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NON-HYDROCARBON MINERAL RESOURCE POTENTIAL OF PARTS OF NORTHERN CANADA

Preliminary resource assessments of parts of
Northern Yukon, Mainland Northwest Territories
and the Arctic Islands, including islands in Hudson Bay

PART I

METHODOLOGY AND SUMMARY ASSESSMENTS

PART II

DETAILED ASSESSMENTS AND APPENDIXES

(Includes text figure showing oil and gas
potential of parts of northern Canada)

DEPARTMENT OF ENERGY, MINES AND RESOURCES
GEOLOGICAL SURVEY OF CANADA

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

Ottawa, CANADA

November 1980
Price: $20.00

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by

Economic Geology Division

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DETAILED ASSESSMENTS AND APPENDIXES

(Includes text figure showing oil and gas potential
of parts of northern Canada by Institute of
Sedimentary and Petroleum Geology,
Geological Survey of Canada)

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PART I

METHODOLOGY AND SUMMARY ASSESSMENTS

NON-HYDROCARBON MINERAL RESOURCE POTENTIAL OF PARTS OF NORTHERN CANADA

Summary and Conclusions

1. This report presents subjective assessments of the potential of parts of northern Canada to contain resources of uranium, gold, silver, copper, nickel, lead-zinc, iron, molybdenum, and some industrial minerals, in addition to resources of those commodities already known. The assessments vary greatly in detail and degree of confidence, reflecting mainly the variations in current state of the geological information base of the areas in question. For these and other reasons the assessments presented herein are considered preliminary and, in most cases, much additional work will be required before more accurate assessments can be made.

2. The area involved in this study includes the extreme northern part of Yukon Territory, the northwest coastal part of Northwest Territories including Mackenzie Delta and adjacent areas, the northeastern part of the District of Mackenzie, all of District of Keewatin including islands in Hudson Bay and all of the Arctic Islands (District of Franklin). In total, the study region encompasses about 1.2 million square miles of landmass.

3. The study area has been subdivided into seven major regions and a total of 77 individual areas within the major regions. For the most part the major regions are defined by *geographic* characteristics, while the individual areas are outlined on the basis of *geological* continuity. Local exceptions to this scheme occur, particularly in boundary areas between major regions. The major regions are:

   I Northern Yukon and Northwestern Mackenzie Region
   II Western Arctic Islands Region
   III Northern Arctic Islands Region
   IV Central Arctic Region
   V Northeastern Mackenzie District
   VI Keewatin Region
   VII Eastern Arctic Islands and Hudson Region (includes islands in Hudson Bay)

4. Maps 1 and 2 accompanying this report show the major regions, individual areas assessed, the locations of "proven" and "significant"[1] mineral deposits (Map 1) and the locations of other mineral occurrences (Map 2). The mineral deposit locations and coded information on Maps 1 and 2 were generated mainly from the CANMINDEX (Canadian Mineral Deposit Index) computerized file system and the relevant data for individual deposits and occurrences is contained in Appendixes 1A and 1B (Part II).

5. The mineral resource assessments were made on the basis of deposit-types using a subjective deposit-model analogy method. This means, essentially, that information on the geology and known mineral deposits/occurrences in an area is examined to determine if geological characteristics are present that satisfy the requirements for the particular deposit-type being considered and if known deposits (if present) represent examples of the "expectable" deposit types. Through a number of iterative steps an appropriate rating on a scale ranging from "nil" to "very high" is assigned, reflecting a subjective judgment of the probability that one or more deposits of the type being considered is present but undiscovered. This rating is called the Resource Potential rating. A second rating is then assigned that reflects subjective judgments as to the significance of the predicted but undiscovered deposits, in terms of deposit-model characteristics such as size, grade, commodities present, etc and in terms of other factors such as distance from transport facilities, infrastructure developments in the area/region, etc. This is called the Economic Development Potential rating. For the purposes of this study the timeframe for economic development has been taken as the next 20 years. Certain resources, chiefly iron, do not fit easily into the type of assessment methodology outlined above and, in such cases, slightly different subjective judgment techniques have been employed.

6. There are many difficulties inherent in the methodology used in assessments, and these are emphasized throughout the report. For the most part they can be related to one or more of four categories of uncertainty. These are:

   i) inadequacies in the geological information base;
   ii) inadequacies or incompleteness of deposit-type models;
   iii) unevenness in the quantity and quality of past exploration in areas, or in many cases, the absence of exploration;
   iv) uncertainties concerning future activities in the north that will affect the potential for economic development of deposits, if found.

7. The summary assessments for individual areas are presented in Section 4 (Part I) in tabular form. In these tables, the resource potential ratings are cast mainly in terms of commodities (gold, copper, iron, etc) rather than in terms of deposit-types. The detailed deposit-type assessments, from which the summary assessments of Section 4 are condensed, are given in Section 6 (Part II).

8. Following are the principal highlights of resource potential and economic development potential ratings derived in the course of this study. For identification of areas referred to, Maps 1 and 2 must be consulted. The numbers at the head of each section following refer to the Table identification in Section 4.

   4.I Northern Yukon and Northwestern Mackenzie Region

   The main commodity potential in this region is for uranium in British Mountains-Barn Uplift area (Area 1) and, to a lesser extent, in Mesozoic (Jurassic and Cretaceous) rocks of northern Porcupine Plateau (Area 2) and Richardson Mountains (Area 3). Note, however, that because of the types of deposits that might be expected, the potential for economic development is considered to be low. Areas 1 and 2 also have moderate potential for tungsten, based on reconnaissance geochemical survey results and on known mineralization associated with the Mt. Fitton pluton. There is considered to be some possibility (moderate) for additional gold (placer) occurrences in the Firth River-Sheep Creek area (1).

[1] "Proven" and "significant" mineral deposits have particular meanings in this report. These terms are defined in Section 2 (Part I). Descriptive summaries of "proven" and some "significant" deposits are provided in Section 5 (Part I).

4.II Western Arctic Islands Region

Little potential is apparent in this region, except for a low-moderate possibility for the occurrence of uranium associated with Proterozoic rocks of the Minto Arch (11). A low potential for silver is assigned to the same area (11).

4.III Northern Arctic Islands Region

The most significant points of interest in this region are the moderate to very high resource potential ratings assigned to lead-zinc or lead deposits of shale-type or sandstone type in rocks of the Hazen Trough of northern Ellesmere Island (14A) and equivalent or similar Paleozoic rocks in adjacent Franklinian Miogeosynclinal strata (14B) and in parts of area 15 (Sverdrup Basin) southwest of Hazen Trough. Also, moderate and very high potential ratings are assigned to the possibility of shale-type and carbonate-type lead-zinc deposits, respectively, in Franklinian strata (14B) of the Cornwallis Lead-Zinc District (see also Area 22, Central Arctic Region). In terms of potential for economic development, the shale-hosted and carbonate-type are assigned higher ratings than the sandstone-type because of expected higher grades. Particularly in the already-established Cornwallis Lead-Zinc District, additional carbonate-type deposits are considered to have a good potential for economic development.

A low to moderate copper potential, in several different deposit-type categories is assigned to parts of Area 15 (Sverdrup Basin Mesozoic rocks), Area 18 (Precambrian basement rocks of eastern Ellesmere Island) and Proterozoic strata of the Thule Basin sequence (18A).

4.IV Central Arctic Region

Precambrian volcanic rocks of the Prince Albert Group (Areas 31 and 33) are assigned a moderate to high potential for gold deposits and, if discovered, these should have a good potential for economic development. The western Prince Albert Group belt (31) is also considered to have a moderate potential for nickel and volcanogenic sulphide deposits, although the economic development potential for nickel is rated poor. Area 26 (also Prince Alabert Group rocks) has a similar nickel potential, but is considered to have a moderate to high potential for gold.

The known iron deposits (Melville East and Melville West) of Areas 31 and 33 are of good tonnage and grade and are considered to have a moderate potential for eventual development.

The Paleozoic strata in Area 22 flanking Boothia Uplift (23) have similarities to the Franklinian Paleozoic rocks (14B) of the Cornwallis Lead-Zinc District (Northern Arctic Islands Region) and are considered to have a moderate potential for carbonate-type lead-zinc deposits.

4.V Northeastern Mackenzie District

Overall, this district has considerable potential for the occurrence of deposits of uranium, gold, silver and volcanogenic massive sulphides (VMS) additional to those already known. Notable are the high resource potential and good economic development potential ratings assigned for uranium in Area 38 (Hornby Bay and Dismal Lakes groups), the moderate to very high ratings for gold in a number of areas, particularly 41A, 41D (Contwoyto Lake-Itchen Lake area), 44 and 45, and similar ratings for silver in Areas 39 (Great Bear Batholith-Hepburn Fold Belt) and 45 (Hope Bay-Elu Inlet). For volcanogenic massive sulphide deposits, felsic volcanic rocks of the Yellowknife Supergroup, particularly in Areas 41A, 41B and 41D are considered to have a very high potential. Possibilities are good for economic development if such deposits are discovered.

4.VI Keewatin Region

Like Northeastern Mackenzie District, Keewatin Region seems generally favourable, particularly for uranium and gold and to a lesser extent for copper and volcanogenic massive sulphide deposits in specific areas. Most notable are the high to very high resource potential and good economic development potential ratings assigned for uranium to several areas including the Thelon Sandstone Formation (47B), the Dubawnt Lake Gneisses (48B), the Baker Lake Basin Dubawnt Group rocks (49) and the Amer Group sediments (50). Southern Keewatin Region Archean greenstone belts of Areas 55, 58 and 62 are considered particularly favourable for gold and for volcanogenic massive sulphide deposits. In the case of the former belt (58 – Kognak River-Tavani) a moderate to high potential for copper is assigned, although this rating is influenced by the potential for copper occurring in volcanogenic massive sulphide deposits. Iron in Area 58 has been assigned a moderate resource potential rating.

4.VII Eastern Arctic Islands and Hudson Region

This region is considered to have some potential for gold, nickel, volcanogenic massive sulphide, lead-zinc, and iron, mainly on Baffin Island. On Baffin Island, the two most promising areas are 67, underlain mainly by Archean rocks of the Mary River Group (gold, nickel, volcanogenic massive sulphides, iron) and 65, underlain by Proterozoic rocks of Borden Peninsula, including the Society Cliffs Formation dolomite that hosts the Nanisivik Mine, and the Arctic Bay Formation shales. This region is considered to have a very high potential for additional carbonate-type lead-zinc deposits (Nanisivik type) and a high potential for the occurrence of shale-type lead-zinc deposits in the Arctic Bay Formation rocks. In either case, the potential for economic development is considered good. Area 69 (Piling Group sedimentary rocks) of central Baffin Island is considered to have variable potential (moderate to high) for all three types of lead-zinc deposits (sandstone-type, shale-type, carbonate-type) but probably a shale-type deposit would have the best chance for economic development.

In addition to the major Mary River iron deposit of Baffin Island (Area 67) and the numerous smaller iron formation occurrences in Mary River Group rocks, significant iron formation is present on southern Baffin Island and on the Belcher and Nastapoka islands in Hudson Bay. The potential for economic development of the latter deposits seems low, however. Some (low to moderate) nickel potential is assigned to the Ottawa Islands in Hudson Bay because of the presence of "komatiitic" ultramafic rocks which are commonly associated with nickel deposits elsewhere.

PART I

METHODOLOGY AND SUMMARY ASSESSMENTS

SECTION 1

INTRODUCTION

General Statement

This report attempts to assess the metallic minerals potential of parts of northern Yukon and mainland Northwest Territories, and all of the Arctic Islands including those islands in Hudson Bay that are administered by the Northwest Territories. It is a companion publication to earlier reports dealing with the mineral potential of the Western Arctic Region (Geological Survey of Canada, 1978) and with some more specific areas within the large regions covered by the present document (Geological Survey of Canada, 1980).

It should be emphasized that this is intended to be a preliminary judgment of resource potential only. As is apparent from the text, there still exist large gaps in the geological and mineral deposit knowledge base of the northern and Arctic regions of Canada and it will be many years before the type of detailed assessments that are possible in southerly, better-documented and better-explored regions can be attempted.

Notwithstanding the above reservations, it is concluded on the basis of present knowledge, that the northern and Arctic regions can be considered to have good potential to contain commercial quantities of Canada's major trade metals (including uranium) but from this statement to the actuality of economic recovery of such commodities is a large step. Currently, for example, only one mine is in operation north of the mainland coast (Nanisivik Mine on Baffin Island) although the Polaris lead-zinc deposit on Little Cornwallis Island is scheduled to be brought into production by Arvik Mines Limited in the near future. Other proven[1] and significant[1] deposits of iron, uranium, copper, zinc, and gold are known (see Section 5 of this report) and undoubtedly many of these deposits would already be in production or moving toward production if they were located in more southerly regions of the country. The fact that they are not in production is attributable mainly to the usual constraints of northern and Arctic operations – high costs, remoteness, distances from markets, transportation and labour difficulties, general lack of infrastructure – and not to deficiences in the size and quality of the ore deposits. By the same token, many of the northern regions have geological characteristics comparable to or analogous with regions elsewhere in the country from which traditional mineral production has come. The lack of known deposits in such comparative northern areas may be in large part due to the relatively low intensity of exploration efforts that have taken place to date. In sum, there seems good reason to conclude that many of the northern areas possess productive potential that is comparable to the better-explored southern regions.

Developments in the northern regions over the next decade or so, spurred particularly by the need for discovery and exploitation of frontier oil and gas supplies, and the attendant evolution of better sea and land transport facilities (roads, pipelines, Arctic tanker systems) may be expected to improve the likelihood of significant northern mining operations as well.

Organization and Content of the Report

The main part of this report is divided into seven sections. Section 2 outlines the methods of study, sources of information, and definitions of some technical terms. Section 3 provides general geographic and geological descriptions of the seven major regions into which the study area has been subdivided. These regions, from west to east are:

- I Northern Yukon and Northwestern Mackenzie Region
- II Western Arctic Islands Region
- III Northern Arctic Islands Region
- IV Central Arctic Region
- V Northeastern Mackenzie District
- VI Keewatin Region
- VII Eastern Arctic Islands and Hudson Region

As will be apparent, the boundaries of the major regions are somewhat arbitrarily chosen and they do not always conform to conventional subdivisions of the northern territories. As an example, the islands in Hudson Bay (Belcher, Ottawa, Nastapoka) although part of District of Keewatin are included here in Eastern Arctic and Hudson Bay Region for purposes of descriptive convenience and, to a lesser degree, for geological reasons. The major regions have been, in turn, subdivided into a total of 77 smaller areas which are defined essentially on the basis of geological characteristics. The major regions and their subdivisions are shown on Maps 1 and 2, accompanying the report.

Section 4 provides, mainly in table form, summaries of the mineral potential ratings derived for the various commodities considered, for the individual areas within major regions. The information on which these summary assessments are based is abstracted from Section 6, in which the detailed evaluations of individual areas are presented.

Section 5 contains brief descriptions of the major known deposits in the various regions, along with a tabular summary of the main characteristics of each deposit (tonnage, grade, elements present, etc). Section 7 contains brief notes on some miscellaneous and industrial mineral occurrences of the regions but little attempt is made to provide systematic potential ratings, mainly because of lack of information.

Three Appendixes are attached. Appendixes 1A and 1B are CANMINDEX (see Section 2) index listings of mineral deposits and occurrences that correspond to the mineral deposit locations and codes shown on Maps 1 and 2, respectively. Appendix 2 contains descriptions of the criteria used to evaluate areas and regions, on the basis of various deposit-type models. Appendix 3 shows oil and gas potential of northern Canada.

Contributors and Acknowledgments

This report is the result of work by a number of individuals of the Economic Geology Division of the Geological Survey of Canada. The following are the principal contributors with their primary areas of responsibility.

[1] For definitions of these and other terms see Section 2 of this report.

Commodity/Deposit Type Assessments	
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Silver	R.I. Thorpe
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Nickel (asbestos, chromium, platinum)	O.R. Eckstrand
Volcanogenic massive sulphides	S.M. Roscoe, D.F. Sangster, R.I. Thorpe
Lead-zinc	D.F. Sangster
Iron	G.A. Gross, C.R. McLeod
Molybdenum	R.V. Kirkham
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Metallogeny of Northwest Canadian Shield (Section 6.V)	S.M. Roscoe
Appendix 2 – Characteristics of Mineral Deposit Types and Criteria for Assessment of Areas	S.S. Gandhi, V. Ruzicka, R.I. Thorpe, R.V. Kirkham, O.R. Eckstrand, D.F. Sangster, G.A. Gross
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The work also draws heavily on the accumulated expertise of many other staff members of the Geological Survey of Canada. Particular acknowledgment is extended to G.D. Jackson, T. Frisch, W.R.A. Baragar, W.W. Heywood, M. Schau, J.R. Henderson, W.C. Morgan, P.H. Thompson, F.H.A. Campbell, P.F. Hoffman, F.W. Chandler, T.M. Gordon, K.E. Eade, J.B. Henderson and A.N. LeCheminant of the Precambrian Division in Ottawa; W.D. Goodfellow and I.R. Jonasson of the Resource Geophysics and Geochemistry Division in Ottawa; J.W. Kerr, D.K. Norris and R.L. Christie of the Institute of Sedimentary and Petroleum Geology in Calgary, E.T. Tozer of I.S.P.G. (Ottawa), and W.W. Shilts of Terrain Sciences Division, Ottawa. Advice and consultation provided by these people is gratefully acknowledged but the opinions and interpretations contained in the report are the responsibility of the authors.

SECTION 2

DEFINITIONS, SOURCES OF INFORMATION AND METHODS OF STUDY

Introduction

The technical terms and concepts used in this report will be familiar to geoscientists and those associated with the mineral industry but other readers may be unfamiliar with much of this terminology. In the sections that follow, a few terms and concepts are explained, but it is beyond the scope of this report to provide a complete glossary of technical terms. Most of the latter may be found in standard reference texts such as the "Glossary of Geology".[1] A number of different methods are used to make resource assessments, ranging from simple areal or volumetric comparisons (e.g. if volume "X" of a particular rock type in area "A" is known to contain "Y" tons of metal then volume "X" of the same rock type in area "B" may be expected to contain "Y" tons of metal also, although it seldom does) to complicated mathematical and statistical treatments. The method used in this study falls somewhere between the extremes noted above and is called the "deposit-model analogy" method. Much of this Section outlines the terms, methods and concepts behind this approach. Additional details of criteria for deposit-models are given in Appendix 2.

Definitions

Reserves and Resources

These terms are not used interchangeably, but have specific meanings. Without delving into the technical details of the various categories of reserves and resources and the differences in terminology that exist in classifications and terminologies amongst different commodities (e.g., iron, uranium) the general meanings of the terms as used in this report are as follows.

Resources

Natural concentrations of materials or minerals valuable to man that exist in or on the earth's crust from which, under specific conditions, particular commodities (e.g. copper, silver, uranium, iron) can be extracted. Resources can either be known (identified) or surmised or speculated to exist (undiscovered resources).

Reserves

Only that part of a resource from which a commodity or commodities can be extracted economically (i.e. at a profit) under current conditions of operation. A resource thus may become a reserve through, for example, an increase in the price of a commodity; conversely, a decline in price or an increase in costs of production can convert a reserve to a sub-economic resource. There are several categories of reserves (measured, indicated, inferred), generally based on the degree of certainty concerning the amounts and metal content (grade) of the material available for mining.

CANMINDEX

CANMINDEX stands for Canadian Mineral Deposit Index. It is a computerized file of mineral deposits and occurrences in Canada that has been under construction at the Geological Survey for the past several years, in collaboration with provincial governments and with the Department of Indian and Northern Affairs in the case of the northern territories. It is, at this stage, an index-level file only; that is, it contains such types of information on mineral deposits and occurrences as name, location, main minerals or commodities present, commodity "status" (see following section), brief geological descriptions and source references. It does not attempt to include detailed technical information ("deep" file) on mineral occurrences.

At present the CANMINDEX file is still incomplete for the northern territories (as for many other parts of Canada) but it is being added to daily. It currently contains information on about 2000 mineral occurrences north of latitude 60°N. Of this total, about 900 entries are included in the area covered by this report. Maps 1 and 2 have been prepared essentially from information in CANMINDEX although it should be noted that the file system is presently deficient in records for some types of deposits, notably gold and iron. Some additional deposits/occurrences that are not presently in CANMINDEX have therefore been added by hand.

"Proven" and "Significant" Mineral Deposits; Mineral Occurrences

These terms are used on Maps 1 and 2 accompanying this report and they are coded in the mineral deposit listings of Appendixes 1A and 1B. They have particular connotations in the context of this report. In the CANMINDEX file system commodities in mineral occurrences/deposits are classified according to a "status" code as follows:

01 – commodity is being produced

02 – the deposit has calculated reserves of a commodity but has never produced

03 – the deposit has had past production, known reserves are present but the commodity is no longer being produced

04 – exhausted; the commodity is no longer produced and there are no known reserves or demonstrated resources

05 – two-dimensional data (e.g. length and width) and grade are available (public) but not enough to calculate reserves

06 – one-dimensional data and grade (e.g. a drill hole; one trench)

07 – present; commodity reported but insufficient data are available (public) to allow the status to be classified

08 – the commodity occurs at a producing mine or in a significant deposit but it is not known whether it is being, or will be extracted for sale.

For the purposes of this report and as depicted on Maps 1 and 2, "proven" deposits (those with published grade and tonnage data) are deposits which have a CANMINDEX status for at least one commodity of 01 or 02. "Significant" deposits are those which have a status of 03 to 06 inclusive. The mineral occurrences of Map 2 mainly contain commodities given a status of 07.

Thus, the system used here is a method of screening or filtering a large number of mineral occurrences to attempt to identify those which may be considered most important from:

a. an economic point of view;

b. the point of view of their significance in suggesting whether or not the area or geological environment in which they occur has potential to contain undiscovered deposits of a similar (but larger) kind that may have potential economic importance (if discovered).

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[1] Glossary of Geology; American Geological Institute, Washington, D.C., 1972, 805 p.

It is appreciated that this is an arbitrary concept and there are examples in the study area where the presence of "significant" (status 03-06) or "proven" deposits (status 01 or 02) may not actually be very significant in either geological terms or economic terms. A case in point is the Coppermine River area (37) of Northwestern Mackenzie region. Here, literally hundreds of minor copper occurrences (status 07) are known in the volcanic rocks of the Coppermine River Series (see Map 2) but only a dozen or so are "significant" and only five "proven" (see Map 1) in the context of the CANMINDEX system noted above. Because even the "proven" (commodity) deposits are small and have little chance of economic development in the context of high-cost northern operations, the probability is that they will not be significant in economic terms. Although there may remain many more similar deposits to be discovered in this region, their economic potential may still be low.

In spite of the type of problem noted above it is (still) necessary to have some method of screening occurrences to cast them into economic potential terms (see later section). The present system, although imperfect, represents a beginning in this process.

Deposit Model

The term "deposit model" is used frequently in this report and it is the basis on which the assessments of the mineral potential of individual areas have been made. A deposit model is what it implies; a concept of a particular type of mineral deposit that takes account of the characteristics (physical, chemical, dimensional, etc) of deposits and their immediate geological environments that are considered to be generally similar and thus to belong to the same class. This means that the characteristics of the deposits and their environments (type of rock present, age of rocks, alteration of rocks, structures of the rocks, etc) have been sufficiently well-documented in a large number of deposits of the same type (commonly, in many parts of the world) that there has grown up a good "working model" of the way in which the mineral deposit was formed and, of particular importance, a good knowledge of the kind of indicator features or "fingerprints" that should be looked for in the geology of a region or area in order to assess the chances of a mineral deposit of the type considered being present (but undetected). A variety of deposit models have been constructed by geologists over time for various commodities and commodity combinations, and the features that characterize such individual models are discussed in detail in Appendix 2 to this report.

Geological Ages and Time Scales

Throughout this report, generally-accepted geological age terminology is used. These terms and their approximate meanings in terms of millions of years are given in Table 2.I.

Phanerozoic is a general term used to denote rocks that are younger than Precambrian. Commonly, specific terminology will be prefixed by one or more supplementary adjectives; e.g. *lower Upper Cretaceous;* meaning that the rocks in question were formed (deposited) in a *stratigraphic* interval determined to be the lower part of the geological section in which Upper Cretaceous rocks were laid down. Terms such as *Late, Early, Middle* are *time* specific; terms such as *Lower, Upper*, refer to relative *position* of rock formations (e.g. Upper Cretaceous strata were deposited above, and thus later than, Lower Cretaceous strata).

Table 2.I Geological time scale

Relative age	Terminology General	Specific		Approximate Age[1] (millions of years)
Youngest	CENOZOIC	Quaternary		1.5
		Tertiary		65
	MESOZOIC	Cretaceous		135
		Jurassic		190
		Triassic		225
	PALEOZOIC	Permian		280
		Carboniferous	Pennsylvanian	325
			Mississippian	345
		Devonian		395
		Silurian		440
		Ordovician		500
		Cambrian		570-600
	PROTEROZOIC	Hadrynian		1000-1070
		Helikian		1750-1850
		Aphebian		2600-2650
Oldest	ARCHEAN	Archean		Oldest rocks known ~3800

[1] Numbers refer to the approximate age of the boundary with the next oldest sequence.

Sources of Information

This report depends on three principal sources of information. These are:

a. the expertise of individuals who contributed directly in the writing of the report, and those who were consulted regarding their geological knowledge of the various regions covered by the study. (See Section 1);

b. the geological and mineral deposit literature of the study area (see following); and

c. output from the CANMINDEX mineral deposit file system. This is included in the form of the data listings given in Appendixes 1A and 1B and mineral occurrence distribution (location) and coding (type of occurrence) plots which were then transformed to the format used in Maps 1 and 2.

In connection with b) above a variety of information sources were used. In addition to published Geological Survey geological and geochemical maps and reports (see References), information from mining companies, other government agencies (chiefly the Department of Indian and Northern Affairs), various scientific journals, and in some cases, university-based investigations were used. In terms of the two political regions encompassed in the study area (Yukon and Northwest Territories) the main sources of information on mineral occurrences and deposits are given below. More general references occur throughout the report, particularly in Section 3.

Yukon Territory

Mineral information on Yukon was recorded in an annual series of publications of the Geological Survey from 1961 through 1968 (Skinner, 1961, 1962; Green and Godwin, 1963, 1964; Green, 1965, 1966; Findlay, 1967, 1969a, 1969b). Since

1969 similar review reports have been published by the Department of Indian Affairs and Northern Development (now Indian and Northern Affairs), such as Craig, 1972; Craig and Milner, 1975; Sinclair and Gilbert, 1975; Sinclair et al., 1975, 1976; and Morin et al., 1977. Earlier records are contained in Annual and Summary Reports (now mainly out of print) of the Geological Survey from 1898 through 1933, many of which have been collected in a single volume (Bostock, 1957). Records for the period 1934 to 1940 are summarized in a series of Geological Survey reports by Bostock (1935, 1937, 1941, etc).

The principal geological base reference for much of the area in question is Norris et al., 1963 (Geological Survey of Canada Map 10-1963) supplemented by various maps and reports issued by the Geological Survey in subsequent years. These sources are numerous and a complete listing is not provided here, although specific sources referred to in the report are given in the list of references.

District of Mackenzie, Northwest Territories

Mineral occurrences that were known in the Northwest Territories prior to about 1940 for District of Mackenzie and about 1964 for District of Keewatin were recorded in publications of various types, including reports dealing with specific map areas. Information on early work on these occurrences must thus be compiled from these dispersed source documents. Since 1940 the record of mineral exploration activities has been quite systematic for District of Mackenzie. Lord (1941, 1951) gives a systematic record (including quotes from many of the earlier sources) to about the end of 1950 for those properties on which exploration was done. This record was extended by McGlynn (1971) through 1959, and subsequently for some years by a series of annual reports (Baragar, 1961, 1962; Baragar and Hornbrook, 1963; Schiller and Hornbrook, 1964a; Schiller, 1965; Thorpe, 1966). The period 1966-1968 was covered in two reports by Thorpe (1970, 1972), one dealing exclusively with exploration programs for copper on properties in the Coppermine River area. Starting with the 1969 exploration season, this record has been continued with publications by the Department of Indian and Northern Affairs (Padgham et al., 1975; Padgham et al., 1976; Padgham et al., 1978; Laporte et al., 1978).

A few general accounts of the mineral deposits of the Northwest Territories have been published. One of these was by Thorpe (1969) and another by Padgham (1973).

District of Keewatin, Northwest Territories

Beginning with Schiller (1965), information on exploration programs in District of Keewatin is contained in the reports referred to above for District of Mackenzie. In general, however, exploration activities, and also the reporting of those activities were much more "spotty" in the case of the District of Keewatin than for District of Mackenzie. Many of the early records of exploration activities are in copies of reports contained in the confidential Central Technical Files of the Geological Survey of Canada and in files of assessment reports maintained by the Department of Indian and Northern Affairs. Since the summer of 1969 a more complete record of exploration activities and mineral occurrences has been maintained by the Department of Indian and Northern Affairs. The pertinent publications are by Laporte (1974a, 1974b), Padgham et al. (1976), and Laporte et al. (1978), and cover the period 1969 to 1973 and 1975. Comments pertaining directly to the metallogeny of the eastern District of Keewatin are contained in publications by Ridler and Shilts (1974a, 1974b).

Arctic Islands, Northwest Territories

Sporadic references to occasional exploration efforts in the Arctic Islands are contained in some of the sources noted in the previous sections (N.W.T.) but there is not a systematic information base for earlier work in this region.

Beginning in the 1970s, however, the Department of Indian Affairs and Northern Development included sections on Arctic Island exploration activities in its annual reports on work in the Northwest Territories (see, for example, Laporte et al., 1978). Apart from these sources, the information concerning mineral potential of the Arctic Island areas contained in this report is obtained mainly from the general geological literature and from consultation with geologists familiar with the region.

Methods of Resource Assessment

General

The information that has gone into the preparation of assessments of mineral potential for individual areas within the study region (Sections 4 and 6) is drawn primarily from the expertise and knowledge of individual contributors, and other geologists consulted, coupled with the results of systematic studies of mineral deposits by the Geological Survey of Canada, other data on mineral deposits and occurrences from the literature, and from the CANMINDEX file and other resource files. The deposit model analogy approach for undiscovered but predicted deposits and the evaluation of the importance of known deposits are the main rationales used for determining the resource potential and economic potential ratings of Tables 4.I to 4.VII, Section 4.

The deposit model analogy method depends on (a) the existence of good working concepts of the nature, origin and geological "controls" for the particular deposit-type being considered (e.g. nickel and copper-nickel deposits associated with ultramafic and mafic igneous rocks; massive sulphide deposits and iron formations associated with certain types of volcanic rocks; uranium deposits associated with conglomerate, etc); and (b) sufficient geological knowledge of the areas being assessed ("target area") to permit the recognition of the presence/absence of favourable geological indicator features of the types of deposit being considered (deposit-model). Obviously the level of geological knowledge varies from region to region and from area to area and this unevenness of the data base commonly provides the greatest difficulty in systematic application of the deposit-model approach. Large parts of the Arctic have only been geologically mapped at a reconnaissance level, and descriptive data on mineral occurrences is limited in coverage and variable in quality. Thus the necessary information on a scale detailed enough for accurate assessment of the mineral potential is commonly inadequate or lacking. In such cases, the geologist(s) appraising the area must fall back on subjective judgments based on his or her cumulative experience of mineral deposits and interpretations of the significance of the limited geological information available. Another difficulty in this approach is, in many cases, the incomplete status of models available for certain types of deposits.

Resource Potential Rating Methods

Ratings of the mineral resource potential of individual areas (Sections 4 and 6) are done in several interrelated steps. The available mineral deposit and geological information (maps, reports, mineral data files, personal experience) of the area is examined to identify environments having the characteristics appropriate for specific mineral deposit-models or specific commodity types (e.g., nickel deposits associated with ultramafic rocks). The characteristics (mineral assemblages, size, grade, etc) of mineral deposits or occurrences in the area are considered to determine if they constitute:

a. significant resources or potential resources in themselves;

b. indicators that additional deposits are likely to be present (but undiscovered) and that such additional deposits could constitute significant resources of the commodities being considered;

c. representative deposits of a type that, even if additional deposits are present (but undiscovered), are unlikely to constitute significant resources of the commodity being considered.

In the absence of known deposits, the area being assessed must be rated solely on the basis of the degree of concurrence of the known geological features with those features required to satisfy the appropriate deposit-model being considered.

On the basis of the procedures outlined above, judgments about the mineral potential of the area in terms of specific commodity-types are derived. These will usually fall into one of several categories, as follows:

a. geological environments favourable for the commodity-type being considered are absent or unlikely to be present;

b. geological environments favourable for the commodity-type being considered are possible but indications are that they will not be widespread or not fully developed in terms of the requirements of the deposit-model(s) for that commodity. This judgment may or may not be supported by the presence or absence of known deposits;

c. favourable geological environments are identifiable and reasonably well documented. Known mineral deposits have characteristics appropriate to the requirements of the model(s) but may not necessarily contain or imply significant resources;

d. as for c) but many positive features of the deposit-model can be readily identified and mineral deposits (if known) show characteristics typical of those accounting for significant resources of the commodity(ies) being considered, or are indicators of undiscovered deposits that could be important resources.

These general judgments may then be refined further by the application of additional qualifications such as the effect of the intensity of past exploration in the area and special procedures in the case of commodities such as iron. At the end, a qualitative assessment is derived of the potential of the area to contain the deposit-type being considered. This assessment is called the Resource Potential rating.

The second stage of the overall rating process is the assignment of an Economic Development Potential rating for deposits of the area, both in the case of known deposits and in the case of deposits (or resources) prognosticated to be present on the basis of the Resource Potential rating. In the case of northern assessments the Economic Development Potential rating is particularly important for a number of reasons. For example, a high or favourable Resource Potential rating in an area where there are already a number of known deposits may not be particularly significant in terms of future mineral development if the rating is qualified by the judgment that the additional deposits believed to be present but undiscoverd are likely to be of the same class or type as those already known and if this class is characterized by small and/or low-grade deposits standing little chance of being economically exploitable. In this case the area should be assigned a low Economic Potential rating even though the Resource Potential rating is favourable. The Economic Potential rating is particularly significant in the case of iron deposits since many or most significant deposits in an area are likely to be known already and the critical part of the overall assessment is not so much whether more deposits of the same type are likely to occur, but whether or not the known deposits are likely to become economically exploitable through such influences as transport and infrastructure developments, changes in market specifications, corporate policies and the like (see Appendix 2 for a detailed discussion of these factors).

Assessment of the economic development potential of mineral deposits in far northern regions is obviously difficult and subjective, since such assessments depend heavily on judgments about what will happen in the future. A case in point has already been noted in connection with the possible effects of frontier energy (oil and gas) developments on mining in the north. Many other variables that are difficult to assess at this stage are also apparent. For purposes of this report, subjective judgments regarding the likely course of northern development over the next twenty years have been incorporated into the ratings for economic development potential, but it must be emphasized that these judgments are general and not specific or quantitative. Undoubtedly, many unforeseen or unexpected future developments will affect the validity of these judgments.

Economic development would most likely be feasible in the case of commodities with high value/weight ratios, such as gold, silver, and uranium. However, exceptions to this will undoubtedly occur in cases where there is good access to tidewater, and the Nanisivik mine on Baffin Island as well as the lead-zinc deposits of Little Cornwallis Island and some of the major iron deposits on Baffin Island and Melville Peninsula are cases in point.

Assessment Rating Scales

The Resource Potential and Economic Potential methods outlined in the previous section are presented as rating scales in Table 2.II. The ratings assigned to individual areas for various commodities and deposit types are summarized in Tables 4.I to 4.VII of Section 4. As noted, details of the assessments are found in narrative form in Section 6.

Deficiencies in Resource Assessment Methods

A number of points concerning limitations to the assessment rating methods discussed in the previous pages should be emphasized. Perhaps most important is the need to bear in mind that all resource assessments are temporal; that is, they represent "snapshots" of the situation as judged to exist at the moment of the assessment but many of the factors incorporated in the assessment process are dynamic and will change over time. Input factors such as the level of geological and mineral deposit knowledge will change as more detailed geological mapping is completed and better documentation of known deposits is advanced; deposit models will become changed or refined as new concepts are developed and additional information about critical characteristics of the models is obtained; and, the kind and intensity of exploration conducted will obviously affect the "residual exploration potential" of an area.

This general problem is reflected in the difficulties in making assessments which, of necessity, must frequently be made on the basis of relatively low levels of geological knowledge. For example, it is quite possible that deposits will ultimately be found in areas rated as nil or low on the basis of present knowledge. This may be particularly true for deposit-types that could occur in granitic metamorphic terranes where little exploration has traditionally been done. It is probably less likely for deposit-types that are generally found in other terranes but that by themselves or in terms of their favourable environments represent small "targets". It is probably least likely, but still possible, in the case of much larger targets such as: (1) layered ultramafic-gabbro complexes that may contain chromium or platinum deposits, or (2) basal Proterozoic fluviatile clastic sequences that may contain uranium or paleoplacer gold. In all these cases additional information based on more detailed geological mapping or additional knowledge based on the results (positive or negative) of extensive exploration might have significantly changed the initial ratings assigned.

On the Economic Development Potential ratings side of the assessment process a variety of unforeseen or unexpected factors that can affect other types of northern development may have "ripple effects" that can influence mineral development. Perhaps the most common example of this would be various kinds of transport development.

Table 2.II Assessment rating scales and definitions

A. RESOURCE POTENTIAL RATING

Code	Rating	Explanation
N	Nil	For the deposit or commodity types considered the resource potential in terms of known and undiscovered deposits is considered, for practical purposes, as zero.
L	Low	On the basis of either the geological environments present or the characteristics of known mineral occurrences, or both, there is some resource potential, but significant resources are considered unlikely.
M	Moderate	Because either favourable geological environments are present, or known mineral occurrences/deposits (if present) show characteristics typical of those comprising resources of the commodity considered, or both, there is a possibility of significant additional resources being present in undiscovered deposits.
H	High	Because the geological environment is known to contain many or most of the characteristics of environments elsewhere that have deposits of a particular type that constitute important resources of a commodity, or because deposits of that type are present, or both, it is probable that significant undiscovered deposits of the type are present.
VH	Very High	one or both of the following may apply: a. the geological environment(s) are so favourable that there is little doubt that undiscovered or undefined[1] deposits are present; b. known deposits present have documented characteristics such that it is considered that their development is primarily a matter of time and is dependent on non-geological (economic) factors[2].

B. POTENTIAL FOR ECONOMIC DEVELOPMENT (within the next twenty years)

Code	Rating	Explanation
01	Good	Features of known deposits or likely characteristics of undiscovered or undefined deposits probably present, coupled with proximity to transport access (e.g. tidewater) or planned transport routes (e.g. roads) suggest that the potential for economic development is high.
02	Moderate	As above but less certainty about the exploitability characteristics of deposits (grade, tonnage, metallurgical problems, market demand, etc) and about transport and logistics feasibility (e.g., long distances to tidewater, difficult access terrain, etc).
03	Low	Many uncertainties about the exploitability characteristics of known or undiscovered but suspected deposits. Transport, logistics, infrastructure facilities, etc unlikely to be adequate within the timeframe considered.
04	Nil	Primarily because the exploitability characteristics of known or suspected deposits are poor, economic development within the timeframe considered is highly improbable regardless of favourable transport, access or infrastructure facilities.
05		Not possible to assess because of lack of information.

[1] Particularly in the case of iron, known deposits may have adjacent zones or extensions to ore zones that have not been accurately delineated or investigated but may, given sufficient stimulus by changed economic factors, prove to be of equal or greater significance than the original known and delineated zones.

[2] It is especially in this category that overlap and ambiguity between the Resource Potential rating and the Economic Development Potential rating is evident. This is because an area that received a Very High rating may contain "proven" known deposits (see Definitions, this section) and thus the potential economic implications of the presence of such deposits are unavoidable. For example, if one or two "proven" deposits are already known and there is a very high probability that additional (but undiscovered) deposits of the same type are present, the discovery of such an additional deposit may make it economically feasible to develop the necessary infrastructure for exploitation of the deposits as a group, with production feeding to a single central mill.

Another major problem that can arise concerns the translation of assessment ratings into judgments about economic value. Attempts can be made to predict existence of deposits and to forecast their potential for development but still little or nothing can be inferred about their total economic worth. For example, a high probability of many small deposits or a low probability of an extremely large, rich deposit might be predicted. In both instances, depending on local circumstances, a high probability of development might exist. Nevertheless, when translated into "mineral potential" or dollar values these two examples can have a very different significance. The former case may have only local importance, whereas the latter could be of national or even international importance. An example of this might be a small, high grade precious metal deposit in the District of Mackenzie contrasted with a large lead-zinc deposit in the District of Franklin. Deposits of both types could have a high probability of existence and development yet their economic worth could be vastly different. In terms of "dollars-per-square kilometre" the former could be minor whereas the latter might make a significant contribution to Canada's total mineral production.

Also, the assigned Resource Potential ratings deal with whether or not it is likely that at least one deposit is present or can be delineated, and nothing can be inferred from a high rating as to the number of deposits that might be present in the area.

The above problems can not be covered adequately in the resource assessment process used in this report. To some degree they are treated in a few of the deposit models, such as the volcanogenic massive sulphide model where a spectrum of grades and tonnages can be predicted, and the deposits in general are found in clusters, but in other cases, such as the sedimentary copper model, no provision for variations in grade and tonnage is possible. "High" or "very high" resource potential and "good" economic development ratings as used in this report, thus do not necessarily imply deposits of major economic importance.

SECTION 3

GENERAL REMARKS CONCERNING THE MAIN REGIONS OF THE STUDY

Introduction

The total northern mainland and Arctic Islands area of this study has been divided into seven major regions (Map 1 and Map 2). For the most part the major regions are defined largely on a geographic and physiographic basis so that the boundaries of major geologic elements do not necessarily correspond to major region boundaries and, commonly, the principal geologic elements may extend through two or more adjacent regions. In the sections that follow the general physiographic and geologic features of each major region are described briefly, followed by more detailed discussions of major region subdivisions (totalling 77), the latter being defined chiefly on the basis of geological characterisitcs. These individual area subdivisions (Maps 1 and 2) comprise the basic "units" on which the mineral potential assessments have been constructed and which are summarized in Section 4. For an overview discussion of the metallogeny of the northwestern Canadian Shield (Northeastern Mackenzie District and Keewatin Region) the reader is referred to Section 6, Part II of the report.

I. Northern Yukon and Northwestern Mackenzie Region

General Description

This region lies generally along the northern mainland coastal area between the Alaska-Yukon border on the west and Cape Young east of Darnley Bay on the south shore of Dolphin and Union Strait. Its southern boundary is arbitrarily defined for purposes of this report as a line following approximately 69° north longitude, passing close to the towns of Inuvik and Aklavik in Mackenzie Delta region and then trending northwesterly across extreme northern Yukon to the Firth River near the Alaska-Yukon border.

In northern Yukon the region embraces four main physiographic subdivisions that correspond closely with the geological subdivisions shown on Maps 1 and 2. These are (west to east) British Mountains (1), the northern extremity of Porcupine Plateau (2), northern Richardson Mountains (3) and Yukon Coastal Plain (4). In District of Mackenzie, Mackenzie Delta of Arctic Coastal Plain (4), Anderson Plain (5) and Horton Plain (parts of 5, 7, 8 and 9A) comprise the main physiographic subdivisions. Except for British and Richardson Mountains in Yukon and extreme northwestern Mackenzie the region is one of generally low relief with landforms sloping toward Beaufort Sea and Amundsen Gulf, interrupted locally by features such as the Smoking Hills and Melville Mountains (Anderson Plain).

Geological Descriptions of Subareas (Map 1)

(1) Proterozoic, Paleozoic and Mesozoic Rocks of Brooks-British-Barn Mountains Highs (Brooks Range Geanticline)

The oldest recognized rocks of this northwest Yukon region, which includes the Romanzof and Barn uplifts, comprise a thick sequence of folded and faulted miogeosynclinal clastic sediments, in part metamorphosed to schists, quartzites and phyllites, along with some crystalline limestone. This assemblage, known as the Neruokpuk Group, has been assigned various ages and it may range from Proterozoic through Late Silurian (Lenz, 1972)[1]. In part the Neruokpuk of Barn Mountains area is apparently equivalent to the Road River Formation of widespread occurrence in northern Yukon (Norris, 1973a). The Neruokpuk has been intruded by a number of Middle-Late Devonian granitic plugs that form a discontinuous line along the cores of Barn and Romanzof uplifts (Mt. Hoidal, Mt. Sedgwick, Mt. Fitton). Recent regional geochemical surveys by the Geological Survey (Goodfellow, 1979) suggest that other hidden plutons may also exist in this area. Unconformably overlying the Neruokpuk rocks in this region are rocks ranging in age from probably Devonian to Jurassic. They include a thick Cambrian succession of agglomerates, slates and minor crystalline limestone in northwest British Mountains near the Alaska-Yukon border, black calcareous shales (Kayak Formation), cherty limestones, and limestones (Lisburne Group), Permian and Triassic sandstones (Sadlerochit Formation), Upper Triassic siltstones and limestone (Shublik Formation) and Jurassic shales (Kingak Formation). Norris (1973a) notes that "...the unconformity separating the Neruokpuk from the Kayak and younger rocks is one of the most profound in the Canadian Cordillera; it corresponds to the unconformity at the base of the Sverdrup Basin in the Arctic Archipelago" (p. 30). On the flanks of Barn Mountains, a distinctive Mississippian chert and quartz-pebble conglomerate (Kekiktuk Formation) "...lies with marked unconformity on the Neruokpuk" (Norris, 1973a, p. 28). Upper Jurassic and Lower Cretaceous shales, sandstones and conglomerates are the youngest strata in the area, marking syntectonic deposition in Late Mesozoic time. One of the prominent features of this area is the complex structural geometry and stratigraphic repetition due to successive periods of early high-angle reverse faulting and younger overlapping low-angle thrust faults.

(2) Interior Cover Rocks (mainly Jurassic and Cretaceous sedimentary rocks)

Between British-Barn Mountains to the west and the Richardson Mountains trend on the east, the northern extension of Porcupine Plateau is underlain principally by Lower Cretaceous shales and sandstones with small outliers of non-marine Upper Cretaceous "molasse" mudstones (marine) and clastic (terrigenous) sediments of the Fish River Group (Young et al., 1976).

(3) Northern Richardson Mountains Jurassic and Cretaceous Sedimentary Rocks

Northwestern and northeastern Richardson Mountains comprise a complex segment of Jurassic and Cretaceous sediments that have been buckled and sliced by numerous steeply-inclined northerly-trending faults of Late Cretaceous-Tertiary origin. In northwestern Richardson Mountains Late Precambrian argillites, limestones, dolomites and conglomerate (Neruokpuk?) and overlying Cambrian to Permian strata (limestones, shales, siltstones, sandstones) are exposed intermittently, particularly in White and Cache Creek uplifts along the western flanks of the mountains (Norris, 1973a). In northeastern Richardson Mountains the dominantly Jurassic and Cretaceous terrane includes a stratigraphically-complex Cretaceous flysch (conglomerate, shale, sandstone, turbidites) assemblage that grades eastwards (into District of Mackenzie) into bedded ironstones and shales, siltstones and mudstones (Young, 1977). The ironstones are, in part, phosphatic and manganiferous, locally containing up to 25-30 percent P_2O_5. According to Young (op. cit.) average composition of the beds in the Rapid Creek-Big Fish River area is: Fe_2O_3 – 33%; P_2O_5 – 14%; MnO – 5%. Phosphatic beds contain a number of interesting and unique minerals, including lazulite, brazilianite, augelite,

[1] It should be noted, however, that current usage generally restricts the Neruokpuk Group to Precambrian.

arrojadite, kulanite, baricite and penikisite that, particularly in the case of lazulite, have provided prize museum-grade mineral specimens (see Delta Iron prospect, Map 1 and Appendix 1-1A).

(4) Arctic Coastal Plain (Tertiary and Quaternary sediments and surficial deposits) (Yukon Coastal Plain)

In northern Yukon the coastal plain region is blanketed mainly by Quaternary outwash gravels and sands, conglomerates, shales, muds and alluvial sediments, the lower parts of which (mainly marine shales) are represented by strata of the Upper Cretaceous Boundary Creek Formation and Fish River Groups. Eastwards in Mackenzie Delta and northwestern Anderson Plain regions, Fish River and Boundary Creek strata are overlain by Tertiary nonmarine sands, gravel, lignite and muds of the Reindeer Formation and equivalents (Young et al., 1976). In eastern Mackenzie Delta and northern Anderson Plain these strata are, in turn, overlain by sands and gravel presumably equivalent to the Upper Tertiary (Neogene) Beaufort Formation.

(5) Anderson Plain Cretaceous-Tertiary Cover Rocks

East of the Mackenzie Delta part of Arctic Coastal Plain (4), Anderson Plain is underlain mainly by lower Upper Cretaceous bituminous shales, black marine shales, bentonitic shales and jarosite-bearing bands (hydrous iron sulphates) of the Smoking Hills Formation and marine shales, bentonitic shales and siltstones of the overlying (late upper Cretaceous) Mason Creek Formation. The Smoking Hills Formation is equivalent to the Boundary Creek Formation of northern Yukon and Mackenzie Delta region and unconformably overlies Albian (middle Cretaceous) shales, siltstones, sandstones and bentonitic shales of the Horton River Formation (Young et al., 1976). The Smoking Hills Formation is burning locally in Anderson Plain region ("Smoking Hills"), forming "brightly coloured, hardened mudstone, cinders, earthy hematite and selenite crystals" (op. cit., p. 28). The upper part of the formation is radioactive, apparently due to the presence of a highly organic and sulphate-rich shale (op. cit., p. 28).

(6) Cape Parry Paleozoic Rocks

Much of the flat featureless plain of Parry Peninsula is underlain by Paleozoic carbonate strata, mantled locally by morainal glacial drift. The Paleozoic strata are mainly flat-lying to gently dipping dolomites of the Ordovician-Silurian Ronning Group (Yorath et al., 1969).

(7) Horton Plain Paleozoic Rocks

Cretaceous and Tertiary strata of Anderson Plain (5) in the eastern part of the area lie on Horton Plain basal Paleozoic sandstones and "Cambrian and/or Lower Ordovician" siltstones, dolomites, sandstones, and shales of the Macdougal Group, Ordovician-Silurian strata of the Ronning Group and Devonian calcareous and gypsiferous dolomites and bedded limestones of the Bear Rock Formation (Yorath et al., 1969). Locally, the Bear Rock Formation is highly brecciated and exhibits sinkhole and karst features.

In the western part of the area, south of Mackenzie Delta, Anderson Plain cover rocks lie mainly on dark calcareous shales of the Devonian Hare Indian Formation (op. cit.).

(8) Brock Inlier Proterozoic-Lower Paleozoic Rocks

East of Darnley Bay, Proterozoic-Paleozoic strata are exposed in the northern part of the Coppermine Arch (Brock Inlier). These strata have, in general, been correlated with similar rocks of the Shaler Group of Minto Arch on Victoria Island (11) and the Rae Group (part of 36) of Coppermine River area by Young (1977), Dixon (1979), and others. The strata include basal(?) shales, argillites and siltstones overlain disconformably by dolomite, sandstone, limestone and siltstone. Locally the upper part of the succession contains gypsum beds. All of the rocks have been invaded by swarms of diabase dykes and sills that are presumably equivalent to the Coronation Sills that cut Rae Group strata of the Coppermine area. These sills have yielded radiometric ages between 605 m.y. and 718 m.y. (Young, 1977).

(9A) Cape Young-Cape Hearne Paleozoic Rocks

East of Brock Inlier, the western part of Horton Plain is underlain mainly by Paleozoic strata of Arctic Plateau (9A) that are equivalent to similar strata on Victoria Island (9B) and on the mainland west of Coronation Gulf (9C). For the most part they comprise Ordovician-Silurian carbonates (limestone, dolomite) with some shales. In the extreme southwest part of the area, basal (Cambrian-Ordovician) sandstones and shales of the succession are exposed flanking Proterozoic strata of Brock Inlier (Coppermine Arch).

Evidence of Mineralization

In northwest Yukon placer gold has long been known in stream gravels of the Sheep Creek-Firth River areas. Other metals, including tungsten (scheelite) and chromite are found in creeks of the same general area. Geochemical reconnaissance surveys (Goodfellow, 1979) have indicated the presence of above-background concentrations of tungsten, nickel, copper, molybdenum, lead and zinc, and locally uranium in stream sediments in a discontinuous belt along the northeastern flank of Romanzof Uplift and extending south to the Barn Uplift area. In the Barn Uplift area the Devonian Mt. Sedgwick granitic pluton has been investigated in the past for associated tungsten, copper and molybdenum occurrences and uranium mineralization is known in this pluton, as well as in association with the similar Mt. Fitton body to the south.

In northeast Richardson Mountains, the presence of extensive phosphatic ironstones with associated museum-grade mineral specimens in the Cretaceous sequence has been noted previously, and, further east, bituminous shales of the Smoking Hills Formation of Anderson Plain are anomalously radioactive. Elsewhere in this region, direct evidence of metallic mineralization is scanty, beyond the presence of local pyrite in some of the sedimentary strata.

II. Western Arctic Islands Region

General Description

As used in this report Western Arctic Islands Region includes the Queen Elizabeth Islands west of the 110° meridian (Map 1), Banks Island and most of the western part of Victoria Island, including Prince Albert Peninsula. The southern boundary of the region (with Northern Yukon and Northwestern Mackenzie Region) is arbitrarily defined as Amundsen Gulf and, in part, Dolphin and Union Strait, separating Victoria Island from District of Mackenzie. The region embraces part of the area described in a previous preliminary resource assessment report (Geological Survey of Canada, 1978).

Figure 1. *Main physiographic subdivisions of Northern Arctic Islands Region and the northern part of Western Arctic Islands Region. Scale approximately 1 inch = 115 miles (Davies et al., 1976).*

Physiographically, the region includes Arctic Coastal Plain, and the western parts of Innuitian and Arctic Lowlands regions (Fig. 1).

The main geologic elements (Fig. 2) are the western part of the Mesozoic Sverdrup Basin (15 of Map 1), the western, dominantly clastic, Paleozoic succession of Franklinian Miogeosyncline (14C), Precambrian and Paleozoic strata of Arctic Platform (11, 9B, 12-9D) and unconsolidated Tertiary and Quaternary deposits of Arctic Coastal Plain (4). On Map 1, additional geologic subdivisions have been made to distinguish consolidated Tertiary rocks (13) from the Tertiary-Quaternary unconsolidated deposits of Arctic Coastal Plain (4). Similarly, the Quaternary cover blanketing parts of Banks and Victoria Islands has been outlined (10). A complex sequence of Paleozoic-Mesozoic strata (16) near Mould Bay, southeast Prince Patrick Island has also been indicated separately on Map 1.

Geological Descriptions of Subareas (Map 1)

(14C, 15) Northern Arctic Upper Paleozoic-Mesozoic Belt (Sverdrup Successor Basin)

In the northern part of Western Arctic Islands Region the main geological elements consist primarily of Paleozoic and Upper Paleozoic-Mesozoic successions of Franklinian Miogeosyncline (14C) and Sverdrup Basin (15) respectively.

These strata are described in a subsequent section (III Northern Arctic Islands Region). The principal difference in Franklinian strata in the two regions is the gradation from dominantly carbonate sequences in Northern Arctic Islands Region to dominantly clastic lithologies in the Western Arctic Islands Region, the latter lithologies being well displayed in the Devonian Melville Island Group of western Melville Island (Tozer and Thorsteinsson, 1964) and in equivalent rocks of northeast Banks Island (Thorsteinsson and Tozer, 1962; Miall, 1976, 1979). The ubiquitous Devonian Blue Fiord limestone appears to mark the end of dominantly carbonate deposition in this region.

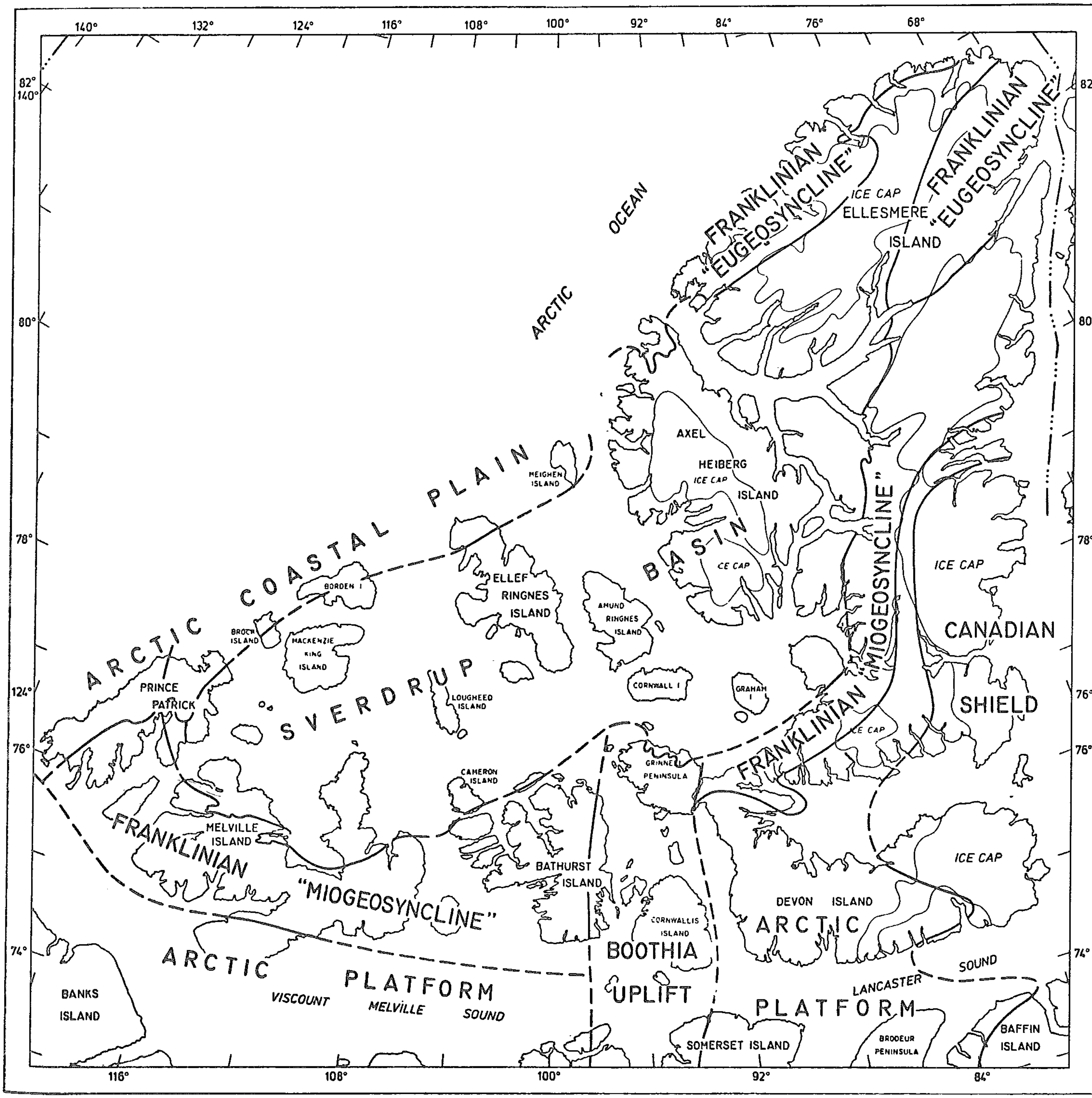

Figure 2. *Main geologic elements of Northern Arctic Islands Region and the northern part of Western Arctic Islands Region. Scale approximately 1 inch = 105 miles (Davies et al., 1976).*

(9B, 9D, 12) Arctic Platform Paleozoic Rocks of Victoria Island

Flat-lying to gently dipping Ordovician and Silurian limestones, dolomites and shales with Cambrian(?) basal sandstone members underlie much of Victoria Island, mantling the flanks of Proterozoic strata (11) exposed along Minto Arch-Shaler Mountains (Thorsteinsson and Tozer, 1962). These strata are correlative with similar rocks of mainland District of Mackenzie (9A, 9C).

(11) Minto Arch Precambrian Rocks

Proterozoic carbonates, sandstones, shales and subordinate gypsum beds of the Shaler Group are exposed along Minto Arch, Shaler Mountains, western Victoria Island. The Shaler Group strata, of Hadrynian or Helikian age, are intruded by numerous dolerite sills and overlain – possibly unconformably – by plateau basalts of the Natkusiak Formation totalling about 800 m in thickness (Thorsteinsson and Tozer, 1962; Baragar, 1976; Christie, 1964). Sandstone, dolomite and subordinate bedded chert of the basal Glenelg Formation of the Shaler Group are also exposed on extreme southern Banks Island (Thorsteinsson and Tozer, 1962; Miall, 1976). Shaler Group Proterozoic strata have been correlated with similar rocks of Brock Inlier (8 – Northern Yukon and Northwestern Mackenzie Region), Rae Group of Coppermine area (36 – Northeastern Mackenzie District) and Duke of York Inlier of southern Victoria Island (36 – Central Arctic Region) (see Dixon, 1979 for a summary of these correlations).

(10, 4) Banks-Victoria Islands Quaternary Cover and Arctic Coastal Plain (Tertiary and Quaternary Sediments and Surficial Deposits)

Parts of southeast Banks Island and the Prince Albert Peninsula-Shaler Mountains area of Victoria Island are blanketed by thick glacial drift, largely morainal (10). On western Banks Island numerous exposures of sands and gravel (locally reworked by fluvioglacial processes) of the Tertiary-Quaternary Beaufort Formation (4) occur with (10).

(13) Consolidated Tertiary Sedimentary Rocks (Eureka Sound Formation)

Parts of northern Banks Island are underlain by sandstone, shale and silt of the Upper Cretaceous-Tertiary Eureka Sound formation (Thorsteinsson and Tozer, 1962) which covered and locally overspread much of the Mesozoic succession of Sverdrup Basin. The Eureka Sound rocks are further described in a following section (III Northern Arctic Islands Region – 17).

(16) Mould Bay Paleozoic and Mesozoic Rocks

A small area in the vicinity of Mould Bay, southeast Prince Patrick Island is underlain mainly by Devonian nonmarine sandstone, siltstone and shale of the Griper Bay Formation and down-faulted outliers of overlying Sverdrup rocks, chiefly marine and nonmarine sandstone, siltstone, shale and subordinate conglomerate of Jurassic and Cretaceous Wilkie Point, Mould Bay and Isachsen formations (Tozer and Thorsteinsson, 1964; Miall, 1975). These rocks are equivalent to Paleozoic and Mesozoic strata of 14C and 15 respectively, but because of local structural complexities they are designated as a separate sub-area (16) on Map 1.

Evidence of Mineralization

Native copper with cuprite, tenorite and other copper minerals have long been known in basalts of the Natkusiak Formation of Shaler Mountains, Victoria Island (see Map 2) but in spite of fairly extensive exploration no economic deposits have been discovered (Thorsteinsson and Tozer, 1962; Baragar, 1976).

Tozer and Thorsteinsson (1964) noted the presence of a coal seam "...at least 5 feet thick" (p. 225) in the Isachsen Formation (Cretaceous) of Prince Patrick Island. Miall (1979) also described low rank lignite coal seams in the Eureka Sound Formation of Banks Island. He also noted "...traces of pyrite mineralization" (p. 53) in the lower, cherty dolomite member of the Glenelg Formation (Shaler Group – 11) at Cape Lampton, extreme southern Banks Island. Pyrite was also noted intermittently in cuttings from the Blue Fiord dolomite at depths of 8000-10 000 feet (2440-3050 m) in a well (Orksut I-44) drilled on south-central Banks Island. Fluorite is present in Blue Fiord Limestone in another well (Storkerson Bay) in the western part of the island. Miall (1975) also notes that "...a carbonate-shale facies change of major stratigraphic importance is present on Banks Island" (p. 53) and that this may have implications for the occurrence of Cornwallis-type lead-zinc accumulations. The facies change referred to by Miall occurs between the Middle(?) Devonian carbonate Blue Fiord Formation and the overlying shale-siltstone-argillaceous limestone Orksut Formation.

III. Northern Arctic Islands Region

General Description

As used in this report Northern Arctic Islands Region includes Ellesmere, Axel Heiberg, Devon, Bathurst, Cornwallis, and eastern Melville islands as well as most of the lesser islands of the Sverdrup and Parry groups. For convenience, the southern boundary of the region has been arbitrarily taken as the Lancaster Sound-Viscount Melville Sound passage ("Northwest Passage") and the western boundary essentially as the 110°W longitude meridian. The latter boundary is dictated by the previously established eastern boundary of an earlier study of the Western Arctic Region[1]. These boundaries obviously do not correspond to the boundaries of major geological units or trends, many of which extend into the adjacent Central Arctic Region, Western Arctic Islands Region and, in the case of the Thule Basin trends on southeast Ellesmere Island, into Greenland.

Northern Arctic Islands Region encompasses parts of three main physiographic regions – Arctic Coastal Plain, Innuitian Region and Arctic Lowlands – as well as a number of smaller physiographic divisions of the main regions (Fig. 1). The main geological elements of the Arctic Archipelago are shown in Fig. 2.

For purposes of this study the major geological elements or "packages" that have been isolated on Map 1 include the Precambrian Shield rocks of eastern Ellesmere and Devon Islands (Areas 18 and 18A of Map 1), the central Paleozoic belt (14A, 14B, 14C), Sverdrup Basin Mesozoic sandstones and shales (15), Tertiary cover rocks of Sverdrup Basin (17), lower to middle Paleozoic rocks of northwestern Ellesmere Island (19) and metamorphic rocks of Lower Paleozoic and older age fringing northwest Ellesmere Island (20).

[1] Geological Survey of Canada, 1978.

Geological Descriptions of Sub-Areas (Map 1)

(18) Eastern Ellesmere Undifferentiated Lower Paleozoic and (?)Proterozoic Rocks

This area consists largely of highly metamorphosed (granulite facies) Precambrian basement rocks that include quartz-feldspar granulites, metamorphosed cordierite and/or sillimanite-bearing sedimentary rocks, amphibolites, banded pyroxene-bearing granulite gneisses and foliated to locally massive granites, commonly intermixed with granulites (Frisch et al., 1978). Intense deformation and metamorphism obscure age and stratigraphic relationships between map units. A generally northerly foliation (gneissic) trend is evident, but local variations in trend are common and complicated.

(18a) Thule Basin Proterozoic Rocks

Local exposures along the coast of southeast Ellesmere Island (e.g. Smith Bay; south of Alexandra Fiord) define the approximate western limits of the unmetamorphosed Proterozoic sedimentary and volcanic rocks of Thule Basin, exposed mainly on western Greenland. These rocks, consisting mainly of sandstones, conglomerates and siltstones with basaltic flows and sills near the base of the section, lie unconformably on the Ellesmere Precambrian basement rocks (18) and dip gently east toward Baffin Bay. They are correlatable with similar strata of middle Proterozoic age (Wolstenholme Formation) in the Thule area of west Greenland (Frisch et al., 1978).

(14) Northern Arctic Paleozoic Belt (Franklinian Miogeosyncline)

On Map 1, Paleozoic strata (mainly Ordovician, Silurian and Devonian) of eastern Ellesmere, Devon, Bathurst and Melville Islands have been subdivided into three units. On northern Ellesmere Island, late Cambrian to Silurian sediments (14A) were deposited in Hazen Trough and on adjacent slope and shelf areas (Trettin et al., 1979, Trettin, 1971). Strata in this area comprise three main units; Grant Land Formation (Cambrian siltstones, argillaceous siltstone, minor sandstone); Hazen Formation (Ordovician cherts, calcareous sandstones, limestones, conglomerate); and Imina Formation (Silurian flysch-type sandstone, siltstones and subordinate conglomerate). The last two formations comprise the strata of the Hazen Trough proper.

South of Hazen Trough and extending southwesterly through Ellesmere Island to Bathurst Island, thick sequences of lower to middle Paleozoic sedimentary rocks were deposited in successive stages of the Franklinian Geosyncline (14B). In central and southern Ellesmere Island, Kerr (1967, 1968, 1976) and others have divided the Paleozoic succession into three major divisions: (1) upper Proterozoic and basal Cambrian clastic sediments succeeded by lower-middle Cambrian carbonates; (2) lower to upper Ordovician carbonates and evaporites; and, (3) an upper Ordovician to middle-Upper Devonian succession dominated by carbonate rocks (dolomite, limestone, limey siltstones, mudstones) in the lower and middle parts and progressing to non-calcareous clastic sediments (sandstones, quartzites, siltstones in its upper (middle-Upper Devonian) units (see Kerr, 1976, Table 2). A distinctive reefal carbonate unit, the Blue Fiord Formation occurs in the lower Devonian part of the succession (Trettin, 1978). Correlative Paleozoic rocks, ranging in age mainly from Ordovician through Devonian and in lithologies from thick carbonate and carbonate-evaporite sequences to clastic sediments (sandstones, siltstones, silty limestones) in the middle-upper Devonian units underlie most of Devon, Cornwallis and parts of eastern Bathurst Island (Morrow and Kerr, 1977; Thorsteinsson, 1958; Thorsteinsson and Kerr, 1968; Kerr, 1974). Ordovician carbonate-evaporite rocks of the Cornwallis Group (Bay Fiord, Thumb Mountain and Irene Bay Formations) contain the lead-zinc deposits of Arvik Mines Limited on Little Cornwallis Island (Kerr, 1968). Strata of the 14B succession are generally correlative with Paleozoic sediments fringing the Precambrian core of Boothia Peninsula in the Central Arctic Region to the south (22).

In part of southern Ellesmere Island and on Bathurst and Melville Islands the dominantly carbonate Ordovician-Devonian succession (14B) of the Franklinian Geosyncline grades northwesterly and westerly and stratigraphically upward to dominantly clastic rocks (sandstones, shales, conglomerates) of mainly middle Devonian to Permain age (14C) of the Parry Islands Fold Belt part of the geosyncline (Kerr, 1974; Tozer and Thorsteinsson, 1964). On eastern Bathurst Island occurs the remarkable right-angled structural juxtaposition of the Paleozoic carbonate successions (14B) affected by the northerly-trending Cornwallis Fold Belt (Early Devonian) and the Paleozoic carbonate-clastic successions affected by the younger (Late Devonian-Early Permian) Parry Islands Fold Belt (Kerr, 1974).

(15) Northern Arctic Mesozoic Belt (Sverdrup Successor Basin)

Parts of western Ellesmere Island, Axel Heiberg Island, Sverdrup Islands, northern Melville Island and the other western Queen Elizabeth Islands of Western Arctic Islands Region (Prince Patrick, Borden, Mackenzie King Islands) are underlain by Paleozoic (subordinate), Mesozoic and Tertiary strata of Sverdrup Basin (Thorsteinsson and Tozer, 1960). This great succession of sediments, deposited unconformably on Paleozoic strata of the Franklinian Geosyncline, reaches 12000 metres in thickness in places. In general the succession is clastic, dominated by non-marine and marine sandstones, shales and conglomerates with subordinate limey beds. Middle Pennsylvanian to Permian sandstones, cherts and conglomerates comprise the basal members of the succession (e.g. Canyon Fiord Formation, Assistance Formation, Trold Fiord Formation) on the southern and eastern margins of the basin (Melville Island, Sabine Peninsula, Cameron Island, Ellesmere Island) but along the northwestern margins non-marine sands and gravels of the Tertiary or Pleistocene Beaufort Formation (4) cover much of the lower part of the Sverdrup succession. On Borden Island marine calcareous sandstone and limestone of the upper Triassic Schei Point Formation represent the oldest Sverdrup rocks exposed along the northwest rim of the basin (Tozer and Thorsteinsson, 1964).

In the northeastern extremities of Sverdrup Basin, Carboniferous and Permian strata underlie much of central Ellesmere Island and lie on older Paleozoic rocks of Franklinian Miogeosyncline (14B) and Hazen Trough eugeosynclinal (Franklinian) strata (14A) to the east and generally similar Franklinian eugeosynclinal Paleozoic rocks (19) to the northwest (Thorsteinsson, 1974). On the northwest edge of the basin, non-marine clastic quartzose sediments of the lower Carboniferous Emma Fiord Formation exposed on Kleybolte Peninsula north of the mouth of Nansen Sound are the oldest Sverdrup rocks recognized (Thorsteinsson, 1974). Elsewhere on Ellesmere and Axel Heiberg Islands the basal Sverdrup strata are mainly extensive redbeds (red sandstone, conglomerate, minor siltstone, shale and limestone) and red and grey sandstones of Late Carboniferous-Early Permian age (Borup Fiord Formation, Canyon Fiord Formation). The lower Pennsylvanian Otto Fiord Formation, containing thick evaporite and salt beds, is one of the principal diapir-forming sequences in the Arctic and has been extensively drilled for exploration for gas (e.g. Ellef Ringnes Island). The Mesozoic succession of Sverdrup Basin consists mainly of thick units of interbedded marine shales and siltstones and sandstones of mainly non-marine origin. Limestones and calcareous sandstones are present in the middle Triassic Schei Point Formation. The Cretaceous parts of the succession contain local coal seams, notably in the lower Cretaceous Isachsen, Christopher and Hassel formations and the upper Cretaceous Kanguk formation contains bentonite beds on Banks Island (Miall, 1979).

(17) Sverdrup Basin Tertiary Rocks

Remnants of the upper, conformable part of the Sverdrup succession (Eureka Sound Formation) occur at various localities within Sverdrup basin and locally outside the basin limits, indicating overspreading of the unit (Thorsteinsson, 1974). On Map 1, however, only the principal areas of Tertiary rocks within the basin have been shown. The Tertiary and/or upper Cretaceous Eureka Sound Formation consist mainly of non-marine sands or nearshore sands, interbedded shales with plant and wood remains and coal seams and, on Bathurst Island, one interbedded andesitic flow (Kerr, 1974). The age of the Eureka Sound Formation is uncertain; it was assigned a Tertiary age by Tozer and Thorsteinsson (1964) but late Cretaceous marine fossils (microflora, dinoflagellates) have been identified from beds on Bathurst Island (Kerr, 1974). In part, the problem seems related to the terminology used to distinguish Eureka Sound non-marine beds from the upper Cretaceous Kanguk Formation, an assemblage of dominantly marine shales. Kerr (1974) assigned upper Cretaceous beds on Bathurst Island to the Eureka Sound Formation although they contain marine shales.

(19) Northwest Ellesmere Island Paleozoic Rocks

Franklinian eugeosynclinal rocks fringe Sverdrup Basin along the northwest coast of Ellesmere Island and on northern Axel Heiberg Island. In M'Clintock Inlet area they consist of Middle Ordovician or older, partly metamorphosed carbonate-chert-keratophyre assemblages (felsic and intermediate flows and breccias, tuffs and tuffaceous sediments) and a younger (late Middle Ordovician to Late Silurian) sequence of variable lithologies. The latter includes a basal(?) section carrying chert pebble conglomerates with felsic volcanic clasts, laminated felsic flows and tuffs, limestone and dolomite (Cape Discovery Formation) and an overlying dominantly volcanic (intermediate flows, flow breccia and calcarenite tuffs) unit (M'Clintock Formation). Overlying these units are Ordovician to Silurian shales, siltstones, conglomerates and sandstones with dolomite and limestone members (Ayles Formation) near the base of the section (Trettin, 1969a). Near the top of the section are calcareous sandstones, siltstones and shales of the Imina Formation, characterized by the common occurrence of authigenic pyrite and correlative with Imina strata of Hazen Trough (Trettin, 1976). Several serpentinized ultramafic bodies cut, or are in fault contact with, partly metamorphosed chert-argillite-keratophyre units and are probably of early Middle Devonian age (Trettin, 1969a).

Elsewhere on northwest Ellesmere Island and on northern Axel Heiberg Island generally similar Franklinian sequences have been, in part, correlated by Trettin (1976) with Grant Land, Hazen and Imina Formation rocks of Hazen Plateau, northeast Ellesmere Island. Volcanic sequences tentatively correlative with the M'Clintock Formation of M'Clintock Inlet area are present in the Yelverton Bay area, northwest Ellesmere (Yelverton Complex) and on northern Axel Heiberg (Rens Fiord Complex), but are absent from interior Ellesmere sections (e.g. Hazen Plateau).

(20) Metamorphosed (Proterozoic?) Rocks of Northwest Ellesmere Island

Crystalline basement rocks of, in part, possible Proterozoic age (Trettin, 1976; Frisch, 1974b) are exposed along the northwest coast of Ellesmere Island approximately between Phillips Inlet south of Alert Point and Camp Nares on the extreme northern tip of the island. They include various amphibolites and greenschists, banded gneisses, muscovite, biotite and garnet schists of the Cape Columbia Complex in Cape Nares area (Trettin, 1969a) and other rocks of generally similar lithologies and metamorphic grade exposed intermittently along the coast to the southwest (see Frisch, 1974b). In the M'Clintock Inlet area they include parts of the older(?) metamorphic terrain previously noted under area 19. The metamorphic rocks are intruded by plutons of generally Devonian or older age that range in composition from granodiorite through quartz diorite, syenite and gabbro to peridotite, the latter comprising the previously noted ultramafic rocks of M'Clintock Inlet area.

Evidence of Mineralization

Frisch et al. (1978) note "impressive gossans...over pyrrhotite ± chalcopyrite ± sphalerite rich zones up to 8 m wide" (p. 138) in gneisses (18) near Alexandra Fiord, southeast Ellesmere Island. They also noted malachite staining in metasediments at several southeast Ellesmere localities, including on cliffs formed by Thule Basin rocks (18a).

In addition to the Polaris and Eclipse lead-zinc deposits (see Sect. 5 this report) Thorsteinsson and Kerr (1968) noted that "lead and zinc mineralization zones apparently are confined to the Thumb Mountain Formation (Cornwallis Group) and occur in widely separated regions on both Cornwallis and Little Cornwallis Islands" (p. 14).

Morrow and Kerr (1977) noted base metal showings (galena, sphalerite) in Thumb Mountain rocks exposed on Grinnell Peninsula, northwest Devon Island (14B) that may be similar to the Little Cornwallis Island lead-zinc mineralization (p. 65). They also noted that pyrite and galena mineralization occurs on Grinnell Peninsula in vuggy Devonian limestone that may be age-equivalent to the Devonian Blue Fiord Formation. Considerable exploration of Grinnell Peninsula was conducted by Cominco Ltd. in 1971 and 1972. Tozer and Thorsteinsson noted a small galena showing in Blue Fiord limestone east of Weatherall Bay, northeast Melville Island (1964, p. 225).

Thin lignite coal seams are widespread in upper Cretaceous and Tertiary strata (chiefly Eureka Sound and Isachsen Formations) but are of poor quality and suitable only for local use. Massive gypsum beds occur in a 450 foot section of the Cornwallis "formation" on Bache Peninsula, Southeastern Ellesmere Island (Christie, 1967).

On Judge Daly Promontory, northeast Ellesmere Island, sphalerite, galena and pyrite mineralization occurring in Ordovician limestone (dolomitized?) of the Copes Bay Formation (Map 1, 14B) was investigated by a private company in 1974 (Gibbins et al., 1977, pp. 64-65).

IV. Central Arctic Region

General Description

The Central Arctic Region consists of eastern Victoria Island, Somerset, Prince of Wales and King William Islands, and Boothia and Melville Peninsulas on the mainland, all in Franklin District, and that part of Keewatin District lying north of the Arctic Circle. There are several settlements in the southern part of the region, the largest of which is Cambridge Bay on the southern coast of Victoria Island.

The region is underlain by a variety of Precambrian rocks, almost exclusively in mainland areas, and platformal Paleozoic sedimentary rocks, generally carbonates, on the islands.

The Paleozoic carbonate rocks, and some associated generally basal, clastic sedimentary rocks of eastern Victoria and King William Islands (9D, see notes on area 12 for the Western Arctic Islands Region), and flanking the Boothia Arch on Somerset and Prince of Wales Islands (22, see notes on area 14B for the Northern Arctic Islands Region) are generally similar and extend into adjacent regions.

Precambrian rocks of the Wellington Inlier (21) on Victoria Island have been correlated with one member of the Aphebian Burnside River Formation which is exposed on Kent Peninsula to the south (Dixon, 1979). The rocks are mostly bright red to pink quartzitic sandstone and conglomerate, but include some siltstone and a bed 15 m thick of cherty ironstone.

Proterozoic clastic sedimentary rocks of the Duke of York Inlier (36) on Victoria Island have been correlated by Dixon (1979) with similar rocks of the Rae Group in the Coppermine area and of the upper part of the Glenelg Formation in the Minto Arch area.

The Precambrian rocks of Boothia Arch (23) form the spine of Boothia Peninsula and the western part of Somerset Island. These rocks consist largely of gneiss and granite, but a few small areas of ultramafic rocks and a few areas of Helikian sedimentary rocks are present.

The area of gneissic-granitic rocks (46B) south of Queen Maud Gulf and Adelaide Peninsula is a continuation of the Queen Maud Block of Heywood and Schau (1978). The latter is represented by area 46A (Northeastern Mackenzie District) and extends south into Keewatin Region.

The heterogeneous belt of rocks comprising area 24 includes (a zone of) mylonitic rocks termed the Slave-Chantrey zone by Heywood and Schau (1978), the Chantrey Group of Aphebian(?) supracrustal rocks consisting of limestone and quartzite, with lesser greywacke, slate, chert and mafic volcanic rocks (Heywood, 1961), and discontinuous bands and patches of Prince Albert Group(?) that are enclosed in gneisses.

The Hayes River-Pelly Bay gneiss belt (25) consists of gneisses and granitic rocks and the belt passes into other similar areas at its southern end. Areas 26, 31 and 33 all contain Prince Albert Group supracrustal rocks. The latter are considered to be Archean in age and are most extensive in area 26 west of the Hayes River and in area 33 west of Committee Bay. Elsewhere these supracrustal belts are very narrow. The Prince Albert Group rocks consist of schists, greywacke, quartzite, iron formation, mafic volcanics, ultramafic lavas and sills, and minor rhyolite and carbonate-bearing rocks (Heywood, 1967; Schau, 1974, 1975, 1977, 1978; Frisch, 1974a; Frisch and Goulet, 1975; Campbell, 1974). Area 27 includes Paleozoic carbonate rocks on Simpson Peninsula and Wales Island in the Gulf of Boothia. Equivalent rocks occur in area 30 on the east side of Melville Peninsula. These strata are similar to those of the same age on Baffin Island (area 63) in Foxe Basin (area 73) and on Southampton Island (area 76). Gneissic-granitic rocks in areas 28, 32 and 34 are generally similar to granitic terranes elsewhere in the region but may include some highly deformed and/or highly metamorphosed equivalents of Prince Albert Group or Chantrey Group (or equivalent) supracrustal rocks. Area 34A is interpreted as a large allochthonous block and includes a large body of anorthositic gabbro (Okulitch et al., 1978).

The Repulse Bay-Melville Peninsula area (35) consists primarily of Penrhyn Group sedimentary rocks, but narrow belts of overthrust and infolded Prince Albert Group rocks are also present. This area forms the west part of the Foxe Fold Belt (Jackson and Taylor, 1972). The Penrhyn Group rocks are considered to be Proterozoic in age and consist of greywacke, quartzite, pelitic rocks, marble and other calcareous units, and their paragneiss equivalents (Heywood, 1967; Reesor, 1974; Reesor et al., 1975; Okulitch et al., 1977, 1978). The rocks have been subjected to several episodes of deformation (Okulitch et al., 1978).

Evidence of Mineralization

The main iron deposits of this region occur in Prince Albert Group rocks on the east (33) and west (31) sides of Melville Peninsula. They are described in Section 5. No uranium occurrences are known in the region, although above-background uranium responses have been recorded from ground and airborne radiometric surveys and reconnaissance geochemical surveys conducted by the Geological Survey in several areas, including Area 35 (Repulse Bay-Melville Peninsula) in Penrhyn Group rocks and in Prince Albert Group rocks of northern Melville Peninsula (28).

On Somerset Island, Paleozoic strata (22) flanking Boothia Arch are considered to have potential for lead-zinc mineralization of the Cornwallis-type (Northern Arctic Islands Region) and one small occurrence is known at Alston Bay on the northwest shore of Somerset Island. Also in this region, a few small diamonds have been discovered in kimberlite bodies cutting Paleozoic rocks of southeast Somerset Island (22). A number of other minor metallic mineral occurrences known in this region are shown on Map 2, including small molybdenum showings near Rasmussen Basin and Pelly Bay, southern Boothia Peninsula.

V. Northeastern Mackenzie District

General Description

This region is bounded on the south by a line extending northwest from the Keewatin-Mackenzie border near Dubawnt Lake approximately to Great Bear Lake. Its northern limit is the Arctic Coast at Coronation Gulf and Queen Maud Gulf. The largest settlement in the area is Coppermine on Coronation Gulf. Silver is mined near the region on Great Bear Lake, and small silver veins have been worked near Hope Bay, east of Bathurst Inlet.

The rocks of this region are primarily of Archean and Proterozoic ages, although Paleozoic carbonate sediments are present in the Cape Young-Cape Hearne area (9C) in the extreme northwestern part of the region. The carbonate rocks overlie dolostone, shale and sandstone of Early Paleozoic age, formerly included with the Rae Group (Baragar and Donaldson, 1973; Dixon, 1979) but now considered a separate unit. These rocks in turn overlie sediments of the Proterozoic Rae Group proper (36). The Coppermine River Group (37) underlies the Rae Group and consists largely of continental basalts (Copper Creek Formation) and an overlying red sandstone-siltstone unit of more restricted areal extent known as the Husky Creek Formation (Baragar and Donaldson, 1973). Copper occurrences in the Coppermine River Group have been described by Thorpe (1970) and Kindle (1972). The Dismal Lakes Group, primarily dolomite with a unit of sandstone and intercalated black shale at the base, and the Hornby Bay Group together comprise area 38 and successively underlie the Coppermine River Group (Fraser et al., 1970).

The Proterozoic sedimentary rocks described above lie on a basement of gneissic and massive granitic rocks, and some subaerial felsic volcanic rocks, that together comprise the Great Bear Batholith terrane, and on rocks of the Hepburn Fold Belt and Epworth Group (Fraser et al., 1972; Hoffman et al., 1978). These basement rocks and the Muskox layered ultramafic-gabbro complex (Smith, 1962; Smith and Kapp, 1963; Smith et al., 1967) that intrudes them are grouped as area 39.

The sedimentary rocks of the Epworth Group (40) of Early Proterozoic (Aphebian) age have been mapped and described by Fraser et al. (1960) and Hoffman et al. (1970, 1971, 1978). The Epworth Group consists primarily of clastic and carbonate sedimentary rocks that represent a thin shelf sequence to the east and grade to a thicker more basinal sequence to the west.

Areas 41, 44 and 45 lie within the northern part of the Slave Structural Province and are thus underlain by Archean Rocks (Fraser et al., 1960; Fraser, 1964; McGlynn and Henderson, 1970). Areas 41 A, B, C, D and 45 include Archean supracrustal (Yellowknife Supergroup) greenstone belt sequences that are similar in most respects to such sequences in the Superior Province and elsewhere in the world. The remainder of the 41 area contains more abundant gneissic and granitic rocks, although some metasedimentary supracrustal rocks of the Yellowknife Supergroup are present. Area 44 is geologically very similar to the latter.

Area 42 is underlain by flat-lying, mainly clastic, rocks of the Goulburn Group which are the thin stable platform-cover equivalents of part of the Epworth Group sequence to the west. To the east these rocks also pass into basinal equivalents in Kilohigok Basin (Bathurst Inlet, area 43). The Goulburn Group rocks in Kilohigok Basin are a mixture of clastic and carbonate sedimentary rocks (Campbell and Cecile, 1975, 1976). Overlying Helikian sedimentary rocks consist largely of continental clastic rocks near the base of the sequence, some stromatolitic dolomite in the Parry Bay and Kanuyak formations, and red arkose- siltstone sediments that overlie basalts of the Ekalulia Formation (Campbell, 1978). These rocks are equivalent to the sequence from Hornby Bay Group to Rae Group in the Great Bear Lake-Coppermine region.

The eastern part of Northeastern Mackenzie District (46A), from Queen Maud Gulf south to a contact with the overlying Thelon Formation, consists of gneissic and granitic rocks belonging to the Churchill Structural Province. Although deformed and metamorphosed during the Hudsonian orogeny, these rocks could contain equivalents to Archean rocks of the Slave Province. However, because of their metamorphic character, lack of geochronological studies, and the reconnaissance nature of the geological mapping, such Archean rocks have not been identified. This area forms part of the Queen Maud Block of Heywood and Schau (1978).

A large area in eastern Mackenzie District (47A) and western Keewatin District is underlain by flat-lying conglomerates and sandstones of the Thelon Formation of Helikian age (approximately 1700-900 m.y.). These clastic sediments in some places overlie older units of the Dubawnt Group and in other places lie with marked unconformity on granitic basement rocks with a regolith marking the contact (Wright, 1967; Fraser et al., 1970). A small area of gneissic-granitic rocks (48A) lies south of the exposure area of the Thelon Formation.

Evidence of Mineralization

Volcanogenic massive sulphide (Zn-Cu-Pb-Ag) deposits with proven tonnage are known in the region at High Lake, Hackett River and Takiyuak Lake (see Section 5 of this report), and the Izok Lake deposit of the same type lies immediately south of the boundary of the region. Other significant, potentially major, deposits in the region include the YUK-PEC uranium deposit in the Dismal Lakes area, the Contwoyto Lake gold deposit, and gold-bearing quartz veins near the Tree River on Coronation Gulf. Numerous other gold occurrences are also known in the region (see Section 6). A small copper deposit, the No. 47 Zone, is known in the Coppermine River area, as are numerous other copper occurrences (Maps 1 and 2).

