Devonian formation in James Bay and is upper Lower Devonian in age. The limestones, I suspect, may be the equivalent of the Abitibi and Williams Island formation of Middle Devonian age. Descriptions of selected rubble samples from the Kaskattama River are included as an Appendix to this report to provide some insight to the lithologies.

Several important observations can be made from the finding of the Devonian. It "fits" the developing regional philosophy of a basin in Hudson Bay. It provides hitherto unknown clastic rocks in the section, and therefore, the possibility of good clastic reservoirs. The Devonian carbonates often exhibited fragmental and reefy textures as well as occasional good intercrystalline and vuggy porosity. These variations and additions to our prior knowledge are encouraging to further petroleum exploration.

There is a further deduction possible from the new information. Nelson suggests that rocks probably equivalent to the Williams Island formation of James Bay are present on the Kaskattama River. In James Bay, the Williams Island is overlain by a bituminous shale called the Long Rapids formation, and therefore, this shale may also be present on the permits. There are other reasons to support the possible presence of a shale. The long outcropless coast is suspect of being a soft lithology such as a shale. Also, seismic results on the permits indicate the uppermost rock unit to have a velocity of 9150 ft/sec, possibly a shale. Since the Long Rapids is a bituminous shale, it is interesting and encouraging to speculate on its presence in the geological sequence of Hudson Bay. Further, if the bituminous content is considerably increased and if it is the surface rock in the permit area, then it might be of economic interest as an oil shale.

At this stage of exploration, the more obvious surface geological work has been completed. Further canoe traverses should be carried out on the upper reaches of the Kaskattama as well as on the Black Duck and Niskibi rivers. Since the new information indicates far less overburden than previously thought, even the medium and smaller streams should be worked by canoe and helicopter. Also, a helicopter-supported geological party could be of considerable use along the coastal strip and over the tidal flats and shoals.

Geophysics

The seismic operations were conducted by Heiland Exploration and are adequately described in their report. The logistics of the operation and the interpretation of the results are briefly considered herein.

The operation was planned as an attempt to complete the work started in the spring, but prematurely terminated by a very early break-up. Cold days, high winds and unpredictable flying conditions had proven very limiting for a winter operation. Therefore, the summer work was attempted as a ground approach to avoid the flying problems. The goals were still the same: (1) to establish a series of refraction seismic points along the beach from Cape Tatnam to the Black Duck River, and (2) to determine the suitability of the section for a large scale reflection seismic program. Again, the project partially failed, and again, largely because of difficult logistics. However, the combined results of the two attempts have provided some major answers. Among these are:

(1) The seismic work agrees with the airborne magnetometer results at Kaska and the Black Duck.

(2) There is now good evidence, both magnetometer and seismic, to conclude that there are some 3,000 feet of sedimentary rocks present at the mouth of the Kaskattama River.

(3) The maximum thickness of sediments in the Hudson Bay and James Bay lowlands occurs in the Kaska area. The general thickness of sediments elsewhere along the coast rarely exceeds 2,000 feet, except on the permits.

(4) The thickness of glacial cover along this section of the coast is remarkably thin, being 78 feet at the Black Duck River and only 40 feet at Kaska. These very shallow overburden thicknesses point to the probability that the area of thick glacial cover is general over the lowlands, thinning towards the Bay. This is important from various exploration and drilling viewpoints.

(5) As mentioned in the previous section, a unit with velocities in the order of 9,150 ft/sec underlies the overburden along the coast. The unit is of highly variable thickness, being absent at Kaska Post, but 179 feet thick at the Kaska beach and nearly 500 feet thick at the Black Duck beach. The unit is surmised to thicken bayward. It is unknown in outcrop, but speculation suggests it may be a Devonian shale or possibly a Cretaceous sand-shale unit.

(6) Those velocities in the range of 11,850 ft/sec to 12,600 ft/sec are believed to represent Devonian strata, largely carbonates. This unit has a variable thickness of 200 to 500 feet. It is interesting to note that Hobson (1964) does not report values in this range from the York Factory area.

(7) Those units with velocities between 13,500 ft/sec and 18,000 ft/sec are considered as representing Silurian and Ordovician strata. These velocities tend to group about 14,000 ft/sec and 17,500 ft/sec, but no subdivision has been attempted as yet. Total thickness of these units can exceed 2,700 feet.

(8) Basement velocities are in the order of 22,000 ft/sec. Good contrast between the sedimentary sequence and basement is established.

(9) There is no seismic evidence as yet to suggest the presence of Proterozoic sediments in the permit area.

(10) As shown on the map accompanying the geophysical report, the very gentle slope of the Precambrian in Ontario gives way in hinge-line fashion in the permit area. In effect, the Federal and Provincial seismic work illustrates a gradual dip of the basement towards the Bay. Our values at Kaska and at Black Duck are critical, since they confirm a marked steepening of the dip bayward, allowing for agreement between the data on-shore and the magnetometer data offshore, thereby confirming the basinal theory.

(11) While insufficient reflection work was done, present results indicate good quality records are obtainable by this method. Further reflection work is warranted.

(12) This ground exercise was the first attempt at a summer operation in what is traditionally a winter operation area. Valuable experience was gained. The conclusion is that given a large enough operation and access to presently available equipment, summer work is feasible for the strip between the tree line and the low tide mark.

Further seismic work in the permit area would be very useful. Some reconnaissance refraction control is needed in the offshore and a loose grid reflection pattern is needed along the coastal strip. The offshore control might come from conventional marine seismic or gas-exploder programs. However, some very useful refraction reconnaissance could be done on the ice using a ski-plane and motor toboggan. This method should probably precede marine work. The on-shore reflection grid is needed to help locate one or two suitable locations for a drilling test. A hole should probably be drilled on-shore before any extensive marine surveys are undertaken so that some firm correlations between rocks and their velocities can be established.

Geomorphology

Throughout the exploration program particular attention has been paid to the geomorphology in the permit area, partly for clues to the geology and partly for logistical considerations. This section of the report deals with the geomorphology of the coastal strip. The general subject is touched on repeatedly in Part II concerning access, and many of the conditions described are illustrated by the photographs in Part IV.

The coastal topography from the Severn River to Cape Churchill is developed on an extensive area of marine-laid glacial silts and clays. Gravel and boulders formed a rather minor part of the deposits. The action of the present receding bay-waters on this landscape produces hard mud flats in the tidal zone with occasional boulder-strewn patches. Locally, gravels are piled in bars and spits while the sand is accumulated in beaches. Large boulders are plucked and scattered on the tidal mud flats by the yearly ice movements.

The extensive areas where beaches are presently forming represent possible travel routes. It would be possible to drive a car at high speed along the wet sand of a receding tide. When dry, the sand blows and drifts but is still very trackable. The tops of the beaches give a "Cape Cod" type of landscape with dunes and blowouts. However, while beaches several miles long are common, they are actually discontinuous and offset. Since the beaches are built on the hard glacial clays, they are really elongated isolated sand "islands" on a clay base. Therefore, if the beaches are to be used in summer for transportation, a means of handling the clay must be found. At Kaska, it was found that the broad tidal zone below the beach line is a very hard glacial clay. The surface, while firm and flat, is very rough for a small-wheel vehicle but probably very trackable for a large-wheel vehicle with low pressure tires. Therefore, while the tide is out, there is a large area for the swamp-buggy type of equipment to work.

The area which presents the greatest problems is between the end of the scrub willow on the last of the raised beaches and the present beaches. This zone normally has a hard clay base and a good cover of sea grasses. It is in part flooded by the highest tides. Within this area are shallow lagoons and minor depressions where the clay is somewhat softened. These areas along with some others in which clay is currently being deposited, are completely impossible for any land vehicle except at high tide when they are well covered by water, giving a buoyancy to the swamp buggies.

In the same overall zone between the tree line and the present beach there is an additional problem in the form of outflow channels. These are meandering systems, which vary from a few feet to a hundred yards in width, and are filled by the high tide. The channels are characterized by vertical banks in smooth clay and at low tide they can be like tank traps. At high tide, a swamp buggy goes in all right but has difficulty climbing out again since there is no vegetation on the clay to provide traction over the lip of the channel. This is a real problem, but one that can be solved.

Progressing inland from the sea, the old raised beaches are often gravelly and provide good travel. The areas between the old beaches become increasingly swampy with the increased vegetation and lack of drainage. The tree line is usually along a major old beach feature and is marked by sparse, very tough and stunted spruce. Usually a well developed game trail follows the same ridge. Further inland the area soon becomes typical spruce and muskeg cover. Here, sparse to medium spruce cover is common with heavier growth along the better drainage areas, including the banks of minor streams and the flanks of higher old beach ridges.

PART II

ACCESS CONSIDERATIONS

Introduction

Since the filing of the acreage in 1962, Sogepet Limited has been faced with very difficult logistical problems with regard to access to the permits. From the beginning of the project, special attention has been paid to this problem, culminating in serious study during the past summer. Knowledge of the problems to be faced was required in preparation for the use of land vehicles for seismic work and the movement of drilling equipment. This section of the report attempts to outline the various approaches to the permits and the problems involved in each of the alternatives.

In this report the assumption is made that the maximum stratigraphic section available to an on-shore drilling position will be at some location along the coast line. Since the mouth of the Kaskattama River is roughly at a mid-point along the beach within the acreage, all studies are directed toward reaching this general position. Kaska was the name of the old Hudson's Bay post at this position and the name "Kaska" is used herein to identify the area around the river mouth.

Kaska is a surprisingly remote location. In the past it was a small outpost for the Hudson's Bay Company and a centre for a few Cree Indian trappers but there have been no people living there for the last twenty years. Historically, contact was with York Factory one hundred miles away by sea, canoe or dog sled. Contact was probably also maintained with Fort Severn one hundred and twenty-five miles away. The post was supplied by a Hudson's Bay Company boat which would anchor offshore. Supplies would be lightered ashore by sea canoe. At York Factory and Fort Severn, the boat could enter the river and unload directly on shore. Now, both Kaska and York Factory are abandoned while Fort Severn remains an active Indian community. The closing of the coastal posts has been followed by the near-disappearance of Indians skilled at coastal travel.

Summer or Winter

There is no doubt that any seismic operation inland from the tree line would have to be carried out in winter. This is due to the high percentage of muskeg terrain. The same would probably apply to any drilling operation with one or two exceptions. The water supply for a winter drilling operation could be a real problem since most of the lakes and streams freeze to bottom.

For that strip of land between the tree line and the coast, usually one to four miles wide, a summer operation both for seismic and drilling might prove practical. Given a large-enough operation and the opportunity to check out the various low pressure wheeled-amphibious vehicles, it is probable that suitable equipment is presently available for seismic work in this narrow area. The higher efficiency of men and equipment in summer would substantially improve both seismic and drilling production.

In the offshore areas, drilling is initially a summer operation. However, experience may prove that seismic reconnaissance can be done more economically in winter from the ice than in summer along the shallow coast.

