OPEN FILE
DOSSIER PUBLIC 786

MINERAL AND HYDROCARBON RESOURCE POTENTIAL OF THE PROPOSED NORTHERN ELLESMERE ISLAND NATIONAL PARK, DISTRICT OF FRANKLIN, N.W.T.

(Phase 1)

DEPARTMENT OF ENERGY, MINES AND RESOURCES
GEOLOGICAL SURVEY OF CANADA

DEPARTMENT OF INDIAN AND NORTHERN AFFAIRS

PART I – **Introduction**

PART II – **Information Base**

PART III – **Mineral and Fuel Resource Assessments**

PART IV – **Recommendations**

Prepared for the Interdepartmental Working Committee on Northern Mineral and Energy and Resource Assessment

DEPARTMENT OF ENERGY, MINES AND RESOURCES
GEOLOGICAL SURVEY OF CANADA

MINISTRE DE L'ENERGIE, DES MINES ET DES RESSOURCES
COMMISSION GEOLOGIQUE DU CANADA

August 1981
Price: $5.00

Ottawa, CANADA

GEOLOGICAL SURVEY OF CANADA

OPEN FILE 786

MINERAL AND HYDROCARBON RESOURCE POTENTIAL OF THE PROPOSED NORTHERN ELLESMERE ISLAND NATIONAL PARK, DISTRICT OF FRANKLIN, N.W.T.

(Phase I)

Department of Energy, Mines and Resources
Geological Survey of Canada

Department of Indian and Northern Affairs

PART I

INTRODUCTION

PART II

INFORMATION BASE

PART III

MINERAL AND FUEL RESOURCE ASSESSMENTS

PART IV

RECOMMENDATIONS

Prepared for the Interdepartmental Working Committee on
Northern Mineral and Energy Resource Assessment

CONTENTS

Preface

The new National Parks policy, introduced by the government of Canada in early 1979, recognizes the DINA requirement that "inventories" of mineral and fuel resource potential be made prior to setting aside lands for park purposes. Responsibility for implementing this policy rests with the Department of Indian and Northern Affairs.

A joint interdepartmental committee called the Working Committee for Northern Mineral and Energy Resource Assessment (MERA) was formed in early 1980 to conduct the required assessments. Committee membership includes representatives from the Department of Indian and Northern Affairs, the Department of Energy, Mines and Resources and Parks Canada Program of the Department of the Environment.

This report presents preliminary (Phase I) assessment results for the proposed Northern Ellesmere Island National Park, one of five northern areas currently being considered as potential parks. The other areas are: Northern Yukon, Banks Island North, Bathurst Inlet, and Wager Bay.

The Phase I reports are based on office investigation using data and information available at hand. They do not include field investigations conducted specifically for the assessments. In many cases, however, field investigations will be required before more confident judgments can be made concerning the potential of these areas to contain undiscovered mineral and fuel resources. Such investigations will comprise Phase II of the assessment process and may result in significant changes in the potential ratings assigned During phase I studies.

D.C. Findlay
Geological Survey of Canada

T.W. Caine
Department of Indian and Northern Affairs

Co-Chairmen, Working Committee on
Northern Mineral and Energy Resource Assessment

SUMMARY OF MAIN FINDINGS

1. This report provides preliminary assessments of the potential for the proposed northern Ellesmere Island park to contain undiscovered deposits of metallic minerals, gypsum, coal, oil and gas, soapstone and amber.

2. Only one minor metallic mineral occurrence (copper) is known in the proposed park area. This was discovered only recently (1980), emphasizing the lack of modern mineral exploration in the region. Coal, gypsum, chalcedony, and amber occurrences are known; the coal was first discovered and mined by members of the Nares expedition (1871-73).

3. The study concludes that a number of areas with significant potential for undiscovered metallic minerals, mainly Cu, Pb, and Zn, are present within the proposed park area. The southeastern portion of the proposed park contains formations particularly suitable for unidscovered deposits of lead and zinc and, to a lesser extent, copper. The northwestern segment of the proposed park contains volcanic units regarded as favourable for polymetallic (Cu, Pb, Zn) deposits and carbonate formations with potential for lead-zinc deposits.

4. Areas underlain by post-Devonian strata may have potential for significant coal seams in addition to those already known.

5. The over-all potential for undiscovered oil and gas in the park is rated as low; a small area north and northeast of Lake Hazen is considered to have moderate potential.

6. One small area of serpentinite near M'Clintock Inlet may have potential for soapstone material suitable for carving. The most valuable known commodity in the proposed park area may be amber in the Lake Hazen area. With the current world shortage of amber, these deposits warrant further investigation.

PART 1

1. INTRODUCTION

Introduction

This review was made in response to the requirements for mineral and energy resource assessment of northern lands being considered for national parks and other conservation purposes. Parts of the area involved in this northern Ellesmere Island study have been discussed in preliminary form in two earlier reports (Geological Survey of Canada 1980a, b). The present study incorporates some of the findings of the earlier work but includes new assessments where required.

The area in question is shown in Figure 1 and encompasses about 35 120 square kilometres (13 560 sq. mi.) bounded on the southeast by Archer Fiord, Lady Franklin Bay, and Robeson Channel. The northeastern boundary begins at Wrangel Bay, follows a line northwesterly to Grant Ice Cap and thence northerly to meet the coast at Good Point. The southwestern boundary proceeds out of Archer Fiord up Beatrix Bay, continuing to an unnamed peak with altitude 3070 ft (917 m) and thence southwesterly to another peak at 3770 ft (1149 m). From there the line follows directly WNW to Mt. Thompson and then NW to a point southwest of Yelverton Lake. The boundary proceeds from there northeast to Barbeau Peak, then NNW to Commonwealth Mountain, and thence to meet the coast at Borrup Point by way of Mount Ayres.

This report presents preliminary assessments of the resource potential of this portion of Northern Ellesmere Island for metallic minerals, including uranium. A subjective method of mineral resource potential was employed; the methodology is discussed in detail in Geological Survey of Canada (1980b).

The assessments for oil and gas potential incorporate methodologies developed by the Oil and Gas Resource Evaluation Division, Department of Indian and Northern Affairs, Ottawa and the Institute of Sedimentary and Petroleum Geology, Geological Survey of Canada. The coal assessments were done by the Geological Survey of Canada, Ottawa.

Contributors and Acknowledgments

This report involved work by a number of individuals in various agencies. Primary responsibilities were as follows:

Metallic minerals: D.F. Sangster (Geological Survey of Canada, Ottawa).

Oil and gas: D.C. Smith (Department of Indian and Northern Affairs, Hull, Que.) and A.F. Embry (Institute of Sedimentary and Petroleum Geology, Geological Survey of Canada, Calgary, Alberta).

Coal, soapstone, and amber: D.F. Sangster (Geological Survey of Canada, Ottawa).

Illustrations and Support Services: R.D. Lancaster (Geological Survey of Canada, Ottawa).

Overall Report Preparation: D.F. Sangster (Geological Survey of Canada, Ottawa).

PART 2

INFORMATION BASE

The only types of information available for mineral and hydrocarbon assessments of Northern Ellesmere Island are geological maps and reports published by the Geological Survey of Canada. No records of either mineral exploration or hydrocarbon-directed geophysical surveys within the proposed park area exist in the files of the Department of Indian and Northern Affairs.

Appendix A, provided by Parks Canada Program, provides general background information on the proposed park. This Appendix also includes information on Axel Heiberg Island, site of an earlier proposed park no longer being considered. Boundaries for the proposed park have also been revised since the report was prepared.

Geological Base

In addition to the geological reports referred to in the text to follow, this study has benefitted from much unpublished information resulting from recent mapping by H.P. Trettin, A.F. Embry, and U. Mayr, Geological Survey of Canada.[1]

The geology of the proposed park area (Fig. 1) is most conveniently discussed in terms of two major age groupings of rocks: 1. Precambrian to Late Paleozoic and, 2. post Late Paleozoic. Because of differences in geological complexity and detail of available information, the Precambrian – Late Paleozoic group of rocks is presented in two parts: a) Hazen Trough, that part of the proposed park lying south of Porter Bay Fault Zone (Fig. 1); and, b) northwestern magmatic belt, that part lying north of the same fault zone (Fig. 1).

Mineral Occurrences

Only one metallic mineral occurrence has been reported within the proposed park boundaries (Trettin, 1981a). As pointed out by Trettin (ibid.), the relative lack of known metallic mineral occurrences "reflects the reconnaissance nature of the geological work and the lack of prospecting" (p. 105-106).