Copper occurrences are known in the basal units of the Rae Group (36), in strata of the Dismal Lakes and Hornby Bay groups (38) and in sedimentary and volcanic rocks of Bathurst Inlet area (43) but they are small and of low grade and have little economic potential. Small low grade nickel (with minor copper) pods occurring in the marginal rocks of the large ultramafic-gabbro Muskox layered intrusion (northern part of 39) have been investigated in the past but are not economic. Minor chromite also occurs in this intrusion. In the extreme northeastern part of the region and in adjacent southwestern Central Arctic region a number of small nickel occurrences are known along Perry River on the mainland south of Perry Island.

In addition to the previously noted YUK-PEC (Mountain Lake) uranium deposit (see also Section 5) other small uranium occurrences are known in Helikian sandstones of the Hornby Bay-Dismal Lakes groups (38) and several small vein-type uranium occurrences are present in the Great Bear Batholith-Hepburn Fold Belt-Muskox Intrusion area (39). A copper-molybdenum prospect is known near Contwoyto Lake and disseminated molybdenite has been reported in diorite of the Hope Bay-Elu Inlet volcanic belts (45).

VI. Keewatin Region

General Description

Keewatin Region, for purposes of this report, includes the mainland part of Keewatin District lying south of the Arctic Circle. The main settlement in the region is Baker Lake, accessible from Hudson Bay via Chesterfield Inlet as well as by air. Other settlements are at Eskimo Point, Rankin Inlet, Chesterfield Inlet and Wager Bay.

This region lies within the Churchill Structural Province and the rocks consist of Archean and Proterozoic(?) basement gneisses and granites, Archean supracrustal rocks (volcanics and sediments), and Proterozoic supracrustal rocks, primarily sedimentary.

The Thelon Formation (47B), a large part of which lies within the Thelon Game Sanctuary, has been noted with regard to eastern Mackenzie District. The rocks have been mapped and described by Donaldson (1965, 1969), Wright (1967) and Fraser et al. (1970). Similarly area 48B is an extension of a gneissic-granitic terrane (48A) from eastern Mackenzie District.

Dubawnt Group rocks of Proterozoic (Aphebian) age in the Baker Lake Basin (49) consist of clastic sediments, largely sandstone, conglomerate and mudstone of the South Channel and Kazan formations and subaerial felsic volcanic rocks of the Christopher Island (alkaline) and Pitz (calc-alkaline) formations. These rocks have been mapped and described by Donaldson (1965, 1969), Wright (1967), Fraser et al., (1970) and LeCheminant et al. (1976, 1977, 1979a,b,c). Area 50, north of Baker Lake, contains Aphebian sedimentary rocks of the Amer Group and surrounding gneissic and granitic rocks (Heywood, 1977; Tippett and Heywood, 1978). The Amer Group rocks are most abundant in the west part of the area and consist primarily of clastic rocks, sandstone and shale, although a dolomitic limestone unit is also present. This area forms the western part of the Armit Lake Block of Heywood and Schau (1978).

Areas 51, 53, 55, 58, 59 and 62 contain greenstone belts, probably all of Archean age, although this is only well established in the case of areas 55, 58, and 62. In area 53 the greenstone belts are moderately to highly metamorphosed and include some ultramafic volcanic rocks. The presence of the latter suggests a possible relationship to belts of Prince Albert Group rocks farther north (see Central Arctic Region). Mapping in areas 51, 53 and 55 has been by Reinhardt and Chandler (1973), Wright (1967), Bell (1971), Eade (1971, 1976) and Eade and Chandler (1974, 1975). The Kognak River-Tavani greenstone belt (58) has been mapped and studied in greater detail (Davidson, 1970a, 1970b; Heywood, 1973; Ridler, 1971, 1972, 1973, 1974; Ridler and Shilts, 1974a, 1974b; Eade, 1974). This area forms the major segment of the Rankin Inlet-Ennadai greenstone belt. Volcanic rocks here are similar to those of the Superior Province and five mafic to felsic volcanic cycles have been recognized between Padlei and Tavani (Ridler and Shilts, 1974a). The Rankin Inlet (59) area has been mapped by Heywood (1973) and Laporte (1973, 1975). Area 62 has been mapped in part by Eade (1973).

Area 52 is located north of the Kognak River-Tavani greenstone belt and consists largely of gneissic and granitic rocks of Archean and Proterozoic ages. North of Chesterfield Inlet this area includes a large part of the Armit Lake Block of Heywood and Schau (1978) and the southern part of their Committee Bay Block. Generally similar rocks are present in the Kazan River Terrane (54).

The Daly Bay Complex (52A), located about 60 miles (95 km) northeast of Chesterfield Inlet, consists of a suite of intensely deformed and highly metamorphosed layered rocks (Heywood, 1967). These are mainly mafic-rich quartz-feldspar gneisses and migmatites, but also include some amphibolite and quartzite. Several layered anorthosite and gabbro bodies are also present. Gordon (1971) has reported the presence of minor amounts of diopside-forsterite marble, calc-silicate rocks, and pure quartzite.

Areas 56 and 57 and much of area 58 west of Padlei are underlain by Proterozoic sedimentary rocks of the Hurwitz Group, and narrower belts of these rocks extend through area 58 nearly to Tavani. These rocks have been mapped and described by Eade (1971, 1974), Eade and Chandler (1974, 1975), and Bell (1968, 1970a, 1970b) and may be stratigraphically equivalent to Amer Group rocks in area 50. The Hurwitz Group rocks are mainly clastic sediments, although dolomite is present in the lower part of the Ameto Formation, and in overlying sediments (Watterson Formation) in Watterson basin. Mafic volcanic rocks and associated tuffaceous sediments comprise the upper part of the Ameto Formation in the Kaminak-Quartzite Lake belt (Bell, 1970b; Eade and Chandler, 1975).

Area 60 is gneissic-granitic terrane south of the Kognak River-Tavani greenstone belt and is bounded on the south by the Manitoba border. It surrounds areas 61 and 52 and is geologically similar to areas 52 and 54 and other gneissic-granitic terranes. Area 61 includes Aphebian (Hurwitz Group), as well as Archean sedimentary rocks and area 62 (Thlewiaza River Belt) contains Archean volcanic and sedimentary rocks (Wright, 1967; Eade, 1973).

Evidence of Mineralization

Significant known deposits within the region include the Lone Gull uranium deposit near Schultz Lake, the B zone gold deposit near Cullaton Lake, and iron deposits on the McConnell River, at Mistake Bay, and near South Henik Lake (see Section 5 of this report for further information on these deposits). Small lenses of sulphides of volcanogenic massive sulphide type, as on the Gemex property, are considered to be significant indicators of potential for this deposit type. The Ferguson Lake (area 53) and Rankin Inlet (former mine, area 59) are important Cu-Ni deposits in this region (Section 5).

Occurrences on Christopher Island with small reserves of uranium and molybdenum, many other uranium occurrences within the Baker Lake Basin (area 49), and numerous uranium occurrences located in proximity to the unconformity at the base of the Thelon sandstone (area 47B) indicate considerable potential for uranium deposits of a number of types in the region. In addition to the B zone gold deposit, area 58 also contains several other small gold deposits, such as Shear Lake, and numerous occurrences are known here and in area 55. This suggests that the greenstone belts in at least the southern part of the region are favourable for discovery of major gold deposits. Iron formation is also widespread in the greenstone belts of southern Keewatin Region. In view of the generally poor rock exposure, particularly in a wide zone flanking Hudson Bay, other important iron deposits could be proven in future in addition to those at McConnell River, South Henik Lake and Mistake Bay that have already been partially explored.

Although relatively few Cu-Ni occurrences are known in the region, the Ferguson Lake and Rankin Inlet deposits must be considered to indicate potential for further discoveries.

VII. Eastern Arctic Islands and Hudson Region

General

This region includes Baffin Island, Southampton Island and many smaller islands within Hudson Bay and along the coast of Baffin Island. In part because of its great extent, the region encompasses many geological environments and rocks of many ages, from Archean to Mesozoic.

Baffin Island

On Baffin Island large areas are underlain by predominantly sedimentary, Aphebian rocks of the Piling and Lake Harbour Groups, and associated granitic rocks, by Aphebian(?) rocks, largely volcanic, of the Hoare Bay Group, and by Archean or Aphebian volcanic and associated rocks of the Mary River Group. A sequence of Helikian clastic and carbonate sedimentary rocks, with locally underlying basaltic flows occupies a graben-bounded trough across Borden Peninsula. Helikian rocks, mainly coarse clastic sediments, are also exposed just north of Fury and Hecla Strait. Paleozoic carbonate sediments underlie the western part of Brodeur Peninsula and Mesozoic strata occupy an area on the eastern side of Borden Peninsula and adjacent Bylot Island.

Granitoid rocks are predominant in many areas (64, 68, 71, and 72) on Baffin Island. In areas 64, 68 and 72 these rocks are mainly gneissic but in area 71 and the easternmost part of area 69, massive granitic rocks are most abundant. In addition a large part of area 74 consists of gneissic and granitic rocks. Areas underlain by these rocks are generally of less metallogenetic interest than areas underlain by volcanic and sedimentary strata. Consequently the latter are considered below in more detail.

(29) Fury and Hecla Strait Proterozoic-Archean Rocks

North of Fury and Hecla Strait a basal redbed sequence of conglomerate, grit, sandstone and siltstone is overlain successively by a pink quartzite formation, a transition sequence of varicoloured shale, siltstone and sandstone, and the Autridge Formation (Chandler et al., 1980; Chandler, personal communication). The latter consists of at least 500 m of black shale. The units below the Autridge Formation belong to the Fury and Hecla Strait Formation. These rocks are of Helikian and/or Hadrynian age.

(65) *Borden Peninsula Proterozoic Rocks*

This area is underlain by an Aphebian basement gneiss complex, a sequence of Helikian volcanic and sedimentary rocks, and Paleozoic sedimentary rocks (Blackadar, 1970; Lemon and Blackadar, 1963; Olson, 1977). The Helikian sedimentary rocks are of most interest for mineral potential and Blackadar (1970) has divided these into two groups: the Eqalulik and the Uluksan. The older Eqalulik Group is comprised of the Nauyat Formation, an assemblage of massive and pillowed basalts, andesites, and thin tuffaceous beds, and the Adams Sound Formation quartzitic sandstones. Overlying the Eqalulik Group, the Uluksan Group comprises the Arctic Bay Formation (shale, dolomite), the Fabricius Fiord Formation (quartzite, shale, conglomerate), the Society Cliffs Formation (dolomite), the Victor Bay Formation (dolomite, shale), the Athole Point Formation (limestone), the Strathcona Sound Formation (mudstone), and the Elwin Formation (sandstone, siltstone, shale). This entire sequence is cut by the Franklinian diabase dyke swarm and, locally, covered by Lower Paleozoic sedimentary rocks. Olson (1977) has pointed out that major unconformities or disconformities occur between the Society Cliffs and Victor Bay formations, between the Victor Bay and Strathcona Sound formations, and between the Lower Paleozoic sediments and older rocks, including the Franklinian diabases.

The northern and southern boundaries of Area 65 are largely defined by large faults (the North Baffin Rift Zone) which, on stratigraphic evidence, have been shown to have been active during sedimentation of most of the Uluksan Group (Iannelli, 1979).

(67) *Mary River Group Rocks, Northern Baffin Island*

The Mary River Group consists of intermediate-mafic metavolcanic rocks and associated mafic and ultramafic intrusions, a variety of metasedimentary rocks, and a few felsic metavolcanic rocks (Jackson and Taylor, 1972). Amphibolite and metabasalt are locally interbedded with minor micaceous schist, metagreywacke, quartzite, felsic metavolcanic rocks, and chlorite-garnet schist. Meta-gabbro, serpentine and a few sill-like bodies of meta-anorthosite up to 1100 ft (335 m) thick are present. Metasedimentary and intrusive rocks, including quartzite that is fuchsitic in part, iron formation, and some metagabbro and amphibolite form the lower part of the Mary River Group. In part of the Mary River region 2000 ft (600 m) of mafic metavolcanic rocks are present at the base. The uppermost formation consists of metamorphosed shales and greywacke. Mafic metavolcanic rocks occur at the base and at various other horizons in the latter unit and locally make up most of the formation.

Mafic and ultramafic sills and dikes, up to 1000 ft (300 m) or more thick, and small plugs up to 1 mi (1.6 km) or so in diameter occur throughout the Prince Albert and Mary River Groups (Jackson and Taylor, 1972). The ultramafic rocks are commonly associated with iron formation. Sill-like anorthosite bodies with amphibolitic borders are up to 1100 ft (335 m) thick and are associated with mafic metavolcanic rocks.

The Mary River Group rocks form the east part of the Committee Fold Belt and have been complexly deformed about northeast-trending axes (Jackson and Taylor, 1972).

(69) *Piling Group Sedimentary Rocks*

The Piling Group of rocks on Baffin Island extends from near Pangnirtung on Cumberland Peninsula northwest to Barnes Icecap (area 69). Metasedimentary rocks of the group, in stratigraphic sequence, are quartzite, marble, graphitic sulphide schist (possibly meta-chert in part) and metagreywacke (Morgan et al., 1976). Marble is particularly abundant in the northern part of the region. The graphitic sulphide schist contains disseminated pyrite and pyrrhotite. Iron formation about 60 m thick is present southwest and southeast of Barnes Icecap. Metabasalts are present in the lower part of the greywacke unit along the south side of the area.

(70) *Hoare Bay Volcanic Rocks, Cumberland Peninsula*

The Hoare Bay Group is a thick, intensely deformed sequence of metasedimentary and intermediate to mafic metavolcanic rocks with associated serpentinized ultramafic intrusions (Jackson, 1971; Jackson and Taylor, 1972). Minor iron formation and metachert are also present, and a little marble and rusty schist outcrop along the northwest margin of the group.

(74) *Foxe Peninsula-Frobisher Bay Terrane*

This area is underlain by supracrustal rocks, primarily sedimentary, of the Lake Harbour Group and by granitic rocks. The Lake Harbour Group rocks lie in the Dorset Fold Belt of Jackson and Taylor (1972) and consist of biotite-quartz-feldspar gneiss, marble, quartzite, amphibolite, and rusty graphitic quartz-rich gneiss. The rocks are thus lithologically very similar to those of the Penrhyn and Piling groups and are probably their depositional equivalents (Jackson and Taylor, 1972). The Lake Harbour Group rocks are predominantly in the almandine amphibolite metamorphic facies. Mafic volcanic rocks about 500 ft (150 m) thick that overlie quartzite are present at the west end of the fold belt on Foxe Peninsula and the West Foxe Islands (Blackadar, 1967).

(63, 66, 73) *Paleozoic (mainly) and Mesozoic (minor) Rocks of Baffin Island-Foxe Basin*

Paleozoic strata underlie parts of northwest Baffin Island (Brodeur Peninsula – 63), and most of the islands of Foxe Basin (73). Paleozoic strata of eastern Melville Peninsula (Central Arctic Region – 30) are equivalent to, and part of, the Foxe Basin Paleozoic sequence. On Northern Baffin Island younger (Mesozoic) strata occur in limited distribution on southern Bylot Island and adjacent Borden Peninsula (66).

The term "Foxe-Baffin structural depression" has been used by Trettin (1975) to encompass Paleozoic strata that occur in Foxe Basin proper (73; 30 of Central Arctic Region) as well as similar rocks preserved in downdropped fault blocks on western Baffin Island (63). The Foxe-Baffin depression is bounded by two major structural highs that expose Precambrian rocks – northeastern and central Baffin Island on the northeast and Melville Arch (Melville Peninsula) on the west.

The basal members of the Foxe-Baffin Paleozoic sequence are shallow marine to subtidal conglomerates, coarse sandstones and calcareous sandstones of the Gallery Formation, overlain by sandstones and argillaceous, silty and sandy dolostones of the Turner Cliffs Formations. Both these Cambrian-lower Middle Ordovician assemblages comprise the Admiralty Group, exposed on northwestern Baffin Island (63) and in Foxe Basin proper (73) and presumed to underlie Middle and Upper Ordovocian strata of Ship Point Formation (sandstone, dolostone, shale, mudstone) and Map Units "Ols" (dolomitic limestone) and "Ols" (reefal dolomitic limestone; calcareous dolostone) on eastern Melville Peninsula (Trettin, 1975). The latter two units are, in part, equivalent to the Baillarge Formation (silty and shaly limestone; argillaceous limestone; cryptocrystalline limestone, locally dolomitic) that disconformably overlies the Ship Point on northwestern Baffin Island. Younger Paleozoic strata

(Lower-Middle Silurian) are represented by the upper part of the Baillarge Formation (cryptocrystalline limestone) and the overlying Cape-Crauford Formation (dolomite, evaporite solution breccias) on northwestern Baffin and by Map Unit "OScb" (dolomitic limestone; dolostone; local breccia) in the Foxe Basin sequence (Trettin, 1975). Rocks equivalent to Cape Crauford, upper Baillarge and "OScb" are not exposed in Melville Peninsula sections (30).

On southern Bylot Island and adjacent Baffin Island (Borden Peninsula) Mesozoic-Cenozoic strata (66) occupy parts of the Eclipse trough (Jackson and Davison, 1975). Named the Eclipse Group, these strata have a total thickness of about 1000 m and comprise repetitive sections of sandstones, shales, siltstones, and mudstones. Coal seams, locally up to 5 ft (1.5 m) thick are present here and there. The sequence probably ranges from Late Cretaceous to Tertiary (Paleocene-Eocene) in age (op. cit).

Hudson Bay Region

(75) Northern Southampton Island Granitic Terrane

On Southampton Island (75) and nearby Coats Island, Heywood (1970a, 1971) mapped amphibolite, quartzite, calc-silicate rocks, felsic to intermediate gneisses, and minor anorthosite and gabbroic anorthosite. The age of these rocks is uncertain but they may be correlative with rocks in the Dorset Fold Belt on southern Baffin Island (area 74).

(77) Islands in Hudson Bay

The Belcher Fold Belt is considered to be one of the erosional remnants (the Cape Smith Belt of northern Ungava and the Labrador Trough are other major remnants) of an Aphebian geosyncline that surrounded the Superior Province of northern Quebec (Ungava Craton). Deposition in the Belcher Fold belt was cyclic, with each cycle beginning with volcanism and ending with deposition of quartzitic and chemical sediments (Dimroth et al., 1970). The stratigraphic sequence of these Proterozoic rocks totals 20,000 to 30,000 feet (6100 to 9150 m; Hofmann and Jackson, 1969). Each cycle consists of mafic volcanic (spilitic) rocks overlain by greywacke, tuff and argillite, and these sedimentary rocks grade upward into interbedded and massive dolomite and orthoquartzite.

The South Sleeper, Farmer, Twin and Ottawa islands are composed mainly of mafic extrusive and intrusive rocks (Dimroth et al., 1970). Strata on the Ottawa Islands also include ultramafic lava flows (Baragar and Lamontagne, 1980). Quartzite and iron-formation are the main rock types exposed on the Nastapoka Islands.

(76) Paleozoic Rocks of Northern Hudson Bay (Southampton, Coats and Mansel Islands)

Ordovician and Silurian strata of Hudson Basin in the northern part of Hudson Platform underlie the western and southern parts of Southampton Island and Mansel and Coats Islands. The Ordovician section lying unconformably on Precambrian rocks includes mainly shallow marine limestones and dolomites of the Bad Cache Rapids and Churchill River groups and thick reefal (algal) limestones of the upper Red Head Rapids Formation (Sanford and Norris, 1973). On Southampton Island, numerous oil shale occurrences have been found in a black shale unit ("Oil Shale Interval") that occurs in the Upper Ordovician sequence near the Ordovician-Silurian interface (Nelson and Johnson, 1976) and a possible second petroliferous shale unit was described by Sanford and Norris (1973) from the lower part of the Ordovician sequence, at the top of the Bad Cache Rapids Group. According to Nelson and Johnson (op. cit.) analyses of the oil shale interval average 13 gallons/ton and single analyses up to 35 gallons of oil per ton were reported. The Bad Cache Rapids and Churchill River groups, and the Red Head Rapids Formation of Hudson Basin are, in part at least, equivalent to unit "Ols" and the lower part of the Baillarge Formation of the Foxe Basin and Baffin Island Ordovician sequences (Trettin, 1975).

Lower Silurian strata are absent from the northern Hudson Basin section but Middle and Upper Silurian carbonates (dolomites, limestones) comprise the bulk of the Paleozoic sequence exposed on Southampton and Coats Islands. The Silurian strata have been subdivided into a number of formations including Severn River, Ekwan River, Attawapiskat and Kenogami River (Sanford and Norris, 1973).

Evidence of Mineralization

The principal iron deposits of Baffin Island (Mary River, Eqe Bay, Chorkbak Inlet, Maltby Lake), Belcher Islands (Innetalling Island), and Nastapoka Islands, and the producing Nanisvik lead-zinc deposit of northwestern Baffin Island are described in Section 5 of this report. In addition to these deposits there are numerous other iron formation occurrences in the region, chiefly in the Mary River rocks of Baffin Island and to a lesser extent in Piling Group rocks of central Baffin Island.

In the Fury and Hecla Strait area (29), uranium and thorium mineralization has recently been discovered in Upper Proterozoic sedimentary rocks on the Baffin Island side (Eastern Arctic Islands and Hudson Region) of the strait. Exploration activity for uranium has also spread into similar terrane on the Melville Peninsula side (Central Arctic Region). Other minor uranium occurrences are known in Precambrian quartzites of the Lake Harbour Group, southern Baffin Island (74) and in volcanic-derived metamorphosed sediments of the same general area.

Ultramafic rocks in the Mary River and Piling groups of Baffin Island and in volcanic strata of Ottawa Islands in Hudson Bay may have some potential for nickel deposits (see Section 6) but to date no significant occurrences are known. Minor asbestos is known in an ultramafic body near the Mary River iron deposit. A few minor nickel occurrences are also known in ultramafic rocks of the Hoare Bay Group, Cumberland Peninsula, northeast Baffin Island (70).

In the Dewar Lakes area south of Barnes Icecap on central Baffin Island, Tippett (1978) reported massive pyrrhotite with "2-3 percent disseminated chalcopyrite and bornite" in rusty, gossanized amphibolite schists of the Piling Group (69). Minor base metal occurrences are known elsewhere in the region, but except for the Nanisivik Mine none have proven economic to date. As pointed out elsewhere in this report, however, (Section 4) Proterozoic rocks of Borden Peninsula and Piling Group sedimentary rocks are considered to have good potential for the occurrence of certain types of lead-zinc deposits.

SECTION 4

SUMMARY RESOURCE ASSESSMENTS OF INDIVIDUAL AREAS

Introduction

The tables that follow summarize the detailed resource assessments for individual areas given in Section 6. In the tables, ratings for Resource Potential (R) and Economic Development Potential (E) are coded according to the scheme given in Section 2 (Methods of Study). For convenience of reference, the code interpretations for these are repeated below:

Resource Potential Rating	Economic Potential Rating
N – Nil	5 – Not assessable
L – Low	4 – Nil (no possibility)
M – Moderate	3 – Low
H – High	2 – Moderate
VH – Very High	1 – Good

Commonly, a combined code rating is used in an area; e.g., N-L.

In the tables the ratings are arranged according to major region (Northern Yukon and Northwestern Mackenzie, Western Arctic Islands, etc) and according to area subdivisions within major regions (1, 2, 3, etc). The general commodities or deposit-types for which the areas have been rated are listed across the top of the tables. Note that the commodity list here does not correspond exactly to the mineral deposit symbol code list given on Maps 1 and 2. This is because the rating tables have been generalized to emphasize the major commodities considered important. For example, the mineral deposit symbol list contains two entries for uranium (01 – uranium or uranium plus thorium; 02 – uranium plus copper, plus or minus other elements) but in the tables these have been generalized to one rating for uranium.

It should also be noted that although the individual assessments of Section 6 are done mainly on the basis of deposit-type, these have been translated in the tables to commodities, with one exception. The exception is VMS (volcanogenic massive sulphide type) which is retained as a type, rather than being disaggregated into its contained commodities (zinc, copper, silver and possibly lead and gold). This is because deposits of this type are polymetallic and their metal contents are only partially predictable.[1]

The relationships between commodities and deposit-type are best illustrated in the case of the ratings for Pb + Zn in the tables. The detailed assessments for the areas involved (Section 6) have been made on the basis of three deposit-types (shale-hosted deposits, carbonate-hosted deposits, sandstone-hosted deposits) but the highest potential rating for Pb-Zn derived from any one of the deposit-type assessments in an area has been used in the tables. For details of the Pb + Zn assessments, it is thus necessary to refer to Section 6.

Many areas are unrated for various commodities in the tables. This means that the information available is considered inadequate to make an assessment (code 5 in Economic Potential Rating). It does not necessarily mean that the area is considered to have no potential to contain mineral resources. In the latter case the rating N (nil) is used.

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[1] Another exception to this occurs in the case of some of the copper potential ratings in the tables, where, because of difficulties in disaggregating the potential ratings for various deposit-types that might contribute copper (nickel-copper deposits, VMS, etc) the general copper potential may be an aggregate of several deposit-type potentials.

TABLES 4.I-4.VII

SUMMARY MINERAL RESOURCE ASSESSMENTS FOR INDIVIDUAL AREAS

Table 4.I Northern Yukon and Northwestern Mackenzie Region

Resource Potential Rating (R) / Economic Development Potential Rating (E)

AREA	U		Au		Ag		Cu		Ni		VMS		Pb+Zn		Fe		Mo		
NO.	R	E	R	E	R	E	R	E	R	E	R	E	R	E	R	E	R	E	REMARKS
1	H	4	M	1			L-M	4					N	-	L	3	L-M	3	Low possibility of phosphate potential under Fe (Areas 2 and 3); probably moderate potential for tungsten in Areas 1 and 2.
2	M	4					L	4					N	-	L	3	N	-	
3	M	4			N	-	L	4					N	-			N	-	
4	M	4			N	-	N	-									N	-	
5	M	4			N	-	N	-									N	-	
6	N	-			N	-	L	4					L-M	2			N	-	
7	L	4			N	-	L	4					L-M	2			N	-	
8	L	4					L	4	N-L	4							N	-	
9A					N	-	L	4									N	-	

Table 4.II Western Arctic Islands Region

Resource Potential Rating (R) / Economic Development Potential Rating (E)

AREA	U		Au		Ag		Cu		Ni		VMS		Pb+Zn		Fe		Mo		
NO.	R	E	R	E	R	E	R	E	R	E	R	E	R	E	R	E	R	E	REMARKS
9B	N	-	N		N	-	N				N	-					N		
10	N	-	N		N	-	N				N	-	N-L				N		
11	L-M	2	N-L	3	L	3	L	4	N-L	4	N	-	N-L				N		
12			N		N	-	L	4			N	-	N-L				N		
13	N-L	-	N		N	-	N				N	-					N		Manganese present on Banks Island but not of commercial grade.
14B	N	-	N		N	-	N				N	-	N				N		
14C	N-L	-			N	-	L	4			N	-					N		
15	N-L	-			N	-	L	4			N	-					N		
16	N-L	-			N	-	L	4			N	-					N		

Table 4.III Northern Arctic Islands Region

Resource Potential Rating (R) / Economic Development Potential Rating (E)

AREA	U		Au		Ag		Cu		Ni		VMS		Pb+Zn		Fe		Mo		
NO.	R	E	R	E	R	E	R	E	R	E	R	E	R	E	R	E	R	E	REMARKS
14A	L						L	4					*VH	2			N-L	4	*For Pb-Zn parts of 14A, 14B, 14C and 15 of N and E Ellesmere Island have variable potential for Pb-Zn, depending on deposit type. See Section 6. Part of 14B in Cornwallis Pb-Zn district has VH rating for carbonate-type. **Refers to rocks of 14A exposed within 15, north of Ellesmere Island. Area 19: Low potential for asbestos and platinum. Area 20: As above and also low potential for chromite.
14B	L						L	4					*L	2			N		
14C	L	5					L	4					*M	4			N		
15	L						L-M	4			**L	5	*				N		
17	L		L	4	N	-	N	-									N		
18	N-L	-	N-L	2			L-M	4									N		
18A	L	2	M	3-4			L-M	4									N-L		
18B	N-L																N		
19	N-L	-	M	4			M	3-4	N-L	4	L	5					L	4	
20	N-L						M	3-4	N-L	4							L	4	

Commodity/Deposit Type Legend

U – uranium
Au – gold
Ag – silver
Cu – copper
Ni – nickel
VMS – volcanogenic massive sulphides (Cu+Zn+Ag ± Pb,Au)
Pb+Zn – lead-zinc
Fe – iron
Mo – molybdenum

Table 4.IV Central Arctic Region

Resource Potential Rating (R) / Economic Development Potential Rating (E)

AREA NO.	U		Au		Ag		Cu		Ni		VMS		Pb+Zn		Fe		Mo		REMARKS
	R	E	R	E	R	E	R	E	R	E	R	E	R	E	R	E	R	E	
9D	N-L		N	-			N-L				N	-					N		
21			L	2-3	N	-	L	4			N	-					N-L		
22	L	5					L	4			N	-	M	3			N		
23							L	4	L	4	N-L	3					N-L		
24			L	1			L	4			L	3	N	-			N-L		
25			N-L	1			L	4									N-L		
26			M-H	1			L	4	M	4	L	3	N	-			N-L		Area 26: some potential (L-M) for asbestos and carving stone.
27							N-L										N		
28	L	5	N-L	1			L	4									N-L		
29	L-M	2-3	L	2-3			L	4	L	4	N-L		N	-			L	4	Area 29: some potential (L-M) for carving stone.
30	N-L						N-L										N		
31	N-L		M-H	1			L	4	L	4	M	2	N	-	M-H	2	N-L		Area 31: as above (carving stone).
32	N-L		N-L	1			L	4									N-L		
33	N-L		M	1			L	4	M	4	L	3	N	-	M-H	2	N-L		Area 33: asbestos (L-M); carving stone (L).
34	N-L		N-L	1			L	4			N	-					N-L		
34A			N-L	1			L	4			N-L	3					N-L		Area 34A: low potential for platinum and chromite.
35	N-L		L-M	1			L	4			N	-	M	-			N-L		
36			N-L	2-3							N	-							
46B							L	4	L-M	4	N	-					L	4	

Table 4.V Northeastern Mackenzie District

Resource Potential Rating (R) / Economic Development Potential Rating (E)

AREA NO.	U		Au		Ag		Cu		Ni		VMS		Pb+Zn		Fe		Mo		REMARKS
	R	E	R	E	R	E	R	E	R	E	R	E	R	E	R	E	R	E	
9C					N	-	L	4									N	-	
36	L-M	3	N-L	2	N-L	3	L	4					L	3			N	-	
37	L	4			N-L	4	L-M	3									N	-	
38	H	1	L-M	2	N	-	L	4									N-L	4	
39	M	3	L-M	1	M-H	1	L	4	L	4	M	2					L	4	Area 39: some potential (low) for asbestos and chromite.
40	M	3	L	2			L	4			N	-	M	3			N	-	
41	N-L	4	M	2			L	4			N-L	1			N-L	3	L	4	
41A	N	-	VH	1			L-M	2	L	4	VH	1					L	4	
41B	N	-	M	1			L	2			VH	1					L	4	
41C	N	-	M	1	M	2	L	2			M	1					L	4	
41D	N	-	M-H	1			M	1-2			VH	1					L	3	
42	L-M	3	M	2	L	2	L	4	L	4	N	-	M	3			N	-	
43	M	2	M	2	L	3	L	4			N	-	L	3			N	-	
44	N	-	M-H	2			L	4			N-L	1					N-L	4	
45	N	-	M-H	2	M-H	2	L	4			M	2					L	4	Area 45: good potential for small Au and Ag deposits; moderate potential for major deposits.
46A			N-L	1			L	4									N-L	4	
47A			L	2			N-L	4									N-L	4	
48A			N-L	1			L	4									L	4	

<u>Commodity/Deposit Type Legend</u>

U – uranium
Au – gold
Ag – silver

Cu – copper
Ni – nickel
VMS – volcanogenic massive sulphides (Cu+Zn+Ag ± Pb,Au)

Pb+Zn – lead-zinc
Fe – iron
Mo – molybdenum

Table 4.VI Keewatin Region

Resource Potential Rating (R) / Economic Development Potential Rating (E)

AREA NO.	U R	U E	Au R	Au E	Ag R	Ag E	Cu R	Cu E	Ni R	Ni E	VMS R	VMS E	Pb+Zn R	Pb+Zn E	Fe R	Fe E	Mo R	Mo E	REMARKS
47B	H-VH	1-2	L	2			N-L	4									N-L	4	
48B	H	1-2	N-L	1			N-L	4									L	4	
49	H-VH	1-2	L-M	2	L	3	L-M	3									L-M	2-3	
50	H-VH	1-2	L-M	2			L	4									N-L	4	Area 50: low potential for asbestos.
50A	L?	5	L	2			N-L	4											
51			M	1			L	4			M	2-3					L	4	
52			N-L	1			L	4	L	4							L	4	
52A							N-L	4									N-L	4	Area 52A: low potential for platinum and chromite.
53			L-M	1			L-M	3	L-M	4	M	2-3					L	4	Area 53: low potential for asbestos, platinum and chromite. Moderate for carving stone.
54			N-L	1			L	4	L	4							L	4	Area 54: asbestos (L), carving stone (M).
55			H	1-2			L-M	4	L	4	M	3					L	4	Area 55: asbestos (L).
56			L-M	2			L	4									N-L	4	
57	L-M	3	L-M	2			L	4									N-L	4	
58	L-M	3	VH	1			M-H	2	L	4	H	2			M	3	M	3-4	Area 58: carving stone (L); under copper includes Cu potential in VMS.
59			M	1			L-M	3	L-M	4							N-L	4	Area 59: asbestos (L); carving stone (L-M).
60			N-L	2			L-M	3-4									L	4	
61			L-M	1			L-M	3-4									N-L	4	
62			M-H	2			L-M	3-4			M-H	2					N-L	4	

Table 4.VII Eastern Arctic Islands and Hudson Region

Resource Potential Rating (R) / Economic Development Potential Rating (E)

AREA NO.	U R	U E	Au R	Au E	Ag R	Ag E	Cu R	Cu E	Ni R	Ni E	VMS R	VMS E	Pb+Zn R	Pb+Zn E	Fe R	Fe E	Mo R	Mo E	REMARKS
29	L-M	3	L	3			L	4									L	4	
63	L	3					N-L	4									N	-	
64	L	4					N-L	4									N-L	4	
65	L-M	2					M	3					H-VH				N-L	4	Area 65: under Pb+Zn additional potential for both carbonate-hosted type and shale-hosted type exists.
66	N-L	4					N	-									N	-	
67	L	5	M-H	1			L	3	M	4	M	2			M-H	2	L	3-4	Area 67: some potential for asbestos, carving stone, chromite and platinum (see under Nickel, Section 6).
68							N-L	4									N-L	4	
69	L	5	N-L	2			L	4	L-M	4	N-L	3-4	M-H	1-3			N-L	4	Area 69: under Pb+Zn has different E ratings, depending on type. Also some potential for asbestos and carving stone under 69 and 70 (see Nickel, Section 6).
70	N-L	-	M	1			L	4	L-M	4	L	3					N-L	4	
71	L	4					N-L	4									N-L	4	
72	L	4					L	4									N-L	4	
73	N-L	-					L	4									N	-	
74	L	4	N-L	1			L	4	L	5			L	2	L	3	N-L	4	Area 74: some potential for asbestos and carving stone (see Nickel, Section 6). Also some potential for platinum and chromium.
75	L	4	N-L	1			N-L	4									N-L	4	
76	N-L	-					N-L	4									N	-	
77	L	5					L	4	L-M	3			M	2	L-M	3	N	-	Area 77: some potential (L-M) for nickel and carving stone on Ottawa Islands.

U – uranium
Au – gold
Cu – copper
Ni – nickel
Pb+Zn – lead-zinc
Fe – iron
Ag – silver
VMS – volcanogenic massive sulphides (Cu+Zn+Ag ± Pb,Au)
Mo – molybdenum

SECTION 5

DESCRIPTIONS OF PROVEN AND SIGNIFICANT DEPOSITS

Introduction

Table 5.1 summarizes the main characteristics (commodities present, grade, tonnage, etc) of the proven deposits and some of the significant deposits (Map 1) of the study region. For the most part these deposits occur in the mainland Northwest Territories. Exceptions occur in the case of the Mt. Davies-Gilbert (Delta) iron deposit of northern Yukon, the Eclipse and Polaris lead-zinc deposits of Little Cornwallis Island, the Nanisivik lead-zinc mine of northern Baffin Island and several of the larger iron deposits of Baffin Island, Belcher Islands and Nastapoka Islands of the Eastern Arctic Islands and Hudson Region (Fig. 3). The only region in which deposits of either the proven or significant category are not known to date is Western Arctic Islands.

Brief descriptions of many of the individual deposits are given below.

I Northern Yukon and Northwestern Mackenzie Region

Iron

(Areas 2, 3) Mount Davies Gilbert Area (Delta Iron)
(Fig. 3 and Map 1)

Cretaceous sediments consisting of interbedded black shale, sandy shale, and siderite are exposed in the northern part of the Richardson Mountains along Cache Creek, Fish River, Boundary Creek, and Rapid Creek, between latitude 68°25' and 68°35'. Sections containing numerous siderite beds range in thickness from 500 to 1500 feet and contain 15 to 20 percent iron and 1.5 to 3 percent phosphorus (P_2O_5), with some individual layers containing as much as 14 to 20 percent P_2O_5. Thirteen specimens from the iron-rich beds analyzed at the Geological Survey of Canada averaged 22.5 percent iron, 13 percent P_2O_5 (phosphorus pentoxide), and 2.9 percent manganese (Young, 1972, 1973; Young et al., 1976; Young, personal communication, 1976).

The siderite occurrences are of little interest as an iron resource because of their low grade, the intimate admixture of clay and phosphate minerals and their remote location. It is technically feasible to produce iron from this material; however, the processing methods are complicated and also costly because they involve high energy consumption.

III Northern Arctic Islands Region

Lead-Zinc

(Area 14B) Arvik (Polaris) Lead-Zinc Deposit

The Arvik deposit on Little Cornwallis Island, about 600 miles (960 km) north of theArctic Circle, was discovered in 1960 by Bankeno Mines Limited and was subsequently optioned by Cominco Limited. In 1972-73 a decline 5300 ft (about 1590 m) long was driven and 600 ft (180 m) of cross-cuts were established. Five thousand tons of ore were mined with 3600 tons used as a test shipment and the balance stockpiled. A decision to go into production was deferred in 1976 due to government smelting requirements (Northern Miner, June 24, 1976), but recently a decision has been made to put the Polaris deposit into production in early 1982 (Annual Report, Cominco Ltd., 1979).

Reserves in the deposit are 25 000 000 tons at a grade of 14.1% Zn and 4.3% Pb. The gross metal value of this ore is in excess of $1.5 billion dollars at 1979 prices. The ore is coarse grained and presents no metallurgical difficulties.

In every respect the deposit is of the so-called "Mississippi Valley" or "carbonate" type (Sangster, 1974) lead-zinc deposit (see Appendix 2). It is controlled by karst solution caverns and breccias and is confined within dolomite and limestone of the upper part of the Ordovician Thumb Mountain Formation, in close spatial association with a major facies change (Kerr, 1977). The ore is composed essentially of sphalerite, galena, and pyrite.

(Area 14B) Eclipse Deposit

This deposit is similar in character and in geological setting to the Polaris deposit (Schiller, 1965; Thorpe, 1966). The Eclipse deposit is located 27 km northeast of the Polaris and was also discovered in 1960. Extensive drilling in 1965-66 outlined two ore zones with a combined tonnage of 1 535 000 tons at a grade of about 12.4% Zn and 2.2% Pb. Further exploration of the deposit was carried out in 1971.

IV Central Arctic Region

Iron

(Area 31) Melville Peninsula – West

Highly metamorphosed magnetite iron-formation located in prominent ranges on the east and west sides of the peninsula was mapped in detail and systematically sampled between 1968 and 1970. Five major iron deposits were delineated in the western iron range that is located 15 miles east of the coast of Committee Bay and extends northeast for a distance of 30 miles. More than three billion tons of iron resources were indicated in these deposits within the limits for possible open pit mines, with more than one billion tons in the largest deposit. The relatively coarse grained magnetite iron-formation predominant in all the large deposits contains 32 to 38 percent iron and iron concentrates of very good quality, with excellent recovery of iron from the crude material, can be obtained by magnetic separation methods.

The iron-formation is associated with Prince Albert Group rocks that consist of metagreywacke, metavolcanics and amphibolite and ultramafic and granite intrusions, and with younger quartzite and dolomite beds and diabase dykes. The iron-formation is complexly folded and repeated within the western limb of a broad regional synclinal structure which is disrupted by cross faults. These faults also separate individual folded segments of iron-formation that plunge steeply north and form the iron deposits.

The favourable grade and excellent quality of these resources for concentration, the compact fold structures which could provide large tonnages of ore in a single open pit mine and the proximity of the deposits to tide-water, even with a limited season for shipping, may make them attractive for future development.

(Area 33) Melville Peninsula – East

Iron-formations occur on the east side of Melville Peninsula in a geological setting very similar to that in the west. More than one billion tons of iron-formation with an iron content of 23 to 34 percent has been indicated in five deposit areas located in a belt that extends southwest from Roche Bay for a distance of 30 miles. The highly metamorphosed magnetite iron-formation is amenable to concentration to provide high quality concentrates but the deposits are disrupted in some places by mafic intrusions and amphibolite (General References: Heywood, 1967, Wilson and Underhill, 1971).

Table 5.1 Summary of proven and some significant[1] mineral deposits, northern and arctic regions

Area No. (Map 1)	Deposit No. (Appendix 1A and Map 1)	Deposit Name	Commodity(ies)	Reserves (tonnes)	Grade	Distance to ocean (km)	Remarks
I	Northern Yukon and Northwestern Mackenzie Region						
3	N3-10-2	Mt. Davies-Gilbert (Delta Iron)	Fe		15-20% Fe 1.5-3% P_2O_5	40	Interbedded siderite and shale in sections 500 to 1500 feet (150 – 450 m) thick at several locations.
III	Northern Arctic Islands Region						
14B	N4-5-2	Polaris	Zn-Pb	22.9×10^6	14.1% Zn 4.3% Pb	On coast	In preparation for production.
14B	N4-5-1	Eclipse	Zn-Pb	1.4×10^6	12.4% Zn 2.2% Pb	On coast	Possibility of future development in conjunction with Polaris.
IV	Central Arctic Region						
33	N3-3-4	Melville East	Fe	$>1 \times 10^9$	23-34% Fe	Near coast	Five deposit areas in a belt extending 30 miles (50 km).
31	N3-3-5 to 10	Melville West	Fe	3×10^9	32-38% Fe	Up to 30	Five major deposits in a belt extending 50 km.
V	Northeastern Mackenzie District						
38	N2-7-281	Mountain Lake (PEC-YUK)	U	not yet defined (significant tonnage inferred)	.3-.5% U_3O_8	90 (Coppermine)	Several lenses under current exploration; considerable drilling done.
41A	N2-6-97	North Vein (Sidewalk Group)	Au		.4 oz/ton	On coast	Zone 670 m long and 1.7 m wide defined by 30 shallow drill holes.
41A	N2-6-42	H. Group	Au		.45 oz/ton	10	Two zones, 57 m and 76.5 m in length; a third zone a little longer.
41D	N2-6-13	Contwoyto Lake (Can. Nickel main showing)	Au	several million	.3 oz/ton or better	190	A much larger tonnage available at a lower grade. Feasibility studies currently under way.
37	N2-7-68	No. 47 deposit	Cu	3.72×10^6	3.07% Cu	65	Small but good grade.
37	N2-7-143	June deposit	Cu	$.9 \times 10^6$	2.5% Cu	60	Similar to No. 47 but smaller and lower grade.
41A	N2-6-51,52,53	High Lake	Cu-Zn-Ag	4.72×10^6	3.6% Cu, 2.45% Zn .1% Pb, .6 oz/ton Ag	50	Tonnage contained in two zones. Perhaps nearly economic when Cu price high. Relatively near Coronation Gulf.
41A	N2-7-264,265	Takiyuak Lake (Hood No. 10)	Cu-Zn-Ag	450×10^3	5% Cu; 3.5% Zn 1.0 oz/ton Ag	170	425 000 tonnes of lower grade material in two other zones. Small but rich.
41D	*	Izok Lake	Cu-Zn-Pb-Ag-Au	10.9×10^6	2.8% Cu, 1.4% Pb 13.7% Zn, 2.0 oz/ton Ag	225	Outside of, but near, the 41D area. Excellent grade for a deposit of this type.
41B	N2-6-44 to 49	Hackett River	Zn-Ag-Pb-Cu	18.2×10^6	Approx. 7% Zn, 1.0% Pb, 5 oz/ton Ag, .25% Cu	80	Reserves in 5 deposits. Deposits incompletely defined by drilling. Other deposits will likely be found in the area.
41B	N2-6-128	Yava	Zn-Cu-Pb-Ag-Au	$1\text{-}2 \times 10^6$	Approx. 3% Zn, .5% Cu, .5% Pb, 3 oz/ton Ag, .03 oz/ton Au	125	Deposit open below 80 m.
VI	Keewatin Region						
49	N2-5-19	Lone Gull (Schultz Lake; Sisson Lake)	U			80 (to Baker Lake)	Estimated to contain 9×10^6 Kg U_3O_8 on basis of first 40 drill holes. Much drilling since. One hole intersected >1% U_3O_8 for 30.5 metres.

49	N2-4-10	Occurrence 68-1	U, Mo			On Baker Lake	Reserves 72 700 kg U_3O_8, 68 000 kg MoS_2
49	N2-4-11	Occurrence 68-2	U, Mo			On Baker Lake	Maximum estimate of reserves 455 000 kg U_3O_8, 910 000 kg MoS_2.
49	N1-4-122	Occurrence 68-4	U			45 (to Baker Lake)	Reserves 455 000 kg U_3O_8. Ore grade 0.46% U_3O_8.
58	N1-5-8	Cullaton Lake (B zone)	Au	168×10^3	.74 oz/ton Au	255	Potential for 90 000 tonnes additional, and 180 000 tonnes at a lower grade in nearby A Zone and Shear Lake deposits.
58	N1-5-28	Heninga Lake (Gemex)	Cu-Zn-Ag			150	Incompletely explored, probably <1 000 000 tonnes of ore in 3 lenses in a sulphide zone 850 m long. Located on proposed Polargas pipeline route ("Eastern" Route)
53	N1-5-14,15,16	Ferguson Lake	Ni-Cu	Moderate	less than 1% of each Ni, Cu	230 (145 to Baker Lake)	Grades "submarginal" but exact values not available. Drilling of two zones is inferred to have indicated a moderate tonnage. Very near proposed Polargas pipeline route ("Eastern" Route).
59	N1-4-96	Rankin Inlet	Ni-Cu		2.6% Ni, 0.7% Cu	On coast	Past producer. 400 000 tons mined at this grade. Some Pt and Pd recovered.
58	N1-5-69	South Henik Lake	Fe			190	Several lenses of iron-formation up to 90 m thick and 8 km long.
58	N1-4-68	McConnell River – West	Fe	400×10^6	29-40% Fe	90	About 95 km west of Eskimo Point. Possibly comparable iron-formation east of the river.
58	N1-4-77,78,79	Mistake Bay	Fe			On coast	Iron-formation in 5 occurrences.

VII Eastern Arctic Islands and Hudson Region

65	N4-3-6	Nanisivik	Zn,Pb	5.29×10^6 (Jan. 1, 1979)**	11.54% Zn, 1.23% Pb	On coast	Producing mine. Production started October, 1976. To end of 1978 mined 1 212 300 tons (1 099 800 tonnes) of ore.
67	N3-2-4	Mary River	Fe	27×10^6	68% Fe	96 (to Milne Inlet)	Resources measured in No. 1 deposit.
				133×10^6	68% Fe		Measured and indicated in a second deposit area.
				100×10^6	66% Fe		Indicated in a third deposit area. There are approximately 500×10^6 tonnes additional iron-formation with 30% Fe in narrow zones in the area.
67	N3-2-19	Eqe Bay	Fe	360×10^6	32-45% Fe	Near tidewater	Iron-formation distributed in 4 deposit areas.
74	N2-2-4	Chorkbak Inlet	Fe	360×10^6	20% Fe	Near tidewater	Iron-formation in five deposit areas.
74	N2-2-11	Maltby Lake	Fe	200×10^6	34% Fe	11	Iron-formation in tightly folded structures.
77	NO-2-6	Innetalling Island (Belcher Islands)	Fe	1×10^9	27% Fe	On ocean	Iron-formation for a distance of 19 km.
77	NO-2-17	Nastapoka Islands	Fe(Mn)			On ocean	Substantial Fe resources in iron-formation up to 53 m thick containing about 30% Fe and 2% Mn.

[1] See Section 2, "Definitions" for explanation of "Proven" and "Significant". Deposits in the significant category are underlined. Some "Occurrences" from Appendix 1B are listed here (double underlined) for which it is known that reserves are present, but data have not been published.

* Outside of area. Included because it is near area 41D.

** Reserves at mine start up(1976) were 6 412 400 tonnes.

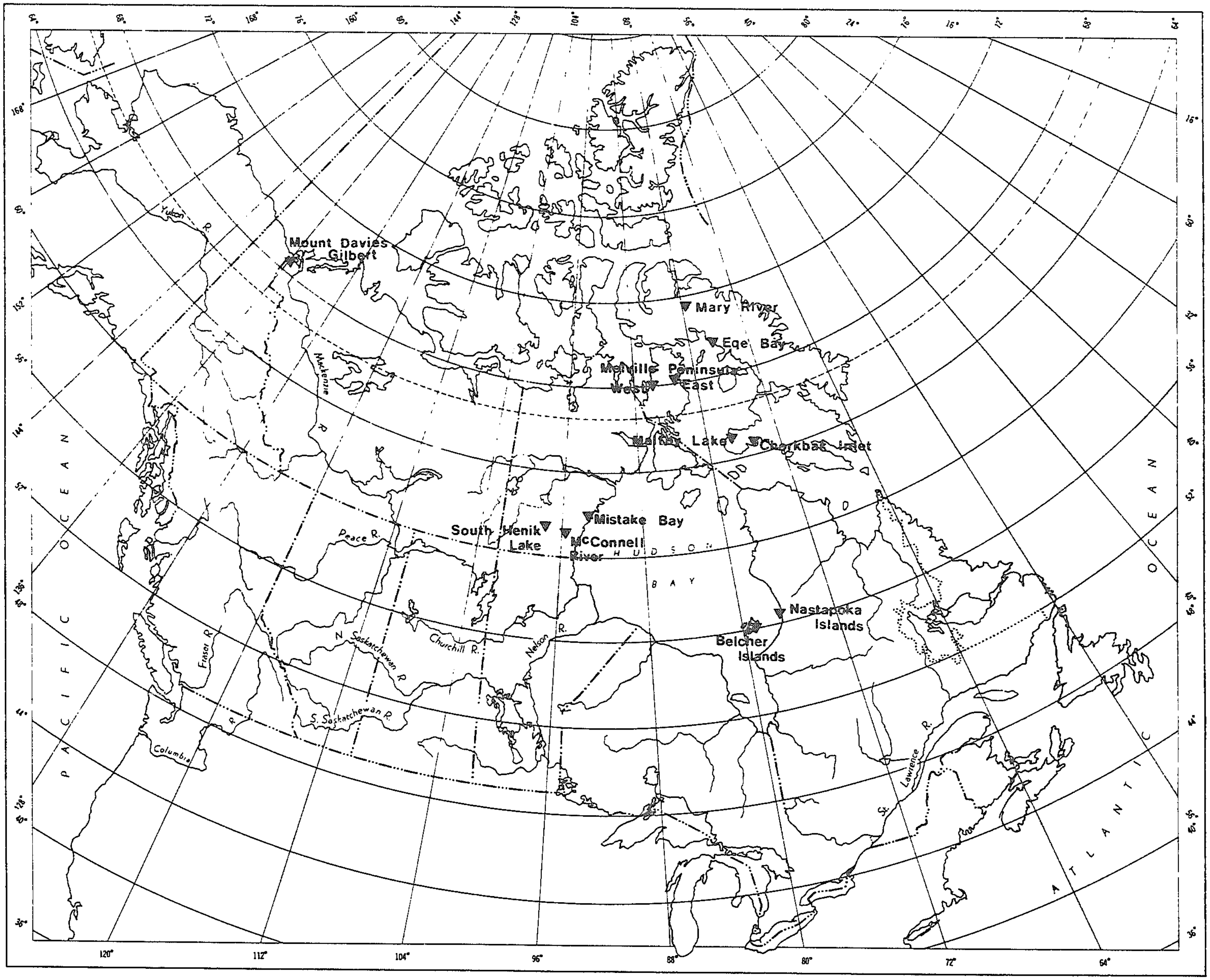


Figure 3. Distribution of iron deposits of major significance within the study region.

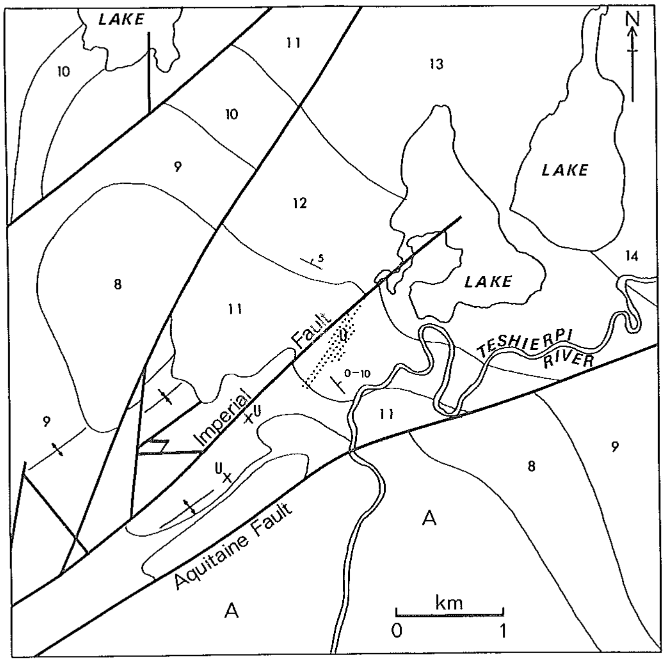


Figure 4. Surface geology of the Mountain Lake uranium deposit; X represents uranium showings and dotted pattern is the surface projection of the deposit; unit numbers are those used by Baragar and Donaldson (1973, see also text); Based on the data by Aquitaine Ltd. (Bizard and Salat, 1969) and Imperial Oil Ltd. (Ahuja, 1974) and F. Hassard (personal communication) of Trigg, Woollett and Associates Limited.

V Northeastern Mackenzie District

Uranium

(Area 38) Mountain Lake Deposit (PEC-YUK Claims)

Exploration History: Uranium showings on the PEC claim group were discovered during 1969 by an airborne radiometric survey carried out over the Dismal Lakes-Great Bear Lake area by Aquitaine of Canada Limited (Bizard and Salat, 1969). Some drilling was done in the vicinity of the showings in 1975 by the company under a joint venture with Eldorado Nuclear Limited but the results were not encouraging (Hassard and Woollett, 1975). During 1972, Trigg, Woollett and Associates Limited conducting surveys for Imperial Oil Limited, discovered numerous high-grade radioactive boulders scattered over a distance of several kilometres north and west of the showings, and the area north of the PEC claims was staked as the YUK claims (Ahuja, 1974). A systematic study of the boulder distribution and Pleistocene geology suggested a source additional to the showings. More intensive exploration followed, and in 1976 drilling just north of the PEC claim group boundary intersected the main deposit at a depth of 75 to 150 m, beneath overburden up to 60 m thick. Part of the deposit extends into the PEC claim group which is under exploration by the Aquitaine-Cominco Joint Venture.

The following brief description is based on the presentations in 1978 by F. Hassard of Trigg, Woollett & Associates Limited at the Geoscience Forum in Yellowknife, and by S.S. Gandhi of the Geological Survey of Canada at the Mineralogical Association of Canada Uranium Short Course in Toronto.

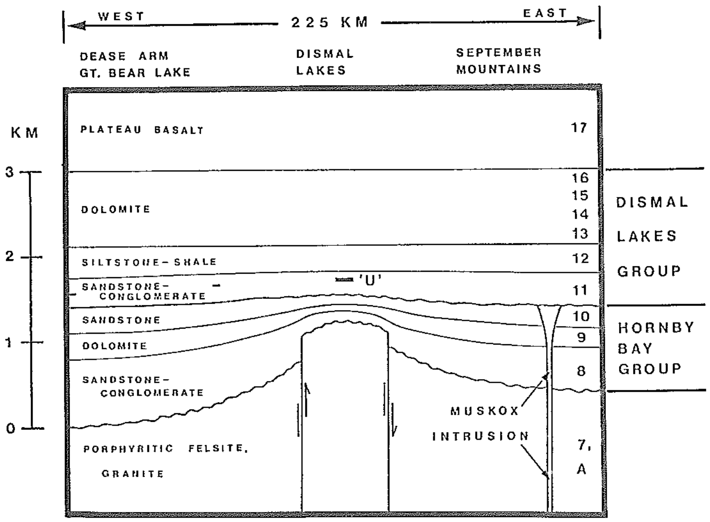


Figure 5. Stratigraphic position of the Mountain Lake uranium deposit ("U") in the Dismal Lakes area (after Baragar and Donaldson, 1973 and Ahuja, 1974).

Geological Setting: The Surface geology of the area around the uranium deposit is shown in Fig. 4. Uranium mineralization occurs in the sandstone-conglomerate unit no. 11, of the Helikian Dismal Lakes Group (Baragar and Donaldson, 1973; Ahuja, 1974). The host beds dip gently to the northeast. The unit is predominantly quartzose, white to buff sandstone, and includes basal and intraformational conglomerate beds. The basal conglomerate marks an unconformity between the Early Helikian Hornby Bay Group of sediments (unit 8: sandstone-conglomerate; unit 9: dolomite-chert; unit 10: sandstone), and Aphebian basement consisting of felsic volcanic rocks and granite of the Great Bear Batholith (unit 7, and 'A' in Fig. 5). Pebbles of these older rocks are found in the conglomerates of unit 11. In the vicinity of the deposit, the Hornby Bay Group strata are folded, and the basal conglomerate of unit 11 contains red sandstone pebbles of unit 8, and directly overlies the latter as well as the granite. These features suggest a local basement high and a small trough, possibly fault-controlled, which received clastic sediments from local sources. Red oxidized regolith is developed on the granite. The age of this regolith is not certain but it is probably pre-Hornby Bay Group. Unit 11 is overlain conformably by thinly bedded siltstone and dark grey shale of unit 12, with a transition zone between the units. A thick sequence of dolomites overlies unit 12, and forms the upper part of the Dismal Lakes Group (units 13 to 16, Baragar and Donaldson, 1973).

The major faults of the area affect all the sedimentary rocks and may be reactivated older faults in the basement. Mineralization predates the latest movement on the faults, as evidenced by the Imperial fault (Fig. 4) which has a post-mineralization vertical displacement of 60 m.

Mineralized Zones: The uranium mineralization is in stratiform lenses, up to 2 m thick, which pinch and swell and at places bifurcate and coalesce, but which are confined to a stratigraphic zone up to 40 m thick in the upper-middle part of unit 11. Unit 11 is 50 to 175 m thick in this area. The mineralized intersections in drill holes vary considerably in grade, length, and stratigraphic position, and therefore correlation from one hole to another is difficult. However, the general pattern indicated by drilling is that there are three major lenses and several minor lenses, ranging in length up to 400 m, in width up to 200 m, and in grade from 0.5 to 0.3% U_3O_8. Higher grades over very narrow widths are encountered locally, but these are exceptional and occur commonly at or near faults.

Mineralogy: Uranium occurs mainly as sooty pitchblende along with minor black unidentified oxides (coffinite?) which are disseminated in the matrix of the sandstone in bands parallel to bedding, and also occur locally in spots and irregular patches, as rims on pebbles in conglomerate beds, and along small fractures. Yellow and green secondary minerals occur along fractures, in vugs and in some parts of the disseminated zones. Chalcopyrite and pyrite are present in minor amounts in the disseminated zones but their distribution is irregular. Traces of cobalt and nickel arsenides occur locally in the disseminated zones and also with uranium minerals along fractures. Minor silver values, commonly a fraction of an ounce per ton, are encountered in high grade uranium sections. Red hematite staining is developed in places, commonly along the margins of the mineralized zones. Minor chlorite and clay minerals are also present in the zones.

Age of Mineralization: Pb-U isotopic analyses on one sample of drill core collected by S.S. Gandhi, yielded a discordant age of 794 million years. This is interpreted as representing a post-mineralization event, most probably faulting, that disturbed the isotopic equilibrium of the earlier uranium mineralization. The original mineralization is probably close to the age of the host sandstone which is believed to be Neohelikian (1000 – 1400 Ma) from its regional geological relationships (Baragar and Donaldson; 1973).

Economic Potential: Size and grade of the Mountain Lake deposit has not yet been announced by the companies involved in its exploration; however the deposit probably contains in the order of a million tons or so of ore with grades in the range of typical sandstone-type deposits in the southwestern United States. Considering its remote location, the deposit is not likely to be economic under current or near-future conditions. The possibility of an open-pit operation exists, but the stripping ratio would be rather high, and problems could arise due to permafrost. A group of similar deposits, or a larger one would be economically attractive, and potential for these exists in the extensive host unit.

Gold

(Area 41A) Coronation Gulf (Tree River) Gold Veins

Gold veins are exposed on Coronation Gulf a few kilometres east of the Tree River. They are simple quartz veins that are mineralized with very light coloured pyrite. The veins are generally steeply dipping, cut gneissic granitic rocks, and in many cases strike northeasterly.

The North vein is exposed in two segments, separated by a gap of 1550 ft (474 m) on the property of James River Mines Limited. It is also exposed on the Consolidated Manitoba Mines property to the north for a distance of 160 ft (49 m), and again on the property of McIntyre Procupine Mines Limited. On the James River Mines Limited property, the two vein segments, 730 and 400 ft (223 and 122 m) long respectively were reported by Precambrian Mining Services in 1964 to carry 0.30 oz/ton Au across 7 ft (2.1 m) for a length of 400 ft (122 m) and 0.84 oz/ton Au across 5 feet (1.5 m) for a length of 320 ft (98 m). Subsequent sampling resulted in reductions in these grades. Four trenches along a length of 160 ft (49 m) on the Consolidated Manitoba Mines property indicated a grade of 0.48 oz/ton Au across a width of 4 ft (1.2 m) (Schiller, 1965; Thorpe, 1966). Over a length of 670 m the North vein has been estimated to grade 0.4 oz/ton Au across an average width of 1.7 m (The Northern Miner, March 20, 1975) on the basis of 30 shallow drill holes.

The H group of Consolidated Manitoba Mines Limited is about six miles (9.5 km) east of the Tree River and an equal distance south of Coronation Gulf. The No. 3 vein on the property is a northeast-striking vein 2 ft to 5 ft (0.6 to 1.5 m) wide that was explored by drilling and trenching in 1966. Gold in the vein is associated with seams of pyrite, and minor chalcopyrite.

The drilling program (3779 ft (1152 m) in 26 holes) failed to substantiate the results of surface trenching (Thorpe, 1972, p. 97). However, seven holes over a vein length of 186 ft (57 m) indicated an average grade of 0.45 oz/ton Au across a width of 4.1 ft (1.25 m).

The No. 1 vein on the north part of the H group of Claims was explored by trenching in 1965 and was traced for a length of 5000 to 6000 ft (1530 to 1835 m). One shoot within the vein was found to grade 0.69 oz/ton Au over a width of 4 ft (1.2 m) for a length of 250 ft (76.5 m), and another shoot a little longer graded 0.73 oz/ton Au across 3.3 ft (1 m) (Thorpe, 1966).

(Area 41D) Contwoyto Lake

The Contwoyto Lake gold deposit is located near the north end of Contwoyto Lake, approximately 250 miles (400 km) northeast of Yellowknife and about 130 to 150 miles (210 to 240 km) from both Bathurst Inlet and Coronation Gulf. The deposit was discovered by Canadian Nickel Company Limited in 1960 and explored extensively for three years.

The deposit occurs in a tightly folded amphibolite bed within an Archean sedimentary sequence, largely metamorphosed argillite and greywacke, of the Yellowknife Supergroup. The gold is associated with pyrrhotite, arsenopyrite, loellingite, pyrite and minor chalcopyrite in quartz-rich bands and lenses. The host garnet-cummingtonite-quartz-sulphide-magnetite gneiss may have been produced by low-grade metamorphism of silicate (-oxide) facies iron formation. The mineralization has been described by Bostock (1968), Schiller and Hornbrook (1964b), Schiller (1965), and Tremblay (1967). McConnell (1964) has pointed out the many similarities between the mineralization at Contwoyto Lake and the gold ore at the Homestake Mine, Black Hills area, South Dakota.

No comprehensive tonnage and grade figures have been released for the deposit, but Knutsen (1974) suggested that a zone with a potential of 18 000 tons per vertical foot, at an unstated grade, had been outlined. He also noted that the zone included several million tons of material at a grade of at least 0.3 oz/ton gold. However, if the deposit were to be mined it would probably be as a large-tonnage low-grade type of operation. Numerous other occurrences of this type of mineralization are present in the Contwoyto Lake area, mainly south of the lake, and a number of these could perhaps be developed to supply additional tonnage.

Volcanic-Hosted Massive Sulphide Deposits

Introduction: A number of important Cu-Zn-(Pb,Ag) massive sulphide deposits are known in this region. These deposits are similar to major deposits of this type in the Superior Province of Ontario and Quebec, in that they are associated with belts of Archean volcanic rocks, and in particular with the felsic members of these belts. The potential for additional deposits of this type in the region is considered to be excellent. The Archean volcanic and associated sedimentary rocks in this region belong to the Yellowknife Supergroup.

A number of the known deposits, described below, are only partially explored, however they contain an aggregate total of at least 40 000 000 tons of ore. Aggregate metal contents in millions of tons of base metals and millions of ounces of precious metals are: zinc 2.8, lead 0.36 and copper 0.77 million tons, silver 120 and gold 1.5 million ounces.

Arctic sea transport may play a key role in eventual development of these deposits. Even the Izok Lake and Takiyuak deposits, farthest inland, are much closer to the coast than to railhead at Hay River. Sea shipping would offer a wider choice of smelter and market destinations for concentrates as well as much lower transport costs. Experience in southern mining belts suggests that once production is attained many more base metal deposits will be discovered and production may continue for many decades.

(Area 41A) High Lake

The High Lake Cu-Zn deposit is located in the northern part of the Archean Slave Province about 30 miles (50 km) from Coronation Gulf. The deposit consists of the copper-rich AB zone and the (relatively) zinc and silver-rich D zone. The deposit was discovered by Kennarctic Explorations in 1955 and subsequently explored by more than 10 000 feet (3060 m) of diamond drilling. The local area has been mapped by Padgham et al. (1974) and the sulphide zones have been described by Johnson (1974).

The sulphide zones occur within a unit of intermediate (mafic?) to felsic pyroclastic rocks that is, in turn, underlain by intermediate and overlain by felsic rocks. Alteration beneath the AB zone, including silicification and, in places, intense magnetite-anthophyllite alteration, is considered to represent a feeder pipe. Deformation has resulted in flattening of some structures and transposition of bedding so that the alteration zones became subparallel to bedding. Intrusion of a quartz diorite-granodiorite body is considered to have produced dalmatianite, anthophyllite and biotite within the alteration zones, pyrite metacrysts and minor remobilization of sulphides within the sulphide zones, and recrystallization of andesite and rhyolite at the intrusive contact.

(Area 41A) Takiyuak Lake

The two Takiyuak Lake massive sulphide deposits of Texasgulf Inc. are very small representatives of this type of deposit. The deposits were discovered in 1972 and are known as the No. 10 and No. 41 zones. They are located about 255 miles (410 km) north of Yellowknife, about 110 miles (175 km) from Coronation Gulf, and are 2½ miles (4 km) apart.

The "Hood River" No. 41 deposit has been described by Rockingham (1979). This deposit is located near Takiyuak Lake in the Takiyuak volcanic belt which extends north-northeasterly from the southern end of Takiyuak Lake for a distance of approximately 48 km. Mafic pillow lavas and tuffs and intercalated carbonate beds at the base of the stratigraphic succession are overlain by rhyolite flows, felsic and mafic agglomerates, and a few mafic flows. Above this is a laterally extensive mafic unit of pillowed and massive flows and tuffs (Fig. 6).

The deposit is on the southeast limb of a southwest-plunging syncline. The host rocks and the deposit were metamorphosed to lower amphibolite facies (Rockingham, 1979). Felsic volcanic rocks that underlie the deposit are underlain in sequence by a series of amygdaloidal flows and by pillowed mafic flows. On the basis of Cu/Cu+Zn ratios and cobalt contents Rockingham concluded that sulphide deposition took place in two separate periods or cycles.

(Area 41D) Izok Lake

The Izok Lake deposit is significantly larger than those at Takiyuak Lake and is abnormally high in grade for a deposit of this type (Table 5.I). It is located 30 miles (50 km) south of the Takiyuak deposits and was discovered in 1974 through boulder prospecting and, subsequently, by drilling from ice on the lake in 1975. A drill cross section is shown in Figure 7.

The volcanic host rocks of the deposit are moderately metamorphosed. A pipe-like "stringer zone" (so-called because it commonly contains chalcopyrite-bearing veins in highly altered, commonly very chloritic rocks) that is often present in deposits of this type, consists in this case of a unit of chlorite-biotite-cordierite rocks. Footwall rocks are andesite and rhyolite lavas and tuffs, and hangingwall rocks include andesite, dacite, dacitic tuff, felsic agglomerate, and felsic to mafic tuffs (Money and Heslop, 1976). Because of metamorphism the felsic volcanic rocks are now essentially quartz-feldspar-muscovite-biotite gneisses.

(Area 41B) Hackett River

The Hackett River deposits are located 45 miles (72 km) south of Bathurst Inlet and about 300 miles (480 km) north-east of Yellowknife. The area was first extensively explored in 1967 and by 1974 six individual massive sulphide deposits had been delineated and it had been proven that three of these contained significant tonnages of ore.

The series of deposits is situated within a belt of Archean supracrustal rocks of the Yellowknife Supergroup (Fig. 8). The enclosing sequence consists of interbedded volcanic and sedimentary rocks. In proximity to the deposits many of these rocks are recognized to be of felsic pyroclastic character. A thin limestone unit is present within the footwall sequence.

The Hackett River deposits contain much less copper than does the High Lake deposit. The lead grade, in spite of the fact that the grade at Izok Lake is even higher, is high for Archean deposits of this type. However, the high silver grade is the most important compositional feature of the ore, and at the current silver price is of considerable economic importance.

It has been reported that exploration work to date has proven a total of 21 000 000 tons (Northern Miner, January 24, 1980, p. 3) for the Hackett River deposits. These deposits include the Main, Cleaver, Boot, Jo and Jo South, although individual tonnage figures have been published for only the Main, Boot and Cleaver deposits (Table 5.I).

(Area 41B) Yava

The Yava deposit is located in the Hackett River greenstone belt approximately 30 miles (50 km) south of the Hackett River deposits. A geochemical anomaly was located in the vicinity of the deposit in 1972 and the deposit was discovered by diamond drilling in 1974 and 1975. The mineralized zone is approximately 600 ft (180 m) long, up to 100 ft (30 m) wide and is open to depth.

The volcanic belt in the vicinity of the Yava deposit is about 1¼ miles (2 km) wide. The deposit consists of strati-form and stringer zone portions and is located in a sequence of mafic and felsic volcanic rocks. The footwall rocks are andesitic or dacitic and are interpreted as subaerially deposited welded ash flows (Frith and Roscoe, 1980).

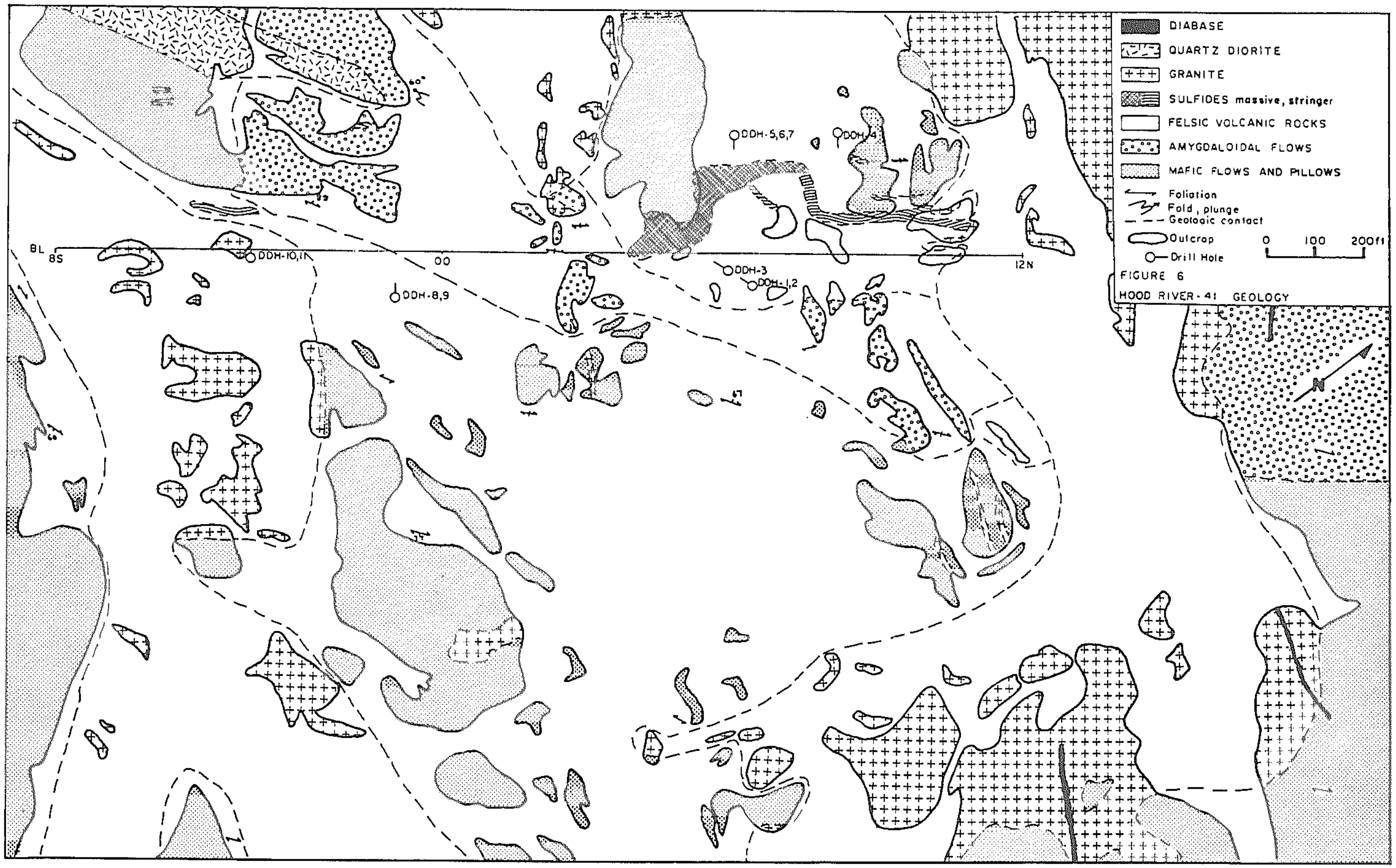


Figure 6. *Surface geology of the Hood River 41 sulphide deposit (from Rockingham, 1979).*

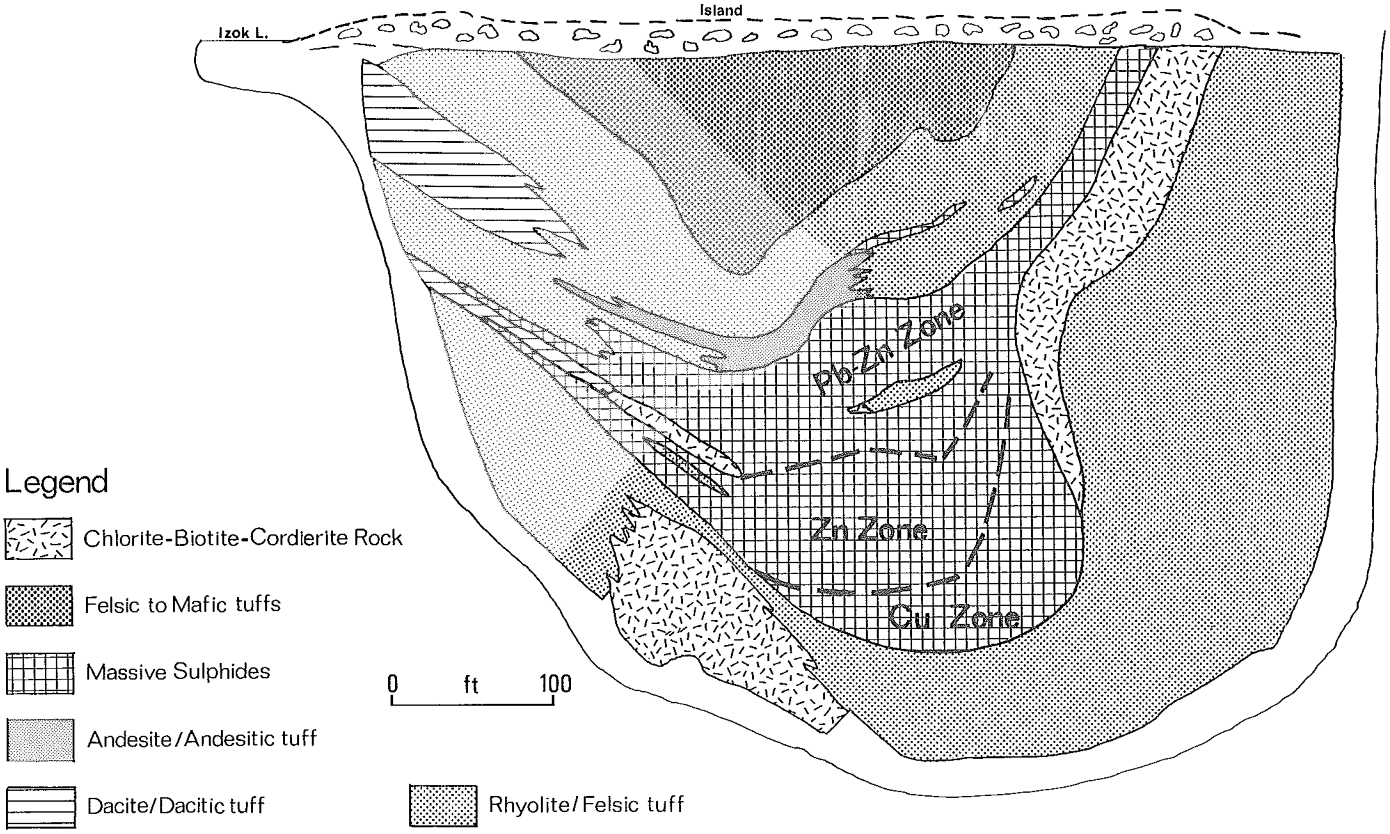


Figure 7. *Cross section–Izok Lake Deposit (after Money and Heslop, 1976).*

The hangingwall rocks are rhyolitic tuffs and more massive quartz-eye bearing rhyolitic rocks. This sequence of rocks is believed by Frith and Roscoe (1980) to have been deposited in a caldera. The upper succession of volcanic rocks includes some intertonguing andesitic lavas and also sill-like bodies of quartz-feldspar porphyry.

The Yava deposit is interpreted by Frith and Roscoe (1980) to be located near the top of a relatively thin atypical volcanic sequence that was deposited above a basement high.

Copper

(Area 37) No. 47 Deposit

The No. 47 deposit is located in the Coppermine River area approximately 65 km south of the settlement of Coppermine on Coronation Gulf and 535 km north of Yellowknife. The deposit was discovered as a result of intensive exploration of copper occurrences in continental basalts of the Coppermine River Group during the period 1967-1969 (Thorpe, 1970; Kindle, 1972).

The deposit is structurally controlled by a fracture-breccia zone along a major northeast-striking fault that cuts the basaltic sequence. Inferred reserves have been calculated at 4 106 000 tons at an average grade of 3.07% copper, after allowing for 15% dilution by wallrock containing 0.6% copper.

Smaller, geologically similar, copper deposits in the area are the June, which contains about 1 000 000 tons at a grade of 2.5% Cu, and the much smaller Dick, Carl, and MGB 18 deposits.

VI Keewatin Region

Uranium

(Area 49) Lone Gull (Schultz Lake) Deposit

The Lone Gull prospect, owned by Urangesellschaft Canada Limited, is in the Schultz Lake area about 75 km west of the hamlet of Baker Lake. The prospect occurs within an area underlain by shallowly-dipping Aphebian impure quartzites and conformably overlying orthoquartzites. The metasedimentary rocks are intruded by syenite, lamprophyre, and fluorite-bearing granite. These lithologies are overlain by extensive areas of regolith in the vicinity of the prospect, with the regolith being a subunit of an extensive fluvial sandstone sequence to the west of the prospect area. Mineralization occurs within the underlying metasedimentary rocks. To the end of 1978 20 of 40 diamond drill holes had intersected mineralization and resulted in a preliminary reserve estimate of 20 million lbs U_3O_8.

(Area 49) Occurrence 68-1

Mineralization at Occurrence 68-1 is hosted within a fractured xenolithic lamprophyre dyke that has been intruded into granulitic gneiss. Based on 19 short drill holes totalling 3200 ft (975 m) metal contents of 160 000 lbs U_3O_8 and 150 000 lbs MoS_2 were estimated.

(Area 49) Occurrence 68-2

Mineralization at this occurrence is hosted within fractured and altered Kazan Formation sandstone which has been intruded by lamprophyre dykes. Ten drill holes totalling 2000 ft (610 m) indicated a mineralized zone containing, at a maximum, 1 000 000 lbs U_3O_8 and 2 000 000 lbs MoS_2.

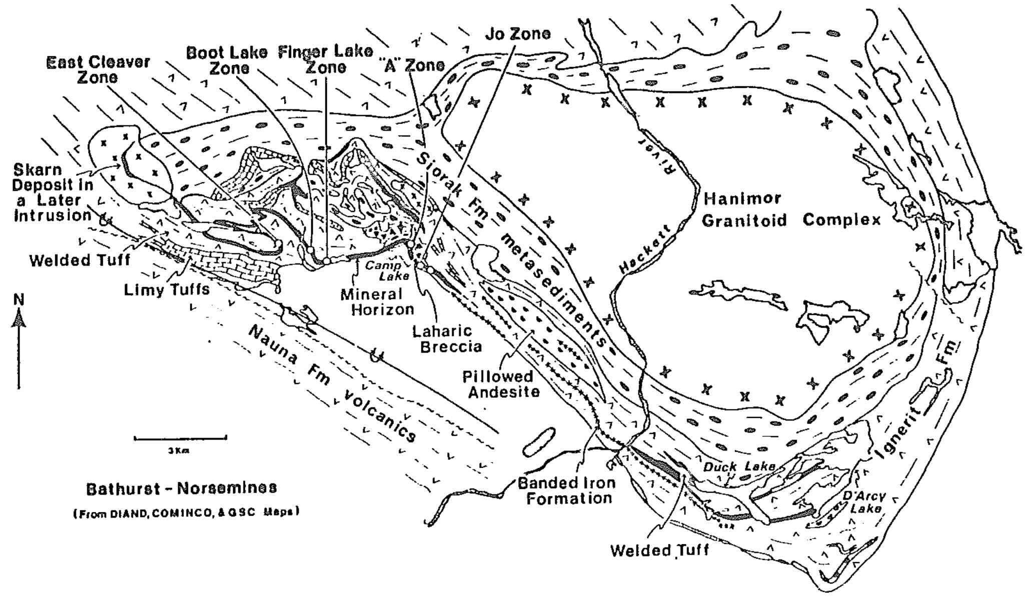


Figure 8. *Distribution of deposits and general geology, Hackett River area (from Frith and Roscoe, 1980).*

(Area 49) Occurrence 68-4

Occurrence 68-4 occupies a series of north to northwest trending fracture zones within granitoid gneiss. Four diamond drill holes indicated a mineralized zone averaging 6 ft (1.83 m) in width with a grade of 0.46% U_3O_8 that contains in excess of one million lbs of U_3O_8.

Gold

(Area 58) Cullaton Lake (B Zone) Deposit

This deposit is located about 250 miles (400 km) northwest of Churchill, Manitoba and 140 miles (225 km) west of Hudson Bay. The deposit was discovered by a prospector for Selco Exploration Limited in 1961 by panning crushed material from a rusty frost-heaved boulder.

The B Zone deposit consists of a mineralized unit of quartz-magnetite iron formation that is locally highly folded and fractured. The ore forms an irregular unit consisting of quartz, chlorite, carbonate and sulphides. Chlorite and pyrrhotite are associated with high gold values, but coarse arsenopyrite, while relatively abundant, is not so closely associated. Four steeply plunging ore zones, transgressive to the bedding of the iron formation, have been recognized. The deposit contains 185 000 tons of proven ore at a grade of 0.74 ounces/ton gold, and there is potential for an additional 100 000 tons. A decline was sunk on the property in 1975 and efforts are currently being made by the present owners, O'Brien Gold Mines Limited, to place the deposit in production.

The iron formation hosting the deposit strikes about N10°W and is separated from the enclosing greywacke by narrow units of carbonate-rich tuff. These sedimentary rocks, together with underlying mafic volcanic rocks, make up the Archean Henik Group (Eade, 1964; 1966; 1974).

The A Zone deposit, in the same general area, is probably of similar type. This deposit probably contains a similar tonnage, but is of lower grade.

Shear Lake: The Shear Lake deposit is located about 2 km northeast of the B Zone deposit and an equal distance south of the airstrip at Cullaton Lake. The deposit is located in basal quartzite of the Proterozoic Hurwitz Group and was discovered in 1947 by Hudson Bay Mining and Smelting Co. Ltd. and subsequently explored by Selco Exploration Co. Ltd. from 1961 to 1963. Gold in the deposit is on fracture surfaces and, in part, is associated with pyrite as fracture fillings in the quartzite. The fracturing and brecciation are related to a northwest-striking fault that cuts the quartzite. To a considerable depth the pyrite has been weathered to earthy iron oxides. These characteristics resulted in considerable drilling difficulties, namely high drilling costs because of the tough quartzite and problems of determining grade because earthy hematitic fracture fillings were washed away. The average grade intersected at three points along a length of 810 feet (250 m) in the North-Northwest zone was 0.53 oz/ton gold across estimated true widths of 5, 18 and 5 feet (1.5, 5.5, and 1.5 m). In the Northeast zone an intersection of 0.63 oz/ton Au was obtained 170 ft (52 m) below a surface trench that gave 0.34 oz/ton Au across 10 ft (3 m). However, the zones can only be properly tested by underground work. Two additional holes were drilled by O'Brien Gold Mines Limited in 1973, after which they dropped their option on the property.

In summary, although known gold deposits in the area are small, they can be developed without the availability of additional transport capabilities. The relatively small plant required for production can be flown to the existing Cullaton airstrip, and further transport requirements could be met the same way. The present high gold price is particularly favourable to production from the deposits.

Nickel

(Area 53) Ferguson Lake

The Ferguson Lake Cu-Ni sulphide deposits were discovered and explored by Canadian Nickel Company Limited in the mid 1950s and are associated with an east-west striking hornblendite unit several thousand feet long and averaging 100 ft (35 m) wide. Poorly-substantiated reports indicate moderate tonnages of submarginal grade in two zones along strike from each other, but no reserve figures have been published (Wright, 1967). Mineralization consists of pyrrhotite and chalcopyrite. There may be potential for additional deposits in similar rocks to the west, and further exploration would probably be triggered if a pipeline were to be constructed along the nearby proposed ("Eastern") pipeline route.

This deposit is probably a subeconomic example of type 1 nickel deposits described in Appendix 2.

(Area 59) Rankin Inlet

The Rankin Inlet nickel-copper deposit was mined as a small high-grade operation from 1957-62, producing about 400 000 tons at a calculated recovery grade of about 2.6% nickel and 0.7% copper (Laporte, 1974). Platinum and palladium, averaging 0.03 and 0.06 oz/ton respectively in the ore, were also recovered (Can. Mining Jour., August 1957, p. 93). Subsequent exploration and mapping has located other ultramafic bodies in the same general area but without encountering significant mineralization to date.

The deposit occurs at the base of a weakly-differentiated peridotitic sill that was intruded between sediments (greywacke, quartzite, dolomite) and overlying mafic volcanic rocks (Bannatyne, 1958; Laporte, 1975). This is fairly typical of the geological setting of type 2 nickel deposits as described in Appendix 2.

Volcanic-Hosted Massive Sulphide Deposits

Introduction: In southern Keewatin District belts of Archean greenstones (areas 55, 58 and 62, in particular) are generally similar to belts in the Superior Province of Ontario and Quebec that host highly productive Cu-Zn-Ag-Au(Pb) massive sulphide deposits. No major deposits have as yet been defined in Keewatin District but a number of known small deposits and showings of this type and the favourable geological characteristics of the area suggest a high potential. As an example of the favourable geology, in area 58 five mafic to felsic volcanic cycles, each with evidence of associated exhatative activity, have been mapped (Ridler and Shilts, 1974a).