Direct Approach From Sea

Landing heavy equipment, such as a drilling rig in the Kaska area appears to be difficult, but not impossible. The equipment would probably be shipped by rail to Churchill, then loaded on a Hudson's Bay Company boat. The problem of getting the equipment from the ship to the shore at Kaska is difficult. For this, a landing barge capable of hauling a bulldozer would also have to be brought to Kaska. The season is very short, probably beginning about the first of August and possibly ending by the middle of October for this operation. At present, a land route seems more practical than an approach from the sea.

By Air

The use of float aircraft, while very widespread in the north, is really of quite limited use along the Hudson Bay lowlands, particularly near the coast. The sea, itself, is out of the question except for Canso aircraft, with rare exception. In two summers of reconnaissance flying, and desiring to land at almost any place possible, only three marine landings have been made and all at considerable risk. The factors are the wind, rough water, obscured boulders in the muddy shallows and quick falling tides. The Canso, of course, can be used although limited by wave conditions. However, the extensive shallows prevent getting the aircraft even near the shore. A canoe is required and then used in the majority of cases with hazard. The tide also causes many problems for this type of operation. Even York Factory with its sheltered anchorage is only usable by the Canso at high tide.

In the case of smaller aircraft, contrary to general opinion, their use is really very limited. While landing on the large rivers and lakes is easy, there are very few suitable lakes and practically no sea lagoons deep enough for an Otter or even a Cessna. It should be noted that while the number of landing places is still very small, there are many more available for the Cessna compared with the Otter because of the lesser draft.

The secondary rivers such as the Kaskattama, Black Duck and Niskibi are of limited and uncertain use. The lower reaches of these rivers are quite acceptable when the water is high, but unusable when low. Further, the river levels are unpredictable. It can happen that in one week in August a Cessna could not land, but with heavy rains the next week a loaded Otter could land with safety.

One serious problem to the use of aircraft is that the starting bases such as at Ilford or Churchill are more than one hundred miles away. There is no way to forecast the weather in the permit area and considerable distance has been flown before it becomes apparent if weather will permit a landing. If a landing is made, the likelihood of fog and low cloud is so ever-present that departure is always uncertain. This, of course, is the result of the geographical quirk which puts essentially Arctic water against a warm land mass. A fog problem also exists in winter as a fog bank forms constantly over the open water of the shore lead.

Helicopters are a logical answer to many of the problems. The chief limiting factors are wind and range. The winds are often sufficient to keep a helicopter grounded or of little use. The lack of supply stations means that extensive layouts of fuel must be made by fixed-wing aircraft. Nevertheless, if the size of operation warrants it, many operations could be carried out by helicopter. For certain work, the use of larger helicopters such as S55's and S58's might be warranted.

The use of light aircraft on oversized low pressure tires has been considered. While expert opinion would be needed, it seems entirely possible that repeated landing could be made on the present beaches and on the more recent of the raised beaches. The limiting factors to this approach are wind, range and landings confined to beaches. In general, it would seem that the helicopter would prove more versatile for the summer operation.

The past winter's seismic operation proved that a ski-equipped Otter could be used for reconnaissance seismic operations. This same sort of operation may well prove feasible on the Bay ice beyond the open lead. Obviously, however, such an operation would require a back-up aircraft for safety. This approach may prove very successful for this type of geophysical reconnaissance.

In general, the area is more accessible to aircraft in winter than in summer. Landing places suitable for light aircraft are available all along the shore. Limiting factors are wind, extreme cold, unpredictable weather and unpredictable snow. The combination of extreme cold and hard-blown and rough snow results in many broken skiis and is a serious factor in this remote, poor radio area.

The winter offers a possibility of moving moderately large equipment. An aircraft such as a DC-3 or Bristol Freighter on skis could bring in all equipment necessary to drill a core drill hole, including portable Arctic-type housing and probably even a small bulldozer. Undoubtedly, the landing spot would have to be pre-located with a light aircraft, probably an Otter carrying a ski-toboggan for running out the strip. The operation would also require continuing light-plane support.

Overland from Ilford

The hamlet of Ilford, on the Canadian National Railway line, is the starting point of several winter roads. These winter roads are really "cat and sled" routes for hauling heavy equipment and supplies. One of these routes was used extensively during the construction and maintenance of the Mid-Canada Line and runs from Ilford to Winisk. The route passes about fifty miles inland from Kaska along the Old Beach feature. This route was flown this past summer for the following reasons:

(1) To establish if the road is of any use in summer, even for swamp buggies.
(2) Is it suitable for truck traffic in winter?
(3) What is the nature of the river crossing and banks?
(4) What do the various routes from Old Beach to Kaska look like?

The route of the winter road is shown on the accompanying map. Essentially, the sleighs start at Ilford, although loading may be done at Gillam. From Gillam the road heads east along the 22nd Base Line to the North Angling River. The road then proceeds to Angling Lake, then easterly again to Old Beach. The trail winds through spruce and brush which varies from sparse to heavy and often traverses the length of lakes. The river crossings at the Pennycutaway and Hayes appear very gentle and the whole route seems to offer little problem in the way of hills.

The summer use of the road by muskeg or swamp vehicles is not practical. Swamp buggies could cover the route but their low pressure tires would suffer excessively from punctures caused by deadwood and they would also be ruled out by the long stretches on open lakes which would be painfully slow travelling for these machines. As a winter route, it is probably quite feasible for the type of wheeled vehicles used by the oil industry. However, these vehicles might not offer many advantages over the sleighs.

From Old Beach to Kaska the only practical route would be to cut a road with a bulldozer. It does not seem feasible for equipment of any size to follow the river on the ice. The river gradient is surprisingly steep and the course is meandering and deeply incised with many rapids. The timber in the area is often heavy along the river banks but is generally fairly light on the flat. A generous estimate of the time to cut and scrape a winter trail from Old Beach to Kaska might be two weeks of bulldozer time.

This overland route, as outlined above, currently seems the most feasible way of placing any conventional oil rig at Kaska. It is an awkward and costly operation and perhaps should be avoided in favor of an airborne core drill approach.

A Coastal Land Route from Churchill to Kaska

The only type of vehicle which could make the land trip from Churchill to Kaska in summertime would be a swamp buggy. Several large swamp buggies using low pressure "terra-tires" could make such a trip with careful planning. The equipment used should be of the long chassis variety and have excellent flotation and stability characteristics. Such vehicles could make excellent time along the beaches. Where slippery clay and soft sand became a problem, they could alternatively go along the tidal flats or move inland into the grass and low willow area.

The problems with the swamp buggies would be: (1) the river crossing at the Nelson River, and (2) costly and time consuming punctures to the "terra-tires". The second would be unavoidable but might be kept to a minimum with care. The Nelson River crossing, however, is a real problem. Careful consideration suggests that the swamp buggies could cross the Nelson immediately upstream from Port Nelson, but with some hazard to men and equipment. The main hazards are wind, tidal and current effects. Waiting for proper conditions could be very time consuming. The actual crossing could be made in half a day but the support of at least two outboard boats would be required.

The time required to make the trip from Churchill to Kaska by swamp buggy over the approximately two hundred and seventy mile route is estimated to be between one and two weeks. This approach is obviously worth considering only for a large seismic operation which can justify supporting a minimum of four buggies and a full complement of parts, etc. In my opinion, it should be staffed by experienced buggy operators and assisted by perhaps four two-man sea canoe teams manned by coastal Cree Indians.

PART III

RANDOM NOTES ON PERTINENT SUBJECTS

Wind

The wind is one of the constant and adverse factors to consider and causes many problems. There seems to be always a wind blowing along the coast, and it is more often a real wind than a breeze. Moderate to strong winds are common day after day. The ocean winds are invariably cool to cold; however, very warm winds off the land are common in the lowlands. In the lowlands, protection from the wind is usually available. Further north, however, there is no vegetation and often no topography for shelter and here one could be totally exhausted by continuous exposure to the wind, even at moderate temperatures.

The wind will seriously limit all forms of work in the near-shore shallows. It also limits the use of ultra-light aircraft and helicopters. A very real effect is the loss of seismic crew time due to the "noise" level caused by the wind. This latter factor compounded the logistical problems and caused considerable time loss during the seismic operations in September. In winter operations, further aircraft and seismic crew time losses were caused by blowing snow.

Aero-magnetometer Interpretation

The results of the Federal-Provincial magnetometer programs were released in the fall of 1964. While not "field work", a note is included herein on some interpretations of the government survey carried out for Sogepet by Huntec Limited of Toronto. In general, these results confirm the earlier results of magnetometer work done by Sogepet in 1963 and already reported. The new work does indicate that the syncline opening seaward from the area of Rupert Creek to Nelson River--York Factory to Cape Tatnam does not contain any substantial thickness of sediments in the on-shore area. Sedimentary thickness along the coast in this area probably rarely exceeds 1500 feet. In the permit area, thicknesses of 2900 feet are indicated at Kaska. One new bit of information suggests a thin area fifteen to twenty miles south of Kaska. Data here is conflictive, with suggested depths to basement from 600 to 2800 feet. Possibilities of basement topography, of major faults, of the presence of Proterozoic sediments, of intrusion of the Paleozoic sediments must all be considered. However, the data still strongly suggests a syncline plunging bayward with its axis near Kaska or slightly to the east. Present evidence suggests a minimum of 3,000 feet of Paleozoic strata at the coast along this axis.

Gillam Island

During a flight in late September, S. J. Nelson and R. D. Johnson visited a proposed hydro development on the lower Nelson River some six miles above the head of the tide. A drilling rig operating in mid-river was visited and quite a bit of core was scanned. All core seen gave impressions of Silurian age. It was in general pale gray, cream and buff, fine-grained carbonates, and was generally tight with occasional spotty, poor to fair inter-crystalline and pinpoint porosity. No oil staining was noted. There was a rumour that seismic work indicated crystalline basement at 800 feet at the location. This point is twenty-five miles west of York Factory.

Broad River Outcrop

An outcrop of limestone was reported (unpublished report) in the tidal zone near the mouth of the Broad River, south of Cape Churchill. This area was carefully observed during a flight along the coast while the tide was low. No sign of the outcrop was found. The report of the outcrop was important since this is the only intimation of outcrop along the coast from Cape Churchill to Wabuck Point near Winisk.

Pen Islands

The Pen Islands just east of the Manitoba-Ontario border are really a headland, called West Pen Island, and a long offshore bar, called East Pen Island. East Pen Island is gravel-covered and without appreciable vegetation. It presumably is vulnerable to flooding during storms and to scouring by the bay ice in winter.

Overburden

Earlier work in the James Bay area and along the Nelson River areas suggests thicknesses of overburden might range from 100 to 700 feet. The general philosophy was that this overburden of glacial material would thicken towards the coast. Some suggestions were made by the Geological Survey of Canada that the thickness of cover-over-rock under Hudson Bay appeared to be quite thin, generally less than forty feet and often only ten feet thick. Our recent seismic data also suggests that the overburden at the coast is one hundred feet or less. Therefore, the new data seems to indicate that the thickest glacial deposits are on-shore and that the Pleistocene deposits are thinning bayward from the coast. Overburden, therefore, should not be a major problem even to diamond coring.