Other commodities reported within the area under study include coal, gypsum, chalcedony, and amber (Christie, 1964).

Copper

A small occurrence of tennantite $((Cu, Fe, Zn, Ag)_{12}As_4S_{13})$ in dolomite of Unit 8 (Fig. 1) has recently been reported by Trettin (1981a, p. 105) who described it as follows:

"The surface area of the deposit, perhaps 10 m to a few tens of metres in diameter, is strewn with fragments of dolostone weathered in place that contain scattered crystals, or lumps of crystals, of tennantite, surrounded by haloes of malachite and minor azurite. The tennanite content of the specimens collected varies from trace amounts to an estimated 5-10 per cent by volume. The crystals are euhedral, mostly tetrahedral in habit and vary in edge length from 0.7 mm to about 3 cm".

---

[1]Since final preparation of this report, some of this information has been released in Open File (Trettin, 1981c; Trettin and Mayr, 1981; Trettin and Frisch, 1981).

Coal

Christie (1964) reported on a number of coal occurrences in Cenozoic rocks of the area as follows: "The coal seam of Watercourse Valley was discovered by members of the Nares expedition,[1] and a small tonnage was mined and used. Subsequent parties also have mined and burned some of the coal.

The coal seam, the base of which is not exposed, is at least 20 feet thick. The coal is brittle, fractured, and well banded. The seam is nearly free of sand layers which aggregate only about 10 inches in thickness." (Christie, 1964, p. 59).

The coal breaks with a platy fracture parallel with the bedding and has a conchoidal fracture in other directions. It is shiny black, becoming dull and decrepitated on weathering or desiccation. The high water content and occasional brownish cast of the coal indicate a general lignitic character." (Christie, 1964, p. 72).

In the Gilman River area (north end of Lake Hazen), "coal beds are mostly about 6 inches to 2 feet thick. Five beds are exposed in Gilman River, and a seam 8 feet or more thick is exposed along the lake shore west of Gilman River. The coal is compact, shining black to brownish, and moderately friable. Cracking and decrepitation take place after prolonged exposure to air. Proximate analyses of the coal indicate a rank of sub-bituminous B" (Christie, 1964, p. 52).

Chalcedony

"Nodules of pale yellow chalcedony, or celadonite, were observed scattered on the surface of basalt conglomerate about 35 miles northeast of Lake Hazen. The conglomerate, which is probably of Mesozoic or Tertiary age, occurs as a small isolated group of remnant caps on hills. The chalcedony is banded, and the surface of the pebbles is parallel with the banding. The pebbles originally may have been cavity fillings in volcanic rock, and now are residual debris on and in the conglomerate" (Christie, 1964, . 73).

Gypsum

"A gypsum body outcrops on the east shore of M'Clintock Inlet, about 12 miles from the mouth. The exposure apparently is a lens-shaped bed up to about 400 feet thick and 1,000 feet long. The adjacent rocks are andesitic volcanic flow-rocks and breccias of the M'Clintock group.

Thick beds of anhydrite and gypsum are widely exposed at the head of Clements Markham Inlet. A coarsely crystalline selenite vein cuts the gypsiferous rocks at the sharp bend in Gypsum River. In this, crystal plates generally up to 6 inches wide, and some 12 inches wide, were observed" (Christie, 1964, p. 73).

Amber

"Amber nodules and finely broken coal are concentrated in bands along the beach at the east end of Lake Hazen. The yellow, red, and brown lumps of amber are up to an inch in diameter, and are conspicuous in the black coal debris.

Pale yellow amber is abundant as scattered nodules and 'swarms' of nodules in the coal seams near Lake Hazen. The 'swarms', or concentrations of nodules, may be more than 50 per cent amber, and up to 4 inches thick and several feet wide along the bedding plane. The amber is limited to certain horizons, but occurs indiscriminantly with either thick or thin coal seams" (Christie, 1964, p. 72-73).

---

[1] A Royal Navy expedition in 1871-73 commanded by Captain Sir George Nares.

Regional Geology

1. Precambrian to Late Paleozoic

Northeastern Ellesmere Island, including the proposed park area, consists of three major lower Paleozoic depositional and tectonic belts: the southeastern "miogeoclinal" shelf, the Hazen Trough, and the northwestern magmatic belt. The contact between the "miogeoclinal" shelf and Hazen Trough belt lies approximately along the central portion of Judge Daly Promontory; hence the entire southeastern "miogeoclinal" belt falls outside the proposed park area. The boundary between Hazen Trough and the northwestern magmatic belt coincides approximately with the Porter Bay Fault Zone (Fig. 1) and its continuation south of Yelverton Inlet. Because of differences in geological complexity and available information between the area south of Porter Bay Fault Zone (Hazen Trough) and that north of the same fault zone (northwestern magmatic belt), the geology of the two areas will be discussed separately below. The map (Fig. 1) also contains separate geological legends for each area.

(a) Hazen Trough

Three lower Paleozoic formations dominate the stratigraphy in Hazen Trough: Grant Land, Hazen, and Imina Formations (Trettin, 1971).

Early Ordovician and/or earlier

Grant Land Formation

Throughout Hazen Trough, two subunits of the Grant Land Formation can be recognized although they have not been delineated in Fig. 1. The lowermost subunit "consists mainly of medium- to coarse-grained sandstone with lesser amounts of interbedded red and green slate and phyllite, and still less pebble conglomerate. In the upper subunit . . . . .the sandstone and conglomerate content decreases upward in the section and the content of green and red slate and phyllite increases accordingly; furthermore, the sandstones become finer-grained upward" (Trettin, 1971, p. 21).

Early to late Middle Ordovician

Hazen Formation

This formation "consists mainly of chert, shales, siltstone, and limestones with lesser amounts of calcareous siltstone, breccia, and dolostone. These various rock types are generally thinly stratified and interbedded. Individual beds seem to be extensive, with the possible exception of the breccias" (Trettin, 1971, p. 39).

With increasing amounts of argillaceous impurities, the chert grades to shale. In the St. Patrick's Bay area (southeastern region of Fig. 1), Trettin (1971, p. 39-40) has distinguished four informal members characterized lithologically upwards as shale, limestone-chert-shale, chert, and shale. The cherts consist of both radiolarian chert and "replacement" chert; the latter replaces all other rock types. The limestones are regarded as mainly resedimented carbonates derived from the carbonate-dominated "miogeoclinal" shelf belt to the southeast. In the vicinity of the shelf margin (Lady Franklin Bay area), the resedimented carbonate clasts, together with chert, siltstone, and shale clasts, are found in breccias consisting of pebble- to boulder-sized clasts in a matrix of lithified lime mud.

Late Middle Ordovician to late Early or Middle Silurian

Imina Formation

Within Hazen Trough, the Imina Formation consists of numerous alternating beds of calcareous and dolomitic greywacke, calcareous and dolomitic siltstones, and calcareous and dolomitic shale.

Trettin (1971, p. 66) has calculated that over 85% of the Imina Formation consists of greywacke and shale. Primary structures in the Imina Formation greywackes show that paleocurrents entered Hazen Trough from the northwest and were deflected to the southwest parallel with the trough axis.

Depositional Environments

The lower Paleozoic Franklinian Basin, in the northeastern end of which Hazen Trough lies, probably rests on Precambrian continental crust (Trettin and Balkwill, 1979). That the Franklinian Basin (and Hazen Trough) is, in fact, an intracratonic-basin is deduced from the presence of Precambrian crystalline terranes exposed both north and southeast of the basin and which "probably underlie it in its entirety" (Trettin and Balkwill, 1979, p. 750).

The Grant Land Formation, consisting of nonmarine and marine sandstones and shales, was largely deposited under alluvial conditions (Trettin, 1971, p. 36). The assemblage represents a normal continental to shallow marine transgression onto the Precambrian craton.

The lithologies and depositional conditions of the Grant Land Formation contrast markedly with those of the overlying Hazen Formation which represents a "starved basin" facies, consisting of a condensed succession of radiolarian cherts, shales, and resedimented carbonates. The overlying "flysch facies" of the Imina Formation effectively brought to a close deep-water sedimentation in the Hazen Trough.

(b) Northwestern magmatic belt

Lying north of the Porter Bay Fault Zone (Fig. 1), the magmatic belt is structurally and lithologically much more complex and varied than Hazen Trough. Prior to 1975, only parts of this belt had been mapped and even then only on a reconnaissance scale. In that year a detailed mapping program was begun under the leadership of H.P. Trettin, Geological Survey of Canada. The summary to follow combines information from the published reconnaissance mapping with the more recent unpublished maps and notes supplied by Trettin. This mixture of published and unpublished information, with its combination of named and unnamed formations, confirmed and tentative ages and correlations, etc. has required the use of numbered units, rather than formation names, in Fig. 1. In all instances, however, reference is made to the source documents.