The small Gemex deposit is briefly described below. In addition, occurrences of massive sulphide type are known at Spi Lake (area 58) and at Rochon Lake, near Ennadai Lake (area 55).

(Area 58) Heninga Lake (Gemex)

This deposit is located in the Heninga Lake area about 95 miles (150 km) west of Hudson Bay. The deposit consists of three lenses of massive sulphide ore in a sulphide zone 2800 ft (830 m) long. The largest lens is apparently 600 ft (180 m) long and about 35 ft (10.5 m) wide. The total size of the deposit has not been fully determined, but there are probably less than 1 000 000 tons in the three lenses. The deposit is located near one of the routes proposed by Polargas for an Arctic gas pipeline.

Iron

(Area 58) McConnell River Deposits

The drift-covered west deposit has been indicated by magnetic surveys to be about three miles long with an average width of 650 feet and probably contains 400 million tons of mineable crude ore (Moore, 1959). Limited drill core data show that the iron-formation consists of medium to fine-grained magnetite and specular hematite interbanded with recrystallized chert, and intercalated in biotite schist. Drill core samples were reported to average 40 percent iron (Laporte, 1974). The deposit is in a predominantly drift-covered area with scattered outcrops of Kaminak Group layered schist and gneiss to the south and fine grained recrystallized tonalite or granodiorite to the north (Bell, 1971).

Mistake Bay: Metasedimentary rocks of the Archean Kaminak Group contain magnetite-quartz iron-formation within a few miles of tidewater at Mistake Bay. Heywood (1973) reported that "The iron-formations are as much as 200 feet thick and consist of alternating layers 1/8 inch to 12 inches thick, of magnetite and quartz interbedded with chert, jasper, very fine grained quartz or slate as much as 4 feet thick." An appreciable amount of material grading 20 to 22 percent iron has been indicated in the area near Mistake Bay, with other iron-formation exposed about 30 miles to the north. Also, significant extensions of iron-formation are suggested by aeromagnetic anomalies.

South Henik Lake: Archean rocks of the Henik Group described by Eade (1974) include jasper-hematite, siliceous magnetite-hematite and quartz-magnetite iron-formation that occurs in bands up to six miles long in an area west of South Henik Lake. The iron-formation is thin-banded and from two to 300 feet thick with interbedded clastic and volcanic rocks. Typically the iron-formation occurs within thick sequences of greywacke and argillite with some lenses adjacent to volcanic rocks.

No exploration work has been carried out to evaluate the economic potential of these deposits. The deposits are situated about 575 miles northeast of the Alberta tar sand deposits, a possible source of fuel for processing.

VII Eastern Arctic Islands and Hudson Region

Lead-Zinc

(Area 65) Nanisivik Mine

The mine is located about 450 miles (720 km) north of the Arctic Circle on the south shore of Strathcona Sound, a fiord at the north end of Baffin Island. Prior to establishment of Nanisivik townsite, the nearest community was at Arctic Bay, 27 kilometres to the west.

The property was staked in 1957 by Texas Gulf Sulphur and detailed work was started in 1958. Bulk samples were taken from the east end of the deposit in 1969 and the west end in 1972, after extensive drilling had outlined the deposit. Underground development of the mine commenced in 1974 and production started in October, 1976 with a mill capacity of 2000 tons per day. To the end of 1979 approximately 1 778 560 tonnes had been mined and reserves as of January 31, 1980, were 3 250 000 tonnes at a grade of 1.2% Pb and 11.9% Zn. An additional 600 000 tonnes is classified as possible ore (Canadian Mines Handbook, 1980-81, p. 182).

The Nanisivik deposit (Olson, 1977) is located in the Society Cliffs dolomite, a unit within a sequence of Proterozoic (Helikian) rocks that is preserved in a major northwesterly-trending graben extending across Borden Peninsula. The Society Cliffs Formation consists predominantly of laminated algal dolomite.

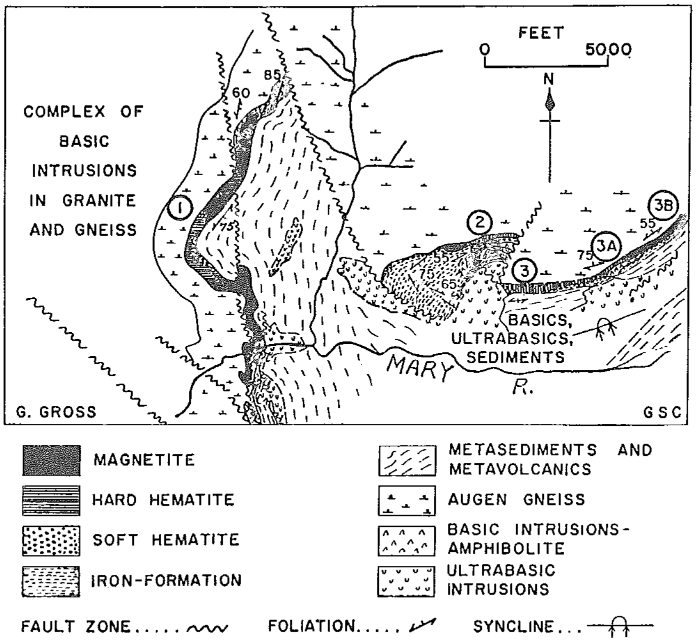


Figure 10. Geology of the Mary River area, Baffin Island. High grade magnetite and hematite zones are numbered 1 to 3B (from Gross, 1966).

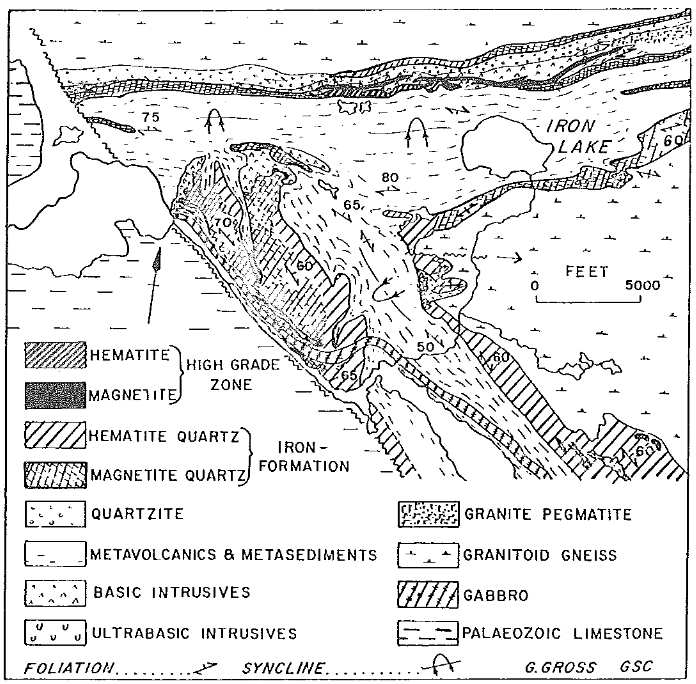


Figure 11. Geology of the Iron Lake area, north of Mary River, Baffin Island (from Gross, 1966).

The orebody is flat-lying, has an east-west extent of about 3050 metres, a width of 60-120 m and a thickness of about 18 m. The ore consists of sphalerite, galena, pyrite, and dolomite. Some silver and cadmium are associated with the sphalerite; silver content is high relative to other carbonate-hosted deposits.

The deposit shows features of dolomitization, solution and collapse brecciation, and karst development. The sulphide ores are in sharp contact with barren dolomite. These features are characteristic of "carbonate-type" lead-zinc deposits. The deposit contains a vertical keel of pyrite flanked by smaller wings of Pb-Zn mineralization.

Iron

(Area 67) Mary River area, Baffin Island

Iron resources in the Mary River area occur in three deposit areas located from 40 to 60 miles southeast of the head of Milne Inlet. About 360 million tons of iron resources, ranging in grade from 68 to 66 percent iron and containing less than 2 percent silica, have been measured or indicated by drilling and systematic sampling in these areas. Substantial amounts of lower grade iron-formation that are amenable to concentration, possibly 500 million tons, with an average iron content of 30 percent, occur adjacent to or in the vicinity of the high grade deposits.

The principal deposit forms a prominent ridge north of Mary River and consists of unusually high grade iron-formation that is a steeply dipping arcuate band about 200 feet thick and 1½ miles long (Fig. 10). This band is made up of interlayered zones of hard blue porous hematite and dense hard magnetite and about 127 million tons containing 68 percent iron have been confirmed by drilling within the possible limits of an open pit mine.

Several bands of hematite and magnetite iron-formation extend eastward from the Mary River deposit and sampling indicates about 133 million tons containing 68 percent iron. Another deposit area closer to Milne Inlet has several narrow lenses of hematite and magnetite, within lower grade iron-formations, which have an average iron content of 66 percent iron and are estimated to represent about 100 million tons of ore (Fig. 11).

The iron deposits occur within the Mary River Group of rocks composed of metamorphosed shales and greywacke, quartz-mica schists, mafic metavolcanic rocks, massive to pillowed amphibolite, ultramafic rocks, felsic metavolcanic rocks, quartzite, garnet-mica-hornblende schists and iron-formation. These rocks form tightly folded belts that are highly metamorphosed and show evidence of two or more stages of deformation and are distributed as outliers in the older granite, granodiorite and gneissic terrane.

Comprehensive field and laboratory studies completed in the 1960s indicated that production and transportation of the Mary River area resources through Milne Inlet was technically feasible. However, marketing and economic factors have not encouraged further planning for the development of the iron deposits. The natural high quality of the resources, their location in relation to tidewater port sites and moderate size remain favourable factors for consideration in utilization of this resource in the future for export or domestic markets (General references: Gross, 1966, 1970; Jackson et al., 1978c).

Eqe Bay area, Baffin Island: Diamond drilling, sampling and field surveys conducted about 10 years ago delineated about 360 million tons of iron in four deposits of iron-formation in the vicinity of Eqe Bay on the southwest coast of Baffin Island. The iron-formation occurs within folded and highly deformed metasedimentary and metavolcanic rocks, apparently of the Mary River Group, and is reported to be composed predominantly of magnetite with some interlayered hematite beds. Test work shows that a high proportion of the iron can be concentrated by using magnetic separation methods. The remote location, rising costs of mine development and the current abundance of iron ore available in the Atlantic market area has discouraged further investigation of the iron resources in the area (General Reference: Laporte, 1974).

(Area 74) Chorkbak Inlet, Baffin Island

Five interesting deposits of magnetite iron-formation containing about 360 million tons of iron resources with an average iron content of less than 20 percent iron were drilled and sampled in this area on the south shore of Foxe Peninsula about 20 years ago. The highly metamorphosed iron-formations occur in bands ranging from 100 to 500 feet in thickness and are associated with hornblende and biotite-quartz-feldspar gneisses and distributed along the coast for a distance of 10 miles (General References: Anon, 1957b, 1958a; Blackadar, 1967a).

Maltby Lake area, Baffin Island: Highly metamorphosed magnetite iron-formation located about 7 miles inland from the northwest coast of Foxe Peninsula was sampled and mapped about 25 years ago. Approximately 200 million tons of resources with an average grade of 24 percent iron were delineated. The iron-formation is associated with amphibolite and granitoid gneissic rocks, contains lenses up to 3 feet thick composed of pure magnetite, and occurs in a tightly folded structure that is about two miles long and up to one half mile wide.

(Area 77) Innetalling Island, Belcher Islands

Lake Superior type iron-formation is distributed throughout the Belcher Islands within a sequence of shale, argillite, dolomite, quartzite, greywacke and volcanic rocks. The most favourable area for the occurrence of iron resources suitable for concentration is located on Innetalling Island and was mapped, sampled and drilled between 1955 and 1959. About a billion tons of fine grained cherty magnetite iron-formation with an average iron content of 27 percent was outlined in a narrow fold structure that extends south from Fairweather Harbour for about 9 miles. The granular cherty iron-formation is about 150 feet thick in this area, however the resource estimates are based on the lower granular-magnetite-rich zone that is about 90 feet thick and from which 3.4 tons of crude ore can provide one ton of concentrate, containing 67 percent iron and 7.5 percent silica, when ground to only a relatively coarse grain size that passes through a 150 mesh screen.

Apparently little evaluation of these iron resources has been carried out since that time; however, the iron-formation on Tukarak Island and around Haig Inlet appears to constitute substantial resources of low grade material (General References: Anon, 1955, 1957a; Jackson, 1960).

Nastapoka Islands: Lake Superior type iron-formation occurs throughout this chain of islands on the east coast of Hudson Bay for more than 100 miles. The iron-formation dips westward at a low angle and is composed of various facies of carbonate, cherty magnetite and hematite, silicate and jasper material. The richer beds range in thickness from 40 to 170 feet, the iron content varies from 30 to 40 percent and the manganese content from 1 to 4 percent. The higher manganese content commonly found in the Nastapoka iron-formations is of considerable interest although no manganese occurrences of significant size have been reported (General References: Anon, 1958b, 1959).

PART II

DETAILED ASSESSMENTS AND APPENDIXES

6. DETAILED ASSESSMENTS OF INDIVIDUAL AREAS

Introduction

This section contains the area by area assessments that have been condensed in the summary tables (4.I to 4.VII) of Section 4, Part I of this reort. In addition to assessments done for individual areas, it also contains a general overview of the geology and mineral deposits of the Northwestern Canadian Shield by S.M. Roscoe. The latter applies not only to Northeastern Mackenzie District, but to Keewatin Region and most of the mainland part of the Central Arctic Region as well. For this region the review presents a capsule chronological sketch of its geological evolution, followed by a more detailed discussion of its known and postulated metallogeny, also arranged in chronological sequence.

The material in Part II of this report has had only minor editing and it is a compendium of the views of individual contributors regarding the mineral resource potential of the various areas assessed during the course of this study.

I NORTHERN YUKON AND NORTHWESTERN MACKENZIE REGION

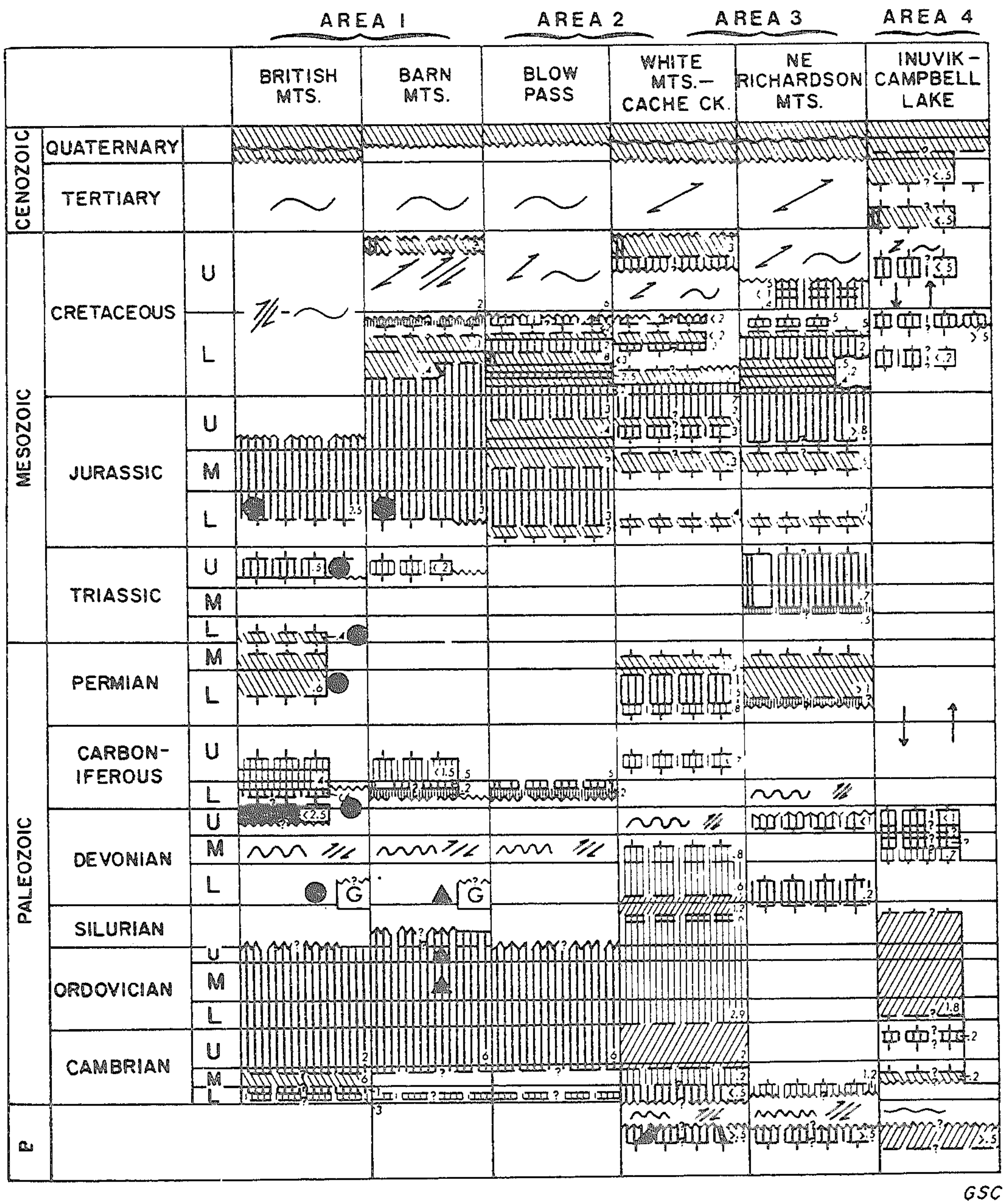
URANIUM

Introduction

Figures 12, 13, 14 and 15 present interpreted targets for uranium exploration in this region based on existing conceptual models for uranium mineralization. Continental and near shore clastic rocks, especially those on or near angular unconformities provide the most favourable targets. Most of the units indicated as favourable (Figures 12,13,14 and 15) are permeable enough for effective movement of uranium-bearing fluids and contain suitable reductants to form effective traps. Potential source materials in this area include highly anomalous granites of the British and Barn Mountains and early to mid-Paleozoic and perhaps Late Precambrian black shales, some of which are known to be mineralized (Bell and Jones, 1979), albeit not likely of direct economic significance.

Some of the granites may have developed mineralization either through (a) differentiation, (b) interaction with favourable host rock (i.e. contact metamorphic), or (c) by supergene processes acting on (a) or (b) or both. The anomalous radiometric responses of Mo and Mo-Cu occurrences in the Mount Sedgwick stock bear witness to process (a). Uranium associated with Mo-W mineralization at the contacts of the Mount Fitton stocks bear witness to process (b). Process (c) mineralization is only speculative.

Of the four factors (source material, transportation [i.e. "plumbing"], traps, and protection or preservation) governing the development of economic mineral deposits, the preservation factor is the most difficult to evaluate for the general region. This factor everywhere in the world presents the double-edged problem, namely that it should be good enough to protect and preserve an economic deposit, but not so good as to prevent detection of



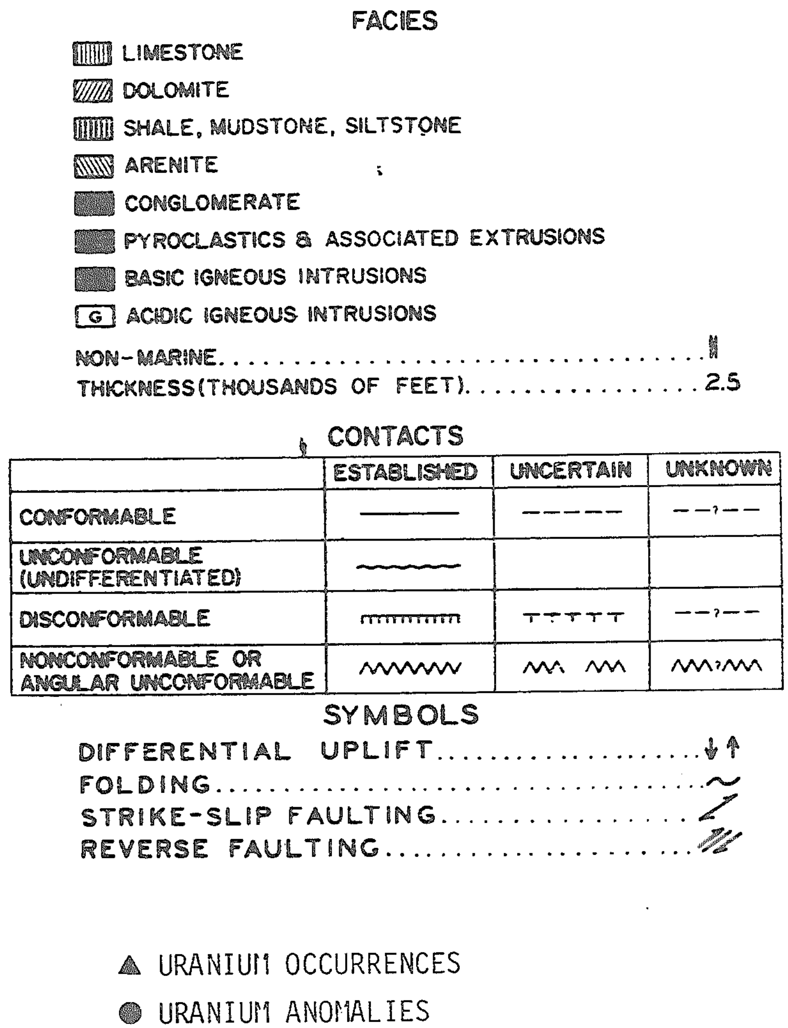


Figure 12: Stratigraphic correlation between Areas 1, 2, 3, and 4, Northern Yukon and Northwestern Mackenzie Region showing stratigraphic location of known uranium occurrences and geochemical anomalies (Norris, 1973).

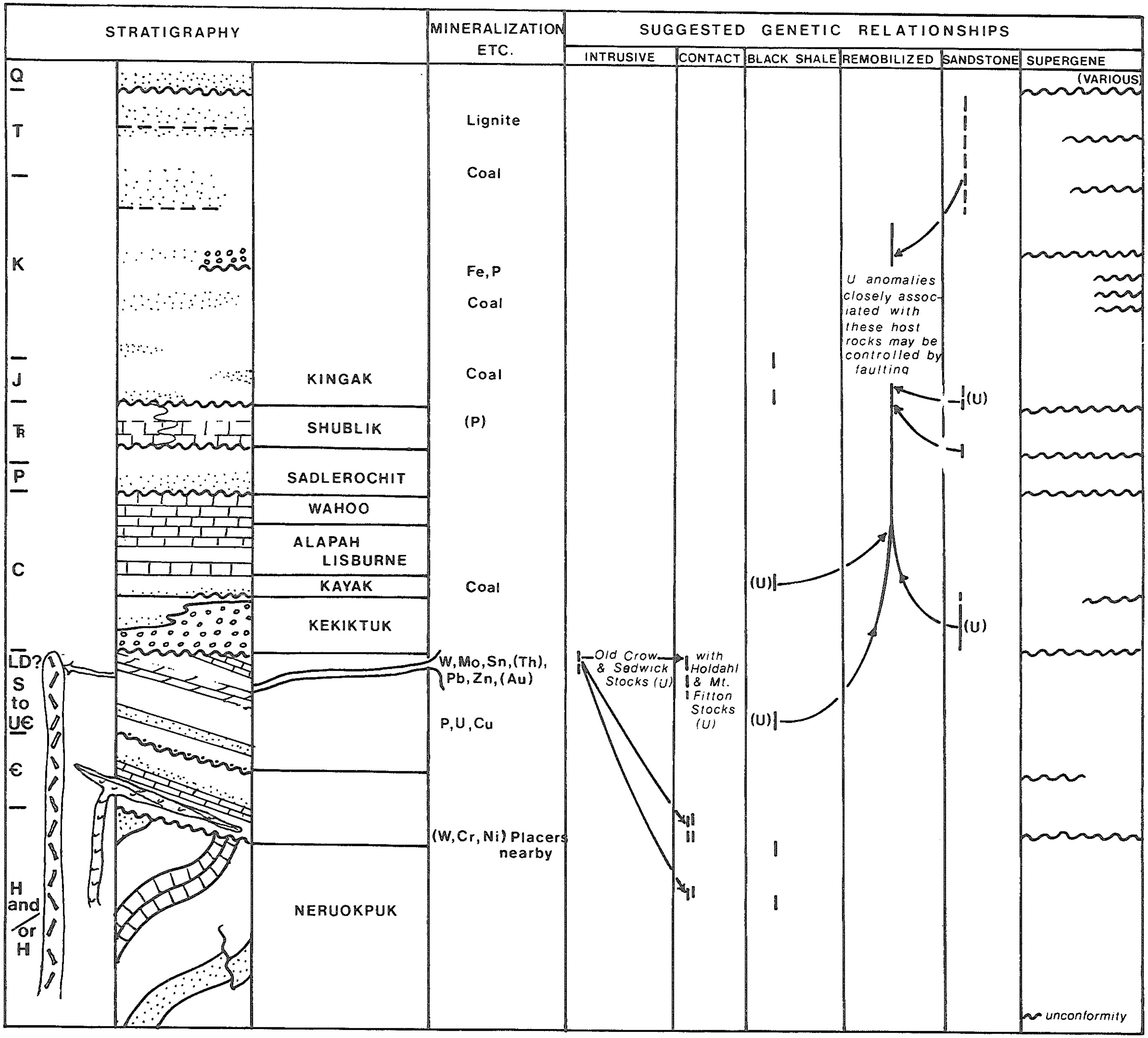


Figure 13: Potential targets for uranium exploration, Northern Yukon (Areas 1, 2 and part of 3).

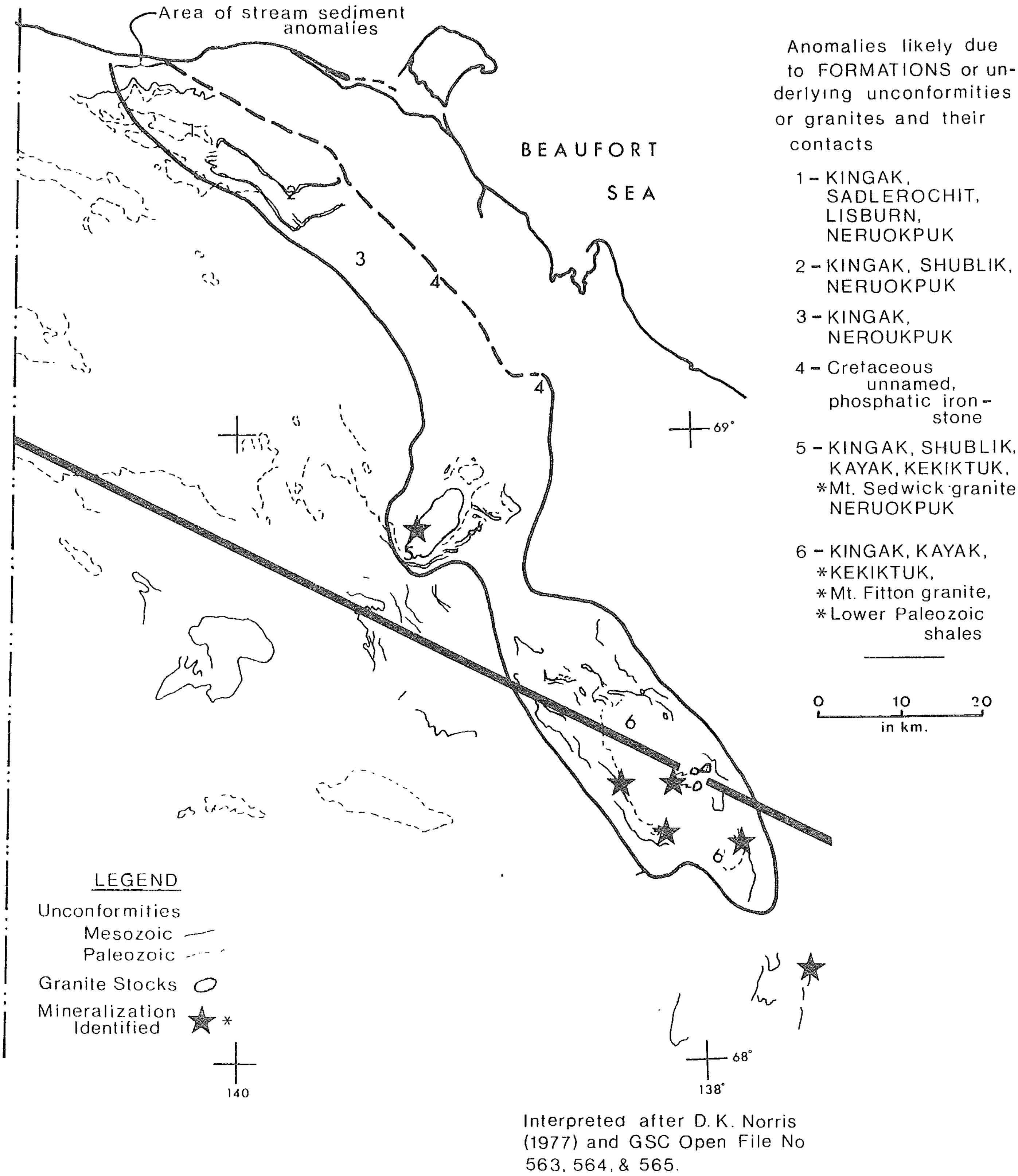


Figure 14: Generalized geology of the Romanzof Uplift-Barn Uplift (Area 1), Northern Yukon showing the approximate locations of Mesozoic and Paleozoic unconformities and the general belt of stream sediment anomalies (various metals, including uranium) detected by the Geological Survey of Canada Geochemical Reconnaissance Surveys (Goodfellow, 1979).

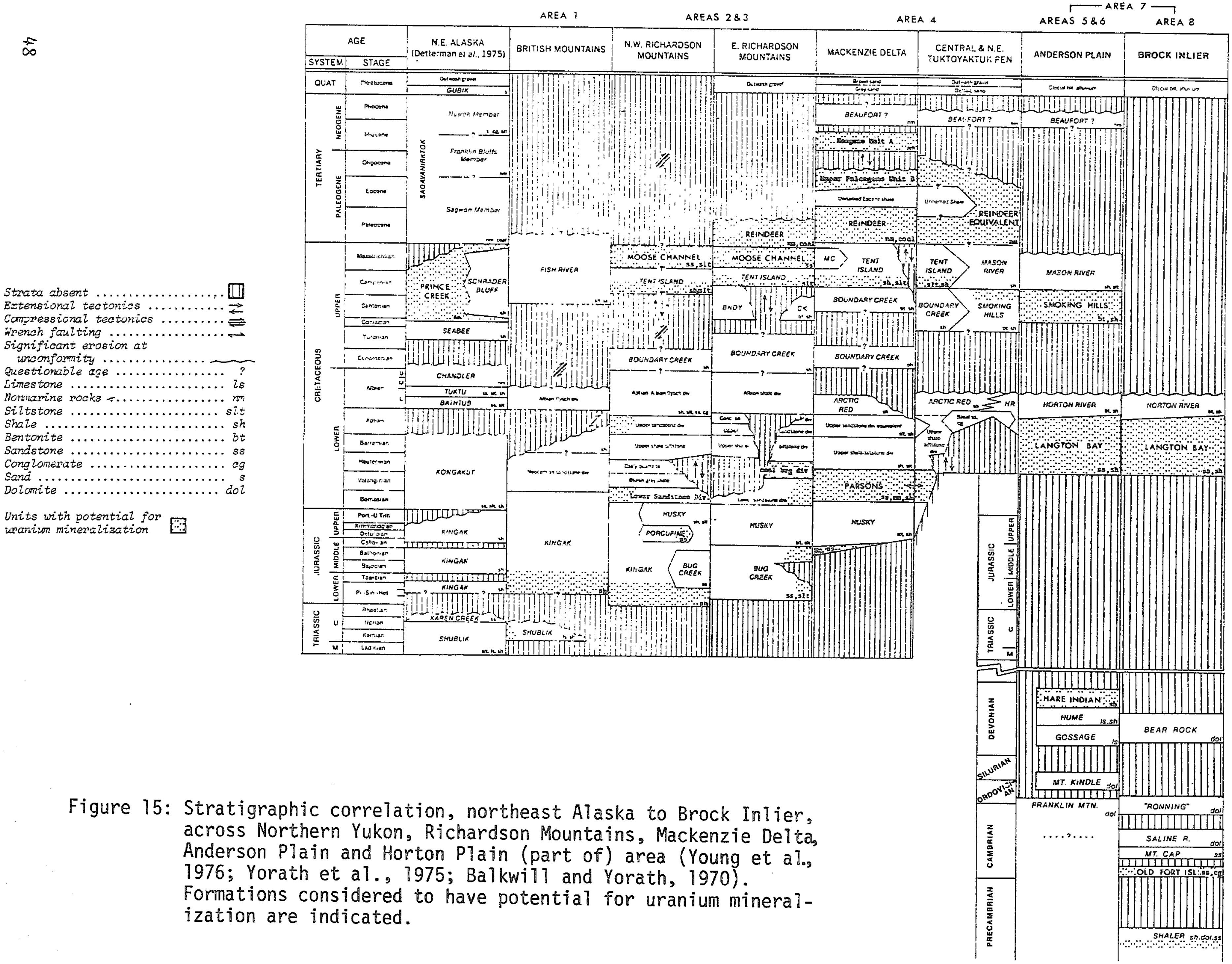


Figure 15: Stratigraphic correlation, northeast Alaska to Brock Inlier, across Northern Yukon, Richardson Mountains, Mackenzie Delta, Anderson Plain and Horton Plain (part of) area (Young et al., 1976; Yorath et al., 1975; Balkwill and Yorath, 1970). Formations considered to have potential for uranium mineralization are indicated.

some surficial aspect, such as weathered mineralized outcrop, indicative geophysical response, or chemical anomalies in stream- or groundwaters or stream sediments. Thus, if protective characteristics are excellent, exploration may be reduced to very expensive "wildcatting", or drilling for "blind" orebodies. This area presents very special problems, namely that west of the Richardson Mountains the terrane is entirely non-glaciated, and all of the region is in the permafrost zone and has for the last 60 million years undergone dry but increasingly cold climatic conditions of weathering. All developed economic deposits of uranium in sandstone, coal and granites in the Western World are in decidedly different terranes. Exploration companies are more active in areas in Canada where deposits and occurrences are better known and terrane response characteristics better understood. In this region only one company has embarked on a reasonably intensive program and it is important to note that it found almost immediately, based on the geological model for sandstone-type uranium deposits, encouraging occurrences in the Barn Mountains as well as the Mt. Fitton occurrence. Based on the history of development elsewhere, the present low level of exploration here and the unique terrane characteristics,as well as relatively difficult logistic problems,it is unlikely that an economic deposit of uranium will be realized here in the next 20 years, notwithstanding moderate to high potential for deposits. Ratings assigned in the region range from H4 to M4.[1]

(i) Proterozoic, Paleozoic and Mesozoic Rocks of Brooks-British-Barn Mountains Highs

Units outcropping in this area are shown in Figures 12, 13 and 15. Anomalous uranium geochemical response (Figure 14) has been demonstrated for several units. Very anomalous outcrop areas and actual uranium occurrences

[1] See Table 4.I, Part I

are known (Bell and Jones, 1979) in mid-Devonian granites at Mt. Sedgwick and Mt. Fitton, in basal carboniferous (Kekiktuk Fm) sandstones and conglomerates and Lower Paleozoic shales and cherts. The granites and sandstones are rated as high potential but with a nil probability for development of an economic deposit in the next twenty years.

(2) Interior Cover Rocks (Blow River Embayment)

Units outcropping in this area are shown in Figure 15. No occurrences are known here but continental and near shore marine sandstone deposits as indicated,are possible targets for uranium mineralization. Resource potential is rated as moderate with a nil probability for development of an economic deposit in the next twenty years.

Regional reconnaissance geochemical surveys (G.S.C. Open Files 563 to 565, 1979) show only a few very slightly anomalous responses in the Blow River and Northern Richardson Mountains. These are generally related to the Tent Island and Boundary Creek Formations

(3) Northern Richardson Mountains

The comments and assessment are the same as for area (2).

(4) Arctic Coastal Plain and Mackenzie Delta

Units of interest are shown in Figures 12 and 15. No uranium occurrences are known here but continental sandstone deposits of Mesozoic to mid-Tertiary age are possible targets for deposits and their potential is rated as moderate with a nil probability for development of an economic uranium deposit in the next twenty years.

(5) Anderson Plain Cretaceous-Tertiary Cover Rocks

Units of interest in this area are shown in Figure 15. Middle Devonian Hare Indian Formation shows a high gamma-ray log response (Yorath et al., 1975) related to black shales. This unit is unlikely to host an economic deposit but could have been important regionally as a source for further concentration of uranium in supergene processes in such formations as Langton Bay, Smoking Hills and perhaps Beaufort. Accordingly a rating of moderate potential is assigned, but nil probability for development in the next twenty years.

(6) Cape Parry Paleozoic Rocks

The Franklin Mountain Formation is not a good target for uranium prospection and as it is the only geologic unit present, the potential of the area is rated as nil.

(7) Horton Plain Paleozoic Rocks

Units outcropping in this region are shown in Figure 15 and are a thinner continuation of Ordovician to Cretaceous rocks of Anderson Plain and Brock Inlier. The overall rating is low with a nil probability for development in the next twenty years.

(8) Brock Inlier Proterozoic-Lower Paleozoic Rocks

Units outcropping in this area are shown in Figure 15. Deposits of sandstone or unconformity-related types are possible in some Precambrian Shaler Group rocks; these however are significantly younger than rocks hosting mineralization in Dismal Lakes area. Cambrian sandstones and conglomerates are possible targets for mineralization but their potential is rated as low, as is the case with the younger Langton Bay formation.

GOLD

(1) Proterozoic, Paleozoic and Mesozoic Rocks of Brooks-British-Barn Mountains Highs

According to hearsay, placer gold was recovered from the bars of the Firth River as early as 1899 (Sandy, 1948). A small staking rush took place in the winter of 1947-48. However, there is little recorded production of placer gold from the Firth River. Sixty ounces were reputedly recovered in 1935 (Sandy, 1948). Minor amounts were recovered in 1973 (Sinclair and Gilbert, 1975) and as much as 55 ounces was produced in 1979 from a location at 69°10'N, 140°09'W on Sheep Creek, a left limit tributary of the Firth River (G. Gilbert, pers.comm.,1980).

According to Sandy (1948), the gold on the Firth River occurs in gravel benches and bars for a distance of 30 miles below the mouth of Joe Creek. The gold occurs mainly as small, well-worn, flattened grains about the size of rolled oats. The source of the gold is uncertain. The area was not covered by Laurentide glaciation and D.K. Norris (pers. comm., 1980) considered the probable source to be sedimentary rocks of the underlying Neruokpuk Group. Sandy (1948) reports rumours of "quartz samples streaked with gold" and observed quartz stringers with "iron and specks of copper" in the area but no bedrock source for the placer gold has been documented.

Placer gold has also been discovered north of Mount Fitton on Anker Creek (O.L. Hughes, pers. comm., 1980). Neither the nature nor extent of this occurrence is known but it is probably related to the granitic pluton exposed at Mount Fitton which is known to have related base metal occurrences.

The potential for placer gold deposits is moderate. Occurrences are known on the Firth River and its tributaries but other rivers, such as the Malcolm, that cut the Neruokpuk Group also have potential. The potential for placer gold deposits in streams draining the Mount Fitton and Mount Sedgwick granitic stocks is considered low (to moderate?) because of the lack of documented occurrences.

I NORTHERN YUKON AND NORTHWESTERN MACKENZIE REGION

COPPER

(1) Proterozoic, Paleozoic and Mesozoic Rocks of Brooks-British-Barn Mountains Highs

No significant copper occurrences have been found in this region but Goodfellow (1979) has identified some areas where stream sediments have anomalous values in copper. Streams in one area west of Mount Fitton also contain anomalous amounts of Pb, Ba, Zn, Ag, and Mo and the area is underlain by unnamed shales and quartzites (Norris, 1977) suggesting the possibility of shale-hosted, conformable base metal sulphide deposits. Stream sediments in an area underlain by submarine Cambrian mafic lavas (Norris, 1977) north of the Firth River contain anomalous amounts of Cu, Ni, and Co. This chemical assemblage suggests the possible presence of magmatic Ni-Cu deposits, conformable volcanic exhalative Cu deposits, or simply that these mafic (and possibly ultramafic) rocks contain above average crustal levels of Cu, Ni and Co without any economic concentrations. In the northwest end of the Buckland Hills at about latitude $69^{0}30'$ and longitude 140^{0} in an area underlain by Proterozoic phyllites and quartzites (Norris, 1977) stream sediments contain anomalous amounts of Cu, Co, U,and Ag (Goodfellow, personal communication, 1980). Conceivably this chemical assemblage might be derived from sedimentary copper deposits.

(6) Cape Parry Paleozoic Rocks

A remote possibility exists of sedimentary deposits in basal Paleozoic rocks.

(7) Horton Plain Paleozoic Rocks

A remote possibility exists of sedimentary deposits in basal Paleozoic rocks.

(8) Brock Inlier Proterozoic-Lower Paleozoic Rocks

A slight possibility exists of sedimentary deposits in Proterozoic rocks.

(9A) Cape Young-Cape Hearne Paleozoic Rocks

A remote possibility exists of sedimentary deposits in basal Paleozoic rocks.

NICKEL

(8) Brock Inlier Proterozoic-Lower Paleozoic Rocks

The geology of this area correlates well with that of the Minto Arch (11) but the speculative potential for nickel-copper appears even less favourable. Only the uppermost unit of the Shaler Group is reported to contain minor gypsum, and very few of the gabbro sills have reached this stratigraphic level (Aitken *et al*., 1969; Balkwill and Yorath, 1970); thus there has been little opportunity for gabbroic magma to incorporate sulphur from gypsum to form nickel-copper sulphides.

I NORTHERN YUKON AND NORTHWESTERN MACKENZIE REGION

LEAD-ZINC

(1) Proterozoic, Paleozoic and Mesozoic Rocks of Brooks-British-Barn Mountains Highs

(2) Interior Cover Rocks (Mainly Jurassic and Cretaceous)

(3) Northern Richardson Mountains Jurassic and Cretaceous Sedimentary Rocks

These areas in the present report correspond to lead-zinc Area A in a previous assessment (Evaluation of the regional mineral potential of the Western Arctic Region; G.S.C. Open File 492, 1978). In the latter report, Area A was designated as having a certain potential to contain lead-zinc deposits of the "shale-type". In the present report this potential has been downgraded to essentially nil for two reasons: 1) a better understanding acquired in the meantime by the author of both the geology of the area and the deposit-type under consideration; 2) in the philosophy of resource evaluation, sub-areas regarded as having a certain level of potential in a relatively small area (such as the Western Arctic Region) will very commonly be down-graded in potential when included in a larger area. This is due to the fact that, because the ratings are relative (i.e. relative to other sub-areas), an increase in size of the total study area will usually result in inclusion of higher-potential sub-areas which will in turn result in the original sub-area being assigned a relatively low, or even nil, potential.

(6) Cape Parry Paleozoic Rocks

Ronning Group dolomites, exposed here on Parry Peninsula (Fig.16), are overlain unconformably to the south (see Area 7) by Bear Rock Formation or beds of Cretaceous age (Yorath *et al*., 1969). Given the near-horizontal attitude of the strata in this area, either or both of the above unconformities might be extrapolated to just above the present exposed surface of the Ronning Formation in Area 6. Thus Area 6 possibly has potential to contain "carbonate-type" lead-zinc deposits.

(7) Horton Plain Paleozoic Rocks

Within this area, dolomites of the Ronning and Bear Rock Formations are overlain with profound unconformity by Cretaceous strata (Yorath *et al*., 1969). Furthermore, the contact between Bear Rock and Ronning is also a disconformity with up to 150 feet (47 m) local relief. On the basis of these observations, the area is considered to contain geology favourable for the occurrence of "carbonate-type" lead-zinc deposits.

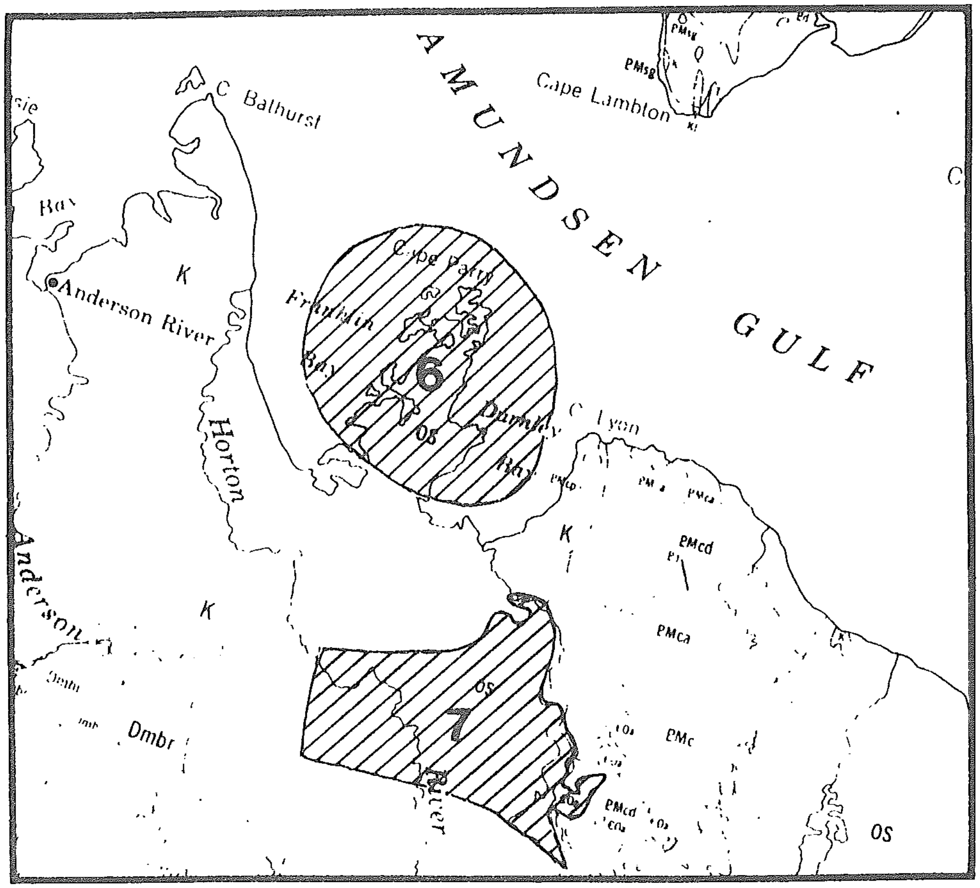


Figure 16: Areas with some lead-zinc potential (see text), Northwestern Mackenzie Region (Region I).

IRON

(2) Interior Cover Rooks
(3) Northern Richardson Mountains Jurassic and Cretaceous Sedimentary Rocks

Areas 2 and 3 contain manganiferous and phosphatic siderite iron beds interlayered with shale in upper Lower Cretaceous rocks in the Mount Davies Gilbert area (see Section 5, Part 1)on either side of the Yukon-Northwest Territories boundary. As previously stated the siderite beds are of little importance as a potential source of iron.

The abnormally high amount of phosphate associated with the siderite beds may be an indication of phosphate resources in this sequence of rocks; however, no samples of a quality and grade suitable for fertilizer raw materials have been reported. The phosphate is known to occur as apatite and in phosphate-silicate minerals. Some of the occurrences of phosphatic silicate material contain exotic assemblages of minerals (Mandarino and Sturman, 1976, Mandarino *et al*., 1977)that are in demand for museums and by collectors and the area may possibly sustain a small industry for the supply of mineral specimens in the future.

The sequence of rocks containing siderite and black shale represent sedimentary fillings of trenches and grabens in a highly faulted euxinic marine environment and is of considerable metallogenetic significance. Mudstones containing abnormal amounts of copper, zinc, lead and precious metals may be present in this rock succession but significant occurrences are not known at present.

According to Young *et al*., (1976) the bedded ironstone and shale facies of the Albian flysch sequence are distributed over the Cache Creek High and westward through the area where the above named exposures were examined by these authors.

Seventy feet of the same ironstone and shale facies were reported by Young (1973) in the Babbage River area, about 50 miles northwest of Mount Davies Gilbert in Area 2.

Possible occurrences of other metalliferous mudstone could be associated with the ferruginous facies of the Albian stage sediments.

I NORTHERN YUKON AND NORTHWESTERN MACKENZIE REGION

MOLYBDENUM

(1) Proterozoic, Paleozoic and Mesozoic Rocks of Brooks-British-Barn Mountains Highs

Tungsten- and molybdenum-bearing skarns are known to occur adjacent to Devonian intrusions on Mount Fitton (Vokes, 1963, p. 228; Gabrielse, 1957) and Goodfellow has found anomalous Mo concentrations in stream sediments in the vicinity of the Devonian granite at Mount Sedgwick and also some minor molybdenite occurrences in NW-trending fissures in the granite (G.S.C. Open File 565, 1979; Goodfellow, personal communication, 1980).

An area north of the Firth River adjacent to Alaska, underlain by the Lisburne Group, has stream sediments that contain anomalous amounts of fluorine and molybdenum. These anomalies are of unknown genesis and importance. In the southern Barn Mountains just east of the Old Crow Flats in an area underlain by Cambro-Ordovician Road River shales (Norris, 1977) stream sediments contain anomalous amounts of Mo, Ag, U, and Ba (Goodfellow, personal communication, 1980). These anomalous stream sediments are also of unknown genesis and importance.

I NORTHERN YUKON AND NORTHWESTERN MACKENZIE REGION

TUNGSTEN

(1) Proterozoic, Paleozoic and Mesozoic Rocks of Brooks-British-Barn Mountains Highs

Tungsten has long been known in stream gravels draining the area underlain by small Devonian granitic plutons of British Mountains-Barn Uplift (Mt. Sedgwick, Mt. Fitton, Mt. Hoidáhl) and the tungsten mineral wolframite occurs with copper and molybdenum mineralization on the flanks of Mount Fitton near the southern boundary of Area 1 (Vokes, 1963; see also "uranium" and "molybdenum", this section). Tungsten anomalies in stream sediments have also been recorded in a number of other localities in Area 1 (e.g. Firth River-Sheep Creek area) during the course of reconnaissance geochemical surveys conducted by the Geological Survey in 1978 (Goodfellow, 1979). In part, these geochemical expressions may reflect the presence of other small "blind" granitic plutons that do not outcrop. In summary, although no significant tungsten deposits are known there is considerable indirect indication of widespread tungsten mineralization in this area, and the potential for significant undiscovered deposits is considered moderate.

II WESTERN ARCTIC ISLANDS REGION

URANIUM

(11) Minto Arch Precambrian Rocks

The Minto Arch contains mainly Proterozoic sedimentary and volcanic rocks associated with evaporites of the Helikian or Hadrynian (?) Shaler Group (Thorsteinsson and Tozer, 1962, 1970). The northeastern part of the Minto Arch is underlain by a variegated sequence of the Glenelg Formation containing conglomerate, sandstone, siltstone, shale, limestone and dolomite. The western part of the Minto Arch is made up of a more monotonous sequence consisting of sandstone, shale, limestone and anhydrite of the Kilian Formation.

Locally the Glenelg Formation unconformably overlies Archean granitic rocks. The rocks along this unconformity should be regarded as favourable for uranium mineralization of the unconformity-related type.

The evaporites of the Kilian Formation could have been, on the other hand, a source of uranium-bearing brines that might have deposited uranium in the clastic sediments and thus formed sandstone-hosted uranium deposits.

However, more field evidence is needed to confirm these hypotheses.

II WESTERN ARCTIC ISLANDS REGION

SILVER

(II) Minto Arch Precambrian Rocks

There is a slight possiblity that small native silver deposits could be found in association with mafic sills in this area. If such deposits were found they would probably support only a very small scale mining operation.

GOLD

(II) Minto Arch Precambrian Rocks

The basal sandstones of the Glenelg Formation are predominantly grey, fine grained, quartzitic, and very commonly interbedded with greenish black silty shales. These rocks are considered to be of marine origin so the possiblity of discovery of paleoplacer gold deposits appears to be very slight.

II WESTERN ARCTIC ISLANDS REGION

COPPER

(11) Minto Arch Precambrian Rocks

A slight possibility exists of sedimentary deposits. A number of minor copper occurrences have been found in the Natkusiak flood basalts (Thorsteinsson and Tozer, 1962). Known occurrences are small discordant types and have no economic potential but possibly some small economic vein and replacement (discordant) deposits might be found. The large important conformable native copper deposits in the Keweenaw Peninsula of Michigan occur in the same general geological environment as the Natkusiak volcanic suite; nevertheless, no conformable native copper or copper sulphide occurrences have been found in the Natkusiak basalts.

(12) Prince Albert Peninsula Paleozoic Rocks

A very remote possibility exists of sedimentary deposits in basal Paleozoic rocks.

(14) Northern Arctic Paleozoic Belt

A remote possibility exists of sedimentary deposits in the Devonian Hecla Bay and Griper Bay Formations, the Pennsylvanian Canyon Fiord Formation, and the Permian Sabine Bay and Assistance Formations (Tozer and Thorsteinsson, 1964).

(15) Northern Arctic Upper Paleozoic-Mesozoic Belt (Sverdrup Successor Basin)

A very remote possibility exists of sedimentary deposits in the Lower Triassic Bjorne Formation (Tozer and Thornsteinsson, 1964).

(16) Mould Bay Paleozoic-Mesozoic Rocks

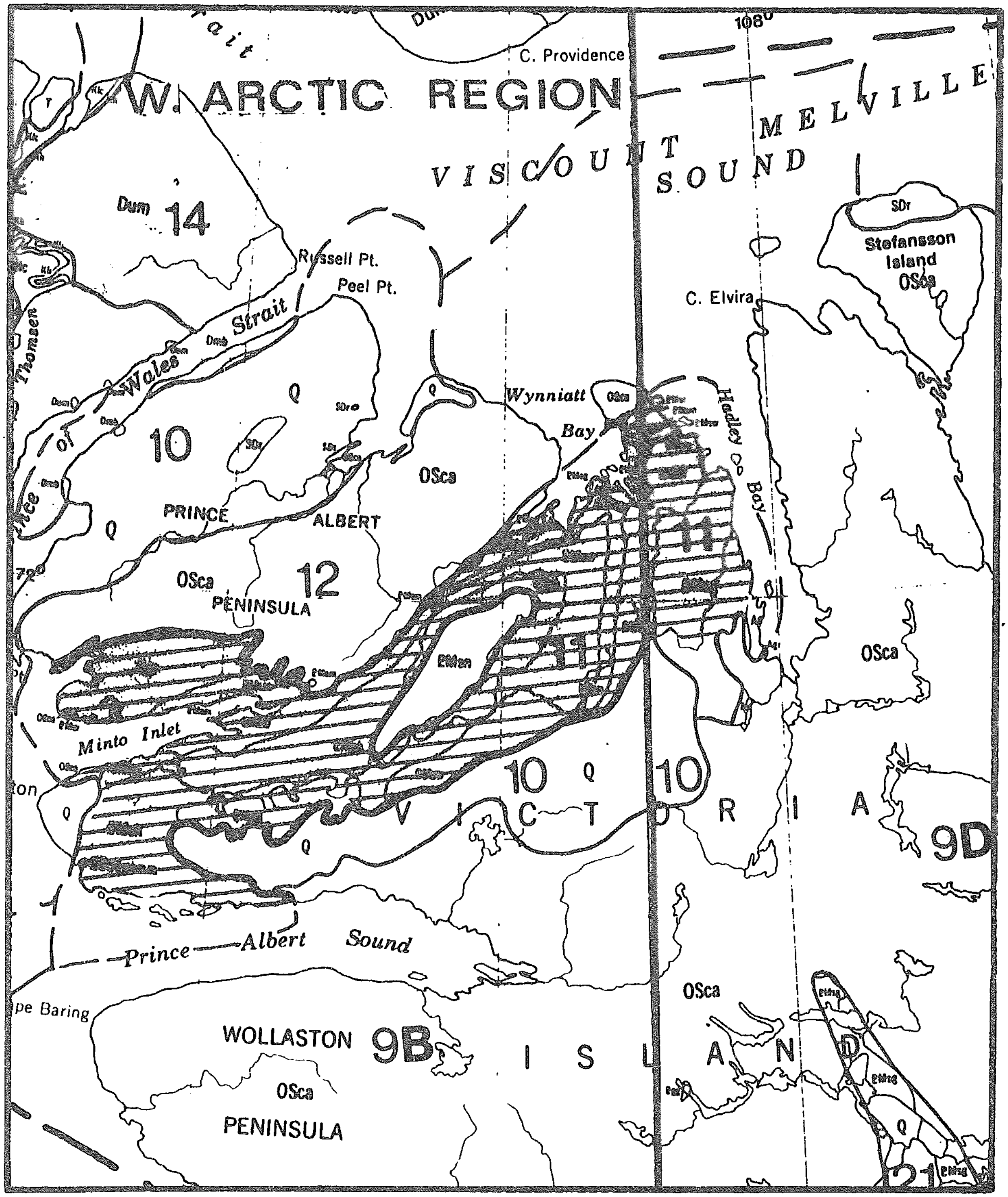
There is a very remote possibility of sedimentary deposits in the Griper Bay Formation.

II WESTERN ARCTIC ISLANDS REGION

NICKEL

(11) Minto Arch Precambrian Rocks

No nickel occurrences have been reported in this region. There could possibly be some highly speculative potential for nickel-copper deposits associated with diabase-gabbro sills (Christie, 1964) which intrude the Shaler Group (Thorsteinsson and Tozer, 1962), of which two formations, Minto Inlet and Kilian, contain sulphate-rich (gypsum, anhydrite) beds (Fig. 17). This is similar to the geological setting of nickel-copper deposits at Noril'sk, Russia and the Duluth complex, Minnesota. In both of these, there is evidence that mafic magmas have incorporated sulphur from footwall rocks to form nickel-copper sulphide concentrations at the base of sill-like intrusions. Unfortunately, one perhaps crucial difference is that the Minto Arch sills appear to be virtually undifferentiated in contrast to the Noril'sk intrusions.



Ni-Cu potential: associated with mafic plutons.

Figure 17: Area with potential for Ni-Cu deposits, Western Arctic Islands Region.

II WESTERN ARCTIC ISLANDS REGION

LEAD-ZINC

(14B) Northern Arctic Paleozoic Belt, Mainly Carbonate Rocks

That part of the northwest coast of Victoria Island lying within Area 14B was identified as Area F in an earlier lead-zinc assessment (Evaluation of the regional mineral potential of the Western Arctic Region; G.S.C. Open File 492, 1978). The area has been re-assigned a nil potential in the present report for the same reasons outlined in discussions of lead-zinc potential in Areas 1, 2 and 3 (Northern Yukon and Northwestern Mackenzie Region). The main geological reason for Area F now being regarded to have low or nil potential is that the carbonate unit in question, the Blue Fiord Formation, is limestone rather than dolomite and is hence now regarded as of much lower potential than other sub-areas in the study region.

(10) Banks-Victoria Island

(11) Minto Arch Precambrian Rocks

(12) Prince Albert Peninsula Paleozoic Rocks

These areas on Victoria Island were previously considered geologically to be relatively favourable for the occurrence of lead and zinc (Evaluation of the regional mineral potential of the Western Arctic Region; G.S.C. Open File 492, 1978). Designated as Areas D and E in the 1978 report, these are now considered to have little or no relative potential for the same reasons as discussed under "Lead-Zinc" in Areas 1, 2 and 3 (Northern Yukon and Northwestern Mackenzie Region) in the present report. The main geological reason for downgrading these areas is that, since 1978, further investigation has convinced this author that a basement of sialic composition is of paramount importance to the occurrence of "sandstone-type" lead-zinc deposits. The absence of this on Victoria Island accordingly affects the lead-zinc rating assigned these areas.

URANIUM

(18) Eastern Ellesmere Proterozoic Belt

The Eastern Ellesmere Proterozoic Belt is made up mainly of Lower Proterozoic granitic gneiss and granite. It is unlikely that these rocks contain economic uranium deposits that could be discovered and exploited in the foreseeable future. On the other hand these rocks might have been a good source of uranium for formation of deposits in adjacent sedimentary basins.

General Remarks Concerning Uranium Potential of Northern Arctic Islands Region and Notes on Adjacent Western Arctic Islands and Central Arctic Regions

There are presently only two known uranium occurrences in the Phanerozoic sedimentary rocks of the Arctic Islands; only one of these represents a potential ore-forming process. This almost complete lack of encouragement may be due in part to insufficient exploration in this vast and remote area, or perhaps to extreme surficial leaching of uranium in the polar environment. However, the results of two seasons of field work by members of the Uranium Resource Evaluation Section suggest that the uranium potential of the region is probably very low.

The approach taken has been that of hypothesis testing. Based on known geology and an understanding of how natural processes may concentrate uranium, attempts have been made to predict where uranium mineralization was most likely to have occurred. Field work was then carried out to test the various models.

Unlike other orogenic systems in Canada, the Innuitian system presents the economic geologist with relatively few geological processes which have the potential to concentrate uranium. Suitable Phanerozoic igneous and metamorphic rocks are restricted to northernmost Axel Heiberg and Ellesmere Islands. What is more, many of the sedimentary-diagenetic processes which formed the extensive deposits of sedimentary rocks are most unlikely to concentrate uranium; lower Paleozoic shelf carbonates of the Franklinian geosyncline are suitable hosts for base metals, but not for uranium. Even the potentially more favourable sandstones of the Sverdrup successor basin are products of several cycles of erosion and sedimentation, the outcome of which is generally further chemical dispersion and homogenization instead of the reverse.

Our present understanding of the uranium potential is summarized using simplified stratigraphic columns of the Franklinian and Sverdrup Basins (Figs. 18 and 19 respectively). Symbols identify positions in the stratigraphic sequence where uranium has been found or where it was predicted the element might be concentrated. A summary of the regional geology is provided by Trettin et al. (1972).

The possibility of unconformity related deposits exists where crystalline basement rocks are overlain unconformably by upper Proterozoic to lower Cambrian clastic rocks (Fig. 18). One of the best prospects of this type is the Aston Formation of northwestern Somerset Island, recently examined by an exploration company without success. There is no reason to suspect that phyllites, sandstones and conglomerates within the Ellesmere Group and Kennedy Channel Formation of east-central Ellesmere Island would be any more encouraging. Although suitable rock types are more widespread here, the unconformity is apparently not exposed. The unconformity is exposed to a limited extent at several localities along the east coast of southern Ellesmere Island. The potential host rocks in this area are basal clastics of the Thule Basin sequence (Frisch et al., 1978).

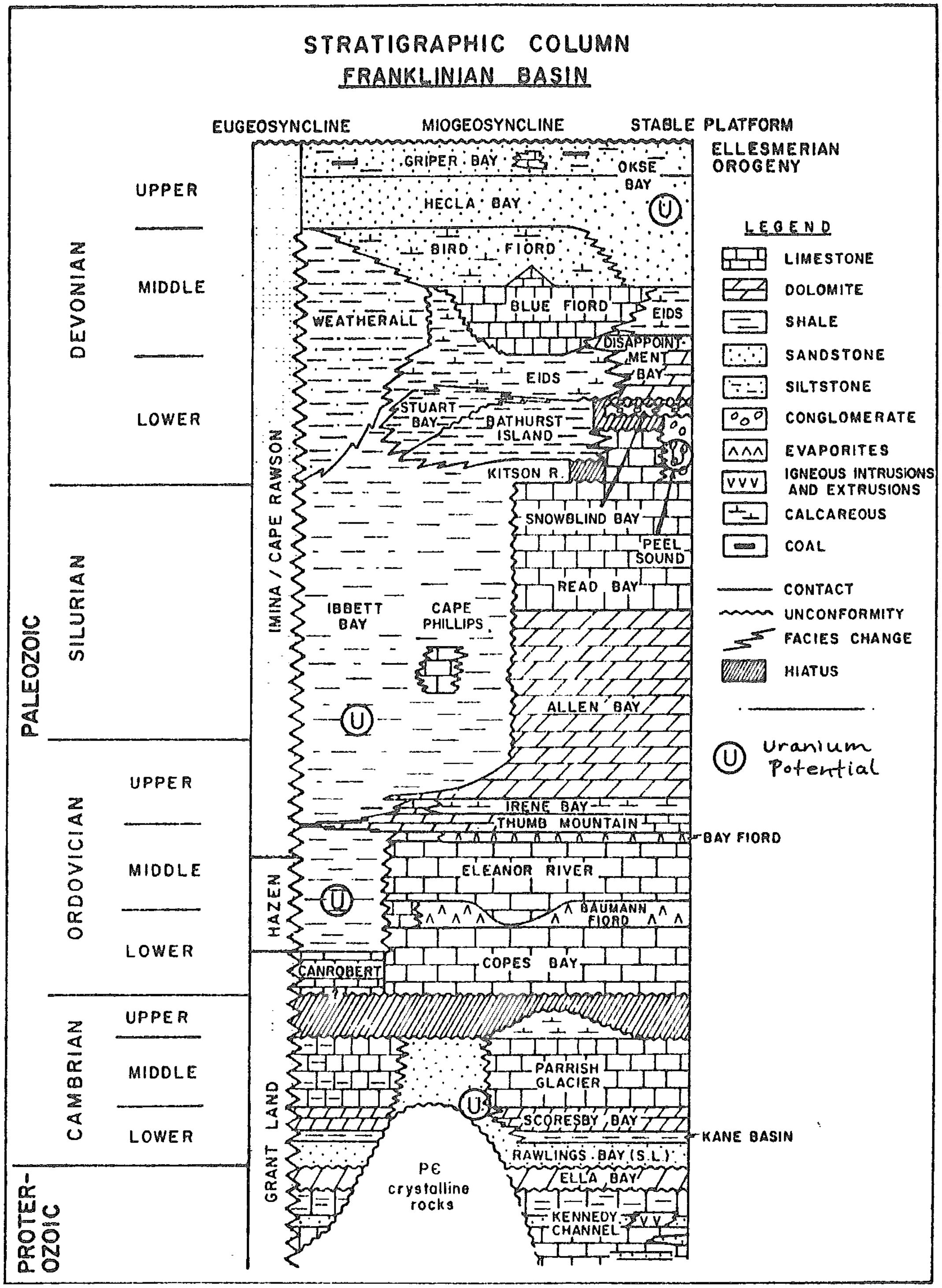


Figure 18: Stratigraphic column of Franklinian Basin (from Stuart-Smith and Wennekers, 1977).

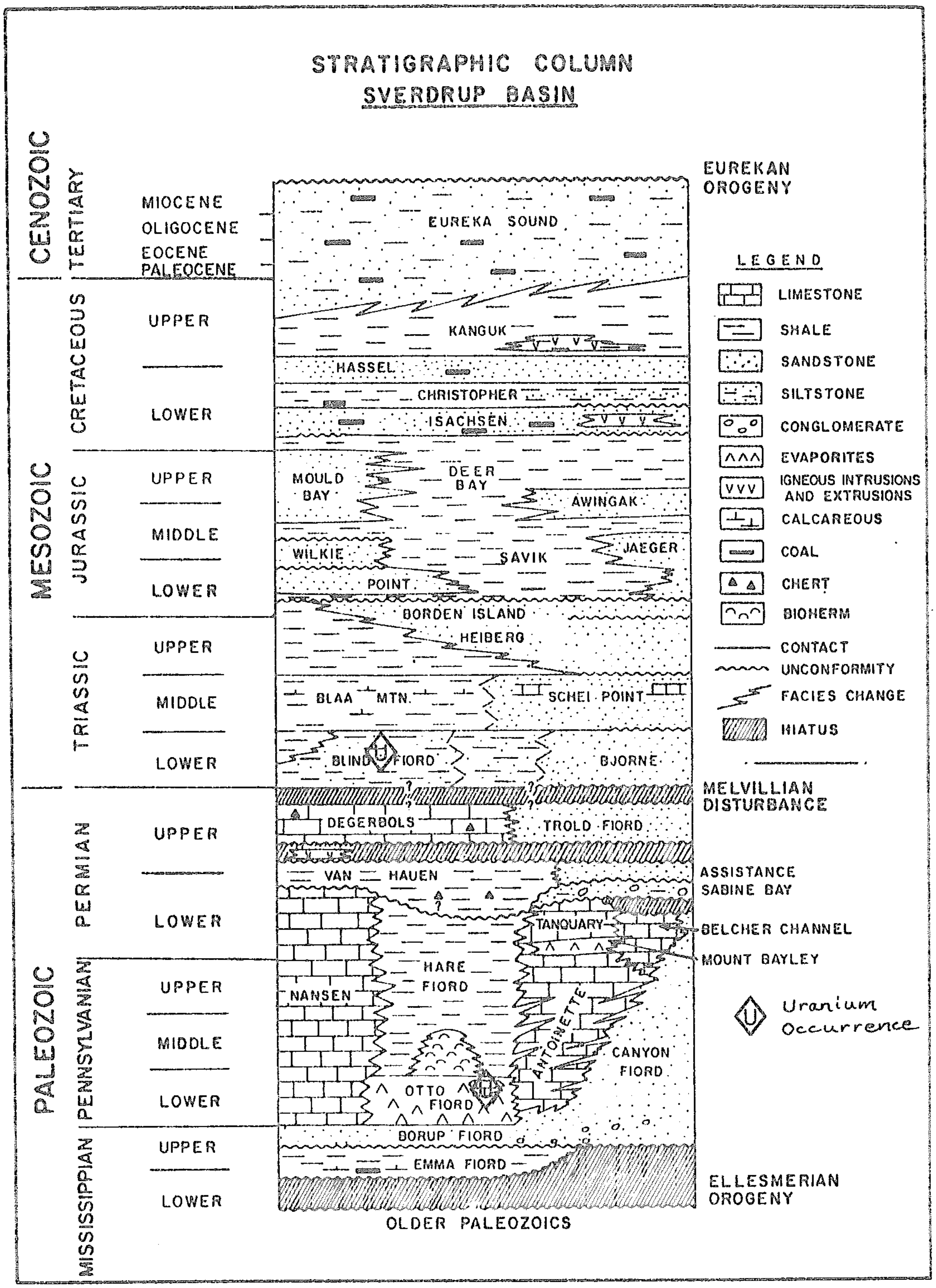


Figure 19: Stratigraphic column of Sverdrup Basin (from Stuart-Smith and Wennekers, 1977).

Minor enrichments of uranium might be anticipated in 'starved-basin' deposits, such as the Hazen and Ibbett Bay Formations (Fig. 18) of northeastern Ellesmere and northwestern Melville Islands, respectively. However, these synsedimentary enrichments would only be potentially economic if locally upgraded by subsequent igneous or metamorphic cycles of enrichment. From the literature, this possibility does not appear to exist.

One of the most potential host rocks in the Arctic Islands was thought to be the Peel Sound Formation (Fig. 18) of Prince of Wales and northwestern Somerset Islands. Late Silurian to Early Devonian emergence of the Boothia Uplift produced a clastic wedge derived in large part from erosion of crystalline basement rocks. With increasing distance from the source area, the clastics grade from boulder conglomerates to shale and carbonates (Miall, 1970). According to the granite-source model of ore formation (Stuckless and Nkomo, 1978), uranium may have been mobilized by meteoric waters percolating through the granites and gneisses in the core of the uplift, transported laterally into the clastic wedge and precipitated at sites of chemical reduction. Unfortunately, field work by both the Geological Survey of Canada and an exploration company has failed to detect any radioactivity.

The granite-source model was also applied to the middle and upper Devonian clastic strata exposed over a wide area from central Ellesmere to Banks Islands (Okse Bay Fm. and equivalents, Fig. 18). The model was tested without success at several localities, but most rigorously in the Vendom Fiord area of south-central Ellesmere Island. In this area, fluvial sandstones are presently positioned close to Precambrian gneisses and granites, the suspected source of the sands (Embry and Klovan, 1976; Trettin, 1978) and the proposed source of uranium in Late Devonian time. The sandstones were found to be texturally and chemically mature, indicating sediment transport distances which were probably beyond the range of granite-traversing, meteoric groundwaters. Whatever the reason, suitable settings in the sandstones were devoid of uranium.

Turning to sediments of the Sverdrup Basin, the only significant uranium showing found to date is hosted by bituminous carbonates of the Otto Fiord Formation (Fig. 19), a major marine evaporite deposit of Pennsylvanian age. The occurrence was found within the Dumbbells Dome salt diapir on Ellef Ringnes Island (Jonasson and Dunsmore, 1979), where evaporites and associated rock types have intruded into Cretaceous clastics.

When sea water is evaporated, part of the contained uranium remains in solution, becoming concentrated in the residual brines (Dunsmore, 1977). If these brines come in contact with organic-rich sediments, an uneconomic, synsedimentary enrichment of uranium may result. This is believed to be what the Dumbbells Dome occurrence represents, evidence of the first step along the path to potential ore deposits. If, during burial and compaction of the salt, the brines were expelled to overlying sandstones where they were effectively channeled, ore grade concentrations might result at sites of chemical reduction.

Field work was carried out throughout west-central Ellesmere and eastern Axel Heiberg Islands in an attempt to detect uranium concentrations in sandstones stratigraphically above the evaporites. None was found, probably because the evaporites were effectively sealed beneath many thousands of metres of impermeable shales and siltstones (Fig. 19). Uranium-bearing brines may have escaped downward and then out through the permeable Borup Fiord Formation, but this rock unit is exposed only in a basin margin position, well away from the main evaporite deposit. The conclusion is that uranium deposits may exist somewhere along the escape routes taken by the brines, but that these sites are probably many thousands of metres beneath the surface and thus impossible to locate.

The second known uranium occurrence is located within the lower Triassic Blind Fiord Formation, Svartfjeld Peninsula, northwestern Ellesmere Island. A bed of pelagic fauna (ammonoids) about one foot thick in a cliff section along Smith Creek (Tozer, 1967; Fig. 4, zone 1) contains minor amounts of uranium. This occurrence is regarded as a normal consequence of very slow rates of deposition, and is of no significance with respect to potential ore formation.

It is also unlikely that other Mesozoic and Cenozoic clastic sediments contain any economic concentrations of uranium. Four of the most promising sandstone units have been examined in the field (namely, the Bjorne, Heiberg, Isachsen and Hassel Formations), and none provided any encouragement whatsoever. Basically, the material making up this vast volume of rock has been derived from pre-existing sedimentary rocks, possessing very low uranium resource potential, by processes which are unlikely to concentrate the element.

The igneous and metamorphic terranes along the north coast of Ellesmere and Axel Heiberg Islands have not been studied by the writer, so no meaningful comment can be made at this time. However, for logistical reasons alone, it is thought unlikely that much interest will be shown in the area in the foreseeable future.

In conclusion, indications are that the uranium resource potential of the Phanerozoic basins of the Arctic Islands is very low.

III NORTHERN ARCTIC ISLANDS REGION

GOLD

(17) Sverdrup Basin Tertiary Rocks

These rocks are exposed on Lougheed Island, Ellef Ringnes Island, the north tip of Melville Island, and extensively in the vicinity of Eureka Sound, as well as in smaller areas scattered elsewhere on Ellesmere Island. They consist mainly of continental sandstones and commonly contain low-grade coal deposits that can be used locally for fuel. These Tertiary sedimentary rocks may have some potential (low) for paleoplacer gold deposits.

(18A) Proterozoic Rocks of Thule Basin

The base of the Thule Basin sequence along the east coast of Ellesmere Island consists of a unit of quartz sandstone and quartz-pebble conglomerate (Frisch *et al*., 1978). The Thule Group rocks dip gently and rest on an older highly metamorphosed basement. A much thicker quartz sandstone unit (subdivision IV) with subordinate quartz-pebble conglomerate is present higher in the section, above a basalt-redbed sequence. While possible sources for gold are presently unknown in the basement rocks, the quartz-pebble conglomerate, especially in the basal unit, may have a moderate potential for paleoplacer gold deposits.

(18) Eastern Ellesmere-Devon Precambrian Rocks

The rocks of this area are highly metamorphosed, in part to granulite facies. Some of the least metamorphosed sedimentary rocks and amphibolites may have some potential, rated as very low, for gold deposits.

(19) Northwest Ellesmere Island Paleozoic Rocks

The rocks in this area are a eugeosynclinal assemblage that includes felsic and intermediate flows and breccias, tuffs and tuffaceous sediments. These rocks probably represent an environment that has a moderate potential for gold deposits.

III NORTHERN ARCTIC ISLANDS REGION

COPPER

(14A) Hazen Trough Eugeosynclinal Paleozoic Rocks

A remote possibility exists of sedimentary deposits in the Cambro-Ordovician Grant Land Formation (Trettin, 1971). Dunsmore and Jones, during the course of a uranium reconnaissance survey in 1979, noted a large, 10m diameter copper stain on a cliff face of Grant Land Formation on the north side of the middle branch of Stepanow Creek on northern Ellesmere Island (latitude 81°09', longitude 84 01'30") (Dunsmore and Jones, personal communication, 1980). They were not able to examine this mineralization in place, hence, the origin and significance of the occurrence is unknown. They also found very minor amounts of chalcopyrite in fractures in the Grant Land Formation near mafic dykes about one kilometre east of the copper stain. A possibility also exists of conformable "shale-hosted" massive base metal sulphide deposits in the Ordovician Hazen Formation (Trettin, 1971; see also lead-zinc assessment,this report).

(14B) Northern Arctic Paleozoic Belt:Mainly Carbonate Rocks

A slight possibility exists of economic concentrations of copper in "carbonate-hosted" deposits. This type of deposit and environment is more favourable for the occurrence of lead and zinc but a few minor copper occurrences of this type are known on Grinnell Peninsula, Devon Island and in the Eclipse area on Little Cornwallis Island. Promising copper occurrences of this type are known in the major lead-zinc districts of southeast Missouri.

(14C) Northern Arctic Paleozoic Belt:Mainly Clastic Sedimentary Rocks

A very remote possibility exists of sedimentary deposits in Devonian, Permian, and Lower Triassic rocks (Kerr, 1974). The evaporite-redbed Late Devonian Vendome Fiord and Okse Bay formations in south-central Ellesmere Island (Kerr, 1967; McGill, 1974) seem to offer the best potential. A slight potential also exists for magmatic Ni-Cu, skarn, and/or miscellaneous vein and replacement deposits associated with minor mafic Cretaceous (?) intrusions on southern Bathurst Island (Kerr, 1974).

(15) Northern Arctic Upper Paleozoic-Mesozoic Belt (Sverdrup Successor Basin)

A very speculative, ill-defined potential exists for sedimentary deposits, especially in the intertonguing areas between the continental redbed and the marine and evaporitic facies of the Permo-Carboniferous Canyon Fiord, Borup Fiord, Otto Fiord, Antoinette, and Belcher Channel formations. Reduced marine rocks overlying redbeds are the most promising sites for such copper deposits.

(18) Crystalline Precambrian Basement Rocks, Eastern Ellesmere and Devon Islands

Frisch et al.(1978) mention minor copper occurrences in Precambrian granulite facies metasedimentary rocks of the Churchill Province. These occurrences are of unknown affiliation and importance. Uppermost Precambrian (and/or lowermost Paleozoic) rocks (Christie, 1967; Frisch, personal communication, 1980) have a very slight possibility of containing sedimentary deposits. Some lowermost Paleozoic (?) rocks in this area are described as interlayered green and red beds with some thin gypsum units. Such sequences might contain sedimentary copper deposits.

(18A) Proterozoic Rocks of Thule Basin

Frisch et al.(1978) mention the presence of malachite stains in the Helikian interlayered basalt-redbed sequence (II) (about 1000 m.y. old).

The source of this malachite was not mentioned. Minor copper occurrences can be expected in this type of sequence but the overlying black, stromatolitic dolomite unit (Frisch et al., 1978) would seem to be a particularly favourable unit to explore for sedimentary deposits. Conceivably Cu-Ni deposits might occur in association with gabbro sills, but the sills examined appear to be thin and undifferentiated (Frisch, personal communication, 1980).

(19) Northern Ellesmere Paleozoic Volcanic Rocks

(20) Metamorphosed (Proterozoic ?) Rocks of NW Ellesmere Island

Even though no copper occurrences have been found in this area, geological features of this orogenic belt appear favourable for the occurrence of a variety of copper deposit-types. High level, felsic Early Devonian intrusive rocks (Frisch, 1974; Trettin and Balkwill, 1979) might be favourable for the occurrence of porphyry, miscellaneous vein and replacement, and skarn type copper deposits. Differentiated gabbroic noritic intrusions, such as the Early Devonian one at Cape Fanshawe Martin (Christie, 1967; Frisch, 1974; Trettin and Balkwill, 1979), have potential for magmatic Ni-Cu deposits. Subaqueous felsic volcanic sequences such as the Silurian Land Lokk Formation (Trettin, 1969a) could contain volcanogenic base metal sulphide deposits, and submarine mafic pillow lava sequences such as the Silurian Svartevag Formation on northeastern Axel Heiberg Island (Trettin, 1969a) and the Ordovician M'Clintock Formation on northern Ellesmere Island could contain volcanogenic copper deposits. Redbed and related sequences such as the Devonian Stallworthy Formation on northern Axel Heiberg Island (Trettin, 1969a), and the Ordovician Cape Discovery and Taconite River Formations on

Ellesmere Island (Trettin, 1969c) might contain sedimentary deposits. Some of the Precambrian terrane (Frisch, 1974b; Trettin and Balkwill, 1979) might contain metasedimentary and/or metavolcanic deposits. Belts of Alpine ultramafic rocks have been outlined in this region (Trettin and Balkwill, 1979). If these are mantle slices left behind after the closing of oceans, it is conceivable that related ophiolite sequences, possibly containing volcanogenic copper deposits, may be found in these areas. "Carbonate-hosted" copper deposits might be found in the Silurian dolomites overlying the Ordovician volcanic rocks in the M'Clintock Inlet area in northern Ellesmere Island (Trettin and Balkwill, 1979). This general environment is somewhat similar to the setting of the unusual, yet important, Ruby Creek copper deposits in Devonian carbonate rocks in the western part of the Brooks Range, Alaska.

III NORTHERN ARCTIC ISLANDS REGION

NICKEL, CHROMITE, ASBESTOS, PLATINUM

(19) Northern Ellesmere Paleozoic Volcanic Rocks

Nickel

Three moderately large (8 to 20 km long) ultramafic masses occur in this area but no nickel occurrences are known. The two serpentinized peridotites at M'Clintock Inlet (Fig. 20: Trettin, 1969a; Frisch, 1974b) are tentatively classified as Alpine by Frisch, in which case potential for nickel is vanishingly small. The other body on Kleybolte Peninsula is dyke-like dunite, said to occupy a fault zone (Trettin, 1969c), but its petrological affinity remains obscure, and potential would appear to be negligible.

Chromite

There could conceivably be some potential for chromite deposits in the Kleybolte dunite (Fig. 20), which reportedly contains some chromite (Trettin, 1969c), but no other similarities to known chromite deposits are apparent.

Asbestos

There could conceivably be some potential for asbestos deposits in the ultramafic masses in this area, though none has been reported.

Platinum

There could be some potential for placer platinum deposits in the drainages or beach sands related to the ultramafic masses, similar to the platinum placers of southeastern Alaska.

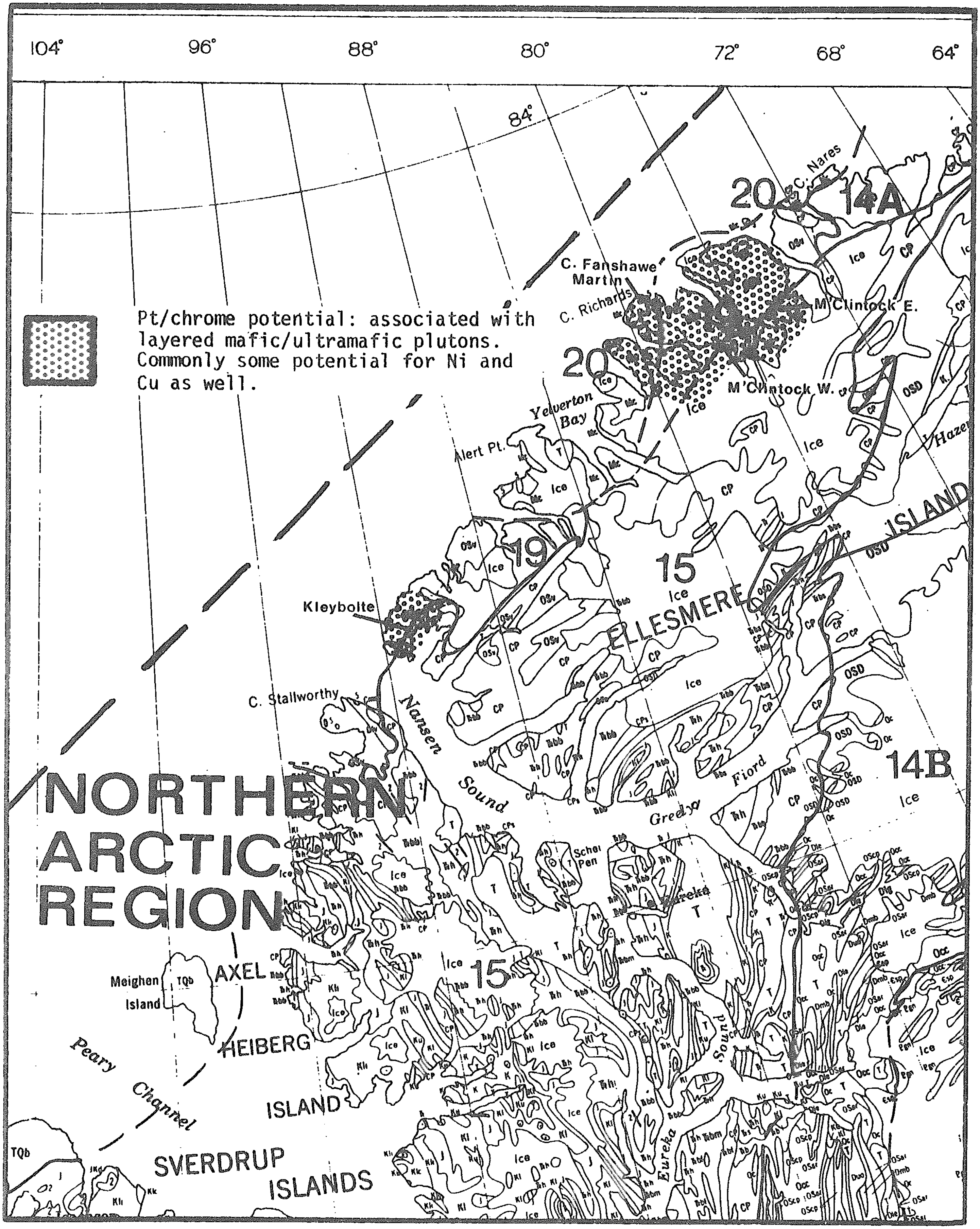


Figure 20: Areas with potential for Pt and Cr deposits, Northern Arctic Islands Region.

(20) Metamorphosed (Proterozoic?) Rocks of NW Ellesmere Island

Nickel

Some potential for nickel-copper deposits of the Stillwater type could conceivably exist in the 11 km long gabbro-peridotite complex on Cape Fanshawe Martin (Fig. 20: Frisch, 1974b).

Chromite

The Cape Fanshawe Martin layered gabbro-peridotite complex (Frisch, 1974b) may have some potential for chromite deposits of the Bushveld-Stillwater type, although orthopyroxenite, the ultramafic rock type most commonly associated with chromite deposits in such intrusions (Irvine, personal communication, 1980) was not specifically noted.

Platinum

Potential for platinum deposits of the Bushveld-Stillwater type could exist in the Cape Fanshawe Martin highly differentiated and layered gabbro-peridotite complex.

Asbestos

There could be some potential for asbestos in the northern ultramafic portion of the Cape Fanshawe Martin layered complex, although no asbestos was reported, and there is little indication of structural deformation other than block tilting (Frisch, 1974b).

III NORTHERN ARCTIC ISLANDS REGION

LEAD-ZINC

(Parts of Areas 14A, 14B, 14C and 15) Northern Ellesmere Island

Within Area A shown in Fig. 21, the Grant Land and Hazen Formations are regarded as favourable for the occurrence of lead-zinc deposits.

The Grant Land Formation is a basal, feldspathic quartzite "derived from a metamorphic-plutonic terrane of sialic composition" (Trettin, 1971, p. 31). Paleogeographic reconstruction, based on paleomagnetic evidence (Irving, 1979), 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, consisting of a "starved basin" facies of shales, radiolarian cherts and carbonates, occurs within a fault-bounded trough roughly centered on present-day Hazen Lake (Trettin, 1971; Trettin and Balkwill, 1979). Moreover, to the northwest, along the coast of Ellesmere Island, several occurrences of volcanic rocks have been shown, or assumed, to be equivalent in age to the Hazen Formation (Trettin and Balkwill, 1979; Trettin et al., 1972, pp. 105-109). Thus, the Hazen Formation of Ellesmere Island and the correlative Ibbet Bay and Canrobert Formations on Melville Island (Trettin, 1971, p. 46), are regarded as favourable for the occurrence of "shale-type" lead-zinc deposits.