Coal Search, Churchill Area

Rumors and early reports of coal in the Churchill area has been given attention, and effort has been made separately by both S. J. Nelson and R. D. Johnson to locate the supposed deposit. So far these efforts have failed despite many hours flying. The country is very difficult, being virtually impassable in summer and a frozen plain in winter. There is very little relief and no sign of outcrop.

The importance and reason for following this lead is not for the economic significance of the coal, although this may be important. The probability is that the material, which is reported as friable, is probably a peat or lignite related to the Pleistocene. Similar deposits are known in Ontario. However, if the coal were older it would mean a tremendous addition to the geological knowledge. From our regional information it is unlikely that a coal would be found in the Ordovician or Silurian which are the supposed strata present. It is unlikely even to be Devonian from our present thinking. The most logical guess might be that Cretaceous rocks, including coal, are present in Hudson Bay and onlap in this area. Two other possible ages for the coal might be the Upper Paleozoic (Carboniferous) or Tertiary and both would change our present geological concepts.

Efforts to locate or rule out the "coal" will continue until resolved.

Use of Indians

The bands of Indians have gradually left the coast over the past few decades until at present these coastal people are hard to find. There is the group at Fort Severn and probably several other groups available in James Bay, but these groups are generally experienced further down the coast. The old band from York Factory were moved to Split Landing and now represent the best source of Indian men. With one or two notable exceptions, the band at Churchill are somewhat spoiled for this sort of work. An additional few experienced coastal men might be found at Shamattawa. It would be unwise to rely on the river Indians for coastal work. Most of the experienced coastal Indians are now middle-aged or older.

Swamp Buggies

The seismic and geological parties at Kaska in September used a revolutionary light-weight, Canadian-made amphibious vehicle called a "Penguin" which is produced by Pengor Limited, Carleton Place, Ontario. These vehicles and their trailers can be transported in an Otter aircraft and are light-weight enough to be man-handled in difficult spots. We found that they did not bog down except in really wet swamps or on mud without vegetation cover. These particular units have certain design weaknesses in the body which caused serious breakdowns. However, in general the machines were quite impressive.

It became obvious that the vehicles needed for the area are large-wheeled, light-weight, floatable, swamp buggies with the low pressure "terra-tires". Even so, these vehicles would have to operate in pairs. They could possibly move their camp along with the job. However it would seem more feasible to establish a base camp and leave the buggies at the job site. The crews would have to be ferried back and forth, probably by helicopter.

Bears and Other Game

During previous field work very little big game has been seen. Rarely, small bands of cariboo and the odd lone moose have been sighted. Ducks seem to be abundantly present all summer along the tidal strip. In September, thousands of ducks and geese pass through and rest along the coast. A coastal speckled trout is common in the lower pools of the smaller rivers and streams.

Polar bears are a worry as these animals are surprisingly abundant along the coast. It is common to see one or two bears during each flight between York Factory and Kaska. Further south, on one flight over East Pen Island, four bears were seen on that small island. These animals also range inland as much as one hundred miles.

APPENDIX

LITHOLOGICAL DESCRIPTIONS

These lithological descriptions are included in this report to emphasize the changed character of the rubble along the Kaskattama River as compared with the Severn and Nelson rivers. All descriptions with the exceptions of the last, are of rubble selected along the river from its mouth to station K2 near the southern limit of the permit. The last lithology described is from outcrop. The rubble selected is largely attributed to the Devonian by Nelson's report. The collection, however, undoubtedly contains both Ordovician and Silurian rocks. It is a random sampling slanted towards the lithologies suggested as Devonian.

Similar rocks in similar abundance were found on the lower reaches of the Niskibi and Black Duck rivers. The same lithologies were found at Rainbow Island in the lower Hayes River, but the abundance was notably much less at this location.

Lower Kaskattama River Gravels
- Collected between the beach and the tree line two miles from the coast

(1) Sandstone, medium brown, in part medium reddish cast, very fine to finely grained, calcareous to limy, hard, tight.

(2) Siltstone, medium buff-grey, silty to very fine sandy, argillaceous limy, quite soft, nutty, tight.

(3) Sandstone, medium deep brick-red, very fine grained, slightly calcareous, very hard, dense, tight.

(4) Limestone, light "terra cotta", argillaceous and finely silty, dense, tight.

Kaskattama River Gravels and Rubble
- Collected between the tree line and Station K1, between two and ten miles from the coast

<u>Classic Rocks</u>

(1) Sandstone, dark medium brown, yellowish weathering, very coarse vitreous quartz grains, well rounded and sorted, matrix limy with

fine argillaceous and fine sandy material, hard, tight.

(2) Sandstone, medium brown, slight reddish cast, very fine grained, medium calcareous, platy, hard, tight.

(3) Siltstone, medium yellow-brown, in part very fine sandy, very thin bedded laminae, true cross-bedding, tight.

(4) Siltstone, much as above only medium rose-red colour.

Carbonate Rocks

(5) Bryozoan? rubble with reddish sandy to silty limy matrix, 75% Bryozoa, hard, tight.

(6) Limestone, cream with reddish cast, silty to very fine sandy texture, in part bioclastic, hard, tight.

(7) Limestone, cream. Appears to be a stromatoporoidal limestone with infilling and interbeds of reddish lime mud, good small vuggy porosity.

(8) Limestone, yellow-buff, slightly dolomitic, microcrystalline, very fine silty texture, hard, tight.

(9) Limestone, a reefy brecciated-looking rock mottled red and green, green fragments with red matrix, abundant calcite growths, hard, tight.

(10) Dolomite, alternate red and green layering ($\frac{1}{4}$"), slightly calcareous, microcrystalline, hard, dense, tight.

(11) Limestone, very thin interbeds of red and greenish-buff, hard, chalky, tight.

(12) Limestone, orange-buff, microcrystalline, argillaceous, tight.

(13) Limestone, reddish, in very thin interbeds, hard chalky texture, tight.

(14) Limestone, medium red, finely crystalline, very fine sub-oolitic texture, hard, tight.

(15) Limestone, light grey mottled reddish, finely crystalline, coarse bioclastic breccia, tight.

(16) Dolomite, medium dark grey, microcrystalline, hard, dense, tight.

(17) Limestone, medium brown-grey, microcrystalline, coarsely fossil fragmental, a clean crinoidal bank, tight to excellent porosity. This lithology and variations therof is very common.

(18) Limestone, medium grey-green, microcrystalline, earthy texture, argillaceous, moderately soft, nutty, tight.

(19) Limestone, yellow-buff, platy, tight. (Looks Silurian)

(20) Limestone, medium to dark brown-grey, microcrystalline, hard, dense, tight.

(21) Limestone, yellow-buff with pale red interbed ($\frac{1}{4}$"), microcrystalline, argillaceous, dense, tight.

(22) Limestone, light medium grey-brown, microcrystalline, excellent pinpoint and small vuggy porosity, minor calcite infilling.

(23) Limestone, cream-brown, microcrystalline, argillaceous, minor, dark (bituminous?) partings.

Kaska #1 Representative Rubble Sample
- Collected at Station K1, ten miles from the coast

(1) Limestone, medium rosy-red, argillaceous, sub-platy, hard, tight.

(2) Dolomite, medium honey brown, very finely crystalline, sucrose texture, very finely sandy, hard, tight.

(3) Limestone, mottled cream to orange-buff, microcrystalline, fine sandy texture, very finely sandy, tight.

(4) Limestone, cream, microcrystalline, silty texture, hard, tight.

(5) Limestone, medium grey-brown, microcrystalline, mottled with darker grey-brown more dolomitic patches, tight.

(6) Limestone, medium grey-brown, argillaceous, in part fine sandy texture, tight.

(7) Limestone, cream, microcrystalline, fine sandy texture, very fine calcarenite with soft lime cement, tight with spotty fair to good pinpoint and small vuggy porosity.

Kaska #1 Special Rubble
- An unusual lithology collected at Station K1

Limestone, rose-red mottled medium grey, the medium grey limestone probably being Stromatoporoids and the red silty limestone an infilling, tight with slight trace of vuggy porosity.

Kaska #2 Rubble
- Collected as rubble in very near-outcrop condition at Station K2, twelve and one-half miles from the coast

Limestone, light grey-cream, fine to coarse bioclastic texture, in part reefy rubble, hard marly cement, tight with spotty poor to good pinpoint porosity.

Kaska #2 Outcrop
- Collected as outcrop at Station K2

Limestone, medium light yellowish cream, argillaceous to touch, nutty fracture, very fine sugary texture, no fossils, tight.

P A R T I V

P H O T O G R A P H S

The photographs included in this section have been selected to illustrate various conditions and situations discussed in the text. They provide a clear and fair presentation of the general Cape Tatnam area in summertime. The geomorphology of the area including the character of the present beach and tidal flats is particularly stressed.

PHOTO 1

The winter road from Ilford to Winisk is shown at the Hayes River crossing. The terrain and forest cover is typical of the area between Gillam and "Old Beach". No steep banks occur at the main river crossings. Note the Hayes River at this point is shallow with a single deep channel.

PHOTO 2

The upper reaches of the west fork of the Kaskattama River just north of "Old Beach". The river is somewhat incised along a meandering course and the stream gradient is surprisingly high. The vegetation is typical of the "Old Beach" area. The "old beach" is not a single feature but a series of raised beaches particularly prominent in this area.