Because much of the geological information in the northwestern magmatic belt is not yet published, it is not possible to present even summary descriptions of the many individual formations. Instead, a general summary is presented below.

Oldest rocks in the area (Unit 1) are gneissic granitic intrusions (syenites and pegmatites) and associated amphibolites near the mouth of Markham Fiord. Named the Cape Columbia Complex by Frisch (1974), these crystalline rocks were metamorphosed to amphibolite facies at about 1000 Ma (Sinha and Frisch, 1976).

Rocks considered to be slightly younger than Unit 1 are the undifferentiated schists (possibly metavolcanic rocks) of Unit 2 and the metamorphosed carbonate, sandstone, and minor volcanic rocks of Unit 3.

The Proterozoic history of the area may have closed with formation of the carbonate, shale, sandstone, and mafic sills of Unit 4 and the somewhat similar lithologies of Unit 5.

Paleozoic sedimentation appears to have begun with the Cape Discovery Formation (Unit 6) of immature sandstone followed by the extensive volcanic rocks of the M'Clintock Formation (Unit 7).

This volcanic phase is overlain by an assemblage (Unit 8) composed of the Ayles Formation (dolostone), Taconite River Formation (sandstone), Zebra Cliffs Formation (limestone and dolostone) and an unnamed formation of sandstone. Trettin (1981a) reported a low angular unconformity between the last two formations.

This unconformity may have been a precursor to a more extensive uplift in the area. Unit 9 (Map unit 4 in Trettin, 1980a) is a pebble conglomerate of probable nonmarine (braided river?) origin and hence probably is unconformable on all older formations.

Felsic volcanic rocks and radiolarian chert constitute Unit 10. The remaining, pre-orogenic sedimentary succession is composed of immature sandstone (Unit 11; Imina Fm), sandstone and minor conglomerate (Unit 12; Lands Lokk Fm), limestone (Unit 13; Marvin Fm), and mudrock (Unit 14).

Depositional Environments

The structural complexities and paucity of fossils in the northwestern magmatic belt preclude definitive statements regarding depositional environments in this region. Trettin and Balkwill (1979) have published general statements for the area and these are summarized below.

Basement to the Paleozoic strata in the region consists of: 1. Neohelikian or older metasediments intruded by felsic plutons and pegmatites; 2. Hadrynian(?) metasediments consisting largely of carbonate, sandstone, and shale. These latter metasediments might represent a shallow marine transgression onto a sialic craton.

The Paleozoic succession in the area probably began with Units 6 and 7, dominated by volcanic flows and pyroclastics, immature sandstones, and carbonates. "The volcanic rocks are felsic to intermediate in composition, and the carbonate strata associated with them are of shelf origin" (Trettin and Balkwill, 1979, p. 756). From this it might be inferred that volcanism occurred in a shallow marine environment.

The second phase of sedimentation (Units 8-14) "was characterized by carbonate and clastic sedimentation. The carbonates were laid down in intertidal to outer shelf settings, and the clastic sediments in shelf and coastal-plain environments. Marked facies changes over short distances are apparent" (Trettin and Balkwill, 1979, p. 756).

2. Ellesmerian Orogeny

The most extensive and intensive deformation in the Queen Elizabeth Islands, the Ellesmerian Orogeny, progressed from north to south and produced markedly different structural characteristics at different times.

Within the northwestern magmatic belt, folding and faulting occurred mainly along southwesterly to westerly trends, producing major thrust plates as well as several basement uplifts bounded by steeply dipping faults. Metamorphism accompanying this deformation is mainly of subgreenschist to greenschist facies, but reaches amphibolite grade in parts of northwestern Ellesmere Island. Deformation commenced not later than Middle Devonian and was completed prior to late Early Pennsylvanian time.

Within Hazen Trough, "the rocks show tight and complex folds, commonly of concentric type in thick chert units, and of chevron type in the flysch. Innumerable faults, including southeastward directed minor thrusts, are associated with them "(ibid., p. 759). Deformation "cannot have occurred earlier than . . . .Middle Devonian nor later than . . . .Early Carboniferous" (ibid, p. 759).

During the orogeny, the M'Clintock Ultramafic Massifs (Unit 15) and quartz monzonite intrusions (Unit 16) were emplaced.

3. Undivided post-Ellesmerian Orogeny sedimentary rocks (Upper Paleozoic to Tertiary)

Introduction - Upper Paleozoic, Mesozoic and Tertiary strata in the proposed park area occur in two distinct areas which are separated by the Lake Hazen Fault Zone. The fault zone trends northeast from the head of Tanquary Fiord to Black Cliffs Bay and lies at the base of the Garfield Range. North of the fault zone, upper Paleozoic strata are commonly exposed on nunataks and in the Clements Markham Inlet area. Mesozoic strata are more restricted in distribution north of the fault, occurring mainly due east of the head of Tanquary Fiord. The upper Paleozoic and Mesozoic strata in this upland region are folded and cut by numerous thrust faults.

South of the fault zone upper Paleozoic, Mesozoic and Tertiary strata occur in a low-lying structural basin in the Lake Hazen area. The basin is transected by the Cuesta Creek thrust fault which places Mesozoic strata onto Tertiary. The strata in the hangingwall of the thrust are deformed into a doubly-plunging syncline which is narrow and isoclinal to overturned at both ends but is broad and open in the middle. The Tertiary strata in the footwall are mainly flat-lying although folds have been noted along Gilman River a few kilometers south of the Cuesta Creek fault.

Upper Paleozoic Strata - North of the Lake Hazen Fault Zone upper Paleozoic strata are up to 3000 m thick and contain numerous facies changes and unconformities.

The oldest strata are Upper Mississippian shale and siltstone assigned to the Emma Fiord Formation. These strata are found only in the Clements Markham area and are only a few hundred metres thick. The overlying sequence is Early to Middle Pennsylvania in age and is much more widespread. The basal strata are red, coarse grained, fluvial-deltaic clastics which correlate with the Canyon Fiord Formation. The basal clastics are overlain in the central part of the area by a complex of interfingering dark dolomite, evaporites, and bioherms which correlate with the Otto Fiord and Nansen Formations. Overlying these strata is a second interfingering system of carbonates, dark shales and minor evaporites of Early Permian age. The uppermost sequence consists of fine-grained sandstone of Early to Late Permian age which is correlative with the Assistance and Trold Fiord Formations. These strata change facies to cherty limestones and shales of the Degerbols and Van Haven Formations to the north. South of the fault zone only the uppermost portion of the Lower Permian carbonate and the Assistance Formation are exposed.

Mesozoic Strata - The initial Mesozoic deposits are interbedded shale, siltstone and very fine-grained sandstone (marine shelf origin) of Early Triassic age. The strata are assigned to the Blind Fiord Formation and thicken from 100 m at Lake Hazen to 425 m north of the Lake Hazen Fault Zone. The Blind Fiord Formation is absent over the Tanquary High (Nassichuk and Christie, 1969) where the Heiberg Formation is the basal Mesozoic unit.

The Schei Point Formation unconformably overlies the Blind Fiord Formation. In general older units occur at the base of the Schei Point Formation in a northward direction. The Formation consists of shales and limestones; at least two regional unconformities have been recognized within the Schei Point Formation.

The Heiberg Formation conformably overlies shales of the Schei Point Formation and near the head of Tanquary Fiord it rests directly on lower Paleozoic strata. The Heiberg Formation consists predominantly of fine-grained sandstone with interbedded siltstone and carbonaceous shale and is of deltaic origin. It thickens from 22 m at Lake Hazen to 500 m at Tanquary Fiord and is latest Traissic to earliest Jurassic in age.

The overlying Jurassic-Cretaceous strata consist of a succession of alternating sandstone and shale units. Unconformably overlying the Heiberg Formation in the Lake Hazen region are 10 m of Lower Jurassic shale conformably overlain by 55 m of fine to coarse-grained marine sandstone also of Early Jurassic age (Jaeger Formation). A distinctive white, fine to medium-grained sandstone unit (60 m) of Middle Jurassic age unconformably overlies the Early Jurassic sandstone. At Tanquary Fiord a shale unit intervenes between these two sandstones and the lower contact with the Jaeger Formation appears to be conformable.