(14B) Eastern Ellesmere Island

The Cape Phillips Formation shales were interpreted by Trettin and Balkwill (1979, p. 756) to have been deposited in a back-reef basin. Within this basin, possibly formed by faulting, deposition of the graptolitic

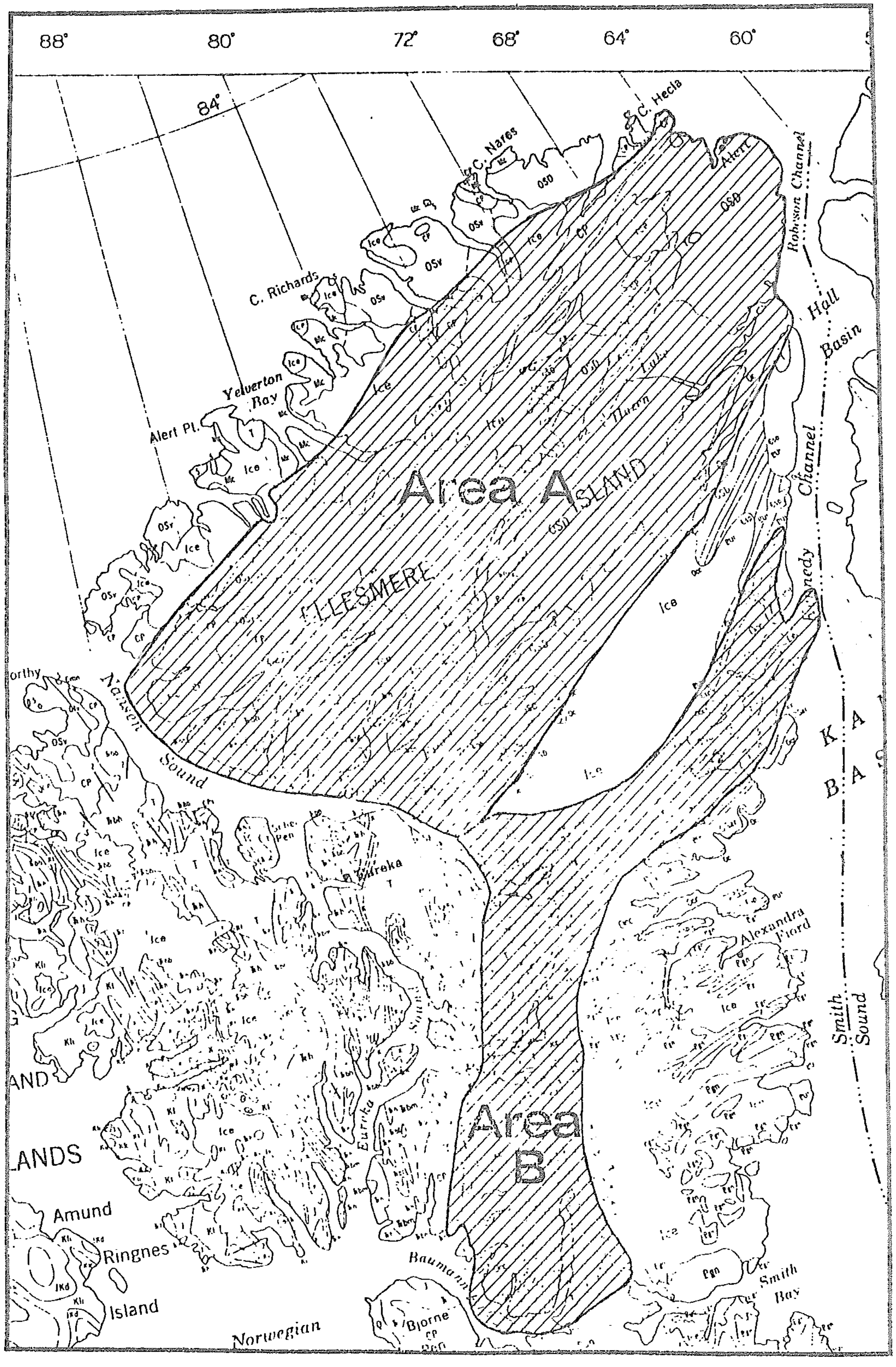


Fig. 21: Areas on Ellesmere Island with lead-zinc potential
(see text for details)

shales was slow; Kerr (1977a) describes the formation as having been deposited under euxinic conditions. As a consequence of these interpretations, the Cape Phillips Formation is regarded as having some potential for "shale-type" lead-zinc deposits. One of the main outcrop areas of this Formation is in eastern Ellesmere Island (area B, Fig. 21).

Also within this area, the dolomitic Allen Bay Formation passes abruptly into shales of the Cape Phillips Formation (Kerr, 1976). Facies changes such as this are generally regarded as a favourable geological situation for "carbonate-type" lead-zinc deposits. Hence, the Allen Bay Formation in eastern Ellesmere Island is considered to have good potential to contain "carbonate-type" lead-zinc occurrences.

(14B) Cornwallis Lead-Zinc District

That part of area 14B lying between Wellington Channel, Barrow Strait, eastern Bathurst Island, and southern Grinnell Peninsula (Fig.22) is referred to as the Cornwallis Lead-Zinc District (Kerr, 1977b). The District contains at least fourteen "carbonate-type" lead-zinc occurrences, two of which, Arvik and Polaris, have reported reserves. Most of these occurrences, including Arvik and Polaris, are found in carbonates of the Thumb Mountain Formation; two, however, are found in formations above the Thumb Mountain. Kerr (1977b) has convincingly argued that lead-zinc mineralization in the Thumb Mountain Formation dolomite is controlled by brecciation resulting from uplift within the Cornwallis Fold Belt (Kerr, 1977a). The Cornwallis Lead-Zinc District, accordingly, is recognized as an area with good potential to contain other "carbonate-type" lead-zinc deposits, particularly in the Thumb Mountain Formation. In addition, the Allen Bay Formation, also consisting largely of dolomite, abruptly passes into shales of the Cape Phillips

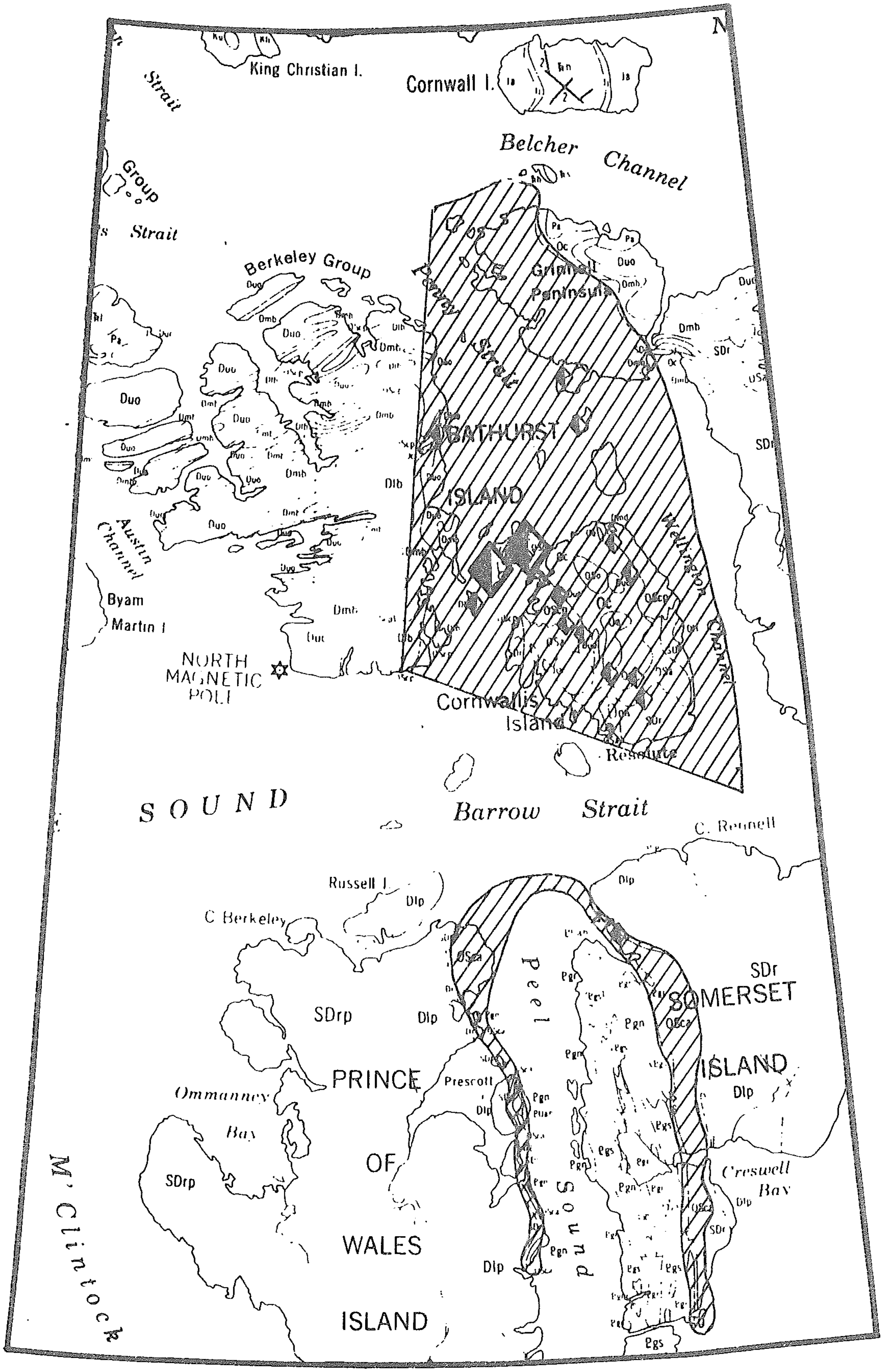


Figure 22: Cornwallis Lead-Zinc District and favourable carbonate strata flanking Boothia Arch (Central Arctic Region).

Formation within the Cornwallis Lead-Zinc District (Kerr, 1977b, p. 1407). Not only is a dolomite-shale facies change regarded as a favourable geological situation for "carbonate-type" lead-zinc deposits in general, but also one of the occurrences mentioned in Kerr (1977b, p. 1408) is situated in the Allen Bay Formation near its abrupt change into the Cape Phillips Formation. Hence, the Allen Bay Formation is also regarded as having good potential to contain "carbonate-type" lead-zinc deposits.

The Cornwallis Lead-Zinc District is also one of the major outcrop areas of the Cape Phillips Formation, a unit previously discussed (see Area 14B - Eastern Ellesmere Island) in terms of "shale-type" lead-zinc deposits.

III NORTHERN ARCTIC ISLANDS REGION

MOLYBDENUM

(14A) Hazen Trough Eugeosynclinal Paleozoic Rocks

There is a speculative and remote possibility of economic concentrations of molybdenum in "starved shale" facies of Ordovician Hazen Formation (Trettin, 1971).

(18) Crystalline Basement Rocks, Eastern Ellesmere and Devon Islands

A very remote possibility exists of molybdenum deposits in Precambrian granitic rocks and felsic, crystalline metamorphic rocks in southeast Ellesmere and eastern Devon Islands.

(19) Northern Ellesmere Paleozoic Volcanic Rocks

(20) Metamorphosed (Proterozoic?) Rocks of NW Ellesmere Island

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

IV CENTRAL ARCTIC REGION

URANIUM

Introduction

The region contains both Precambrian and Phanerozoic rocks. The Precambrian complexes of this region are relatively more favourable for uranium mineralization than the Lower Paleozoic sedimentary rocks.

There is a possibility that the Precambrian rocks may contain uranium mineralization of several types, such as uraniferous pyritic quartz-pebble conglomerates, veins and unconformity-related deposits, disseminations in igneous and metamorphic rocks, and sandstone-hosted deposits. Two Aphebian fold belts, the Committee and the Foxe extend through the region (Jackson and Taylor, 1972). Similar Aphebian fold belts, such as the Wollaston Domain, Saskatchewan, host uranium deposits elsewhere in the Canadian Shield.

Only a limited amount of exploration for uranium has been carried on by the mining industry in this region. On the other hand reconnaissance investigations for uranium conducted by the Geological Survey of Canada were relatively extensive and included airborne surveys, geochemical surveys and, locally, ground radiometric surveys complementary to geological mapping. As a result of the latter surveys, uranium anomalies exceeding clarke values were detected in area 35 (Repulse Bay-Melville Peninsula) in Penrhyn Group rocks. Appraisal of the uranium potential of the Central Arctic region is presented only for areas that were studied from available documents and reconnoitered in the field. The areas included in the uranium appraisal are those with numbers from 28 to 35 inclusive.

(28) Northern Melville Peninsula Precambrian Rocks

Most of the rocks in the area are Archean granitic to monzonitic gneisses of little economic interest. However, in the Folster Lake area (Frisch, 1974a; Maurice, 1979) a small belt of Prince Albert Group rocks is intruded by granites and overlain with angular unconformity by late Precambrian sediments. The succession includes: discontinuous regolith; quartz- and granite-pebble conglomerate with scattered magnetite; green sericite schist with magnetite; hematite-rich quartzite; sericite schist with quartz lenses; tremolite-marble conglomerate; marble with scattered pebbles; calcareous quartzite. A geochemical survey in this area has shown an increase in uranium content of the basement granitoid rocks close to the Late Precambrian sediments. The radioactivity also occurs along fractures in a granitic intrusion. The sediments themselves have a low uranium content except for a phyllite bed near the basal conglomerate. At one locality the radioactivity seems to be associated with a magnetite-bearing sandstone at the base of the Late Precambrian formation. No economic uranium deposit has been discovered in northern Melville Peninsula. The inaccessibility of the area has not encouraged further exploration of the known anomalies.

(29) Fury and Hecla Strait Proterozoic-Archean rocks

The Fury and Hecla Strait divides area 29 into two parts: (a) the northern part included in Eastern Arctic Islands and Hudson Region, and (b) the southern part in the Central Arctic Region.

The southern part contains geological environments favourable for disseminated uranium mineralization in granitic and/or metamorphic rocks and for vein and unconformity related deposits. However, a substantial part of this area is made up of Archean granitic rocks that are unlikely hosts for economic uranium deposits.

(30) Foxe Basin Paleozoic Rocks

The Paleozoic rocks of Foxe Basin have been mapped in some detail (Trettin,1969b) to assess their potential as petroleum source or reservoir beds. They are mainly limestones and dolomites ranging in age from early Ordovician to early Silurian and were deposited in the structural depression of the Foxe Basin. No resource potential was indicated – the paucity of organic material shows them to be of little interest as oil and/or uranium prospects.

(31) Committee Bay - Northern Melville Belt of Prince Albert Rocks

(33) Committee Bay - Parry Bay Prince Albert Rocks

The metasedimentary and metavolcanic rocks of the Prince Albert Group consist of the following (Campbell,1973; Schau,1973;): (a) metasedimentary rocks,including biotite gneiss and schist, garnet biotite gneiss, metagreywacke, amphibolite, grey and white quartzite, iron-formation, conglomerate (quartz pebble) cut by granite, pegmatite, and gabbro dykes, and (b) metavolcanic rocks: mafic and ultramafic rocks are present but not abundant.

Zircon dating of a gneiss, interpreted to have originally been a felsic volcanic rock, has yielded an age of 2953 Ma for rocks of the Prince Albert Group (Wanless, 1979). These rocks are intruded by the granitoid gneisses.

Apart from the contained iron formation, no mineral resources have been found in rocks of the Prince Albert Group.

(32) Committee Bay-Hall Lake Granite Gneiss Belt

(34) Wager Bay-Parry Bay Granite Gneiss Terrane

Granitic to monzonitic gneisses of Archean age (older than 2500 Ma) appear to be intrusive into Prince Albert Group rocks. These gneissic rocks are generally low in uranium (Maurice, 1979); occasional anomalies are probably associated with younger intrusions, granitic or pegmatitic.

(35) Repulse Bay-Melville Peninsula Penrhyn Group Rocks

The Penrhyn Group is an interbedded succession of discontinuous regolith (quartz, sillimanite, biotite graphite schist), quartzite, pelitic and psammitic gneiss, calc-silicate gneiss, marble, and minor amphibolite.

This succession is intruded by biotite granite dykes, sills and plutons many of which are unfoliated and pegmatitic or aplitic.

The Penrhyn Group has been affected by complex folding during the Hudsonian orogeny and by regional metamorphism to amphibolite facies that ended more than 1750 Ma ago.

The Penrhyn sediments were deposited between 2500 Ma and 1800 Ma. Although these sedimentary rocks are of an age and type which host uranium deposits in other areas (such as the Wollaston Domain, Saskatchewan), no economically interesting anomalies were observed in Melville Peninsula. The airborne radiometric survey (1975), geochemical reconnaissance program (1978) and follow-up (Maurice, 1979) indicated that anomalies are limited to small felsic intrusions. Four anomalies ranging between 175 and 1200 ppm U were observed in such a setting. At an additional locality a skarn was described that was radioactive (400 ppm U). This rock has, however, no regional extension and therefore presents limited prospects for exploration.

Cominco Limited has recently prospected part of the area but is not planning to pursue its investigation at the present time.

GOLD

(21) Wellington Inlier, Victoria Island

The Precambrian (Aphebian?) quartzitic sandstone and conglomerate in this area are considered to be of fluvial origin (Dixon, 1979) and thus have potential as hosts of paleoplacer gold deposits. A source for gold could have been provided by Slave Province rocks exposed about 40 km to the south. However, the base of the clastic sequence, which might be most favourable, is apparently not exposed and consequently the potential of the area is rated as low.

(36) Duke of York Proterozoic Inlier, Victoria Island

Sedimentary rocks in this area are correlated by Dixon (1979) with similar rocks in the Rae Group in the Coppermine area and in the upper part of the Glenelg Formation in the Minto Arch area. The base of the sequence in the Duke of York inlier is not exposed. This and the postulated marine depositional environment suggest that the potential for paleoplacer gold deposits is very slight.

(23) Boothia Arch Precambrian Rocks

This area consists primarily of Precambrian gneissic rocks, with some small granite bodies and a few very small ultramafic bodies. The gold potential is accordingly inferred to be low.

(24) Chantrey Inlet - Pelly Bay Precambrian Belt (Includes Slave-Chantrey Mylonite Zone)

Rocks of the Chantrey Group include quartzite and there could thus be some potential for paleoplacer gold deposits in the belt. However, the best potential for gold deposits is probably along the north margin of the belt in association with volcanic rocks of probable Archean age. The overall gold potential is rated as low.

(25) Hayes River - Pelly Bay Gneiss Belt

No reasons are known to suppose that significant gold deposits are present in the area. However, the area undoubtedly contains metasedimentary rocks and it is thus possible that sediment-hosted gold veins or deposits of Contwoyto Lake (Homestake) type could be present. The gold potential for the area is considered to be very low.

(26) Hayes River - Pelly Bay Belt of Prince Albert Group Rocks

The Prince Albert Group rocks in this area include ultramafic volcanic rocks,ultramafic intrusions, fuchsitic quartzite and mafic volcanic rocks. These rocks represent an environment favourable for gold (and possibly antimony) deposits of (1) volcanic exhalative type similar to some in the Barberton area, South Africa, and (2) associated with major zones of shearing that cut mafic or ultramafic volcanic rocks.

The overall gold potential of the area is rated as moderate to high.

(28) Northern Melville Peninsula Precambrian Rocks

The rocks of this area are grossly similar to those of areas 25 and 32 and the gold potential is consequently rated as very low. However, small remnants of Prince Albert Group rocks may be present locally and these have moderate potential.

(29) Fury and Hecla Strait Proterozoic - Archean Rocks

Orthoquartzite and quartz pebble conglomerate units similar to those known in the Proterozoic sequence on the north side of Fury and Hecla Strait (see notes for Eastern Arctic Islands and Hudson Region) are also present in this area, and there is thus considered to be some (low) potential for paleoplacer gold deposits.

(31) Committee Bay - Northern Melville Belt

This belt of rocks contains iron formation and other lithologies of the Prince Albert Group (see area 26). The gold potential of the area is thus rated as moderate to high.

(32) Committee Bay - Hall Lake Granite - Gneiss Belt

The comments and rating for area 28 also apply here.

(33) Committee Bay - Parry Bay Prince Albert Belt

This belt contains iron formation, fuchsitic quartzite, ultramafic lavas or sills and other Prince Albert Group lithologies (see notes for area 26). In the eastern half of the area the belts of Prince Albert Group rocks are narrow relative to the area 33 outline. South of Committee Bay and for approximately 30 miles (50Km) west of this bay gold deposits may be unlikely to occur because of the high grade of metamorphism (Schau, 1978). The overall gold potential for the belt is rated as moderate.

(34) Wager Bay - Parry Bay Granite - Gneiss Terrane

The gneissic rocks of this area are grossly similar to those of areas 25 and 32 and the gold potential is thus considered to be very low.

(34A) Barrow River Gneissic Area

This area is geologically similar to area 34 and the gold potential is rated as very low for the same reasons.

(35) Repulse Bay - Melville Peninsula Penrhyn Group Rocks

The metallogeny of Penrhyn Group rocks and of their equivalents on Baffin Island, the Lake Harbour and Piling Groups, has not been well studied, nor has enough mineral exploration been conducted for occurrences to be discovered that might elucidate the potential of these sedimentary groups. However, some potential for gold is inferred for Piling Group rocks because of the presence of carbonate facies iron formation that is associated with lean oxide facies iron formation. Similar carbonate facies iron formation, although not described, may be present in the Penrhyn Group, and this group may thus have similar potential. Graphitic quartz-rich gneiss (meta-chert?) in these sedimentary groups could have been a favourable lithology for the accumulation of gold, either in carbonaceous material or in associated iron sulphides. During subsequent deformation-metamorphism gold could have been mobilized to form gold-bearing veins or to be adsorbed (?) in sulphide-rich bands, perhaps in zones of lower metamorphic grade. While speculative, these exploration possiblities probably warrant testing. The presence of quartzite in the sedimentary sequences suggests some (low) potential for paleoplacer gold deposits. The presence in area 35 of narrow belts of Prince Albert Group rocks, interpreted to result from overthrusting and then infolding of these Archean rocks into the Penrhyn Proterozoic sequence, is significant in that the contained mafic volcanic and ultramafic rocks are favourable for gold occurrence.

The overall gold potential for area 35 is rated as low to moderate.

IV CENTRAL ARCTIC REGION

COPPER

(9D) Victoria Island-King William Island Paleozoic Rocks

A very remote possibility exists of sedimentary deposits at the base of the Paleozoic succession.

(21) Wellington Arch, Victoria Island

A slight possibility exists of sedimentary deposits in Proterozoic rocks and at the base of the Paleozoic succession (Dixon, 1979).

(22) Paleozoic Sediments Flanking Boothia Arch

A slight possibility exists of sedimentary deposits in Paleozoic sedimentary rocks flanking the Boothia Uplift, especially where redbed sequences are overlain by or intertongue with reduced marine rocks. The Siluro-Devonian Somerset Island and Peel Sound Formations and related rocks seem to have the best potential (Miall *et al*., 1978a, 1978b)

(23) Boothia Arch Precambrian Rocks

A slight possibility exists of sedimentary deposits in Helikian sedimentary sequences such as the Aston and Hunting Formations (Fortier & Blackadar, 1959; Dixon, 1974; Chandler, 1980). The Precambrian crystalline rocks are not well documented and could conceivably contain some miscellaneous copper deposits.

(46B) Northwestern Keewatin District Gneiss Terrane

(24) Chantrey Inlet-Pelly Bay Precambrian Belt

(25) Hayes River-Pelly Bay Gneiss Belt

(26) Hayes River-Committee Bay Belt of Prince Albert Group Rocks

(28) Northern Melville Peninsula Precambrian Rocks

(31) Committee Bay-Northern Melville Belt of Prince Albert Group Rocks

(32) Committee Bay-Hall Lake Granite-Gneiss Belt

(33) Committee Bay-Parry Bay Prince Albert Belt

(34) Wager Bay-Parry Bay Granite-Gneiss Terrane

(34A) Barrow River Gneissic Area

(35) Repulse Bay-Melville Peninsula Penrhyn Group Rocks

The geology and mineral deposits in these largely crystalline Precambrian terranes are not well known and conceivably this large area of northern Keewatin District and Melville Peninsula could contain some important copper deposits. Magmatic Ni-Cu deposits related to gabbroic or meta-gabbroic intrusions, volcanogenic polymetallic base metal or copper deposits, and, less likely, copper deposits of sedimentary and porphyry types might be found in these areas. Some Ni-Cu showings are known southeast of Perry Island and in the Committee Bay belt.

(27) Simpson Peninsula-Wales Island Paleozoic Rocks

(30) Foxe Basin Paleozoic Rocks

A very remote possibility exists of sedimentary deposits at the base of the Paleozoic succession.

(29) Fury and Hecla Strait Proterozoic-Archean Rocks

A slight possibility exists of sedimentary deposits in the Helikian sequence (Chandler, 1980; Chandler *et al.*, 1980). Although it is not well exposed in outcrop, Chandler *et al.* (1980) indicate that a thin unit of stromatolitic dolomite and black shale separates the upper and lower red-bed sequences. This unit would seem to be a favourable site for the occurrence of sedimentary copper deposits. The transition beds and Autridge Formation black shales overlying the redbed sequences and a pink quartzite formation also would seem to offer some potential for sedimentary deposits (Chandler *et al.*, 1980).

IV CENTRAL ARCTIC REGION

NICKEL, ASBESTOS, CARVING STONE, PLATINUM, CHROMITE

(11) Minto Arch Precambrian Rocks

For notes on the potential of this area see writeup under Western Arctic Islands Region.

(23) Boothia Arch Precambrian Rocks

Nickel

No nickel occurrences are known in this area, but scattered ultramafic rocks are said to have associated gossans and sparse sulphides (Blackadar and Christie, 1963; Blackadar, 1967c). These ultramafic rocks occur in a sequence of intensely metamorphosed sedimentary and mafic volcanic rocks, a setting which appears similar to nickel-producing, komatiite-bearing Archean sequences elsewhere in the world, and therefore may have some potential for nickel deposits. The known ultramafic rocks lie in the general area outlined on Fig. 23.

Asbestos

The ultramafic bodies in this region are described as small, and have a high alumina content (Blackadar, 1967c), neither of which bodes well for significant potential for asbestos.

(26) Hayes River-Committee Bay Belt of Prince Albert Group Rocks

Nickel

Numerous ultramafic bodies, some known to be peridotitic komatiite flows, occur along most of the strike length of this belt (Fig. 23; Heywood, 1961,

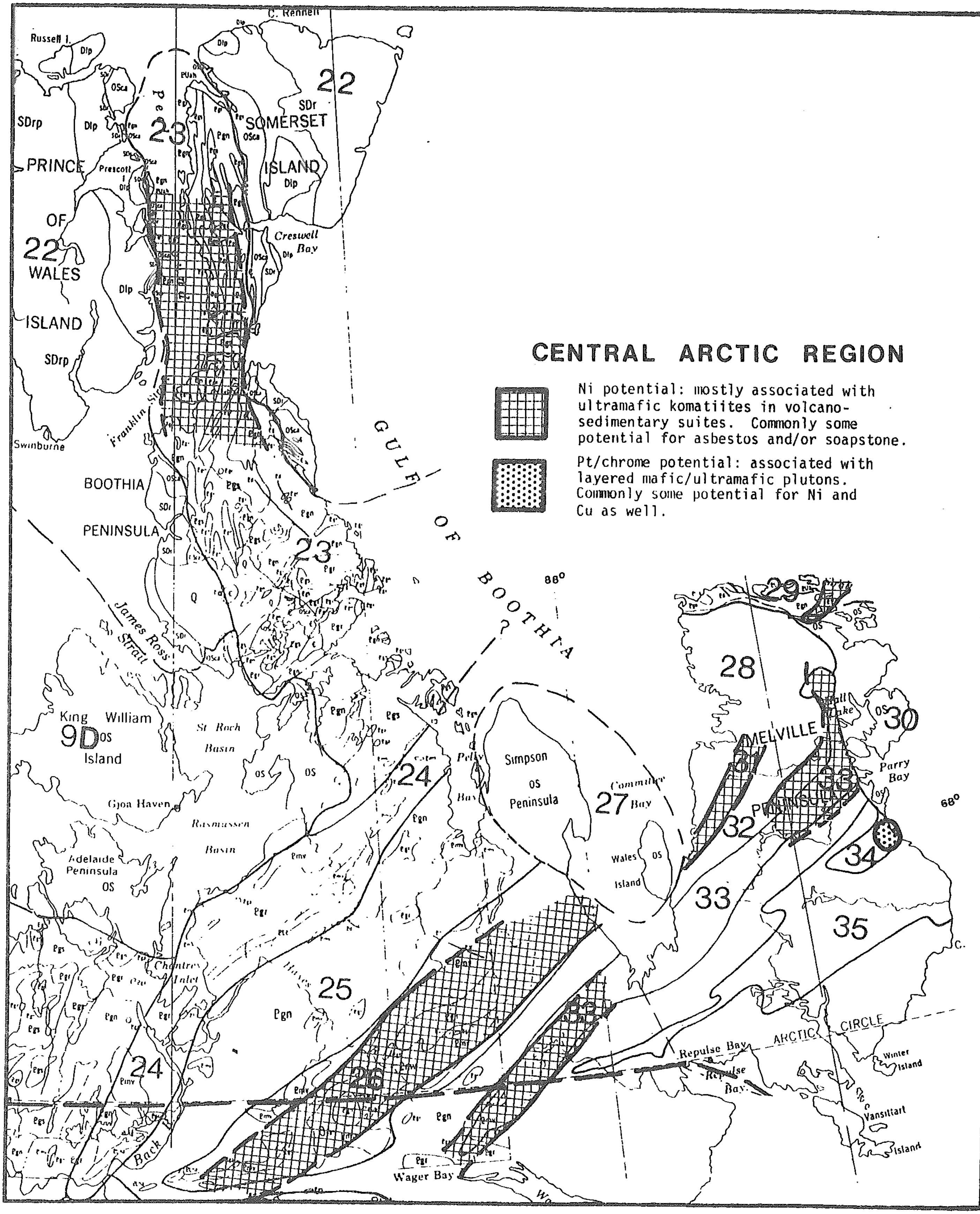


Figure 23: Areas with potential for Ni, Pt and Cr deposits, Central Arctic Region.

1967; Schau, 1974, 1977; Campbell, 1974). The other rocks are mainly metasedimentary schists, iron formation and quartzite, but some volcanic rocks are present as well. No nickel sulphide occurrences of any significance are known, but the belt has not been extensively explored for nickel. However, geochemical till samples identify two areas in the southwest end of the belt that have distinctly anomalous nickel and copper values (Rencz and Shilts, in press). Although the tectonic environment of this belt was uncharacteristically stable (Schau, 1977), the geochemical anomalies, the abundance of komatiitic ultramafic rocks, and other similarities to nickel-producing, komatiite-bearing Archean greenstone belts are considered to favour some potential for type 2 nickel deposits (see Appendix 2) in this belt.

Asbestos

Ultramafic bodies in the central and western part of the belt appear large enough (up to "hundreds of meters"thick, Schau, 1974) and have undergone sufficient deformation to present some potential for asbestos deposits of possible economic interest. Unfortunately remoteness of these areas from tidewater will be economically disadvantageous.

Carving Stone (serpentinite, soapstone)

Some soapstone has been found suitable for carving (Schau, 1974). Consequently, there is clearly good potential for more soapstone and also for serpentinite, although the high cost of transportation from these remote areas diminishes its value.

(29) Fury and Hecla Strait Proterozoic-Archean Rocks

Nickel

No nickel occurrences are reported, and little if any exploration appears to have been done, but there may be some nickel potential associated with komatiitic ultramafic rocks considered to be part of the Prince Albert Group in the Bouverie Islands region (Fig. 23: Schau, 1977). Associated rocks include mafic volcanics and sediments and iron formation, much as in nickel-producing Archean greenstone belts elsewhere.

Asbestos (chrysotile)

It is doubtful that there could be potential for asbestos in the komatiitic ultramafic rocks of the Prince Albert Group in view of the apparently narrow widths of the bodies observed by Schau (1977).

Carving Stone (soapstone, serpentinite)

There could be soapstone or serpentinite suitable for carving in some of the komatiitic ultramafic rocks of the Prince Albert Group.

(31) Committee Bay-Northern Melville Belt of Prince Albert Group Rocks

Nickel

Minor nickel occurrences are known in this area, and a few komatiitic ultramafic bodies have been mapped in association with mafic volcanic rocks and oxide iron formation of the Archean Prince Albert Group (Heywood, 1967; Laporte, 1974b; Frisch and Goulet, 1975). Some potential for nickel deposits of the komatiitic type is considered to exist.

Asbestos

Komatiitic ultramafic sills of the Prince Albert Group could have some potential for asbestos deposits since they have undergone the requisite deformation. However, they appear to be few in number and relatively small, so the potential would appear to be limited.

Carving Stone

The komatiitic ultramafic rocks of the Prince Albert Group are altered to serpentinite and talc-carbonate rocks and could therefore provide suitable material (soapstone or serpentinite) for carving.

(33) Committee Bay-Parry Bay Prince Albert Belt

Nickel

A number of ultramafic bodies occur at either end of this belt (Fig. 23), associated with metavolcanic rocks and paragneisses (Heywood, 1961, 1967 ; Schau, personal communication, 1974). By analogy with the Prince Albert Group in Area 26, it is presumed that these ultramafic bodies are also of komatiitic affinity. No significant nickel occurrences are known, but it is likely that exploration for nickel has been, at best, cursory. Consequently, some potential for type 2 nickel deposits (see Appendix 2) is considered possible.

A 500 m long, elliptical, feldspathic metapyroxenite body northwest of Hall Lake was drilled by Aquitaine in 1973 and a small tonnage of low grade nickel-copper sulphides was indicated. Other similar, but larger, metapyroxenite bodies having potential for economic nickel-copper deposits might exist.

Asbestos

There may be some potential for asbestos deposits in view of the presence of ultramafic bodies, some of which may be sufficiently large, and had a probable history of deformation.

Carving Stone (soapstone, serpentinite)

Ultramafic rocks in this area have some potential for carving stone, though no production is known, and only a few of the bodies on Melville Peninsula are near tidewater.

(34A) Barrow River Gneissic Area

Platinum, Chromite

A layered gabbroic-anorthosite body containing amphibolite layers near Foxe Basin (Fig. 23: Okulitch et al., 1978a, 1978b) appears to be differentiated, and may have some potential for platinum and/or chromite deposits of the Bushveld-Stillwater type.

(46A) Eastern Mackenzie-Churchill Province Gneissic-Granitic Rocks

(46B) Northwestern Keewatin District Gneiss Terrane

Nickel

In 1970, mineralized norite boulders forming a north-northwest trending train at least 8 km long was discovered at the mouth of the Perry River (Fig. 26), and assays up to 2.47% Ni and 1.93% Cu were obtained (Laporte, 1974b). Subsequent exploration aimed at identifying the bedrock source discovered numerous nickel-copper showings in mafic igneous and various gneissic rocks up to 50 km south of the original boulders, but none were demonstrably the true source. Consequently, there remains potential for significant nickel-copper deposits represented by the boulders.

In addition to this, scattered gabbroic plutons have been recognized throughout much of Area 46B and the eastern half of 46A; no nickel-copper occurrences are known, but some potential for nickel-copper deposits cannot be ruled out.

IV CENTRAL ARCTIC REGION

VOLCANOGENIC MASSIVE SULPHIDE DEPOSITS

(24) Chantrey Inlet-Pelly Bay Precambrian Belt (includes, in part, Slave-Chantrey mylonite zone)

Because some volcanic rocks are known along the north margin of this belt and also occur, along with chert, in the Chantrey Group, the area is considered to have some (low) potential for volcanogenic massive sulphide deposits.

(26) Hayes River-Committee Bay Belt of Prince Albert Group Rocks

(33) Committee Bay-Parry Bay Prince Albert Belt

The Prince Albert Group in these belts includes mafic and ultramafic lavas and associated sedimentary units. However, due to the general lack of felsic volcanic rocks, the potential for volcanogenic massive sulphide deposits is rated as low.

(29) Fury and Hecla Strait Proterozoic-Archean Rocks

On small islands near the east end of this area, iron formation is present that is considered to belong to the Prince Albert Group (Schau, personal communication, 1980). This suggests that volcanic rocks belonging to the same group may also be present and that there is thus a possibility (very low potential) that volcanogenic massive sulphide deposits may be present.

(31) Committee Bay-Northern Melville Belt of Prince Albert Group Rocks

Volcanic rocks of the Prince Albert Group are present in this belt. Because these are known to include felsic units, the belt is considered to have a moderate potential for volcanogenic massive sulphide deposits.

LEAD-ZINC

(22) Paleozoic Sediments Flanking Boothia Arch

A small lead-zinc occurrence in Thumb Mountain Formation carbonates on the north shore of Aston Bay on Somerset Island (Fig. 22) suggests the possibility of a southern extension of the Cornwallis lead-zinc district mentioned in Area 14B to the north. Only that part of the Thumb Mountain Formation (and its equivalents) occurring within the Cornwallis Fold Belt (Kerr, 1977a) is considered to have potential for deposits of the "carbonate-type".

(24) Chantrey Inlet-Pelly Bay Precambrian Belt (includes, in part, Slave-Chantrey mylonite zone)

Quartzite and carbonate units within the Chantrey Group could possibly host sandstone-type and carbonate-type deposits, but this is considered highly unlikely.

(26) Hayes River-Committee Bay Belt of Prince Albert Group Rocks

(31) Committee Bay-Northern Melville Belt of Prince Albert Group Rocks

(33) Committee Bay-Parry Bay Prince Albert Belt

Prince Albert Group rocks include quartzite and thin carbonate units. The quartzite, in part fuchsitic, is closely associated with mafic and ultramafic volcanic rocks and, although its environment of deposition is not well understood, it is considered very unlikely to host sandstone-type lead-zinc deposits. Similarly, the thin carbonate units are not considered to represent an environment favourable to formation of carbonate-type lead-zinc deposits.

(35) Repulse Bay-Melville Peninsula Penrhyn Group Rocks

It has been suggested elsewhere (see lead-zinc assessment of Eastern Arctic Islands and Hudson Region) that graphitic sulphide-rich gneiss and graphitic schist of the Piling Group on Baffin Island may represent an environment favourable for shale-hosted lead-zinc deposits. The Penrhyn Group contains similar lithologies and consequently this area is assigned a moderate potential for shale-type deposits. Also carbonate rocks of the Penrhyn Group could possibly host carbonate-type deposits.

IRON

(31) Committee Bay-Northern Melville Belt of Prince Albert Group Rocks
(33) Committee Bay-Parry Bay Prince Albert Belt
(35) Repulse Bay-Melville Peninsula Penrhyn Group Rocks

Iron-formation occurs in the Prince Albert Group of rocks which consists of metagreywacke, metavolcanics, amphibolite with associated mafic and ultramafic rocks, granite intrusions and younger quartzite and dolomite. The Prince Albert Group rocks are distributed from southwest of Committee Bay northeast across Melville Peninsula and may be correlated with the Mary River Group on Baffin Island. The iron-formation described in the east and west deposit areas of Melville Peninsula (Section 5) forms sizeable compact deposits of highly folded iron-formation that can be easily processed to provide high quality magnetite concentrate. The Prince Albert Group rocks are the most favourable hosts for iron-formation; however, they have not been prospected in detail southwest of Committee Bay. It is unlikely that undiscovered iron resources would exceed the quantity of resources presently known in the principal deposit areas described.

Field observations in the Mary River area indicate that metallogenetic conditions are favourable for the occurrence of polymetallic sulphide and nickel mineralization in association with the iron-formations and similar favourable conditions may exist in the Prince Albert and Penrhyn groups of rocks.

MOLYBDENUM

(21) Wellington Arch, Victoria Island

There is a very remote possibility of molybdenum deposits associated with small areas of Precambrian granitic rocks.

(23) Boothia Arch Precambrian Rocks

A remote possibility exists of molybdenum deposits associated with Precambrian granitic rocks and Phanerozoic carbonatites and/or alkaline intrusions.

(46B) Northwestern Keewatin District Gneiss Terrane

A remote possibility exists of molybdenum deposits associated with Precambrian granitic rocks.

(24) Chantrey Inlet-Pelly Bay Precambrian Belt

(25) Hayes River-Pelly Bay Gneiss Belt

(26) Hayes River-Committee Bay Belt of Prince Albert Group Rocks

(28) Northern Melville Peninsula Precambrian Rocks

(31) Committee Bay-Northern Melville Belt of Prince Albert Group Rocks

(32) Committee Bay-Hall Lake Granite-Gneiss Belt

(33) Committee Bay-Parry Bay Prince Albert Belt

(34) Wager Bay-Parry Bay Granite-Gneiss Terrane

(34A) Barrow River Gneissic Area

(35) Repulse Bay-Melville Peninsula Penrhyn Group Rocks

In the areas listed above, a remote possibility exists of molybdenum deposits associated with Precambrian granitic rocks.

(29) Fury and Hecla Strait Proterozoic-Archean Rocks

A remote possibility exists of molybdenum deposits associated with Precambrian granitic rocks and minor byproduct molybdenum in "unconformity-type" uranium deposits beneath Helikian sedimentary cover rocks.

V NORTHEASTERN MACKENZIE DISTRICT

PRECAMBRIAN METALLOGENY, NORTHWESTERN CANADIAN SHIELD

(Northeastern Mackenzie District, Keewatin Region and part of Central Arctic Region)

S.M. Roscoe

Ore deposits may be considered as small and rare products of the same geological processes that have resulted in the formation and modification of extensive bodies of rock. The rocks mapped in northern Canada record a long progression of geological events that are either known, or that might be expected, to have been accompanied by the formation of mineral deposits comparable to those found in better explored areas with like geological histories. Assessments of the resource potential of a region thus require an understanding of its geological history as well as of concepts (commonly termed 'conceptual models' or simply 'models') of the ways in which various specific types of deposits are formed. Models used in assessments are reviewed elsewhere in this paper as are geological features of the various districts within the study region. The following outline of geological and metallogenic history of the mainland Precambrian parts of the region, it is hoped, will make it easier to understand area by area assessments of resources and potential resources.

General Distribution of Precambrian Rocks

Precambrian time is divided into an earliest, 'Archean', interval including events prior to 2.5 billion years ago and a younger 'Proterozoic' division. The most important known rocks and mineral deposits of Archean age in the present study area are in the 'Slave Structural Province', which extends south from Coronation Gulf, and in the 'Rankin-Ennadai Structural Subprovince' 400 km southeast in the southern part of Keewatin District (Fig. 24, 25). These rocks and mineral deposits are very similar to Archean

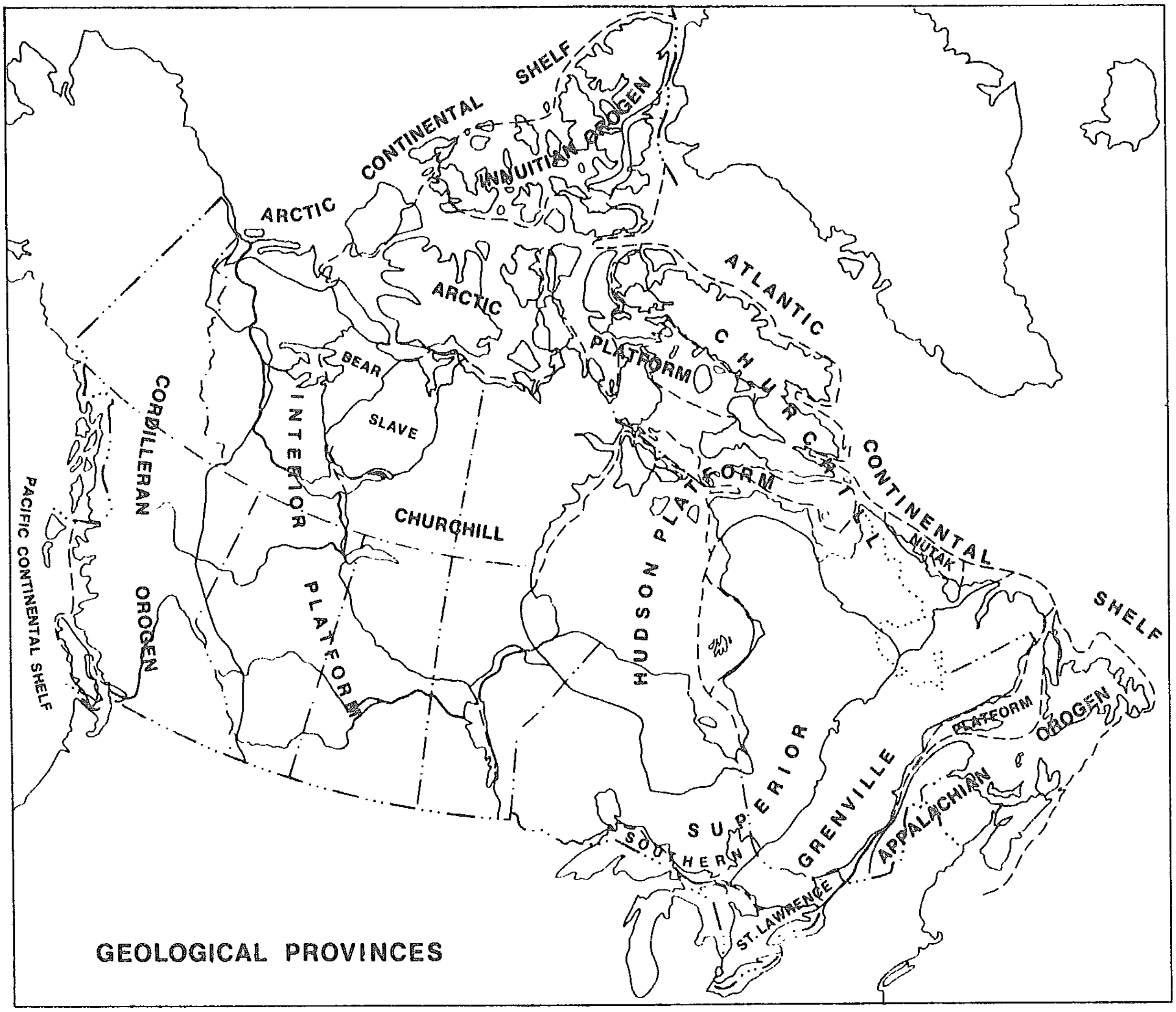


Figure 24: Geological Provinces of Canada.

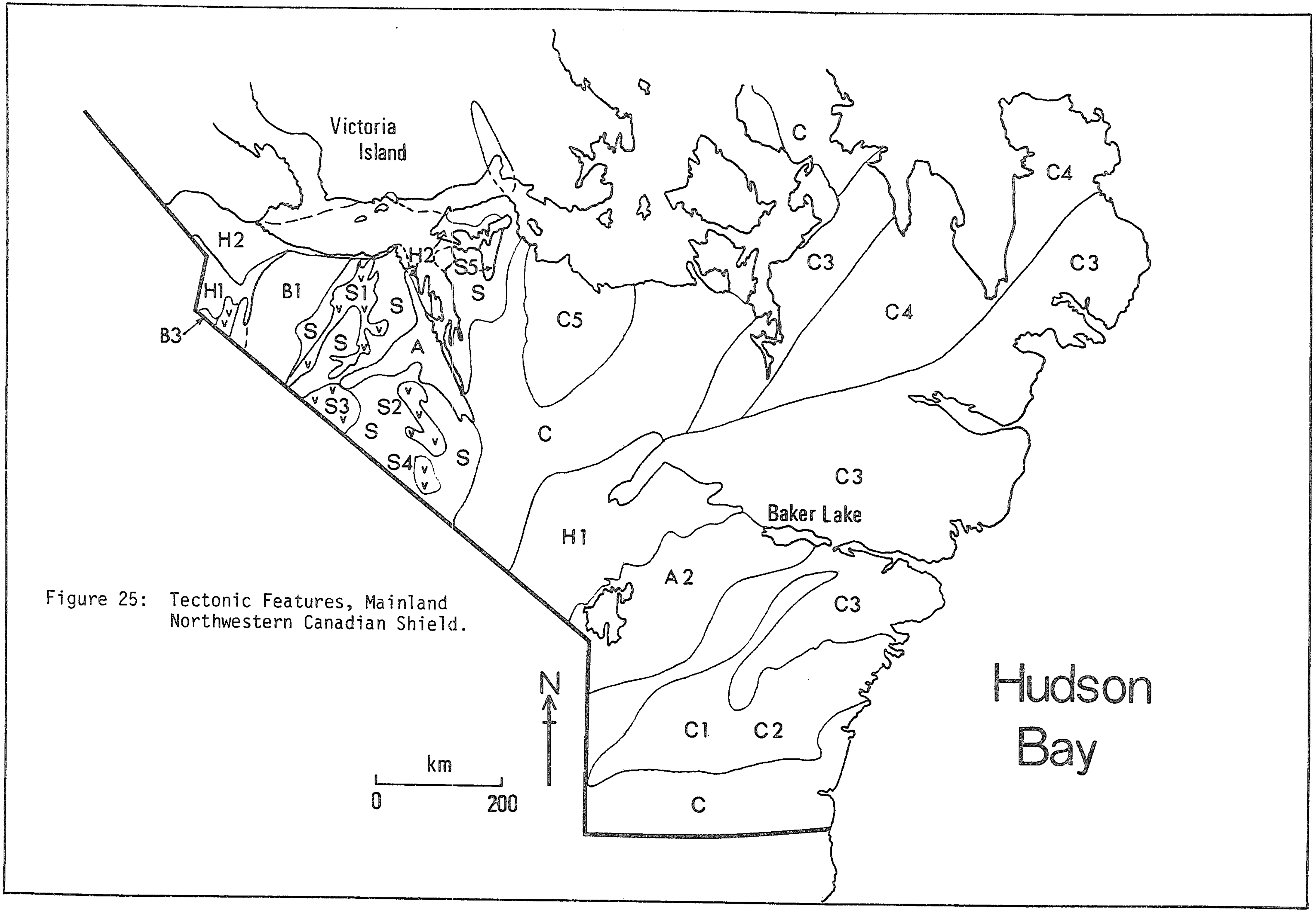


Figure 25: Tectonic Features, Mainland Northwestern Canadian Shield.

Figure 25

TECTONIC FEATURES, MAINLAND NORTHWESTERN CANADIAN SHIELD

LEGEND

SLAVE PROVINCE: a craton little changed since Archean time.

s - undivided granitic rocks, gneiss, metasedimentary rocks

s1, s2, s3, s4, s5 belts of highly deformed Archean metavolcanic and metasedimentary rocks

CHURCHILL PROVINCE: a craton formed in Aphebian time (1.8 b.y.)

c- undivided, mainly granitic gneisses;

c1 Rankin-Ennadai subprovince characterized by Archean rocks like those in the Slave Province but deformed again after early Aphebian strata (c2) were deposited; c3 areas containing belts of highly deformed supracratonic Aphebian metastrata; c4 - areas containing belts and remnants of highly deformed supracratonic Archean metastrata.

BEAR PROVINCE: an Aphebian craton. B1 - fold belt of early Aphebian strata; B2 - highly deformed early Aphebian volcanic rocks; B3 - late Aphebian volcanic rocks, sediments, granite.

COVER ROCKS: A -early Aphebian strata on Slave Province; A2 - Late Aphebian volcanic rocks, arkose, intrusive rocks in Churchill Province; H1 - Early Helikian sandstone on Bear and Churchill provinces; H2 - Helikian and Hadrynian strata on Bear and Slave province.

rocks in the 'Superior Structural Province', a great crescent-shaped belt extending from the Thompson area in Manitoba through northern Ontario and north through much of Quebec. It includes, along the east shores of James Bay and Hudson Bay, a number of islands that are within this study area.

The region between the Slave and Superior provinces and extending northward to Melville Peninsula, Baffin Island and eastern Devon and Ellesmere Islands is termed the 'Churchill Structural Province'. Rocks within it were intensely deformed and transformed into gneisses – banded recrystallized rocks – in early Proterozoic time, probably about 1.9 billion years ago during the initial phase of the 'Hudsonian Orogeny', while rocks in the adjacent Slave and Superior provinces remained essentially as they were at the end of Archean time 2.5 billion years ago. The Rankin-Ennadai subprovince is an area within the Churchill province where effects of the Hudsonian orogeny were relatively mild. As mentioned previously, it contains Archean rocks and mineral deposits very like those in the Superior and Slave provinces as well as gneisses derived from these and from early Proterozoic rocks. Gneisses in the remainder of the Churchill province were probably derived also in part from such rocks but they were also formed in part, perhaps largely, from Archean rocks whose formation predated the development of the Superior and Slave Structural Provinces.

Slightly deformed early Proterozoic sedimentary and volcanic rock formations overlie Archean rocks in northern and western parts of the Slave Province (Fig. 25). In the 'Bear Structural Province' west of the Slave, these strata were much deformed 1.8 to 1.9 billion years ago, as were rocks of similar age within the Churchill province. A central zone within the Bear province contains a narrow northerly trending belt of early Aphebian volcanic rocks - the Akaitcho Group - and granitoid intrusive rocks. The western part of the Bear province contains slightly younger ('Late Aphebian' - 1.75 to 1.9 b.y.), little disturbed intermediate to felsic volcanic rocks (andesite, dacite, rhyolite) that were erupted onto land surfaces, minor sediments derived mainly from the volcanics, and granitic bodies of the same age as the volcanic rocks. This region is notable for its uranium and silver deposits.

Rocks analogous to those in the western part of the Bear province were deposited and intruded in the Churchill province in Late Aphebian time. These continental sedimentary, volcanic and associated intrusive rocks, termed the Dubawnt Group (Donaldson, 1965), occur in basins through a broad zone extending 400 km southwest from Baker Lake. Their deposition followed deep erosion that bevelled early Aphebian mountains, and accompanied development of rifts (deep fractures) that bounded basins of continental sedimentation and tapped sources of magma (molten rock) that then intruded the deformed crustal rocks and formed volcanoes on the surface. This sector of the Churchill province comprises the greater part of an extensive uranium metallogenic province.

The Bear province is the youngest structural province in the northern Shield; no major cycles of deposition followed by extensive deformation and mountain building have occurred since the end of Aphebian time. Sedimentary and volcanic rocks were deposited atop the various earlier formed complex structural domains, however, and igneous rocks intruded into them (mainly as dykes and sills), during succeeding 'Helikian' (1.0 to 1.75 b.y.) and 'Hadrynian' (0.57 to 1.0 b.y.) intervals of Proterozoic time. These younger rocks have been only slightly deformed — tilted and warped along with underlying basement rocks into open basins and very gently inclined fault blocks.

In early to mid-Helikian time, quartz-rich sands and gravels were spread out as a thick sheet over much of the mainland northern part of the Canadian Shield. Three main structural basins contain remnants of this sheet. The Hornby Bay Group northeast of Great Bear Lake is preserved in the gently-dipping south limb of a large basin of Helikian and Hadrynian rocks that is largely covered by Paleozoic sediments and seas in the Coronation Gulf-Victoria Island and Amundsen Gulf region. The Group unconformably overlies various rocks in the northern end of the Bear province and occurs in outliers well to the south. The Thelon Formation is preserved in a large basin flanking and overlapping the northwest side of the zone of Dubawnt rocks. It is also found as outliers in down-faulted blocks outside the main basin. It unconformably overlies tilted, bevelled Dubawnt strata as well as older Aphebian rocks. The Athabaska Formation in northern Saskatchewan is the third major basinal remnant of this sandstone. Although outside the present study area, it is mentioned here because the major uranium deposits that have been discovered at its base underline the potential importance of the Thelon and Hornby Bay rocks as possible hosts of such deposits.

Younger Helikian strata overlie Archean rocks and overlap the Hornby Bay sandstone in the Coronation Gulf area. They include marine carbonate rocks, shale, and basalt lava flows and include the top-most part of the Hornby Bay, the Dismal Lakes Group, the Coppermine River Group, and, probably, the Shaler Group on Victoria Island. Lavas of Coppermine River and Shaler Groups host occurrences of copper both in the form of copper-rich sulphide and in the form of native metal. Occurrences of the latter are of special interest as the Inuit, the first miners in northern Canada, long exploited these as sources of metal for implements and for commerce.

Several million tons of potential sulphide ore have been outlined to the southwest of Coppermine in veins within the thick sequence of basalt flows. Shale overlying the flows is noteworthy because shales above basalt in the strikingly similar Keweenawan belt in Michigan, United States contain an important bedded copper deposit.

Hadrynian sediments and basalt overlie Aphebian basement rocks on Baffin Island. The Nanisivik Mine on the Borden Peninsula produces zinc and lead concentrates with an appreciable silver content from a deposit that fills a channel, or cave, dissolved in Hadrynian limestone.

Mineral Deposits in Archean Rocks

Widespread, thick successions of volcanic rocks and sedimentary rocks derived largely from these volcanics were deposited during a short interval 2.7 billion years ago. The rocks were subsequently highly deformed, altered, and uplifted and bevelled by erosion so that they now occur only as remnants – herein termed 'belts' – of strata that were initially deposited throughout more extensive areas. Northeasterly-trending belts of these Archean rocks are present in areas labeled on the accompanying map as 51, 53, 55, 58 and 62 in the Rankin-Ennadai subprovince in Keewatin District and in areas 41A, B, C, D and 45 in the Slave province in Mackenzie District where they trend northerly. Older rocks have been discovered in the region but these have not yet been delineated on regional geological maps, nor are they known to contain mineral deposits especially different from associated younger rocks. Several additional areas 24, 26, 33 and 35 in northern Keewatin contain sedimentary and volcanic rocks that may have been deposited at nearly the same time as the Archean rocks mentioned above. Geologically and metallogenetically, however, they are more like some belts of Proterozoic rocks deposited less than 2.5 billion years ago.

Volcanogenic deposits

Volcanic rocks of the Yellowknife Supergroup and those in Keewatin District were extruded, for the most part, onto the sea floor. These were mainly mafic (basalts to andesite) lavas but locally felsic volcanic rocks (rhyolites) were extruded, piles of fragmented volcanic materials were deposited and bodies of molten rock were intruded to near the surface. These areas, former sites of submarine volcanoes, were evidently particularly favoured sites for the formation of deposits of massive sulphides, containing important amounts of base and precious metals, that have been found within a number of the volcanic belts in the study region as in similar belts elsewhere in the world. Their formation involved leaching of metals from hot, volcanic rocks by sea water and redeposition of these metals in concentrated form as sulphides at vents of submarine hot springs. They are mounds of mixed iron sulphide, zinc sulphide, lead sulphide, copper-iron sulphide, silica (quartz) and altered volcanic ash generally atop altered volcanic rocks containing abundant veins of copper-iron sulphide.

Volcanogenic massive sulphide deposits are the most valuable type mined in Archean rocks in the southern Canadian Shield. More than half the deposits known there (Boldy, 1977) contained at least one million tons of sulphide ore with varied amounts of metals – most characteristically about 6% zinc, 2% copper, trace amounts to 2% lead, 0.5 to 4 ounces silver to the ton, and 0.02 ounces gold to the ton. Exceptionally large deposits have yielded most of the metal production, been mined through several decades, and have provided the main economic base for large communities such as Rouyn-Noranda. No such 'giant' deposits have yet been found in the north but otherwise those discovered in the Northwest Territories are no smaller, no less abundant in proportion to areas of host volcanic rocks, and no less metal-rich on the average than those in the south.

Table 5.1 shows grades and tonnages indicated to date in volcanogenic deposits discovered and partially evaluated within the study area. The High Lake deposit is in the northern part of area 41A approximately 50 km south of Coronation Gulf. Interesting prospects and geology attractive to mineral explorers are found throughout an extensive adjacent area. The Izok Lake deposit, the richest known of this type in Canada, is just south of the boundary of the study area a few kilometres west of area 41D. This deposit is held by Texasgulf Inc. who have also discovered several small deposits near Takiyuak Lake in the southwest part of area 41A. The cluster of Hackett River deposits explored by Cominco Limited in area 41B, 80 km southwest of Bathurst Inlet, is interesting because of the high aggregate tonnage that has been discovered and its exceptionally high silver content. Several other deposits, not yet delineated, are known in the belt – the Yava deposit 40 km to the south and Musk Lake, 35 km farther south. The most intensely explored volcanogenic deposit in Keewatin is the Gemex deposit at the south end of Heninga Lake in area 58. Another occurrence near Carr Lake is apparently very limited in size but its existence must be considered to enhance further the potential for area 58 which is relatively favourably situated with respect to possible future transport developments. An occurrence near Ennadai Lake in area 55 has been tested by Shell Canada Resources Limited and found to be discouragingly thin and low grade, but further exploration in this belt seems well justified.

An unusual type of volcanic-hosted deposit is found near Muskox Lake in the southern part of area 41C. It consists of a swarm of veins that contain galena and sphalerite. The metal ratios in these veins are similar to those in the most silver-rich beds in the Yava and Hackett River deposits in area 41B. The veins are in a fragmental rhyolite, probably formed where a rhyolite mass was extruded onto the land surface of an island volcano. The volcanic rocks in area 41C are unique within the Slave Province not only because the bulk of them were deposited subaerially rather than beneath the sea (Lambert, 1978) but also because they postdate other Archean strata in the area. They are younger than a thick sequence of turbidite sediments that overlie the volcanic rocks of area 41B.

Nickel deposits in volcanic rocks and sills

Ultramafic lavas (high magnesium and iron, low silica rocks) occur in an Archean belt near Griffin Lake and Watterson Lakes at the west end of area 58 (Eade and Chandler, 1975). Elsewhere, as in the Timmins area and in Western Australia, nickel-rich sulphide concentrations, including important ore deposits, are found in similar rocks. The Griffin Lake belt can be considered favourable terrane for prospecting for such nickel ores although no significant occurrences of nickel have been reported therein. Similar possibilities cannot be entirely discounted in other belts where no ultramafic rocks have been reported, as these rocks are not always easily recognized and extensive areas of volcanic rocks are known only from widely spaced observations. Ultramafic rocks are also sources of carving stone.

The presence of ultramafic rocks should alert us to possibilities that mineral deposits in addition to the nickel deposits mentioned above may be present. Associated thick intrusive bodies, for example, might contain asbestos, perhaps chrome, platinum metals and copper, although it seems unlikely that such bodies are present in the Griffin Lake belt. More importantly (with respect to the present study area), ultramafic rocks are present in many major gold camps (e.g. Timmins, Larder Lake, Malartic, and Kalgoorlie). The Cullaton Lake gold deposit in iron formation is only a few kilometres east of the occurrences of ultramafic lava at Griffin Lake. The association of gold ores with ultramafic rocks may not be because the latter provide a particularly important source of gold as some have thought, but rather because of a series of peculiarities in the way belts containing ultramafic rocks have evolved. Events in the evolution of these belts perhaps included (1) the tapping of magma chambers at considerable depth by particularly deep fissures to yield the early erupted ultramafic lavas, (2) pervasive carbonate alteration of ultramafic and surrounding rocks, and, commonly (3) the deposition of abundant iron-rich and sulphide-rich sediments.

Deposits in Archean Sedimentary Rocks

Detritus largely derived from volcanically active areas was spread out and deposited downslope on the seafloor by turbidity currents and this process continued – in many places, on an intensified scale – after vulcanism ceased within those parts of the volcanic-sedimentary belts that are presently preserved. Thicknesses of several kilometres of these chemically immature sediments (greywackes) were thus deposited in rapidly downsinking basins, particularly in the western part of the region, as for example east of area 41B. This sort of sedimentation and subsequent compaction and lithification of the clastic sediments are not processes likely to form ore deposits. Chemical and biochemical sediments, more interesting metallogenetically, were deposited locally amongst volcanic rocks during pauses in volcanic activity and within the main sedimentary basins during pauses in deposition of the turbiditic sediments.

The thickest and most extensive of these chemical sediments are chert-magnetite iron formations in Keewatin areas 58, 62, and 51. These are similar to iron formations mined in other regions where bulk transport of magnetite concentrates to steel mills is competitive economically. Oxide facies iron formations are notably rare and poorly developed in the western Archean areas except, perhaps, along the east flank of area 41C.

Gold-bearing iron formations are found in a number of areas and programs are underway to develop small gold mines at Cullaton Lake in the western part of area 58 and also at Contwoyto Lake in area 41D. This special, distinctive, class of gold deposit must be regarded as extremely important as it includes the Homestake mine in South Dakota, United States, the largest gold mine in the western hemisphere and a producer for more than 100 years. The host iron formations, or facies thereof, are rather special rocks containing iron-bearing carbonates or iron-magnesium silicates derived from metamorphism of carbonates, iron sulphides and abundant arsenic. These occur as zones within more normal banded chert-magnetite iron formations at Cullaton Lake but at Contwoyto Lake and elsewhere they are thin formational units of banded grunerite-garnet rock. Numerous such beds are found throughout area 41D. Others have been reported in the Hood River area (41) west of Bathurst Inlet and in area 44 east of the Inlet.

The non-turbiditic Archean sedimentary rocks are of interest also because a large proportion of ore mineral-bearing veins (most importantly gold-bearing quartz veins) that have formed after their host rocks were deformed and fractured, are found in or near such sedimentary beds. These associations may have been developed in several ways:

1. the sediments served as the source of metals, other components of the deposits, and of transporting agents such as water and carbon dioxide (sulphur, arsenic, precious metals, copper, and other metals are notably concentrated in some carbonaceous shales);
2. chemically reactive materials such as carbon, carbonate, and iron that were concentrated in the sediments caused deposition of ore minerals; and
3. relatively soft plastic sediments, or extremely brittle chert of cherty iron formation influenced the way the rocks fractured when they were deformed, and thus resulted in the development of preferred channelways for ore-forming fluids.

Many important examples of associations of gold-bearing veins with iron formations in Precambrian areas throughout the world could be cited. Unlike the gold-bearing iron formations mentioned previously, these gold deposits are not restricted to a particular type or facies of iron formation. In some major gold mining districts (e.g. Timmins and Kalgoorlie) ultramafic rocks – a common gold deposit association previously mentioned – and abundant carbonate rich rocks as well as ferruginous sediments host gold deposits.

In Mackenzie and Keewatin Districts, examples of gold occurrences that are located near iron formation and carbonaceous pyritic sediments are found along the northeast flanks of areas 41C and 41B.

Deposits in subvolcanic intrusive rocks

Volcanic areas commonly contain igneous bodies that cooled and solidified before reaching the surface. Igneous rocks may also be intruded to shallow depths within sedimentary belts lacking volcanic rocks. Various shallow level intrusions host a variety of types of mineral deposits; some formed at the time of intrusion; some slightly or considerably later. Most important amongst them are porphyry copper and molybdenum deposits in or near relatively small intrusions of intermediate to felsic composition. No major deposits, and relatively few small deposits of this type have been found, however, in Precambrian rocks. Closely allied deposits are also important sources of tungsten and precious metals in various localities outside the region of interest. Shallowly emplaced ultramafic and mafic intrusions contain important ores of nickel, asbestos, chromium, nickel-copper-platinum, copper, iron and titanium.

Factors involved in formation of ore deposits in shallowly emplaced intrusions include: segregation of ore minerals accompanying crystallization of molten rock; dissolution of metals from rocks through chemical reactions with water entrapped in the rocks that were intruded; development of zones of easy fluid circulation and sites for ore mineral deposition in rapidly chilled, intensely fractured, upper zones in the intrusions and in rock broken up by steam explosions; and prolonged circulation of fluids driven by heat from deeper parts of the cooling intrusion.

The Ferguson Lake nickel prospects east of Yathkyed Lake in area 53, and the former Rankin Inlet nickel mine in area 58 are examples of deposits in subvolcanic mafic intrusions. Copper veins are found in a dioritic intrusion near James River (area 41A). Networks of molybdenum- and copper-bearing veinlets in a granitic body west of the north end of Contwoyto Lake in area 41D may represent a porphyry type deposit.

Deposits in syntectonic Archean rocks

The Archean strata were intensely crumpled immediately following their deposition, in a continuum of crustal dislocations that began with the initial volcanic eruptions along rifts and ended with the development of a new, stable, crustal block - a 'craton'. Strata, deeply downbuckled, were heated and this resulted in metamorphic transformations of minerals, expulsion of water, and – in the deepest, hottest zones – partial melting generated granitic magmas that rose into cooler rocks before crystallizing. Various mineral deposits were formed during these tectonic-magmatic processes, e.g. gold quartz veins that cut deformed rocks and that may themselves be deformed; veins spatially related to zones of metamorphic alterations; pegmatite (very coarse-grained granite) dykes near the peripheries of late granite plutons. Most such deposits contain very different concentrations of various metals and elements from those found in massive sulphide and other deposits that were formed before their host rocks were much disturbed. For example, gold is highly concentrated relative to silver and base metals, arsenic, antimony and tellurium relative to sulphur, and significant amounts of molybdenum and tungsten are commonly present in syntectonic and late tectonic gold deposits.

A few lithium, tantalum and beryllium-bearing pegmatites are known near the edge of the present study region south of Contwoyto Lake but the only one reported within the region is at Muskox Lake ($65^{o}42$'N, $108^{o}12$'W). Some features of a remarkable cluster of such pegmatites east of Yellowknife are worth mentioning even though chances of discovering similar pegmatites elsewhere are not great. These dykes are mostly within metamorphosed sedimentary rocks near muscovite granite plutons. Those closest to the intrusions, or within their margins contain beryllium. Farther away are pegmatites containing tantalum and beryllium, then ones containing tantalum, tin, and lithium, and finally furthest away, lithium with a little tantalum (Mulligan, 1965). Quartz veins locally containing rich but small concentrations of gold are found still farther away near areas of least metamorphosed sediments. Concentrations of tungsten, lead, zinc and copper and molybdenum, presumably deposited from metamorphically derived fluids, are also found in such veins. It may be added that in other regions there are pegmatites rich in molybdenum commonly along with lithium, in uranium commonly with molybdenum, and in gem stones (blue tourmaline approaching gem quality has been noted in some Yellowknife pegmatites). Numerous uraniferous pegmatites have been found in southern Baffin Island within this study region.

Extensive quartz veins, sections of which contain considerable gold, cut a granitic body and highly deformed strata at the Coronation Gulf coast in area 41A. South of James River, also in area 41A, gold quartz veins are found in a small granitic intrusive. A few kilometres east of this, prospect pits have been blasted in a narrow silver-rich lead-zinc-antimony vein within metamorphosed sediments. A number of gold prospects at the east margin of area 41C along the Back River have been tested by drilling. Gold occurrences are also present in metavolcanic rocks in areas 45, 55, and 58.

Most belts of metavolcanic rocks show some indications that important amounts of gold may have been emplaced in favourable structures during metamorphism but it is difficult to evaluate the productive potential of any given area. As previously mentioned, extensive carbonate-rich rocks, iron formations and ultramafic rocks may mark an area as favourable for gold deposits, but the converse is by no means true. Some major gold deposits, including those at Yellowknife, were emplaced in unobtrusive schistose zones transecting sequences of little altered volcanics that contain only minor layers of interflow sedimentary rocks.

Archean post-orogenic intrusive bodies

Three small intrusive bodies of alkalic syenitic rocks and carbonatite have been mapped near Kaminak Lake (area 58). They intrude deformed Archean rocks and are apparently aligned along a late Archean rift in the Rankin-Ennadai subprovince. Some intrusions of this type elsewhere contain ores or important concentrations of niobium, copper, rare earth elements, uranium, phosphate rock, magnetite, beryllium, or tantalum.

Earliest Aphebian and/or Archean Supracratonic Strata

A thick sequence comprised mainly of stream deposited, coarse feldspathic quartzite is found as erosional remnants near Henik Lakes in area 58. It contains beds of pyritic quartz pebble conglomerate and, locally at its base, volcanic rocks. These rocks, termed the Montgomery Lake Group (Eade, 1974) were deposited, evidently between 2.25 and 2.7 billion years ago atop the eroded land surface of the Rankin-Ennadai craton. The Group was tilted, folded and largely eroded prior to deposition of early Aphebian Hurwitz strata that overlie it and also overlie basement rocks through extensive areas of the Ennadai-Rankin subprovince in Keewatin District. The Montgomery and Hurwitz rocks (excepting upper units), respectively, resemble lower, pyritic conglomerate-bearing units and upper formations in the Huronian Supergroup in Ontario. Pyritic conglomerates in the Huronian rocks and in South Africa contain large proportions of the world's uranium and gold reserves. They are believed to be fossil placers formed when the earth's atmosphere lacked free oxygen. None have been found in rocks known to be less than 2.25 b.y. old. Those in outcrops of Montgomery rocks have only low uranium contents and erratic but generally very low gold contents. Areas that could be explored for buried, possibly richer, conglomerate beds are limited in extent.

Sequences of no less ancient strata were deposited atop Archean granitoid basement rocks in the northern part of the Churchill province. These are the Prince Albert Group and Mary River Groups found in extensive belts in areas 26, 31, 33 and 67. They contain very extensive bands of quartz-magnetite iron formation, ultramafic volcanic rocks, basalt, quartzite, and argillaceous sedimentary rocks. Some sections of iron formations are sufficiently rich and extensive, as well as favourably located with respect to possible sea transport, to raise hopes that they may be mined eventually. The ultramafic rocks could contain nickel ores and felsic and mafic volcanics in the northeast part of area 31, volcanogenic massive sulphide deposits. The belts – particularly their least metamorphosed parts – should be prospected for gold in view of the fact that ultramafic rocks and iron formations are present in many gold mining areas. The apparent greater than 2.25 b.y. age of the rocks suggests that the quartzite units could contain uranium or gold-bearing pyritic quartz pebble conglomerate beds if parts of these units were deposited in stream beds, or perhaps on beaches, where heavy minerals might have been concentrated as placers. This possibility is reinforced by the fact that the unusual combination of ultramafic rocks with quartzite is found in two areas – Sakami Lake east of James Bay in Quebec, and Jacobina in Brazil – which contain significant ore grade uranium and gold deposits.

Early Aphebian Rocks in the Churchill Province

Supracratonic strata deposited within the Churchill Province between 2.25 and 1.85 b.y. (most probably) include the Hurwitz Group in the Ennadai-Rankin subprovince, the Amer Group in Central Keewatin, and the Chantrey, Penrhyn and Piling Groups that occur, respectively, in areas 24 and 35 in northern Keewatin and 67 on Baffin Island.

The Hurwitz and Amer Groups contain similar sedimentary rocks in similar orders of succession, reflecting deposition first of (1) very thick blankets of quartz sand on a stable shelf (probably at about 2.25 b.y. if correlations with the Cobalt Group on the paleoclimatological evidence suggested by Young (1973) are valid), then slow deposition of (2) a shaly sequence including dolomite and very minor iron formation and finally (3) more rapid deposition of a thick sequence composed of lenses of feldspathic sands and muds. Many low grade stratiform uranium deposits have been found in the upper unit of the Amer Group and a few are known in the lower unit. The uranium concentrations were formed evidently prior to lithification of the host beds; that is, as mud beds were laid down, while groundwater circulated in buried sandy beds, and during compaction and dewatering of the sedimentary pile. Various metals and sulphides are concentrated with uranium in these deposits (A.R. Miller, personal communication, 1980) and it seems likely that base metal deposits may have been formed elsewhere in these rocks, particularly within carbonaceous shale in the middle sequence (2). This shale resembles formations that contain very large zinc-lead deposits in the McArthur River area of Australia and in the Mackenzie Mountains in northwestern Canada. Thus the middle and upper Hurwitz rocks in the western part of Area 58 and in

Area 57, as well as Amer rocks in Area 50, are regarded as favourable for zinc-lead deposits as well as uranium deposits.

The Penrhyn, Piling and Chantrey Groups consist of highly metamorphosed strata folded together with basement gneisses. They include thin discontinuous basal layers of quartzite, extensive thin layers of marble and calc-silicate rocks, pyritic graphitic slate, and thicker overlying units of micaceous quartzite, slate, greywacke or gneisses derived therefrom. Volcanic and ultramafic rocks form extensive layers in the lower part of the Piling Group and are present locally in northern areas of Penrhyn rocks. Minor lenses of iron formation are also present in some areas of lower Piling rocks. Occurrences of base metal sulphide minerals have been reported in various parts of the Penrhyn and Piling belts. Deposit types most likely to be found in these rocks include: massive copper-rich sulphides in the thicker volcanic sequences, particularly in the lower Piling (Tippett, 1978); shale-hosted stratiform zinc-lead deposits; and nickel and asbestos in ultramafic rocks. Veins containing base metals and a breccia zone containing radioactive minerals have been reported in the Piling Group (Tippett, 1978) but the economic significance of these is unknown.

Aphebian Rocks of the Coronation Geosyncline, Bear and Slave Provinces

The oldest Proterozoic rocks in the northern parts of the Bear and Slave Provinces (areas 42 and 43, 40 and east half of 39) record a complete orogenic cycle (Hoffman, Fraser, and McGlynn, 1970) that began perhaps nearly 2.1 b.y. ago and ended about 1.8 b.y. ago. These rocks (Akaitcho, Epworth, and Goulburn Groups) were deposited in a broad, southerly trending zone of crustal downwarping termed the Coronation Geosyncline (Hoffman, 1973). The cycle began with rupturing of the crust and eruption of Akaitcho volcanics near the centre of Area 39. These may contain base metal-bearing massive sulphide deposits although none have yet been found. Thick blankets of quartz sand containing shaly beds and layers of quartz pebbles were deposited on the Archean craton by westerly and northerly flowing streams. Uranium and copper minerals may have been concentrated locally in these sands or at the unconformity beneath them, but the potential for economic deposits seems slight.

The crust warped downwards, most rapidly towards the west, and seas flooded the geosyncline. Carbonate rocks and westerly thickening wedges of clastic sediments, fining towards the west, were deposited atop the sands. An off-shelf sequence of black shale – the Fontano Formation (Hoffman, St. Onge, Carmichael and de Bie, 1978) – deposited in the east part of Area 39 could contain bedded zinc-lead sulphide deposits.

Akaitcho volcanic and sedimentary strata and Epworth shales in the eastern half of Area 39 were deformed, metamorphosed, and intruded by large granite bodies – themselves subsequently deformed – and by smaller, more mafic, younger plutons (Hoffman _et al._, 1980). These include some ultramafic plugs that could contain small nickel deposits. No base metal or precious metal deposits have been reported in this orogen, but metals would have been carried in fluids driven by orogenic processes, so possibilities that they may have been concentrated in favourable structures cannot be discounted. Deposits most likely to be economically significant would be copper veins and gold quartz veins.

During the final phase of orogeny, sands were spread out over extensive land surfaces, basalt flows were erupted locally, and strata in Area 40 were folded. Uranium veins have been found in basalt interlayered with red sandstone near the south end of Bathurst Inlet in Area 43. There may be possibilities of discovering other small uranium deposits in the upper molasse sequence preserved in this area and in places within Area 40.

Late Aphebian Rocks

Continental sediments and volcanic rocks, with related intrusive rocks, of the Dubawnt Group in Keewatin (area 49) were formed at about the same time as the somewhat similar rocks of the western part of the Bear Province (west half of area 39). In the Great Bear Lake area, however, volcanic eruptions and intrusion of granitic magma occurred on a much grander scale than in Keewatin. The Bear strata are intruded by great subjacent bodies of coarse granite, and possible basement rocks are in evidence only very locally (McGlynn, 1979).

Dubawnt strata, in contrast, overlie basement rocks and are intruded by relatively small plutons. There are differences also in the ranges of compositions and sequences of development of suites of igneous rocks in the two areas. Most notably, the Dubawnt suite includes abundant alkalic types, some subsilicic rocks, and rocks with a high content of volatile constituents – fluorine, carbon dioxide and water – and perhaps a relatively low sulphur content.

The two areas are both metallogenetically favourable for uranium, but the Dubawnt belt contains a number of types of deposits that are unlikely to be found in the Great Bear belt (particularly not in area 39). For example: impregnations in widespread, once porous, fluvial, arkosic sandstones; vein deposits like those in basement rocks beneath Dubawnt strata; and concentrations of uranium in fractured alkalic intrusions. It should be pointed out also that the economic uranium deposits at Great Bear Lake – veins containing pitchblende, cobalt-nickel arsenides, and silver – were formed much later than their host rocks as a result of processes in Helikian time (as discussed below) and that comparable processes are unlikely to have occurred in the Dubawnt belt.

There may be possibilities that breccia pipe-type copper deposits are present in Area 39 (west) as a significant deposit of this type has been found in rhyolitic to dacitic volcanic rocks in the southern part of the Bear Province. Similar possibilities exist in areas of Dubawnt volcanic rocks in Keewatin (area 49). Some Dubawnt uranium deposits contain lead, selenium, and gold,so significant by-product production of these metals is a possibility. Moreover, base and precious metals are found in a number of prospects lacking uranium and it is conceivable that some time in the future such deposits may be mineable in Keewatin. Fluorite granites, which occur outside as well as within Area 49, should be prospected for tin, tungsten, and molybdenum (Fig. 31).

Younger Proterozoic Cover Rocks and Intrusives

Remnants of early to mid Helikian sandstones, comparable to the Athabaska Formation in northern Saskatchewan, include the Thelon Formation (area 47), sandstone in the Dismal Lakes and the Hornby Bay Groups (area 38), and Ellice River Formation found in patches around Bathurst Inlet and Melville Sound (area 43).

The base of these formations and subjacent fractured and paleosol-mantled rocks have been considered prime targets for so-called unconformity-related uranium deposits. The greatest potential for discovery of rich deposits of this class is considered to be present in situations where sandstone overlies early Aphebian metasediments like the Amer Group rocks which themselves may contain strata-bound concentrations of uranium. The Lone Gull deposit 75 km west of Baker Lake, like many important Australian deposits, fits this 'recipe'. Various factors other than age and type of basement rocks, however, have played important roles in localizing known uranium occurrences at such unconformities and in overlying sandstones. These include: facies variations in the sandstones, basement topography, paleosol development, and fracturing. Thus the presence of Archean or late Aphebian subjacent rocks should not in itself deter exploration. The special favourability of the unconformity beneath these Helikian sandstones may be due to an especially long erosion interval prior to their deposition or to their deposition over (as well as their derivation from) very extensive areas of crystalline rocks. Other unconformities beneath younger and older sandstones should also afford some favourable sites for significant deposits.

Metals other than uranium may be concentrated near unconformities where various types and ages of rocks are overlain by various strata, not necessarily great sandstone sheets. The common link amongst diverse unconformity related deposits is perhaps the development of restricted systems of flow of metal-bearing waters in rocks with open spaces formed by fractures, by dissolution along fractures (cave systems, sink holes), and by interstices between coarse clasts. Solutions may be driven through such buried channelways by artesian flow, by water expelled from wet sediments as they are compacted due to continuing loading of additional sediments, or by thermal convection.

Galena - bearing veins in Archean granite at Galena Point along the west shore of Bathurst Inlet near its mouth (area 41) were evidently formed as open space fillings at shallow depths presumably beneath an unconformity. They are remarkably similar to veins found at the unconformity between Archean granite and overlying Helikian limestone along the north shore of Lake Superior (Franklin and Mitchell, 1977). The numerous galena-calcite-quartz-chalcopyrite veins, in places closely spaced and locally up to a metre thick, represent fillings of open fractures. They do not contain significant amounts of silver. A small scale mining operation was once started at this site. It is doubtful that another such attempt by a few individuals would be any more successful and the veins are too small to support a normal mining operation.

Other evidence that the Archean-Proterozoic unconformity merits prospecting is found 60 km southwest of Galena Point along the west shore of a lake at the east side of the Kennarctic River ($67^{0}25$'N, $110^{0}49$'W). Here an unconformity between Archean rocks (pyritic volcanic sediments and granite) and Proterozoic limestone is poorly exposed in frost-heaved blocks. A small unmapped outlier of limestone probably underlies most of the lake basin. The matrices of the transitional rocks (rubbly grit and conglomerate) are heavily impregnated with copper-sulphide. The occurrence is 4 km northeast of the High Lake massive sulphide deposit.

The small native silver-carbonate veins formerly mined at Hope Bay Mine on the south coast of Melville Sound (area 45) are believed to have been formed in fractures a short distance below Proterozoic sediments and a gabbro sheet which have been eroded off the Archean strata that host the veins. The unconformity between weathered Archean rocks and overlying, shallowly-dipping

Proterozoic sediments is exposed in a number of places nearby (Campbell, 1979). A shallowly-dipping intrusive sheet of gabbro follows this unconformity for many tens of kilometres, here and there cutting across it. We can speculate that water entrapped in weathered, fractured Archean rocks beneath the unconformity leached metals (silver preferentially) from sulphide in volcaniclastic rocks, and that the silver-calcite veins were formed when these solutions were circulated near the gabbro as it cooled. This mode of origin has been suggested for the native silver-calcite-cobalt arsenide veins at Cobalt, Ontario (Boyle and Dass, 1971). It may also apply to the rich pitchblende or native silver-bearing cobalt nickel arsenide-calcite veins at Great Bear Lake (Thorpe, 1974).

Gabbro intrusions are present throughout the Coronation Gulf area near unconformities between Archean or Aphebian rocks and overlying, nearly flat-lying, Proterozoic strata. Some of these intrusions have been capable of moving and concentrating metals, as shown by occurrences of economically insignificant copper veins. They intrude unconformities and sandy rocks considered worthwhile targets for uranium exploration, uraniferous shaly beds, shaly or tuffaceous beds likely to contain concentrations of silver as well as more common metals. It seems likely therefore that some small, rich pitchblende veins and more small, rich silver veins like those at Hope Bay Mine will be discovered below, above, or within some of the thickest of these intrusive sheets.

URANIUM

(36) Proterozoic (Rae Group) and Paleozoic Sedimentary Rocks

The basal unit (no. 19) of the Rae Group consists of 15 m of sandstone and 45 m of green and dark grey shale, and is traceable for a strike length of 200 km. The sediments were deposited in reducing environments as indicated by the presence of pyrite crystals and nodules and some occurrences of syngenetically deposited, disseminated chalcocite (McGlynn and Fraser, 1972; Kindle, 1972; Baragar and Donaldson, 1973). Hence there is some potential for sandstone-type, shale-hosted and unconformity-related uranium deposits, although no occurrences have been reported as yet. Another unit (no. 21) with similar lithologies is present at a stratigraphically higher level and may be regarded as favourable for sandstone-type and shale-hosted deposits.

(37) Coppermine River Group Proterozoic Volcanic Rocks

Plateau basalts predominate in this group, and were extruded in highly oxidizing environments, as indicated by hematitized flow-tops and also by the associated red sandstones and siltsones which constitute the remainder of the group (Baragar and Donaldson, 1973). These red sedimentary rocks are unfavourable for deposition of uranium. The basalts and the fault zones cutting them however are mineralized with copper sulphides that are widely distributed, and may provide local reducing environments favourable to uranium deposition from circulating groundwaters. No uranium occurrences have been reported but the possiblity of vein-type occurrences in the basalt similar to the Pomie Prospect (see area 43) cannot be ruled out. In general however the area has a low potential for uranium.

(38) Hornby Bay and Dismal Lakes Groups

These Helikian sedimentary groups include continental sandstones and associated conglomerate beds, which are favourable for sandstone-type uranium deposits, as exemplified by the Mountain Lake deposit on the PEC-YUK claim groups. The stratigraphic position of the deposit is illustrated in Fig.5(Part I). The deposit is essentially stratiform, is located near a basement high and has been affected by faults. Its small size and location in an area lacking infrastructure make it subeconomic, for the near future, but it has grades comparable to sandstone-type deposits mined in the southwestern United States. A group of small deposits like it or a larger deposit would be economically attractive. Exploration for uranium in these rocks began in 1969 and has been intensified in recent years, and several small occurrences have been discovered.

The unconformity at the base of the Hornby Bay Group is an attractive exploration target for unconformity-related deposits in view of its similarity in geological setting to the unconformity at the base of the Athabasca Formation in Saskatchewan, and much of the recent exploration effort in the area has been directed towards it. No significant uranium, however, has been detected as yet at the unconformity and the exposed parts of it suggest an oxidizing environment unfavourable for deposition of uranium in contrast to the reducing environment common at the base of the Athabasca Formation. Nevertheless local favourable conditions may occur, and the exposed parts represent only a fraction of the extent of the unconformity accessible to exploration.

(39) Great Bear Batholith - Hepburn Fold Belt - Muskox Intrusion

This area is favourable for vein-type uranium deposits. Several occurrences are known, and these can be grouped into two sub-types: simple pitchblende veins and fracture-fillings with minor amounts of gangue minerals namely hematite, quartz, chlorite and calcite, e.g. the RAH prospect [1] and giant quartz veins and stockworks with minor amounts of copper sulphides, pyrite, pitchblende and hematite, e.g. the McLaren Lake copper prospect (Roed, 1968). Economic potential of these types of deposits, however, is very limited in view of their small size and the erratic distribution of uranium in them.

Polymetallic veins of complex mineralogy, like the ones mined at Port Radium, carrying pitchblende, native silver and bismuth, copper sulphides, sulpharsenides of cobalt and nickel, pyrite, hematite, quartz and carbonate minerals (Jory, 1964; Lang et al., 1962; Robinson and Morton, 1972; Robinson and Ohmoto, 1973) are not known in the study area. Some potential for these, however, exists in view of the extension of the north-east striking strike-slip faults, which apparently controlled the subsidiary fracture system now occupied by the veins at Port Radium, into the western part of the study area underlain by the Bear Batholith and genetically related volcanic rocks and associated sediments (McGlynn 1977; Hoffman et al., 1976, 1978; Gandhi, 1978).

Consideration must also be given to the possibility for two other types of deposits, namely the disseminated type in paragneiss and volcanogenic deposits in felsic volcanic rocks and tuffaceous sediments of the Akaitcho Group in the Hepburn Fold Belt, although no example of these is yet known in the area.

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[1] Mines and Mineral Activities, Northern Affairs Program, Department of Indian and Northern Affairs, 1977.