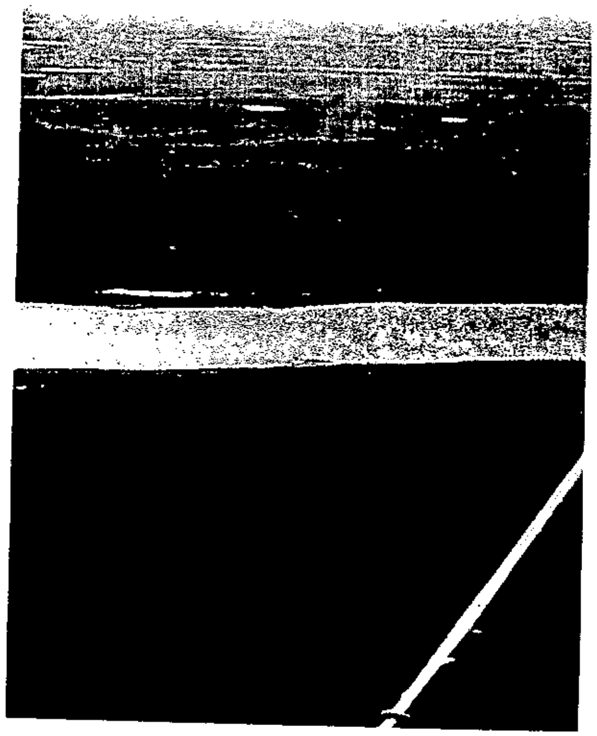


Photo 1

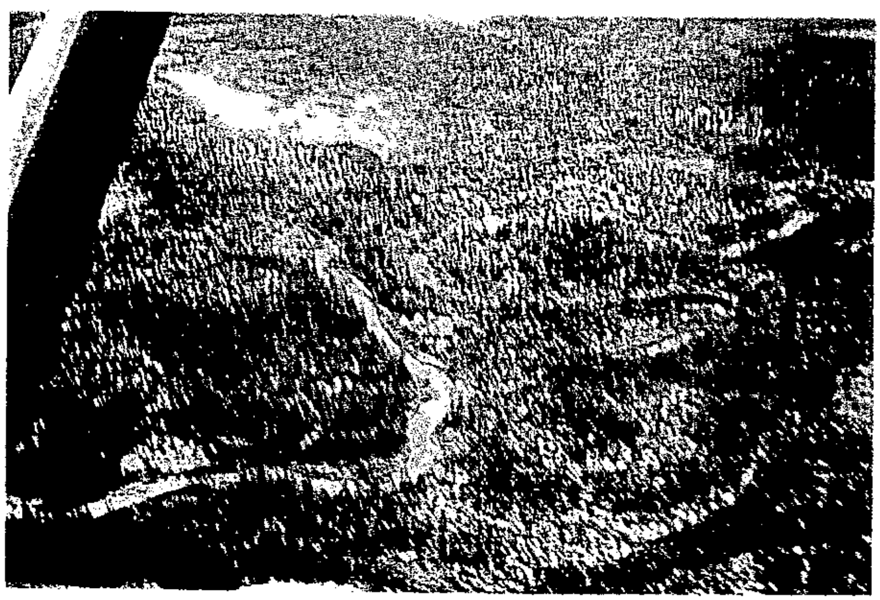


Photo 2

PHOTO 3

The Kaskattama River midway between "Old Beach" and Kaska. The river is markedly incised along a meandering course but the over-all bearing of the river is unusually straight. Note the very sparse vegetation on the far side. Also, note the typically narrow rim of heavy spruce growth along the near river bank. The river itself is quite shallow and fast flowing with numerous rapids. The stream is clear at low water but "muddies" quickly with fluctuation because of the amount of unconsolidated material along its course.

PHOTO 4

A typical view of some raised beach features midway along the Kaskattama River. Such features are common through the area. Note the sparse spruce cover on the old beaches. The light-coloured material under the spruce is more often thick moss cover than sand. The muskeg and lakes between the beaches are typical. These lakes are invariably very shallow, being too shallow to land an aircraft and usually freezing to bottom in winter.

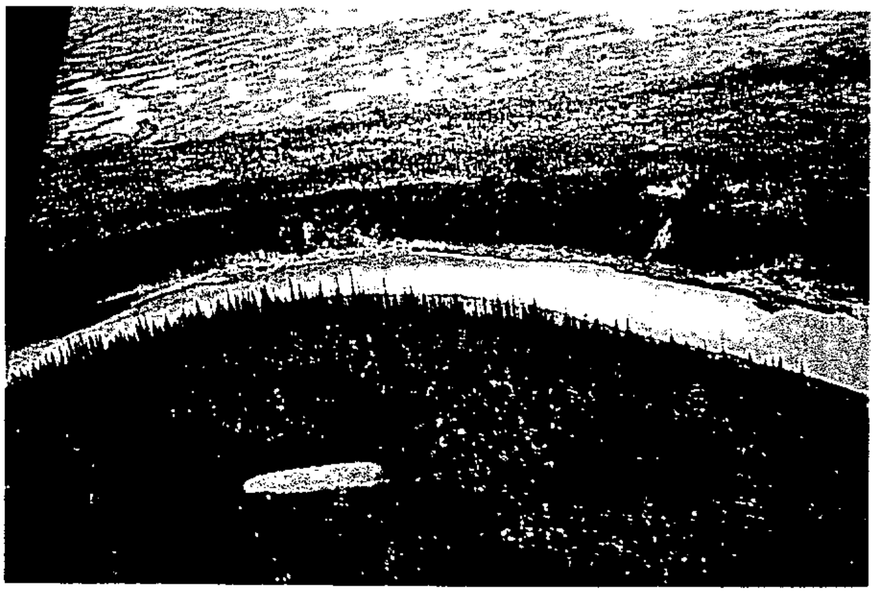


Photo 3

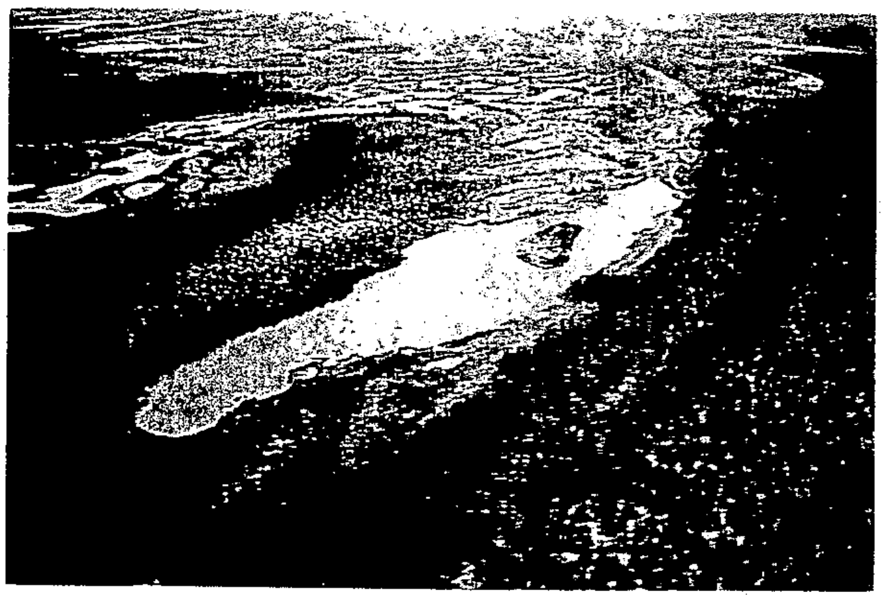


Photo 4

PHOTO 5

Another view along the Kaskattama River showing similar terrain to Photo 4 but with somewhat heavier spruce cover.

PHOTO 6

The mouth of the Kaskattama River. The photo covers the barren zone from the tree line to the beach. The lower half of this stretch of river is affected by tide which was in when the picture was taken.

Photo 5

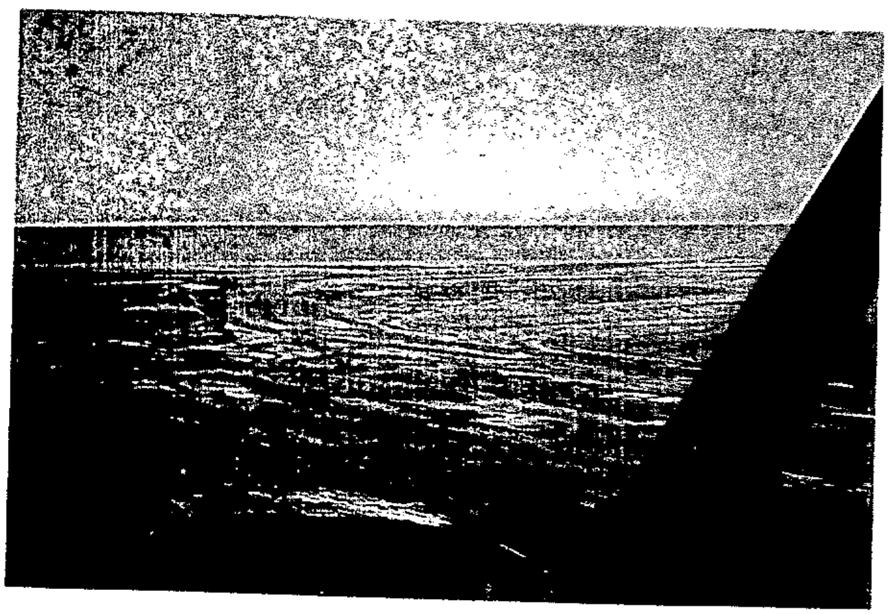


Photo 6

PHOTO 7

This photo is taken from the tree line looking bayward over the Kaskattama delta and is a ground shot covering the identical stretch of river that Photo 6 does from the air. The machines in the foreground are the "Penguins" used for seismic work in this area.

PHOTO 8

From the same location as Photo 7 but looking up the Kaskattama River. Two of the three-man seismic crew, the surveyor and the shooter, are standing by a Penguin and trailer rigged as a shooting unit with radio contact with the recording unit.

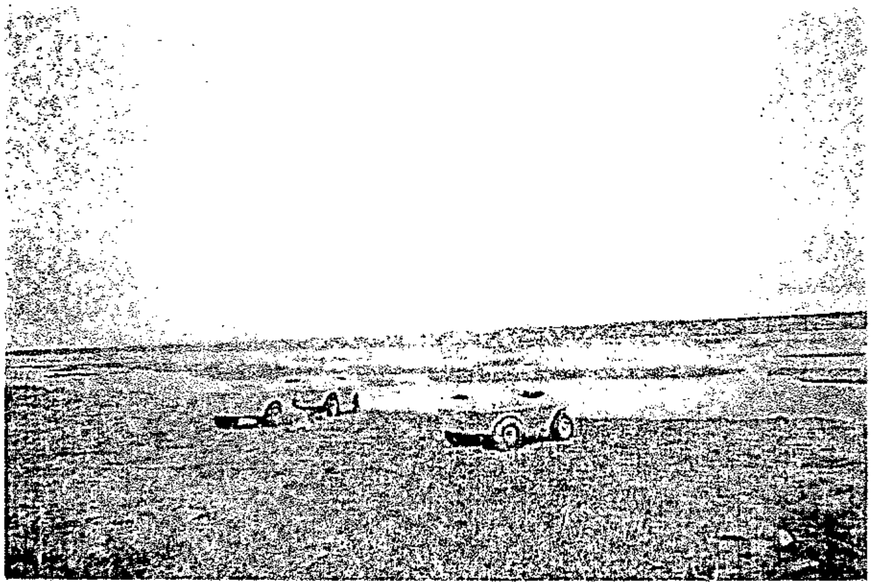


Photo 7

Photo 8

PHOTO 9

The shooter and surveyor using the shooting unit to lay out geophones along a raised beach. Note the slight but well defined drop between the ridge and inter-ridge area. The ridges provide good travel while the inter-ridge area is muskeg and willow.

PHOTO 10

The recording Penguin and trailer at a position along a major raised beach ridge which coincides with the tree line. The trailer holds the recording instrument and developing facilities.