The Middle Jurassic sandstone unit is conformably overlain by 100 m of dark grey, silty shale of the Ringnes Formation (lower Upper Jurassic). These shales are in turn conformably overlain by 120 m of fine to coarse-grained sandstone of the Awingak Formation.

The overlying Deer Bay Formation is 350 m thick in the Tanquary Fiord area and consists of silty shale and siltstone. The Deer Bay Formation in the Lake Hazen area is only 30-40 m thick and unconformably overlies the Awingak Formation.

At Lake Hazen the Deer Bay Formation is unconformably overlain by 40 m of deltaic sandstone of the Isachsen Formation which thickens to 200 m at Tanquary Fiord and there it conformably overlies the Deer Bay Formation. The Isachsen Formation is conformably overlain by the Christopher Formation which consists of shale and siltstone. The latter is 720 m thick in the Lake Hazen region but only the basal portion is preserved at Tanquary Fiord. At Lake Hazen the Christopher Formation is conformably overlain by 40 m of fluvial-deltaic sandstone and numerous basalt flows of the Hassel Formation (late Albian), youngest formation in the core of the syncline in the hangingwall thrust plate (p. 7). The Kanguk Formation, an Upper Cretaceous shale unit which overlies the Hassel Formation on western Ellesmere Island, may possibly be present in the footwall between the Eureka Sound Formation and the Hassel Formation.

In summary a substantial and complex section of Mesozoic strata occurs in the study area. The strata can be directly compared with the Mesozoic section of the main Sverdrup Basin to the west. The alternating succession of sandstone and shale units contains numerous facies changes and unconformities.

<u>Tertiary strata</u> - The Tertiary strata of the Lake Hazen region have been studied in detail by Miall (1979). He assigned all the strata to the Eureka Sound Formation and recognized two informal members. The lower of the two, the sandstone-mudstone member, consists of interbedded fine to medium-grained sandstone, siltstone, shale and coal of fluvial origin. The member is widespread in the Lake Hazen basin and is estimated to be 450 m thick. The upper conglomerate member, 450 m thick, consists mainly of conglomerate with subordinate sandstone. This member represents alluvial fan deposits derived from uplifts along the Lake Hazen Fault. The Eureka Sound Formation in the area is dated as Eocene to possibly Oligocene by Miall (1979). The conglomerate member may possibly be Miocene in age on the basis of a pine cone occurrence reported by Blackadar (1954).

PART 3

MINERAL AND FUEL RESOURCE ASSESSMENTS

1. METALLIC MINERALS

Methodology

Assessments of mineral potential were made using techniques developed in earlier studies (Geological Survey of Canada, 1980a, b). Unlike earlier studies (e.g. Geological Survey of Canada, 1980b) the process used here did not attempt to assign ratings or judgments of the potential for economic development of undiscovered mineral deposit-types that may be present in the area.

The assessment process thus involved subjective judgments as to the potential for occurrence of deposits containing the various metals and commodities considered, without regard to the potential such undiscovered deposits may or may not have for eventual economic development.

The geology of the area was considered from the viewpoint of whether or not it showed recognizable geological characteristics (rock types, lithological characteristics, depositional or intrusion environments, etc) that suggested a potential for particular deposit-types or commodities. Geological criteria for these deposit-types or commodities have been described in an earlier publication (Geological Survey of Canada, 1980b).

The assessments presented here for the various commodities considered should be regarded as indicative only; their resolution and refinement to yield more accurate and predictive values requires considerably more detailed information than is presently available.

Assessment results

Resource assessments for a wide variety of commodities have recently been published for northern Canada, including the proposed northern Ellesmere Island park area (Geological Survey of Canada, 1980a, b). Since these studies were completed, an improved appreciation of the geology of the northwestern magmatic belt has emerged (Trettin, 1981b) and correspondingly better metallic mineral assessments for some commodities can now be made. Geological information on the Paleozoic geology of Hazen Trough and the post-Ellesmerian Orogeny sediments in the entire park area has, however, remained unchanged; consequently statements regarding resource assessments for these areas will be paraphrased from the previous reports.

Gold

Northwestern Magmatic Belt

"The rocks in this area are a eugeosynclinal assemblage that includes felsic and intermediate flows and breccias, tuffs, and tuffaceous sediments. The rocks probably represent an environment that has a moderate potential for gold deposits" (Geological Survey of Canada, 1980b, p. 78).

Copper

Hazen Trough

A low possibility exists of sedimentary copper deposits in the Grant Land Formation (Units Cgl; COgl,h; see Fig. 1). Geological Survey of Canada personnel, during the course of a uranium reconnaissance survey in 1979, noted a large, 10 m diameter copper stain on a cliff face of Grant Land Formation, outside the proposed park area, on the north side of the middle branch of Stepanow Creek (lat. 81°09'; long. 81°01'30"). They were not able to examine this mineralization in place, hence the origin and significance of the occurrence is unknown but it does confer some degree of copper potential to the Grant Land Formation.

Northwestern Magmatic Belt

The small occurrence of tennantite reported by Trettin (1981 a) is the only known copper occurrence in the proposed park area. The occurrence itself may be economically insignificant but, in view of the virtual absence of extensive mineral exploration in the area, could be regarded as geologically significant in that it at least signifies the presence of base metals in the region. Additionally, geological features of this belt appear favourable for the occurrence of a variety of copper deposit-types. Felsic Early Devonian high level, intrusive rocks (Unit 16) might be favourable for the occurrence of porphyry, miscellaneous vein and replacement, and skarn type copper deposits. Subaqueous felsic volcanic sequences such as Units 7 & 10 could contain volcanogenic base metal (including copper) sulphide deposits.

Molybdenum

Hazen Trough

There is a speculative and remote possibility of economic concentrations of molybdenum in "starved shale" facies of Ordovician Hazen Formation (Unit Oh; parts of COgl,h, and OSh,i)

Northwestern Magmatic Belt

Even though no molybdenum occurrences have been reported in this region, the complex geology and presence of felsic intrusions indicate that porphyry, vein, and skarn type molybdenum deposits might occur.

Lead-zinc

Hazen Trough

The high to very high potential for certain units in the Hazen Trough to contain lead-zinc deposits has been discussed in previous publications (Geological Survey of Canada, 1980b; Sangster, 1981) and is summarized here.

The Grant Land Formation (Units Cgl and part of COgl,h) is a basal, feldspathic quartzite "derived from a metamorphic-plutonic terrane of sialic composition" (Trettin, 1971, p. 31). Paleogeographic reconstruction, based on paleomagnetic evidence, would place deposition of the Grant Land Formation in a low-latitude environment. These attributes favour the occurrence of "sandstone-type" lead-zinc deposits.

The overlying Hazen Formation (Units Oh; parts of COgl,h and OSh,i), consisting of a "starved basin" facies of shales, radiolarian cherts, and carbonates, occurs within a fault-bounded trough. There is, moreover, little doubt that northwestern Ellesmere Island was an area of anomalously high geothermal and tectonic activity during the Ordovician (cf. volcanic members of Units 7 and 10). Within Hazen Trough slump breccias occur within Hazen Formation, suggesting synsedimentary tectonic instability. All these features (low sedimentation rate, synchronous volcanism, and synsedimentary faulting) combine to impart a high lead-zinc potential to the Hazen Formation.

Northwestern Magmatic Belt

The thick sequences of submarine volcanic rocks in Unit 7 and 10, containing portions of felsic to intermediate composition, render these units favourable for the occurrence of volcanogenic Cu-Pb-Zn massive sulphide deposits.

Several features combine to invite metallogenic comparison of these units with those hosting the polymetallic, volcanogenic, massive sulphide deposits of New Brunswick. Similarities include:

1. Age of host rocks (Ordovician).
2. Volcanic belts rest on sedimentary sequences floored by sialic crust.
3. The volcanic rocks are intercalated with marine sedimentary rocks.
4. A middle Ordovician period of deformation, plutonism, and metamorphism, noted by Trettin and Balkwill (1979, p. 752) is unique in the entire Arctic Islands and coincides very closely in age with the Taconic orogeny in New Brunswick.

Thick carbonate units, such as the Ayles and Zebra Cliffs Formations (part of Unit 8) and the Marvin Formation (Unit 13) are potential sites for carbonate-hosted lead-zinc deposits. Two crucial features must be present in order to impart a high potential to these units: 1. the carbonate rocks should be largely dolomite, and 2. the carbonate rocks should underlie an unconformity or disconformity. By these criteria, Marvin Formation is eliminated because it is largely limestone; Zebra Cliffs and Ayles Formations are dolomite and the former is overlain, with low angular unconformity (Trettin, 1981b, p. 103), by an unnamed unit of immature sandstone. The tennantite occurrence mentioned previously (see under copper) occurs in the Zebra Cliffs dolomite below this unconformity.