(40) Epworth Group Sedimentary Rocks

This area has been little explored for uranium. The Aphebian Epworth Group (Fraser, 1974; Hoffman et al., 1970, 1978) includes siltstones and sandstones of mixed alluvial, coastal marine and aeolian origin in the Odjick Formation in the lower part of the group. Some of these beds are regarded as favourable for sandstone-type uranium mineralization. In the middle part of the group, the Fontano Formation contains a black, laminated pyritic and carbonaceous shale approximately 80 m thick, which was deposited in a deep euxinic marine basin. Shales deposited in such reducing environments are commonly enriched in uranium and other metals, and have a potential for low grade deposits.

(41) Slave Province Archean Rocks

This area has a very low potential for economic deposits of uranium, as is generally the case with Archean terranes elsewhere. An unconfirmed occurrence of (pegmatitic?) uranium is reported at Contwoyto Lake but it is economically insignificant.

(42) Goulburn Group Proterozoic Cover Rocks

The lower deltaic and clastic fluvial facies and the middle carbonate facies of the group are preserved in the area. The basal Western River Formation and the overlying Burnside River Formation (Tremblay, 1971; Campbell and Cecile, 1976) are favourable for sandstone-type deposits. The associated grey shales may also be enriched in uranium. In addition there is a possibility for unconformity-related deposits at the base of the group. Exploration to date has been essentially of a reconnaissance nature.

(43) Kilohigok Basin Proterozoic Sediments and Overlying Continental Basalts

Vein-type uranium occurrences are found in the basalts interbedded with the upper red clastic sediments of the Brown Sound Formation of the Aphebian Goulburn Group, at the Pomie Prospect (Wright, 1975; Mines and Minerals Activities, 1977, Department of Indian Affairs and Northern Development). Potential for additional occurrences of this type exists, but these are of limited economic interest.

The Western River and the Burnside River Formations, mentioned earlier as potentially favourable units for unconformity-related shale-hosted and sandstone-type uranium deposits, extend into this area.

The strata of the Goulburn Group are folded, faulted and unconformably overlain by Helikian Formations. The oldest Helikian rocks of the Tinney Cove Formation were deposited in fault troughs and in turn unconformably overlain by the basal clastic fluvial sediments of the Ellice River Formation (Campbell, 1978 and 1979). Both these unconformities are marked by oxidation and weathering of the rocks underneath and by the presence of a regolith. They are thus favourable for unconformity-related deposits, and anomalous radioactivity is reported at two localities by Campbell (1979). One is at Kongoyuar Point in Elu Inlet where weak radioactivity was detected at the unconformity between the Tinney Cove and Ellice River Formations, and is being explored by Cominco Limited in joint venture with E & B Explorations Limited. The other is on the largest of the islands in Elu Inlet east of Ovayor Hill, where the Ellice Formation rests on deeply weathered Archean rocks and locally anomalous radioactivity is encountered in the basement.

Weak radioactivity is also encountered in a grey-black shale bed within the dolomitic Parry Bay Formation that overlies the Ellice River Formation

(Campbell, 1978). The shale bed is pyritic with minor chalcopyrite, and greater concentrations of uranium could be present in it elsewhere.

The Parry Bay Formation is unconformably and disconformably overlain by the Kanuyak Formation which is correlated with the Dismal Lakes Group (see area 38) and is overlain by basalts of Ekalulia Formation that are correlative with the basalts of the Coppermine River area (Campbell, 1978). In contrast to the Dismal Lakes Group, the Kanuyak Formation is very thin (0-60 m) and discontinuous and consists predominantly of dolomitic rocks with only minor arkosic beds. Hence it is regarded as having little potential for economic uranium deposits.

(47A) Proterozoic Thelon Sandstone Formation

Comments on the uranium potential for this area are combined with those for area 47B (see uranium evaluation for Keewatin Region).

GOLD

(36) Proterozoic (Rae Group) - Lower Paleozoic Sedimentary Rocks

This area encompasses an assemblage of sandstones, shales, argillites, dolomites, and limestones that has a total thickness of about 4000 feet (1200 m). There is no geological basis to suppose the potential for gold is anything but very low to nil. There is an outside possibility that some paleoplacer gold could be present in quartzite units of the Rae Group.

(38) Hornby Bay and Dismal Lakes Groups

The Hornby Bay Group consists of a unit of sandstone and minor conglomerate with a maximum total thickness of as much as 3000 ft (900 m), a unit of stromatolitic dolomite up to 2000 ft (600 m) thick, and a succession of mudstones, siltstones, and sandstones, as much as 2000 ft (600 m) thick (Fraser et al., 1970). The sandstone-conglomerate units, especially the lower one, probably hold a low to moderate potential for paleoplacer gold deposits.

The Dismal Lakes Group is a sandstone-shale-argillite-dolomite-limestone succession about 4000 ft (1200 m) thick. The potential for paleoplacer gold deposits in sandstone is probably low to moderate.

(39) Great Bear Batholith-Muskox Intrusion-Hepburn Fold Belt

No significant gold deposits are known in the Bear Province and the potential in the Bear Batholith area is considered to be very low. However, Hoffman et al.(1978) have reported that the Akaitcho Group of the western part of the Hepburn Fold Belt consists of metabasalt, metafelsite (rhyolitic tuffs, dacitic flows) and metasedimentary rocks (predominantly pelites, rare thin beds of white quartzite). Pods of serpentinite are known in amphibolitic migmatite derived from the Akaitcho Group. This rock assemblage suggests low to moderate potential for gold deposits of the quartz vein or schist (shear) zone types.

Highly metamorphosed sedimentary rocks of the Epworth Group along the east part of the area are considered to have low gold potential.

(40) Epworth Group Sedimentary Rocks

Quartzite and associated conglomeratic units of the Odjick Formation are potential host rocks for gold deposits of paleoplacer type, perhaps especially near the eastern edge of the area where deposition was under shelf-like conditions in contrast to more basinal conditions to the west. However, the overall gold potential is rated as low.

(41) Slave Province Archean Rocks

In the Slave Province, as in Superior Province, gold is commonly associated with volcanic and associated sedimentary rocks which comprise the greenstone belts. The deposits are often, at least in their present form, controlled by structural features that range from minor fractures and shears to major schist or "shear" zones. Numerous occurrences of this type, especially further south in the Slave Province, suggest that the potential is good for this type of deposit. However, the most significant deposits known in northern Slave Province are not of this type.

One significant type of deposit within area 41 is a syngenetic type known as the Contwoyto Lake type (Baragar and Hornbrook, 1963, p. 13-22; Schiller and Hornbrook, 1964a, p. 10-16, and 1964b; Schiller, 1965, p. 12-14; Bostock, 1967 and 1968; Tremblay, 1967; McConnell, 1964). This type of deposit (Section 5) consists of gold-bearing amphibolitic beds (in a sedimentary sequence) that contains disseminated arsenides (loellingite and arsenopyrite) and sulphides, and bears many similarities to the Homestake gold deposit, South Dakota (McConnell, 1964). The Contwoyto Lake deposit was discovered in 1960 and explored extensively for three years by International Nickel. No comprehensive tonnage and grade figures have been released but Knutsen (1974) suggested that a zone with a potential of 18,000 tons per vertical foot, but at an unstated grade, had been outlined. He also noted that the zone included several million tons of material at a grade of at least 0.3 oz/ton gold. However, if the deposit were to be mined it would probably be as a large-tonnage low-grade type of operation. Numerous other occurrences of this type of mineralization are present in the Contwoyto Lake area, mainly south of the lake, and a number of these could perhaps be developed to supply additional tonnage.

The other type of gold mineralization with at least some proven potential is in the Tree River area near the Arctic Coast (Schiller, 1965; Thorpe, 1966) where quartz veins, in many cases two to six feet wide, cut gneissic, generally granitic, rocks. Five zones on one property have an aggregate length of 1,240 feet, an average width of 3½ feet and a grade of approximately 0.6 oz/ton gold.

In summary in areas 41A, B, C, and D the potential for volcanic-related gold deposits is rated as moderate. In addition to volcanic-related deposits the 41A area also contains the Coronation Gulf (Tree River) veins noted above.

The remainder of the 41 area must be rated moderate to high insofar as potential for Contwoyto Lake type deposits is concerned. However, because of the presence of the known Contwoyto Lake deposit and other occurrences of the same type, the potential of that portion bounded by areas 42, 41B, 41C, and 41D must be rated very high.

(42, 43) Goulburn Group Proterozoic Cover Rocks; Kilohigok Basin

It would seem likely that there is potential for paleoplacer gold deposits in the Proterozoic sediments of the Kilohigok Basin (areas 42, 43). The best potential is probably within quartz pebble conglomerate and associated mature sandstone-grit of the Western River Formation, and perhaps especially where these sediments are of platformal flat-lying character west of Bathurst Trench (area 42). Deposits of Contwoyto Lake type, including extensions of those known near Contwoyto Lake, could have served as a source for gold. Sandstones and quartzites of the Burnside River Formation (areas 42, 43) and of the Tinney Cove and Ellice River Formations (area 43) could also host such deposits (Campbell and Cecile, 1975, 1976, 1978; Campbell, 1978; Dixon, 1979).

Also in area 43, on the Jameson Islands at the mouth of Bathurst Inlet, the Jameson Island sediments would appear to have very good potential for paleoplacer gold deposits. These sediments consist of a basal sequence of quartz-pebble conglomerate and grit, overlain by progressively finer grained quartzites, with minor finer grained sandstones and siltstones near the top of the section (Campbell, 1978). The relationship of these sediments to other formations in the general area is not known.

(44) Northeastern Slave Gneissic-Granitic Rocks

This area is geologically similar to area 41 (outside of the greenstone belts).

A gold occurrence of the Contwoyto Lake type (see notes on area 41) is known east of Bathurst Inlet (about 66°42'15" N, 107°27'10" W). This and other occurrences indicate that this type of mineralization is widespread in the Slave Province, and suggest that further exploration directed specifically toward this type should be carried out. Pending further exploration the potential for this type of deposit in Archean rocks of the Slave Province in area 44 cannot be properly evaluated, but it has been tentatively rated as moderate to high.

(45) Hope Bay-Elu Inlet Archean Volcanic Rocks

This area contains greenstones and associated rocks in two greenstone belts, the Hope Bay and Elu Inlet belts. The area is thus similar to areas 41A, B, C, and D.

A considerable number of gold occurrences are known in the Hope Bay greenstone belt, which contains a high proportion of pillowed basaltic lavas. The most significant gold occurrences may be those on Ida Point (68°14'30" N, 106°34' W), where arsenopyrite-bearing quartz veins occur in minor shear zones, and those explored by Radiore Uranium Mines Ltd. (68°01'10" N, 106°46'15" W) which are narrow but high grade quartz veins (Thorpe, 1972). A small tonnage is indicated for the latter property, but for a normal mining width the grade would be marginal or uneconomic. The gold potential in the Hope Bay volcanic belt is rated as moderate to high.

(46A) Eastern Mackenzie Churchill Province Gneissic-Granitic Rocks

Because such gneissic-granitic terranes only rarely host significant gold deposits, the potential for the presence of economically-important gold deposits is considered to be very low.

(47A) Proterozoic Thelon Sandstone Formation

The coarse clastic sediments of the Thelon Formation are potential host rocks for paleoplacer gold deposits. The nearest known Archean gold occurrences at Ennadai Lake and along the Back River in the eastern Slave Province are approximately 150 km away from the present exposure limits of the Thelon formation. However, some gold could have been derived from closer sources because it seems likely that gold was to some extent concentrated in Aphebian clastic rocks.

Because the best potential gold sources are either distant or speculative, the overall potential for gold deposits is assumed to be low.

(48A) Dubawnt Lake Gneissic-Granitic Area

Rating and rationale as for area 46A.

SILVER

(36) Proterozoic (Rae Group) - Lower Paleozoic Sedimentary Rocks

This area of sedimentary rocks and diabase sills is considered to have a very low to nil silver potential. There is a slight chance for discovery of (a) small silver veins associated with thick diabase sills, or (b) silver associated with sedimentary copper deposits for which there is some potential.

(37) Coppermine River Group Proterozoic Volcanic Rocks

Minor silver, especially in calcite veins closely associated with occurrences of native copper, has been found in the area. However, the possibility of economic occurrences of this type, or, alternatively, of veins associated with some of the gabbroic sills in the area, is considered to be extremely low.

(39) Great Bear Batholith-Muskox Intrusion-Hepburn Fold Belt

Within the Great Bear Batholith belt in the area northeast of Great Bear Lake there is a moderate to high potential for the occurrence of complex Ag-U-Co-Ni-As-Cu veins of the Echo Bay type. These veins often show an association with NE-striking (tensional?) faults, and sometimes with giant quartz veins which have similar strikes.

Some uranium occurrences near Hunter Bay, and Co-Ni arsenide and bismuth occurrences around the east end of Great Bear Lake, suggest that there is potential along major northeast-striking faults and their subsidiary breaks in the area extending from Great Bear Lake northeast to the Coppermine River for this complex type of vein deposit. The Echo Bay and Terra mines in the Great Bear Lake area are proof that this type of deposit can be mined in the area.

(41C) Back River Archean Volcanic Rocks

This area includes both submarine and subaerial volcanic rocks. Thin carbonate units, in part of carbonate iron formation type and possible exhalative origin, are present at a number of locations. The subaerial volcanic rocks, generally felsic, are associated with major caldera structures (Lambert, 1976, 1978). The rim areas of these caldera structures are marked by major arcuate zones of breccia in which the fragments have a carbonate matrix and/or have been highly carbonatized.

A lead-silver occurrence is known at a locality near Muskox Lake, and also near one of the breccia zones noted above, in which the sulphides fill fractures and form the matrix in brecciated rhyolitic pyroclastic rocks that were probably deposited under subaerial conditions. This mineralization is very similar to the richest mineralization in the uppermost parts of the Hackett River and Yava massive sulphide deposits (Roscoe, personal communication, 1980).

Roscoe considers that because (1) the mineralized fracture zones are extensive and (2) a bulk sulphide concentrate would be rich in lead and silver due to the fact that pyrite and chalcopyrite are present in only minor amounts, these mineralized zones could prove to be economic in the future. It seems likely that additional silver deposits of this type are present in the area.

(42) Goulburn Group Proterozoic Cover Rocks

By analogy with small veins of native silver in the Hope Bay area (see notes for area 45), there could be some potential for similar veins in association with diabase sills along the base of the Goulburn Group sequence in area 42 or the outlier at Rockinghorse Lake to the west. However, although they could probably be mined if discovered, the overall economic significance of such veins would be minor.

(43) Kilohigok Basin Proterozoic Sediments and Overlying Continental Basalts

It is probable that a little silver is present in association with occurrences of native copper in the continental basaltic rocks of the Ekalulia Formation, in analogy with occurrences in the Coppermine River area (see notes for area 37). Some small silver veins, such as are known in the Hope Bay area (45), could also be associated with diabase sills or sheets in the area. However, deposits of these types are, at best, of only minor economic importance.

(45) Hope Bay-Elu Inlet Archean Volcanic Rocks

This area is near the northeastern limit of the Slave Province and about 60 to 120 km northeast of Bathurst Inlet. Native silver is known to occur in the area in veins in and near the margin of the Hope Bay volcanic belt (Thorpe, 1972a). Two main veins, both short and lenticular, were discovered near granitic rocks which intrude the margins of the volcanic belt. Although of small size, the veins were spectacularly rich in native silver. In 1974 a small mill was established here by Hope Bay Mines Ltd. and 64,244 ounces of silver were produced from 843 tons of ore (Laporte et al., 1978). In 1975 another 10,763 ounces were obtained from 712 tons of ore. This production was in addition to 10 tons of hand-sorted ore averaging 4,863 oz/ton Ag that were shipped in 1973. The total silver production from the veins in the period 1973 to 1975 was thus 123,637 ounces.

The small size of the veins means that, unless additional larger veins are located, the deposits have no great economic significance. The native silver in these veins is, in part at least, in beautiful tree-like dendritic forms in calcite so that if similar additional veins are found they could be mined on a small scale or possibly worked for mineralogical specimens.

Genetically the veins may be related to extensive very shallowly dipping diabase sheets in the area and were probably formed at roughly 1350 m.y. There is a moderate to high probability of finding more small veins, but the probability of finding much larger deposits is considered to be low.

V NORTHEASTERN MACKENZIE DISTRICT

COPPER

(9C) Cape Young-Cape Hearne Paleozoic Rocks

A remote possibility exists of sedimentary deposits in basal Paleozoic rocks.

(36) Proterozoic (Rae Group)-Paleozoic Rocks

A possibility exists of sedimentary deposits, especially where reduced marine rocks overlie continental redbeds. Kirkham (1970, 1974) has described such occurrences in the basal units of the Rae Group where these rocks overlie redbeds and basaltic flows of the Coppermine River Group. Nevertheless, known occurrences are either too thin or too low grade to be economically attractive and exploration was not successful in tracing the mineralized beds very far along strike. Dixon (1979) has indicated that the upper two units of the Rae Group as mapped by Baragar and Donaldson (1973) are probably Paleozoic and could be part of the Saline River Group. Similar rocks including red and green beds overlain by dolomites in the Hottah Lake area south of Great Bear Lake are known to contain minor amounts of copper. This environment is favourable for the occurrence of sedimentary deposits.

(37) Coppermine River Group Proterozoic Volcanic Rocks

The Coppermine River lavas host numerous minor copper occurrences that were the object of considerable exploration in the period 1967 to 1969 (Thorpe, 1970; Kindle, 1972). Most of these occurrences are of the minor discordant type and have no economic potential. Nevertheless, a few deposits such as the DOT #47 Zone of Coppermine River Mines Limited (4,106,000 tons 3.07% Cu) and the June deposit of Bernack Coppermine Exploration Limited (1,000,000 tons of 2.5% Cu) eventually might be able to support small mining operations if infrastructure is developed in the area. These small discordant occurrences are somewhat similar to ones in the Natkusiak basalts on Victoria Island and Ekalulia Formation basalts in the Bathurst Inlet area. Generally even under favourable conditions this type of deposit only supports small, marginally profitable mining operations. The large important concordant native copper deposits in the Keweenaw Peninsula of Michigan occur in the same general geological environment as the Coppermine River lavas, however, no significant concordant native copper or copper sulphide occurrences have been documented in the Coppermine River area. During the major exploration period, 1967 to 1969, several occurrences were reported to be of the concordant type. Most of these occurrences were checked by the writer and were found to be local concordant copper concentrations related to cross-cutting mineralized faults and veins. A slight possibility remains that major concordant copper deposits were overlooked during the 1967 to 1969 exploration, but the existence of this type of deposit in this area should be viewed as very speculative.

(38) Hornby Bay and Dismal Lakes Groups

Minor fracture-controlled copper occurrences are known in these rocks but these occurrences have no economic potential. Copper sulphides occur in association with "sandstone- and unconformity-type" uranium deposits and a possibility exists that small amounts of copper could be produced as a byproduct of uranium mining. A minor chance exists of sedimentary copper deposits in these rocks.

(39) Great Bear Batholith-Muskox Intrusion-Hepburn Fold Belt

A variety of small miscellaneous vein and replacement copper deposits might be expected to occur in this area. A remote possibility exists of porphyry deposits related to shallow, felsic porphyritic intrusions in the Bear Province and a slight possibility exists of sedimentary deposits in the Hepburn Fold Belt. Some low grade magmatic Cu-Ni occurrences have been explored along the base of the Muskox Intrusion but these have not shown any economic promise.

(40) Epworth Group Sedimentary Rocks

A low probability exists of sedimentary deposits in these strata and a remote possibility exists of economic Cu-Ni deposits associated with gabbroic sills that invaded the Epworth Group.

(41) Slave Province Archean Rocks

A slight possibility exists of economic copper deposits somewhere within this large area of Archean rocks, especially where small segments of greenstone belts and shallow intrusive rocks might have been missed in the reconnaissance geological mapping of the area. Volcanogenic base metal sulphide, miscellaneous vein and replacement, magmatic Ni-Cu, and porphyry deposits offer the best potential.

(41A) Northern Slave Province Greenstone Belts

A reasonable probability exists of significant copper-rich volcanogenic massive sulphide deposits. Kennco Explorations (Canada) Limited announced 5,206,000 tons grading 3.53% Cu and 2.46% Zn (Northern Miner, March 30, 1967) in their High Lake deposit, which is open to depth. If this tonnage could be increased substantially at this grade or if deposits of comparable grade and tonnage could be found in the area, a reasonable probability exists that viable mining operations could be established in the district before the end of the century. A possibility also exists for miscellaneous vein and replacement, magmatic Cu-Ni, and porphyry deposits in the area.

(41B) Hackett River Greenstone Belt

(41C) Back River Archean Volcanic Rocks

Important polymetallic volcanogenic massive sulphide deposits (e.g., > 20 million tons of Ag- and Zn-rich ore, Northern Miner, June 24,1976) have been outlined in the belts and a reasonable probability exists that more can be found including Cu-rich varieties. If some sort of infrastructure is developed in the northern part of the Slave Geological Province then a reasonable probability exists that some deposits will be developed in the area before the end of the century. A possibility also exists for miscellaneous vein and replacement, magmatic Cu-Ni, and porphyry deposits in these belts.

(41D) Contwoyto Lake-Itchen Lake Area

The important Izok Lake volcanogenic massive sulphide deposit (12,150,000 tons grading 2.8% Cu, 13.77% Zn, 1.4% Pb, and 2.05 oz/ton Ag, Northern Miner, May 5, 1977) occurs in these rocks immediately south of the boundary of the study area. Since this deposit is probably larger than the published tonnage, because a large part of it is probably mineable by open pit methods, and since similar but smaller deposits of the same type are known in the area, a significant probability exists that a mining operation will be established before the end of the century. A porphyry-type Cu-Mo occurrence is known in the area but since it is at an early stage of exploration, insufficient information is available to know whether or not it would support a viable mining operation. A possibility also exists for miscellaneous vein and replacement and magmatic Cu-Ni deposits.

(42) Goulburn Group Proterozoic Cover Rocks

A slight possibility exists for sedimentary deposits, minor copper associated with uranium deposits, some miscellaneous vein and replacement deposits, and magmatic Cu-Ni deposits related to gabbroic sills.

(43) Kilohigok Basin Proterozoic Sediments and Overlying Continental Basalts

Minor discordant copper occurrences are known in Helikian sedimentary and volcanic rocks in the Bathurst Inlet area but none of these occurrences have been demonstrated to have any economic potential. As in the cases of the Minto Arch area on Victoria Island and the Coppermine River area, a slim possibility exists that some of these discordant occurrences might support small mining operations. A slight possibility exists for sedimentary and magmatic Cu-Ni deposits (*see* Campbell, 1978).

(44) Northeastern Slave Gneissic-Granitic Rocks

(46A) Eastern Mackenzie Churchill Province Gneissic-Granitic Rocks

A slight possibility exists of exploitable copper deposits in this large area of crystalline rocks, especially in areas of metamorphosed volcanic and shallow intrusive rocks. Some Cu-Ni occurrences are known south of Perry Island. The geology in this large area is very poorly documented, hence it would be premature to speculate much about the copper potential of these regions.

(45) Hope Bay-Elu Inlet Archean Volcanic Rocks

Some low to modest potential exists for volcanogenic, magmatic Ni-Cu, porphyry, and miscellaneous vein and replacement deposits in this area.

(47A) Proterozoic Thelon Sandstone Formation

A slight possibility exists for sedimentary deposits and minor amounts of byproduct copper associated with "sandstone-" and "unconformity-type" uranium deposits.

(48A) Dubawnt Lake Gneissic-Granitic Area

A slight possibility exists of porphyry and miscellaneous vein and replacement deposits related to shallow granitic and syenitic intrusions and of minor byproduct copper related to "unconformity-type" uranium deposits.

NICKEL, CHROMIUM, ASBESTOS

(37) Coppermine River Group Proterozoic Volcanic Rocks

Nickel-copper, Chromium

Although continental mafic volcanic rocks are exposed in the area, the Muskox layered complex from Area 39 (see below) extends north beneath these rocks in the area immediately east of the Coppermine River (Fraser *et al.*, 1972). This layered complex becomes thicker and wider to the north and has some potential for nickel-copper and chromite deposits. Because of rapidly northward-thickening cover rocks, however, the economic potential is poor.

(39) Great Bear Batholith-Muskox Intrusion-Hepburn Fold Belt

Nickel

Nickel-copper occurrences are associated with the Neohelikian Muskox intrusion, a layered mafic/ultramafic pluton (northeastern part of Area 39, Fig. 26) discovered by the Canadian Nickel Company in 1956, and subsequently explored extensively by that company and others (Smith, 1962; Smith and Kapp, 1968). Nickel-copper sulphides (and associated platinum-palladium) occur in two modes in the 120 km long dyke-like body (Chamberlain, 1967):

1) as nickel-copper sulphide concentrations along the east and west contacts and upper border zone. Erratic values of nickel and copper and discontinuous nature of the sulphide zones makes economic exploitation unlikely;

2) as disseminated nickel-copper sulphides in two thin chromite-rich bands within the central layered series of the pluton. Although continuous, these bands are too narrow and low grade to have economic potential.

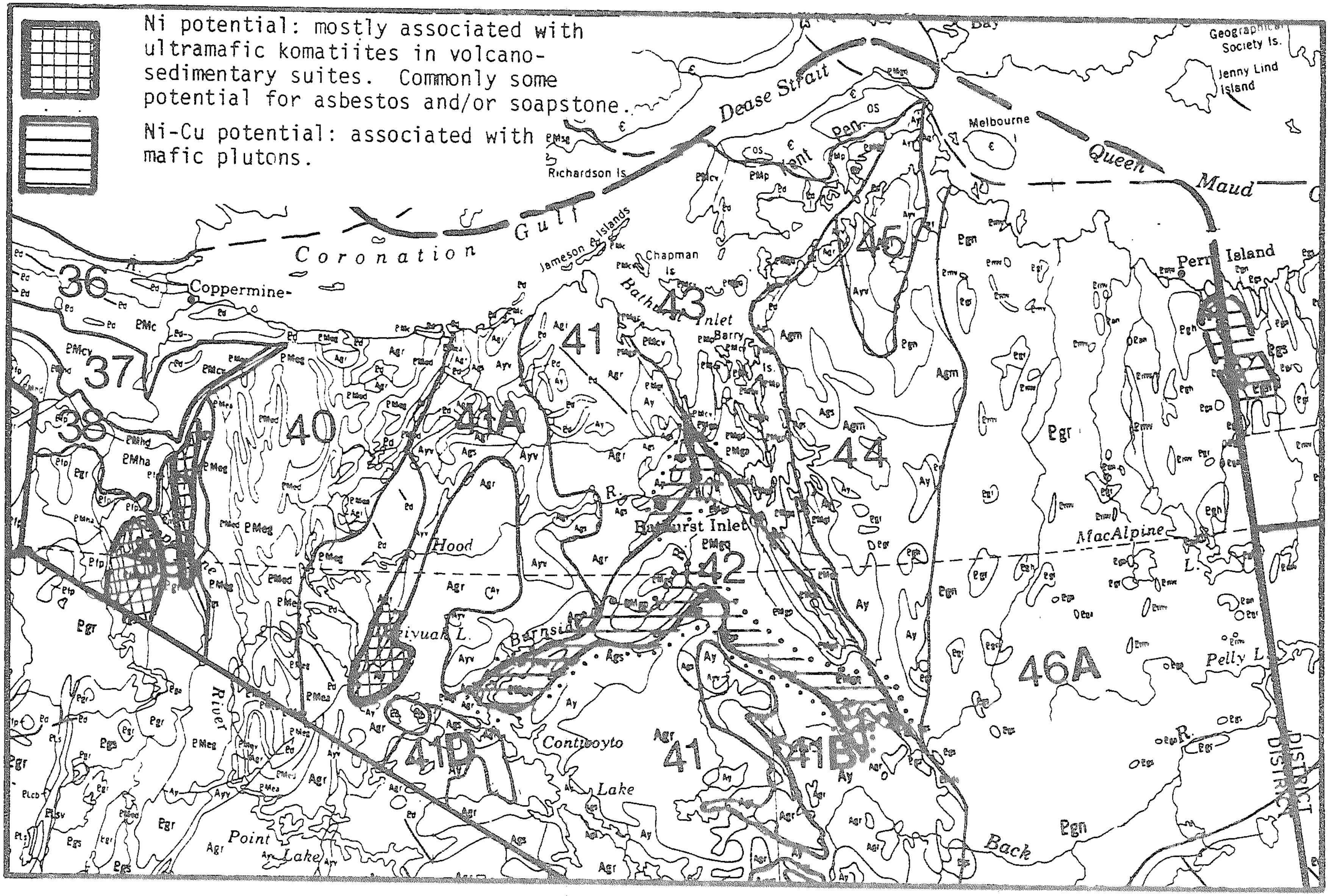


Figure 26: Areas with potential for Ni and Ni-Cu deposits, Northeastern Mackenzie District.

Pods of serpentinite, together with metabasalts, metafelsite, and metasediments in the Akaitcho Group (Hoffman _et al._, 1978) in the south central part of Area 39 (Fig. 26), suggest a komatiitic suite of supracrustal rocks. Although no nickel occurrences are known, the possibility exists of nickel deposits of the komatiitic type associated with these serpentinites.

Gabbroic and pyroxenitic plutons that are considered to be late phases of the Hepburn batholith (Fig. 26: Hoffman _et al._, 1980) could conceivably have some potential for nickel-copper deposits, though no associated nickel occurrences are known, and there are few if any examples of nickel in mafic plutons of this setting.

Chromium

Chromite is known to be concentrated, but not in sufficient quantity to be of economic interest, in one horizon within the Muskox mafic-ultramafic layered complex. It is possible that chromite in more substantial concentration may be present elsewhere in the complex.

Asbestos

Potential for asbestos may exist in serpentinite pods of sufficient size in the Akaitcho Group (Hoffman _et al._, 1978).

(41A) Northern Slave Province Greenstone Belts; Largely Yellowknife Supergroup Rocks

Nickel

Nickel occurrences are not reported in this area; nickel probably has not been a focus for exploration. However, some potential for nickel deposits may exist related to sparse ultramafic rocks east of Takiyuak Lake (Fig. 26) that intrude a sequence of Archean mafic to felsic volcanics and sediments (Gill, 1976). From their setting it seems likely that the ultramafic rocks are komatiitic in character, and that the lithologic assemblage as a whole is broadly similar to komatiite-bearing (nickel-producing) Archean volcano-sedimentary sequences elsewhere.

(42) Goulburn Group Proterozoic Cover Rocks

Nickel-copper

Significant nickel occurrences appear to be lacking in this area. There could conceivably be some highly speculative potential for nickel-copper deposits associated with the extensive gabbroic sills intruded into the basal units of the Goulburn group (Fig. 26: Fraser, 1964; Tremblay, 1971). In a manner similar to that proposed for the nickel-copper deposits of Noril'sk, Russia and the Duluth complex, Minnesota, the gabbroic magma has traversed sulphur-rich wallrocks (pyritic Yellowknife metasedimentary rocks in this case) affording the opportunity to generate nickel-copper sulphides in the magma. These sulphides could segregate into basal concentrations when the gabbroic magma is emplaced as sills. Some evidence for differentiation (e.g., diorite, gabbro, pyroxenite) favours the analogy with Noril'sk and Duluth, but the apparent lack of olivine does not. If such deposits exist they could carry significant contents of platinum and palladium.

(46A) Eastern Mackenzie-Churchill Province Gneissic-Granitic Rocks

See writeup under Central Arctic Region, Area 46B.

V NORTHEASTERN MACKENZIE DISTRICT

VOLCANOGENIC MASSIVE SULPHIDE DEPOSITS

(39) Great Bear Batholith-Muskox Intrusion-Hepburn Fold Belt

Within the western part of the Hepburn Fold Belt portion of this area, rocks of the Akaitcho Group are considered to have moderate potential as hosts for massive sulphide deposits. Hoffman *et al.* (1978) have reported that these rocks consist of metabasalt, metafelsite (rhyolite tuffs, dacitic flows) and metasedimentary rocks (predominantly pelites, rare thin beds of white quartzite). Pods of serpentinite are known in amphibolitic migmatite derived from the Akaitcho Group.

(41) Slave Province Archean Gneissic-Granitic Rocks

(44) Northeastern Slave Gneissic-Granitic Rocks

The possibility for discovery of massive sulphide deposits within these areas is no doubt generally low to very low. However, it is probable that there are local high potential areas in which metamorphosed mixed felsic volcanic-sedimentary rocks are present, but have not been distinguished from more granitoid gneissic rocks at the scale at which they have been mapped.

(41A) Northern Slave Province Greenstone Belts

The High Lake deposit, with more than 5,000,000 tons of proven Cu-Zn ore, is located in the northern part of this area, approximately 50 km from Coronation Gulf, and the small Takiyuak deposits (Hood No. 10 and Hood No. 41 zones) are near the southern tip of the area (see Part I, Section 5 for descriptions of these deposits). Interesting prospects and geology attractive to mineral explorers are found throughout most of the remainder of the area. Consequently, the potential for occurrence of deposits of this type is rated as very high.

(41B) Hackett River Greenstone Belt

The cluster of Hackett River deposits (see Part I, Section 5 and Fig. 8) that have been explored by Cominco Limited in this area, about 80 km southwest of Bathurst Inlet, is interesting because of the high aggregate tonnage (21,000,000) that has been proven to date and their exceptionally high silver content (approximately 4.5 oz/ton Ag). Several other deposits, not yet fully explored, are also known in the belt – the Yava deposit is 40 km to the south and Musk Lake, 35 km farther south.

In view of these proven and partially explored deposits, and other known prospects in the area, the belt must be rated very highly as to its potential for additional discovery and definition of deposits of volcanogenic massive sulphide type.

(41C) Back River Archean Volcanic Rocks

The volcanic rocks in this area were deposited partly under subaerial conditions (Lambert, 1976; 1978), and they are similar in these and other features to the rocks in the Hackett River volcanic belt in the vicinity of the Hackett River and Yava deposits (Frith and Roscoe, 1980). One similarity is the presence of limy tuffs, carbonatized agglomerates, and carbonate-cemented breccias in the Back River and Hackett River areas (Lambert, 1976, 1978; Frith and Roscoe, 1980).

A silver-lead occurrence in the area is compositionally similar to the richest mineralization in the uppermost parts of the Hackett River and Yava massive sulphide deposits (Roscoe, personal communication, 1980). This occurrence and the geological similarities between this area and the Hackett River volcanic belt suggest at least a moderate potential for volcanogenic massive sulphide deposits.

(41D) Contwoyto Lake-Itchen Lake Area

The Izok Lake deposit (see Part I, Section 5 of this report), the richest known of this type in Canada, is just south of the boundary of the study area and a few kilometres west of area 41D. The presence of this deposit is sufficient reason, especially in view of the fact that such deposits normally occur in clusters, to give the area a very high rating for its potential to contain additional deposits of this type.

(45) Hope Bay-Elu Inlet Archean Volcanic Belts

The Hope Bay greenstone belt apparently contains only a very small proportion of felsic volcanic rocks and this may indicate a lower potential for deposits of massive sulphide type than in other greenstone belts in the Slave Province. Also, Cominco Limited and Noranda Mines Limited carried out reconnaissance geological surveys of the belt a few years ago and concluded that it was not particularly favourable. However, the belt does contain a carbonaceous black shale unit, indicating an hiatus in volcanic activity, and the overall potential is rated as moderate.

LEAD-ZINC

(36) Proterozoic (Rae Group) Sedimentary Rocks

Hoffman (1969) noted that in Hadrynian (Helikian?) sediments of the Rae Group, above the Coppermine River basalts, there could be potential for mineralization of the "carbonate-type" in shelf-edge carbonates adjacent to basinal shales and evaporites. Such facies boundaries probably exist in the Richardson River and Hornaday River basins, and on Victoria Island within the Shaler Group sediments.

(40) Epworth Group Sedimentary Rocks

In this area a unit of pyritic and carbonaceous black shale (the Fontano Formation) overlies thick dolomite of the Rocknest Formation. In the Asiak Fold and Thrust Belt east of Cloos Anticline this shale is about 80 m thick (Hoffman *et al*., 1978) and may be a good host rock for base metals.

Within Epworth Group sediments of the Epworth Fold Belt a carbonate to shale facies change is represented by the change from the Kuuvik Formation (carbonate) to the Cowles Lake Formation (Hoffman *et al*., 1970) and may suggest some potential for carbonate-type Pb-Zn deposits (Sangster, 1970 and in Economic Geology Subdivision Open File 492, 1978).

Hoffman *et al*. (1970) also report a few hundred feet of laminated black pyritic shale at the base of the Recluse Formation. "The black shales are interpreted as having been deposited slowly in a deep euxinic marine basin 'starved' of sediment" (Hoffman *et al*., 1970, p. 206). The euxinic basin is considered to have been caused by rapid subsidence accompanied by volcanism in the Great Slave Lake region. These geological parameters suggest the possibility of "shale-type" lead-zinc deposits in the basal Recluse Formation.

(42) Goulburn Group Proterozoic Cover Rocks

According to Campbell and Cecile (1976a), the Aphebian Kilohigok Basin (most of which is contained in Area 42, Fig. 27) was a large, intracratonic basin filled with sediments of the Goulburn Group. The initial transgression of the group across the gneissic Archean basement resulted in deposition of quartzites and quartz-pebble conglomerates of the Western River Formation. Because of the relatively undeformed nature of the Kilohigok Basin, quartzites of the Western River Formation outcrop mainly around the margins of the Basin as shown on a map published by Campbell and Cecile (1976b). Paleogeographic reconstruction (Irving, 1979) suggests deposition of the formation at relatively low paleolatitudes. This, together with the transgressive nature of the Western Arm quartzites and their juxtaposition with sialic basement rocks, results in assignment of a potential for "sandstone-type" lead-zinc deposits to the Western River Formation.

(43) Kilohigok Basin Proterozoic Sediments and Overlying Continental Basalts

Solution collapse breccias have been reported in dolomites of the Helikian Parry Bay Formation(Campbell, 1978; 1979). The breccias were formed before the unconformably overlying Kanuyak Formation and hence are not modern karst breccias. Consequently, because the Parry Bay Formation is almost entirely dolomite, contains solution collapse breccias, and occurs beneath an unconformity, it must be considered as a potential site for "carbonate-type" lead-zinc deposits (Fig. 27). As a negative factor, however, it must be noted that nowhere in the Parry Bay Formation are the breccias cemented by secondary white sparry dolomite (F.H.A. Campbell, personal communication, 1980) so characteristic of ore-bearing carbonate breccias

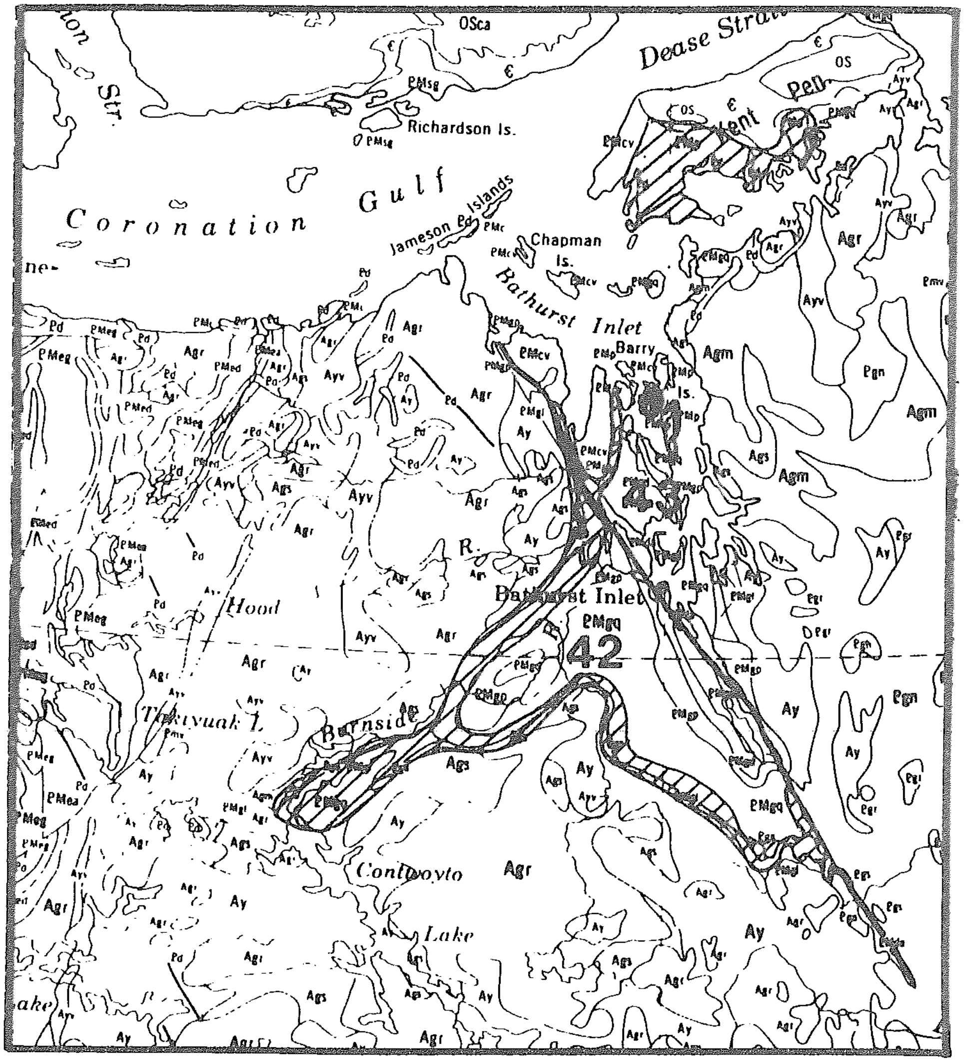


Figure 27: Areas with potential for lead-zinc deposits, Northeastern Mackenzie District.

elsewhere in the world. However, although uncommon, lead-zinc mineralization is known to occur, in certain deposits, without associated white sparry dolomite and so the possibility of a "carbonate-type" lead-zinc deposit cannot be ruled out entirely.

IRON

(41) Slave Province Archean Rocks

Several occurrences of iron-formation in Archean rocks of the Slave Province are of interest mainly for their metallogenic significance as guides in exploration for polymetallic sulphide, nickel, and gold deposits.

MOLYBDENUM

(38) Hornby Bay and Dismal Lakes Groups

A remote possibility exists of extractable byproduct levels of molybdenum in "sandstone"- and "unconformity-type" uranium deposits, should the latter be developed in this area.

(39) Great Bear Batholith-Muskox Intrusion-Hepburn Fold Belt

A possibility exists of porphyry, vein, breccia pipe, and aplite-pegmatite type molybdenum deposits, and byproduct levels of molybdenum in copper and/or uranium deposits, related to shallow, intrusive, felsic porphyry bodies in this part of the Bear Province. Nevertheless, exploration to date has not identified any significant concentrations of molybdenum.

(41) Slave Province Archean Rocks

(41A) Northern Slave Province Greenstone Belts

(41B) Hackett River Greenstone Belt

(41C) Back River Archean Volcanic Rocks

Some low potential exists for various types of molybdenum deposits related to shallow granitic intrusions. The best possibilities are in and near subvolcanic intrusions.

(41D) Contwoyto Lake-Itchen Lake Area

A possibility exists that porphyry Mo and/or Cu-Mo deposits related to shallow, subvolcanic, felsic intrusions may be present. One Cu-Mo porphyry-type occurrence has been identified northwest of Contwoyto Lake, but it is at an early stage of exploration and hence little is known about its economic potential. Some potential also exists for vein and aplite-pegmatite molybdenum deposits related to granitic intrusions in greenstone belt terranes.

(44) Northeastern Slave Gneissic-Granitic Rocks

A very remote possibility exists of viable molybdenum deposits in this felsic crystalline terrane.

(45) Hope Bay-Elu Inlet Archean Volcanic Belts

A slight possibility exists of molybdenum deposits related to shallow granitic intrusions in this area. Thorpe (1972, p. 119) mentioned that molybdenite disseminated and in quartz veins occurs scattered for 8 miles (12.9 km) along the western contact of the Elu Inlet greenstone belt in a reddish dioritic (?) body.

(46A) Eastern Mackenzie-Churchill Province Gneissic-Granitic Rocks

A remote possibility exists of viable molybdenum deposits in this felsic crystalline terrane.

(47A) Proterozoic Thelon Sandstone Formation

A very remote possibility exists of extractable byproduct levels of molybdenum in "sedimentary" uranium deposits.

(48A) Dubawnt Lake Gneissic-Granitic Area

A very slight possibility exists that molybdenum deposits are present in association with shallow granitic and syenitic intrusions and with "unconformity-type" uranium deposits.

TITANIUM, VANADIUM

(41) Slave Province Archean Rocks

In area 41A a differentiated gabbroic (possibly gabbroic to ultramafic) body 10 miles northwest of Kathawachaga Lake, in the Contwoyto Lake area, has been found to contain vanadium-bearing titaniferous oxides (Laporte *et al*., 1978). An estimate for one of two mineralized areas was 61,550 tons per vertical foot of 18.42% Fe, 0.22% V and 11.86% Ti, which would suggest titaniferous magnetite rather than ilmenite as the oxide phase (E.R. Rose, personal communication). Considering the remote location the titanium and vanadium are probably not of economic significance.

VI KEEWATIN REGION

URANIUM

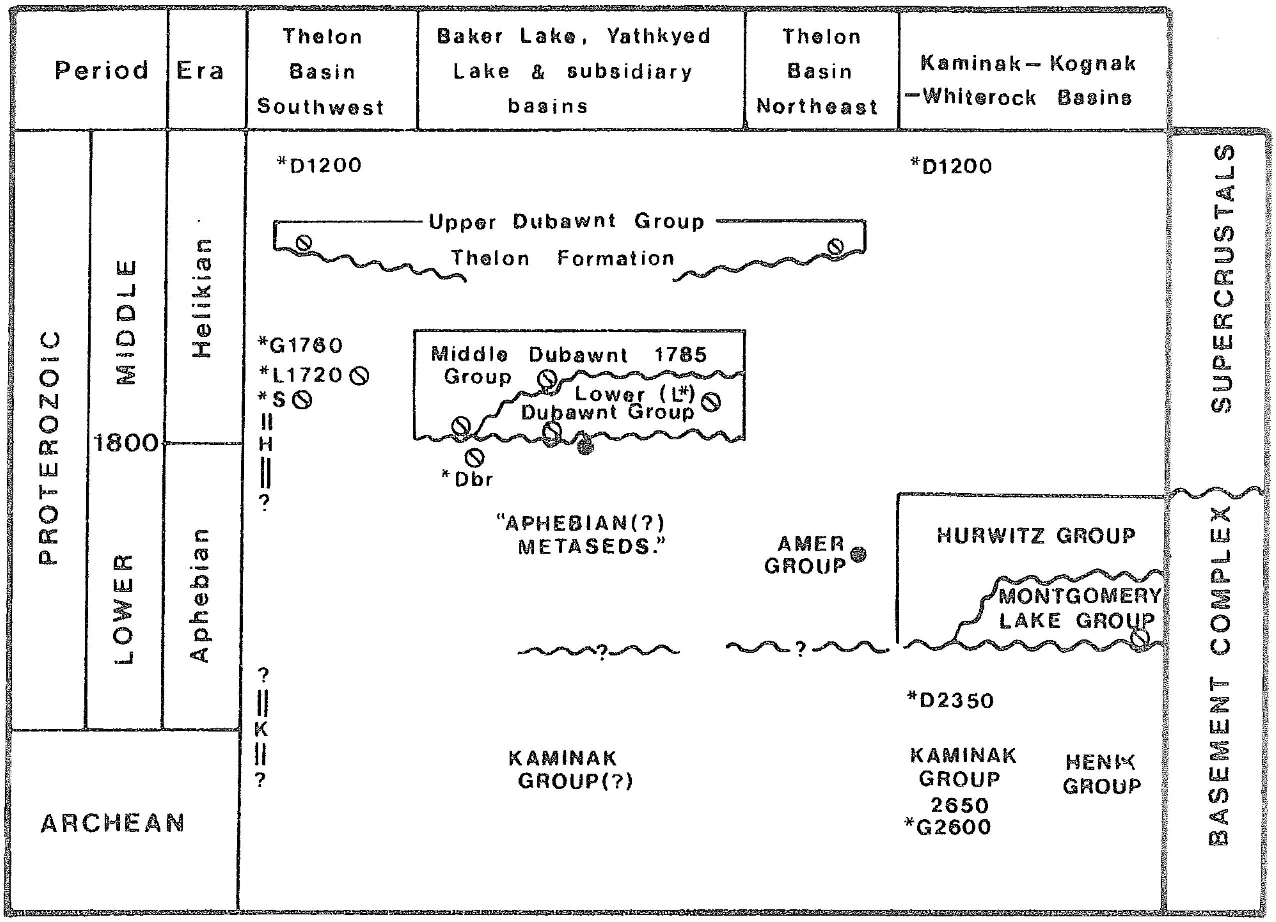
Introduction

The uranium metallogenic province of Keewatin and Mackenzie Districts lies within part of the Churchill Structural Province (Areas 47 to 50). Archean basement rocks, consisting of granitoid gneisses and sedimentary and volcanic belts, were metamorphosed and intruded by granitic plutons during the Kenoran orogeny. Intermittent periods of tectonic stability followed during which Lower Proterozoic (Aphebian) shelf facies sediments were deposited in local basins in the northern portions (Amer Group) and in the central and southern portions (Montgomery Lake and Hurwitz Groups) of the Keewatin District. These rocks were strongly folded and deformed during the Hudsonian orogeny between 1760 and 1835 Ma. (Wanless and Eade, 1975).

During this period segments of the Churchill province underwent a stage of intracratonic rifting with the deposition of continental sediments, volcanics and their related intrusive rocks, termed the Dubawnt Group (Donaldson, 1965). The stratigraphic position of known uranium mineralization in these Proterozoic strata is shown in Fig. 28a.

Method of Evaluation of Uranium Potential

Keewatin Region was evaluated for its uranium and associated base metal potential in terms of six main deposit types, all of which are represented by exploitable concentrations of these metals in Canada or elsewhere in the world. The major deposit types are: i) stratiform pyritic quartz pebble conglomerate ii) stratabound deposits in red continental sandstones and volcaniclastic rocks, iii) fracture controlled mineralization within supracrustal rocks and the basement complex, iv) hypabyssal alkaline and granitoid intrusions, v) syngenetic mineralization within early Aphebian metasedimentary rocks, vi) unconformity-type deposits. The following assessment of this uranium province in the Districts of Keewatin and Mackenzie is discussed in terms of these six deposit types.



|| K, H = Kenoran & Hudsonian orogenies

*G, S, D, L, Dbr = Granite, syenite, diabase, lamprophyre and diatreme breccia; ages in Ma

●⊘⊘ Stratigraphic position of mineralisation

Fig 28a

Stratigraphic position of uranium occurrences associated with Proterozoic supracrustal rocks, District of Keewatin and eastern part of Mackenzie District.

(47A, 47B) Proterozoic Thelon Sandstone Formation

The region outlined by areas 47A and 47B represents the present erosional remnant of a predominantly continental fluvial conglomerate-sandstone blanket of Helikian age that rests unconformably upon a diverse multitude of lithologies ranging from Archean greenstone belts and gneisses to Late Aphebian to earliest Helikian Dubawnt sedimentary and volcanic rocks.

The Thelon Formation overlies predominantly early Aphebian Amer Group and equivalent(?) units and late Aphebian-earliest Helikian volcanic and sedimentary rocks of the lower Dubawnt Group along its northeastern and southeastern margins, an area extending from northwest of Schultz Lake southwestward to Outlet Bay. The remainder of the Thelon Formation rests predominantly upon granitoid gneisses along its northern and northwestern margins (Wright, 1967; Donaldson, 1969).

Unconformity-type uranium deposits typified by known economic deposits in the Athabasca region, Saskatchewan exhibit the following principal features: 1) they are stratigraphically confined to the unconformity surface between continental fluvial sandstones and an underlying basement complex 2) host rocks are most commonly of Aphebian or Helikian age 3) they are associated with faults in the basement complex and overlying sandstone 4) extensive chemical alteration has taken place along the unconformity 5) they are spatially related to areas where sandstones are underlain by early Aphebian metasedimentary rocks (Tremblay, 1978a; Hoeve, 1978; Hoeve and Sibbald, 1978a).

Based on reconnaissance mapping (Wright, 1967; Donaldson, 1966, 1969), these geological parameters have been recognized in areas 47A and 47B, and the favourable areas will be discussed in relation to whether or not they lie outside or within the Thelon Game Sanctuary (Fig. 28b). The latter covers approximately 66% of the combined areas of 47A and 47B and has been set aside as a wildlife refuge in which mineral exploration is prohibited.

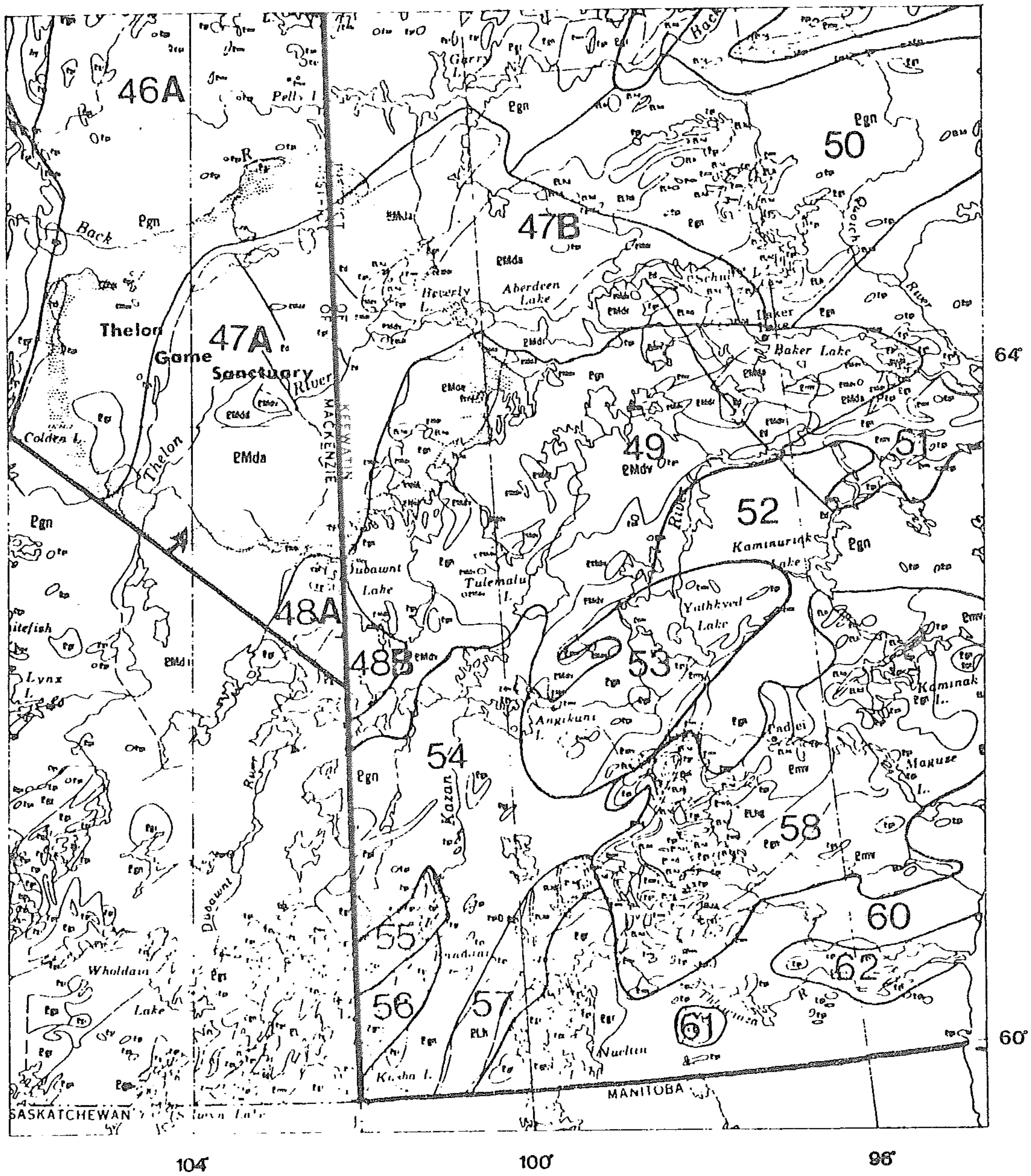


Fig. 28b: Thelon Game Sanctuary, District of Keewatin and Mackenzie. The stippled zone lies in-side the boundary of the sanctuary.

The most favourable area outside the sanctuary is in the general Schultz Lake-Marjorie Lake region (part of area 50 and the eastern part of area 47B). The Thelon Formation predominantly overlies Amer Group and equivalent strata in these areas. The Thelon sandstone is relatively thin here in its main area of exposure as well as in a number of small outliers. Exploration has been actively conducted in this region since the early 1970's and to date one potentially economic high grade uranium deposit, named the Lone Gull, owned by Urangesellschaft Canada Ltd. has been found and is under active drill exploration. This deposit is approximately 75 km west of the hamlet of Baker Lake. No final reserve figures have been calculated by Urangesellschaft Canada Ltd. but on the basis of 20 mineralized diamond drill holes the company has suggested it might be possible to prove 20 million pounds of U_3O_8 (Northern Miner, Sept. 21, 1978; July 19, 1979, p. C21).

In addition, Thelon Formation sediments overlie predominantly granitoid gneisses south of Garry Lake, area 47B, and west of Dubawnt Lake, area 48A (Wright, 1967) and may be somewhat less favourable in these areas, although the potential is still considered to be good. Consequently these regions outside the Thelon Game Sanctuary possess a very high potential for unconformity-type uranium mineralization considering the presence of one potentially economic deposit west of Baker Lake and their striking similarity to the Athabasca uranium district.

Several areas within the sanctuary in areas 47A and 47B are very similar to the Schultz Lake-Marjorie Lake region. These are: i) the area west of Lookout Point on the Thelon River, ii) the area west and northwest of Beverly Lake and iii) the area from Dubawnt Lake northeastward to Marjorie Lake. These exhibit the combination of geological parameters that suggest a very high potential for uranium mineralization. The Thelon Formation overlies granitoid basement along the northwest portion of areas 47A and 47B (Wright, 1967). The absence of Aphebian metasedimentary basement rocks suggests that the uranium potential for this segment of area 47A-47B is less than where Aphebian rocks occur, and consequently the potential is rated as moderate to high.

(49) Baker Lake Basin (Dubawnt Group Rocks)

The Baker Lake Basin is defined as a belt of continental sedimentary and volcanic rocks with related intrusive equivalents that extends southwestward from the eastern end of Baker Lake to Tulemalu Lake, a distance of approximately 300 km (LeCheminant et al., 1979b). Smaller parallel subbasins occur in the areas of: i) Yathkyed-Angikuni Lakes, ii) Kamilukuak-Dubawnt Lakes and iii) in the area from Outlet Bay to Wharton Lake. The latter area lies within the Thelon Game Sanctuary.

The Dubawnt Group comprises a three-fold sequence of rocks i) a lower clastic redbed sequence-South Channel and Kazan formations, ii) a volcanic-sedimentary sequence comprising the Christopher Island, Kunwak and Pitz formations and iii) an upper red clastic sequence, the Thelon Formation. The Dubawnt Group rests upon a variable basement complex consisting of Archean and/or early Aphebian metasedimentary and metavolcanic rocks, granitoid gneisses and mafic to felsic intrusive rocks (Donaldson 1965; LeCheminant et al., 1976, 1977, 1979a, 1979b, 1980; Eade, 1976; Eade and Blake, 1977). These lithologies in area 49 have been the focus of intensive uranium exploration since the late 1960's and as a consequence uranium with associated metals (Cu,Pb,Ag,Mo,Se,Au,Zn) and base metal occurrences (Cu,Pb,Zn) have been recognized principally in the Dubawnt Group rocks as well as the immediately adjacent basement complex.

The uranium potential of the area defined as the Baker Lake Basin has been assessed with respect to the following mineralization styles:

i) red continental fluvial arkosic and volcaniclastic sediments,

ii) fracture controlled mineralization in Dubawnt Group rocks and adjacent basement complex, and

iii) hypabyssal alkaline and granitoid intrusions.

i) Red continental arkosic and volcaniclastic sediments

Continental fluvial lithologies that host uranium mineralization can be subdivided into a) red arkosic sandstones and conglomerates and b) red volcaniclastic conglomerates, sandstones and siltstones.

a. Sandstone-hosted deposits

Sandstone hosted mineralization is predominantly restricted to the eastern portion of the Baker Lake Basin between the Kazan River and Christopher Island, at the eastern end of Baker Lake. Mineralization, uranium with subordinate copper and silver, is restricted to continental alluvial fan-braided river deposits which consist of an interbedded conglomerate-sandstone sequence.

Mineralization exhibits a close spatial relationship to porous arkosic sandstone beds of the Kazan Formation that have been intruded and altered by large dyke complexes that are considered to be both equivalent in age and genetically related to the Christopher Island Formation (Miller, in press). Since 1973, Pan Ocean Oil Ltd. has been actively exploring the U-Cu-Ag occurrences in the area of Bissett and Martell Lakes, approximately 60 km south-southeast of the settlement of Baker Lake. Exploration diamond drilling in 1975 and 1976 to a depth of 587 ft. (179 m) on these occurrences has shown well mineralized arkosic units with intersections of 372 ft. (113 m) averaging 2.6 lbs U_3O_8 (Northern Miner, Oct. 4, 1979, p. 1). Deep drilling in 1979 on the same prospects intersected mineralization to 1140 ft (347 m) with grades of around 1 lb. U_3O_8/ton over one to two foot (30 to 60 cm) vertical thicknesses (Northern Miner, Oct. 4, 1979, p. 1, 2).

The factors that govern mineralization, porous facies of the Kazan Formation intersected by major dyke complexes, suggest, on the basis of geological mapping of the Eastern Baker Lake Basin (Donaldson, 1965; Skippen, unpublished data; LeCheminant *et al.*, 1976, 1977), that the potential for sandstone-hosted U-Cu-Ag mineralization is moderate to high.

b. Deposits hosted by volcaniclastic sediments

The formations that overlie the Kazan Formation, namely the Christopher Island, Kunwak and Pitz Formations, record a period of subaerial volcanism with contemporaneous mass wasting and fluvial deposition. (LeCheminant *et al.*, 1979 a, b; 1980). Sediments intercalated with the volcanic flows and pyroclastics of the Christopher Island and Pitz Formations are of local distribution and range from conglomerate to immature wacke, sandstone, siltstone and shale. However, the Kunwak Formation records a period of alluvial fan sedimentation during a magmatic hiatus that separates the volcanism and sedimentation of the Christopher Island Formation from that of the Pitz Formation. These fluvial sediments may exhibit post-depositional redox alteration indicating a suitable environment for uranium concentration (LeCheminant *et al.*, 1979a; Miller, 1979). Consequently volcaniclastic sedimentary rocks interbedded with subaerial lava and pyroclastic rocks of the Dubawnt Group represent a favourable exploration target within the Baker Lake Basin.

ii) Fracture controlled mineralization

Fracture controlled mineralization within Baker Lake Basin can be divided into two types, a) uranium with associated base metals and, b) base metal mineralization.

Fracture controlled mineralization represents the commonest style of mineralization throughout the Baker Lake Basin area. In many occurrences uranium is the principal metal and it is found in a variety of base metal associations, i) Cu-Pb-Mo-Ag±Zn, ii) Cu-Pb-Se-Au-Ag and iii) Cu-Mo. These occurrences are widely distributed throughout the Baker Lake Basin area but show a spatial relationship to the present margins of the Dubawnt Group rocks and the immediately adjacent or underlying basement complex.

Exploration diamond drilling in the late 1960's by Pan Ocean Oil Ltd. on various prospects in the Christopher Island area, eastern end of Baker Lake, and southwestward from there to Kazan Falls, has indicated subeconomic concentrations of uranium with base metals. Prospects in the Christopher Island area have the following estimated metal contents: 68-1 contains 160,000 lb. U_3O_8 and 150,000 lb. MoS_2 and 68-2 contains a maximum of 1,000,000 lbs. U_3O_8 and 2,000,000 lbs. MoS_2 (Northern Miner, Aug. 8, 1974, p. 17).

The 68-4 prospect, located immediately southeast of Kazan Falls, consists of three north to northwest trending fracture systems that were examined to a depth of 300 ft. (90 m) by six diamond drill holes. A mineralized body was established along the easterly zone and found to contain an estimated 1,000,000 lbs. of U in ore averaging 0.46% U_3O_8 over 6 ft. (1.8 m)(Northern Miner, Aug. 8, 1974, p. 17). The geological setting of the above prospect with its associated mineralization is strikingly similar to the fracture controlled uranium deposits in the Beaverlodge District, Saskatchewan (Tremblay 1972; LeCheminant and Miller, 1978). Thus fracture zones in Dubawnt Group rocks and the basement complex immediately adjacent to these rocks possess a high to very high potential for viable uranium-base metal deposits.

Numerous fracture-controlled base metal occurrences of Cu, Cu-Pb and complex (Pb-Cu-Ag-Bi-Cd-Zn) types have been recognized within Dubawnt Group rocks north and northeast of Tulemalu Lake (LeCheminant et al., 1980). Most occurrences represent small discontinuous concentrations of disseminated to massive sulphides associated with quartz-epidote-fluorite-garnet or quartz-fluorite stockworks. Uranium mineralization is present but is rare and sporadic. Based on the above characteristics the potential for economic vein-type massive sulphide deposits is rated as low.

iii) Mineralization associated with syenitic and granitic intrusions

The intrusive rocks with which mineralization is associated are 1) individual and composite alkalic intrusions related to the Christopher Island Formation alkalic volcanic rocks and 2) fluorite bearing granitic intrusions.

Uranium-bearing occurrences associated with alkalic rocks can be subdivided into: a) Th-U type in alkalic intrusions, and b) U-Cu type in composite syenite-granite complexes and altered wallrocks.

Alkalic intrusions

Alkalic intrusions, termed bostonite, occur principally as dykes, sills and porphyritic stocks within the basement complex and Dubawnt Group rocks in the area north and northwest of Nutarawit Lake (Miller 1979; LeCheminant et al., 1980). Uranium mineralization exhibits two modes of occurrence in association with the bostonitic intrusions, i) disseminated refractory thorium and uranium-bearing minerals and, ii) fracture-filling assemblages of pitchblende with base metal sulphides of Pb, Cu and Mo in and immediately adjacent to intrusive units.

Bostonitic dykes and sills, the predominant intrusive forms, occur as narrow discontinuous units, 1-25 m in width and rarely up to 100 m wide by 300 m long. The radioelement potential of these intrusions is dependent upon the concentration of disseminated refractory thorium- and uranium-bearing minerals, the density of fractures containing uranium and base metals, and dimensions of the bostonitic intrusions. Thus, considering these variables, the potential for viable uranium and/or thorium deposits with subordinate base metals is considered low to moderate.

Composite syenite-granite intrusions

A large composite syenite-granite body has intruded Christopher Island volcanic and sedimentary rocks in an area west of Ford Lake and north of Nutarawit Lake (LeCheminant et al. 1979b, c). Zones within this complex exhibit anomalous radioactivity, in particular the border facies, and uranium with subordinate copper mineralization has been recognized within the border zones and enclosing metasomatically altered rocks (Miller 1979, LeCheminant et al., 1979b, 1980).

Throughout the Baker Lake Basin area, the basement complex and Dubawnt supracrustal rocks are intruded by a variety of alkalic intrusions ranging from differentiated ultramafic to complex mafic syenite intrusions within the basement complex and mafic syenite to composite syenite-granite intrusions within the Dubawnt supracrustal rocks (LeCheminant et al., 1976, 1977, 1979b, 1980; Eade, 1976; Eade and Blake, 1977).

Known mineralization appears to be related to a composite syenite-granite complex, of which only one has been recognized to date. Consequently the factors governing mineralization, namely; i) differentiated complexes within Dubawnt supracrustal rocks and, ii) a high density of mineralized fractures, make this contact metasomatic type of uranium mineralization an exploration target with a moderate to low potential.

Fluorite-bearing granitoid rocks

Post-Hudsonian fluorite-bearing granites, known as the Nueltin Lake granites, and fluorite-bearing granites associated with Dubawnt Group rocks intrude Archean/Aphebian granitoid basement gneisses, Aphebian metasedimentary and metavolcanic rocks and late Aphebian-early Helikian strata throughout southern Keewatin District in the Nueltin-Ennadai Lakes area (areas 55, 56, 57) and northeasterly from there to the Amer Lake-Tehek Lakes area (area 50; Eade 1973, LeCheminant et al., 1980, 1979b, 1977, 1976; Reinhardt and Chandler, 1973). In younger geologic terranes some fluorite-bearing granitic bodies contain uranium, molybdenum, tungsten, tin, and gold mineralization. However there is little information concerning this mineralization type in the study area and the potential is consequently considered as unknown.

(50) Amer Group Proterozoic Sediments and Minor Enclosing Gneisses

(50A) Gneisses, minor Amer Group Proterozoic Sediments

Proterozoic supracrustal metasedimentary rocks of areas 50 and 50A are principally confined to the region enclosed by Baker, Schultz, Amer and Tehek Lakes, although isolated belts occur to the northeast (area 50A). Metasedimentary rocks of the Amer Lake area, informally termed the Amer Group (Heywood, 1977) comprise a sequence of metamorphosed quartzite, feldspathic sandstone, conglomerate, slate, carbonate rocks and derived schists and phyllites of probable Aphebian age which were correlated with rocks of the Hurwitz Group (Wright, 1955, 1967).

The Amer Group overlies a heterogeneous assemblage of volcanogenic rocks, granitoid gneisses and a variety of schists and paragneisses along its northwest and southeast margins (Wright 1967; Tippett and Heywood, 1978) and is unconformably overlain by the Helikian Thelon sandstone along its southwestern margin (Wright, 1967). The Amer Group as defined by Tippett and Heywood (1978) consists of seven units representing two major clastic sequences that are separated by a series of transitional units. The upper clastic unit of the Amer Group hosts the majority of the stratiform uranium occurrences (Curtis and Miller, 1980) which are laterally continuous. This clastic unit consists of folded pelitic, arenaceous and argillaceous metasedimentary rocks. The uranium is accompanied by minor quantities of copper, lead, molybdenum and cobalt.

In 1970, Aquitaine Co. of Canada Ltd., by diamond drilling 37 holes totalling 26,802 ft. (8169 m), proved mineralized lenses over a distance of 600-1525 m with intersections of 0.05-0.12% U_3O_8 over 1-2 m (Laporte, 1974a).

The presently known stratiform uranium mineralization within early Aphebian, Amer Group metasedimentary rocks is strikingly similar to such stratabound U, U-Au and U-Cu deposits as Jabiluka, Ranger and Koongarra in the Cahill Formation, Pine Creek Geosyncline, Australia (Needham and Stuart-Smith 1976; Stuart-Smith et al., in press; Curtis and Miller, 1980) and to deposits within the Wollaston uranium subprovince (Tremblay 1978). Consequently the potential for uranium deposits in the Aphebian metasedimentary rocks appears to be high to very high.

The isolated remnants of metasedimentary rocks in 50A northeast of the Amer-Tehek Lake area represent potential uraniferous environments. However information as to their age, lithological variations and stratigraphic position with respect to the Amer Group rocks is incomplete and therefore the potential is unknown. The potential of the enclosing gneisses to the Amer Group metasedimentary rocks is considered low to negligible.

(58) Kognak River-Tavani Greenstone Belt

The principal area in the Keewatin Region for possible stratiform uranium deposits of pyritic quartz pebble conglomerate type is the Kognak River-Tavani Greenstone Belt (area 58; Map 1). However the rock sequence of interest, termed the Montgomery Lake Group, occupies a limited area immediately west and northeast of South Henik Lake (Figure 29; Eade & Chandler 1975; Eade 1964, 1966, 1974; Bell, 1968, 1970). The folded and metamorphosed continental fluvial sedimentary rocks of the Montgomery Lake Group rest unconformably upon an Archean basement complex consisting of metasedimentary and metavolcanic rocks, "greenstones" and a variety of granitoid gneisses and intrusive rocks. The Montgomery Lake Group consists of a basal pyritic boulder-cobble conglomerate which fines upward into greywacke and quartzite units. The upper unit of the Montgomery Lake Group is overlain by the Hurwitz Group and is interpreted, based on its stratigraphic and lithological features, to be early Aphebian.

Early Aphebian pyritic conglomerates can contain economic concentrations of uranium and/or gold as proven by the Elliot Lake deposit, Canada, and Witwatersrand deposits, South Africa. Features considered favourable for the concentration of uranium and/or gold in such coarse clastic sedimentary rocks are: i) an early Aphebian age, ii) continental fluvial sediments comprised of coarse conglomerates with finer arkosic units, iii) drab coloured pyritic sediments. The metasedimentary sequence of the Montgomery Lake Group displays each of these features and thus represents a suitable environment for paleoplacer uranium-gold mineralization.

The pyritic conglomerates near Henik Lakes were first noted by prospectors of the Kasba syndicate in the early 1950's (Lord, 1953). It was also noted then that they contained a little gold and resembled Witwatersrand conglomerate.

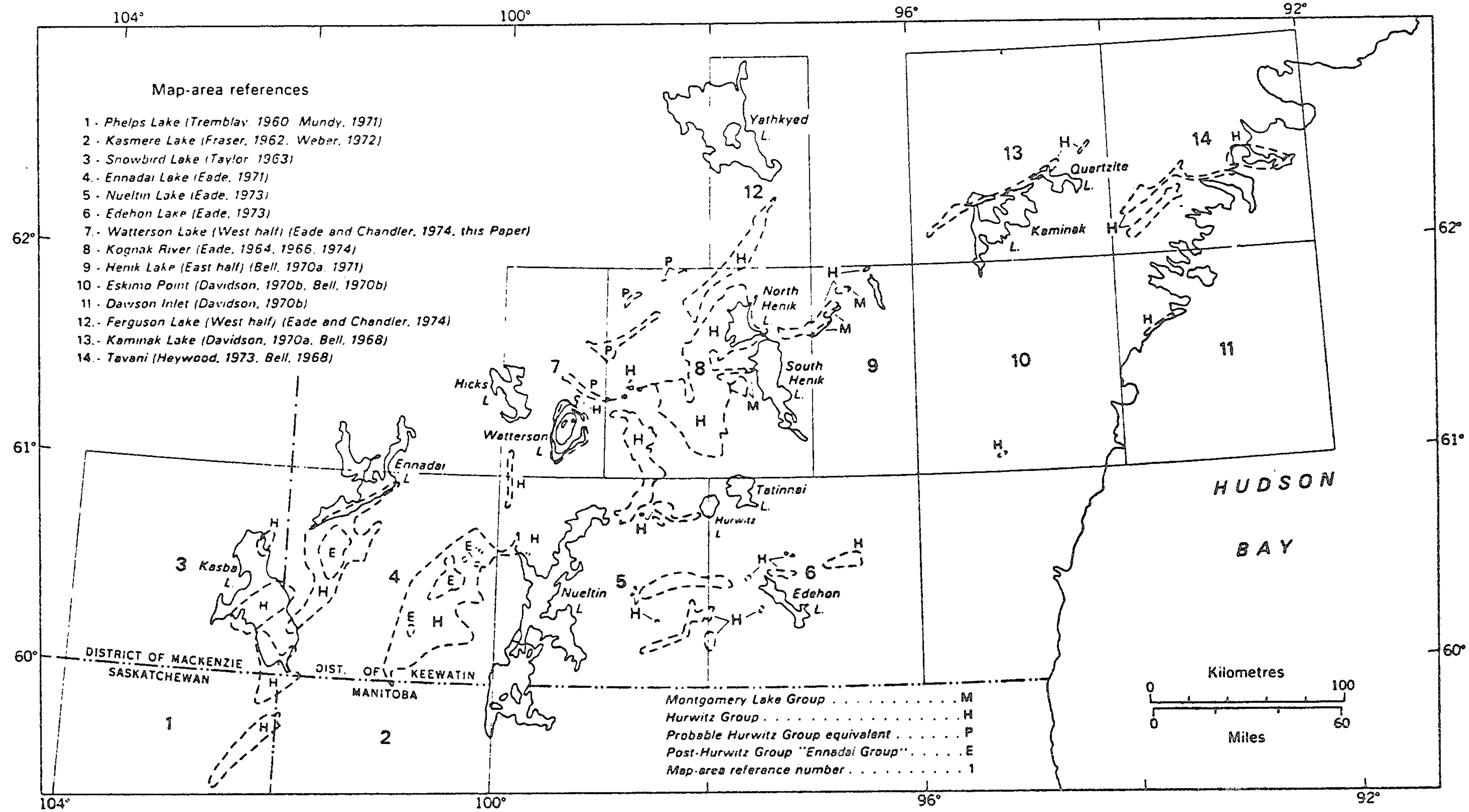


Figure 29: Distribution of Hurwitz Group and associated rocks (Eade and Chandler, 1975).

Conglomerate beds at Cabin Lake 15 km northeast of Henik Lake were tested by drilling in 1960 and found to contain only erratic values in gold, up to 0.1 oz/ton in short sections. Anomalous uranium, thorium and gold values were later found within a pyritic quartz pebble conglomerate sample from a locality 20 km farther northeast (Heywood and Roscoe, 1967). Beds through an 80 m stratigraphic thickness at this locality were tested by drilling in 1970, and other drilling was done at Kinga Lake 12 km farther northeast. The richest intersection that we are aware of contained only 0.017% U_3O_8 and trace amounts of gold through 0.4 m (Roscoe, personal communication, 1980). There are possibilities that richer beds may be found at deeper stratigraphic levels, and also that much uranium had been leached from the beds intersected at shallow depths below the surface. The lack of encouraging assays and the limited areal extent of known favourable strata, however, lead us to consider the potential for viable deposits of this type to be no better than moderate.

GOLD

(47B) Proterozoic Thelon Sandstone Formation

The overall rationale and rating are the same as for area 47A (Northeastern Mackenzie District). If the possibility is considered good that gold could have been reworked from earlier concentrations in Aphebian clastic sediments of the Amer Lake Group (see later comments for area 50), the potential for gold deposits to occur may be a little higher than in area 47A. Also volatile-rich calc-alkaline volcanic rocks of the Pitz Formation in area 49 could host gold deposits that might serve as an additional gold source.

(48B) Dubawnt Lake Gneissic-Granitic Area

Rating and rationale as for area 46A (see notes for Northeastern Mackenzie District).

(49) Baker Lake Basin (Dubawnt Group Rocks)

There is a possibility for gold deposits in association with felsic plutons and volcanic rocks in the area. The volatile-rich calc-alkaline volcanic rocks of the Pitz Formation would seem logical hosts for hydrothermal gold veins. Gold veins could also be hosted by the alkaline rocks of the Christopher Island Formation and associated Martell Intrusions. One gold-bearing vein that cuts rocks of the Kazan and Christopher Island Formations is known in the eastern part of the Baker Lake Basin. The potential for such veins may be particularly good in association with syenite to syenomonzonite bodies of the Martell Intrusions in the east part of the Baker Lake Basin (A. Miller, personal communication).

Sandstone and conglomerate of the South Channel and Kazan Formations could host paleoplacer gold deposits. These sedimentary rocks are relatively near possible gold sources in Archean greenstone and Aphebian (Amer Group) sedimentary sequences. However, the coarse clastics of the South Channel Formation are immature and not highly favourable for that reason.

The gold potential is rated as low for the western part of the area, but for the eastern part, east of Mary Princess Lake, the potential is rated as low-moderate.

(50) Amer Group Proterozoic Sediments and Enclosing Gneisses

The coarser clastic basal portion of the Amer Group sediments could host paleoplacer gold deposits. Potential gold sources are Prince Albert Group rocks in areas 24 and 26 to the north (Central Arctic Region) and greenstone belts in area 51 to the southeast.

The overall gold potential is probably low, but a low-moderate rating is considered reasonable for the western part of the area where Amer Group rocks are most abundant.

(51) MacQuoid Lake-Cross Bay Volcanic Belt

The presence of volcanic-sedimentary belts in this area is considered to be sufficient evidence to give the area a moderate rating for the presence of gold deposits. The area is not well enough known from geological mapping or records of exploration activities to identify important smaller-scale metallotects.

(52) Kaminuriak Lake - Chesterfield Inlet Gneiss Belt

Some metasedimentary (and even metavolcanic) rocks could be included within this very large area and have potential as hosts of gold deposits. Such rocks would probably especially have potential if they have not been metamorphosed above the lower amphibolite facies. However, in general and as noted for area 46A, the gold potential of this area must be rated as very low.

(53) Angikuni Lake - Yathkyed Lake Volcanic Belt

The notes for area 51 generally apply here. In a large part of the area small, highly metamorphosed areas of mafic volcanic rocks included in gneisses represent the remnants of an originally more extensive supracrustal sequence.

The overall gold potential is rated as low to moderate.

(54) Kazan River Gneissic-Granitic Terrane

Many of the Aphebian/Archean gneissic-granitic rocks of the area are probably of no importance from the point of view of gold potential. However, there could be some potential for hydrothermal vein deposits in association with some bodies of late fluorite-bearing granite. The gold potential is rated as very low.

(55) Ennadai Lake Volcanic Belt

This area consists of rocks that are typical of Archean greenstone belts. Because of this and the presence of a large number of small gold occurrences, the gold potential is rated as high.

(56) Kasba Lake-Ennadai Belt of Hurwitz Group Rocks

The basal orthoquartzite unit of the Hurwitz Group is exposed only in one small area within the belt (Eade, 1971). Although not known to be exposed elsewhere, the unit is probably present beneath other Hurwitz sedimentary rocks. This basal orthoquartzite is considered to have low to moderate potential for gold.

(57) Poorfish Lake-Watterson Lake Belt of Hurwitz Group Rocks

A unit of white orthoquartzite (Kinga Formation; Eade and Chandler, 1974, 1975) that occurs at or very near the base of Hurwitz Group sedimentary rocks in Watterson Lake basin could contain paleoplacer gold deposits. The gold potential is rated as low to moderate.

(58) Kognak River-Tavani Greenstone Belt

This area contains the known B Zone, A Zone and Shear Lake deposits in the Cullaton Lake area (see Part I, Section 5). The B Zone deposit is associated with Proterozoic iron formation and the Shear Lake deposit is in a fault zone and associated fractures in Proterozoic quartzite. There are also a large number of minor gold occurrences in quartz veins and schist or "shear" zones in Archean volcanic rocks. The latter rocks are most abundant from about 25 km west of Padlei to the northeast end of the belt. Within these greenstone belts favourable exhalite horizons, including carbonate iron formation with which some important gold deposits are known to be associated in Superior Province and elswhere in the world, have been reported by Ridler (1971, 1972, 1973, 1974) and Ridler and Shilts (1974a, 1974b).

Quartz pebble conglomerate, pyritic at least in part, of the Montgomery Lake Group in the vicinity of South Henik Lake is of Early Aphebian age and has moderate potential for paleoplacer gold deposits of the Witwatersrand type. A minor occurrence of this type is known at Ameto Lake.

The overall gold potential of the area is rated as very high.

(59) Rankin Inlet Volcanic-Intrusive Rocks

Although the age of mafic volcanic rocks in the area may be either Aphebian or Archean, and empirical observation suggests that Archean rocks are better hosts than those of Aphebian age, the gold potential is nevertheless provisionally rated as moderate.

(60) Nueltin Lake-Eskimo Point Gneissic-Granitic Terrane

There could be some potential for hydrothermal vein-type gold deposits in association with fluorite-bearing granites of the Nueltin type in this area. However, the general gneissic-granitic character of the terrane means that the overall potential for discovery of gold deposits is very low.

(61) Unnamed Area of Archean and Hurwitz Group Sedimentary Rocks

This is a small area containing sedimentary rocks of both Archean and Aphebian ages. These rocks could host gold deposits of vein or paleoplacer type, but their potential is probably best rated as low to moderate.

(62) Thlewiaza River Archean Greenstone Belt

This belt of volcanic-sedimentary rocks is poorly exposed and is not well known from either a geological mapping or exploration viewpoint. Based only on the character of the rocks and their probable Archean age, the potential is rated as moderate to high.

SILVER

(49) Baker Lake Basin (Dubawnt Group Rocks)

Silver is present in a number of base metal and complex uranium occurrences in the area. There could be important hydrothermal silver-rich veins in the area, but the greatest potential is probably for by-product production from base metal or complex uranium deposits.

The overall silver potential is rated as low.

COPPER

(47B) Proterozoic Thelon Sandstone Formation

A slight possibility exists for sedimentary deposits and minor amounts of byproduct copper associated with "sandstone- and unconformity-type" uranium deposits.

(48B) Dubawnt Lake Gneissic-Granitic Area

A slight possibility exists of porphyry and miscellaneous vein and replacement deposits related to shallow granitic and syenitic intrusions and of minor byproduct copper related to "unconformity-type" uranium deposits.

(49) Baker Lake Basin (Dubawnt Group Rocks)

A possibility exists of porphyry deposits (including breccia pipes) and of miscellaneous vein and replacement deposits associated with subvolcanic granitic and syenitic intrusions. A slight possibility exists for sedimentary deposits and minor byproduct copper associated with "sandstone- and unconformity-type" uranium deposits. Minor barren skarns have been found in this area (LeCheminant, personal communication, 1980) which are encouraging for the occurrence of mineralized skarns.

(50) Amer Group Proterozoic Sediments and Minor Enclosing Gneisses

Minor amounts of copper occur associated with "sandstone-type" uranium prospects (A. Miller, personal communication, 1980) and a slight possibility exists for sedimentary copper deposits in the area. A slight possibility exists for magmatic Cu-Ni deposits associated with gabbroic sills and plugs and of volcanogenic and miscellaneous vein and replacement deposits in the basement metavolcanic rocks. A slim possibility exists for porphyry deposits associated with either Archean or Proterozoic felsic to intermediate sub-volcanic intrusions.

(50A) Gneisses, Minor Amer Group Proterozoic Sediments

A low probability exists of some unpredictable type of copper deposits in this area of poorly documented geology.

(51) MacQuoid Lake-Cross Bay Volcanic Belt

A low probability exists of volcanogenic massive sulphide, magmatic Cu-Ni, porphyry, and miscellaneous vein and replacement deposits in this metavolcanic belt.

(52) Kaminuriak Lake-Chesterfield Inlet Gneiss Belt

A low probability exists of copper deposits in this poorly documented area, especially in small, possibly unmapped greenstone belt remnants.

(52A) Daly Bay Complex

A very slight possibility exists of copper deposits in these very high grade metamorphic rocks, especially for magmatic Cu-Ni deposits associated with metagabbroic and noritic intrusions.

(53) Angikuni Lake-Yathkyed Lake Volcanic Belt

Magmatic Ni-Cu mineralization associated with amphibolitic rocks is known in the Ferguson Lake area. Possibly more substantial deposits of this type occur in the area. A possibility also exists for volcanogenic massive sulphide, porphyry, and miscellaneous vein and replacement deposits in the area.

(54) Kazan River Gneissic-Granitic Terrane

A low probability exists of copper deposits in this poorly documented terrane, especially in small, possibly unmapped, greenstone belt remnants, and porphyry and miscellaneous vein and replacement deposits associated with Nueltin-type intrusions (Eade, 1973).

(55) Ennadai Lake Volcanic Belt

A low to moderate probabiltiy exists of volcanogenic massive sulphide, magmatic Cu-Ni, porphyry, and miscellaneous vein and replacement deposits in this metavolcanic belt.

(56) Kasba Lake-Ennadai Belt of Hurwitz Group Rocks

(57) Poorfish Lake-Watterson Lake Belt of Hurwitz Group Rocks

Eade (personal communication, 1974) has indicated that a few minor disseminated copper occurrences are known in Hurwitz rocks. A slight possibility exists of sedimentary deposits and of porphyry and miscellaneous vein and replacement deposits associated with Nueltin-type granitic rocks (Eade, 1973).

(58) Kognak River-Tavani Greenstone Belt

This large Archean greenstone belt with abundant felsic and mafic volcanic and intrusive rocks has a good potential for volcanogenic massive sulphide and magmatic Cu-Ni deposits and a moderate potential for porphyry and miscellaneous vein and replacement deposits. Exploration and various geological and geochemical studies have not indicated the existence of large, good grade copper deposits, but considering the large size of the belt, its general similarity to the important Abitibi Belt in the southern Shield, poor outcrop in some areas, logistic problems in this part of the

Arctic, and the preliminary, reconnaissance nature of much of the work carried out to date,one can still be reasonably confident that important copper deposits remain to be found in this area.

(59) Rankin Inlet Volcanic-Intrusive Rocks

A small Ni-Cu mine operated in this area during the period 1957 to 1962 (Bannatyne, 1958; Wright, 1967). A potential exists for larger, more substantial deposits of this type and for other types of copper deposits related to volcanic and intrusive rocks in the area. The proximity of this belt to the coast and the established settlement at Rankin Inlet enhance the possibilities of development in this area.

(60) Nueltin Lake-Eskimo Point Gneissic-Granitic Terrane

(61) Unnamed area of Archean and Hurwitz Group Sedimentary Rocks

(62) Thlewiaza River Archean Greenstone Belt

A low to moderate possibility exists of essentially unpredictable copper deposits in this large, poorly documented area. Large parts of the region have few or no outcrops. Small mapped and unmapped remnants of Archean greenstone belts probably have the best potential for viable copper deposits.