Photo 9

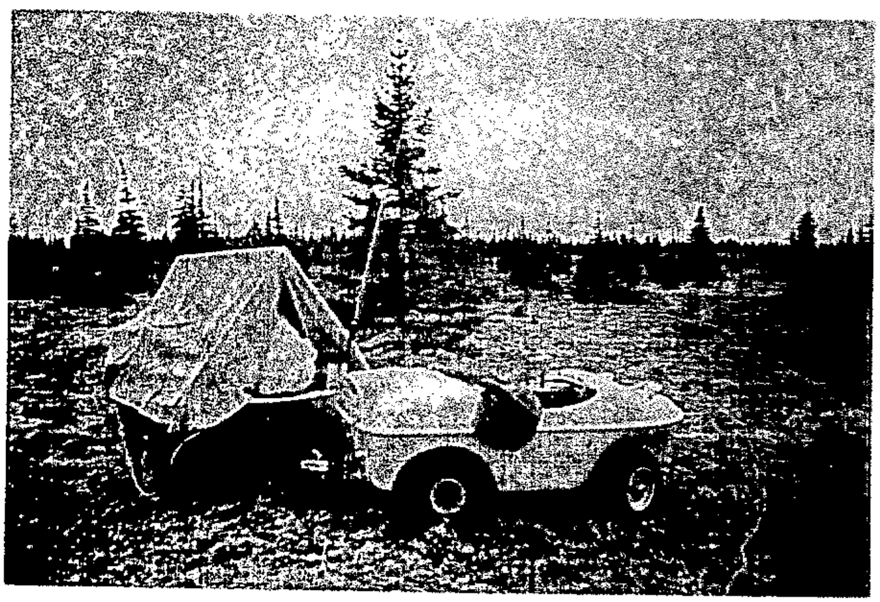


Photo 10

PHOTO 11

This cabin is located at the tree line on the Kaskattama River, the same position as Photos 7 and 8. It is of plywood and frame construction and together with one other similar cabin some four miles upstream at Kaska Post, it is the only habitable building in a radius of more than one hundred miles. It is owned and operated as an out-camp for goose-hunters during the fall.

PHOTO 12

Our geological-geophysical camp at Kaska in September. It is located on the tree line beach ridge near the cabin shown in Photo 11. Note the mixed willow and spruce cover. The camp housed the three-man seismic crew, two geologists and two Cree labourers.

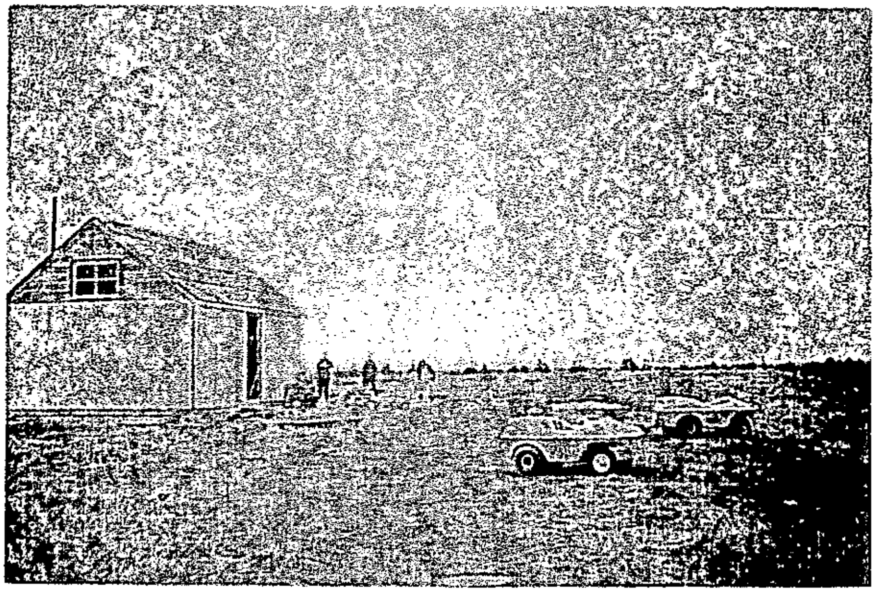


Photo 11

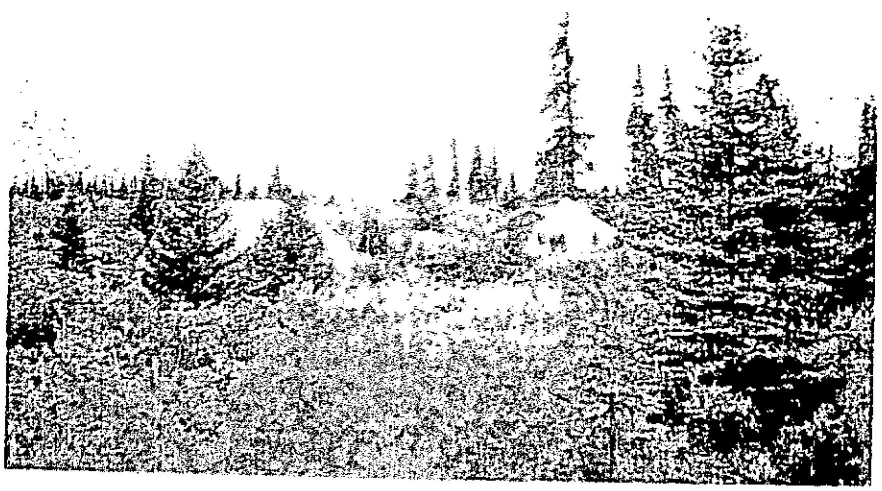


Photo 12

PHOTO 13

Photos 13 to 17 show changes in terrain characteristics moving from the tree line to the coast. Photo 13 illustrates a raised beach feature in front of the tree line yet distant from the coast. Note the moss, low scrub willow and occasional dwarf spruce type of ground cover. Travel along such features is usually very good.

PHOTO 14

A frontal flank of a raised beach midway between the tree line and the coast. The raised beach is to the left and the lower wet grass-covered clay ground is to the right. Note the strewn driftwood which constitutes a serious threat of punctures to swamp buggies using oversized low pressure tires.

Photo 13

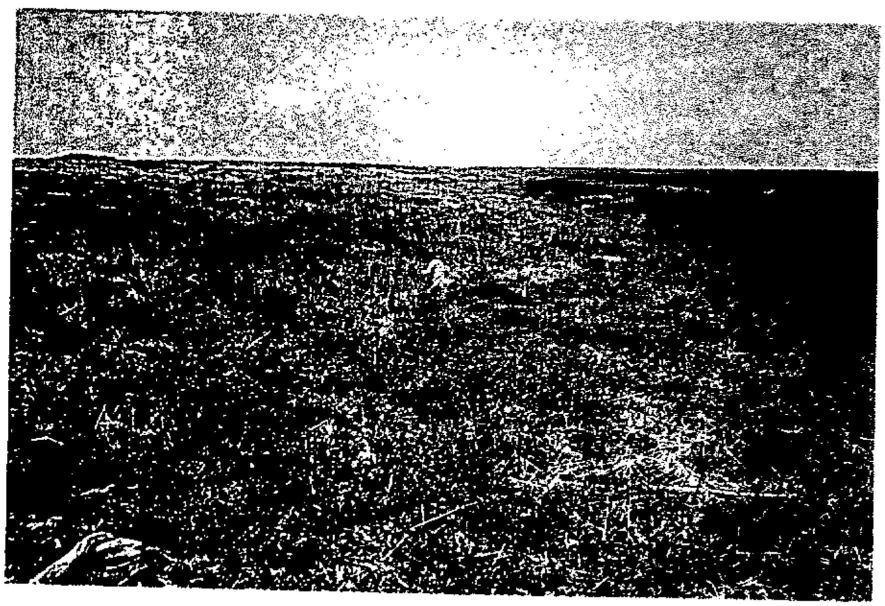


Photo 14

PHOTO 15

An example of the flood channels in the barren zone. These channels fill at high tide and drain during the low tide. They are commonly up to six feet deep with near-vertical smooth clay walls. The photo was taken at high tide. The grassland in the foreground is on a hard clay base. Walking is solid but sometimes slippery in the grass areas.

PHOTO 16

Beach area at Kaska. The beach is clean sand with minor fine gravel with dunes and blow-outs common. There is sparse grass cover and scattered driftwood. Travel is excellent.

Photo 15

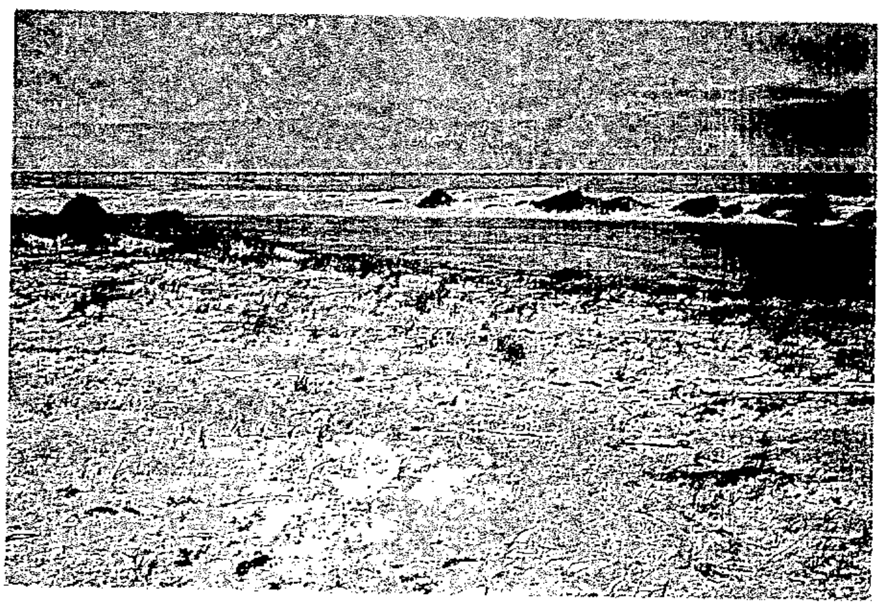


Photo 16

PHOTO 17

The beach front at Kaska just at the turn of the high tide. Note that the beach is developed perhaps six feet above normal high tide. The beach is constructed on hard Pleistocene clays exposed at low tide as vast tidal flats. The sea is roily from normal surface action in the shallows.

PHOTO 18

An aerial view of the present beach complex south of the Kaskattama River. The river mouth is seen in the distance. Note the flood channel in the grass area back of the beach as well as other characteristic features.

Photo 17

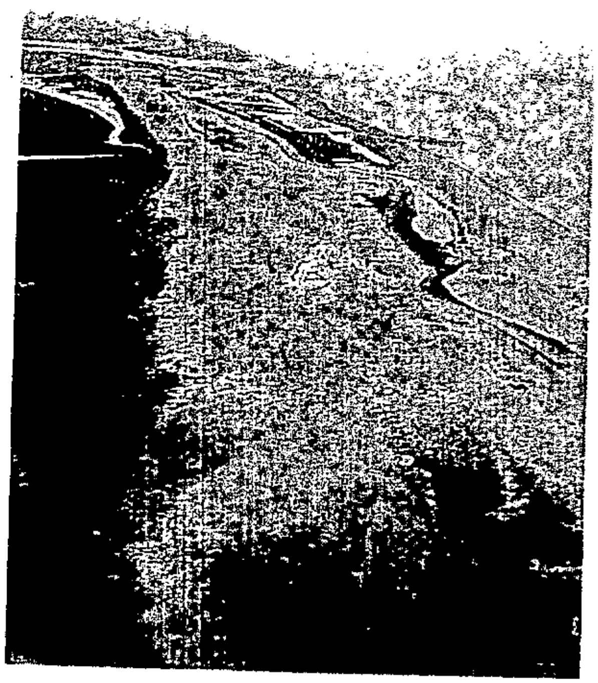


Photo 18

PHOTO 19

A view of the coastal strip further south from Kaska. Note the discontinuity of present beach development and the separation of beach features by flood channels and occasional mud areas as in the lower right corner. Ground vehicles can move rapidly along the beaches but must be in some way equipped to cross these difficult inter-beach areas.