Both the Ayles and Zebra Cliffs Formations are (or were) unconformably overlain by post-Ellesmerian Orogeny sedimentary rocks (Unit 17) inasmuch as sedimentation dominated this part of the Arctic Islands from Early Carboniferous time onward (Trettin and Balkwill, 1979). Outliers of these sedimentary rocks occur within the proposed park area. The most likely region for Unit 17 to overlie (or to have overlain) carbonate rocks of Unit 8 is in a 50-70 km wide belt beginning southeast of M'Clintock Fiord and continuing northeasterly to the opposite side of the proposed park. This belt, therefore, could be considered to have at least moderate potential to contain a carbonate-hosted lead-zinc deposit.

By the same token, metamorphosed carbonate-bearing sequences of Units 4 and 5 (possibly Early Paleozoic), Unit 3 (possibly Hadrynian), and Unit C (age uncertain) should be regarded as having a low to moderate potential to contain lead-zinc deposits.

Summary

A literature survey, without benefit of field checks, has yielded assessments for the following metallic commodities.

1. Lead-zinc

   A high potential exists for undiscovered lead-zinc deposits in the Grant Land and Hazen Formations in the Hazen Trough portion of Fig. 1. A moderate potential rating for volcanogenic massive sulphide deposits (Units 7 and 10) and carbonate-hosted deposits (Units 3, 4, 5, 8, and C) is assigned to the northwestern magmatic belt in Fig. 1.

2. Copper

   In the northwestern magmatic belt, some copper could occur in undiscovered volcanogenic deposits in Units 7 and 10. A low potential can also be assigned to granitic intrusions of Unit 16.

   Within Hazen Trough, the Grant Land Formation is considered to have no more than a low potential for copper.

3. Gold

   A moderate potential for undiscovered gold deposits is assigned to the northwestern magmatic belt.

4. Uranium, molybdenum, nickel, chromite, asbestos, and platinum are all regarded as having a very low potential for occurrence within the proposed park area (Geological Survey of Canada, 1980b).

2. OIL AND GAS

The level of oil industry exploration in this area has been very low. Several surface geological mapping projects have been conducted but no geophysical exploration using seismic, gravity, or magnetic methods has been done. The closest well drilled to test for oil or gas is Gulf et al. Neil M-40, located on Neil Peninsula, southwest Ellesmere Island, 140 km southwest of the proposed park boundary.

Most pre-Ellesmerian Orogeny sedimentary rocks in the area have undergone low grade metamorphism, with the level of metamorphism increasing to the northwest, resulting in any potential source rocks being placed into the overmature category. Although there are abundant fine-grained clastic rocks which could serve as source beds and seals, their potential as a source rock must be downgraded because of this overmaturity. Abundant structures are present throughout the area, but lack of demonstrable reservoir quality rock is an additional factor in downgrading the resource potential, particularly in the northwestern magmatic belt. The Grant Land Formation contains coarse-grained sandstones and conglomerates but their reservoir qualities and extent in the subsurface are unknown.

The Upper Paleozoic to Tertiary strata are relatively undeformed in some areas and have been, and still are, at sufficient depths to have generated, trapped and retained hydrocarbons. The petroleum potential of these strata is evaluated on data from surface geological studies carried out in this area by U. Mayr and A.F. Embry of the Geological Survey of Canada and on comparisons with known hydrocarbon occurrences in the main Sverdrup Basin to the southwest. No geophysical or geochemical data are available to supplement these studies.

Upper Paleozoic - North of the Lake Hazen Fault Zone the Upper Paleozoic strata are highly deformed and are exposed at the surface. In this area the strata have no petroleum potential. Southward, in the Lake Hazen basin, the Upper Paleozoic strata are relatively undeformed and are buried to depths exceeding 3000 m. In this area the Upper Paleozoic strata consist primarily of conglomerate, sandstone and bioclastic limestone and dolomite. Interbedded shale, siltstone and lime mudstone are undoubtedly present but are subordinate to the coarse-grained lithologies. The strata contain good reservoir rocks and adequate seals but it is unlikely that good hydrocarbon source rocks would be present. However, black, fetid dolomite, limestone and shale are common in the outcropping Upper Paleozoic succession to the north, and these strata are excellent candidates for source beds. Hydrocarbons were likely generated during the Mesozoic when the Upper Paleozoic strata were buried to sufficient depths. A portion of the generated hydrocarbons may have migrated up dip to marginal areas such as the Lake Hazen region. The hydrocarbons could have been pooled in structural (mainly fault related) and stratigraphic (porosity pinch outs in shelf carbonates, barrier bars, bioherms) traps prior to Tertiary deformation. The likelihood that the Mesozoic strata overstepped the Upper Paleozoic strata shelfward enhances such prospects. Such a scenario is supported by hydrocarbon shows in marginal Upper Paleozoic strata elsewhere in the Sverdrup Basin (e.g. tar sands in the Canyon Fiord Formation on southern Sabine Peninsula, Melville Island).

Mesozoic - The Mesozoic strata in the Lake Hazen region have petroleum potential because they are relatively undeformed, contain numerous reservoir, seal, and source beds and are stratigraphically complex due to facies changes and unconformities. The main reservoir horizons would be the Schei Point sandstones, Heiberg Formation, Jaeger Formation and Middle Jurassic sandstone unit. The sandstones in all of these units are very porous, are intercalated with adequate seals and are probably within the mature zone of hydrocarbon generation. Potential source rocks are more difficult to assess due to a lack of geochemical data. Shale units within the Schei Point Formation are the main source rocks of the western Sverdrup Basin where giant oil and gas fields have been found. Stratigraphically equivalent shale units are present within the Lake Hazen area and have been buried to sufficient depth over portions of the area to have potentially generated hydrocarbons. In fact, hydrocarbon generation and migration may have taken place during the Tertiary when the Triassic sediments were buried to sufficient depths and would have coincided with the formation of Tertiary structures. Assuming a Schei Point source the main targets would be sandstones within the Schei Point Formation and the Heiberg Formation (the reservoir for almost all of the discovered hydrocarbons in the Sverdrup Basin). It is worth noting that an outcrop of bitumen saturated sandstone in the Jaeger Formation has been observed on the shores of Lake Hazen. This observation is a good indication that hydrocarbons have indeed been generated in this area.

Tertiary - The Tertiary strata in the Lake Hazen area are considered to have no petroleum potential because they lack adequate source beds and seals and very likely have been flushed by fresh water.

Conclusions - Upper Paleozoic and Mesozoic strata in the Lake Hazen basin have moderate potential to contain hydrocarbon pools. All the necessary attributes (reservoirs, seals, source beds and trapping configurations) appear to be present within these strata. A seismic survey to ascertain the nature, size and distribution of structural traps would be necessary to determine whether fields of sufficient size and number occur in the area.

3. COAL

Inasmuch as scattered outcrops of continental post-Ellesmerian Orogeny sedimentary rocks (Units 17 and CPMT) occur throughout the proposed park area, undiscovered coal occurrences are a real possibility. This is particularly true of the northwestern magmatic belt where the younger sedimentary strata have only recently been mapped (Trettin, 1981b).

The largest known coal seam in the area (that at Watercourse Valley; see p. 3) is at least 6 m thick. Because its base is not exposed it could be considerably thicker and contain additional resources.

4. SOAPSTONE

Parts of Unit 15 in the northwestern magmatic belt are known to contain serpentinite, the main material used in soapstone carvings. Although Frisch (1974; pers. communication, 1981) refers to widespread shearing and cataclastic texture in these rocks, which probably decreases their suitability for carving, there is a possibility that some small relatively undeformed, serpentinite masses could be found in this unit.

5. GYPSUM

The potential for undiscovered deposits of gypsum, similar to those known near the head of Clements Markham Inlet (Map 1), to occur in other areas of Unit 17 must be considered excellent.

The gypsum body near M'Clintock Inlet (Map 1), described as a lens within andesitic flows and breccias of Unit 7 (Christie, 1964) is a somewhat unusual occurrence. As gypsum is not normally found in volcanic rocks, the potential for further occurrences of this type is regarded as low.

6. AMBER

The close association between the occurrence of coal and that of amber (see p. 3) suggests that, should additional coal seams be found in the northwestern magmatic belt, they may also contain undiscovered amber deposits, some of which might be of suitable quality for use in jewelry.