NICKEL, ASBESTOS, PLATINUM, CARVING STONE

(26) Hayes River-Committee Bay Belt of Prince Albert Group Rocks

(33) Committee Bay-Parry Bay Prince Albert Belt

For notes on the potential of these areas see writeups under Central Arctic Region.

(50) Amer Group Proterozoic Sediments and Minor Enclosing Gneisses

Nickel

No significant nickel occurrences are known, and probably very little exploration for nickel has been carried out. Small ultramafic bodies interlayered with mafic volcanic rocks in the Amer Lake area (Fig. 30), and exhibiting spinifex texture (Heywood, 1977) are probably of komatiitic affiliation, and consequently are considered to have some potential for nickel deposits of type 2 (Appendix 2). There could also be some potential for nickel-copper deposits (type 3) associated with mafic plutons known in the area.

Asbestos (chrysotile)

Although asbestos in ultramafic rocks was noted by Heywood (1977), he also described the ultramafic bodies as small. If sizeable thick sills are also present, there may be some potential for asbestos deposits.

Carving Stone

Soapstone is reported (Heywood, 1977) and may be suitable for carving stone.

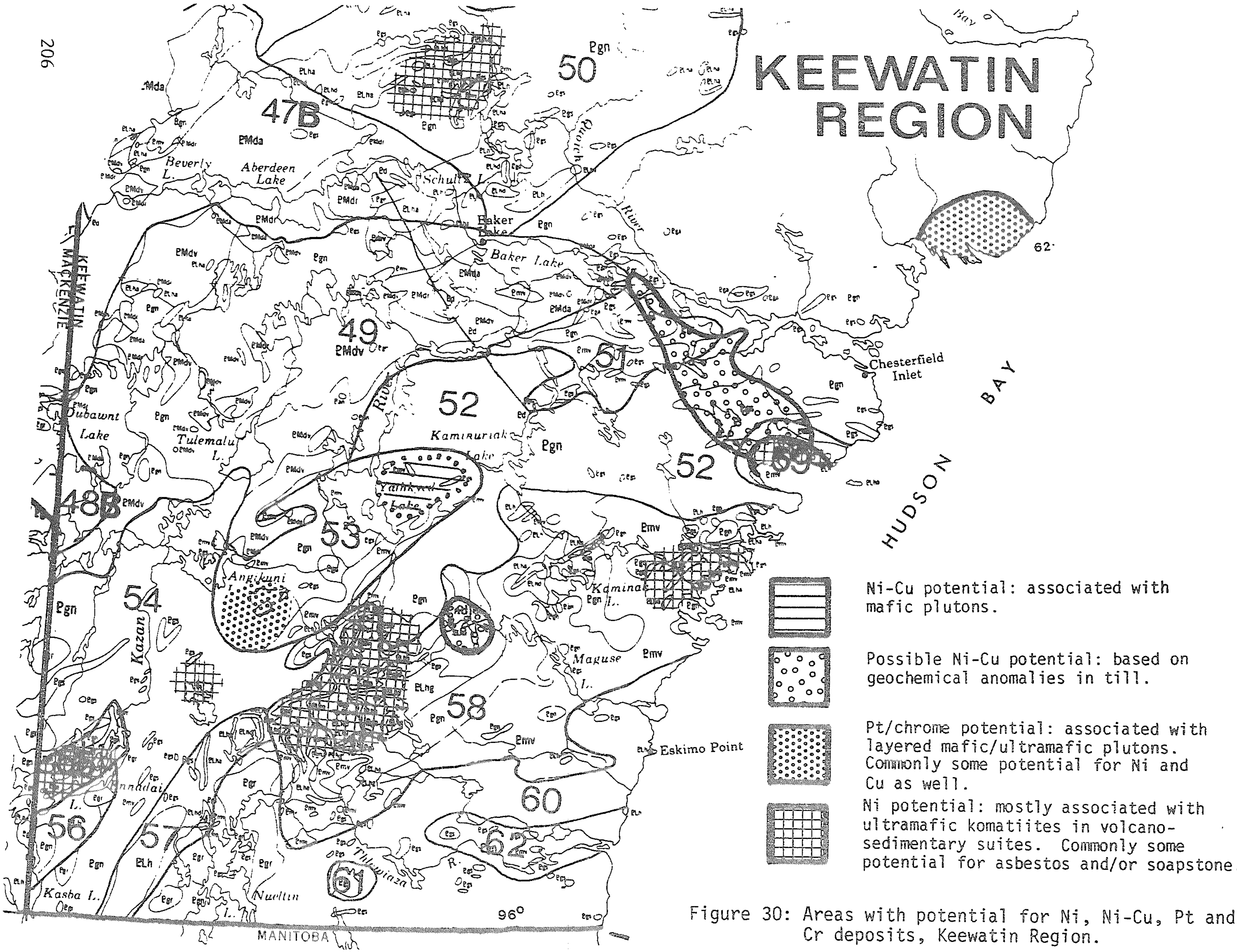


Figure 30: Areas with potential for Ni, Ni-Cu, Pt and Cr deposits, Keewatin Region.

(52) Kaminuriak Lake-Chesterfield Inlet Gneiss Belt

Nickel-copper

Geochemical samples of glacial till with strongly anomalous nickel and copper contents outline a broad belt 160 km long extending northwestward from Rankin Inlet to the east end of Baker Lake (Fig. 30: Rencz and Shilts, in press; Shilts, W.W., personal communication, 1979). Coincident nickel and copper anomalous values probably indicate that the bedrock sources are sulphides contained in mafic or ultramafic rocks, but whether the sulphides are dispersed or concentrated in significant deposits is unknown. Neither nickel occurrences nor ultramafic rocks are known in this area, but aeromagnetic anomalies correspond roughly to the geochemically anomalous belt, and could represent ultramafic or possibly mafic rocks with some nickel-copper potential.

(52A) Daly Bay Complex

Platinum

There could conceivably be some potential for platinum group metals in the anorthositic rocks of the Daly Bay metamorphic complex (Fig. 30: Gordon, 1971, 1972), although lack of evidence of significant differentiation such as is associated with the Bushveld and Stillwater platinum deposits tends to diminish this potential.

(53) Angikuni Lake-Yathkyed Lake Volcanic Belt

Nickel-copper

A significant but uneconomic nickel-copper sulphide deposit associated with mafic rocks at Ferguson Lake (see Part I, Section 5) may be indicative of other, economically more interesting deposits elsewhere in this area (Fig. 30), although it is not clear which of the other mafic rocks may be the ones favourable for nickel-copper deposits.

Platinum

There could possibly be some potential for deposits of platinum group metals in a 15 to 20 km long anorthositic mass about 30 km southwest of Angikuni Lake (Fig. 30: Eade and Chandler, 1975). Marginal anorthositic gabbro and internally located aeromagnetic anomalies (Geol. Surv. Can., 1971b) indicate some differentiation of the mass, possibly similar to the platinum-bearing Bushveld (South Africa) and Stillwater (Montana) complexes.

(54) Kazan River Gneissic-Granitic Terrane

Nickel

Reported occurrences of soapstone as erratics near the northwest end of Hick's Lake (Fig. 30: Lord, 1953), together with an aeromagnetic anomaly (Geol. Surv. Can., 1971a) probably reflect the presence of an ultramafic body which could be an equivalent of komatiitic ultramafic volcanics some 70 km to the east in Kognak River area (58). Accordingly, there could be some potential for type 2 nickel deposits (see Appendix 2).

Asbestos (chrysotile)

Some slight potential for asbestos may exist, associated with the inferred ultramafic body northwest of Hick's Lake.

Carving Stone (soapstone, serpentinite)

Lord's reference to "soapstone erratics reported by Eskimos" near the northwest end of Hick's Lake make it seem likely that this potential source of carving stone has already been tested, and perhaps exploited.

(55) Ennadai Lake Volcanic Belt

Nickel

No nickel occurrences are known. Little is known about the ultramafic rock northwest of Ennadai Lake (Fig. 30: Lord, 1953). It is described as being part of a much larger but poorly defined dioritic to gabbroic mass, but could also belong to the surrounding volcanic suite, and some associated nickel potential cannot be ruled out. Two mafic stocks nearby could also present potential for nickel-copper deposits of type 3.

Asbestos

There could be some potential for asbestos associated with the ultramafic body reported northwest of Ennadai Lake (Lord, 1953).

(58) Kognak River-Tavani Greenstone Belt

Nickel

A few nickel-copper sulphide occurrences are known in this area. One of these (Torin claims) is in a carbonate altered mafic-ultramafic sill on the Ferguson River near the Hudson Bay coast (Fig. 30), but no other ultramafic rocks are known in the vicinity. Another copper-nickel showing (Southern Lake) occurs in mafic volcanic rocks 30 km east of Kaminak Lake but seems of little importance.

Ultramafic komatiite volcanic rocks near Griffin Lake at the west end of this region (Fig. 30: Eade and Chandler, 1975) are associated with mafic volcanic rocks and iron formation and may be more abundant than previously recognized. These rocks have only been explored superficially for nickel, and they are considered to have some potential for the komatiite affiliated type of nickel deposits. Towards the east and west ends of area 58, large masses of Archean mafic to intermediate plutonic rock could conceivably have some potential for nickel-copper deposits.

Geochemical till samples from an area of about 250 square kilometres near Padlei are strongly anomalous in nickel and copper (Shilts, 1975) and seem to be related to an ill-defined gabbroic mass on the up-ice side of the anomalous area. The coincident nickel and copper is suggestive of a sulphide source, but whether the sulphides are dispersed or concentrated in deposits of possible economic interest is unknown. Two other smaller areas also having coincident anomalous nickel and copper contents occur near the south margin of this area.

Asbestos

There is some potential for chrysotile asbestos associated with the ultramafic komatiites at Griffin Lake, although the probably small size of the ultramafic bodies and the remoteness from tidewater militate against economically viable deposits.

Carving Stone (serpentine)

Some of the ultramafic rock at either Ferguson River or Griffin Lake may be suitable for carving stone, but only the former is relatively accessible.

(59) Rankin Inlet Volcanic-Intrusive Rocks

Nickel

This area is considered to have some nickel (-copper-platinum) potential (Fig. 30). The Rankin Inlet mine produced rich nickel-copper-platinum ore from 1957 to 1962 from a small (.5 million tons) deposit in a serpentinized ultramafic sill (Laporte, 1974b). As well, minor nickel-copper occurrences are known in mafic sills north of Rankin Inlet. However, a moderate amount of exploration has to date been unsuccessful in locating additional deposits of either type. In addition to these indications, glacial till geochemical samples that are strongly anomalous in nickel and copper outline a broad belt 160 km long, extending northwestward from Rankin Inlet mine to the east end of Baker Lake (Rencz and Shilts, in press; Shilts, W.W., personal communication, 1979). The meaning of this anomalous zone is not yet clear, but some potential for nickel-copper sulphide deposits cannot be ruled out.

Asbestos

There is little indication of potential for asbestos deposits. Although the region has undergone considerable deformation (Laporte, 1975) the few known ultramafic bodies are probably too small to contain viable deposits.

Carving Stone (Serpentinite)

Some potential for serpentinite carving stone and soapstone may exist, in fact may have been exploited, in the ultramafic rocks of this area, especially in view of their easy accessibility.

VI KEEWATIN REGION

VOLCANOGENIC MASSIVE SULPHIDE DEPOSITS

(51) MacQuoid Lake-Cross Bay Volcanic Belt

While some base metal occurrences of vein type are known in this area, no occurrences appear to have been reported that are definitely of volcanogenic massive sulphide type. Volcanic rocks in the area are, in part, highly metamorphosed and also, in part, poorly exposed. Thus the potential for volcanogenic massive sulphide deposits in the area must be considered as unknown, although it is provisionally rated as moderate.

(53) Angikuni Lake-Yathkyed Lake Volcanic Belt

The level of knowledge regarding the volcanic rocks of this area and the character of these rocks are generally similar to those for area 51. However, some ultramafic lavas are known in the area and a Ni-Cu deposit that is associated with amphibolite (product of moderate to high grade metamorphism of a mafic body) is present at Ferguson Lake. These features are not known to influence the potential of volcanic belts to host massive sulphide deposits, and the potential of the area is thus rated the same as for area 51.

(55) Ennadai Lake Volcanic Belt

The Rochon Lake occurrence of volcanogenic massive sulphide type near Ennadai Lake has been tested by Shell Canada Resources Limited and found to be discouragingly thin and low in grade. However, further exploration in this belt seems well justified and the belt is assigned a rating of moderate potential for massive sulphide deposits.

(58) Kognak River-Tavani Greenstone Belt

The most intensely explored volcanogenic massive sulphide deposits in Keewatin District are the Gemex deposits at the south end of Heninga Lake (see Part I, Section 5 of this report). Another occurrence near Carr Lake is apparently very limited in size, but the existence of this and other occurrences must be considered to auger well for the potential of this area. Five mafic to felsic volcanic cycles have been mapped in the area (Ridler, 1971, 1972, 1973, 1974; Ridler and Shilts, 1974a, 1974b) and during this work evidence was found of exhalative activity over a large part of the area and that part of the area was defined within which exhalative products were primarily of sulphide type. This evidence is considered to support a high potential rating for massive sulphide deposits.

The area is relatively favourably situated with respect to possible future transport developments.

(62) Thlewiaza River Archean Greenstone Belt

Mafic volcanic rocks and iron formation are known in the area, although exposure in most of the belt is poor. The belt is assumed to be geologically similar to the Kognak River-Tavani belt and is given a moderate to high potential rating for the occurrence of massive sulphide deposits.

IRON

(58) Kognak River-Tavani Greenstone Belt

Iron-formation occurs in Archean rocks of the Kaminak and Henik Groups in association with metagreywacke and metavolcanic rocks, and with granitic gneiss and schists. The wide distribution of iron-formation is shown on Map 2. The principal deposits described previously (Section 5) give some indication of the kind, quality and size of iron deposits that have been explored by mapping, sampling and drilling. It is apparent that while thin lenses of iron-formation have been reported in many parts of the region, deposits offering sufficient material of a quality suitable for future mining may be limited to the areas discussed in detail. Nevertheless, further prospecting and examination of iron-formation throughout this district, including that present in Aphebian rocks of the Hurwitz Group, is warranted because an extension of transportation facilities into the district would enhance the possibilities for future economical development of the iron resources.

The major iron-formations explored to date all occur within Archean rocks, as do many occurrences of sulphide facies iron-formation. Further study of the iron-formations is recommended to determine their metallogenic significance for evaluating the potential of these areas to contain deposits of polymetallic sulphides, nickel and gold, and because of their usefulness as guides in exploration for these deposits.

MOLYBDENUM

(47B) Proterozoic Thelon Sandstone Formation

A very remote possibility exists of minor extractable byproduct molybdenum associated with "sandstone- and unconformity-type" uranium deposits.

(48B) Dubawnt Lake Gneissic-Granitic Area

A slight possibility exists of porphyry, vein, and aplite-pegmatite deposits associated with granitic and syenitic intrusions; minor byproduct molybdenum associated with "unconformity-type" uranium deposits, and molybdenum in the felsic crystalline rocks.

(49) Baker Lake Basin (Dubawnt Group Rocks)

The best possibility for molybdenum production in the foreseeable future from this area is as a minor byproduct of mining "sandstone- and unconformity-type" uranium deposits. For example, two uranium prospects on Christopher Island have been reported to contain 160,000 lb U_3O_8 and 150,000 lb MoS_2 and 1,000,000 lb U_3O_8 and 2,000,000 lb MoS_2 (Northern Miner, August 8, 1974, p. 17). Other uranium prospects in the area also contain molybdenum. Porphyry, vein, and aplite-pegmatite deposits also might be found associated with shallow granitic and syenitic intrusions. At least one Nueltin-type fluorite granite (Wanless and Eade, 1975) in the area is known to contain copper and molybdenum (A. Miller, personal communication, 1980). A remote possibility also exists of molybdenum in the felsic crystalline rocks.

(50) Amer Group Proterozoic Sediments and Minor Enclosing Gneisses

A slight possibility exists of minor byproduct molybdenum associated with "sandstone- and unconformity-type" uranium deposits and of molybdenum in the felsic crystalline rocks.

(51) MacQuoid Lake-Cross Bay Volcanic Belt

A remote possibility exists of porphyry, vein, and aplite-pegmatite deposits associated with felsic subvolcanic intrusions.

(52) Kaminuriak Lake-Chesterfield Inlet Gneiss Belt

A slight possibility exists of molybdenum deposits associated with these felsic crystalline rocks.

(52A) Daly Bay Complex

A very remote possibility exists of molybdenum deposits associated with these high grade metamorphic crystalline rocks.

(53) Angikuni Lake-Yathkyed Lake Volcanic Belt

A remote possibility exists of porphyry, vein, and aplite-pegmatite deposits associated with felsic subvolcanic intrusions.

(54) Kazan River Gneissic-Granitic Terrane

A slight possibility exists of molybdenum deposits associated with felsic crystalline rocks.

(55) Ennadai Lake Volcanic Belt

There is some (low) possibility of porphyry, vein, and aplite-pegmatite deposits associated with felsic subvolcanic intrusions.

(56) Kasba Lake-Ennadai Belt of Hurwitz Group Rocks

A very remote possibility exists of minor byproduct molybdenum associated with "sandstone- and unconformity-type" uranium deposits and of porphyry, vein, and aplite-pegmatite deposits associated with Nueltin-type intrusions (Eade, 1973).

(57) Poorfish Lake-Watterson Lake Belt of Hurwitz Group Rocks

A very remote possibility exists of minor byproduct molybdenum associated with "sandstone- and unconformity-type" uranium deposits.

(58) Kognak River-Tavani Greenstone Belt

This large belt of supracrustal Archean rocks could have porphyry, vein, and aplite-pegmatite deposits associated with felsic subvolcanic intrusions.

(59) Rankin Inlet Volcanic-Intrusive Rocks

Felsic intrusions and crystalline metamorphic rocks in this area have a remote possibility of containing molybdenum deposits.

(60) Nueltin Lake-Eskimo Point Gneissic-Granitic Terrane

Young Neultin-type granites (Eade, 1973) might contain porphyry, vein, and aplite-pegmatite deposits. Small, shallow, altered intrusions would seem to have the best potential. Felsic crystalline metamorphic rocks of this area have a slight possibility of containing molybdenum deposits.

(61) Unnamed area of Archean and Hurwitz Group Sedimentary Rocks

There is a very remote possibility of molybdenum deposits in this area.

(62) Thlewiaza River Archean Greenstone Belt

There is a very remote possibility of molybdenum deposits in this area of poorly known geology and poor outcrop.

TIN, TUNGSTEN

(33) Committee Bay-Parry Bay Prince Albert Belt (CENTRAL ARCTIC REGION)

(49) Baker Lake Basin (Dubawnt Group Rocks)

(51) MacQuoid Lake-Cross Bay Volcanic Belt

(56) Kasba Lake-Ennadai Belt of Hurwitz Group Rocks

(57) Poorfish Lake-Watterson Lake Belt of Hurwitz Group Rocks

(60) Nueltin Lake-Eskimo Point Gneissic-Granitic Terrane

Nueltin-type fluorite-bearing granites that postdate the Hudsonian orogeny are known to intrude a variety of older rocks in extensive areas in southern Keewatin District (Eade, 1973). These bodies are particularly concentrated in the Nueltin Lake-Ennadai Lake district (parts of areas 56, 57, 60) and in an area west of Tulemalu Lake (within area 49; Fig. 31). Similar granitic bodies may be present in a belt extending from Wager Bay to the south tip of Committee Bay to Parry Bay on the east coast of Melville Peninsula (Fig. 31; mostly in Central Arctic Region). Other fluorite-bearing granitic rocks are known in an area lying north of Yathkyed and Kaminuriak Lakes (part of area 52) and extending east into area 51 (LeCheminant *et al.*, 1976, 1977, 1979b, 1980; Reinhardt and Chandler, 1973).

Although tin and tungsten have not yet been reported to occur in Keewatin district, there must be considered to be some (low) potential for these metals wherever fluorite-bearing suites of granitic rocks are present. These granitic bodies may also be favourable for the occurrence of molybdenum, as suggested in the assessments for that metal.

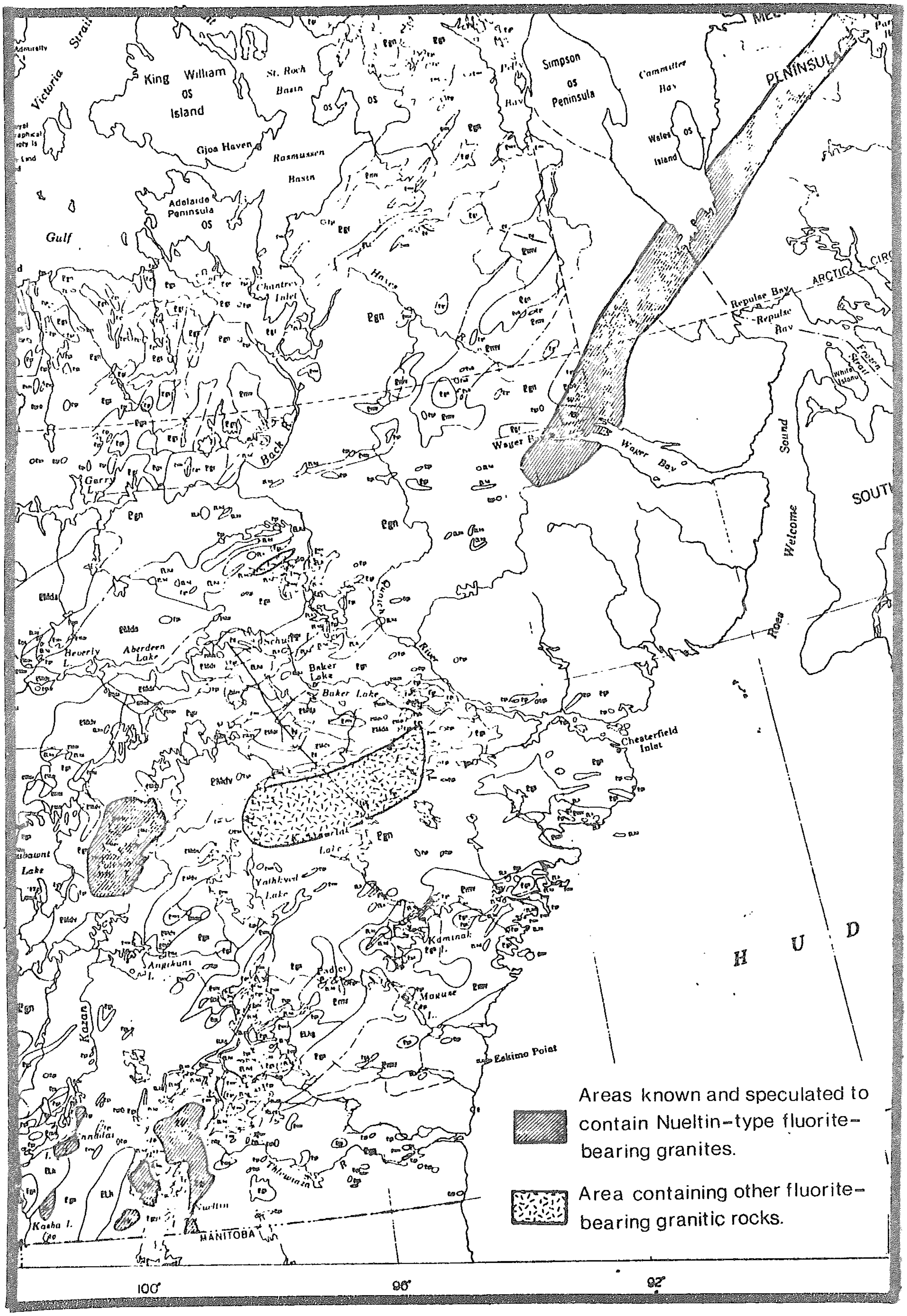


Figure 31: Generalized distribution of fluorite-bearing granitic intrusions.

VII EASTERN ARCTIC ISLANDS AND HUDSON REGION

URANIUM

Introduction

The northern part of this region is largely occupied by Precambrian and Phanerozoic complexes of Baffin Island and adjacent archipelagos including Prince Charles, Nottingham, Salisbury, Resolution and Bylot Islands. The southern part of the region covers waters of Hudson Bay and numerous islands, such as Southampton, Coats, Mansel, Ottawa and Belcher Islands.

No uranium deposit containing identified resources occurs within this region. However, several areas with uranium and/or thorium have been targets for exploration and additional areas should be considered favourable for uranium and/or thorium mineralization.

Although detailed uranium metallogenic studies have been conducted for only small portions of the region, the appraisal of the potential uranium resources was based on these studies, on analogies with other regions containing similar geological environments with identified uranium resources in Canada, Greenland and elsewhere in the world and on results of regional geological mapping conducted in the region by the Geological Survey of Canada.

The metallogenic analysis employs conceptual models established for the most important types of uranium deposits (Ruzicka, 1979), namely (a) uraniferous pyritic quartz pebble conglomerate; (b) vein and unconformity-related deposits; (c) disseminations in igneous and metamorphic rocks; (d) sandstone-hosted deposits, and (e) supergene deposits and uraniferous shales and phosphates.

For practical reasons the region is divided into two parts: (1) the Eastern Arctic Islands containing Baffin Island as the largest segment, and (2) the Hudson Bay Region.

Eastern Arctic Islands

Prominent features of the genetic model now generally accepted for formation of (a) uraniferous pyritic quartz-pebble conglomerates are (1) their proximity to Archean granitic hinterland, (2) deposition of the well sorted detritus in an oxygen - deficient shelf fluviatile environment in lower Aphebian strata, and (3) low degree of metamorphism. Neither a uranium occurrence nor an environment exhibiting these features has yet been found in the region, although Archean granitic rocks and lower Aphebian sedimentary rocks are common. However, most of the favourable Aphebian strata were apparently affected by subsequent orogenies and therefore this type of mineralization might have been reworked to the extent that its original character is not recognizable. Some uranium and thorium mineralization has been found in the Upper Proterozoic sedimentary rocks in the Fury and Hecla Strait area (area 29); (Chandler et al., 1980).

Most of the (b) vein and/or unconformity related deposits formed, as a rule, in spatial relationships to Aphebian fold belts and areas containing granitic domal structures that were unconformably overlain by unmetamorphosed or weakly metamorphosed clastic sediments. Such conditions combined with structural traps apparently led to formation of most uranium deposits in northern Saskatchewan. In the northwestern part of Baffin Island the Archean granitic rocks were apparently the source of uranium in rocks of the Committee fold belt (Jackson and Taylor, 1972). The basement rocks were unconformably overlain by Helikian clastic sediments. Uranium mineralization associated with such an environment has been found in the Fury and Hecla Strait area (area 29); (Chandler et al., 1980). The northwestern part of Baffin Island, especially some portions of areas 29 and 65 (Borden Peninsula) are favourable for this type of mineralization.

Disseminated uranium mineralization in igneous and metamorphic rocks (c) commonly occurs in felsic intrusive and volcanic rocks and in metamorphosed sediments derived from these rocks. Some uranium deposits are associated with alkaline-carbonate complexes. Uranium mineralization of this type has been found at several localities on Baffin Island, but most of the tested occurrences are within the Lake Harbour Group in area 74 (Foxe Peninsula). Uranium-bearing columbite-tantalite found in the Barnes Icecap area of Baffin Island was apparently derived from an alkaline complex similar to the Illimaussaq intrusion of Greenland. Although disseminated uranium mineralization in igneous and metamorphic rocks is the most frequent type of uranium occurrence to be found in the Eastern Arctic Islands, the irregular distribution and relatively low grade of uranium in the host rocks make this type of deposit less attractive for exploration and mining in such remote areas than the previous types.

The (d) sandstone-hosted uranium deposits commonly occur in Phanerozoic continental arenites containing carbonaceous matter. No uranium occurrence of this type has yet been found in the Eastern Arctic Islands region. However, uranium mineralization in feldspathic quartzite of Proterozoic age has been reported from the Cape Dorset Belt within Lake Harbour Group rocks (area 74). This occurrence resembles to a certain degree mineralization associated with feldspathic quartzites in the Amer Lake area, Keewatin District. In addition to the Cape Dorset Belt, environments favourable for this type of mineralization may be found in areas 29 (Fury and Hecla Strait) and 65 (Borden Peninsula).

Uranium mineralization of (e) supergene origin or associated with shales or phosphates has not been identified in this region to date. However, radioactive graphitic schist containing thorium-bearing monazite was found among samples collected by W.L. Davison of the Geological Survey of Canada. This sample apparently came from the Lake Harbour Group near Lake Harbour in area 74 (Foxe Peninsula). Graphitic schist is a common lithologic unit within this area and the presence of uranium-bearing facies in it cannot be excluded (Davison, 1959).

Hudson Bay Region

Although the Hudson region contains lithostratigraphic units considered favourable for uranium mineralization no uranium occurrences have been reported.

(63) Brodeur Peninsula-Borden Peninsula Paleozoic Rocks

(29) Fury and Hecla Strait Proterozoic Rocks

These areas include Proterozoic and Paleozoic rocks of the northwestern part of Baffin Island. They were geologically mapped by Blackadar (1958, 1963, 1970) and more recently, Chandler et al. (1980) carried out mapping combined with ground radiometric surveys in the Fury and Hecla Strait area.

Uranium mineralization has been detected in area 29 in the vicinity of Fury and Hecla Strait (Chandler et al., 1980). This part of this area has also recently been the target of exploration by the mineral industry. The uranium mineralization was found in various geologic environments along the north shore of Fury and Hecla Strait, including (a) in granitic rocks including disseminations in both the granitoid bodies and in pegmatites; (b) vein or mineralized shear zones in both basement and supracrustal rocks; (c) in quartz-pebble conglomerate of Helikian age. The mineralization of all types occurs along the pre-Helikian unconformity (see Fig. 32).

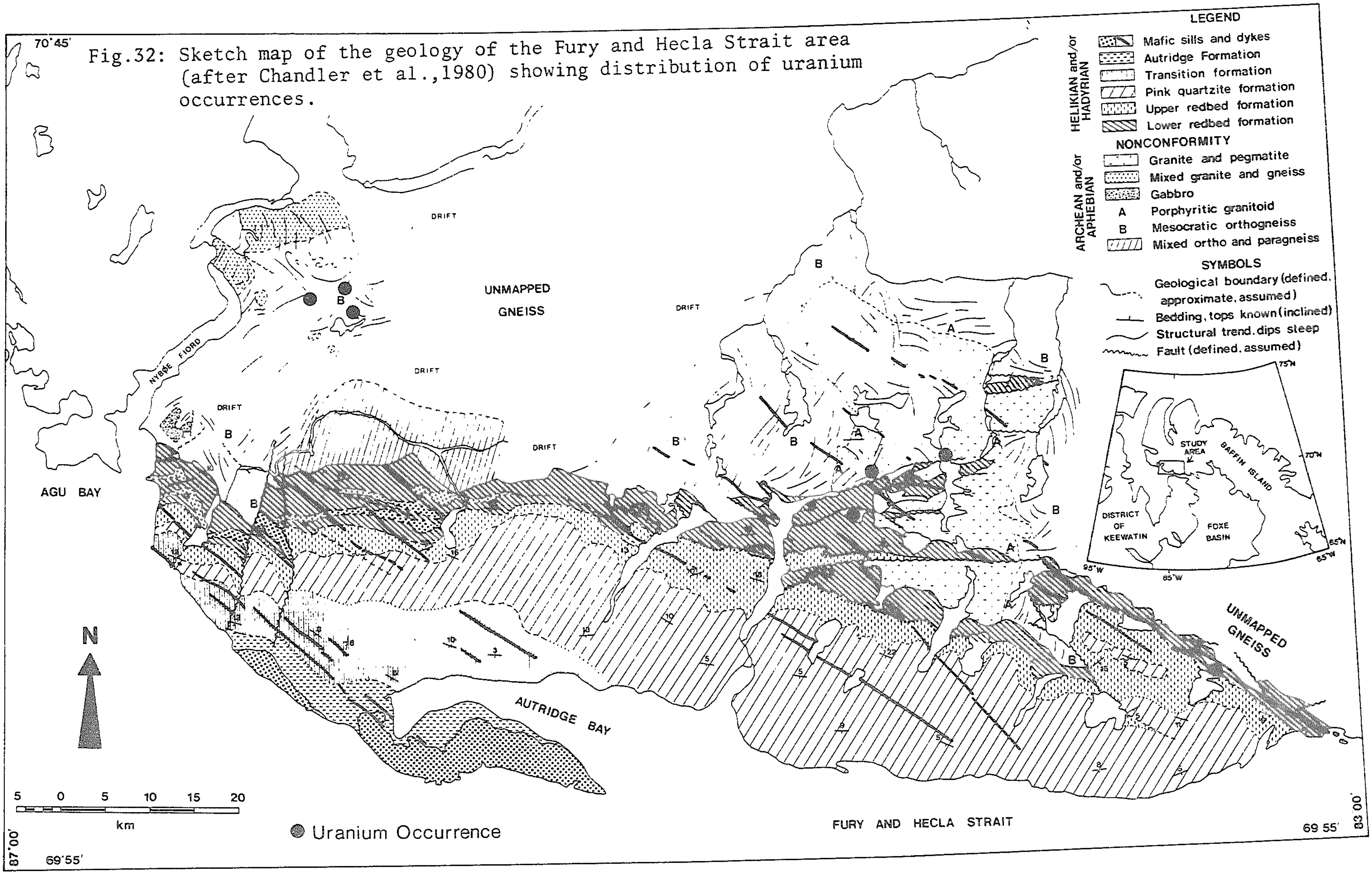


Fig.32: Sketch map of the geology of the Fury and Hecla Strait area (after Chandler et al.,1980) showing distribution of uranium occurrences.

Despite local high grade uranium contents in pegmatitic rocks (a) (exceeding 0.2 percent U at one locality in situ) no uranium ore deposit has been identified. The highest value in the vein-type or mineralized shear zone occurrences (b) was 0.15 percent U in a selected sample. A sample of the quartz-pebble conglomerate (c) contained 0.003 percent U.

The areas along the pre-Helikian unconformity are favourable loci for uranium deposits that may be confined to the pre-Helikian basement rocks, to the Helikian sediments or to the altered zone along the unconformity itself. Radiometric anomalies were detected by the Geological Survey of Canada airborne survey within area 29.

(65) Borden Peninsula Proterozoic Rocks

The Proterozoic rocks of the Borden Peninsula adjacent to Admiralty Inlet were mapped by Blackadar (1970) as Helikian strata of the Equalulik and Uluksan groups. They unconformably overlie the Aphebian Gneissic Complex composed of gneissic granite and migmatite and are in turn overlain by Paleozoic sediments. Although these rocks differ somewhat lithostratigraphically from the uranium-bearing rocks of the Fury and Hecla Strait Formation and the underlying and overlying sequences, the area along the pre-Helikian unconformity is also favourable for uranium mineralization. Most of the sedimentary rocks are considered to have been derived from comparatively leucocratic rocks that, as a rule, have an elevated background content of uranium (Blackadar, 1970). Therefore the segment between the Central Borden Fault and White Bay Fault Zones (Jackson *et al*., 1978d) deserves reconnaissance for uranium mineralization (see Figure 33).

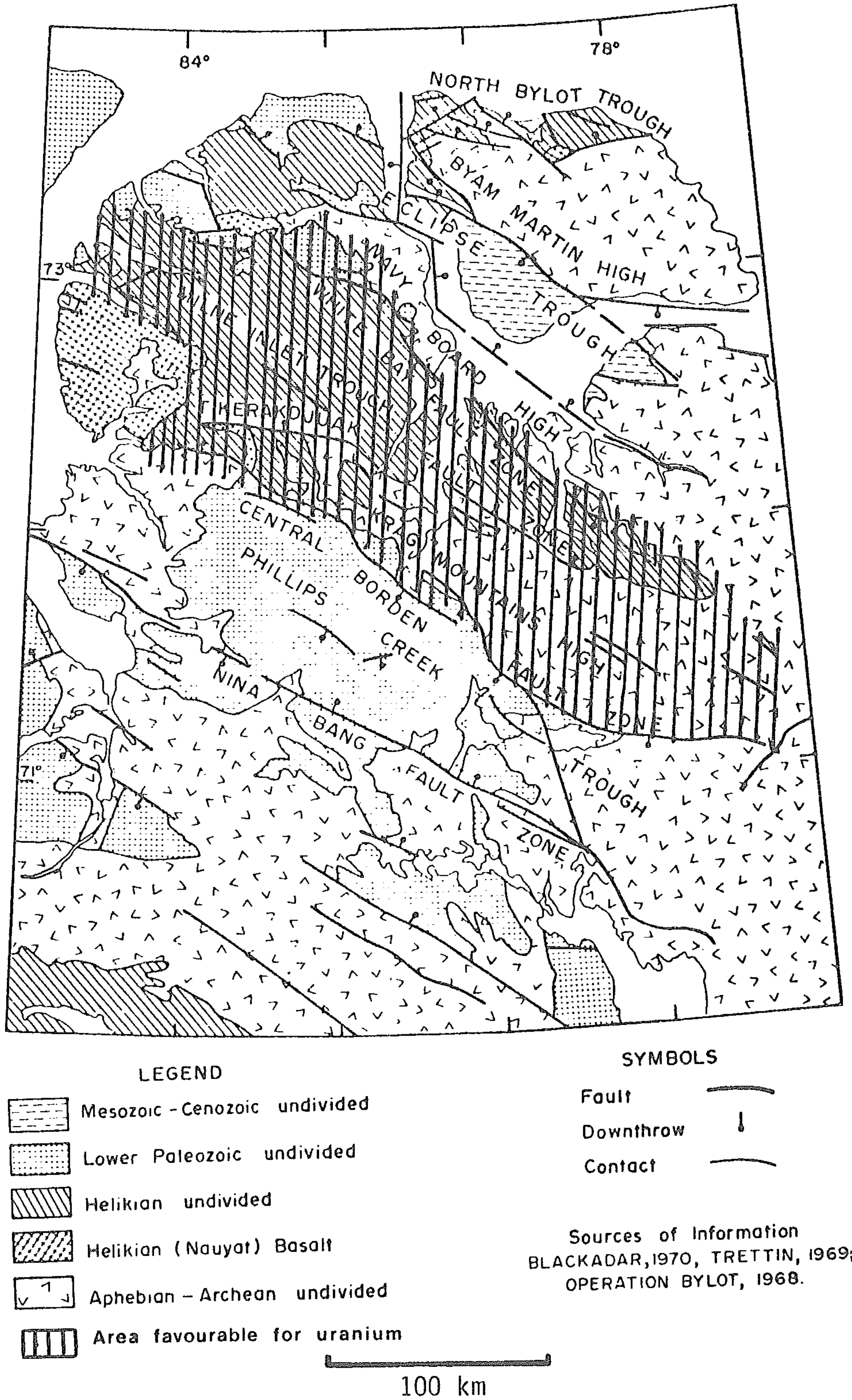


Figure 33: Area favourable for uranium mineralization, Borden Peninsula (Geological base from Jackson et al., 1975)

(66) Eclipse Sound Paleozoic Rocks

The lower Paleozoic succession of the Eclipse Sound area was deposited on an erosion surface. Deposition started under non-marine conditions and proceeded under shallow marine and/or lagoonal conditions. The youngest strata are made up of carbonates and evaporite solution breccias. The material was apparently derived mainly from pre-existing sediments (Trettin, 1969b) and therefore should be considered of low favourability for uranium mineralization.

(67) Mary River Group Rocks, Northern Baffin Island

The Mary River Group rocks comprise intermediate to mafic metavolcanic rocks and associated mafic and ultramafic intrusions, various metasedimentary rocks and only a small amount of felsic metavolcanic rocks (Jackson and Taylor, 1972). From the lithological make-up of this area it is inferred that the geological environment has only low potential for significant uranium deposits.

(69) Piling Group Sedimentary Rocks

This eastern part of the Foxe Belt is a metamorphosed and polydeformed Aphebian succession correlated with the Penrhyn Group on Melville Peninsula (Jackson and Taylor, 1972). This succession, the Piling Group, comprises a lower, relatively thin miogeoclinal, quartzite-pelite-carbonate sequence and an upper, relatively thick eugeoclinal mafic volcanic-distal turbidite succession. Iron formation occurs near the base of the eugeoclinal sequence along the north and south margins of the belt. The Aphebian rocks overlie elliptical domes and concordant sheets of granitoid gneisses believed to be of Archean age.

The rocks in area 69 have been metamorphosed to amphibolite grade in the northwest part and, locally at least, to granulite grade in the southeast part.

Although some small uranium anomalies were observed in cross-cutting pegmatites, both in the Piling Group and in the underlying gneisses, none were of economic extent and grade. Cominco Limited has prospected the area in recent years, concentrating on the base of the Piling near McBeth Fiord where malachite staining is visible in the marble. Pegmatites, also investigated, did not contain economic uranium mineralization.

(73) Foxe Basin Paleozoic Rocks (see Area 30, Central Arctic Region)

(74) Foxe Peninsula-Frobisher Bay Terrane, Lake Harbour Group and Granitic Rocks

Southern Baffin Island is composed of complexly folded medium to high grade metasedimentary rocks of the Dorset Fold Belt (Blackadar, 1967b; Jackson and Taylor, 1972). Quartz-feldspar gneiss, rusty graphitic gneiss, garnet-quartz-feldspar gneiss, granite gneiss, amphibolite and migmatite are most common. Quartzite and thick bands of crystalline limestone are also present. Ultramafic rocks, pyroxenite and serpentinite are rare. Age determinations, indicating the last period of metamorphism of the region, are 1685 Ma to 1740 Ma.

Exploration of the area for uranium (as early as 1969) indicated occurrences in biotite paragneiss, granitic pegmatite and granite.

In the Cape Dorset area uranium and thorium occur in a zone of biotite paragneiss and concordant granite pegmatite. Several radioactive granites also occur in the region – they are mainly thorium-bearing.

In the Lake Harbour area a rich graphite lens was found by W.L. Davison (1959) in the course of geological mapping (1950, 1951).

Several small uraniferous pegmatites are also present in this area but none have economical interest.

(64) Northern Baffin Granitic Rocks (including some Mary River Group)

(68) Cape Christian Granitic Rocks, some Mary River Group

(71) Southern Baffin Granitic Rocks

(72) Hall Peninsula Granitic Rocks, some Lake Harbour Group

(75) Northern Southampton Island Granitic Terrane

Granitic rocks constitute overwhelming portions of the above areas. It is considered unlikely that an economic uranium deposit will be discovered in these terranes in the near future, although discovery of low grade mineralization of the Illimaussaq type (i.e. peralkaline complexes containing uraniferous and thoriferous igneous rocks) cannot be excluded. Uranium-bearing granite pegmatites, commonly occurring in granitic terranes, will probably not constitute mineral resources mineable in the foreseeable future from these northern regions.

(70) Hoare Bay Volcanic Rocks, Cumberland Peninsula

(76) Southampton Plain Paleozoic Rocks

The possibility of finding and developing economic uranium deposits in areas 70 and 76 is limited. No uranium occurrences are known in these areas and the lithological environments present are not known to show features favourable for economic uranium deposits.

(77) Islands in Hudson Bay (excluding area 76)

The region defined by these islands can be subdivided into four sub-regions:

(a) Nastapoka Arc comprising the chain of islands from Long Island in the south through Manitouk and Nastapoka (*sensu strictu*) to Hopewell Islands;

(b) Belcher Islands, including Bakers Dozen, King George and Sleeper Islands;

(c) Ottawa Islands; and

(d) Smith Island.

These are all made up of Aphebian volcanic and sedimentary rocks. A few small islands made up of Archean gneisses occur between the north end of the Hopewell Islands and Mosquito Bay. These are not assessed here. Jackson *in* Dimroth *et al*. (1970) has summarized the geology.

On the mainland, Miller (1978) and Miller and Kerswill (1980) describe uranium anomalies in basal arkosic rocks in Richmond Gulf area and conclude these are due to placer processes, and hence these anomalies are unlikely indicators of potential deposits. The Aphebian unconformity uranium deposit type could possibly be present, but this is considered unlikely except on the north and east sides of the Hopewell Islands; existing maps do not permit assessment. Arkosic red beds on the Loaf Islands and a few other arkosic beds within the area are possible hosts for mineralization but cannot be adequately assessed on the basis of present information.

VII EASTERN ARCTIC ISLANDS AND HUDSON REGION

GOLD

(29) Fury and Hecla Strait Proterozoic - Archean Rocks

On the north side of Fury and Hecla Strait the basal redbed sequence of Helikian or Hadrynian age contains orthoquartzite and quartz pebble conglomerate that in places contains Th-bearing radioactive and other heavy minerals (Chandler, unpublished). These rocks could be favourable for paleoplacer gold deposits, although because of the lack of known possible basement sources of gold the potential is rated as low.

(67) Mary River Group Rocks, Northern Baffin

The widespread occurrence of mafic volcanic rocks and iron formation, and the presence of some serpentinite and ultramafic sills, are geological features that are considered very favourable for the occurrence of gold deposits. Consequently the gold potential is rated as moderate to high.

(69) Piling Group Sedimentary Rocks

The potential of Piling Group metasedimentary rocks to host gold deposits is largely unknown because of the general lack of exploration and because similar rock sequences are not known in more thoroughly explored areas. It is likely that carbonaceous material and iron sulphides in the abundant rusty graphitic metagreywacke lithology are favourable "sinks" for gold, as well as other metals. The age of the Mary River Group to the north is uncertain, but if it is Archean this mafic volcanic terrance could have served as a metal source and later gold mobilization could possibly have occurred in association with deformation-metamorphism of Piling sediments. However, bands of concentrated sulphides or other suitable loci for the deposition of gold in economic concentrations are apparently rare although Morgan et al. (1976) have reported sulphide facies iron formation in the Flint Lake area.

Jackson and Taylor (1972) have reported that iron formation about 60 m thick is present southwest and southeast of Barnes Icecap. Some carbonate facies iron formation is also present and there may thus be some potential for associated gold deposits.

The overall gold potential is rated as very low, except where iron formation is known and there a rating of low to moderate is assigned.

(70) Hoare Bay Volcanic Rocks, Cumberland Peninsula

Because of the lithologies present in the Hoare Bay Group, which include mafic metavolcanic rocks, serpentinized ultramafic intrusions, iron formation, and metachert, the area is considered to have a moderate potential for gold.

(74) Foxe Peninsula - Frobisher Bay Terrane, Lake Harbour Group and Granitic Rocks

The lithologies of the Lake Harbour Group are similar to those of the Piling and Penrhyn Groups (see area 69 and Central Arctic Region, area 35) and consequently the overall gold potential of the area is rated as very low. However, as noted for the similar groups, the metallogeny of sequences of this type is not well understood at present.

(75) <u>Southampton Island</u>

The Precambrian rocks of the north part of Southampton Island are generally similar to those of southern Baffin Island (area 74), and hence the gold potential is rated as very low.

(77) <u>Belcher and Nastapoka Islands, Proterozoic Sedimentary Rocks</u>

Quartzite, orthoquartzite and conglomerate are present in many of the formations on the Belcher and Nastapoka Islands and these could potentially host paleoplacer gold deposits. However, good quartz-pebble conglomerate that occurs at a lower stratigraphic position and is known to contain some heavy mineral concentrations has the best gold paleoplacer potential but is present only on the mainland in the Richmond Gulf area. Consequently, the overall potential on the Belcher and Nastapoka Islands is rated as low. The coarse clastic sediments on the Nastapoka Islands are more proximal and thus of higher potential than those on the Belcher Islands.

VII EASTERN ARCTIC ISLANDS AND HUDSON REGION

COPPER

(29) Fury and Hecla Strait Proterozoic-Archean Rocks

A slight possibility exists of sedimentary deposits in the Helikian sequence (Chandler, 1980; Chandler *et al.*, 1980). Although it is not well exposed in outcrop, a thin stromatolitic dolomite and black shale unit separates the upper and lower redbed sequences (Chandler *et al.*, 1980). This unit would seem to be a favourable site for the occurrence of sedimentary deposits. The transition beds and Autridge Formation black shales overlying the redbed sequences and a pink quartzite formation also would seem to offer some potential for sedimentary deposits (Chandler *et al.*, 1980).

(63) Brodeur Peninsula-Borden Peninsula Paleozoic Rocks

A remote possibility exists of sedimentary deposits in basal Paleozoic rocks.

(64) Northern Baffin Granitic Rocks (including some Mary River Group rocks)

There is a very remote possibility of copper deposits in felsic crystalline rocks or associated with felsic or mafic igneous rocks in the Mary River Group.

(65) Borden Peninsula Proterozoic Rocks

Even though significant occurrences have not been found, this large area of Helikian rocks (Blackadar, 1970; Geldsetzer, 1973; Jackson *et al.*, 1975; Ianneli, 1979; Chandler, 1980) probably has a moderate potential for sedimentary deposits. Reduced marine rocks that overlie or interfinger with continental redbeds, such as the Arctic Bay and Society Cliffs Formations (Jackson *et al.*, 1975, p. 13), probably have the highest potential. Copper minerals also have been noted in the Society Cliffs Formation in the same general carbonate setting as the Nanisivik lead-zinc deposits (Jackson *et al.*, 1975). Although this is not a typical environment for productive copper deposits, the possibility of economic deposits should not be ruled out. The Nauyat basalts (Blackadar, 1970) have a slight potential for miscellaneous vein and replacement deposits of a general Coppermine-type (Kindle, 1972) and a very remote possibility of conformable native copper-copper sulphide deposits of a Keweenaw Peninsula-type (Broderick *et al.*, 1946; Cornwall, 1951; White, 1968).

(67) Mary River Group Rocks, Northern Baffin Island

A possibility exists of volcanogenic massive base and precious metal sulphide deposits associated with felsic and mafic, subaqueous volcanic rocks; porphyry and miscellaneous vein and replacement deposits associated with felsic to intermediate, subvolcanic intrusions, and magmatic Cu-Ni deposits associated with differentiated mafic intrusions. Exploration for copper to date in this area has not been encouraging.

(68) Cape Christian Granitic Rocks, some Mary River Group

(71) Southern Baffin Granitic Rocks

(75) Northern Southampton Island Granitic Terrane

There is a remote possibility of some unpredictable copper deposits in these crystalline terranes.

(69) Piling Group Sedimentary Rocks

(70) Hoare Bay Volcanic Sedimentary Rocks, Cumberland Peninsula

(72) Hall Peninsula Granitic Rocks, some Lake Harbour Group

(74) Foxe Peninsula-Frobisher Bay Terrane, Lake Harbour Group and Granitic Rocks

A slight possibility exists of volcanogenic copper deposits related to metabasalts and perhaps in the lower sulphide-rich parts of the metagreywacke sequences (Jackson and Taylor, 1972; Tippett, 1978, 1979; Morgan, personal communication, 1980). Magmatic Cu-Ni deposits may occur in association with metagabbros and metanorites. A remote possibility exists of some unpredictable copper deposits in crystalline basement and supracrustal sequences. Exploration for copper to date has not been encouraging.

(73) Foxe Basin Paleozoic Rocks

A slight possibility exists of sedimentary deposits in basal Paleozoic rocks (see Trettin, 1975) and of minor byproduct copper associated with "sandstone- and unconformity-type" uranium deposits.

(76) Southampton Plain Paleozoic Rocks

An extremely remote possibility exists of sedimentary or "carbonate-hosted" deposits in basal Paleozoic rocks. Lack of both marked facies changes and terrigenous clastic units at the base of the succession (Heywood and Sanford, 1976) decrease the potential of these rocks relative to other Lower Paleozoic successions.

(77) Islands in Hudson Bay (excluding 76)

A slight possibility exists of sedimentary deposits in Aphebian rocks on small islands along the east coast of Hudson Bay and in the Belcher Islands. Minor, low grade occurrences of this type are known in the Richmond Gulf area of Quebec (Kirkham, 1974; Miller, 1978; Chandler, 1978 and 1980) and possibly similar, more extensive, higher grade deposits might be present in related rocks in the coastal islands. Many minor vein deposits are known in the Belcher Islands (Darling, 1959; Jackson, 1960) but it is doubtful if any of these have economic potential. Other miscellaneous vein and replacement deposits of a "Coppermine-type" (Kindle, 1972) and conformable deposits of the Keweenaw Peninsula-type (Broderick et al., 1946; White, 1968) have a slight chance of occurring in the basaltic units 2 and 13 of Jackson (1960). A slight possibility exists of magmatic Cu-Ni deposits related to gabbroic sills in the Ottawa and Belcher Islands.

NICKEL, ASBESTOS, SOAPSTONE

(67) Mary River Group Rocks, Northern Baffin Island

Nickel

Some reconnaissance level exploration for nickel deposits has been carried out in these regions, but no nickel occurrences are known. Nevertheless there is considered to be some potential for nickel (-copper-platinum) deposits in ultramafic rocks of the Mary River Group. The ultramafic bodies occur intermittently along a broad zone about 150 km long extending eastward from the Mary River iron deposits. The ultramafic rocks are characteristically associated with mafic volcanic rocks, greywacke, quartzite and iron formation (Jackson, 1966; Gross, 1966; Jackson et al., 1978a; Jackson et al., 1978b) very similar to other Archean greenstone belts in the world in which ultramafic komatiite-affiliated nickel sulphide deposits are mined. Small serpentinized ultramafic bodies on Eclipse Sound may have a similar association (Jackson et al., 1975) and possibly similar nickel potential.

Nickel deposits of the size and grade that might be expected, located at least 65 km from undeveloped tidewater (Milne Inlet) would in themselves not likely be economic. However, if the Mary River iron deposits were developed the attendant infrastructure might render nearby nickel deposits (if discovered) economically viable.

Asbestos

Cross-fibre chrysotile asbestos has been reported in serpentinized ultramafic rocks near the Mary River No. 1 iron deposit (Jackson, 1966). There could be some potential for economically interesting asbestos in the larger ultramafic bodies of the Mary River Group (which have all been subject to deformation) similar to mined deposits in Archean tectonized serpentinites of the Abitibi belt of Ontario and Quebec.

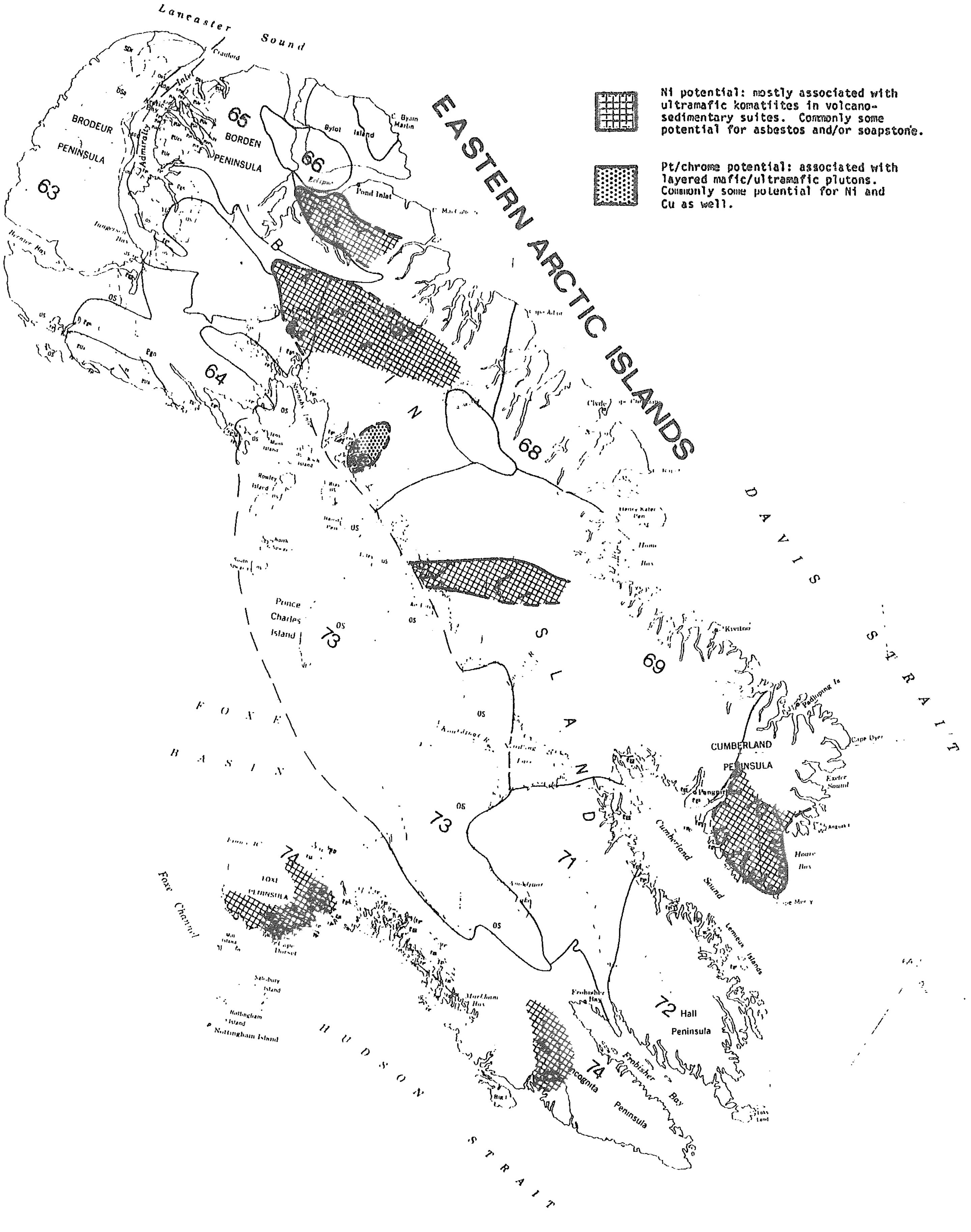


Figure 34: Areas with potential for Ni, Pt and Cr deposits, Baffin Island.

Carving stone (serpentinite)

Small bodies of serpentinized ultramafic rocks within a couple of miles of the coast of Eclipse Sound, west of Pond Inlet (Jackson *et al.*, 1975) might serve as sources of carving stone, if they have not already been exploited.

Chromite

There may be some potential for chromite in a differentiated anorthosite body at Eqe Bay on Foxe Basin (south zone, Area 67, Fig. 34: Jackson, G.D. personal communication). Mafic border zones on both sides of the intrusion open possibilities for chromitite of the Stillwater-Bushveld type.

Platinum

There may be potential for platinum-group elements in an anorthosite body at Eqe Bay on Foxe Basin (Jackson, G.D., personal communication). Mafic border zones are reminiscent of layered differentiates with which platinum deposits are associated in the Bushveld and Stillwater anorthositic complexes.

(69) Piling Group Sedimentary Rocks

Nickel

Little if any direct exploration for nickel has been carried out, and no nickel occurrences are known. Nevertheless, some potential for nickel (-copper-platinum) deposits may exist in the ultramafic bodies of the Piling Group. The ultramafic sills and dykes are associated with mafic volcanic rocks and pyrrhotite-bearing sulphide iron formation in the lower part of the uppermost formation of the Piling Group along the southern side of the belt extending some 150 km eastward from South Tweedsmuir Island in Foxe Basin (Fig. 34: Jackson and Taylor, 1972). These ultramafic rocks resemble, in their general geological setting, other Precambrian ultramafic rocks elsewhere that contain exploited nickel sulphide deposits.

The richest grade and tonnage that could be expected might be of economic interest only if located within a few tens of kilometers of tidewater.

Asbestos

Though occurrences of chrysotile asbestos are not known, there could be some potential for asbestos deposits in the ultramafic bodies in the South Tweedsmuir Island belt of the Piling Group.

Carving stone

There may be possible sources of carving stone (if not already exploited) in the ultramafic bodies near the coast in the South Tweedsmuir Island belt of the Piling Group.

(70) Hoare Bay Volcanic Rocks, Cumberland Peninsula

Nickel

Some reconnaissance level exploration for nickel deposits has been carried out, but only a few insignificant nickel occurrences are known in this area. However, there could be some potential for nickel (-copper-platinum) deposits in meta-gabbro and serpentinites associated with metabasalts and oxide iron formations in part of the Hoare Bay Group (Fig. 34: Jackson, 1971). These present a generally similar geological environment to that in other Precambrian supracrustal belts in the world that contain viable nickel sulphide deposits associated with both gabbroic and serpentinized ultramafic rocks.

Asbestos

There could be some potential for chrysotile asbestos in serpentinites of the Hoare Bay Group as they have undergone deformation (Jackson and Taylor, 1972).

Carving stone

Serpentinites of the Hoare Bay Group might be suitable sources of carving stone.

(74) Foxe Peninsula-Frobisher Bay Terrane, Lake Harbour Group and Granitic Rocks

Nickel

No exploration for nickel is known to have been carried out, and no nickel occurrences are known. A few widely scattered bodies of ultramafic rock of various lithologic affiliations (Fig. 34: Blackadar, 1967b) may have some potential for nickel deposits, but their geologic environment is too poorly understood to recognize similarities with known nickel deposits.

Asbestos

The ultramafic rocks in this region appear to be too pyroxene-rich and too small in general to offer good prospects for significant chrysotile asbestos deposits, but potential for viable deposits cannot be ruled out.

Carving stone

Some carving stone has been taken from a small serpentinite body about 20 km east of Lake Harbour (Davison, 1959). Other serpentinized ultramafic rocks may present additional potential. Limestone affiliated serpentine from Korok Inlet and Aberdeen Bay has been used more extensively than serpentinite as carving stone, and probably presents better potential.

(75) Northern Southampton Island Granitic Terrane

Platinum, chromite

There could be some potential for platinum and/or chromite in bodies of anorthositic rocks on Southampton Island and neighbouring Walrus Island (Fig. 35: Heywood and Sanford, 1976). Reconnaissance mapping revealed no evidence of strong differentiation, similar to that in the platinum and chromite-bearing Bushveld and Stillwater complexes. Nevertheless, these bodies could have local differentiation not detected by reconnaissance-scale mapping.

(77) Islands in Hudson Bay

Nickel

There is no knowledge of exploration for nickel, nor are there any known nickel occurrences in the Ottawa Islands (Fig. 35), but the presence of peridotitic komatiite flows (Baragar and Lamontagne, 1980) signals some potential for nickel. The peridotite flows, together with komatiitic and tholeiitic basalts are tentatively considered correlative with similar rocks in the Ungava Peninsula of New Quebec which contain significant nickel sulphide deposits (Baragar and Lamontagne, 1980). New Quebec Raglan Mines Limited in the Cape Smith fold belt has published reserves of 16,050,000 tons averaging 2.58% Ni, 0.71% Cu in four areas. Though development of these deposits was suspended in 1970, their eventual exploitation seems probable.

Carving stone

Known peridotitic rocks might have some potential for serpentinite carving stone.

Asbestos

The outlook for asbestos seems poor because of the relatively narrow widths (up to about 40 m) of peridotitic rocks, and the apparent low intensity of deformation.

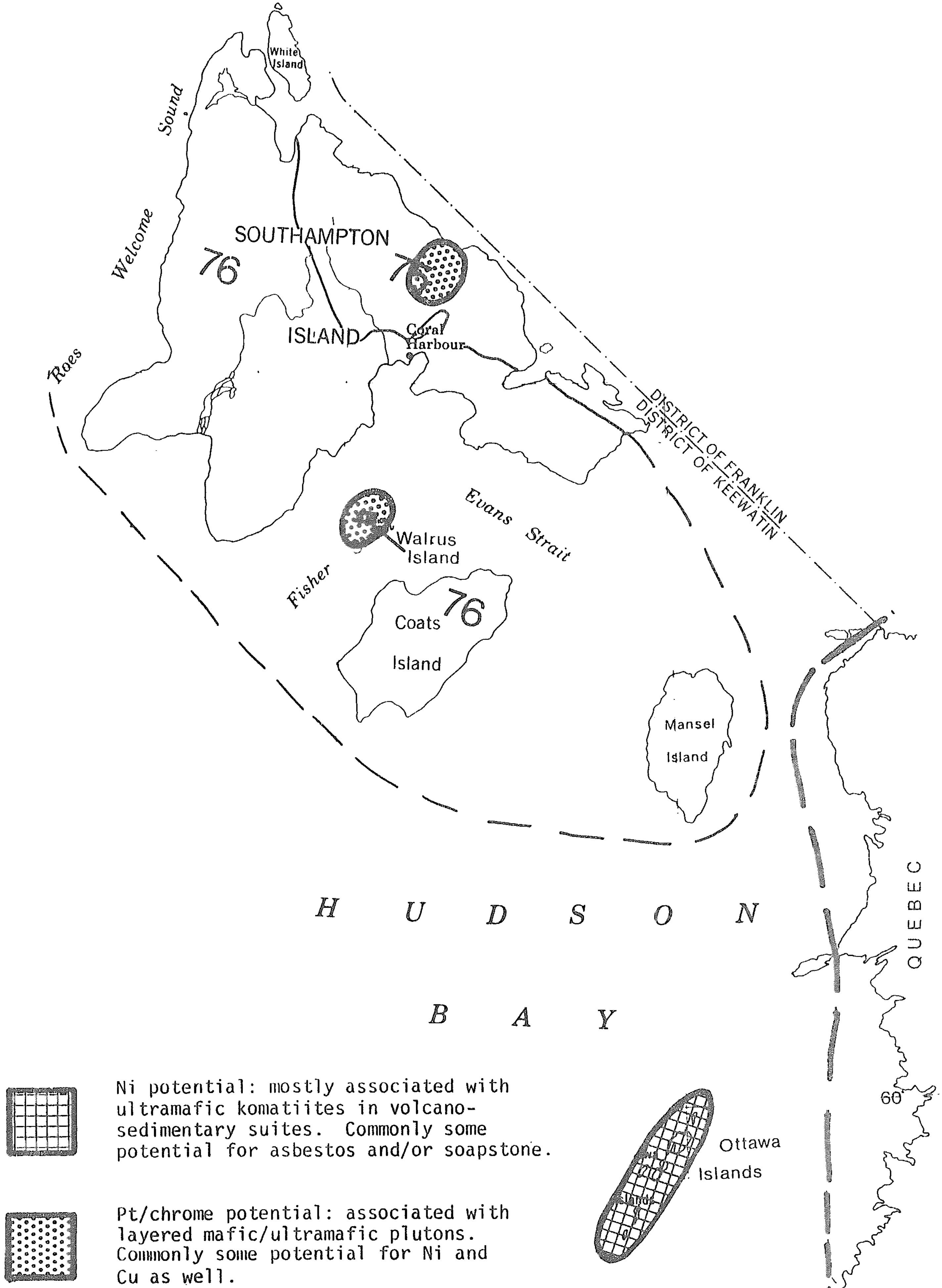


Figure 35: Areas with potential for Ni, Pt and Cr deposits, islands in northern Hudson Bay.

VII EASTERN ARCTIC ISLANDS AND HUDSON REGION

VOLCANOGENIC MASSIVE SULPHIDE DEPOSITS

(67) Mary River Group Rocks, Northern Baffin Island

The chief rocks of interest in this area belong to the Mary River Group which consists of "intermediate to basic metavolcanic rocks and associated basic and ultrabasic intrusions, a variety of metasedimentary rocks, and a few acid metavolcanic rocks" (Jackson and Taylor, 1972, p. 1661). It is the distribution of the acid (felsic) volcanic rocks that is of interest in evaluating this area in terms of volcanogenic massive sulphide deposits. Rocks of this type occur throughout the area; significant concentrations of felsic volcanics have been mapped in the immediate Mary River area and in the Eqe Bay area to the south (G.D. Jackson, personal communication, 1980). Due to the reconnaissance level of mapping, however, it cannot be assumed that other similar concentrations of felsic volcanic rocks do not exist elsewhere in Area 67. Consequently, at the present state of knowledge, it is impossible to isolate sub-areas within Area 67 as being more favourable for "volcanic-type" deposits than other sub-areas. The entire area underlain by Mary River Group rocks is therefore regarded as having at least some potential for deposits of this type.

(70) Hoare Bay Volcanic Rocks, Cumberland Peninsula

Within this area, rocks of the Hoare Bay Group, briefly described by Jackson and Taylor (1972, p. 1665), comprise metasedimentary and metavolcanic rocks. Within the latter, felsic components have been noted but mapping has not been done in sufficient detail to delineate any area(s) of significant concentration of this lithology. Consequently, the entire Hoare Bay Group (area 70) must be considered to have some potential for volcanogenic massive sulphide deposits.

LEAD-ZINC

(65) Borden Peninsula Proterozoic Rocks

This area contains the important Nanisivik lead-zinc mine enclosed in carbonate rocks of the Society Cliffs Formation of Precambrian age. The likelihood of future discoveries of ore-grade material in this Formation, either in the immediate mine area or elsewhere in Area 65, is considered good to excellent.

Stratigraphically below the Society Cliffs Formation, the Arctic Bay formation, comprised dominantly of shale and siltstones, has been recently shown to have been deposited concurrently with faulting associated with the North Baffin Rift Zone (Iannelli, 1979). Deposition of Arctic Bay strata was preceded by extrusion of basaltic flows of the Nauyat Formation (Jackson et al., 1978d) and the entire sedimentary sequence was also intruded by an extensive diabase dyke swarm (Franklin Intrusions). Slow, fine-grained clastic sedimentation (Arctic Bay Formation shale), together with penecontemporaneous growth faulting in an area of slightly higher-than-normal geothermal gradient (the Nauyat Formation basalt and the Franklinian diabase dykes) are regarded as favourable geologic characteristics for the occurrence of "shale-type" lead-zinc deposits.

(69) Piling Group Sedimentary Rocks

This area is underlain by rocks of the Piling Group, their migmatized equivalents, and basement gneiss complex. The stratigraphy, lithology and structure of the Piling Group have been described in brief reports by Morgan et al.(1975; 1976), Tippett (1978) and Tippett et al.(1980).

Unconformably overlying a basement gneiss complex, the Piling Group consists of a lower quartzite, followed by a unit of chiefly carbonate rocks (and calc-silicates), then a graphitic sulphide schist, and finally a very thick unit of metagreywacke (Morgan et al., 1976).

Within the Piling Group, the basal quartzite, the marble, and the graphitic sulphide schist are regarded as favourable for the occurrence of lead-zinc deposits. The quartzite can be interpreted as a shallow-water unit transgressive over a sialic basement. Paleolatitude during deposition appears to have been low (Irving, 1979). All these features suggest the possible occurrence of "sandstone-type" lead-zinc deposits. The carbonate unit is regarded as favourable because it can be correlated across Baffin Bay to the Marmorilik area of western Greenland. There, Vestgron Mines is currently exploiting the 4.4 million-ton Black Angel "carbonate-type" lead-zinc deposit (Fish, 1974). The graphitic sulphide schist unit of the Piling Group is considered to be favourable for the occurrence of "shale-type" lead-zinc deposits. The graphitic sulphide schist could represent the metamorphosed equivalent of a starved-basin facies pyritic, carbonaceous shale. Lithologies such as this, representing slow depositional rates, are known to contain lead-zinc deposits elsewhere in the world (see discussion of "shale-type" lead-zinc deposits in Appendix 2).

Allowing for metamorphic effects and minor variations in lithology, the sequence of lithologies in the Piling Group bears a remarkable similarity to a sequence with high lead-zinc potential reported in northern Ellesmere Island (see description of areas 14A, 14B, 14C, and 15). The similarities in lithologies and stratigraphic succession are evident from Table 6.1 (below) and serve to emphasize the lead-zinc potential of the Piling Group.

PILING GROUP, BAFFIN ISLAND	NORTHERN ELLESMERE ISLAND	
Metagreywacke, psammite, slate (>3000 m)	Subgreywacke, greywacke, argillaceous greywacke	IMINA FM. (>1000 m)
Graphitic sulphide schist (up to 200 m)	Chert, shale	HAZEN FM. (ca. 400 m)
Marble, quartzite, calc-silicates (up to 200 m)	Limestone, chert, shale	
Quartzite (up to 200 m)	Quartzite, siltstone, shale	GRANT LAND FM. (1300 m)
— unconformity —	— unconformity —	
Basement Complex	Basement complex	

Table 6.1 Comparison of lithologies and stratigraphy between Aphebian Piling Group, Baffin Island and Lower Paleozoic formations, northern Ellesmere Island. Piling Group information from Morgan *et al*., (1976), W.C. Morgan and J.R. Henderson (personal communication, 1980). Ellesmere Island information from Trettin (1971), Trettin and Balkwill (1979) and Trettin *et al.* (1979).

(74) Foxe Peninsula-Frobisher Bay Terrane

Inasmuch as this area contains scattered occurrences of quartzite, marble and graphitic rusty paragneiss of the Lake Harbour Group (Davison, 1959; Blackadar, 1967b) which may be correlative with similar lithologies of the Piling Group (Jackson and Taylor, 1972; see also discussion of Area 69), this area may be considered to have some potential to contain any or all of "sandstone-type", "carbonate-type", or "shale-type" lead-zinc deposits.

(77) Islands in Hudson Bay

Several small lead-zinc deposits are known to occur in brecciated dolomites of the Nastapoka Group along a 70 km section on the mainland from Richmond Gulf to the head of Manitounuk Sound. Little is known of these occurrences save for a brief description by Harwood (1949). Consequently, the control on mineralization in the dolomites is not known with certainty. However, inasmuch as the same dolomite unit is also found offshore on Castle, Merry and Long Islands, it is possible that similar "carbonate-type" lead-zinc deposits could occur on these islands as well.

On the Belcher Islands, the correlative formation is the Mavor Formation (Dimroth *et al*., 1970; Chandler, 1980) exposed on Tukarak and Mavor Islands of the eastern Belchers (Jackson, 1960). Dolomite also occurs in several other formations in the Belcher Islands and, until the mineralization in the Richmond Gulf-Manitounuk Sound area is better understood, these Belcher Island dolomites must be regarded as favourable for "carbonate-type" lead-zinc deposits.

VII EASTERN ARCTIC ISLANDS AND HUDSON REGION

IRON

(67) Mary River Group Rocks, Northern Baffin Island

Rocks of the Mary River Group consist of younger Archean or Aphebian metagreywacke, quartzite, metavolcanic rocks, iron-formation, gabbro and ultramafic intrusions, granitic gneisses and schists that are widely distributed in outliers and sinuous belts in the older migmatite, granite and gneissic terrane of the northern part of Baffin Island. Iron-formation appears to occur consistently in these outliers as demonstrated by the iron deposits described previously (Part I, Section 5) in the Mary River area and in the vicinity of Eqe Bay, by many exposures of thinner bands or lenses and by many linear magnetic anomalies where rock exposure is poor or detailed prospecting work has not been reported. An indication of the distribution of iron-formation is given by the plot of known occurrences (Map 2). Characteristic of many of the iron-formation bands prospected are narrow lenses of nearly pure magnetite or hematite which appear to have been primary parts of the iron-formation that were recrystallized and deformed during metamorphism. Rich lenses of magnetite or hematite of considerable thickness occur in thinly banded quartz-magnetite and quartz-hematite iron-formation and account for the high grade deposits in the Mary River area. The occurrence of high grade lenses within the iron-formation improves the prospects of finding deposits of a size that would be suitable as a source of ore concentrate.

The iron deposits that have been explored in the region demonstrate a moderate to high iron resource potential. However, the remote location, lack of transportation and infrastructure in the region and economic factors controlling the supply of iron ore in the Atlantic market area do not favour the development of iron resources in this area for many decades.

The association of the iron-formations with sulphide minerals in rocks of the Mary River Group indicates that metallogenetic conditions are favourable for the occurrence of polymetallic sulphide deposits containing copper, zinc, and silver and probably for gold. The wide distribution of ultramafic rocks in close association with the iron-formations is also recognized as a favourable condition for the occurrence of nickel sulphide minerals. (General references: Gross, 1966; Jackson, 1969; Jackson and Morgan, 1978; Jackson et al., 1978a, 1978b, 1978c; Morgan et al., 1975.)

(74) Foxe Peninsula-Frobisher Bay Terrane, Lake Harbour Group and Granitic Rocks

Magnetite iron-formation occurs as narrow irregular lenses and bands associated with highly metamorphosed rocks including amphibolite, metasedimentary rocks (including crystalline limestone), hornblende-mica schists and granitic gneisses. The iron-formation appears to be most commonly associated with amphibolite and pyroxene-hornblende gneisses in narrow sinuous bands in the gneissic terrane of the coastal area. The iron-formation is from 100 to 500 feet (30-150m) thick in the areas described previously (Section 5) where resources have been delineated, but in most other places where it has been observed it is much thinner. A few high grade lenses occur within the banded iron-formation at Maltby Lake but in general the iron content is relatively low; however, the magnetite iron-formation within these highly metamorphosed rocks can be beneficiated easily to give good quality concentrates.

This relatively low grade material is widely distributed in small deposits along the shallow rocky coastal area and is not likely to be developed for many decades.

(77) Belcher Islands, Hudson Bay

Lake Superior type iron-formation is widely distributed throughout the Belcher Islands and contains potential iron resources that consist of primary magnetite and hematite iron-formation or taconite, rather than naturally concentrated and enriched material as mined around Schefferville, in Quebec and Labrador, and on the Lake Superior ranges. Taconite resources on the Belcher Islands have been indicated on Innetalling Island (see Part I, Section 5), on Tukarak Island and around Haig Inlet where substantial resources occur in parts of the iron-formation as fine-grained cherty magnetite or hematite facies in relatively thin shallowly-dipping linear fold structures.

The mineral composition and iron content of large parts of the iron-formation, in areas beyond Innetalling Island, may not be uniform because of variations in the lithological facies.

(77) Nastapoka, Hopewell and Long Islands

Iron-formation occurs on these islands as relatively thin stratigraphic units and is highly variable in composition, much of it consists of siderite-rich beds. A significant amount of manganese is present in this iron-formation and is of interest although manganese-rich occurrences of suitable quality for industrial use have not been reported. Parts of the iron-formation represent significant low grade taconite resources but these would be relatively difficult to beneficiate.

It is obvious that there are substantial tonnages of taconite resources on the islands on the east side of Hudson Bay, however, their chances of development are overshadowed by the presence in the region of better quality iron-formation on the mainland. The possibility of locating manganese resources in the iron-formation rocks should not be overlooked.

MOLYBDENUM

(29) Fury and Hecla Strait Proterozoic-Archean Rocks

A remote possibility exists of molybdenum deposits associated with Precambrian granitic rocks and minor byproduct molybdenum in "unconformity-type" uranium deposits beneath Helikian sedimentary cover rocks.

(64) Northern Baffin Granitic Rocks (including some Mary River Group rocks)

A very slight possibility exists of molybdenum deposits associated with these felsic crystalline rocks.

(65) Borden Peninsula Proterozoic Rocks

A very slight possibility exists of minor byproduct molybdenum associated with "sandstone- and unconformity-type" uranium deposits.

(67 Mary River Group Rocks, Northern Baffin Island

A slight possibility exists of porphyry, vein, and aplite-pegmatite deposits related to felsic, subvolcanic intrusions and of molybdenum deposits associated with felsic granitic and high grade metamorphic rocks.

(68) Cape Christian Granitic Rocks, some Mary River Group

A remote possibility exists of deposits associated with felsic crystalline rocks.

(69) Piling Group Sedimentary Rocks

(70) Hoare Bay Volcanic and Sedimentary Rocks, Cumberland Peninsula

(72) Hall Peninsula Granitic Rocks, some Lake Harbour Group

(74) Foxe Peninsula-Frobisher Bay Terrane, Lake Harbour Group

A slight possibility exists of deposits associated with felsic crystalline Archean basement and Proterozoic granites and supracrustal rocks.

(71) Southern Baffin Granitic Rocks

A slight possibility exists of molybdenum deposits associated with felsic crystalline rocks.

(75) Northern Southampton Island Granitic Terrane

A slight possibility exists of deposits associated with felsic crystalline Archean basement and Proterozoic granites and supracrustal rocks. Heywood and Sanford (1976, p. 33) mentioned that molybdenite occurs in small pegmatite bodies at Terror Point and Cape Welsford.

(77) Islands in Hudson Bay (excluding 76)

There is an extremely remote possibility of molybdenum deposits on some small islands off northwestern Quebec in felsic crystalline basement rocks and a remote possibility of minor byproduct molybdenum associated with "sandstone-type" uranium deposits in Proterozoic sedimentary rocks.

VII MISCELLANEOUS AND INDUSTRIAL MINERALS

Introduction

In addition to the major metallic commodities discussed in this report, numerous occurrences of minor and industrial materials are known in the northern and Arctic regions. These include: bentonite, phosphate, gypsum, sulphur, various carving stone materials, graphite, mica and the single known occurrence of diamonds (minor) on Somerset Island. In the following section brief notes are provided on the occurrence and potential of some of these materials but no attempt has been made to provide a detailed assessment of industrial materials on a regional or areal basis. For the most part known deposits have little economic significance except in cases where the materials may be used in local "cottage" industries (e.g. carving stone).

Bentonite

Bentonite has a variety of industrial uses but the principal and probably only use for northern supplies would be as an additive in drilling muds. Current and projected Arctic and northern offshore oil and gas drilling operations should ensure a market for the foreseeable future. For drilling mud additives, however, good quality, "high-swelling" sodium bentonite is required, and for economic mining operations high-quality bentonite must be present in discrete layers or beds so that separation of impurities is not necessary. Although bentonite beds are present in several northern and Arctic areas, in general insufficient information on quality is known to assess the economic potential of the material.

Bentonite beds of the upper Lower Cretaceous Horton River Formation ("Bentonitic Zone") are widespread in Anderson Plain area (5) of northwestern Mackenzie, and they have been correlated with similar strata of the Christopher Formation on Banks Island (4, 5) by Yorath *et al* (1975). Miall (1979) however does not mention the presence of bentonite in his detailed description of the Christopher Formation but he does describe bentonite beds in the Upper Cretaceous Kanquk Formation of Banks Island. A drilling program by Trans-Canada Resources Limited in 1971 (4 holes to a maximum depth of 137 feet) in Mackenzie Delta about 24 km north of Inuvik intersected the "Bentonitic Zone" but discrete bentonite beds were not found and the material tested was of low quality. In spite of these negative results the potential for economic grade bentonite in local concentrations remains a possibility.

Sulphur

Native sulphur occurs in association with piercement gypsum-anhydrite diapirs forced through Sverdrup Basin Mesozoic rocks of western Axel Heiberg Island (15). A number of these occurrences were investigated in the later 1960s by PCE Explorations Limited and Noble Mines and Oils Limited but the possibility of economic exploitation of such sources is remote.

Evaporites (Gypsum, Anhydrite, Salt)

Evaporites of ages ranging from Precambrian to Late Paleozoic (Permian) are widespread in the Arctic Islands. The major concentrations occur in the Ordovician Baumann Fiord and Bay Fiord formations and the Carboniferous (Upper Mississippian to Lower Permian) Otto Fiord Formation. These strata occur in   sections on Ellesmere, Axel Heiberg, Devon and

Cornwallis Islands and in the islands of the eastern Sverdrup Group. As noted earlier (Section 3) massive gypsum beds occur in a section up to 150 m thick in the lower member of the Cornwallis "Formation" exposed along cliffs on Bache Peninsula, eastern Ellesmere Island.

Salt deposits have been penetrated in several oil and gas exploration wells drilled to test diapiric structures on Bathurst and Ellef Ringnes Island. Salt occurs principally as diapiric cores in the Bay Fiord (Ordovician) and Otto Fiord (Carboniferous) formations and in one instance (Otto Fiord of Ellef Ringnes Island) 4,000 m of salt was penetrated (Davies et al., 1976).

In total the evaporite resources of the Arctic Islands are undoubtedly vast, but because of remoteness from markets and adequate supplies from other sources, the chances of exploitation of such resources seem slim.

Phosphate

As noted earlier in this report (Section 3) phosphatic ironstones of northern Richardson Mountains (3) Yukon and Northwest Territories carry local occurrences of spectacular complex phosphate minerals which are of interest for mineral collecting purposes and possibly for semi-precious jewellery.

Phosphatic "rock", one of the principal ingredients in mineral fertilizers and a commodity which Canada currently must import (mainly from the United States), occurs in Cretaceous strata of the northern Yukon and in Cambrian, Jurassic and Triassic rocks of western Queen Elizabeth Islands (Western Arctic Region) but known occurrences to date are not of economic extent or quality. However, favourable conditions for deposition of phosphatic beds probably existed in Late Precambrian to Late Paleozoic time in the Arctic regions (R.L. Christie, personal communication) and the possibility that commercial grade deposits may be present cannot be discounted on the basis of present knowledge.

Diamonds

Central Arctic Region (22, east part)

Numerous small kimberlite bodies are known cutting Paleozoic rocks of southeast Somerset Island (Mitchell and Fritz, 1973; Mitchell, 1975, 1976; Mitchell and Clarke, 1976; Brummer, 1978). These bodies were explored for diamonds by Cominco Limited and Diapros Canada Limited. In 1974, Diapros constructed a small mill on Somerset Island and tested 414 tons of kimberlitic material by a heavy mineral concentration process. The concentrates were shipped to South Africa for further testing and a few small diamonds were found (Laporte et al., 1978). Diapros also conducted additional exploration for kimberlites on northern Baffin Island and, although kimberlite indicator minerals were found in overburden, no kimberlite exposures were located (J.E. Brunet, personal communication). The nature and structural controls of the Somerset Island kimberlites are not clearly understood and the existence of other, perhaps diamondiferous bodies in the region must remain a possibility.

Miscellaneous

Small tonnages of graphite were produced by the Hudson's Bay Company (1917-1918) from a deposit in limestone near Lake Harbour (74) on southern Baffin Island and other occurrences of the mineral are known on the island.

Mica was also mined intermittently until the 1930s from the Lake Harbour area. Neither of these commodities would be currently economic to exploit in the northern regions. Carving stone of various types occurs at numerous localities in the regions covered by this report (particularly Eastern Arctic and Hudson) and is of local economic importance to northern communities and artisans. A variety of materials are used for carving but the most common are serpentinized and talc-chloritized ultramafic rocks ("soapstone").

The mineral lazurite, or lapis lazuli, a translucent azure blue or bluish green rock, is a semi-precious stone. There are two small occurrences of this material about 15 km north of Lake Harbour in southern Baffin Island. The main occurrence has been known for many years (Davison, 1959; Higgins, 1968). The second occurrence, 1.6 km further north, was discovered in 1967 as a result of investigations undertaken by the Department of Indian and Northern Affairs and the government of the Northwest Territories in order to establish a possible source of gem and ornamental stone for use in a local handicraft industry (Hogarth, 1968, 1969, 1970; Higgins, 1968; Hogarth and Griffin, 1978).

The lapis-bearing area, as presently outlined, is about 3500 m^2. Although the material is badly fractured and rather light in colour at the surface, it might be of better quality at depth. This would have to be ascertained by diamond drilling (Hogarth, 1971).

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APPENDIX 1A

Listing of all proven and significant deposits to accompany Map 1

Deposits are listed according to:

a) major regions
b) in numerical sequence within primary NTS grid units.

Explanation of Listing Codes

Column 1 – Primary Grid identification (see GRID KEY, Maps 1 and 2)

Column 2 – Mineral deposit/occurrence number

Column 3 – Deposit name and alternate name if applicable

Column 4 – National Topographic System area

Column 5 – Latitude and longitude of deposit location

Column 6 – Deposit type code (see Mineral Deposit Symbol Code, Maps 1 and 2)

Column 7 – Upper – Capsule description of mineralization

– Lower – CANMINDEX commodity status code, as follows:

01 – commodity is being produced

02 – the deposit has calculated reserves of a commodity but has never produced

03 – the deposit has had past production, known reserves are present but the commodity is no longer being produced

04 – exhausted; the commodity is no longer produced and there are no known reserves or demonstrated resources

05 – two-dimensional data (e.g. length and width) and grade are available (public) but not enough to calculate reserves

06 – one-dimensional data and grade (e.g. a drill hole; one trench)

07 – present; commodity reported but insufficient data are available (public) to allow the status to be classified

08 – the commodity occurs at a producing mine or in a significant deposit but it is not known whether it is being, or will be, extracted for sale.