PHOTO 20

Complex beach and bar developments near the Anabusko River between Kaska and Cape Tatnam. The falling tide exposes a barren area of grey clay mud apparently limited to an area of agitated water but restricted drainage. A strip of bare Pleistocene is exposed along the beach in the lower right-hand corner. This particular beach is shown in detail in Photo 21.

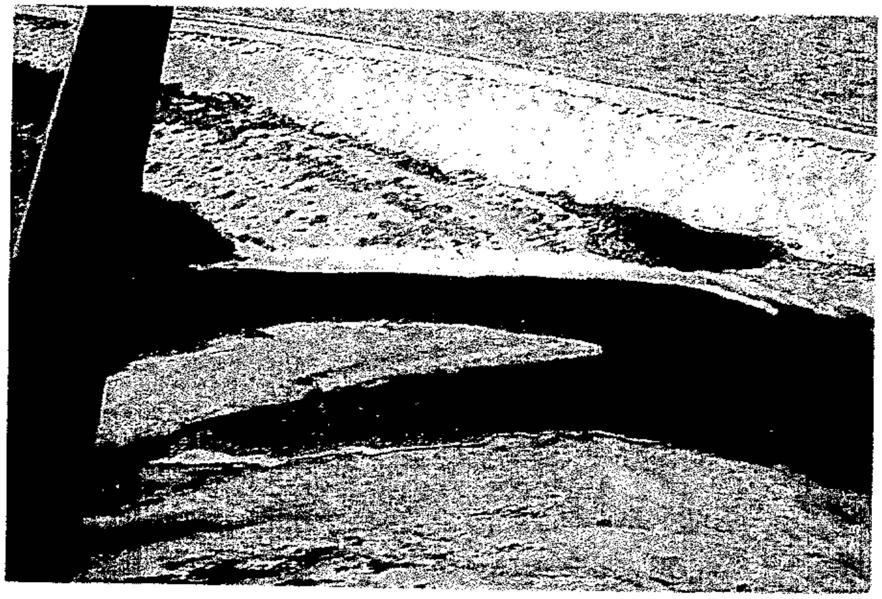


Photo 21

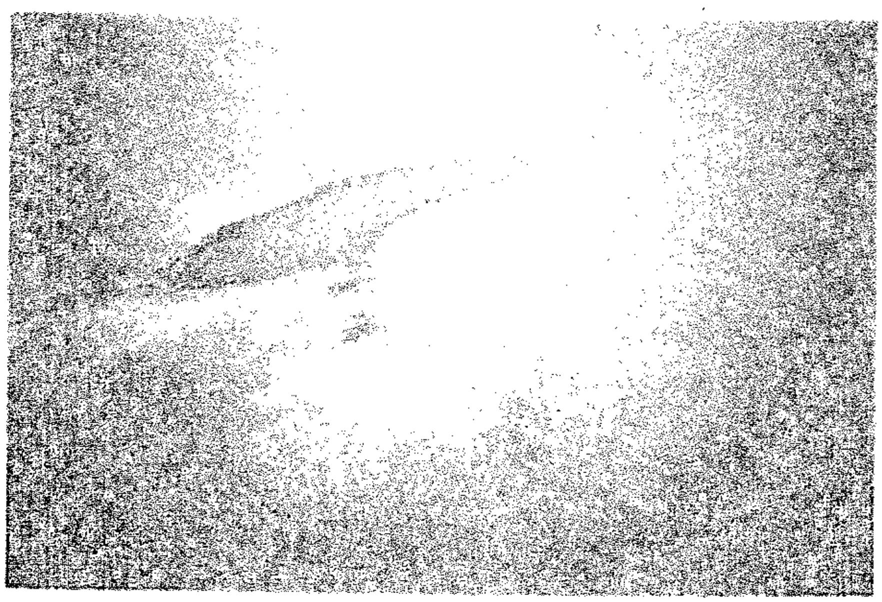


Photo 22

PHOTO 23

A general view from near York Factory looking eastward to Cape Tatnam. Note the lack of beaches compared with the Cape Tatnam to Kaska area (e.g. Photo 18). The tide is falling and a large strip of tidal flats can be seen.

PHOTO 24

A very low angle view of a large exposed tidal flat area north of the Nelson River at low tide. Note the scour line caused by an ice rafted boulder. Polar bear and cariboo tracks were noted on the flat and indicated the ground to be heavy clay mud on top but solid beneath.

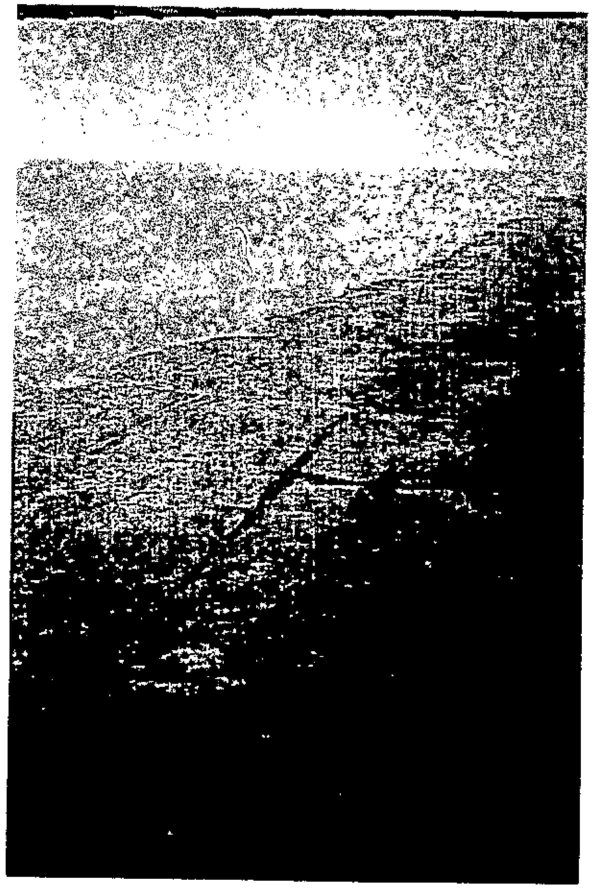


Photo 23

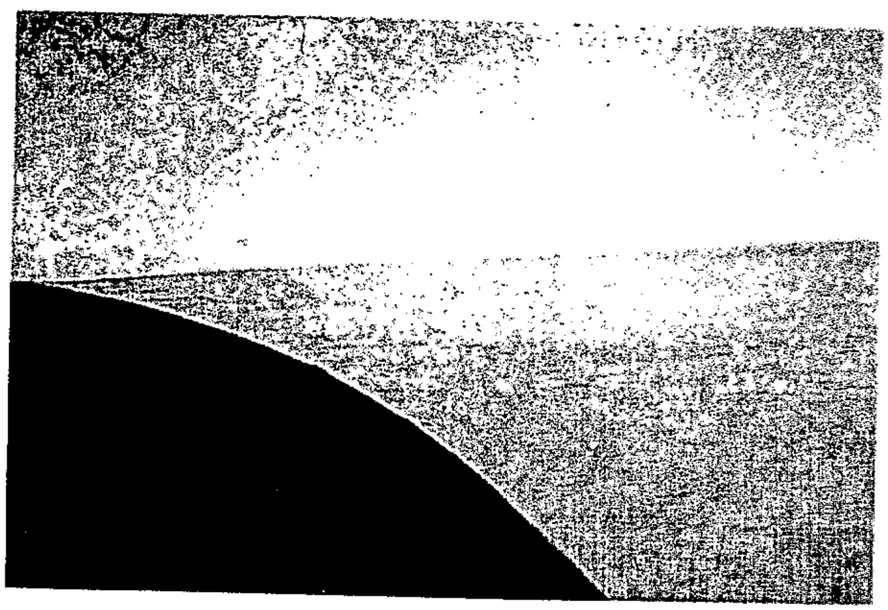


Photo 24

PHOTO 25

Typical beach of the area north of the Nelson River. These beaches are commonly very low compared with the Kaska area. The exposed tidal flat can be seen.

PHOTO 26

An interesting view of the tidal flat area and the sharp drop, in this case, to somewhat deeper water. Note the minor spit development off the tidal flats. The photo was taken in late July yet note the small remanent ice patch.

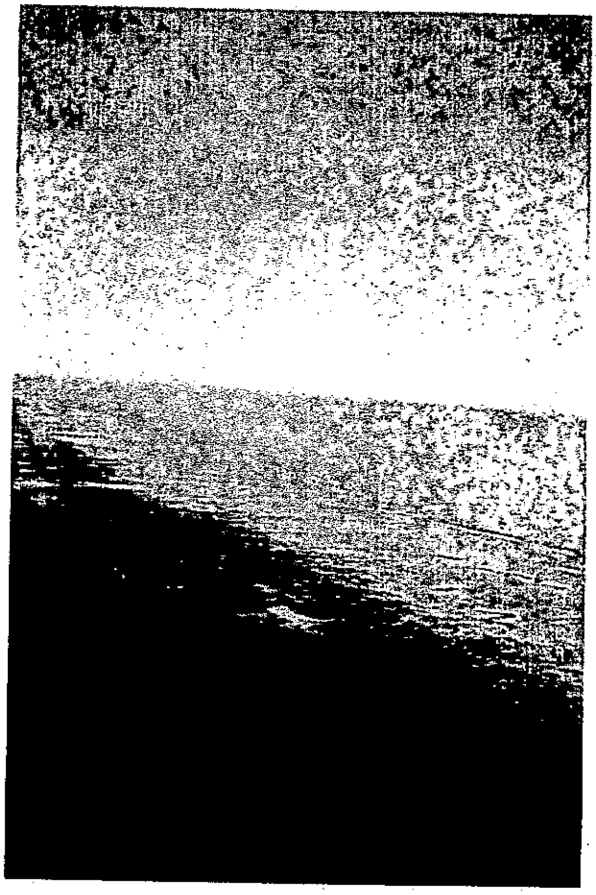


Photo 25

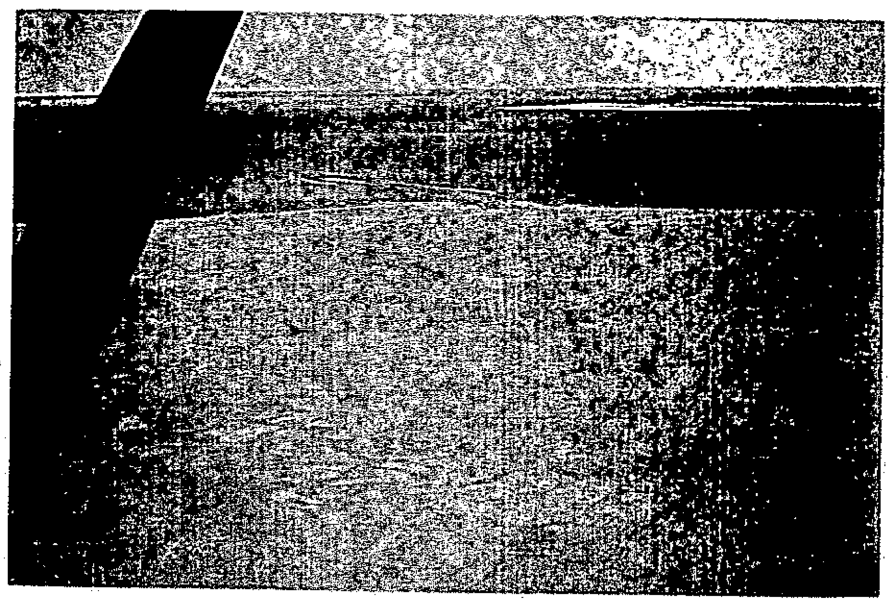


Photo 26

PHOTO 27

A long and well developed offshore gravel bar in the Nelson Shoals area. (Probably the Nelson Shoal proper)

PHOTO 28

A close-up of the flank of a gravel spit in the Broad River area. This development appears to be typical of the gravel bars and spits along the coast. Construction is in the order of six feet above high tide. The gravel is commonly from nut to cobble size.