PART 4
RECOMMENDATIONS

1. Metallic minerals

Inasmuch as the entire proposed park area has never been properly examined for metallic mineral resources, it is suggested that this be done. The examination could take the form of geophysical and geochemical surveys combined with local detailed geological mapping. Based on the preceding assessments specific attention should be paid to the following:

1. The Grant Land and Hazen Formations in Hazen Trough for lead-zinc and copper.
2. Granitic intrusions (Unit 16) and immediate surroundings in the northwestern magmatic belt for copper.
3. Volcanic rocks, particularly the felsic portions, in Units 7 and 10, in the northwestern magmatic belt for Cu-Pb-Zn.

2. Oil and gas

Because most of the proposed park is judged to have only low potential for oil and gas accumulation, it has attracted scant industry interest. Moreover, it is logistically a difficult area to explore. Further clarification of reservoir parameters and the extent of sands and carbonates within the lower Paleozoic rocks and a regional study of source maturity should, however, be undertaken to improve the information base for more accurate assessment.

The area east of Lake Hazen (see Fig. 1) is classified as moderate potential. In order to make a quantitative assessment, the following programs should be completed:

1. Detailed mapping of the Mesozoic sequence around Lake Hazen and its relationship to the overthrust sheet of Ordovician sediments.
2. A detailed seismic program over the areas of Mesozoic and Tertiary deposits and the fault zone, to determine closures and trapping mechanisms.
3. Drilling a well, depending on results of the above two programs.

3. Coal

Coal is the only mineral resource known to have been exploited in the proposed park area. Consequently, to secure a better assessment of the undiscovered resources of this commodity in northern Ellesmere Island, two recommendations may be offered:

1. Examination of all reported occurrences of post-Ellesmerian Orogeny sedimentary rocks for evidence of coal followed, where warranted, by drilling to obtain unweathered samples for analysis and to determine thickness and lateral extent.
2. More detailed study, including drilling of the largest known seam, that in Watercourse Valley, to determine its full thickness and lateral extent.

4 Soapstone

The entire area of Unit 15 (M'Clintock Inlet area) should be examined, particularly the interior portions of the intrusions, to locate possible zones of relatively unsheared, homogeneous serpentinite suitable for carving.

5. Amber

From the close association between amber and coal (p. 3), follow-up programs designed to assess post-Ellesmerian Orogeny sediments for undiscovered coal occurrences could, at the same time, assess the amber potential of these rocks.

All known amber occurrences should be sampled and representative samples sent to a competent gemmologist for appraisal of its use for jewelry. The occurrences near Lake Hazen are very likely the most significant amber deposits in Canada. Inasmuch as amber is in very short supply in the world today, some thought could perhaps be given to collecting the amber on Lake Hazen beach before the area officially becomes a park. Plenty of amber would still remain in place in the nearby coal seams.

PART 5

REFERENCES

Blackadar, R.G.
1957: Geological reconnaissance, north coast of Ellesmere Island, Arctic Archipelago, Northwest Territories; Geological Survey of Canada, Paper 53-10, 22 p.

Christie, R.L.
1964: Geological reconnaissance of northeastern Ellesmere Island, District of Franklin; Geological Survey of Canada, Memoir 331, 79 p.

Frisch, T.
1974: Metamorphic and plutonic rocks of northernmost Ellesmere Island, Canadian Arctic Archipelago; Geological Survey of Canada, Bulletin 229, 87 p.

Geological Survey of Canada
1980a: Preliminary mineral resource appraisal of parts of Yukon and Northwest Territories including proposed northern parks areas; Geological Survey of Canada, Open File 691, 86 p.

1980b: Non-hydrocarbon mineral resource potential of parts of northern Canada; Geological Survey of Canada, Open File 716, 376 p.

Miall, A.D.
1979: Tertiary fluvial sediments in the Lake Hazen intermontane basin, Ellesmere Island, Arctic Canada; Geological Survey of Canada, Paper 79-9, 25 p.

Nassichuk, W.W. and Christie, R.L.
1969: Upper Paleozoic and Mesozoic stratigraphy in the Yelverton Pass region, Ellesmere Island, District of Franklin; Geological Survey of Canada, Paper 68-31, 31 p.

Sangster, D.F.
1981: Three potential sites for the occurrence of stratiform, shale-hosted lead-zinc deposits in the Canadian Arctic; in Current Research, Part A, Geological Survey of Canada, Paper 81-1A, p. 1-8.

Sinha, A.K. and Frisch, T.
1976: Whole-rock Rb/Sr and zircon U/Pb ages of metamorphic rocks from northern Ellesmere Island, Canadian Arctic Archipelago. II. The Cape Columbia Complex; Canadian Journal of Earth Sciences, vol. 13, p. 774-780.

Trettin, H.P.
1969a: Geology of Ordovician to Pennsylvanian rocks, M'Clintock Inlet, north coast of Ellesmere Island, Canadian Arctic Archipelago; Geological Survey of Canada, Bulletin 183, 93 p.

1969b: Pre-Mississippian geology of northern Axel Heiberg and northwestern Ellesmere Islands, Arctic Archipelago; Geological Survey of Canada, Bulletin 171, 82 p.

1971: Geology of lower Paleozoic formations, Hazen Plateau and southern Grant Land Mountains, Ellesmere Island, Arctic Archipelago; Geological Survey of Canada, Bulletin 203, 134 p.

1981a: A tennantite deposit in the M'Clintock Inlet area, northern Ellesmere Island, District of Franklin; in Current Research Part A, Geological Survey of Canada, Paper 81-1A, p. 103-106.

1981b: Unpublished notes and maps of lower Paleozoic and older rocks, northeast Ellesmere Island.

1981c: Geology of Precambrian to Devonian rocks, M'Clintock Inlet area, District of Franklin; Geological Survey of Canada, Open File 759.

Trettin, H.P. and Balkwill, H.R.
1979: Contributions to the tectonic history of the Innuitian Province, Arctic Canada; Canadian Journal of Earth Sciences, vol. 16, p. 748-769.

Trettin, H.P. and Frisch, T.O.
1981: Preliminary geological maps and notes, Yelverton Inlet map-area, District of Franklin; Geological Survey of Canada, Open File 758.

Trettin, H.P. and Mayr, U.
1981: Preliminary geological map and notes, parts of Otto Fiord and Cape Stallworthy areas, District of Franklin; Geological Survey of Canada, Open File 757.

Parks Canada   Parcs Canada

Ellesmere and Axel Heiberg Island – A Natural Area of Canadian Significance

Cover photo:
Several hundred glaciers, some up to 40 kilometres in length, are located in this Natural Area of Canadian Significance

QS - 7056-050-EE-A1

Les rapports sur les réserves projetées pour des parcs nationaux sont également publiés en français.