NORTHERN YUKON AND NORTHWESTERN MACKENZIE REGION

GRID#	OCC#	DEPOSIT NAME(S)	NTS AREA	LOCATION	DEPOSIT TYPE AND CHARACTER --- COMMODITIES AND STATUS
N3-10	2	DELTA IRON MOUNT DAVIES GILBERT	117A/09	68 35 136 45	10 BEDDED QUARTZ-SIDERITE IRON FORMATION FE 5 PHS5 MN 5
N3-10	3	FIRTH RIVER	117C/01	69 09 23 140 09 23	03* GRAVEL BARS ON WEST SIDE OF FIRTH RIVER AU 3

NORTHERN ARCTIC ISLANDS REGION

GRID#	OCC#	DEPOSIT NAME(S)	NTS AREA	LOCATION	DEPOSIT TYPE AND CHARACTER --- COMMODITIES AND STATUS
N4-5	1	ECLIPSE EAST SHOWING	068H/09	75 31 30 096 08	09 OPEN SPACE FILLING IN LIMESTONE & DOLOMITE BRECCIA ZN 2 PB 2
N4-5	2	POLARIS BANKENO	068H/08	75 23 10 096 56	09 MASSIVE & DISSEM SULPHIDES IN LMS & DOL BRECCIA ZN 2 PB 2 AG 2 CD 2

CENTRAL ARCTIC REGION

GRID#	OCC#	DEPOSIT NAME(S)	NTS AREA	LOCATION	DEPOSIT TYPE AND CHARACTER --- COMMODITIES AND STATUS
N2-4	7	HEB WAGER BAY-HAYES RIVER PROJECT	056J/12	66 42 40 091 42	06 MASSIVE SULPHIDE POCKETS IN ULTRAMAFIC INTRUSION CU 6 NI 6
N2-5	17	OTOK PERRY RIVER CLAIMS	066N/05	67 24 18 101 46 36	06 IN PYROXENITE & GRANULITE BANDS & MAFIC INTRUSIONS CU 5 NI 5 FE 7
N3-3	4	MELVILLE PENINSULA EAST PARRY BAY	047A/06	68 30 082 38	10 BANDED IRON FORMATION# ALGOMA TYPE- PRIMARY FE 2
N3-3	5	MELVILLE PENINSULA WEST BOREALIS	047B/07	68 17 085 25	10 BANDED & THINLY LAMINATED IF# ALGOMA TYPE- PRIMARY FE 2
N3-3	6	MELVILLE PENINSULA WEST - 1 BOREALIS 1	047B/07	68 13 00 085 29 54	10 BANDED & THINLY LAMINATED IF# ALGOMA TYPE- PRIMARY FE 2
N3-3	7	MELVILLE PENINSULA WEST - 2 BOREALIS 2	047B/07	68 12 12 085 30 00	10 BANDED & THINLY LAMINATED IF# ALGOMA TYPE- PRIMARY FE 2
N3-3	8	MELVILLE PENINSULA WEST - 3 BOREALIS 3	047B/07	68 11 30 085 30 18	10 BANDED & THINLY LAMINATED IF# ALGOMA TYPE- PRIMARY FE 2
N3-3	9	MELVILLE PENINSULA WEST - 4 BOREALIS 4	047B/07	68 17 54 085 17 12	10 BANDED & THINLY LAMINATED IF# ALGOMA TYPE- PRIMARY FE 2
N3-3	10	MELVILLE PENINSULA WEST - 5 BOREALIS 5	047B/07	68 22 00 085 16 42	10 BANDED & THINLY LAMINATED IF# ALGOMA TYPE- PRIMARY FE 2

NORTHEASTERN MACKENZIE DISTRICT

GRID#	OCC#	DEPOSIT NAME(S)	NTS AREA	LOCATION	DEPOSIT TYPE AND CHARACTER --- COMMODITIES AND STATUS
N2-6	7	BAR-3 BAR LAKE	076E/11	65 41 30 111 13 24	03 GNT-CMNG-SLFD GNEISS BAND (AMPHIBOLITE)IN METASEDS AU 6 CU 7 AS 7
N2-6	10	BRICK	0760/16	67 50 50 106 24	03 QTZ IN MYLONITE BAND IN GREENSTONE BELT AU 6 CU 6 ZN 6 AG 6
N2-6	13	CANADIAN NICKEL-MAIN SHOWING PAT/ CONGO/ MCP	076E/14	65 45 52 111 13 35	03 GNT-CMNG-SLFD GNEISS BAND (AMPHIBOLITE)IN METASEDS AU 2 AG 8 CU 8 AS 8 FE 8
N2-6	22	COT 15 OX (1964)	076J/11	66 42 10 107 26 40	03 GNT-CMNG-SLFD GNEISS BANDS(AMPHIBOLITE)IN METASEDS AU 6 CU 7 AS 7
N2-6	30	ESKER LAKE BAY	076E/11	65 41 36 111 09 12	03 GNT-CMNG-SLFD GNEISS BANDS(AMPHIBOLITE)IN METASEDS AU 6 AG 7 CU 7 NI 7 AS 7
N2-6	37	G GROUP	076M/11	67 43 43 111 21 13	03 VEINS IN GRANITIC OR GRANODIORITIC ORTHOGNEISS AU 5 PB 7 ZN 7 CU 7
N2-6	39	GALENA POINT-2 DON	076N/13	67 53 50 109 54	07 VEINS CUTTING GRANITE PB 6 ZN 6 CU 6 AG 6
N2-6	41	GUNN BEC	0760/16	67 58 35 106 28 20	03 QTZ VEIN IN BAND OF GREENSTONE-MYLONITE AU 6 CU 6 AG 6
N2-6	42	H GROUP	076M/11	67 42 04 111 20 55	04 QTZ VEINS IN SHEARS CUTTING GRANITIC ROCKS AU 5 CU 7 ZN 7 AG 7
N2-6	43	HAC	076K/01	66 03 11 108 25 00	08 IN GRANITIC & MAFIC GNEISS ZN 6 CU 7
N2-6	44	HACKETT R-EAST CLEAVER LAKE CLEAVER LAKE	076F/16	65 55 00 108 27 39	08 STRATIFORM MASSIVE SLFDS IN FELSIC VOLCS ZN 2 AG 2 CU 2 PB 2 AU 2
N2-6	45	HACKETT RIVER - BOOT LAKE ZONE	076F/16	65 54 46 108 26 15	08 STRATIFORM MASSIVE SLFDS IN FELSIC VOLCANICS ZN 2 CU 2 AG 2 PB 2 AU 2
N2-6	46	HACKETT RIVER - JO ZONE NORTH	076F/16	65 54 41 108 21 19	08 STRATIFORM MASSIVE SLFDS IN FELSIC VOLCANICS ZN 6 AG 6 CU 6 PB 6 AU 6
N2-6	47	HACKETT RIVER - JO ZONE SOUTH	076F/16	65 54 34 108 20 36	08 STRATIFORM MASSIVE SFLDS IN FELSIC VOLCANICS ZN 6 AG 6 CU 6 PB 6 AU 6
N2-6	48	HACKETT RIVER-FINGER LAKE ZONE	076F/16	65 54 36 108 25 51	08 STRATIFORM MASSIVE SLFDS IN FELSIC VOLCANICS ZN 6 AG 6 CU 6 PB 6 AU 6
N2-6	49	HACKETT RIVER-MAIN A ZONE BB	076F/16	65 55 05 108 21 59	08 STRATIFORM MASSIVE SULPHIDES IN FELSIC VOLCS ZN 2 AG 2 CU 2 PB 2 AU 2
N2-6	51	HIGH LAKE	076M/07	67 22 50 110 51 20	08 MASSIVE-DISS-VEINLETS/STRATIFORM SLFDS IN METAVOLC CU 2 ZN 2 AU 2 AG 2 PB 2

NORTHEASTERN MACKENZIE DISTRICT

GRID#	OCC#	DEPOSIT NAME(S)	NTS AREA	LOCATION	DEPOSIT TYPE AND CHARACTER --- COMMODITIES AND STATUS	
N2-6	52	HIGH LAKE-AB ZONE	076M/07	67 22 50 110 51 20	08	MASSIVE-DISS-VEINLETS/STRATIFORM SLFDS IN METAVOLC CU 2 ZN 2 AU 2 AG 8 PB 8
N2-6	53	HIGH LAKE-D ZONE	076M/07	67 22 35 110 51 18	08	MASSIVE-DISS-VEINLETS/STRATIFORM SLFDS IN METAVOLC ZN 2 CU 2 AG 2 AU 2 PB 2
N2-6	86	LAHTI (NORTH VEIN) WAN	076O/16	68 00 00 106 28 00	03	QTZ VEIN SYSTEM IN GREENSTONE AU 6 CU 6 AG 6
N2-6	87	LAHTI (SOUTH VEIN) WAN	076O/16	67 59 45 106 27 45	03	QTZ VEIN SYSTEM IN GREENSTONE AU 6 CU 6 AG 6
N2-6	91	MAG/ LOU/ NA MUSKOX LAKE	076C/09	64 42 30 108 12 30	08	DISSEM SLFDS IN VOLCS CU 6 ZN 6 AG 6
N2-6	94	NEW ATHONA-CONTWOYTO LAKE NAT	076E/11	65 41 12 111 12 12	03	GNT-CMNG-SLFD GNEISS BANDS(AMPHIBOLITE)IN METASEDS AU 6 CU 7 AS 7 FE 7
N2-6	95	NOEL PISTOL LAKE	076N/02	67 03 108 47	03	SLFDS IN AMPHIBOLITE BANDS IN METASEDS AU 6 AS 7
N2-6	97	NORTH VEIN P/ Q/ R/ X/ SIDEWALK GROUP	076M/11	67 42 28 111 23 06	03	SHEAR VEIN CUTTING SYENO-DIORITE AU 2 CU 7 PB 7
N2-6	112	SP-11 SEP LAKE	076E/11	65 42 24 111 19 42	03	GNT-CMNG-SLFD GNEISS BANDS(AMPHIBOLITE)IN METASEDS AU 6 CU 7 AG 7 AS 7
N2-6	120	TURNER LAKE-1 COM	076N/02	67 13 46 108 57 10	06	SHEAR ZONE IN METAMORPHOSED QTZ DIORITE CU 6 NI 6 AU 6 AG 6 CO 7 PB 7
N2-6	128	YAVA AGRICOLA LAKE	076G/12	65 36 40 107 56 11	08	MASSIVE SULPHIDE IN FELSIC METAVOLCANIC FLOW ZN 2 PB 2 AG 2 CU 2 AU 2
N2-7	3	ALF GROUP-SHOWING A	086O/05	67 16 06 115 58 30	05	BRECCIA SHEAR ZONE IN BASALT CU 6 AG 7
N2-7	6	ANDY AND COP TESHIERPI NO 10	086O/11	67 35 12 115 07 30	06	IN BRECCIATED ZONES IN SEDS & BASALT CU 6 NI 6
N2-7	38	CARL 7	086N/12	67 44 00 117 35 35	05	CHALCOCITE IN BASALT CU 2
N2-7	43	COMUR	086K/09	66 38 03 116 04 10	01	U IN VEINS & BRECCIA ZONE IN ECHO BAY GROUP ROCKS U 6
N2-7	48	COPPER LAMB	086N/10	67 37 55 116 51 45	05	LENSES IN VEINS IN BASALT CU 6 BA 7
N2-7	49	CORONATION NORTHWEST ZONE CORONATION WEST SHOWING/MGB 18	086N/08	67 20 05 116 27 00	05	VEINS & BRECCIA ALONG FAULT IN BASALT CU 2 AG 8

NORTHEASTERN MACKENZIE DISTRICT

GRID#	OCC#	DEPOSIT NAME(S)	NTS AREA	LOCATION	DEPOSIT TYPE AND CHARACTER --- COMMODITIES AND STATUS
N2-7	51	CU 1-36	0860/05	67 21 20 115 47 30	05 VEINS IN BRECCIA SHEAR ZONES CUTTING BASALTS CU 6 AG 6
N2-7	53	CU-TAR	0860/05	67 18 42 115 47	05 VEINS ALONG FRACTURE ZONES IN BASALT CU 6
N2-7	55	DICK NO 1 AMCO LAKE GROUP	086N/08	67 19 50 116 02 35	05 VEINLETS PODS & IRREG MASSES IN BRECC VEIN IN BSLT CU 2 AG 8
N2-7	68	DOT 47 COPPERMINE R NO 47 ZONE	086N/08	67 24 36 116 24 43	05 TABULAR BODY IN FRACTURED (FAULT ZONE) BASALTS CU 2
N2-7	73	EM 30	0860/06	67 17 40 115 17 40	05 VEIN IN BASALT CU 6 AG 7
N2-7	76	ESC 37/38	0860/12	67 35 15 115 33 25	05 NODULES ADJ TO FAULTS/ ALSO DISSEM/ IN SANDSTONE CU 6
N2-7	77	ESC 63/69	0860/12	67 35 25 115 35 25	05 NODULES & LAYERS IN SANDSTONE ADJACENT FAULT CU 6
N2-7	80	EVE	0860/03	67 06 48 115 06 03	06 NI-CU IN SILICEOUS GNEISS/ NI IN PERIDOTITE CU 6 NI 6
N2-7	91	FAR-3 (H-8)	086N/12	67 44 10 117 41 00	05 VEINLET SWARM IN SHEAR-BRECCIA ZONE IN BASALT CU 6
N2-7	101	GDF 77-78/ HAUG 2 AREA FOKKER CREEK	0860/06	67 23 54 115 27 12	05 FAULT CUTTING BASALT CU 6
N2-7	103	GM/ DM/ FD/ SA	0860/05	67 24 115 34 40	05 IN BRECCIATED ZONES IN BASALT CU 6
N2-7	109	GREG	086N/10	67 41 30 116 55 00	05 VEINS IN BRECCIATED FISSURE ZONES IN BASALT CU 6
N2-7	110	GRR 90	086N/11	67 33 00 117 27 35	05 VEINS IN FRACTURE ZONE IN DOLOMITE CU 6
N2-7	123	HR	0860/11	67 36 10 115 07 35	05 VEINLETS AND STOCKWORK IN BASALT CU 6
N2-7	124	HUSKY	086N/08	67 20 50 116 07 05	05 IN FRACTURES IN FAN-SHAPED ZONE IN BASALT CU 6
N2-7	128	JACK-NO 13 VEIN	086N/07	67 25 116 43 55	05 VEIN CUTTING BASALT CU 6 AG 6
N2-7	133	JIM N92502	0860/05	67 20 50 115 55 15	05 CC-QTZ VEINS ASSOC W SHATTER ZONE IN BASALT FLOWS CU 6 AG 6

NORTHEASTERN MACKENZIE DISTRICT

GRID#	OCC#	DEPOSIT NAME(S)	NTS AREA	LOCATION	DEPOSIT TYPE AND CHARACTER --- COMMODITIES AND STATUS
N2-7	143	JUNE	0860/11	67 34 25 115 03 30	05 FRACTURED BRECCIATED FAULT ZONE IN BASALT CU 2
N2-7	145	KAT 28 KAT NO 1 SHOWING	0860/05	67 15 29 115 52 56	05 DISSEMINATED NATIVE COPPER IN BASALT CU 5
N2-7	147	KAT 37 KAT NO 3 SHOWING	0860/03	67 14 04 115 50 21	05 QUARTZ-CALCITE VEIN FILLING IN SHEARS IN BASALT CU 5
N2-7	149	KIL	0860/05	67 19 42 115 37	05 DISSEM IN SANDSTONE INTERCALATED WITH BASALT CU 5
N2-7	151	LARRY NO 14 LODE	086N/07	67 26 18 116 46 00	05 VEINLETS IN FRACTURE ZONE IN BASALT CU 6
N2-7	152	LARS NO 22 LODE	086N/07	67 27 40 116 38 00	05 SILICIFIED SHEAR ZONE IN BASALT CU 6
N2-7	153	LASH 201-300	0860/11	67 32 15 115 24 30	05 CALCITE VEINS IN BASALT FLOWS CU 6
N2-7	162	LIZ NO 1	0860/11	67 31 45 115 03 25	05 IN BRECCIATED BASALT ALONG FAULT ZONE CU 6
N2-7	164	LKS MCLAREN LAKE	086K/10	66 38 24 116 47 20	05 QTZ VEINS & STOCKWORKS CUT VOLCS & GRANODIORITE? CU 5 AG 7
N2-7	171	MAR 132-133 (MAR NO 5 SHOWING) SOUTH GROUP	086N/07	67 25 30 116 48 50	05 BRECCIA ZONE CUTTING BASALT CU 6
N2-7	179	MAR 500-562 - NO 5 SHOWING	086N/08	67 15 30 116 04 48	05 IN BASALT CU 6
N2-7	183	METAL 13-26	086N/08	67 22 30 116 30 00	05 FILLINGS AND REPLACEMENTS IN BASALT CU 6
N2-7	190	MID 1-100	086N/11	67 41 40 117 09 30	05 SHEAR VEINS IN BASALT/ CU ALSO ASSOC W DIABASE CU 6
N2-7	211	NAN-GRA-PRO/ A & B ZONES GRA 17 & 18	0860/05	67 21 30 115 44	05 VEIN SYSTEMS ALONG SHEAR OR FAULT ZONES IN BASALT CU 6
N2-7	212	NAN-GRA-PRO/ C ZONE NAN 23	0860/05	67 21 50 115 43	05 VEIN SYSTEM ALONG SHEAR IN BASALT CU 6
N2-7	213	NAN-GRA-PRO/ D ZONE	0860/05	67 21 10 115 45	05 FAULT-BRECCIA ZONE IN BASALT CU 6
N2-7	228	PICKLE CROW 350 360 361 & 370 SOUTH BURNT CREEK/ FRANKLIN	0860/05	67 17 55 115 48 55	05 VEIN ALONG FAULT IN BASALTIC FLOWS CU 2 AG 6

NORTHEASTERN MACKENZIE DISTRICT

GRID#	OCC#	DEPOSIT NAME(S)	NTS AREA	LOCATION	DEPOSIT TYPE AND CHARACTER --- COMMODITIES AND STATUS	
N2-7	237	RON/ TER/ HED/ MAS-SHOWING 1 TESHIERPI NO 1	086O/06	67 26 06 115 26 54	05	SHEAR ZONE IN BASALT CU 6
N2-7	238	RON/ TER/ HED/ MAS-SHOWING 2 TESHIERPI NO 1	086O/06	67 25 48 115 29 12	05	VEINS & FAULT BRECCIA IN BASALT CU 6
N2-7	264	TAKIYUAK LAKE-HOOD RIVER NO 10 TAKIJUQ LAKE	086I/02	66 03 35 112 45 15	08	MASSIVE SLFDS IN METAVOLCANICS CU 2 ZN 2 AG 2 AU 8 PB 8
N2-7	265	TAKIYUAK LAKE-HOOD RIVER NO 41 TAKIJUQ LAKE	086I/02	66 02 05 112 42 30	08	MASSIVE SLFDS IN METAVOLCANICS ZN 2 CU 2 AG 2
N2-7	269	TOM	086O/05	67 19 48 115 51 30	05	BRECCIA-VEIN ZONES IN BASALT CU 6 AG 6
N2-7	274	VIC-CLAIM T4577	086N/08	67 18 40 116 07 30	05	REPLACEMENTS IN FRACTURED BASALT ASSOC WITH FAULTS CU 5
N2-7	275	VIC-CLAIM T4580-1	086N/08	67 18 35 116 04 40	05	CHALCOCITE IN DIABASE DYKE CU 5
N2-7	281	YUK MOUNTAIN LAKE PROPERTY	086N/07	67 18 116 51	01	PITCHBLENDE IN HORNBY BAY SANDSTONE U 2
N3-6	3	IDA POINT SILVER SHOWING RUS 24 & 25	077A/03	68 14 15 106 31 40	04	VEINS (BRECCIA) CUTTING GREENSTONE AG 6 CU 7 PB 7 ZN 7 AU 7
N3-6	7	ROBERTS LAKE SILVER VAN 4	077A/03	68 11 00 106 32 45	04	BRECCIATED FRACTURE OR FAULT ZONE IN METAVOLCS AG 3 CU 7 PB 7 ZN 7

KEEWATIN DISTRICT

GRID#	OCC#	DEPOSIT NAME(S)	NTS AREA	LOCATION	DEPOSIT TYPE AND CHARACTER --- COMMODITIES AND STATUS	
N1-4	12	CRI TAVANI ZONE-DDHS S1 & S2	055K/03	62 07 42 093 11 18	05	SLFD LENSES IN BRECCIATED RHYOLITE CU 6 ZN 7 AG 7
N1-4	17	DEE SPI LAKE	055L/04	62 04 11 095 52 50	08	SLFDS IN POD-SHAPED BODIES IN ACID FRAGMENTALS CU 6 ZN 6 AG 6 AU 6 PB 6
N1-4	68	MCCONNELL RIVER EAST	055E/04	61 05 095 45	10	ALGOMA TYPE IRON FORMATION- PRIMARY FE 2
N1-4	77	MISTAKE BAY IRON - AREA NO 3	055K/03	62 13 06 093 10 23	10	BANDED IRON FORMATION # ALGOMA TYPE- PRIMARY FE 5
N1-4	78	MISTAKE BAY IRON - AREA NO 4	055K/03	62 12 50 093 04 02	10	BANDED IRON FORMATION # ALGOMA TYPE- PRIMARY FE 5

KEEWATIN DISTRICT

N1-4	79	MISTAKE BAY IRON - AREA NO 5	055K/03	62 13 39 093 12 07	10	BANDED IRON FORMATION # ALGOMA TYPE- PRIMARY FE 5
N1-4	88	PISTOL BAY GROUP-1 MAR 95 & 96	055K/07	62 29 48 092 48 36	06	IN BRECCIATED QUARTZITE/ALSO IN GABBRO-PERIDOTITE CU 2 NI 2 AG 7 AU 7 AS 7
N1-4	89	PISTOL BAY GROUP-2 MAR 79	055K/07	62 29 30 092 46 54	06	QTZ LENS AT CONTACT OF METAVOLCS & ULTRABASIC SILL CU 2 NI 2
N1-4	90	PISTOL BAY GROUP-3 MAR 15/ 16/28	055K/07	62 28 48 092 44	06	IN GABBRO & GNEISSIC GRANITE CU 2 NI 2 AG 2 AU 2
N1-4	91	PISTOL BAY GROUP-4 MAR 43	055K/07	62 29 18 092 44 18	06	QUARTZ VEIN CU 5 NI 5 AU 5 AG 5
N1-4	92	POL TAVANI ZONE - DDH S6	055K/03	62 07 32 093 23 27	07	DISSEM & AMYGDULE FILLS IN DACITE-RHYOLITE CU 6 ZN 7 NI 7 AG 7 AU 7
N1-4	96	RANKIN INLET MINE W/ P/ HAJ/ VO	055K/16	62 49 12 092 04 48	06	DISS & MASSIVE SLFDS AT BASE OF SERPENTINITE SILL CU 4 NI 4 PT 6 FE 7
N1-4	103	STONECALF LAKE	055L/07	62 26 53 094 50 27	05	SHEAR ZONE BETWEEN PARAGNEISS & AMPHIBOLITE CU 6 AG 7 ZN 7
N1-4	105	TAVANI ZONE - DDH S 5	055K/03	62 08 18 093 19 30	05	DISSEMINATED SLFDS IN ACID TO INTERMEDIATE LAVAS CU 6
N1-4	106	TORIN GROUP-1	055K/03	62 07 07 093 21 46	06	DISS IN SCHIST (ALTERED UM LENS)/ & SHEAR IN VCLCS CU 6 NI 6 AU 6 AG 6 CO 7
N1-4	115	2.5 MILES S OF SE END ONEIL LK PP 102	055L/06	62 23 29 095 07 00	08	SLFD STRINGERS & DISSEM IN ANDESITE CU 6 ZN 7
N1-4	122	68-4 69-4/PIC-14/PIC-15	055M/12	63 41 25 095 46 27	02	FAULT-FRACTURE ZONES CUTTING GRANODIORITE GNEISS U 2 CU 2 AG 2
N1-4	126	74-1 WEST	055M/13	63 49 02 095 35 07	02	U IMPREGNATION AND BANDS IN KAZAN ARKOSE NEAR DIKE U 2 CU 2 AG 5
N1-4	127	74-1E	055M/13	63 48 19 095 33 17	02	U IMPREGNATION IN KAZAN ARKOSE NEAR TRACHYTE DIKE U 2 CU 2 AG 2
N1-4	130	75-6	055M/13	63 50 10 095 35 22	02	U IMPREGNATION IN KAZAN ARKOSE NEAR DIKE ROCK U 5 CU 5
N1-5	8	CULLATON LAKE SOUTH (SHEAR LK) HBMS/ SELCO/ ROYEX/ O BRIEN	065G/07	61 18 24 098 30 12	03	FRACTURES IN BASAL QUARTZITE AU 5
N1-5	22	GOLD ISLAND	065H/04	61 03 18 097 48 54	03	QTZ VEINS IN SHEAR IN ANDESITE NEAR GABBRO SILL AU 6 AS 7
N1-5	28	HENINGA LAKE GEMEX / TOWER / SKIM	065H/16	61 46 25 096 12 10	08	MASSIVE & DISSEM SULPHIDES IN PYROCLASTIC VOLCANIC CU 5 ZN 5 AG 5 PB 5 AU 5

KEEWATIN DISTRICT

GRID#	OCC#	DEPOSIT NAME(S)	NTS AREA	LOCATION	DEPOSIT TYPE AND CHARACTER --- COMMODITIES AND STATUS	
N1-5	34	INK YANDLE-KAMINAK PROJECT	065H/09	61 42 30 096 08 15	07	SLFD LAYERS IN GABBRO & VOLC XENOLITHS CU 6 AG 6 ZN 6 FE 7
N1-5	45	LOWO LAKE SCOTT (SELCO)	065H/04	61 03 06 097 51 24	03	/ QTZ VEIN ALONG SHEAR IN ANDESITE AU 5 AS 7
N1-5	51	NATARAWIT LAKE	065O/01	63 04 42 098 21 06	01	TH-U IN ALKALINE SYENITES U 2 TH 2
N1-5	61	SELCO A ZONE	065G/07	61 16 12 098 30 33	03	AU IN QTZ STRINGERS & W SLFD IN CHERT-MGT FE FM AU 5 FE 7 AS 7
N1-5	62	SELCO B ZONE	065G/08	61 17 098 30	03	AU ASSOC W SLFD/ OXIDE/ CARBONATE PHASES OF FE FM AU 2 AS 7
N1-5	69	SOUTH HENIK LAKE	065H/05	61 27 097 50	10	BANDED IF INTERC W VOLCS & SEDS#ALGOMA TYPE-PRIMRY FE 5
N2-4	3	CHRISTOPHER ISLAND (MAIN ZONE) BL PROJECT	056D/02	64 04 35 094 32 53	02	VEINS FILLING FRACS/ PORE SPACE FILLS/ IN SANDSTON U 5 MO 5
N2-4	6	HAR WAGER BAY-HAYES RIVER PROJECT	056K/07	66 18 15 092 33	05	SLFD ZONE IN METASEDS NEAR AMPHIBOLITE CU 6 NI 6 FE 7
N2-4	10	68-1 CHRISTOPHER ISLAND	056D/02	64 04 43 094 33 06	02	RAD-IMPREGNTN/FRACTURES IN KAZAN ARKOSE NEAR DIKES U 2 CU 2 MO 2
N2-4	11	68-2	056D/02	64 10 10 094 33 34	02	RAD IN XENOLITHIC PART-FELSITE DIKE/FRACT IN DIKE U 2 MO 2
N2-4	12	69-9 CHRISTOPHER ISLAND	056D/02	64 06 26 094 37 22	02	RAD FRACTURES IN CHRISTOPHER ISLAND TRACHYTE U 5 CU 5 MO 5
N2-5	1	AMER LAKE BRO/PRO/BRF/BRI/BRU/BRY	066H/10	65 32 48 096 45 00	01	U IN QTZ-MICA SCHISTS OR MIXED SCHIST & QUARTZITE U 5
N2-5	19	SISSON LAKE	066A/05	64 27 097 36	01	FRAC AND DISSEM IN APHEBIAN METAQTZT U 2

EASTERN ARCTIC ISLANDS AND HUDSON REGION

GRID#	OCC#	DEPOSIT NAME(S)	NTS AREA	LOCATION	DEPOSIT TYPE AND CHARACTER --- COMMODITIES AND STATUS	
N0-2	6	BELCHER ISLANDS HAIG INLET	034D/06	56 20 079 05	10	ARGILLITIC IF & SOME HEMATITE#SUPERIOR TYPE-PRIMRY FE 2
N0-2	17	NASTAPOKA ISLANDS	034C/02	56 08 076 45	10	FE CARB/BANDED IF/MAGNT&HEMAT#SUPERIOR TYPE-PRIMRY FE 2 MN 2
N2-2	4	CHORKBAK INLET WEST CHORKBAK GP/ SHAWKEY 1-4	036B/07	64 28 074 42	10	MAGNT/ BANDED I F IN METASEDS#ALGOMA TYPE- PRIMARY FE 2
N2-2	11	MALTBY LAKE IRON	036C/13	64 55 077 56	10	BANDED IF & 2 BANDS MAGNETITE# ALGOMA TYPE-PRIMARY FE 2
N3-2	4	MARY RIVER AREA - WEST BAFFINLAND	037G/05	71 19 079 21	10	HEMATITE/MAGNT/BANDED IF # ALGOMA TYPE - ENRICHED FE 2
N3-2	19	EQE BAY GRANT-SUTTIE BAY - EQE BAY	037C/09	69 40 24 076 48 20	10	MAGNT/HEMAT BANDS IN METAVOLCS#ALGOMA TYPE-PRIMARY FE 2
N4-3	6	NANISIVIK STRATHCONA SOUND	048C/01	73 03 48 084 30 30	09	MASSIVE SULPHIDES IN DOLOMITE PB 1 ZN 1 AG 1
N4-3	8	SURPRISE CREEK DEE/ M-72 CLAIMS	048A/11	72 30 35 082 06 45	07	STRATABOUND PB-ZN/ CU ALONG FAULTS/ IN DOLOMITE PB 6 CU 6 ZN 6 AG 6 AU 7

APPENDIX IB

Listing of all occurrences to accompany Map 2

Deposits are listed according to:

a) major regions
b) in numerical sequence within primary NTS grid units.

Explanation of Listing Codes

Column 1 – Primary Grid identification (see GRID KEY, Maps 1 and 2)

Column 2 – Mineral deposit/occurrence number

Column 3 – Deposit name and alternate name if applicable

Column 4 – National Topographic System area

Column 5 – Latitude and longitude of deposit location

Column 6 – Deposit type code (see Mineral Deposit Symbol Code, Maps 1 and 2)

Column 7 – Upper – Capsule description of mineralization
– Lower – CANMINDEX commodity status code, as follows:

- 01 – commodity is being produced
- 02 – the deposit has calculated reserves of a commodity but has never produced
- 03 – the deposit has had past production, known reserves are present but the commodity is no longer being produced
- 04 – exhausted; the commodity is no longer produced and there are no known reserves or demonstrated resources
- 05 – two-dimensional data (e.g. length and width) and grade are available (public) but not enough to calculate reserves
- 06 – one-dimensional data and grade (e.g. a drill hole; one trench)
- 07 – present; commodity reported but insufficient data are available (public) to allow the status to be classified
- 08 – the commodity occurs at a producing mine or in a significant deposit but it is not known whether it is being, or will be, extracted for sale.

NORTHERN YUKON AND NORTHWESTERN MACKENZIE REGION

GRID#	OCC#	DEPOSIT NAME(S)	NTS AREA	LOCATION	DEPOSIT TYPE AND CHARACTER --- COMMODITIES AND STATUS
N3-10	1	BARN MOUNTAIN	117A/11	68 35 138 10	12 IN CALCAREOUS SHALE CU 7 V 7 MO 7 W 7
N3-10	4	MOUNT SEDGWICK AREA TRAIL RIVER	117A/13	68 50 139 05	12 SCHEELITE PLACERS IN STREAM GRAVELS W 7

WESTERN ARCTIC ISLANDS REGION

GRID#	OCC#	DEPOSIT NAME(S)	NTS AREA	LOCATION	DEPOSIT TYPE AND CHARACTER --- COMMODITIES AND STATUS
N3-7	1	BOYLENS EASTERN CLAIM GROUP	087H/10	71 31 113 14	05 IN BASALT CU 7
N3-7	2	BOYLENS WESTERN CLAIM GROUP	087H/04	71 03 20 115 52 30	05 BASALT? CU 7 AG 7
N3-7	3	MUSKOX SHOWING W-5	087H/16	71 52 112 43	05 DISS VEINS & REPL IN FAULT BRECCIA/ IN BASALT CU 7 AG 7
N3-7	4	MUSKOX SHOWING-M-125	087H/10	71 37 113 22	05 DISS IN AMYGDALOIDAL BASALT ALONG A FAULT CU 7 AG 7
N3-7	5	MUSKOX SHOWING-M-134	087H/07	71 28 113 38	05 MALACHITE SURROUNDS RED AGGLOMERATE FRAGMENTS CU 7
N3-7	6	MUSKOX SHOWING-M-148	087H/16	71 52 30 112 59	05 DISS IN FRACTURED BASALT & UNDERLYING SEDIMENTS CU 7

NORTHERN ARCTIC ISLANDS REGION

GRID#	OCC#	DEPOSIT NAME(S)	NTS AREA	LOCATION	DEPOSIT TYPE AND CHARACTER --- COMMODITIES AND STATUS
N4-4	1	NORTHEAST CORNWALLIS ISLAND	058G/06	75 21 15 094 09	09 FRAC FILLS IN CARBONATES AT JUNCTION OF 2 FAULTS CU 7 PB 7 ZN 7 NI 7 AG 7
N4-5	3	LITTLE CORNWALLIS ISLAND (CU) HURST LAKE COPPER SHOWING	068H/09	75 31 30 096 09 25	05 IN LIMESTONE AND/OR DOLOMITE CU 7
N5-2	1	ALEXANDER FIORD	039E/13	78 53 075 40	05 IN METASEDIMENTARY GRANULITE GNEISSES CU 7
N5-2	2	BACHE PENINSULA	039H/03	79 02 075 00	05 CU STAIN IN METASEDIMENTARY GRANULITE GNEISS CU 7
N5-2	3	BUCHANAN BAY	039E/13	78 58 075 44	05 GOSSANS AND SLFDS IN METASED GRANULITE GNEISS CU 7
N5-2	4	CLARENCE HEAD	039B/15	76 47 50 077 49	05 CU STAIN IN VOLC + SEDIMENTARY ROCKS CU 7
N5-2	5	EKBLAW GLACIER SHOWING	039F/10	78 30 077 09	11 COPPER SLFDS AND STAIN IN GRANULITE CU 7 MO 7
N5-2	6	HAYES FIORD	039G/01	79 02 076 50	05 MALACHITE STAINS IN GNEISS CU 7
N5-2	7	MAKINSON INLET	039C/05	77 18 50 079 45	05 MALACHITE IN METASED GNEISS/ ASSOC W CALC-SILICATE CU 7
N5-2	8	RUTHERFORD SHOWING	039E/13	78 50 075 23	05 MASSIVE SLFDS IN METASEDIMENTARY GRANULITE GNEISS CU 7
N5-4	1	GRINNELL PENINSULA-1 DEVON ISLAND	059B/06	76 17 04 094 25 42	07 SMALL SOLUTION CAVITIES ALONG FAULTS IN CARBONATES CU 7 PB 7 ZN 7
N5-4	2	GRINNELL PENINSULA-2 DEVON ISLAND	059B/06	76 18 50 094 23 26	07 SMALL SOLUTION CAVITIES ALONG FAULTS IN CARBONATES CU 7 PB 7 ZN 7
N5-4	3	GRINNELL PENINSULA-3 DEVON ISLAND	059B/07	59 27 28 093 59 18	07 SMALL SOLUTION CAVITIES ALONG FAULTS IN CARBONATES CU 7 PB 7 ZN 7
N5-5	1	DUMBBELLS DOME	069F/10	78 37 101 19	01 BRECCIATED CARBONATE WITHIN SALT DIAPIR U 7
N6-2	1	ELLESMERE ISLAND	340E/14	83 00 075 30	05 1 FRAGMENT OF MALACHITE-COATED ROCK CU 7

CENTRAL ARCTIC REGION

GRID#	OCC#	DEPOSIT NAME(S)	NTS AREA	LOCATION	DEPOSIT TYPE AND CHARACTER --- COMMODITIES AND STATUS	
N2-3	1	BROOKS BLUFF	046K/01	66 11 45 084 27 09	05	SLFDS IN GRANITIC GNEISS CU 7
N2-3	2	CAPE REID	046K/09	66 38 47 084 09 33	05	COUNTRY ROCK-DIORITE AND GABBRO CU 7 FE 7
N2-3	3	DUC	0460/06	67 29 40 083 08 30	M	DISSEM IN SCHIST/ SLATE/ & PARAGNEISS ZN 7 CU 7 NI 7 MO 7
N2-3	4	EAST OF BLAKE BAY	046J/10	66 33 22 082 43 13	05	SLFDS IN GRANITIC ROCKS CU 7
N2-3	5	LEP	0460/09	67 33 082 10	M	CLAIMS UNDERLAIN BY LIMESTONE QUARTZITE & SCHIST CU 7 NI 7 ZN 7
N2-3	6	LOCALITY-1	046K/16	66 59 32 084 11 22	01	RADIOACTIVE FELSIC SILL IN CRYSTALLINE LIMESTONE U 7 TH 7
N2-3	7	MELVILLE PENINSULA-LOCATION 3	0460/04	67 01 53 083 56 36	01	RADIOACTIVE FELSIC INTRUSIVE U 7
N2-3	8	MELVILLE PENINSULA-LOCATION 4	0460/04	67 04 17 083 45 20	01	RADIOACTIVE FELSIC INTRUSIVE U 7
N2-3	9	MELVILLE PENINSULA-LOCATION 5	046N/04	67 02 06 085 46 30	01	RADIOACTIVE SKARN IN CONTACT WITH GRANITIC INTRUSV U 7 TH 7
N2-3	10	MELVILLE PENINSULA-LOCATION 6	0460/05	67 26 30 083 35 22	01	RADIOACTIVE FELSIC INTRUSIVE U 7
N2-3	11	MELVILLE PENINSULA-LOCATION 7	0460/05	67 19 38 083 35 22	01	DISSEM RADIOACTIVE MINERAL IN FELSIC INTRUSIVE U 7
N2-3	12	MELVILLE PENINSULA-LOCATION 8	046N/01	67 05 25 084 03 44	01	DISSEM RADIOACTIVE MINERAL IN FELSIC INTRUSIVE U 7
N2-3	13	MELVILLE PENINSULA-LOCATION 9	046N/01	67 04 19 084 03 45	01	DISSEM RADIOCATIVE MINERAL IN FELSIC INTRUSIVE U 7
N2-3	14	MELVILLE PENINSULA-LOCATIONS	046N/01	67 01 53 084 01 01	01	RADIOACTIVE FELSIC INTRUSIVE U 7
N2-3	15	MELVILLE PENINSULA-1	046N/04	67 06 04 085 57 04	01	RADIOACTIVITY ASSOC WITH GREY AUGEN GNEISS U 7 TH 7
N2-3	16	MELVILLE PENINSULA-2	046K/13	66 59 02 085 52 25	01	SLIGHTLY RADIOACTIVE BIOTITE/K-FELDSPAR GRANITE U 7
N2-4	2	ARROWSMITH RIVER	0560/14	67 56 091 13	11	DISSEM NEAR & ALONG SHEARS IN GRANITES CU 7 MO 7

CENTRAL ARCTIC REGION

GRID#	OCC#	DEPOSIT NAME(S)	NTS AREA	LOCATION	DEPOSIT TYPE AND CHARACTER --- COMMODITIES AND STATUS	
N2-4	8	PROJECT WAGER-CURTIS LAKE	056I/11	66 39 089 06	06	PARALLEL DISCONTINUOUS SLFD BANDS IN METASEDS CU 7 NI 7
N2-5	4	D 1 SHOWING (CLAIM NI 86) GAVIN RIVER CLAIMS	066N/05	67 16 20 101 36 20	06	RUSTY BAND OF QUARTZ-PYROXENE GRANULITE OR GNEISS CU 7 NI 7
N2-5	5	D 10 SHOWING (NI 236/ 246/ 247 GAVIN RIVER CLAIMS	066N/05	67 15 45 101 40 30	06	SULPHIDES IN GNEISS CU 7 NI 7 AU 7 FE 7
N2-5	6	D 3 SHOWING (CLAIM NI 36) GAVIN RIVER CLAIMS	066N/05	67 16 45 101 38 45	06	SULPHIDES DISSEMINATED IN QUARTZ-DIORITE CU 7 NI 7 FE 7
N2-5	7	D 4 SHOWING (CLAIM NI 166) GAVIN RIVER CLAIMS	066N/05	67 16 10 101 39	06	GOSSAN IN PYROXENITE CU 7 NI 7 AU 7
N2-5	8	D 7 SHOWING (CLAIM NI 1) GAVIN RIVER CLAIMS	066N/04	67 10 45 101 37 15	06	SULPHIDES IN GARNET GNEISS CU 7 NI 7 AU 7
N2-5	9	D 8 SHOWING (CLAIM NI 118) GAVIN RIVER CLAIMS	066N/05	67 17 50 101 40	06	SULPHIDES IN GRANULITE CU 7 NI 7
N2-5	10	EIRA PERRY RIVER CLAIMS	066N/05	67 22 45 101 44 45	05	IN GABBRO-NEAR PYROXENITE BAND IN GNEISS CU 7 NI 7
N2-5	15	OAT-LIK	066N/05	67 23 10 101 46 15	06	IN AMPHIBOLE-BIOTITE BANDS IN GNEISS CU 7 NI 7
N2-5	16	OCCURRENCE (PERRY RIVER PROJ)	066N/12	67 33 45 101 57 45	06	SULPHIDES DISSEMINATED IN DIABASE CU 7 NI 7
N2-5	20	SWAN SHOWING (PERRY RIVER PROJ	066N/12	67 38 45 101 54	05	IN AMPHIBOLE-BIOTITE-QTZ BANDS IN GNEISS CU 7 NI 7
N3-3	1	AYERGOTADLIK RIVER	047A/04	68 10 57 083 21 49	05	IN ULTRAMAFIC INTRUSION CU 7
N3-3	2	BIL / WAY	047A/13	68 52 30 083 30	06	AT CONTACT BETWEEN AMPHIBOLITE & GNEISS CU 7 NI 7
N3-3	3	JAC 10 AND 11 CLAIMS MELVILLE PENINSULA	047B/02	68 12 35 085 30 40	07	MINOR VEINS/ GOSSAN/ UNDERLAIN BY GREENST & SCHIST CU 7 AG 7 ZN 7 PB 7 FE 7
N3-3	11	MELVILLE PENINSULA-GOSSAN G-11	047B/02	68 13 27 085 31 56	06	GOSSAN ZONE IN QUARTZ-CHLORITE GREENSTONES CU 7 AG 7 NI 7 FE 7
N3-3	12	MELVILLE PENINSULA-GOSSAN G-13	047B/02	68 12 25 085 33	06	MASSIVE SLFDS IN QUARTZ-RICH ZONE IN GREENSTONE CU 7 NI 7 AG 7 AU 7
N3-3	13	MELVILLE PENINSULA-GOSSAN G-14	047B/02	68 12 24 085 31 42	07	MASSIVE TO DISS SFLD IN QTZ PEBBLE CONGL & QTZITE CU 7 ZN 7 PB 7 NI 7 AG 7 FE 7

CENTRAL ARCTIC REGION

GRID#	OCC#	DEPOSIT NAME(S)	NTS AREA	LOCATION	DEPOSIT TYPE AND CHARACTER --- COMMODITIES AND STATUS	
N3-3	14	MELVILLE PENINSULA-GOSSAN G-17	047B/02	68 12 06 085 27 54	05	GOSSAN AT CONTACT OF MGNT-CHERT-FE FM & SCHIST CU 7 AG 7 AU 7 FE 7
N3-3	15	MELVILLE PENINSULA-GOSSAN G-18	047B/02	68 12 24 085 16 24	05	GOSSAN ZONE IN GNEISS/ QUARTZITE/ & AMPHIBOLITE CU 7 AG 7 AU 7 FE 7
N3-3	16	MELVILLE PENINSULA-GOSSAN G-7	047B/07	68 19 48 085 11 42	05	GOSSAN IN GREENST QTZITE & GNEISS NEAR GRN CONTACT CU 7 AG 7 FE 7
N3-3	17	10 MILES NW OF PARRY BAY	047A/06	68 28 15 082 45 26	05	IN METASEDIMENTS? CU 7
N3-3	18	18 MILES EAST OF CAPE SIBBALD	047B/07	68 17 10 085 02 33	05	IN GRANITIC ROCKS CU 7
N3-4	1	MIC	057B/04	68 03 45 095 08	11	IN PYRITIC SCHIST BAND IN GRANITIC RK/ & IN PEGMT CU 7 MO 7
N3-4	2	NIG	057B/02	68 02 45 093 11	M	AT CONTACT OF ULTRAMAFIC PLUG & METAVOLCANICS CU 7 ZN 7 NI 7 AG 7 CO 7
N3-4	3	TURNER-CHANTREY	057B/02	68 03 094 00	11	CU 7 MO 7 ZN 7
N4-4	2	SOMERSET ISLAND	058B/15	72 53 093 53	07	ALONG A FAULT IN LIMESTONE SILTSTONE CU 7 PB 7 ZN 7

NORTHEASTERN MACKENZIE DISTRICT

GRID#	OCC#	DEPOSIT NAME(S)	NTS AREA	LOCATION	DEPOSIT TYPE AND CHARACTER --- COMMODITIES AND STATUS	
N2-5	3	CHESTER BAY	066M/16	67 46 07 102 18 48	10	? FE 7 CU 7
N2-5	11	FLAGSTAFF ISLAND	066M/16	67 48 00 102 16 48	10	? FE 7 CU 7
N2-5	12	L SHOWING (PERRY RIVER PROJECT	066M/08	67 28 30 102 11 30	06	IN AMPHIBOLE-BIOTITE-QTZ BANDS IN GNEISS CU 7 NI 7
N2-5	13	M SHOWING (PERRY RIVER PROJECT	066M/09	67 33 25 102 11	06	IN AMPHIBOLE-BIOTITE-QTZ BANDS IN GNEISS CU 7 NI 7
N2-5	14	N SHOWING (PERRY RIVER PROJECT	066M/09	67 31 20 102 12	06	IN AMPHIBOLE-BIOTITE-QTZ BANDS IN GNEISS CU 7 NI 7
N2-6	1	A-14	076M/02	67 08 41 110 52 56	07	VEINS IN SLATE & RHYOLITE AG 7 PB 7 ZN 7 SB 7 CU 7 AS 7
N2-6	2	AXE (1)	076N/11	67 33 109 05	05	EPIGENETIC FRAC FILLS & DISSEM IN DOLOMITE CU 7
N2-6	3	AXE (2)	076N/11	67 36 18 109 24 16	05	EPIGENETIC FRAC FILLINGS IN BASALT FLOWS & DIABASE CU 7
N2-6	4	AXE/ KIL	076N/11	67 38 30 109 18 20	05	IN BASALT FLOWS CU 7
N2-6	5	B AND C GROUPS	076H/14	65 56 20 105 12	01	IN GRANITE GNEISS U 7
N2-6	6	BAC	076C/16	64 55 108 04	M	IN VOLCANICS CU 7 ZN 7
N2-6	8	BAR-42 SEP LAKE	076E/11	65 42 12 111 18 54	03	GNT-CMNG-SLFD GNEISS BAND (AMPHIBOLITE)IN METASEDS AU 7 CU 7 AG 7 AS 7
N2-6	9	BOX (MAIN SHOWING)	076E/11	65 42 48 111 00 30	03	GNT-CMNG-SLFD GNEISS BAND (AMPHIBOLITE)IN METASEDS AU 7 AG 7 CU 7
N2-6	11	C GROUP	076F/16	65 46 108 08	05	MINOR GOSSAN SLFD IN SILICEOUS ZONES IN METASEDS CU 7
N2-6	12	C GROUP	076M/03	67 10 40 111 02 25	07	SLFDS IN SHEARED BRECCIATED ZONES IN RHYOLITE CU 7 ZN 7 AG 7 PT 7 PB 7 NI 7 AU 7
N2-6	14	CCI	076N/02	67 12 25 108 54 00	05	? CU 7
N2-6	15	CED LAKE PROSPECTING PERMIT 315	076M/02	67 07 110 45	07	UNDERLAIN BY VOLCS & METASEDS CU 7 ZN 7 PB 7

NORTHEASTERN MACKENZIE DISTRICT

GRID#	OCC#	DEPOSIT NAME(S)	NTS AREA	LOCATION		DEPOSIT TYPE AND CHARACTER --- COMMODITIES AND STATUS
N2-6	16	CHAPMAN ISLANDS-1 ISLAND NO 20	076N/14	67 52 45 109 10 30	05	AMYGDULES VEINS & DISSEMINATIONS IN BASALTIC FLOWS CU 7
N2-6	17	CHAPMAN ISLANDS-2	076N/14	67 49 30 109 01 30	05	SEAMS & VEINS IN BASALTIC FLOWS CU 7
N2-6	18	CHILL GROUP-1	076M/07	67 27 16 110 50 26	05	IN CHLORITE SCHIST CU 7
N2-6	19	CHILL GROUP-2	076M/07	67 28 00 110 59 35	05	DISS ALONG SHEAR PLANES IN CHLORITE SCHIST CU 7
N2-6	20	CHUCK GROUP	076L/15	66 48 40 110 59 00	05	DISSEM IN MAFIC VOLCANICS CU 7
N2-6	21	CONCESSION LAKE SW	076E/12	65 40 23 111 46 00	05	IN HORNBLENDE DIORITE OR HB-BIOTITE GRANDIORITE CU 7
N2-6	23	COT 4 OX (1964)	076J/11	66 42 40 107 26	03	GNT-CMNG-SLFD GNEISS BANDS(AMPHIBOLITE)IN METASEDS CU 7 AU 7 AS 7
N2-6	24	DENNIS LAKE	076H/14	65 57 105 23	01	GRANITE GNEISS U 7
N2-6	25	DOUG ALGAK ISLAND	076N/09	67 34 20 108 27 56	05	ALONG JOINTS/IN AMYGDULES/IN BASALTS IN FAULT ZONE CU 7
N2-6	26	DUNC ALGAK ISLAND	076N/09	67 30 108 25	05	PROBABLE FRAC FILLS OR AMYGDULES IN BASALT CU 7
N2-6	27	EKALULIA ISLAND-CHAR GROUP BARRY ISLANDS	076N/09	67 33 108 03	05	VEINS DISS & AMYGDULES IN MASSIVE BASALT & FLOWS CU 7 AG 7
N2-6	28	EKALULIA ISLAND-TINA GROUP BARRY ISLANDS	076N/09	67 33 30 108 01 30	05	VEINLETS ASSOC W DIABASE DYKE IN FRAC ZONE IN BSLT CU 7 AG 7
N2-6	29	ELLICE RIVER AREA	076I/10	66 39 00 104 52 00	05	IN GNEISS CU 7
N2-6	31	F (1)	076N/10	67 33 43 108 57 30	05	EPIGENETIC FRAC FILLS & DISSEM IN DOLOMITE CU 7
N2-6	32	F (2)	076N/10	67 35 16 108 57 00	05	SYNGENETIC-DISSEM/AMYGD/FRAC FILL IN BASALT FLOWS CU 7
N2-6	33	FF/ OP	076F/16	65 50 108 15	05	GOSSANS ON DISS SLFD IN SILICEOUS ZONES IN METASED CU 7
N2-6	34	FGP	076N/10	67 32 50 108 58 00	05	? CU 7

NORTHEASTERN MACKENZIE DISTRICT

GRID#	OCC#	DEPOSIT NAME(S)	NTS AREA	LOCATION	DEPOSIT TYPE AND CHARACTER --- COMMODITIES AND STATUS	
N2-6	35	FINGERS LAKE FOX-BOX	076E/11	65 43 24 111 10 48	03	GNT-CMNG-SLFD GNEISS BAND(AMPHIBOLITE)IN METASEDS AU 7 AG 7 CU 7
N2-6	36	FREDDY LAKE	076H/14	65 56 40 105 11	01	IN BANDS OF METAMORPH RX CONCORDANT W GRANITIC GNS U 7
N2-6	38	GALENA POINT-1 DON	076N/13	67 53 10 109 53 15	07	VEINS CUTTING GRANITE PB 7 CU 7
N2-6	40	GOSSAN LAKE DUD	076E/11	65 36 18 111 01 30	03	GNT-CMNG-SLFD GNEISS BANDS(AMPHIBOLITE)IN METASEDS AU 7 AG 7 CU 7 AS 7
N2-6	50	HI	076M/07	67 28 110 56	07	UNDERLAIN BY VOLCS/ GRANODIORITE/ DIORITE/ DIABASE CU 7 ZN 7
N2-6	54	HOOD RIVER (GOSSAN U-1) BOREALIS	076L/15	66 53 45 110 54 00	08	GOSSAN ON MASSIVE PYRRHOTITE IN FELSIC VOLCS CU 7 ZN 7 AG 7
N2-6	55	HOOD RIVER (GOSSAN U-2) BOREALIS	076L/15	66 53 45 110 47 10	M	GOSSAN CU 7 ZN 7 AG 7
N2-6	56	HOOD RIVER (GOSSAN U-3) BOREALIS	076L/15	66 47 50 110 45 00	M	GOSSAN IN GREENSTONE CU 7 ZN 7 AG 7
N2-6	57	HOOD RIVER (GOSSAN U-4) BOREALIS	076L/15	66 46 30 110 53	M	SLFD STRINGERS & MASSES IN VOLCS NEAR GRANITE CU 7 ZN 7 AG 7
N2-6	58	HOOD RIVER (GOSSAN U-5) BOREALIS	076L/15	66 56 110 54	M	GOSSAN CU 7 ZN 7 AG 7
N2-6	59	HOOD RIVER (GOSSAN U-6) BOREALIS	076L/15	66 49 10 110 57 30	M	GOSSAN CU 7 AG 7 AU 7
N2-6	60	HOOD RIVER NORTH	076K/14	66 58 42 109 21 48	05	IN METASEDS CU 7
N2-6	61	HUNT GROUP	076G/04	65 13 107 43	07	SLFDS AT CONTACT OF AMPHIBOLITE AND METASEDS CU 7 ZN 7 PB 7 CO 7 AS 7
N2-6	62	JACK LAKE (NORTH)	076I/11	66 44 00 105 02 00	M	GOSSAN ON DISSEM SLFD IN GREEN DIORITIC ROCK ZN 7 CU 7
N2-6	63	JACK LAKE (SOUTH)	076I/11	66 41 105 05	M	GOSSAN IN GARNETIFEROUS MAFIC GNEISS CU 7 ZN 7 PB 7 AG 7 FE 7
N2-6	64	JE SUN BAY (CONTWOYTO LAKE)	076E/11	65 43 12 111 22 42	03	GNT-CMNG-SLFD GNEISS BANDS(AMPHIBOLITE)IN METASEDS AU 7 CU 7 AS 7
N2-6	65	JOE GROUP-1 CLAIM T 8825	076O/12	67 39 15 107 48 45	05	FRAC FILLINGS/VEINS/& DISSEM IN GRANITIC ROCKS CU 7 AG 7

GRID#	OCC#	DEPOSIT NAME(S)	NTS AREA	LOCATION	DEPOSIT TYPE AND CHARACTER --- COMMODITIES AND STATUS	
N2-6	66	JOE GROUP-2	076O/12	67 40 00 107 49 55	05	FRAC FILLS & DISSEM IN GRANITIC ROCKS CU 7
N2-6	67	K	076F/15	65 56 15 108 31 45	M	? CU 7
N2-6	68	KANUYAK ISLAND BOB GROUP	076O/05	67 24 06 107 54 00	05	IN DOLOMITE AT OR NEAR CONT WITH OVERLYING BASALT CU 7 AG 7
N2-6	69	KENNARCTIC EXP LTD	076M/07	67 25 00 110 45 00	07	VEINS OR STOCKWORKS CU 7 ZN 7
N2-6	70	KENNARCTIC-SHOWING NO 1 JAMES RIVER RESERVATION	076M/11	67 38 30 111 04	03	DISSEMINATIONS IN QTZ IN SHEAR ZONE IN RHYOLITE CU 7 AU 7
N2-6	71	KENNARCTIC-SHOWING NO 10 JAMES RIVER RESERVATION	076M/03	67 10 30 111 03	07	SHEAR ZONE IN DACITE CU 7 ZN 7 AG 7
N2-6	72	KENNARCTIC-SHOWING NO 12 JAMES RIVER RESERVATION	076M/03	67 07 111 04	05	STRINGERS IN SHEAR OR BRECCIA ZONE IN ALTERED VOLC CU 7
N2-6	73	KENNARCTIC-SHOWING NO 14 JAMES RIVER RESERVATION	076M/02	67 05 30 110 46	05	DISSEMINATIONS IN SHEARED PYROCLASTICS & DACITE CU 7
N2-6	74	KENNARCTIC-SHOWING NO 15 JAMES RIVER RESERVATION	076M/02	67 04 56 110 45 05	05	DISS & STRINGERS IN SHEAR ZONE IN ALTERED DACITE CU 7
N2-6	75	KENNARCTIC-SHOWING NO 2 JAMES RIVER RESERVATION	076M/11	67 35 59 111 02	05	DISS & STRINGERS IN SHEARED CHERTY TUFF BED CU 7 AG 7
N2-6	76	KENNARCTIC-SHOWING NO 3 JAMES RIVER RESERVATION	076M/11	67 37 111 03	05	DISS & REPLACEMENT IN SHEAR ZONE IN VOLCANICS CU 7
N2-6	77	KENNARCTIC-SHOWING NO 4 JAMES RIVER RESERVATION	076M/10	67 31 30 110 58	05	QTZ VEIN IN VOLCS CU 7 AU 7
N2-6	78	KENNARCTIC-SHOWING NO 5 JAMES RIVER RESERVATION	076M/06	67 29 30 111 13	05	DISS ALONG SHEAR IN VOLCANICS CU 7
N2-6	79	KENNARCTIC-SHOWING NO 6 JAMES RIVER RESERVATION	076M/06	67 22 45 111 05	05	DISS IN SHEAR ZONE IN VOLCS ADJ TO DIORITE MASS CU 7
N2-6	80	KENNARCTIC-SHOWING NO 7 JAMES RIVER RESERVATION	076M/06	67 22 111 05	05	SILICIFIED SHEAR ZONE IN RHYOLITE NEAR DIOR STOCK CU 7
N2-6	81	KENNARCTIC-SHOWING NO 8 JAMES RIVER RESERVATION	076M/02	67 14 30 110 58 00	05	DISS & QTZ VEINS IN SHEAR ZONES IN RHYOLITE CU 7
N2-6	82	KENNARCTIC-SHOWING NO 9 JAMES RIVER RESERVATION	076M/02	67 14 110 57	05	QUARTZ VEINS IN SHEAR ZONES IN RHYOLITE CU 7

NORTHEASTERN MACKENZIE DISTRICT

GRID#	OCC#	DEPOSIT NAME(S)	NTS AREA	LOCATION	DEPOSIT TYPE AND CHARACTER --- COMMODITIES AND STATUS	
N2-6	83	KIL (1)	076N/11	67 32 52 109 14 00	05	EPIGENETIC FRAC FILLS & DISSEM IN DOLOMITE CU 7
N2-6	84	KIL (2)	076N/11	67 32 00 109 07 45	05	EPIGENETIC FRAC FILLS & DISSEM IN DOLOMITE CU 7
N2-6	85	KIL (3)	076N/11	67 30 34 109 01 31	05	EPIGENETIC FRAC FILLINGS IN BASALT FLOWS & DIABASE CU 7
N2-6	88	LEWES ISLAND CHAPMAN ISLANDS-3	076N/15	67 53 15 108 54 40	05	IN BASALT FLOWS CU 7
N2-6	89	LOW LAKE PROPERTY L/ J/ O/ H/ K/ M GROUPS	076M/07	67 17 13 110 54 06	07	DISS-MASS IN SHEARS & FAULT BRECCIA/VEINS/IN VOLCS CU 7 PB 7 NI 7 GRP7
N2-6	90	M GROUP	076M/03	67 08 00 111 07 30	05	IN METAVOLCS CU 7
N2-6	92	MOLLIE MAC MINES (AREA NO 2) WEST END OF CANOE LAKE	076M/03	67 08 111 08 30	08	MASSIVE SULPHIDES IN SHEARED RHYOLITE CU 7 ZN 7 PB 7 AG 7
N2-6	93	MOX	076K/02	66 06 25 108 31 45	05	GOSSANS IN METASEDIMENTS CU 7 AS 7 AU 7
N2-6	96	NORMA LAKE SE	076E/11	65 42 19 111 15 45	05	IN SEDIMENTS NEAR FAULT CU 7
N2-6	98	ORANGE DOCS LAKES EASTERN MACKENZIE SYNDICATE	076I/06	66 22 105 09	03	GOSSAN IN QTZ-FELD-BIOTITE GNEISS CU 7 AU 7
N2-6	99	OX	076C/09	64 36 25 108 12 30	M	SLFDS IN GRAPHITIC ARGILLITE CU 7 ZN 7
N2-6	100	PER	076C/09	64 41 108 10	05	GOSSAN ALONG CONTACT BETWEEN MAFIC VOLC & METASEDS CU 7
N2-6	101	PETE GROUP IGLORUA ISLAND	076N/09	67 38 12 108 26 30	05	FRACTURED & BRECCIATED ZONES IN BASALT CU 7
N2-6	102	PIT	076N/06	67 23 20 109 06 35	07	QTZ VEINS/ UNDERLAIN BY DIABASE & SEDS CU 7 ZN 7 AG 7 AU 7
N2-6	103	PLUGGER LAKE EASTERN MACKENZIE SYNDICATE	076I/10	66 34 00 104 51 30	05	GOSSAN IN BIOTITE GRANITE GNEISS CU 7 AG 7
N2-6	104	PORT EPWORTH	076M/12	67 39 50 111 31 00	05	IN METAVOLCS CU 7 PB 7
N2-6	105	ROX	076E/14	65 46 40 111 03 17	03	GNT-CMNG-SLFD GNEISS BANDS(AMPHIBOLITE)IN METASEDS AU 7 AG 7 CU 7 AS 7

NORTHEASTERN MACKENZIE DISTRICT

GRID#	OCC#	DEPOSIT NAME(S)	NTS AREA	LOCATION	DEPOSIT TYPE AND CHARACTER --- COMMODITIES AND STATUS	
N2-6	106	ROY	076B/13	64 55 108 00	M	IN VOLCANICS CU 7 ZN 7
N2-6	107	RUN	076M/11	67 36 111 11	05	SLFDS AS DISSEM/ STRINGERS/ PODS IN FELSIC TUFFS CU 7 AG 7
N2-6	108	SA	076F/16	65 49 20 108 03 20	M	? CU 7 ZN 7
N2-6	109	SAND	076F/16	65 50 25 108 06 18	M	? CU 7 ZN 7 PB 7
N2-6	110	SELLWOOD RIVER	076K/14	66 47 24 109 15 18	05	MINOR DISSEM IN GABBRO CU 7
N2-6	111	SIK-SIK (CU)	076N/12	67 43 18 109 42 36	05	QTZ-CALCITE VEINS CUTTING METASEDS CU 7
N2-6	113	STACK	076N/11	67 42 07 109 20 30	05	IN BASALT FLOWS CU 7
N2-6	114	STOCKPORT ISLANDS-1 MARCET ISLAND	076N/14	67 47 109 05	05	DISS/AMYGDULES/& VEINS IN BASALTIC FLOWS CU 7
N2-6	115	STOCKPORT ISLANDS-2	076N/15	67 47 00 108 59 00	05	VEINS IN BASALT CU 7
N2-6	116	SUE	076F/16	65 57 108 28	05	MINOR GOSSAN SLFD IN SILICEOUS ZONES IN METASEDS CU 7
N2-6	117	TIL	076N/11	67 40 28 109 15 40	05	IN BASALT FLOWS CU 7
N2-6	118	TL	076N/06	67 29 55 109 02 00	05	EPIGENETIC FRAC FILLS & DISS IN DOLOMITE CU 7
N2-6	119	TURNER LAKE GOLD (CCI 34 & 35)	076N/02	67 13 05 108 56 29	03	IN BAND OF ARENACEOUS & AMPHIBOLITIC ROCKS AU 7 AS 7
N2-6	121	TURNER LAKE-2	076N/02	67 11 40 108 56 25	06	? CU 7 NI 7
N2-6	122	WESTERN RIVER-1	076G/16	65 48 36 106 27 10	05	CHALCO GRAINS OR MASSES IN GABBRO SILL CU 7 FE 7
N2-6	123	WESTERN RIVER-2	076G/16	65 46 55 106 25 15	M	CHALCO GRAINS OR MASSES IN GABBRO SILL CU 7 FE 7
N2-6	124	WIG	076L/15	66 48 21 110 50 00	03	QTZ LENSES WITHIN ACID TO BASIC VOLCANIC ROCKS CU 7 AU 7

NORTHEASTERN MACKENZIE DISTRICT

GRID#	OCC#	DEPOSIT NAME(S)	NTS AREA	LOCATION	DEPOSIT TYPE AND CHARACTER --- COMMODITIES AND STATUS	
N2-6	125	WOLF LAKE	076I/03	66 14 105 00 30	01	IN NARROW BANDS OF CHLORITIC SCHIST & IN APLITE U 7 TH 7
N2-6	126	WOLF LAKE	076I/03	66 14 53 105 02	07	GOSSANS/ META-SED BANDS IN GRN-GNSS ROCKS & MIGMAT CU 7 AU 7 ZN 7 NI 7
N2-6	127	WOLLASTON POINT (POLAR GROUP)	076N/10	67 37 108 35	05	DISSEMINATIONS IN BASALT FLOWS CU 7
N2-6	129	ZED	076F/16	65 54 48 108 21 00	05	GOSSANS UNDERLAIN BY QTZ-MICA SCHISTS & QUARTZITES CU 7 AS 7
N2-7	1	AC 42/25/20	086O/06	67 20 50 115 22 35	05	IN FRACTURED BASALT/ALSO ALONG FELSITE DYKE MARGIN CU 7
N2-7	2	AL	086O/10	67 36 00 114 43 25	05	SEAMS/PLATES/DISS/SHEARS/FRACS/VEINS/ IN BASALT CU 7
N2-7	4	ALF GROUP-SHOWING B	086O/04	67 14 31 115 57 52	05	VEIN ASSOCIATED WITH SHEAR ZONE IN BASALT CU 7
N2-7	5	AN/ BON/ BLUE/ DO/ MO	086I/09	66 30 08 112 15 40	06	? CU 7 NI 7
N2-7	7	ARCH 186	086N/12	67 43 00 117 56 25	05	VEIN IN BASALT CU 7
N2-7	8	ARCH 28	086N/13	67 46 00 117 46 50	05	SHEAR ZONE VEIN IN BASALT CU 7
N2-7	9	B	086O/06	67 19 30 115 23 00	05	IN BASALT FLOWS CU 7
N2-7	10	BEE/ DOT/ NEE/ BON TESHIERPI NO 9	086O/10	67 31 48 114 57	05	VEIN/ VEINLETS IN BASALT CU 7
N2-7	11	BET NO 1	086O/11	67 32 55 115 03 20	05	SULPHIDES IN BASALT ALONG FAULT CU 7
N2-7	12	BETH-1	086J/14	66 45 16 115 08 22	06	IN GNEISS ALONG MARGIN OF MUSKOX INTRUSION CU 7 NI 7
N2-7	13	BETH-2	086J/14	66 46 27 115 08 42	06	IN GNEISS ALONG MARGIN OF MUSKOX INTRUSION CU 7 NI 7
N2-7	14	BLUE LAKE GOSSAN	086I/08	66 19 42 112 19 14	05	DISSEMINATIONS/ REGIONAL GEOL- GRANITIC ROCKS CU 7
N2-7	15	BO 57 & 120	086O/05	67 17 00 115 46 00	05	ALONG FRACTURES AND DISSEMINATED IN BASALT CU 7

NORTHEASTERN MACKENZIE DISTRICT

GRID#	OCC#	DEPOSIT NAME(S)	NTS AREA	LOCATION	DEPOSIT TYPE AND CHARACTER --- COMMODITIES AND STATUS
N2-7	16	BOB 101-103	086N/11	67 42 28 117 20 56	05 QUARTZ VEIN IN BASALT CU 7
N2-7	17	BOB 125	086N/08	67 15 35 116 23 50	05 VEIN IN BASALT CU 7
N2-7	18	BONANA LAKE CANINE CLAIMS	086K/09	66 41 00 116 12 20	01 U IN INTRUSIVE PORPHYRY-STRONG RAD WITH FRACTURES U 7
N2-7	19	BUD 1028	0860/05	67 23 00 115 44 00	05 QUARTZ VEIN CUTTING BASALT CU 7
N2-7	20	BUD 37-72/DON 1-36/ORE 73-103	086N/08	67 17 50 116 11 30	05 FAULT BRECCIA & SHEARS/ ALSO DISS/ IN BASALT CU 7
N2-7	21	BUD 398-415/ 418-468/ 541-571	0860/05	67 24 44 115 58 00	05 QTZ VEIN IN FAULT ALONG GABBRO DYKE-SS CONTACT CU 7
N2-7	22	BUD 589-590	0860/05	67 27 25 115 59 00	05 FINE SPECKS IN GABBROIC DYKE INTRUDING BASALT CU 7
N2-7	23	BUD 837-924/ 966-995	0860/12	67 32 20 115 49 00	05 DISS & FRACS IN BASALT/ ALSO FRACS IN SANDSTONE CU 7
N2-7	24	BUD 942-947	0860/12	67 32 05 115 53 45	05 DISS/VEINLETS/& FRAC FILLS IN SHALES & SANDSTONES CU 7 FE 7
N2-7	25	C-1-106 (EB/ SB/ JB) CORONATION GULF NO 1 GROUP	0860/05	67 17 18 115 57 30	05 QTZ VEINS IN SHEAR CUTTING BASALT CU 7
N2-7	26	C-1-159 & C-1-164 (EB/ SB/ JB) CORONATION GULF NO 1 GROUP	086N/08	67 18 12 116 02	05 FAULT BRECCIA & FRACTURES IN BASALT CU 7
N2-7	27	C-1-160 & C-1-166 (EB/ SB/ JB) CORONATION GULF NO 1 GROUP	086N/08	67 18 30 116 01 30	05 BRECCIA ZONE/ VEINLETS/ IN BASALT CU 7
N2-7	28	C-1-164A(EB/ SB/ JB) SHOWING B CORONATION GULF NO 1 GROUP	086N/08	67 18 18 116 01 42	05 FAULT-BRECCIA ZONE IN BASALT CU 7
N2-7	29	C-1-87 (EB/ SB/ JB) CORONATION GULF NO 1 GROUP	0860/05	67 17 24 115 55	05 IN BRECCIA & ALONG FRACTURES IN BASALT CU 7
N2-7	30	CAL (HEARNE COPPERMINE)	086N/10	67 38 117 00	05 IN VEINS/ SHEARS/ FLOW TOPS/ IN BASALT CU 7
N2-7	31	CAL 42	086N/10	67 38 10 116 57 50	05 QTZ VEIN IN BASALT CU 7
N2-7	32	CAL 43	086N/10	67 38 20 116 58 40	05 QTZ VEIN IN BASALT CU 7

NORTHEASTERN MACKENZIE DISTRICT

GRID#	OCC#	DEPOSIT NAME(S)	NTS AREA	LOCATION		DEPOSIT TYPE AND CHARACTER --- COMMODITIES AND STATUS
N2-7	33	CAL 44 CAL-3	086N/10	67 38 05 116 59 00	05	VEIN IN SS DYKE IN BASALT/ ALSO VEIN IN BASALT CU 7
N2-7	34	CAL 45-46 CAL-2	086N/10	67 38 20 116 59 40	05	LENSES & VEINS IN SHEAR CUTTING BASALT CU 7
N2-7	35	CAM	086N/09	67 33 45 116 15 05	05	FAULT ZONE/ REPLACEMENTS/ AMYGDULE FILLS/IN BASALT CU 7 AG 7
N2-7	36	CAN/FOX/CLUB/CO/RED/WG	086O/13	67 54 15 115 50 40	07	VEINS IN DOLOMITE NEAR DIABASE DYKE OR SILL CU 7 AU 7 AG 7 NI 7 CO 7 FE 7 TLC7
N2-7	37	CARL	086N/12	67 44 117 32	07	MOSTLY QTZ AND/OR CALCITE VEINS IN BASALT CU 7 PB 7 AG 7
N2-7	39	CARL 94	086N/11	67 43 30 117 28 55	05	SLFD LENSES IN VEIN CUTTING BASALT CU 7 PB 7 AG 7
N2-7	40	COM-1	086N/09	67 33 12 116 26 54	05	DISSEM NATIVE CU IN APHANITIC BASALT CU 7
N2-7	41	COM-2	086N/09	67 30 48 116 26 42	05	DISSEM NATIVE CU IN APHANITIC BASALT CU 7
N2-7	42	COM-3	086N/09	67 31 36 116 25 48	05	CHALCOCITE PODS IN CALCITE VEINS IN FRACS/ BASALT CU 7
N2-7	44	CON TESHIERPI NO 5	086M/09	67 45 118 15	05	FRAC FILL/REPL/AMYGDULES/DISS IN BRECCIA/IN BASALT CU 7
N2-7	45	COP 14 & 18 & 30	086N/10	67 30 40 116 47 10	05	MASSIVE QUARTZ VEINS IN BASALT CU 7
N2-7	46	COP 361-538	086O/11	67 40 45 115 28 30	05	IN CHERT BRECCIA ALONG SHEAR CUTTING SED ROCKS CU 7
N2-7	47	COP 6 & 9 & 10	086N/10	67 31 10 116 47 00	05	QTZ VEINS CUTTING BASALTS CU 7
N2-7	50	CORONATION SOUTHEAST ZONE CORONATION EAST SHOWING/MGB 86	086N/08	67 19 50 116 22 30	05	QTZ VEINS IN BRECCIATED BASALT ALONG FAULT CU 7 AG 7
N2-7	52	CU-HOC	086O/05	67 19 42 115 48 12	05	VEINS IN FRACTURE ZONES IN BASALTIC FLOWS CU 7
N2-7	54	D	086J/14	66 57 38 115 20 41	05	SLFDS AROUND GRANITE STOCKS & ALONG FAULTS CU 7
N2-7	56	DICK NO 2 ORE	086N/08	67 20 17 116 00 21	05	FRACTURE ZONE IN BASALTS CU 7

NORTHEASTERN MACKENZIE DISTRICT

GRID#	OCC#	DEPOSIT NAME(S)	NTS AREA	LOCATION		DEPOSIT TYPE AND CHARACTER --- COMMODITIES AND STATUS
N2-7	57	DIZ/ JIM/ HERB	086N/07	67 17 30 116 46 40	05	FRACTURE FILLINGS & VEINS IN BASALT & DOLOMITE CU 7
N2-7	58	DOLL 1 SHOWING A	0860/10	67 36 55 114 32 36	05	VEINS FILLING FRACTURES IN BASALT CU 7
N2-7	59	DOLL 8 SHOWING B	0860/09	67 36 51 114 26 55	05	FAULT IN BASALTIC FLOWS CU 7 FE 7
N2-7	60	DON-1	086N/07	67 29 47 116 42 45	05	VEINS IN BASALT CU 7
N2-7	61	DON-2	086N/07	67 29 43 116 40 31	05	NATIVE CU & MALACHITE IN BASALT CU 7
N2-7	62	DON-3	086N/10	67 30 10 116 41 50	05	VEIN IN BASALT CU 7
N2-7	63	DONALDA KIL	0860/05	67 19 31 115 35 41	05	SHEAR & BRECCIA(?) CUTTING BASALTS AG 7 CU 7
N2-7	64	DOT 13 & 20 CIRCLE LAKE 2 & 3	086N/08	67 25 20 116 27 00	05	VEINS IN SHEARED & BRECCIATED BASALT CU 7
N2-7	65	DOT 1425	086N/08	67 25 30 116 21 00	05	FRACTURE (SHEAR) ZONES IN BASALT CU 7
N2-7	66	DOT 145-146	086N/08	67 27 00 116 29 30	05	QTZ VEIN IN BASALT NEAR FAULTS CU 7
N2-7	67	DOT 210	086N/08	67 24 55 116 22 40	05	SHEARED FRACTURED ZONE IN BASALT CU 7
N2-7	69	DOT 725	086N/07	67 23 10 116 42 35	05	VEIN CUTTING BASALT CU 7
N2-7	70	DOT 881 LAKE 450	086N/07	67 25 05 116 46 15	05	VEIN CUTTING BASALT CU 7
N2-7	71	DOT 900	086N/10	67 30 48 116 45 35	05	QTZ VEINS IN BASALT CU 7
N2-7	72	DOT-VANDOO CON EXPL CU	086N/08	67 24 02 116 20 31	05	VEINS IN FRACTURE ZONE ALONG FAULT IN BASALT CU 7
N2-7	74	EMILE PASCAR	086N/07	67 21 116 31	05	IN BASALT CU 7
N2-7	75	ESC SHOWING NO 2 TESHIERPI NO 12	0860/12	67 36 18 115 30 30	05	NODULES IN SANDSTONE (PROBABLY FAULT ASSOCIATED) CU 7

NORTHEASTERN MACKENZIE DISTRICT

GRID#	OCC#	DEPOSIT NAME(S)	NTS AREA	LOCATION	DEPOSIT TYPE AND CHARACTER --- COMMODITIES AND STATUS	
N2-7	78	ESC 68	086O/12	67 36 10 115 30 00	05	NODULES & REPLACEMENTS IN SANDSTONE ADJACENT FAULT CU 7
N2-7	79	ESCAPE	086N/11	67 33 55 117 27 30	05	VEINS & STRINGERS IN FRACTURE ZONE IN DOLOMITE CU 7
N2-7	81	EVE TREE RIVER	086P/01	67 12 112 20	05	STOCKWORK IN FAULT CUTTING DOLOMITE & LIMY SHALE CU 7
N2-7	82	F SHOWING (EB/ SB/ JB) C-1-44 CORONATION GULF NO 1 GROUP	086O/05	67 19 115 53	05	ALONG JOINT SURFACES IN BASALT CU 7
N2-7	83	FAR EXTENSION 1	086N/12	67 44 47 117 37 00	05	QTZ-CARBONATE VEIN CUTTING BASALT CU 7
N2-7	84	FAR EXTENSION 2	086N/13	67 45 15 117 41 40	05	QTZ VEINS IN BASALT CU 7
N2-7	85	FAR EXTENSION 3/4/5	086N/13	67 45 20 117 43 00	05	QTZ-CALCITE VEINS IN BASALT CU 7
N2-7	86	FAR 4 (H-10)	086N/12	67 44 30 117 45 00	05	QTZ VEIN IN BASALT CU 7
N2-7	87	FAR-1 (H-1)	086N/12	67 43 36 117 51 00	05	STRINGERS IN QTZ VEIN CUTTING BASALT CU 7
N2-7	88	FAR-10	086N/12	67 43 42 117 51 54	05	QTZ VEIN IN BASALT CU 7
N2-7	89	FAR-11	086N/12	67 44 36 117 44 42	05	QTZ-CALCITE VEIN IN BASALT CU 7
N2-7	90	FAR-2 (H-3)	086N/12	67 43 48 117 45 36	05	QTZ VEIN IN BASALT CU 7
N2-7	92	FAR-6 (H-15)	086N/12	67 44 24 117 42 36	05	CALCITE VEIN IN BASALT CU 7
N2-7	93	FAR-7	086N/12	67 44 24 117 43 48	05	CALCITE VEIN IN BASALT CU 7
N2-7	94	FRED-1 FRED 105 ?	086N/10	67 34 12 116 57 06	05	QTZ CALCITE VEIN IN BASALT CU 7
N2-7	95	FRED-2	086N/10	67 31 42 116 53 30	05	IN BASALT CU 7
N2-7	96	G SHOWING (EB/ SB/ JB) C-1-64 CORONATION GULF NO 1 GROUP	086O/05	67 18 48 115 53 30	05	SHEAR ZONE CUTTING BASALT CU 7

NORTHEASTERN MACKENZIE DISTRICT

GRID#	OCC#	DEPOSIT NAME(S)	NTS AREA	LOCATION	DEPOSIT TYPE AND CHARACTER --- COMMODITIES AND STATUS
N2-7	97	GAIL	086P/01	67 03 112 06	05 DISS & MASSIVE SLFDS IN SHEAR IN METASEDS-VOLCS CU 7
N2-7	98	GAL	0860/04	67 14 06 115 59 35	05 SHEAR ZONES IN BASALT CU 7
N2-7	99	GDF - CHANCE SHOWING	0860/06	67 24 00 115 27 20	05 SHEARED & SHATTERED ZONE CUTTING BASALT CU 7
N2-7	100	GDF 20/ HAUG 1 AREA	0860/06	67 25 39 115 28 42	05 SHEARED ZONE IN BASALT CU 7
N2-7	102	GL	086N/08	67 27 45 116 01 00	05 IN BASALT IN CONTACT WITH SANDSTONE CU 7
N2-7	104	GO	0860/11	67 32 25 115 21 00	05 FAULT BRECCIA ZONES IN BASALTIC FLOWS CU 7
N2-7	105	GOOD/ BREN	086N/10	67 43 00 116 53 50	05 IN SEDIMENTS & DIABASE & BASALT CU 7
N2-7	106	GORD 153/158	086N/12	67 41 10 117 44 20	05 NETWORK OF CALCITE VEINLETS IN BASALT CU 7
N2-7	107	GORD 301-414	0860/04	67 10 58 115 59 30	05 CHALCOCITE IN BASALT BRECCIA/ NATIVE CU- FLOW TOPS CU 7
N2-7	108	GOS	086J/14	66 57 12 115 21 30	05 DISS IN SHEAR(IN MYLONITE?)& IN JOINT IN METASEDS CU 7
N2-7	111	GUN-1 GENERAL RESOURCES LTD	086N/10	67 36 00 116 31 36	05 DISSEM NATIVE CU/ CHALCOCITE STRINGERS/ IN BASALT CU 7
N2-7	112	GUN-2 GENERAL RESOURCES	086N/10	67 34 54 116 32 54	05 NATIVE COPPER IN BASALT CU 7
N2-7	113	GUN-3 GENERAL RESOURCES	086N/10	67 34 42 116 34 12	05 CHALCOCITE & MALACHITE IN MASSIVE BASALT CU 7
N2-7	114	GUN-4 VANMETAL	086N/10	67 34 42 116 37	05 DISSEM NATIVE COPPER IN BASALT CU 7
N2-7	115	H.P.LAKE CANINE 5-6	086K/09	66 43 30 116 11 30	02 RAD ALONG SLATY ARGILLITE-RHYOLITE TUFF CONTACT U 7 CU 7 AG 7 AU 7
N2-7	116	HA GROUP - SHOWING A TOWER	0860/10	67 36 54 114 52 06	05 VEIN IN SHEAR (FAULT?) IN BASALTIC FLOWS CU 7
N2-7	117	HA GROUP - SHOWING B TOWER	0860/10	67 36 30 114 50 30	05 STRINGERS IN JOINTS ASSOC WITH FAULT/ IN BASALT CU 7

NORTHEASTERN MACKENZIE DISTRICT

GRID#	OCC#	DEPOSIT NAME(S)	NTS AREA	LOCATION	DEPOSIT TYPE AND CHARACTER --- COMMODITIES AND STATUS	
N2-7	118	HA GROUP - SHOWING D TOWER	086O/10	67 36 30 114 46 48	05	VEINS ALONG FAULT IN BASALT CU 7
N2-7	119	HARRY	086N/10	67 38 05 116 53 50	05	QTZ VEIN CUTTING BASALT CU 7
N2-7	120	HAY/ VOIR	086O/10	67 33 30 114 53 40	05	VEINLETS IN BASALT BRECCIA CU 7
N2-7	121	HEPBURN LAKE	086J/05	66 22 115 30	01	 U 7
N2-7	122	HM	086O/05	67 26 10 115 32 40	05	QTZ VEINS ASSOC WITH FAULT IN BASALT CU 7
N2-7	125	IKE 37 & 72	086N/08	67 15 00 116 09 35	05	NATIVE CU IN CHIPS & FLAKES IN BASALT CU 7
N2-7	126	IS 148-149	086N/08	67 18 00 116 00 55	05	VEINS IN FRACTURED/FISSURED ZONE IN BASALT CU 7 AG 7
N2-7	127	IS 179-180	086N/08	67 18 10 116 02 35	05	SEAMS & VEINLETS IN FRACTURE ZONE IN BASALT CU 7
N2-7	129	JENNY NO 1 (HEARNE)(MAIN VEIN) PICKLE CROW 140 141 200 & 201	086O/05	67 20 15 115 50 10	05	VEIN IN FAULT-BRECCIA ZONE IN BASALT CU 7
N2-7	130	JENNY NO 3 PICKLE CROW 140 141 200 & 201	086O/05	67 19 47 115 51 12	85	VEIN IN FRACTURE ZONE IN BASALT CU 7
N2-7	131	JM 22/32 SHOWING NO 8	086O/06	67 25 20 115 18 55	05	CHALCOCITE IN BASALT CU 7
N2-7	132	JIM N92301-413	086N/08	67 22 50 116 00 15	05	FAULT ZONE IN BASALT CU 7
N2-7	134	JIM 26/36 SHOWING NO 5	086O/11	67 31 10 115 12 55	05	CHALCOCITE/ BORNITE IN BASALT CU 7
N2-7	135	JIM-1 HEARNE COPPERMINE	086N/08	67 22 36 116 15 00	05	IN BASALT CU 7
N2-7	136	JIM-2 HEARNE COPPERMINE	086N/08	67 24 36 116 12 48	05	IN QTZ-CALCITE IN BASALT CU 7
N2-7	137	JIM-3 HEARNE COPPERMINE	086N/08	67 22 54 116 11 00	05	DISSEM NATIVE CU IN APHANITIC BASALT CU 7
N2-7	138	JIM-4 HEARNE COPPERMINE	086N/08	67 23 18 116 11 24	05	DISSEM NATIVE CU IN APHANITIC BASALT CU 7

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GRID#	OCC#	DEPOSIT NAME(S)	NTS AREA	LOCATION	DEPOSIT TYPE AND CHARACTER --- COMMODITIES AND STATUS
N2-7	139	JIM/ VIC/ SEPT	086N/08	67 20 33 116 02 00	05 IN BASALT FLOWS CU 7
N2-7	140	JOK ESKIMO	0860/05	67 21 00 115 33 20	05 BRECCIATED ZONE IN BASALT CU 7
N2-7	141	JOS/ CIS/ PAL/ TON/ MIC/ ACK	0860/06	67 26 15 115 03 00	05 IN QTZ STRINGERS IN BASALT ADJ DIABASE DYKE CU 7
N2-7	142	JS/ FM/ RIP	0860/06	67 18 35 115 28 25	05 BRECCIA ZONES/ VEINLETS/JOINTS/FRACTURES-IN BASALT CU 7
N2-7	144	KARLA 1-13	086N/11	67 41 30 117 05 30	05 QTZ VEINS IN BASALT CU 7
N2-7	146	KAT 31 KAT NO 2 SHOWING	0860/04	67 14 43 115 52 04	05 DISSEMINATED NATIVE COPPER IN BASALT CU 7
N2-7	148	KAT 5 KAT NO 4 SHOWING	0860/05	67 16 07 115 51 02	05 IN HEMATIZED & BRECCIATED BASALT FLOW TOP CU 7
N2-7	150	KIL (MACKENZIE MINING)	0860/11	67 35 115 15	05 ASSOC WITH FAULTS IN ALTERED BASALT CU 7
N2-7	154	LASH 321 322 329 & 330 LASH-6	0860/12	67 31 00 115 34 35	05 DISSEM IN SANDSTONE ADJACENT DIABASE DYKE CU 7
N2-7	155	LASH 523-524	0860/05	67 29 25 115 40 55	05 NATIVE CU ALONG FRACS IN BASALT INTERCAL W SEDS CU 7
N2-7	156	LASH-2	0860/12	67 31 00 115 45 36	05 DISSEM & FRAC FILLS ALONG BASALT-SANDSTONE CONTACT CU 7
N2-7	157	LASH-5	0860/12	67 32 12 115 34 42	05 IN VERTICAL FRACTURES IN SANDSTONE CU 7
N2-7	158	LASH-8	0860/12	67 32 54 115 42 18	05 DISSEM IN LIMY SHALES NEAR DIABASE SILL CONTACT CU 7
N2-7	159	LEAH	086N/10	67 37 20 116 36 25	05 NATIVE CU GRAINS &IN VEINS/SLFD IN FRACS/IN BASALT CU 7
N2-7	160	LEL	0860/10	67 31 06 114 49 06	05 AMYGDULES/ DISSEM/ SHEARS/ IN BASALT CU 7
N2-7	161	LINDA	086J/11	66 43 43 115 12 30	06 DISSEMINATIONS CU 7 NI 7
N2-7	163	LIZ NO 2	0860/11	67 31 00 115 03 54	05 STRINGERS ASSOC WITH FAULT CUTTING BASALT CU 7

NORTHEASTERN MACKENZIE DISTRICT

GRID#	OCC#	DEPOSIT NAME(S)	NTS AREA	LOCATION	DEPOSIT TYPE AND CHARACTER --- COMMODITIES AND STATUS
N2-7	165	LLOYD 5	086N/07	67 28 116 43 40	05 QTZ VEIN IN BASALT CU 7
N2-7	166	MAG & MAT	086O/06	67 28 05 115 21 25	05 BASALT BRECCIA ZONES NEAR DIABASE CU 7
N2-7	167	MAR 1-100 (MAR NO 1 SHOWING)	086N/07	67 23 36 116 46 06	05 FAULT BRECCIA ZONE IN BASALT CU 7
N2-7	168	MAR 1-100 (MAR NO 2 SHOWING)	086N/07	67 22 24 116 46 06	05 FAULT BRECCIA ZONE IN BASALT CU 7 AG 7
N2-7	169	MAR 1-100 (MAR NO 3 SHOWING)	086N/07	67 22 48 116 45 18	05 IN MATRIX OF BRECCIA IN BASALT CU 7 AG 7
N2-7	170	MAR 117 RABBIT LAKE	086N/07	67 24 45 116 48 00	05 QTZ VEIN IN BASALT CU 7
N2-7	172	MAR 132-133 (MAR NO 6 SHOWING) SOUTH GROUP	086N/07	67 25 15 116 49 56	05 BRECCIA ZONE CUTTING BASALT CU 7
N2-7	173	MAR 132-133 (MAR NO 7 SHOWING) SOUTH GROUP	086N/07	67 28 06 116 51	05 QTZ-SLFD STRINGER IN BASALT CU 7
N2-7	174	MAR 322-325	086N/10	67 34 05 116 49 00	05 NATIVE CU DISSEM/ SLFDS IN VEINS/ IN BASALT CU 7
N2-7	175	MAR 326-335 NORTH GROUP	086N/10	67 35 38 116 52 40	05 VEINS IN BASALT CU 7
N2-7	176	MAR 500-562 - NO 1 SHOWING	086N/08	67 16 42 116 07	05 CHALCOCITE STRINGERS IN SHEAR ZONE IN BASALT CU 7
N2-7	177	MAR 500-562 - NO 2 SHOWING	086N/08	67 16 12 116 08	05 ZONE OF QTZ-CALCITE VEINS CUTTING BASALT CU 7
N2-7	178	MAR 500-562 - NO 4 SHOWING	086N/08	67 16 24 116 04 54	05 QTZ-CALCITE VEINS IN BASALT CU 7
N2-7	180	MAS 7-8	086O/05	67 27 115 30 35	05 STRINGERS & VEINS ASSOC W FAULT IN BASALT & SLATE CU 7 BA 7
N2-7	181	MAS 9	086O/06	67 26 50 115 29 40	05 QUARTZ-CALCITE VEIN IN BASALT AND SANDSTONE CU 7 BA 7
N2-7	182	MCGREGOR LAKE SOUTH	086J/14	66 51 04 115 14 20	05 DISSEM IN MUSKOX INTRUSION CU 7
N2-7	184	METAL 5 & 7 & 12 MALACHITE LAKE	086N/08	67 23 15 116 28 10	05 IN BASALT (ASSOC WITH FAULT ?) CU 7 AG 7 PT 7