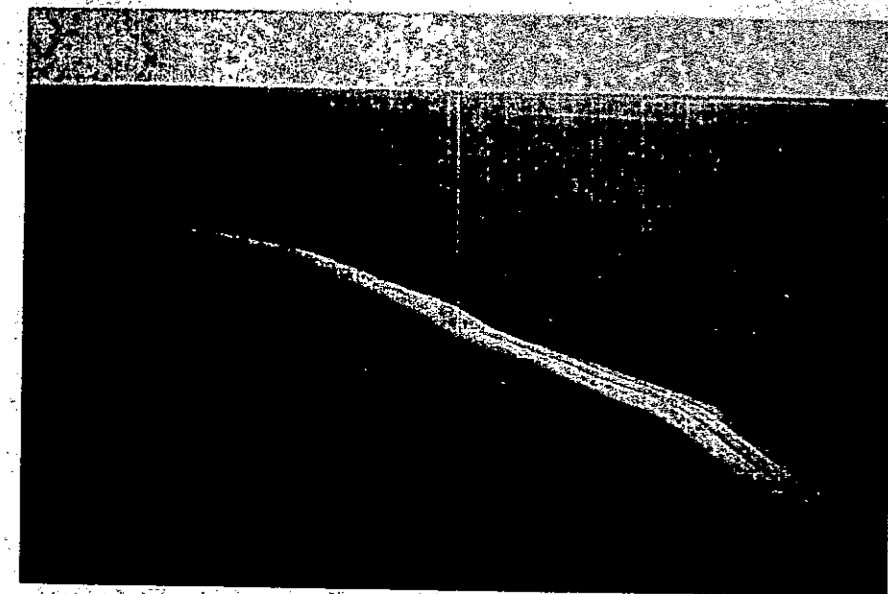


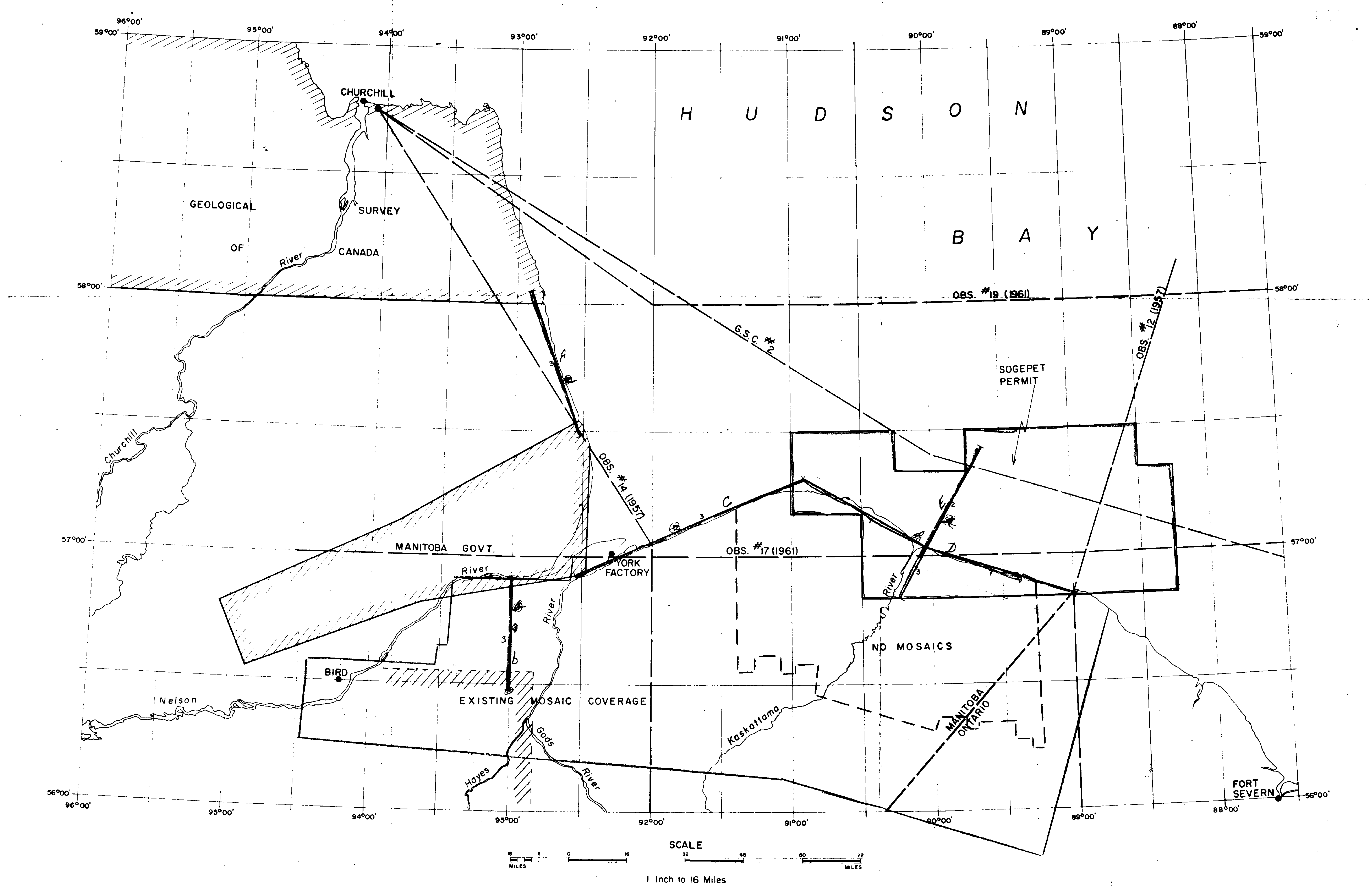
Photo 27

Photo 28


HUDSON
BAY
KASKA BEACH
CABIN
KASKA POST
BLACK DUCK BEACH
NISKIBI BEACH
PROPOSED WINTER ROAD
PRESENT WINTER ROAD
OLD BEACH
MID CANADA LINE
Proposed Dam
York Factory
Atkinson Lake
Cyril L
Lenora L
Fox River
(Gods Lake 53 N.W.)
Kilometres
Nautical Miles
Statute Miles
SCALE 1:500,000

(5)

Geological Survey Maps (2)



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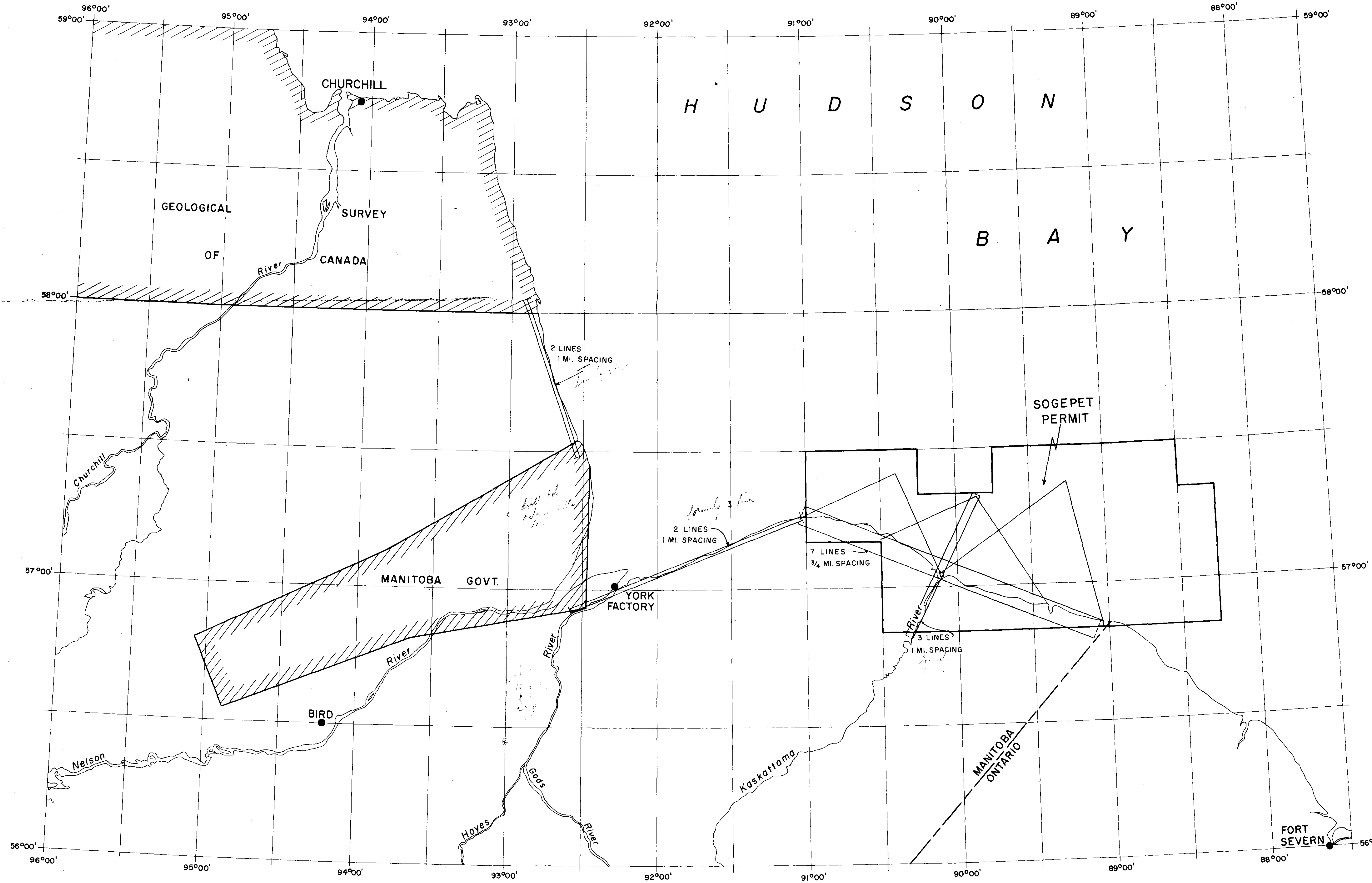