Ellesmere and Axel Heiberg Island - A Natural Area of Canadian Significance

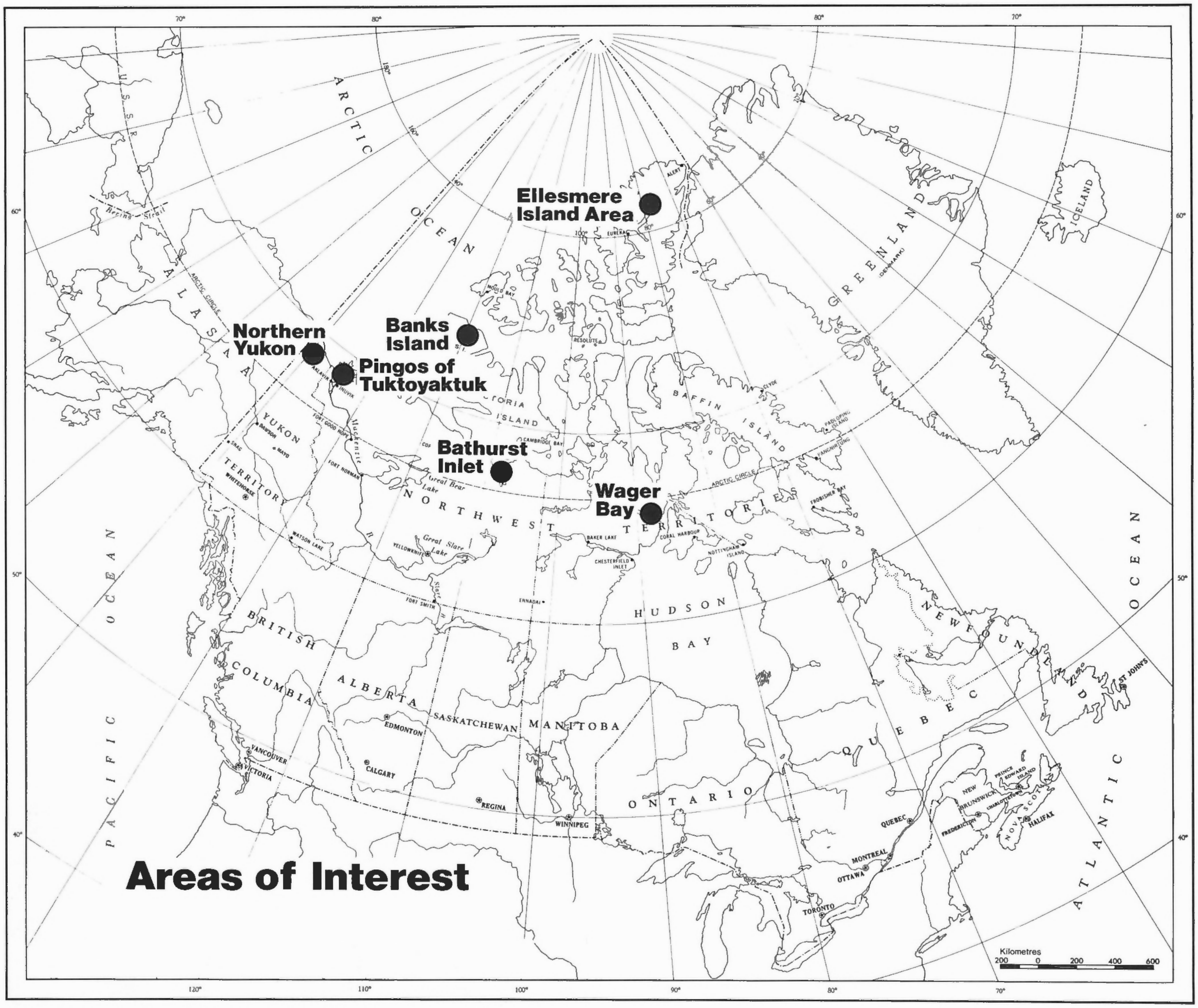
Contents

Introduction

Natural Areas of Canadian Significance are areas which have been identified for preservation in a natural state and are representative of the major natural environments of Canada. They are special places which should be protected as a part of the heritage of all Canadians, now and in the future. The identification and protection of our important natural heritage areas cannot await or accommodate the advances of competing land uses. Action is required while the opportunities exist if the heritage of the past is to be passed on to the future.

Of course, there are many, many different landscapes in Canada, each with its own unique features that inspire love and pride in the hearts of Canadians. To identify the variety of Canada's landscapes, Parks Canada has divided the country into 48 natural regions. It is the aim of Parks Canada to set aside, in each of the 48 regions, an area of outstanding scenery or distinct features, that best portrays the region. So far only 18 of the natural regions have representative parks. Of the 30 regions without parks, 15 are at least partly in the Yukon and the Northwest Territories. Parks Canada, in its effort to further the completion of the national system of parks, has recently identified 6 of the more impressive natural heritage areas worthy of consideration for new parks. They are:

1. Ellesmere and Axel Heiberg Islands
2. Wager Bay
3. Northern Yukon
4. Banks Island
5. Pingos of Tuktoyaktuk
6. Bathurst Inlet


Areas of Interest
Ellesmere Island Area
Banks Island
Northern Yukon
Pingos of Tuktoyaktuk
Bathurst Inlet
Wager Bay
ARCTIC OCEAN
PACIFIC OCEAN
ATLANTIC OCEAN
HUDSON BAY
NORTHWEST TERRITORIES
YUKON TERRITORY
BRITISH COLUMBIA
ALBERTA
SASKATCHEWAN
MANITOBA
ONTARIO
QUEBEC
NEWFOUNDLAND
ALASKA
GREENLAND
ICELAND
VICTORIA ISLAND
BAFFIN ISLAND
Kilometres

The Site

Twenty-five hundred kilometres (1600 miles) northeast of Yellowknife lies Ellesmere Island, the most northerly lands in Canada. Dominated by mountains, fiords, icefields and glaciers these lands, together with an area on Axel Heiberg Island, are lands of long harsh winters and brief cool summers, of cold dry winds and very light snowfalls.

To represent this region of perpetual ice and snow, with its tenacious flora and fauna, Parks Canada has identified a Natural Area of Canadian Significance.

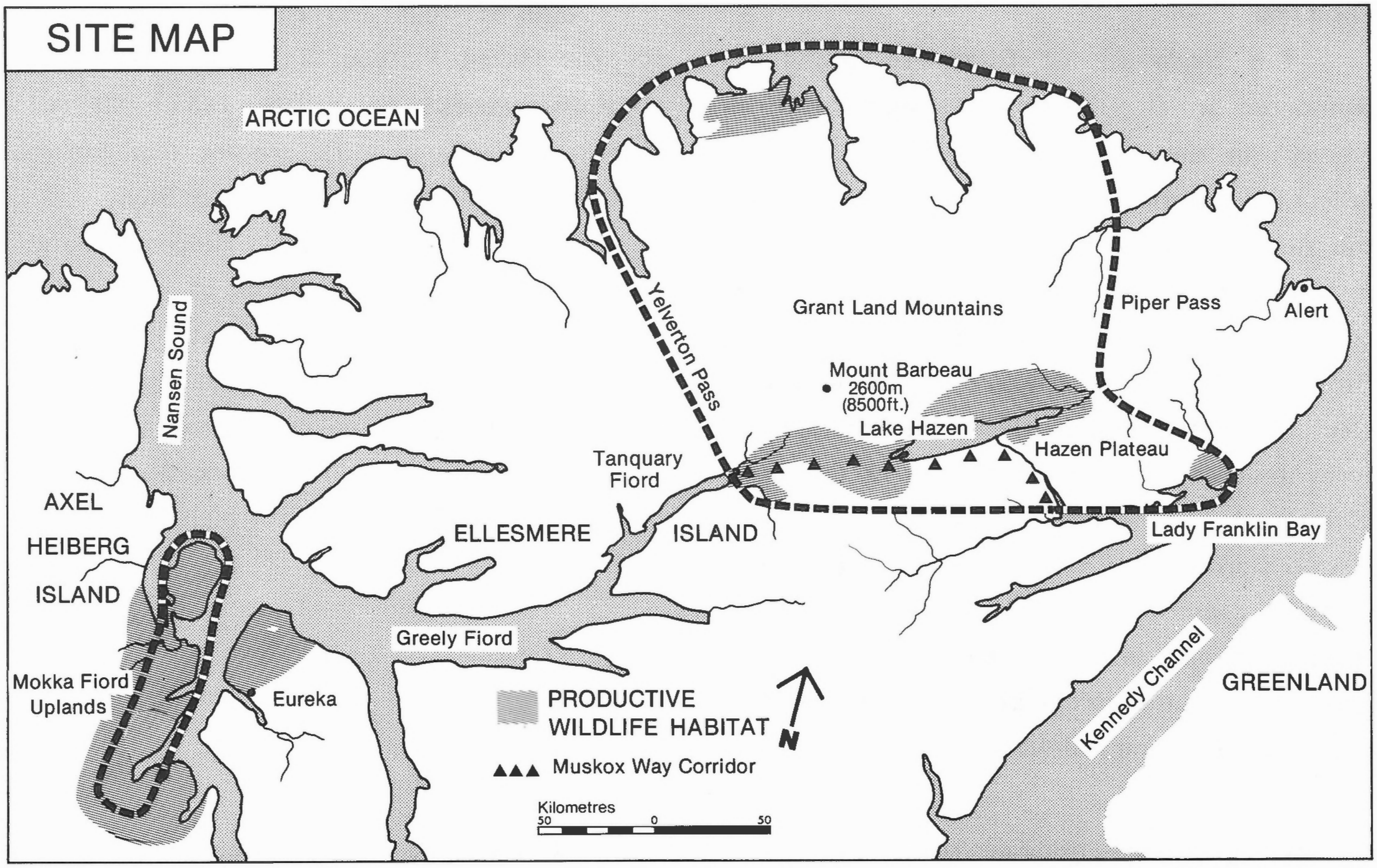
This area of interest is located on the Mokka Fiord Uplands of Axel Heiberg Island, and on a portion of Ellesmere Island that is dominated by the Grant Land Mountains and Lake Hazen Plateau.

The combined area of these two sites would be about 33 800 km^2 (13,500 sq. miles); however, their final boundaries have not been determined.

1 Rock formations near Buchanan Lake

2 Grant Land Ice Cap.

1


SITE MAP
ARCTIC OCEAN
Nansen Sound
Yelverton Pass
Grant Land Mountains
Piper Pass
Alert
Mount Barbeau
2600m
(8500ft.)
Lake Hazen
Hazen Plateau
Tanquary
Fiord
AXEL
HEIBERG
ISLAND
ELLESMERE
ISLAND
Lady Franklin Bay
Greely Fiord
Mokka Fiord
Uplands
Eureka
PRODUCTIVE
WILDLIFE HABITAT
N
▲▲▲ Muskox Way Corridor
Kennedy Channel
GREENLAND
Kilometres
50
0
50

2

The Land

The landscape of Ellesmere Island is dominated by ice. There are several hundred glaciers in the area, some up to 40 km (25 miles) long, with long tongues that stretch into the valleys and fiords. Mount Barbeau (2 600 m), the highest of the Grant Land Mountains and the highest mountain in eastern North America, towers over massive ice fields which stretch almost continuously to the passes that form the east and west boundaries of the area of interest. The north coast is broken by ice-strewn fiords. "Ice shelves" that cling to the northern coast are thought to be the result of sea-ice freezing to the shoreline and remaining fast owing to the combination of great winter cold and low summer melt.

South of Mount Barbeau lies Lake Hazen and the Hazen Plateau, a rolling stream-cut plain, that varies in height from 165 m (500 ft.) near Lake Hazen to cliffs greater than 900 m (3,000 ft.) overlooking Lady Franklin Bay.

Mokka Fiord on Axel Heiberg Island differs from the rugged fiords of the Grant Land Mountains area. Bounded at the sea by gentle slopes, the land rises gradually to the prominent hills of the uplands, creating a more hospitable terrain for a large concentration of the few species that inhabit the high arctic.

1

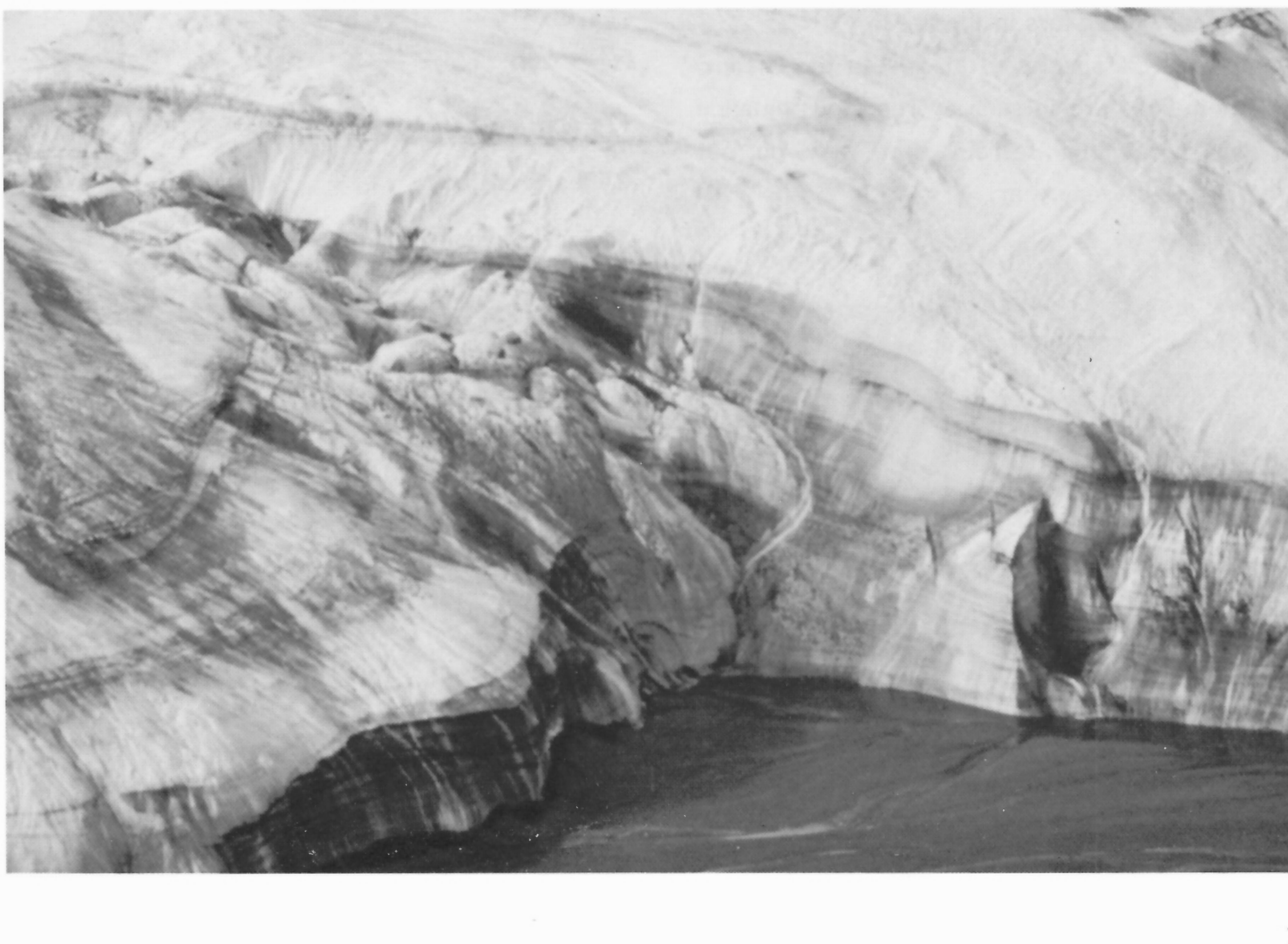
2

1 Archer Fiord

2 Hazen Plateau

3 Henrietta Nesmith Glacier

3



Wildlife and Vegetation

Owing to its long harsh winters, brief cool summers and very low precipitation, most of the area that is not covered in ice and snow is polar desert, windswept and arid, with few plants and consequently little animal life.

Yet, despite the severe climate, there are a few sheltered spots moist enough to support vegetation and maintain a vigorous animal community. The areas around Mokka Fiord and Lake Hazen are examples of such spots.

These sites are known for their large populations of Arctic hare, which often gather in the hundreds. Small herds of musk oxen roam where there is suitable food, and Peary caribou can be found in small groups throughout the region. Wolves, Arctic fox and polar bears are the primary predators in the area.

About 30 species of birds visit the Islands, but their lives are in such a precarious balance in this forbidding terrain that they do not always breed every year.

1 Polar wolf

2 Peary caribou

3 Arctic hare herd

1

2

3

Human History

Remains of ancient cultures discovered in the area have allowed historians to piece together the story of a migratory people who, about 4 000 years ago, crossed Ellesmere Island on their way from the mainland barren grounds to Greenland. It was warmer then, and it is thought that these hunters followed the musk oxen as they migrated north. The route they travelled is now called The Musk Ox Way. Crossing the area, the route is of great interest to archaeologists, for it promises to yield valuable evidence of prehistoric times on this continent.

The first Europeans to reach the area were searching for the Sir John Franklin Expedition, lost in 1845, on its search for the Northwest Passage. Expeditions in 1854 and 1871 began mapping Ellesmere Island, and in 1875 the H.M.S. Alert and Discovery established a base at Fort Conger from which to make sled journeys inland and across to Greenland. Subsequent expeditions also used the quarters at Fort Conger and remains of the buildings are still perched on the rocky terrain.

Today the closest Inuit community is Grise Fiord, the northernmost settlement in Canada, about 400 km (240 miles) from Mokka Fiord and 560 km (350 miles) from Tanquary Fiord. Occasionally hunting parties from this area travel as far as Lake Hazen, but generally these portions of Ellesmere and Axel Heiberg Islands are not used by the Inuit.

The north coast of Ellesmere Island was not mapped completely until 1906. From that time the area has attracted the daring and the adventurous, mountain climbers and modern-day explorers, attempting to reach the North Pole.

1

2

1 Fort Conger

2 Headboards at Fort Conger

3 Archaeological site at Lake Hazen

3

1

2

1 Escarpments near Tanquary Fiord

2 Lake Hazen

If you would like to receive or contribute information on any of the six areas or to comment on their establishment as parks, please write to Parks Canada at one of the following addresses:

Director,
Parks Canada Prairie Region,
114 Garry Street,
WINNIPEG R3G 1G1
Manitoba.

or

Director,
National Parks Branch,
Parks Canada,
400 Laurier Avenue, West,
OTTAWA K1A 0H4
Ontario.