FLIGHT LINE LAYOUT
OF
AEROMAGNETIC SURVEY,
CAPE TATNAM AREA
FOR
SOGEPET LIMITED

J

HUNTING SURVEY CORPORATION LIMITED
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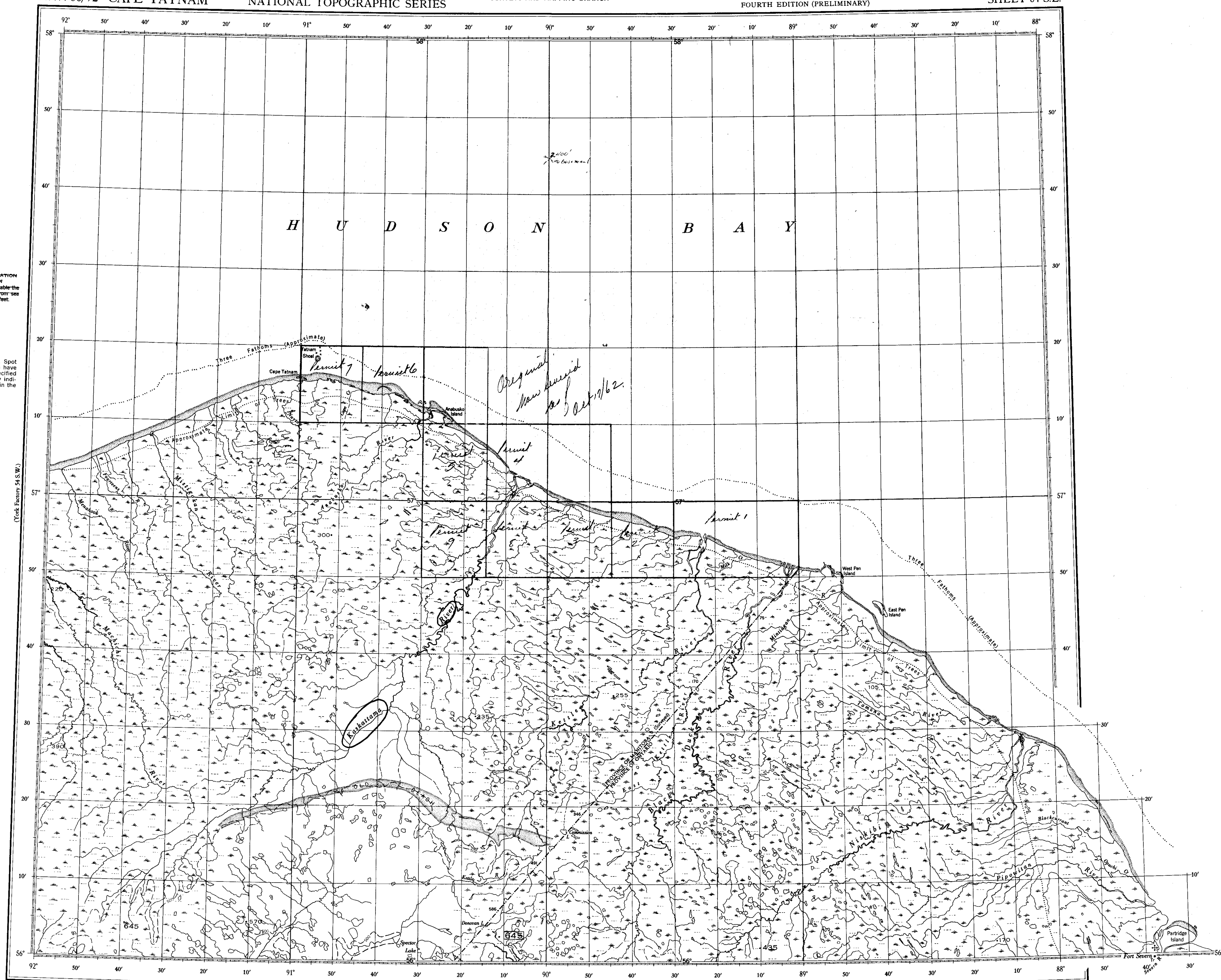
~~From sources available the elevations range from sea level to about 500 feet.~~

HIGHEST KNOWN ELEVATION

56° 05′ N
90° 10′ W

645

Contours are approximate. Spot elevations shown in brown have been obtained along a specified line and do not necessarily indicate the highest elevation in the area.



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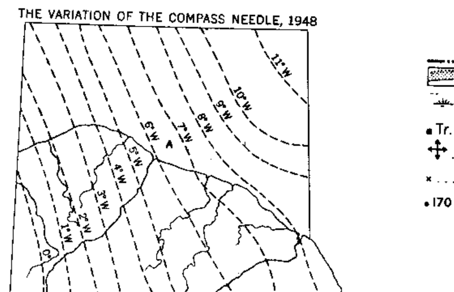

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REFERENCE

- Boundary: Provincial
- Tidal Flat
- Marsh or Swamp
- Tr. Trading Post
- Wireless Station
- Isolated Rock
- •170 Spot Elevation (in feet)

Kilometres / Nautical Miles / Statute Miles

SCALE 8 MILES TO 1 INCH OR 1:506,880

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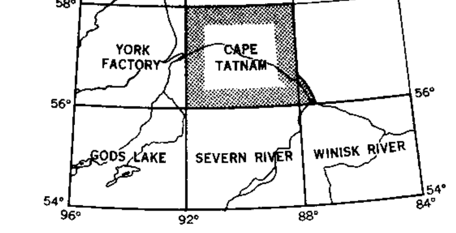

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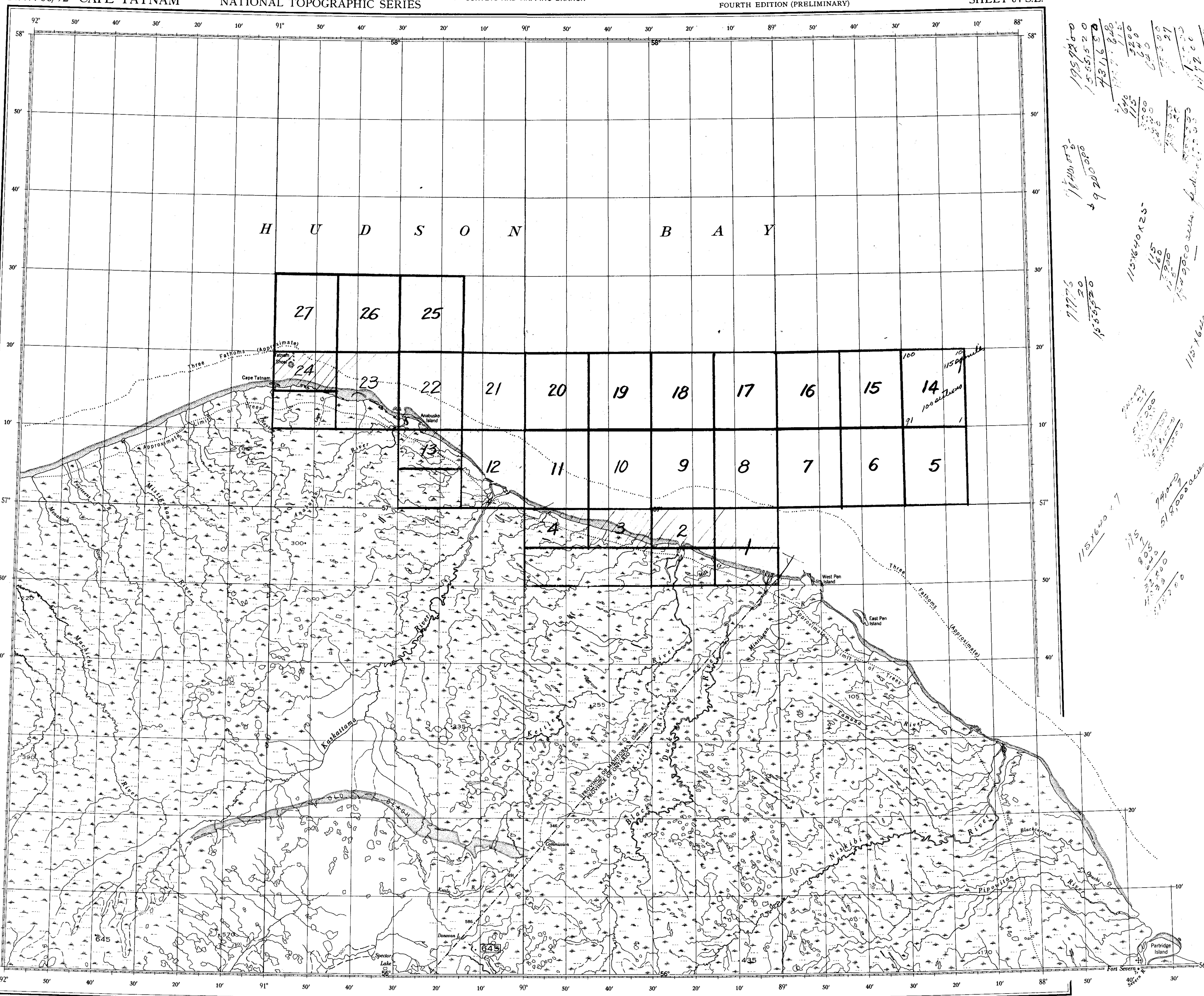
~~HIGHEST ELEVATION UNKNOWN~~
~~From sources available the elevations range from sea level to about 500 feet.~~

HIGHEST KNOWN ELEVATION
56° 05′ N
90° 10′ W
645

Contours are approximate. Spot elevations shown in brown have been obtained along a specified line and do not necessarily indicate the highest elevation in the area.

N B
Manitoba Applications Outlined in BLUE

Federal Areas (Chosen by them) in pencil



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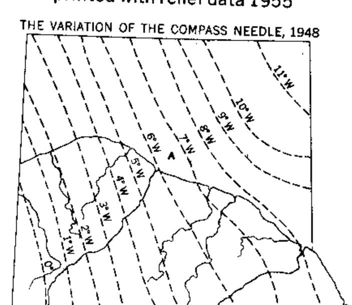

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- Boundary: Provincial
- Tidal Flat
- Marsh or Swamp
- Tr. Trading Post
- Wireless Station
- Isolated Rock
- 170 Spot Elevation (in feet)

Kilometres 10 0 20 40 60 80 100 Kilometres
Nautical Miles 5 0 10 20 30 40 50 Nautical Miles
Statute Miles 5 0 10 20 30 40 50 60 Statute Miles

SCALE 8 MILES TO 1 INCH OR 1:506,880

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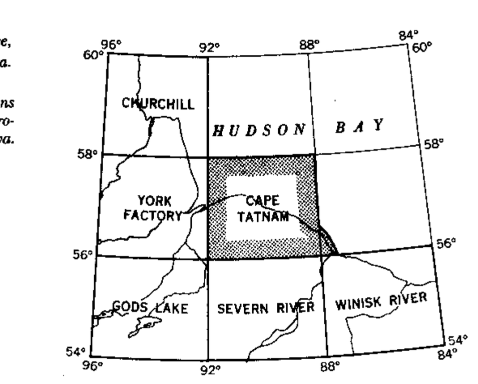

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