NORTHEASTERN MACKENZIE DISTRICT

GRID#	OCC#	DEPOSIT NAME(S)	NTS AREA	LOCATION	DEPOSIT TYPE AND CHARACTER --- COMMODITIES AND STATUS
N2-7	185	MGB 1-100	086N/08	67 20 08 116 24 36	05 IN BASALT FLOWS CU 7
N2-7	186	MGB 101-180/ 232-252	086N/08	67 20 10 116 18 30	05 VEINS AND BRECCIAS IN BASALT CU 7
N2-7	187	MGB 181-185	086N/08	67 21 25 116 21 20	05 DISSEM IN MASSIVE BASALT AND IN AMYGDULES CU 7
N2-7	188	MGB 277	086N/08	67 20 05 116 14 05	05 IN QTZ-CARBONATE VEIN IN BASALT CU 7
N2-7	189	MGB 325-396	086N/08	67 19 20 116 11 00	05 VEINS IN BASALT CU 7
N2-7	191	MID 104 MID-4	086N/11	67 40 18 117 09 48	05 QTZ-CALCITE VEIN IN BASALT CU 7
N2-7	192	MID 108 MID-3	086N/11	67 39 36 117 11 30	05 QTZ-CALCITE VEIN IN BASALT CU 7
N2-7	193	MID 115 MID-2	086N/11	67 39 36 117 09 42	05 QTZ-CALCITE VEIN ASSOC WITH DIABASE DYKE CU 7
N2-7	194	MID 120 MID-1	086N/11	67 38 54 117 11 24	05 CHALCOCITE IN FINE FRACTURES & DISSEM IN BASALT CU 7
N2-7	195	MID-5	086N/11	67 39 24 117 06 06	05 QTZ-CALCITE VEIN IN BASALT CU 7
N2-7	196	MIKE 11/14 SHOWING NO 6	086O/06	67 29 25 115 11 05	05 CHALCOCITE IN BASALT CU 7
N2-7	197	MIKE 21/32 JUDY LAKE	086O/06	67 29 05 115 12 35	05 NATIVE COPPER IN BASALTS CU 7
N2-7	198	MM 1-72	086O/05	67 18 25 115 41 00	05 MOSTLY NATIVE CU VEINLETS IN BASALT CU 7
N2-7	199	MONNIER 19-36 & ILROCK 1-36	086N/07	67 21 15 116 37 40	05 VEIN IN FRACTURE IN AMYGDALOIDAL BASALT CU 7 AG 7
N2-7	200	MOUNTAIN LAKE SHOWINGS BRUCE/JEFF/TIM/MIKE/ROD	086N/07	67 20 116 57	01 YELLOW U STAINING ON FRACTURE FACES IN SANDSTONE U 7
N2-7	201	MUSKOX INTRUSION-1	086J/11	66 42 12 115 08 24	06 IN GNEISS NEAR MARGIN OF MUSKOX INTRUSION CU 7 NI 7 PB 7
N2-7	202	MUSKOX INTRUSION-2	086J/14	66 46 06 115 09 36	06 IN GNEISS NEAR MARGIN OF MUSKOX INTRUSION CU 7 NI 7

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NORTHEASTERN MACKENZIE DISTRICT

GRID#	OCC#	DEPOSIT NAME(S)	NTS AREA	LOCATION	DEPOSIT TYPE AND CHARACTER --- COMMODITIES ANC STATUS	
N2-7	203	MUSKOX INTRUSICN-3	086J/14	66 48 12 115 09 42	06	IN PARAGNEISS NEAR MARGIN OF MUSKOX INTRUSION CU 7 NI 7
N2-7	204	MUSKOX INTRUSION-4	086J/14	66 50 36 115 11 00	06	AT CONTACT OF MUSKOX INTRUSION & PARAGNEISS CU 7 NI 7
N2-7	205	MUSKOX INTRUSION-5	086J/14	66 51 48 115 17 30	07	IN PERIODTITE OF MUSKOX INTRUSION PB 7
N2-7	206	MUSKOX INTRUSION-6	086J/14	66 53 42 115 18 48	06	AT CONTACT OF MUSKOX INTRUSION & PARAGNEISS CU 7 NI 7
N2-7	207	MUSKOX INTRUSION-7 SUE	086J/14	66 57 48 115 10 12	06	AT CONTACT OF MUSKOX INTRUSION & QTZ-MICA SCHIST CU 7 NI 7
N2-7	208	MUSKOX INTRUSION-8	086J/14	66 58 30 115 10 00	06	AT CONTACT OF MUSKOX INTRUSION & QTZ-MICA SCHIST CU 7 NI 7
N2-7	209	MUSKOX INTRUSION-9	0860/03	67 07 18 115 09 06	06	IN ULTRAMAFIC ROCKS NI 7 CU 7
N2-7	210	NAN	0860/06	67 29 24 115 26 50	05	VEINS IN BASALT CU 7
N2-7	214	NOR 27-72/WIL 73-79/HOLE 1-8	086N/09	67 32 00 116 05 25	05	DISSEM & VEINLETS IN BASALT CU 7
N2-7	215	NOR 48	0860/06	67 26 20 115 13 25	05	VEIN IN BASALT CU 7
N2-7	216	NOR 94 SHOWING NO 7	0860/06	67 26 55 115 12 55	05	IN FRACTURED BASALT ALONG FAULT CU 7
N2-7	217	NWT-1 (CLAIM 81) H-7	086N/12	67 44 40 117 47 00	05	BRECCIA & AMYGDULE FILLING IN BASALT CU 7
N2-7	218	NWT-2 (CLAIM 78 OR 79)	086N/12	67 44 45 117 49 00	05	BRECCIA ZONE IN BASALT CU 7
N2-7	219	OOK	086N/09	67 31 47 116 21	05	NATIVE CU AS DISS & NARROW CARB VEINS IN BASALT CU 7
N2-7	220	OP 37-64	0860/04	67 14 52 115 49 00	05	SPECKS OF NATIVE COPPER IN BASALT CU 7
N2-7	221	OX	086J/07	66 16 22 114 44 40	05	? CU 7
N2-7	222	OXO/ TOC	086J/14	66 53 09 115 14 36	06	ALONG MARGINS OF MUSKOX INTRUSION CU 7 NI 7

NORTHEASTERN MACKENZIE DISTRICT

GRID#	OCC#	DEPOSIT NAME(S)	NTS AREA	LOCATION	DEPOSIT TYPE AND CHARACTER --- COMMODITIES AND STATUS	
N2-7	223	PAN/ DIB/ MAS	0860/05	67 20 50 115 35 40	05	VEINS/ BRECCIA/ AMYGDULES/ IN BASALT CU 7
N2-7	224	PAT 2 & 6/ LR 12 & 27 SHOWING NO 9	0860/06	67 26 35 115 21 40	05	CHALCOCITE IN BASALT CU 7
N2-7	225	PAT 5	086N/10	67 32 00 116 40 00	05	QTZ FISSURE VEIN IN BASALT CU 7
N2-7	226	PEC GROUP	086N/07	67 16 18 116 56	02	YELLOW U & GREEN CU STAINS IN MATRIX OF FELS SST U 7 CU 7
N2-7	227	PENNY 1-36 GOLDEN WEST	086N/09	67 35 116 15	05	IN BASALT CU 7
N2-7	229	PRO/ MOC/ KIL	0860/05	67 20 55 115 39 55	05	FRACTURE FILLINGS & VEINS IN BASALTIC FLOWS CU 7
N2-7	230	RAE RIVER	0860/13	67 55 16 115 45	05	IN SANDSTONE CU 7
N2-7	231	RAY	086N/09	67 35 20 116 17 30	05	IN BASALT BORDERING FAULT ZONE CU 7 AG 7
N2-7	232	RAY ADAM	086P/08	67 17 112 16	05	IN CARBONATE WITHIN QTZ VEINS CUTTING GRANITICS CU 7
N2-7	233	RIT	086N/11	67 35 16 117 26 10	05	STOCKWORK VEINS IN FRACTURED DOLOMITE CU 7
N2-7	234	ROB AND SOP	086N/08	67 21 116 25	05	DISSEM IN SHEARED BASALT FLOW HORIZON CU 7
N2-7	235	ROB 1-10	086N/07	67 23 00 116 30 06	05	IN BASALT FLOWS CU 7
N2-7	236	ROBB	086N/08	67 20 25 116 00 15	05	VEINS ALONG SHEARS & FAULTS IN BASALT CU 7
N2-7	239	RT/ EM	0860/06	67 21 115 27 20	05	VEINS/FRACS/BRECCIA/DISS/REPL/FISSURES/IN BASALT CU 7
N2-7	240	SAM-NO 1 VEIN	0860/05	67 20 54 115 50 00	05	BRECCIA-FRACTURE ZONE IN BASALT CU 7
N2-7	241	SAM-NO 2 VEIN NO 11	0860/05	67 21 55 115 52 00	05	IN MATRIX OF BRECCIA ZONE IN BASALT CU 7 AG 7 AU 7
N2-7	242	SD/ NWA/ MCK - SHOWING 1 NWA 97	0860/10	67 40 18 114 54 24	05	QTZ-CALCITE VEIN IN BASALT CU 7

NORTHEASTERN MACKENZIE DISTRICT

GRID#	OCC#	DEPOSIT NAME(S)	NTS AREA	LOCATION	DEPOSIT TYPE AND CHARACTER --- COMMODITIES AND STATUS	
N2-7	243	SD/ NWA/ MCK - SHOWING 16 SD 16	0860/10	67 37 18 114 54 30	05	BLEBS OF SULPHIDES IN BASALT CU 7
N2-7	244	SD/ NWA/ MCK - SHOWING 17 NWA 69	0860/10	67 35 24 114 54 00	05	NATIVE CU PLATES & STRINGERS IN BASALT CU 7
N2-7	245	SD/ NWA/ MCK - SHOWING 18 SD 16	0860/10	67 37 18 114 56 24	05	NATIVE CU PLATES & STRINGERS IN BASALT CU 7
N2-7	246	SD/ NWA/ MCK - SHOWINGS 12 &13 MCK 38	0860/10	67 35 42 114 57 24	05	MASSIVE SULPHIDE VEINS IN BASALT CU 7
N2-7	247	SD/ NWA/ MCK - SHOWINGS 14 &15 SD 17	0860/10	67 37 24 114 57 24	05	SULPHIDE ASSOCIATED WITH CALCITE IN BASALT CU 7
N2-7	248	SD/ NWA/ MCK - SHOWINGS 2 & 3 SD 10	0860/10	67 39 24 114 53 48	05	QTZ-CALCITE VEIN IN BASALT CU 7
N2-7	249	SD/ NWA/ MCK - SHOWINGS 4/5/6	0860/10	67 39 12 114 55 12	05	FRACTURE ZONE IN BASALT CU 7
N2-7	250	SD/ NWA/ MCK - SHOWINGS 7-11 NWA 79	0860/10	67 34 54 114 58 18	05	DISSEMINATIONS IN CALCITE VEINS IN BASALT CU 7
N2-7	251	SE	086I/01	66 01 54 112 15 00	05	VEINS OR STOCKWORKS/ REGIONAL GEOL-PORPH GRANITE CU 7
N2-7	252	SEPTEMBER MT GROUP 3	086N/08	67 19 30 116 02	05	DISSEM/AMYGDULE-FRAC FILLS/VEINS/BRECCIA IN BASALT CU 7
N2-7	253	SEPTEMBER MT 1-SHOWING 1 GL	0860/05	67 28 54 115 56 30	05	IN STRINGERS/ FRACTURES/ JOINT PLANES IN BASALT CU 7
N2-7	254	SEPTEMBER MT 1-SHOWING 2 GL	086N/09	67 30 54 116 01 48	05	IN BASALT CU 7
N2-7	255	SEPTEMBER MT 2-RIVER SHOWING BUD	0860/05	67 26 30 115 40 00	05	IN VEINLET & ALONG JOINT IN SANDSTONE CU 7
N2-7	256	SEPTEMBER MT 2-WESTERN HILL BUD	0860/05	67 27 18 115 52 30	05	MALACHITE & OCCASIONAL PLATES NATIVE CU IN BASALT CU 7
N2-7	257	SHARON 1 NORTH THOMPSON LAKE SHOWING	0860/11	67 33 10 115 10 00	05	CHALCOCITE IN BASALT CU 7
N2-7	258	SHARON 23 THOMPSON LAKE SHOWING	0860/11	67 32 10 115 09 30	05	NATIVE CU IN BASALT CU 7
N2-7	259	SIL/ SP	0860/05	67 17 30 115 46 35	05	FAULT BRECCIA ZONES IN BASALT CU 7

NORTHEASTERN MACKENZIE DISTRICT

GRID#	OCC#	DEPOSIT NAME(S)	NTS AREA	LOCATION	DEPOSIT TYPE AND CHARACTER --- COMMODITIES AND STATUS
N2-7	260	ST GERMAIN FAULT ZONE	086K/09	66 39 45 116 06 00	01 YELLOW STAIN ON RHYOLITE TUFF WHERE FRACTURES CUT U 7
N2-7	261	STAN & TRI (LYNCH) BERNACK	086N/07	67 29 35 116 54 55	05 QTZ VEIN & AMYGDULE FILLING IN BASALT CU 7
N2-7	262	STAN (NORTHLAKE)	086N/07	67 27 54 116 55 00	05 QTZ VEINS IN BASALT CU 7
N2-7	263	SWAK 11	086N/08	67 26 10 116 02 55	05 IN FRACTURE ALONG BASALT-SANDSTONE CONTACT CU 7
N2-7	266	TEA TESHIERPI NO 3	086N/12	67 35 35 117 31 50	05 DISS IN FAULT BRECCIA/FRAC & AMYGDULE FILLS/BASALT CU 7
N2-7	267	TIP	086O/10	67 37 25 114 47 20	05 QTZ VEIN IN QTZITE/ DISS-BRECCIA-REPLAC IN BASALT CU 7
N2-7	268	TOIVO MGB 166-169	086N/08	67 21 00 116 18 30	05 VEIN ASSOCIATED WITH FAULT CUTTING BASALT CU 7
N2-7	270	TRI 1	086N/11	67 36 30 117 04 18	05 FRACTURES AND VEINS IN BASALT CU 7 BA 7
N2-7	271	TRI 4	086N/11	67 36 36 117 00 55	05 VEINS IN FRACTURED BASALT CU 7 BA 7
N2-7	272	VERA GROUP - NIC SHOWING	086O/05	67 18 24 115 48 37	05 LENSES & VEINS IN FRACTURE ZONE IN BASALT CU 7
N2-7	273	VERA GROUP-VERA SHOWING	086O/05	67 18 07 115 48 20	05 QUARTZ VEIN IN FRACTURED BASALT CU 7
N2-7	276	WATER 22 ADERA/ CENTRAL POINT	086N/08	67 27 35 116 02 20	05 BLEBS IN FLAT-LYING ZONES IN BASALT CU 7
N2-7	277	WIL/ NOR	086N/09	67 31 50 116 12 30	05 AMYGDULE FILLINGS & BLEBS IN BASALT CU 7
N2-7	278	WIN 102 SHOWING NO 3	086O/10	67 37 20 114 50 25	05 VEINLETS SPECKS & PLATES IN AMYGDALOIDAL BASALT CU 7
N2-7	279	WIN 90 SHOWING NO 2	086O/10	67 37 30 114 50 20	05 QTZ VEINS IN BASALT CU 7
N2-7	280	XYZ/ SON/ SHEL	086N/11	67 43 20 117 03	05 QTZ VEINS IN BASALT CU 7
N2-7	282	ZO	086J/14	66 56 32 115 04 39	06 DISSEM SLFD IN GOSSANS OVER GRANITIC GNEISSES CU 7 NI 7

NORTHEASTERN MACKENZIE DISTRICT

GRID#	OCC#	DEPOSIT NAME(S)	NTS AREA	LOCATION	DEPOSIT TYPE AND CHARACTER --- COMMODITIES AND STATUS
N3-6	1	CIC GROUP - NORTH 1 SHOWING CIC CLAIM 3	077A/03	68 03 42 106 39 40	07 DISSEM/PATCHES/VEINS/FRAC FILLS IN PORPHYRY CU 7 AG 7 AU 7 ZN 7 AS 7 FSP7
N3-6	2	CIC/ DIP	077A/03	68 03 52 106 38 30	07 VEINS IN FELDSPAR PORPHYRY/ QUARTZITE/ GREENSTONE CU 7 AG 7 PB 7 AU 7 AS 7 FSP7 ZN 7
N3-6	4	KENT PENINSULA-1	077B/01	68 12 108 11	05 DISS SLFDS IN MUDSTONE & SHALE CU 7
N3-6	5	KENT PENINSULA-2	077B/01	68 07 20 108 21	05 SLFDS IN DOLOMITE CU 7
N3-6	6	RIVER SHOWING (CIC CLAIMS) NORTH 13 SHOWING	077A/03	68 04 18 106 40 50	07 QUARTZ VEIN CUTS GREENSTONE & INTERBEDDED SEDS CU 7 AG 7 ZN 7 CO 7 PB 7
N3-6	8	WOLF	077A/03	68 02 106 37	05 QUARTZ-CARBONATE ZONES IN METAVOLCS CU 7 AS 7
N3-6	9	TOD/OZ/FOX/MIN	077A/01	68 10 19 105 59 05	11 MO 7 AU 7 AG 7

KEEWATIN DISTRICT

GRID#	OCC#	DEPOSIT NAME(S)	NTS AREA	LOCATION		DEPOSIT TYPE AND CHARACTER --- COMMODITIES AND STATUS
N1-4	1	ANDREWS LAKE	055M/15	63 56 094 52	02	U IN SANDSTONE NEAR CHRISTOPHER ISLAND TYPE ROCK U 7 CU 7 AG 7 PB 7
N1-4	2	ART	055L/04	62 02 38 095 35 34	07	IN HORNBLENDE SCHIST AND AMPHIBOLITE CU 7 ZN 7
N1-4	3	BLOCK A - OCC 1 PROSPECTING PERMIT 102	055L/06	62 19 30 095 08 15	07	SULPHIDES IN QUARTZ VEINS IN TONALITE INTRUSIONS CU 7 AU 7 AG 7 PB 7 ZN 7 AS 7
N1-4	4	BLOCK A - OCC 2 PROSPECTING PERMIT 102	055L/06	62 18 45 095 05 45	05	STRINGERS & QTZ VEINS IN SHEAR ZONE & GREENSTONE CU 7 FE 7
N1-4	5	BLOCK G PP 102	055L/06	62 19 00 095 23 24	07	QUARTZ VEIN IN VOLCANICS AU 7 CU 7 PB 7 ZN 7 AG 7
N1-4	6	BLOCK I	055L/06	62 24 095 18	07	QTZ VEINS/ AREA UNDERLAIN BY INTRUSIVE ROCKS CU 7 AU 7 PB 7 ZN 7 AS 7
N1-4	7	CAN (PRAIRIE BAY) PIG 2/ 8/ 15	055K/16	62 51 18 092 01 48	06	DISSEMINATED IN METAGABBRO CU 7 NI 7 ZN 7
N1-4	8	CAT MI 10/ MAR 24	055K/02	62 13 06 092 35 34	06	MASSIVE CHALCO IN MAFIC VOLCS/ ALONG A SHEAR ? CU 7 NI 7
N1-4	9	CC 330	055K/16	62 51 00 092 11 24	04	DISSEM SLFDS IN ANDESITE AG 7
N1-4	10	CL	055L/05	62 15 09 095 50 00	07	IN HORNBLENDE SCHIST AND AMPHIBOLITE CU 7 ZN 7
N1-4	11	COM	055K/02	62 13 50 092 36 50	11	UNDERLAIN BY METAVOLC OR METASED ROCKS CU 7 AU 7 MO 7
N1-4	13	DAWSON INLET-1 GOSSAN NO 17	055F/13	61 56 26 093 37 54	05	SLFDS IN QTZ VEINS & DISSEM IN GREENSTONE CU 7
N1-4	14	DAWSON INLET-2 GOSSAN NO 18	055F/13	61 56 06 093 38 51	M	SLFDS IN QTZ VEINS & DISSEM IN GREENSTONE CU 7 AU 7
N1-4	15	DAWSON INLET-3	055F/13	61 48 16 093 44 28	05	IN MAFIC VOLCANIC ROCKS CU 7
N1-4	16	DAWSON INLET-4	055F/13	61 58 12 093 59 42	05	IN PELITIC SCHIST CU 7
N1-4	18	EAST OF TOWNSEND LAKE	055L/11	62 37 45 095 08 50	05	IN SCHISTS CU 7
N1-4	19	ESKIMO (KUDLULIK PENINSULA)	055K/16	62 50 08 092 07 00	06	? CU 7 NI 7 CO 7

KEEWATIN DISTRICT

GRID#	OCC#	DEPOSIT NAME(S)	NTS AREA	LOCATION		DEPOSIT TYPE AND CHARACTER --- COMMODITIES AND STATUS
N1-4	20	GAMMA	055K/03	62 10 07 093 19 08	07	DISSEM SLFDS IN RHYOLITIC SCHIST CU 7 ZN 7
N1-4	21	GIANT YELLOWKNIFE AREA 3176	055L/05	62 19 30 095 30 30	07	GOSSAN ZONE IN VOLCANICS CU 7 AU 7
N1-4	22	GIANT YELLOWKNIFE MINES LTD-1	055K/03	62 07 00 093 17 20	05	? CU 7
N1-4	23	GIANT YELLOWKNIFE MINES LTD-10	055K/04	62 14 35 093 52 26	05	? CU 7
N1-4	24	GIANT YELLOWKNIFE MINES LTD-11	055K/05	62 12 40 093 47 50	05	? CU 7
N1-4	25	GIANT YELLOWKNIFE MINES LTD-12	055K/05	62 13 00 093 49 48	05	? CU 7
N1-4	26	GIANT YELLOWKNIFE MINES LTD-13	055K/03	62 07 56 093 09 30	05	? CU 7
N1-4	27	GIANT YELLOWKNIFE MINES LTD-2	055K/03	62 09 19 093 17 20	05	IN MAFIC VOLCANIC ROCKS CU 7 AU 7
N1-4	28	GIANT YELLOWKNIFE MINES LTD-3	055K/03	62 10 32 093 17 18	05	IN MAFIC VOLCANIC ROCKS CU 7
N1-4	29	GIANT YELLOWKNIFE MINES LTD-4	055K/03	62 02 53 093 19 19	05	? CU 7
N1-4	30	GIANT YELLOWKNIFE MINES LTD-5	055K/03	62 08 30 093 21 17	05	? CU 7 PB 7
N1-4	31	GIANT YELLOWKNIFE MINES LTD-6	055K/03	62 07 30 093 23 56	05	? CU 7
N1-4	32	GIANT YELLOWKNIFE MINES LTD-7	055K/03	62 06 20 093 25 34	05	IN MAFIC VOLCANIC ROCKS CU 7
N1-4	33	GIANT YELLOWKNIFE MINES LTD-8	055K/04	62 03 22 093 30 08	05	IN FELSIC-INTERM INTRUSIVE (PLUS MIGMATITIC) ROCKS CU 7
N1-4	34	GIANT YELLOWKNIFE MINES LTD-9	055K/04	62 14 31 093 51 00	05	? CU 7
N1-4	35	GUN	055K/04	62 13 30 093 54 00	07	QTZ VEINS/ IN MAFIC VOLCANICS ? CU 7 PB 7 ZN 7 NI 7 AU 7 AG 7
N1-4	36	HAPPOTIYIK LAKE	055L/08	62 28 46 094 08 34	05	IN HORNBLENDE SCHIST & AMPHIBOLITE CU 7 AU 7

KEEWATIN DISTRICT

GRID#	OCC#	DEPOSIT NAME(S)	NTS AREA	LOCATION	DEPOSIT TYPE AND CHARACTER --- COMMODITIES AND STATUS
N1-4	37	HUSKY OIL PP 201 - OCC 1	055K/04	62 06 10 093 31 26	05 IN MAFIC VOLCANIC ROCKS CU 7
N1-4	38	HUSKY OIL PP 201 - OCC 2	055K/04	62 04 00 093 35 26	05 IN MAFIC VOLCANIC ROCKS CU 7
N1-4	39	HUSKY OIL PP 201 - OCC 3	055K/04	62 02 34 093 37 26	M IN MAFIC VOLCANIC ROCKS CU 7 AG 7 NI 7
N1-4	40	HUSKY OIL PP 202 - OCC 1	055K/06	62 20 04 093 26 52	05 ? CU 7
N1-4	41	HUSKY OIL PP 202 - OCC 2 MAZE LAKE	055K/06	62 25 08 093 25 00	06 ? CU 7 NI 7
N1-4	42	HUSKY OIL PP 202 - OCC 3	055K/06	62 24 11 093 12 52	11 ? MO 7 CU 7 AG 7
N1-4	43	HUSKY OIL PP 202 - OCC 5	055K/06	62 21 34 093 02 57	05 IN FELSIC TO INTERMEDIATE INTRUSIVE ROCKS CU 7
N1-4	44	HUSKY OIL PP 202 - OCC 6 SOUTH OF GILL LAKE	055K/06	62 24 10 093 05 10	M ? CU 7 AG 7 PB 7
N1-4	45	HUSKY OIL PP 202 - OCC 7 GILL LAKE	055K/06	62 25 24 093 06 03	05 ? CU 7 AG 7
N1-4	46	HUSKY OIL PP 204 - OCC 4 WILSON BAY	055K/06	62 19 08 093 05 12	05 ? CU 7
N1-4	47	IGLOO POINT	055K/08	62 23 09 092 06 48	05 IN MAFIC VOLCANIC ROCKS CU 7
N1-4	48	ISLAND IN KAMINAK LAKE PP 55-L-2	055L/02	62 13 39 094 53 14	05 IN GABBRO OR DIORITE CU 7 NI 7
N1-4	49	JOYCE (KUDLULIK PENINSULA)	055K/16	62 49 48 092 10 53	07 ? ZN 7 CU 7
N1-4	50	KENNCO EXPL PP 48 - OCC 1	055K/10	62 31 51 092 48 30	05 IN MAFIC VOLCANIC ROCKS CU 7
N1-4	51	KENNCO EXPL PP 48 - OCC 10	055K/10	62 34 53 092 46 00	05 IN MAFIC VOLCANIC ROCKS CU 7
N1-4	52	KENNCO EXPL PP 48 - OCC 11	055K/10	62 35 04 092 44 42	05 IN MAFIC VOLCANIC ROCKS CU 7
N1-4	53	KENNCO EXPL PP 48 - OCC 12	055K/10	62 38 17 092 48 10	05 ? CU 7

KEEWATIN DISTRICT

GRID#	OCC#	DEPOSIT NAME(S)	NTS AREA	LOCATION	DEPOSIT TYPE AND CHARACTER --- COMMODITIES AND STATUS	
N1-4	54	KENNCO EXPL PP 48 - OCC 2	055K/10	62 32 16 092 47 00	05	IN MAFIC VOLCANIC ROCKS CU 7
N1-4	55	KENNCO EXPL PP 48 - OCC 3	055K/10	62 31 41 092 42 21	05	IN MAFIC VOLCANIC ROCKS CU 7
N1-4	56	KENNCO EXPL PP 48 - OCC 4	055K/10	62 32 03 092 42 04	05	IN MAFIC VOLCANIC ROCKS CU 7
N1-4	57	KENNCO EXPL PP 48 - OCC 5	055K/10	62 33 17 092 42 20	05	IN MAFIC VOLCANIC ROCKS CU 7
N1-4	58	KENNCO EXPL PP 48 - OCC 6	055K/10	62 34 23 092 42 39	05	IN MAFIC VOLCANIC ROCKS CU 7
N1-4	59	KENNCO EXPL PP 48 - OCC 7	055K/10	62 34 31 092 44 50	05	IN MAFIC VOLCANIC ROCKS CU 7
N1-4	60	KENNCO EXPL PP 48 - OCC 8	055K/10	62 34 15 092 46 10	05	IN MAFIC VOLCANIC ROCKS CU 7
N1-4	61	KENNCO EXPL PP 48 - OCC 9	055K/10	62 34 41 092 47 21	05	IN MAFIC VOLCANIC ROCKS CU 7
N1-4	62	LAD PETER	055L/06	62 28 18 095 01 45	05	IN HORNBLENDE GABBRO OR DIORITE CU 7
N1-4	63	LAST LAKE-1	055K/05	62 15 12 093 45 00	05	? CU 7
N1-4	64	LAST LAKE-2	055K/05	62 16 14 093 40 41	05	IN MASSIVE & PILLOWED ANDESITE & BASALT CU 7
N1-4	65	LAST LAKE-3	055K/05	62 18 00 093 40 42	05	IN MASSIVE & PILLOWED ANDESITE & BASALT CU 7
N1-4	66	LAST LAKE-4	055K/04	62 13 10 093 44 51	03	IN MAFIC VOLCANICS CU 7
N1-4	67	MAGUSE LAKE (P GROUP) CARR LAKE PROJECT	055E/14	61 52 30 095 28 26	11	VEINS IN GABBRO INTRUDING DACITE/ & DISS IN BASALT CU 7 MO 7 AU 7
N1-4	69	MINE (CHAR RIVER)	055K/16	62 52 11 092 11 28	06	? NI 7 CU 7
N1-4	70	MINERAL OCCURRENCE-1 PP 55-L-4	055L/04	62 29 44 095 32 26	05	IN METASEDIMENTARY ROCKS CU 7
N1-4	71	MINERAL OCCURRENCE-1	055K/03	62 13 00 093 12 34	05	? CU 7

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GRID#	OCC#	DEPOSIT NAME(S)	NTS AREA	LOCATION	DEPOSIT TYPE AND CHARACTER --- COMMODITIES AND STATUS	
N1-4	72	MINERAL OCCURRENCE-2 PP 55-L-5	055L/05	62 15 06 095 44 24	05	IN TONALITE CU 7
N1-4	73	MINERAL OCCURRENCE-2	055K/03	62 05 21 093 28 12	05	IN MAFIC VOLCANIC ROCKS CU 7
N1-4	74	MINERAL OCCURRENCE-3 PROSPECTING PERMIT 55-L-6	055L/06	62 19 26 095 03 30	05	? CU 7
N1-4	75	MINERAL OCCURRENCE-3	055K/05	62 29 42 093 50 15	05	IN MAFIC VOLCANIC ROCKS CU 7
N1-4	76	MINERAL OCCURRENCE-4	055L/09	62 31 00 094 08 14	07	IN HORNBLENDE SCHIST & AMPHIBOLITE CU 7 ZN 7
N1-4	80	MISTAKE BAY IRON-AREA 1	055K/03	62 12 02 093 04 37	10	FE FM (INTERBEDDED MAGNETITE & ARGILLITE) FE 7
N1-4	81	MISTAKE BAY IRON-AREA 2 GIANT IRON MINE	055K/03	62 12 58 093 10 05	10	FE FM (INTERBEDDED MAGNETITE & ARGILLITE) FE 7
N1-4	82	MORSO ISLAND - MAR 18	055K/02	62 02 12 092 40 00	06	QTZ VEIN/ IN HORNBLENDE GRANITE ? CU 7 AU 7 AG 7 NI 7
N1-4	83	MORSO ISLANDS - MAR 17	055K/02	62 02 21 092 39 09	06	QTZ VEIN/ IN HORNBLENDE GRANITE? CU 7 NI 7
N1-4	84	NE OF KAMINAK LAKE	055L/07	62 21 00 094 43 26	M	IN FELSIC TUFF/ AGGLOMERATE/ FLOW BRECCIA AU 7 CU 7
N1-4	85	NO	055L/04	62 00 40 095 49 45	05	IN VOLCANIC ROCKS CU 7 NI 7
N1-4	86	PEN (RANKIN INLET PROJECT)	055K/15	62 58 00 092 21 00	05	? CU 7 CO 7
N1-4	87	PERMIT 90	055M/13	63 45 41 095 57 39	01	RAD CALCITE FRACTURES IN CHRISTOPHER ISL VOLCANICS U 7
N1-4	93	PORK PENINSULA	055K/08	62 21 51 092 15 41	05	IN MAFIC VOLCANIC ROCKS CU 7
N1-4	94	PROJECT KEEWATIN (GIANT YK ML) SSE END OF KAMINAK LAKE	055L/03	62 01 18 095 17 30	M	IN HORNBLENDE GABBRO OR DIORITE AU 7 CU 7
N1-4	95	QUARTZITE LAKE A40701-712	055L/08	62 23 26 094 29 26	11	INTERMED TO MAFIC VOLCS/CONT W SEDS & PYROCLASTICS CU 7 MO 7
N1-4	97	REP	055K/04	62 07 40 093 49 30	03	QTZ VEINS/ IN MAFIC VOLCANICS ? AU 7 AG 7 CU 7

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GRID#	OCC#	DEPOSIT NAME(S)	NTS AREA	LOCATION	DEPOSIT TYPE AND CHARACTER --- COMMODITIES AND STATUS	
N1-4	98	ROY	055E/11	61 38 095 05	10	FE FM ASSOC WITH ARCHEAN GREENSTONE FE 7 CU 7
N1-4	99	SOUTH OF CARR LAKE GIANT YELLOWKNIFE 3124 SHOWING	055E/13	61 58 55 095 38 30	08	QTZ VEIN IN GREENSTONE CU 7 PB 7 ZN 7 AG 7 AU 7
N1-4	100	SOUTH OF KAMINAK LAKE	055L/03	62 03 15 095 12 17	05	IN GABBRO OR DIORITE CU 7
N1-4	101	SOUTH OF TOWNSEND LAKE	055L/11	62 33 21 095 13 11	05	IN SCHIST CU 7
N1-4	102	SOUTHERN LAKE VERA	055L/01	62 08 39 094 17 34	06	SLFD POCKETS IN GREENSTONE NEAR MAFIC PLUTONIC RKS CU 7
N1-4	104	TAVANI EXPL	055K/02	62 11 26 092 32 32	11	VEIN TYPE/ IN MAFIC VOLCANIC ROCKS CU 7 AU 7 MO 7
N1-4	107	TORIN GROUP-2	055K/03	62 06 29 093 24 30	05	? CU 7 AU 7
N1-4	108	TORIN GROUP-3	055K/03	62 06 50 093 29 58	05	IN MAFIC VOLCANIC ROCKS CU 7
N1-4	109	TORIN GROUP-4	055K/04	62 06 00 093 33 17	05	IN VOLCANIC ROCKS CU 7
N1-4	110	TURQUETIL LAKE	055E/13	61 55 49 095 58 39	08	DISSEM IN GREENSTONE CU 7 ZN 7
N1-4	111	WHALE COVE GROUP-1 MAR	055K/02	62 10 40 092 34 36	11	VEIN TYPE/ IN MAFIC VOLCANIC ROCKS CU 7 MO 7
N1-4	112	WHALE COVE GROUP-2 MAR	055K/02	62 10 44 092 33 50	06	VEIN TYPE/ IN MAFIC VOLCANIC ROCKS CU 7 NI 7
N1-4	113	WP/ BETH	055K/10	62 38 44 092 48 51	05	IN METAVOLCANIC RKS AND/OR GNEISS CU 7 ZN 7 AG 7
N1-4	114	1.5 MILES NORTH OF ONEIL LAKE	055L/11	62 31 20 095 18 30	05	IN VOLCANIC OR INTRUSIVE ROCKS CU 7
N1-4	116	4 MI SE SOUTHERN LAKE	055L/01	62 08 07 094 07 52	05	IN GREENSTONE CU 7
N1-4	117	4 MI W OF KAMINAK LAKE	055L/03	62 11 37 095 30 00	05	IN HORNBLENDE SCHIST & AMPHIBOLITE CU 7
N1-4	118	4 MILES SOUTH OF ONEIL LAKE PROSPECTING PERMIT 55-L-6	055L/06	62 23 10 095 12 15	05	IN GREENSTONE CU 7

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GRID#	OCC#	DEPOSIT NAME(S)	NTS AREA	LOCATION	DEPOSIT TYPE AND CHARACTER --- COMMODITIES AND STATUS	
N1-4	119	4.5 MILES SW OF SAVAGE LAKE PROSPECTING PERMIT 102	055L/06	62 19 15 095 25 34	05	? CU 7
N1-4	120	5.5 MILES NE OF NE END ONEIL L	055L/07	62 29 42 094 28 17	06	IN HRNB GABBRO OR DIORITE W AMPHIBOLITE INCLUSIONS CU 7 ZN 7
N1-4	121	6 MILES NE OF NE END ONEIL LK	055L/10	62 30 20 094 28 46	05	IN HRNB GABBRO OR DIORITE W AMPHIBOLITE INCLUSIONS CU 7
N1-4	123	68-4A 69-4A	055M/12	63 40 58 095 43 55	02	FAULT ZONES CROSSCUTTING GRANODIORITE GNEISS U 7 CU 7
N1-4	124	7 MI SE SOUTHERN LAKE	055L/01	62 07 13 094 04 07	05	IN GREENSTONE CU 7
N1-4	125	71-5	055M/12	63 42 56 095 40 27	01	FRACTURES IN CHRISTOPHER ISLAND VOLCANICLASTIC SED U 7
N1-4	128	75-3	055M/14	63 47 45 095 07 38	02	U IMPREGNATION IN KAZAN ARKOSE NEAR TRACHYTE DIKE U 7 CU 7
N1-4	129	75-5 BISSETT LAKE	055M/11	63 44 57 095 14 08	02	U-IMPREGNATION IN S-CHANEL CONGLOMERATE NEAR DIKES U 7 CU 7
N1-4	131	76-10	055M/14	63 49 32 095 25 13	02	U-CU IN ARKOSE ADJACENT TO ALKALINE DIKE U 7 CU 7
N1-4	132	76-2	055M/12	63 43 27 095 52 14	01	U IN BIOTITE K-FELDSPAR PEGMATITE U 7
N1-4	133	76-4B	055M/15	63 56 59 094 45 34	02	CU-U IN ARKOSE ADJACENT TO ALKALINE DIKE U 7 CU 7
N1-4	134	SOUTHERN KEEWATIN MOLY #005001	055L/04	62 07 095 45	11	MO 7
N1-4	135	DEVILS LAKE	055E/14	62 22 092 45	11	AU 7 MO 7
N1-4	136	SOUTHERN LAKE	055L/01	62 12 42 094 18 20	11	MO 7
N1-5	1	ANGIKUNI LAKE-1	065J/05	62 15 30 099 52 42	09	SLFD BEARING CARBONATE IN QUARTZO-FELD GNEISS PB 7
N1-5	2	ANGIKUNI LAKE-2	065J/05	62 16 25 099 54 00	07	IN GNEISS CU 7 PB 7
N1-5	3	BOO	065O/01	63 00 08 098 06 27	01	FRACTURE IN CHRISTOPHER ISLAND VOLCANICLASTICWACKE U 7

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GRID#	OCC#	DEPOSIT NAME(S)	NTS AREA	LOCATION	DEPOSIT TYPE AND CHARACTER --- COMMODITIES AND STATUS
N1-5	4	CABIN LAKE	065H/10	61 40 096 58	03 BASAL PEBBLE CONGLOMERATE AU 7
N1-5	5	CARNECKSLUCK LAKE	065G/16	61 53 15 098 14 25	05 SULPHIDES IN VOLCANICS CU 7
N1-5	6	COLLIN LAKE KASBA EXPL	065H/04	61 02 48 097 51 54	03 IN SHEARED & SILICIFIED ANDESITE OR GABBRO AU 7
N1-5	7	CONTOUR LAKE WEST	065H/11	61 42 17 097 01 59	05 SULPHIDES IN MUDSTONE-SILTSTONE OF AMETO FORMATION CU 7
N1-5	9	DIKE LAKE HOOK CLAIMS 1-20 (?)	065G/07	61 22 48 098 45 18	03 SLFDS IN GARNETIFEROUS PARA-AMPHIBOLITE AU 7 CU 7
N1-5	10	EDEHON LAKE DOWNER LAKE	065A/10	60 34 45 096 52 30	05 SLFD SPECKS IN METAGREYWACKE CU 7
N1-5	11	EDEHON LAKE NORTHWEST	065A/12	60 30 42 097 39 18	05 DISS SLFDS IN SHEARED METAGREYWACKE (PARAGNEISS) CU 7
N1-5	12	EM/ JB/ ST TARA	065H/01	61 10 30 096 07 30	10 MGNT & SPCL FE FM INTERCALATED IN BIOTITE SCHIST FE 7
N1-5	13	ENNADAI LAKE LITTLE HUEY	065C/13	60 56 56 101 31 12	03 QTZ LENSES & BODIES IN SERICITE-CHLORITE SCHIST AU 7 AG 7
N1-5	14	FERGUSON LAKE-1 FERG	065I/15	62 52 25 096 55 30	06 SULPHIDES IN ELONGATED BODIES OF HORNBLENDITE CU 7 NI 7
N1-5	15	FERGUSON LAKE-2 FERG	065I/15	62 52 30 096 49 40	06 SLFDS IN ELONGATED BODIES OF HORNBLENDITE NI 7 CU 7
N1-5	16	FERGUSON LAKE-3 FERG	065I/15	62 50 10 096 48 15	05 IN A MAFIC DYKE CU 7
N1-5	17	FOX DEN	065O/08	63 23 35 098 04 03	02 FRACTURE IN MARGINAL PHASE OF QZ SYENITE INTRUSION U 7 CU 7
N1-5	18	GIANT YELLOWKNIFE MINES LTD-1 PROSPECTING PERMIT 10	065I/01	62 00 41 096 22 06	05 MASSIVE SLFDS/ REGIONAL GEOLOGY- VOLCS & SEDS CU 7 ZN 7
N1-5	19	GIANT YELLOWKNIFE MINES LTD-2 PROSPECTING PERMIT 10	065I/01	62 12 50 096 05 34	06 DISSEM/ REGIONAL GEOLOGY- MAFIC VOLCS & INTRUSIONS CU 7 NI 7
N1-5	20	GIANT YELLOWKNIFE MINES LTD-3 PROSPECTING PERMIT 10	065I/01	62 13 00 096 03 45	05 DISS/AREA UNDERLAIN BY CHIEFLY DIOR OR LEUCOGABBRO CU 7
N1-5	21	GIANT YELLOWKNIFE MINES LTD-4 PROSPECTING PERMIT 10	065I/01	62 13 06 096 06 50	05 DISSEM/ REGIONAL GEOLOGY- MAFIC VOLCS & INTRUSIONS CU 7

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GRID#	OCC#	DEPOSIT NAME(S)	NTS AREA	LOCATION	DEPOSIT TYPE AND CHARACTER --- COMMODITIES AND STATUS
N1-5	23	GREG SELCO	065G/08	61 27 12 098 25 42	03 ? AU 7
N1-5	24	GRIFFIN LAKE EAST SELCO	065G/07	61 18 00 098 43 36	03 IN ZONE OF RUSTY FRACTURES AU 7
N1-5	25	GRIFFIN LAKE NORTH	065G/07	61 20 40 098 51 23	05 SULPHIDES IN VOLCANICS CU 7
N1-5	26	GRIFFIN LAKE NORTHWEST	065G/07	61 19 52 098 57 13	05 SULPHIDES IN VOLCANICS CU 7
N1-5	27	HAIRPIN	065P/10	63 35 56 096 58 58	01 U IN REGOLITH AT BASE OF SOUTH CHANNEL CONGLOM U 7
N1-5	29	HOOK LAKE - ZONE 4 SELCO	065G/07	61 20 30 098 52 48	03 QTZ VEINS IN MAFIC VOLCS AU 7 CU 7 FE 7
N1-5	30	HOOK LAKE-ZONE 3 SELCO	065G/07	61 20 54 098 51 12	03 QTZ VEINS & STRINGERS IN HORNBLENDE GNEISS AU 7
N1-5	31	HUD YANDLE-KAMINAK PROJECT	065H/16	61 49 06 096 07 00	05 DISSEM IN CHLORITIZED TUFF CU 7 FE 7
N1-5	32	HURRICANE SELCO	065G/07	61 22 30 098 35 54	03 AU VALUES IN MAGNETITE FE FM WITHIN METASEDS AU 7 FE 7
N1-5	33	HURWITZ LAKE WEST PROSPECTING PERMIT 126	065B/16	60 57 30 098 02	03 QTZ VEIN STOCKWORK IN CHLORITIZED VOLCS AU 7 AS 7
N1-5	35	K (COLUMBIAN NORTHLAND LTD)-1 PROSPECTING PERMIT 176	065I/04	62 10 24 097 52 15	05 DISSEMINATED IN METAVOLCANICS CU 7
N1-5	36	K (COLUMBIAN NORTHLAND LTD)-2 PROSPECTING PERMIT 176	065I/04	62 11 00 097 49 50	05 AREA UNDERLAIN BY METAVOLCANICS CU 7 PB 7
N1-5	37	KAZ 1-12	065P/10	63 41 30 096 53 05	05 QTZ VEINS IN DUBAWNT PORPHYRIES CU 7
N1-5	38	KIM & TEQUILA	065H/15	61 52 30 096 40	01 2 RAD HORIZONS AT BASE OF CONGLOMERATE U 7 AG 7
N1-5	39	KLAUS	065L/10	62 42 30 102 36 40	05 SLFDS ASSOCIATED WITH SHEAR ZONE IN GRANITIC ROCK CU 7
N1-5	40	LAKE 345-1	065P/11	63 36 13 097 15 19	01 U IN FRACTURE IN CHRISTOPHER ISLAND VOLCANICS U 7
N1-5	41	LAKE 345-2	065P/11	63 36 16 097 16 23	01 U IN FRACTURE IN CHRISTOPHER ISLAND VOLCANICS U 7

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GRID#	OCC#	DEPOSIT NAME(S)	NTS AREA	LOCATION	DEPOSIT TYPE AND CHARACTER --- COMMODITIES AND STATUS	
N1-5	42	LAKE 430-1	065P/11	63 30 44 097 27 20	02	SULFIDES & URANIUM IN NE SHEAR ZONE U 7 CU 7
N1-5	43	LAKE 430-2	065P/11	63 30 50 097 27 19	01	U IN FRACTURE IN BASEMENT GNEISS U 7
N1-5	44	LAKE 520-LONGSPUR GRANITE	065P/12	63 37 40 097 45 42	01	GARNET-FLUORITE VEINLETS IN VOLCANICS NEAR GRANITE U 7 FSP7
N1-5	46	LUCKY STRIKE	065P/05	63 27 02 097 54 00	02	U IN CONTACT AUREOLE OF FLUORITE-BEARING GRANITE U 7 PB 7
N1-5	47	MAG	065H/16	61 48 096 08	03	VEIN IN QTZ-PORPH SILL/ ALSO DISS IN SHEARED RHY AU 7 AG 7 CU 7 ZN 7 PB 7
N1-5	48	MONTGOMERY LAKE NORTHEAST	065H/12	61 34 36 097 43 30	05	SULPHIDES IN SHEARED ANDESITES CU 7
N1-5	49	MONTGOMERY PROJECT CLAIM BLOCK	065H/15	61 45 096 50	01	U ASSOC WITH PYRITE IN CONGLOMERATE U 7
N1-5	50	MOUNTAIN LAKE SOUTH AXE GROUP/ SELCO	065G/02	61 09 098 37 00	03	PROBABLY ASSOC WITH FE FM AU 7
N1-5	52	NICHOLSON LAKE	065L/10	62 44 102 45	01	U 7
N1-5	53	NOW 8	065K/10	62 32 100 48 24	05	CHALCOCITE IN SHEARED RHYOLITE CU 7
N1-5	54	NOWYAK LAKE WEST PP 175	065G/15	61 47 42 098 32 21	05	AREA UNDERLAIN BY VOLCANICS & INTRUSIVES CU 7
N1-5	55	NUFLTIN PROJECT-1 PROSPECTING PERMIT 132	065C/02	60 11 08 100 31 25	07	ZONES OF DISSEM SLFDS IN SEDS CU 7 AU 7 AG 7
N1-5	56	NUELTIN PROJECT-2 PROSPECTING PERMIT 136	065C/11	60 36 50 101 12 00	05	MINOR DISSEM SLFD IN GREYWACKE CU 7
N1-5	57	NUT LAKE	065O/01	63 01 14 098 19 39	01	U IN GRANITOID GNSS NEAR BASAL DUBAWNT UNCONFORM U 7
N1-5	58	OTTER LAKE SOUTH	065H/04	61 05 12 097 50 12	03	QTZ VEINS IN GREYWACKE AU 7 AS 7
N1-5	59	ROBIN SHOWING	065J/05	62 22 099 33	07	SLFDS IN ZONE CUTTING GRANITE W SED INCLUSIONS CU 7 AU 7 AG 7 PB 7
N1-5	60	SELCO A EXTENSION ZONE	065G/07	61 18 42 098 32 48	03	AU ALONG SHEARS IN CHERT-MAGNETITE FE FM AU 7 FE 7

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GRID#	OCC#	DEPOSIT NAME(S)	NTS AREA	LOCATION		DEPOSIT TYPE AND CHARACTER --- COMMODITIES AND STATUS
N1-5	63	SELCO C ZONE	065G/01	61 13 00 098 28 12	03	SLFD & MINOR AU IN CHERT-MAGNETITE FE FM AU 7 AS 7 FE 7
N1-5	64	SELCO D ZONE	065G/07	61 18 06 098 38 06	03	IN FE FM LENSES IN TUFFS NEAR QTZ-MONZ DYKES AU 7 FE 7
N1-5	65	SHORT EARED OWL	0650/01	63 00 30 098 02 42	01	FRACTURES IN GRANITOID GNSS ADJACENT TO DUBAWNT RX U 7 CU 7
N1-5	66	SINK (STEW/ BLACKJACK) YANDLE-KAMINAK PROJECT	065H/09	61 40 22 096 11 30	07	PODS &LENSES IN ALTERED FELSIC TUFFS WITHIN GABBRO CU 7 ZN 7 AG 7
N1-5	67	SNOWBOUND LAKE LAKE 688	0650/08	63 21 37 098 25 39	01	FRACTURE IN CHRISTOPHER ISLAND LAVAS AND BRECCIA U 7
N1-5	68	SÖN YANDLE-KAMINAK PROJECT	065H/16	61 50 00 096 05 48	07	LAYERS OF DISSEM TO SEMI-MASSIVE SLFDS IN TUFFS CU 7 ZN 7
N1-5	70	SPEC	0650/07	63 29 54 098 39 09	M	U-FL VEINS CROSSCUTTING MASSIVE SULPHIDE VEIN U 7 PB 7 CU 7 AG 7 CD 7 ZN 7 FSP7
N1-5	71	SURPRISE	0650/01	63 14 52 098 01 12	01	U IN FOLIATION OF EP-CH-BI PARAGNSS NEAR UNCONFORM U 7
N1-5	72	TEB 1-18 CLAIMS	0650/09	63 34 45 098 28 15	05	VEINS ALONG FRACTURES IN SHEARED PORPHYRIES CU 7 PB 7
N1-5	73	THI 1-4 CLAIMS THIRTY MILF LK/ PP 213/ TMT	065P/10	63 38 05 096 41 25	07	VEINS & BRECCIA IN GNEISS & DIABASE CU 7 PB 7 AG 7 ZN 7 SB 7 BA 7
N1-5	74	THLEWIAZA RIVER	065A/07	60 29 096 51	11	IN GRANITE MO 7
N1-5	75	TUL 9-15 & 26-36 CLAIMS	0650/03	63 10 45 099 22	05	STRINGERS BLEBS & FRACTURES IN SHEARED PORPHYRY CU 7
N1-5	76	WEST RIDGE SELCO	065G/07	61 18 00 098 30 36	03	FRACTURES IN QUARTZITE AU 7
N1-5	77	YENS	065H/15	61 55 096 45 30	01	RAD ASSOC WITH PYRITE MATRIX IN RUSTY CONGLOM U 7
N1-5	78	8 MILES NW CARR LAKE	065I/01	62 10 54 096 03 26	05	SULPHIDES IN VOLCANICS CU 7
N1-5	79	9 MILES NNW OF CARR LAKE	065I/01	62 12 34 096 01 00	05	SULPHIDES IN VOLCANICS CU 7

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GRID#	OCC#	DEPOSIT NAME(S)	NTS AREA	LOCATION	DEPOSIT TYPE AND CHARACTER --- COMMODITIES AND STATUS	
N2-4	1	ACE	056E/12	65 40 095 52	01	U IN A NARROW SKARN ZONE IN CRYSTALLINE LIMESTONE U 7
N2-4	4	CHRISTOPHER ISLAND (ZONE 2) BL PROJECT	056D/02	64 06 21 094 36 57	02	VEINLETS IN FRACTURES IN SANDSTONE CU 7 U 7
N2-4	5	CHRISTOPHER ISLAND (ZONE 3) BL PROJECT	056D/02	64 06 42 094 37 12	02	ALONG & BETWEEN FAULTS IN TUFF CU 7 U 7 AG 7
N2-4	9	PROJECT WAGER-KRF	056K/06	66 21 093 15	06	ZONES OF DISSEM SLFDS IN METASEDS CU 7 NI 7
N2-4	13	69-9A CHRISTOPHER ISLAND	056D/02	64 06 46 094 37 14	02	RAD FRACT IN KAZAN & CHRISTOPHER ISL ARKOSE/VOLC U 7 CU 7 AG 7 MO 7
N2-4	14	71-1 NORTH CHANNEL OCCURRENCES	056D/02	64 09 15 094 30 45	01	RADIOACTIVE FELSITE DIKE IN GNEISS U 7
N2-4	15	71-2 NORTH CHANNEL OCCURRENCES	056D/02	64 08 53 094 32 48	02	U-BREXIATED GNEISS-PERIPHERAL TO ALKALINE INTRSN U 7 CU 7 TH 7
N2-4	16	71-4	056D/02	64 04 50 094 31 36	02	FRACTURES IN CHRISTOPHER ISLAND VOLCANIC PLUGS U 7 CU 7
N2-4	17	71-4 ZONE CHRISTOPHER ISLAND/ BL PROJECT	056D/02	64 04 30 094 31	02	SHEARED-FRACTURED CONTACT OF DIABASE DYKE-SANDSTON U 7 CU 7
N2-4	18	WEST KETYET RIVER PROJECT	056D/11	64 37 35 095 26 11	11	MO 7 PB 7 CU 7 ZN 7
N2-4	19	TAC CLAIMS	056D/12	64 35 50 095 41 42	11	MO 7 PB 7
N2-5	2	BRY GROUP	066H/10	65 32 30 096 50 50	01	YELLOW MINERAL STAIN ON FRACTURES IN RA LENSES U 7
N2-5	18	SCHULTZ LAKE	066A/13	64 47 097 46	05	QTZ VEIN ASSOC WITH FAULT ZONE IN METASEDS CU 7

EASTERN ARCTIC ISLANDS AND HUDSON REGION

GRID#	OCC#	DEPOSIT NAME(S)	NTS AREA	LOCATION	DEPOSIT TYPE AND CHARACTER --- COMMODITIES AND STATUS
N0-2	1	BELCHER IS-INNETALLING IS NO 1	033M/15	55 53 14 079 01 28	05 IN VOLCANIC ROCKS CU 7
N0-2	2	BELCHER IS-INNETALLING IS NO 2	033M/15	55 53 14 079 03 29	05 IN VOLCANIC ROCKS CU 7
N0-2	3	BELCHER IS-INNETALLING IS NO 4	034D/02	56 05 14 078 56 25	05 IN LIMESTONE/ DOLOMITE/ OR ARGILLITE CU 7
N0-2	4	BELCHER IS-WEST OF FRENCH IS	033M/11	55 49 22 079 18 01	05 IN VOLCANIC ROCKS CU 7
N0-2	5	BELCHER IS-WEST OF SNAPE IS	033M/11	55 46 20 079 20 05	05 IN DIABASE ? CU 7
N0-2	7	BELCHER ISLANDS-BROOMFIELD IS	033M/11	55 43 31 079 10 36	05 IN DIABASE ? CU 7
N0-2	8	BELCHER ISLANDS-FLAHERTY IS	033M/13	55 52 43 079 34 54	05 IN PILLOWED BASALT CU 7
N0-2	9	BELCHER ISLANDS-HAIG INLET	034D/03	56 17 12 079 07 30	05 IN VOLCANIC ROCKS CU 7
N0-2	10	BELCHER ISLANDS-MOORE IS NORTH	034D/06	56 28 07 079 29 28	05 IN VOLCANIC ROCKS CU 7
N0-2	11	BELCHER ISLANDS-MOORE IS SCUTH	034D/04	56 14 39 079 37 39	05 IN VOLCANIC RCCKS ? CU 7
N0-2	12	BELCHER ISLANDS-SAINSBURY PT	033M/11	55 40 28 079 13 55	05 IN VOLCANIC RCCKS CU 7
N0-2	13	BELCHER ISLANDS/ TUKARAK IS-1	034D/02	56 14 02 078 46 47	05 QUARTZ-CALCITE VEINS FILLING FRACTURES IN BASALT CU 7
N0-2	14	BELCHER ISLANDS/ TUKARAK IS-2	034D/02	56 12 57 078 48 58	05 QUARTZ-CALCITE VEINS FILLING FRACTURES IN BASALT CU 7
N0-2	15	BELCHER ISLANDS/ TUKARAK IS-3	034D/02	56 10 24 078 50 21	05 QUARTZ-CALCITE VEINS FILLING FRACTURES IN BASALT CU 7
N0-2	16	BELCHER ISLANDS/ TUKARAK IS-4	034D/02	56 06 01 078 54 05	05 QUARTZ-CALCITE VEINS FILLING FRACTURES IN BASALT CU 7
N1-1	1	EDGELL ISLAND	025H/14	61 50 065 00	01 SEVERAL PEGMT DIKES & STOCKWORKS ARE RADIOACTIVE U 7 TH 7 MO 7
N1-1	2	META INCOGNITO PENINSULA	025M/10	63 40 070 30	01 TH BEARING GRANITE PEGMT SILLS-DIKES CUT PARAGNEIS TH 7 U 7

EASTERN ARCTIC ISLANDS AND HUDSON REGION

GRID#	OCC#	DEPOSIT NAME(S)	NTS AREA	LOCATION	DEPOSIT TYPE AND CHARACTER --- COMMODITIES AND STATUS	
N1-1	3	MIKE & FOX CLAIMS	025N/09	63 42 48 068 20 00	01	 U 7 TH 7 RE 7
N1-1	4	RAMSAY RIVER NORTH	025M/10	63 42 070 33	01	RAD-GRANITE PEGMT OCCUR AS SILLS & DIKES U 7 TH 7
N2-0	1	CAPE DYER (CLAIM NO N 25998)	016K/11	66 42 061 22	06	DISSEM TO MASSIVE SLFDS IN GABBRO CU 7 NI 7 AU 7
N2-0	2	WALRUS INLET/ ST ROCH HARBOUR	016L/16	66 55 062 10	06	DISSEM TO MASSIVE SLFDS CU 7 NI 7 MO 7
N2-2	1	ANDREW GORDON BAY	036B/11	64 32 075 24	01	NUMEROUS RADIOACTIVE PEGMATITE DIKES U 7
N2-2	2	ANOMALY 36 B 11-A1	036B/12	64 33 075 31	01	RAD IN LOCALIZED AREAS IN BIOTITE PEGMATITE U 7 TH 7
N2-2	3	AREA 36 C8-A2	036C/08	64 19 076 15 30	01	RADIOACTIVITY IN GRANITE GNEISS U 7
N2-2	5	CHORKBAK INLET (SHAWKEY NO 1) WEST CHORKBAK GP/ SHAWKEY 1-4	036B/07	64 28 35 074 48 40	10	MAINLY DISS MAGNETITE IN BANDS GARNET-AMPHIBOLITE FE 8
N2-2	6	CHORKBAK INLET (SHAWKEY NO 2) WEST CHORKBAK GP/ SHAWKEY 1-4	036B/07	64 28 40 074 37 00	10	MAINLY DISS MAGNETITE IN BANDS GARNET-AMPHIBOLITE FE 8
N2-2	7	CHORKBAK INLET (SHAWKEY NO 3) WEST CHORKBAK GP/ SHAWKEY 1-4	036B/07	64 28 20 074 43 50	10	MAINLY DISS MAGNETITE IN BANDS GARNET-AMPHIBOLITE FE 8
N2-2	8	CHORKBAK INLET (SHAWKEY NO 4) WEST CHORKBAK GP/ SHAWKEY 1-4	036B/10	64 31 05 074 35 00	10	MAINLY DISS MAGNETITE IN BANDS GARNET-AMPHIBOLITE FE 8
N2-2	9	DON	036C/08	64 16 48 076 23 24	01	RADIOACTIVITY WITH GRANITE GNEISS U 7 TH 7
N2-2	10	KEEKA LAKE	036G/02	65 03 074 36	01	A BAND OF RADIOACTIVE BIOTITE-GRANITE GNEISS U 7 TH 7
N2-2	12	MINGO LAKE AREA	036A/13	64 47 073 57	01	TH-BEARING PATCHES IN GRANITE & GRANITIC ROCKS TH 7
N2-2	13	PAT	036C/08	64 19 00 076 14 30	01	RAD IN FELSPATHIC QUARTZITE & GRANITE-PEGMT SILLS U 7 TH 7
N2-2	14	SHUKBUK BAY PERMITS 78 & 81/CENTRAL GROUP:	036B/16	64 52 30 074 00	01	RAD IN A BAND OF GARNET-BIOT GNSS/IN QTZT & GRANIT U 7 TH 7
N2-2	15	TIM AREA 36 C8-A4	036C/08	64 28 24 076 03 18	01	RADIOACTIVE GRANITE PEGMATITE & BIOTITE PARAGNEISS U 7 TH 7

EASTERN ARCTIC ISLANDS AND HUDSON REGION

GRID#	OCC#	DEPOSIT NAME(S)	NTS AREA	LOCATION	DEPOSIT TYPE AND CHARACTER --- COMMODITIES AND STATUS
N2-3	17	TERROR POINT	046A/02	64 05 080 55	11 MO 7
N2-3	18	CAPE WELSFORD	046F/07	65 28 083 35	11 MO 7
N3-1	1	DOME 3	027B/12	68 33 071 14	05 GOSSAN IN SCHIST ASSOCIATED WITH AMPHIBOLITE CU 7
N3-1	2	CLYDE RIVER MOLY #027001	027C/14	69 47 18 070 45	11 MO 7
N3-2	1	CENTRAL BORDEN FAULT ZONE	037G/05	71 17 43 079 12 00	07 IN UNDIVIDED METASED & METAVOLC ROCKS CU 7 ZN 7 PB 7
N3-2	2	ISORTOQ RIVER (BAFFIN ISLAND)	037E/12	70 30 18 075 06 03	05 IN METAMORPHIC ROCKS CU 7
N3-2	3	MARY RIVER AREA - EAST	037G/06	71 25 25 079 12	10 ALGOMA TYPE IRON FORMATION- PRIMARY FE 7
N3-2	5	MINERAL OCCURRENCE (BAFFIN IS)	037G/02	71 01 32 077 29 35	05 IN UNDIVIDED METASED & METAVOLC ROCKS CU 7
N3-2	6	TURNER RIVER	037G/03	71 11 45 078 07 12	05 IN INDIFFERENTIATED GNEISSES CU 7
N3-2	7	TURNER RIVER	037G/06	71 28 20 078 33	11 MO 7
N4-3	1	BARRY GROUP	048C/02	73 02 22 085 04 15	05 DISSEM IN DOLOMITE ADJACENT TO GABBRO DYKE CU 7
N4-3	2	GO GROUP-SH 6 SHOWING VICTORIA FAULT/STRATHCONA PROJ	048A/07	72 28 10 081 56 30	07 PROBABLY STRATA BOUND IN DOLOMITE CU 7 ZN 7 PB 7
N4-3	3	GO GROUP-SH 7 & 8 SHOWINGS VICTORIA FAULT/STRATHCONA PROJ	048A/07	72 28 00 081 57 45	07 PROBABLY STRATABOUND IN DOLOMITE PB 7 ZN 7 CU 7
N4-3	4	GO GROUP-SH 9 & 10 SHOWINGS VICTORIA FAULT/STRATHCONA PROJ	048A/07	72 28 20 081 57 30	07 PROBABLY STRATABOUND IN DOLOMITE PB 7 ZN 7 CU 7
N4-3	5	M GROUP-AR 6 SHOWING	048A/06	72 21 36 082 09 50	05 SKARN CU 7
N4-3	7	SH 12 & SH 13 PROSPECTING PERMIT 84	048A/07	72 27 081 38	07 PROBABLY STRATABOUND IN DOLOMITE PB 7 CU 7

APPENDIX 2

CHARACTERISTICS OF MINERAL DEPOSIT TYPES

AND

CRITERIA FOR ASSESSMENT OF AREAS

CRITERIA FOR THE EVALUATION OF URANIUM RESOURCES

S.S. Gandhi

General Remarks

In terms of world production and reserves, the most significant uranium deposits are of quartz-pebble conglomerate-type, sandstone-type and unconformity-related type. In the past, vein-type deposits have been productive, but their relative importance has declined in recent years.

In the context of the Canadian north, only those deposits with contained uranium metal in the order of several million kilograms would be economically attractive, with grade playing a critical role in the feasibility. In many parts of the world, material grading as low as 0.085 per cent U (0.1 percent U_3O_8) is mined, but in the Canadian north it is unlikely that a deposit averaging less than 0.2 percent U would be economically viable unless it is exceptionally large, even allowing for a projected increase in the current price of uranium over the near future. These constraints of size and grade generally put several deposit types, by their very nature, into subeconomic and uneconomic categories. These include syngenetic deposits in pegmatites, alkaline intrusions, coal, phosphates, tuffs and black shales, and contact metasomatic and metamorphic deposits. This generalization is supported by many examples of these deposit types located in more accessible parts of the world, which are unlikely to be developed in the foreseeable future. However, exceptions to the generalization cannot be ruled out, and one possible exception is provided by deposits associated with granites and pegmatites, and related rocks, which have proven to be economic in some cases. For this reason a note prepared by V. Ruzicka on the latter class of deposits is appended to this report. The present assessment is made with the above considerations in view, and emphasizes certain deposit-types rather than covering the entire spectrum of deposit-types for individual areas.

Major Deposit Types

A. Quartz-pebble conglomerate deposits

Pyritic quartz-pebble conglomerate lenses and beds in arkosic sandstones, containing uraninite and brannerite, form the major uranium deposits of the Elliot Lake area in Ontario. The estimated total content of uranium in these deposits exceeds 400 million kilograms. Thorium is present in a roughly equal amount, but it is not recovered at present because of lack of a market.

The deposits are considered to be detrital in origin. Both pyrite and uraninite are believed to have been transported under anoxic atmospheric conditions during Early Proterozoic time (~2,200 Ma ago), which allowed preservation of readily oxidizable pyrite and uraninite during transportation (Roscoe, 1957, 1969; Pienaar, 1963; Robertson and Steenland, 1960; Robertson, 1978; Theis, 1978). Brannerite is believed to have formed later by diagenetic reactions between uraninite and titanium minerals (Ramdohr, 1957; Ferris and Rudd, 1971; Theis, 1978). Similar quartz-pebble conglomerate in South Africa contains gold as the principal ore mineral (Liebenberg, 1955; Ramdohr, 1958; Pretorius, 1975).

The main criteria used for assessment of areas as to their potential for deposits of this type are:

i) Presence of quartz-pebble conglomerate in arkosic sequences;

ii) Early Proterozoic age when anoxic conditions prevailed;

iii) Presence of pyrite in the conglomerate;

iv) Evidence of predominantly fluvial sedimentation;

v) Suitable source area, in particular granitic terrane.

Deposits of this type are commonly low grade. The Elliot Lake deposits contain 0.08 to 0.13 percent U on the average, but their large size, ranging from 10 to 400 million tonnes, makes them economically viable.

B.Sandstone-type Deposits

Uranium deposits in sandstones account for over 95 percent of the total production and reserves in the United States, estimated at 214,000 and 505,000 tonnes of U metal respectively. A majority of them are in the western United States. The host rocks were deposited in continental fluvial environments, and range in age from Paleozoic to Tertiary. Shaly beds are either interbedded with or overlie the sandstones. The mineralization consists of pitchblende and/or coffinite, carnotite and tyuyamunite, in the intergranular space of the host rock. The ore bodies are commonly stratiform lenses elongated parallel to the paleocurrent direction of the host beds, but many display a variety of configurations with respect to the stratification of the sandstone host. Subtypes include the deposits which have a characteristic C-shape in cross-section, referred to as roll-front, and those in unconsolidated sand and gravel of ancient stream channels protected from erosion by a resistant capping unit such as basaltic flows.

Regardless of their geometry, the deposits are epigenetic; i.e. mineralization took place after deposition of the host rock and formed by reduction of dissolved uranium in the circulating groundwaters (Adler, 1974; Fischer, 1974; Harshman, 1972; Rackley, 1976; Adams et al., 1978). Uranium is believed to have been contributed by granitic and/or felsic volcanic rocks in surrounding regions during weathering, and transported in groundwater as dissolved oxidized uranyl ion or in chemical complexes, e.g. uranyl carbonate complex. Where this groundwater encounters reducing environments caused by the presence of organic remains, pyrite, H_2S gas etc., a decrease in oxidation potential and generally a concomitant decrease in acidity, cause uranium to be precipitated as reduced solid species (Hostetler and Garrels, 1962; Langmuir, 1978). Other metals that may accompany uranium in the process are copper, molybdenum, vanadium, and selenium and these are recovered as byproducts from some deposits.

The criteria useful in resource assessment of this type of deposits are:

i) Presence of fluvial sandstone, deposited in continental or near shore environments;

ii) Presence of a reducing agent in the host rock, e.g. organic remains, pyrite, H_2S gas; or evidence of reduction reactions.

iii) Evidence for an oxidizing environment in the source area;

iv) Proximity to source rocks enriched in uranium, e.g. felsic volcanics, tuffaceous shales which may be interbedded with the host sandstones, granite, paragneiss;

v) Basin margin uplift concurrent with sedimentation.

Mineable deposits in the United States range from several tens of thousands to a few million tons, with average grades between 0.08 to 0.25 percent U. Higher grades up to a few percent U are commonly restricted to thin layers or zones that are a few centimeters thick and have a sharp cut-off on one side coincident with a reduction front. The deposits commonly form clusters as seen in the uranium districts of New Mexico, Colorado, Utah and Wyoming. An example of a sandstone-type deposit in a Precambrian formation in the District of Mackenzie is the Mountain Lake deposit described in Part I, Section 5 of this report.

C. Unconformity-related deposits

This important group of deposits has come to light only recently, with the first discovery in 1968 at Rabbit Lake in the Athabasca basin of northern Saskatchewan, followed by nine other discoveries since then in that region, which together have added over 150,000 tonnes of uranium metal to the Canadian reserves. The deposits are located along the margin of the basin within 200 m depth, and most of the deeper parts of the 107,000 km^2 basin still remain to be explored. An equally prolific basin of similar geological setting is located in northern Australia.

The deposits occur at the unconformity between the folded and metamorphosed supracrustal rocks of Aphebian age (~2200-1600 Ma) and the overlying nearly horizontal, continental sandstone of Helikian age (~1600-1300 Ma). Paleo-regolith is preserved at many places along the unconformity. The deposits are elongated along faulted or brecciated zones in the basement, and are commonly up to 1.5 km in length. Their width and depth are much smaller, usually less than 150 m. In cross-section they have a crude mushroom or carrot shape. Most of the mineralization occurs in highly altered basement rocks as pods, veins and disseminations, but in a few deposits in the Athabasca basin significant amounts also occur in the overlying sandstone as veins and disseminations. Uranium occurs mainly as pitchblende with subordinate coffinite and secondary uranium minerals. Textures indicate two to five generations of pitchblende. Gangue minerals include hematite, chlorite, quartz, calcite and sericite. Some spectacular concentrations of uranium have been encountered locally. Some of the deposits contain significant quantities of gold or nickel and cobalt.

The genesis of the deposits is not yet well established. Three main hypotheses and several modifications have been proposed. These invoke surficial supergene concentration, ascending hydrothermal solutions, or diagenetic-hydrothermal concentration. The supergene hypothesis postulates leaching of uranium by oxidized groundwaters from weathered basement rocks, and its deposition at suitable reducing sites at the unconformity where such reductants as pyrite or graphite may be present. It has much in common with the processes visualized for the origin of sandstone-type deposits. The mineralization probably took place during the erosion of basement and deposition of the cover rocks (Knipping, 1974; Langford, 1977). A modified version of the hypothesis suggests supergene enrichment in pre-existing lower grade syngenetic deposits in sediments of the basement, either at the site or nearby (Dodson et al., 1974; Needham and Stuart-Smith, 1976; Dahlkamp, 1978). In the second group of hypotheses it is postulated that ascending hydrothermal solutions of magmatic, anatectic or metamorphic origin may have deposited uranium as they emerged at the unconformity surface into a markedly contrasting physico-chemical regime (Beck, 1969; Little, 1974; Morton, 1977; Morton and Beck, 1978; Munday, 1978). These hypotheses are compatible with fluid-inclusion studies suggesting a temperature of formation of approximately 150^{0} to $225^{0}C$ and pressures corresponding to some 5000 m burial depth, and the isotopic ages of mineralization ranging from 1000 to 1250 Ma. The same features however are interpreted differently in the third, diagenetic-hydrothermal, model which postulates extensive circulation of diagenetic fluids in thick covering sandstones, which became hydrothermal in character as they reached deeper levels, and deposited uranium leached from the sediments at suitable reducing sites in the basement (Hoeve and Sibbald, 1978).

Regardless of the genetic concepts, the deposits have certain features that serve as useful criteria in resource evaluation:

i) A pronounced unconformity between a granitic and/or metasedimentary basement and relatively undisturbed continental fluvial sandstone;

ii) Presence of regolith and/or evidence of extensive chemical weathering of the basement;

iii) Fault zones and breccia zones in the basement;

iv) Presence of graphitic or pyritic rocks in the basement;

v) Helikian age of the sandstone sequences; however older or younger sequences that meet the above criteria are also considered favourable.

The unconformity-related deposits are high grade, 0.25 to 2.5 percent U on the average, and have a substantial metal content ranging from 5000 to 200,000 tonnes uranium. These features plus their rather simple mineralogy and a geometry allowing for low cost mining and milling make them highly profitable, and hence they require relatively short lead time for development. They are thus particularly attractive exploration targets in the Canadian north.

D.Vein-type Deposits

These are the classical veins localized along open fractures and brecciated or sheared zones, which are in many cases subsidiary to major faults. There are two main types of veins: (i) simple pitchblende veins carrying small amounts of hematite, calcite, chlorite and/or quartz. For example, those being mined at Beaverlodge in northern Saskatchewan that may contain more than 25,000 tonnes uranium metal. Fluorite is present in some simple veins. (ii) Polymetallic veins of complex mineralogy, carrying pitchblende, native silver and bismuth, nickel-cobalt arsenides, silver and copper sulphides, sphalerite, galena, pyrite, quartz, calcite, dolomite and hematite. For example, those mined at Port Radium on Great Bear Lake which produced close to 5200 tonnes of uranium and are currently producing silver.

Several episodes of mineralization are recognized in both types of veins (Kidd and Haycock, 1935; Campbell, 1955; Robinson, 1955; Jory, 1964; Badham et al., 1972; Sassano et al., 1972; Thorpe, 1974; Tremblay, 1978). It is generally agreed that the deposits were formed by precipitation from heated (150 to 400^{o}C) aqueous solutions. The origin of the mineralizing solutions however is debatable, and no single hypothesis seems to explain all the features of numerous veins which occur in varied geological settings. The classical hypothesis regarded them as deposited by hydrothermal solutions derived from granitic magma (Kidd and Haycock, 1935; Mursky, 1973; Shegelski, 1973; Robinson, 1955; Beck, 1969). Some of the simple veins are closely associated with granitic intrusions and/or felsic volcanic rocks. Another hypothesis is based upon derivation of ore-bearing solutions from the country rocks while they were undergoing metamorphism (Robinson and Morton, 1972; Robinson and Ohmoto, 1973; Sassano et al., 1972; Tremblay, 1978). The heated brines, connate or meteoric water (but not magmatic) leached uranium and other metals from the sedimentary and tuffaceous rocks enriched in these metals, and deposited them at favourable structural sites. The associated metals in these polymetallic veins have a geochemical affinity to gabbroic magma, and it has been postulated that they may have been added during a separate episode of mineralization (Mursky, 1973; Thorpe, 1974). A hypothesis of supergene concentration by surface meteoric waters near a paleosurface has also been postulated (Langford, 1977, 1978).

The main criteria used in resource evaluation are:

i) Open fracture system in competent rocks, preferably subsidiary to a major fault;

ii) Proximity to a potential uranium source, either a granitic intrusion, felsic volcanics, or uraniferous tuffs or sediments;

iii) Wallrock alteration marked by such minerals as hematite, chlorite and clay minerals.

The deposits are tabular, moderately to steeply dipping, and carry high grade stringers and veins as well as minor disseminations in wall rocks. The thickness of veins is generally limited to a few centimeters, hence the average grades attained in underground mining are in the range of 0.17 to 0.26 percent U, despite the fact that the veins themselves are much higher in grade. In resource evaluation, pertinent generalizations are (i) the mineable deposits are few and restricted to certain small areas, despite the wide distribution of numerous small uneconomic simple veins in varied geological settings, and (ii) they are difficult to find and exploit.

A Note Concerning Disseminated Magmatic, Pegmatitic and Contact Deposits in Igneous and Metamorphic Rocks (V. Ruzicka)

Deposits included in this group are those associated with granites, migmatites, syenites, pegmatites and carbonatites.

The largest known deposit of this general class is Rössing in Namibia, which is associated with granitic rocks that were intruded into a thick geosynclinal series and subsequently metamorphosed (NEA/IAEA, 1978). The primary uranium mineralization occurs as disseminations of uraninite. Secondary enrichment occurs in upper parts of the ore bodies.

This deposit is interpreted to have formed by saturation and replacement of migmatized country rocks by granitizing fluids that introduced uranium mineralization along shears, fractures, joints and bedding planes (ibidem).

Uranium resources of the Rössing deposit amount to more than 100,000 tonnes U in ores containing about 0.03 percent U.

Deposits in this category occur also in Canada, Brazil and Greenland. They range in size from less than 1,000 to more than 10,000 tonnes U in ores containing in average 0.03-0.13 percent U.

CRITERIA FOR ESTIMATION OF GOLD POTENTIAL

R.I. Thorpe

Gold potential has been qualitatively assessed with a number of specific types of gold deposits in mind. This is a valid approach even though the significance of some features of the deposits used in construction of the deposit types may not be accounted for in terms of genetic processes, and in fact in some cases there may be no generally accepted genetic model. Four deposit types have received primary consideration, (1) syngenetic stratiform deposits of presumed volcanic exhalative origin, (2) structurally-controlled deposits associated with Archean greenstone belts, (3) deposits associated with intrusive felsic porphyritic rocks, and (4) placer and paleoplacer gold deposits. A fifth type, deposits associated with subaerial felsic volcanic rocks is probably of little importance in the areas being studied. Some of the characteristics and factors possibly controlling the occurrence of these deposits are given below.

Gold Deposits of Stratiform Exhalative Type

Most deposits of this type are located in sequences of submarine volcanic rocks (greenstone belts). An overall criterion is that these rocks be of Archean age because, empirically, these are more favourable for gold deposits, by far, than similar rocks of younger age. This group of deposits has, arbitrarily, been divided into four subtypes.

1. One class or subtype of such deposits that can be recognized consists of gold-bearing iron formation of carbonate facies, mixed carbonate-oxide facies, or mixed sulphide-oxide iron formation. Favourable geological characteristics for the occurrence of such deposits may include:

a. evidence for volcanic exhalative processes; this may include the presence of lean oxide facies iron formation, chert, pyritic chert and possibly carbonate (limestone) horizons of the type that occur fairly widely in Archean greenstone belts of the Slave province.

b. the presence of occurrences of this type

c. evidence for mafic-felsic cycles

d. presence of felsic volcanic rocks, and especially of contacts between these felsic rocks and overlying mafic volcanic or sedimentary rocks.

Deposits of this type include the Morro Velho, Brazil, and, in part at least, deposits in the Geraldton and Pickle Crow districts, Ontario. In the Northwest Territories gold is associated with a thin unit of carbonate iron formation in the Back River district, Slave province.

The Morro Velho deposit was reported by Fleischer and Routhier (1973) to have produced more than 250 tons (7,291,600 ounces) of gold. However, it has also been reported that the deposit produced 500 tons of gold in the period 1834 to 1958, and gold had been recovered from surface workings for 100 years prior to 1834 (South African Mining and Engineering Journal, April 1979, p. 49). Reserves in 1976 were about 1,200,000 ounces of gold in ore with a grade of 0.224 oz/ton, and production was then being increased from 40,000 to 50,000 tons per month.

The Hard Rock Mine, Geraldton District, Ontario, produced 1,458,775 tons of ore in the period 1938 to 1951 with recovery of 269,174 ounces of gold. The Pickle Crow and Central Patricia mines, Pickle Crow district, Ontario, produced, respectively, 3,260,000 tons of ore (1,488,177 ounces gold) in the period 1935 to 1966 and 1,729,250 tons (621,800 ounces gold) in the period 1934 to 1951.

2. A second type of stratiform exhalative gold deposit is the Contwoyto Lake or Homestake type. This type of deposit is generally similar but occurs in a sequence of rocks that is predominantly sedimentary, and arsenide minerals form an important part of the mineralization. The host unit is in essence an amphibolite or silicate iron formation; carbonate, although it may have been present originally, is not usually preserved. Criteria (c) and (d) above do not apply and, aside from (b), only the presence of lean oxide facies iron formation (a) may serve as a very general guide to potential. Low-grade occurrences of this type may take the form of pyrrhotitic or arsenopyrite-bearing amphibolite. Although the associated rock sequence is largely sedimentary, the deposits may be associated with volcanic activity. Because of the grade of metamorphism, however, tuffaceous beds would probably not be recognized.

Occurrences of this type are widely distributed in the Slave province, but the only significant proven deposit is at Contwoyto Lake.

The Contwoyto Lake deposit contains a few million tons at a grade of 0.3 oz/ton gold, and a far larger tonnage at a lower grade, although the latter information has not been published and the size may not even be fully defined. The Homestake Mine through 1973 produced 110,994,000 tons of ore from which 32,210,690 ounces of gold were recovered. At the end of 1973 the total measured, indicated and inferred ore reserves above the 6800 level were 15,870,500 tons at a grade of 0.28 oz/ton gold. It is thus evident that deposits of this type can be very large, and for this reason further exploration for these deposits throughout the Slave province would appear to be warranted.

3. The third type of stratiform exhalative gold deposit is associated with ultramafic volcanic rocks and/or associated ultramafic sills. Few deposits of this type are known. However, the common association of gold deposits with green (fuchsitic) carbonate and talc-rich units, rocks which have probably formed due to intense alteration of ultramafic flows or sills, suggests that original gold accumulations of some type (possibly exhalative) may have been present prior to carbonate metasomatism and other intense alteration.

Criteria for assessing potential for this type of deposit include (a.) above. However, the principal criterion is simply the presence of ultramafic volcanic rocks or sills because the more local scale features, or metallotects, that might be extremely significant indicators of the potential of an area, are generally not known.

The Detour River deposit of Amoco Canada Petroleum Co. Limited in northeastern Ontario may be of this type. The ore zone is a pyrrhotite- and chalcopyrite-bearing chert unit in a tuffaceous series that is in contact with an altered ultramafic body.

The Detour River deposit has been reported to contain 10,000,000 tons of ore at a grade of 0.2 oz/ton gold.

4. The fourth type of stratiform gold deposit, possibly of exhalative origin, consists of pyrite in disseminated to nearly massive layers in mafic (to intermediate?) pyroclastic units within greenstone belts. Too few deposits of this type are known to select more than broad scale criteria. Thus the presence of mafic volcanic sequences, and in particular major pyroclastic units, are, at the scale of this study, the main criteria that can be applied. The Silver Stack and Montauban gold deposits, Quebec,

are examples of this type of deposit (Filion et al., 1977; McAdam and Flanagan, 1976). These deposits show the closest association with polymetallic massive sulphide types; the Montauban lenses are at the same stratigraphic horizon and are gradational into lenses of zinc-lead mineralization of massive sulphide type.

A number of gold zones are present in the Montauban area. One contains 98,000 tons at a grade of 0.19 oz/ton Au and 1.99 oz/ton Ag and another 137,230 tons at a grade of 0.22 oz/ton Au and 0.60 oz/ton Ag. Two small gold zones on an adjacent property total 81,000 tons at average grades of 0.27 oz/ton Au and 0.74 oz/ton Ag. Subsequent work indicated the North gold zone to grade 0.15 oz/ton gold across 32.2 ft. (9.8 m) for a length of 1600 ft (488 m) and to a depth of 250 ft (76 m). This suggests approximately 1,100,000 tons of ore (McAdam and Flanagan, 1976). Prior to the start of production the Silver Stack deposit was reported to contain 4,356,600 tons at a grade of about 0.18 oz/ton gold (The Northern Miner, November 9, 1978, p. 1).

Structurally Controlled Gold Deposits

Deposits considered to belong to this class are located in sequences of submarine volcanic rocks within Archean greenstone belts. Some of these deposits consist of simple gold-bearing quartz veins, generally located along minor schist or "shear" zones in pillowed mafic volcanic rocks. Some favourable quartz veins may be gray or black in colour, but in most cases the presence of minor amounts of sulphide minerals is the only indication the veins may be gold bearing.

Major zones of schist or "shear-zone" type are generally more complex; the Yellowknife gold deposits are examples. A common characteristic of these gold deposits is the presence of (a) carbonate minerals of different compositions as gangue constituents, as late veins, and, most characteristically, as a constituent of pervasive wallrock alteration. Also, as noted above, many of these gold deposits are associated with (b) green (fuchsitic) carbonate rock and/or talc-rich units, rocks which have probably formed due to intense alteration of (c) ultramafic flows or sills. The (d) extensive and intense wallrock alteration probably reflects the fact the ores were formed by major hydrothermal systems, and these in turn appear to have been controlled, in many cases at least, by (e) major regional linear shear (fault) structures.

The prime criterion for considering an area to have potential gold deposits is simply the (A) presence of submarine basaltic pillow lavas and/or ultramafic lavas. This is especially so in the case of major schist or "shear-zone" deposits because the controlling structural features are often not evident due to erosion of the associated highly altered rock. Of course the (B) presence of gold occurrences of whatever type, of (C) major structures, or of (D) highly altered (especially carbonatized) rock, are also positive factors.

Simple gold-quartz vein deposits can range from very small and uneconomic to very significant producers. The Tundra and Discovery Mines, N.W.T., which produced 187,704 tons of ore and 104,528 ounces of gold and 1,033,000 tons and 1,028,970 ounces, respectively, can serve as examples. Some of the major schist or "shear-zone"deposits can be very much larger.

The Giant Yellowknife Mine that produced 10,112,264 tons with recovery of 5,328,217 ounces of gold from 1948 to 1978 is a good example. Reserves at the Giant Mine at the end of 1978, including small tonnages on the adjacent properties of affiliated companies, were 1,216,000 tons at an average grade of 0.27 oz/ton gold.

Deposits Associated with Intrusive Felsic 'Porphyry'

The deposits under consideration here are those in Precambrian greenstone belts and, in many cases at least, the host felsic bodies are porphyritic and have probably been emplaced in subvolcanic positions in felsic volcanic centres. The host intrusive bodies range from single large dikes, such as host the large low-grade gold deposits on the BOB and PR claims at Indin Lake in the western Slave province, to a complex set of such dikes (the Sigma Mine, Quebec), to complex composite plugs and stocks of different felsic phases (Lamaque Mine, Quebec, and McIntyre or Schumacher Mine, Ontario). The rocks in the latter cases, as illustrated particularly well by the McIntyre Mine, may be very highly altered, presumably as a result of circulation of great volumes of fluid in hydrothermal systems, as was suggested for major schist zone deposits.

Criteria for assigning potential to an area for this type of deposit would theoretically include (a) the presence of intrusive fine-grained, often porphyritic, felsic bodies, (b) a significant thickening of felsic volcanic rocks or the presence of coarse felsic pyroclastic material indicating that a felsic volcanic centre is probably nearby, and (c) the presence of porphyry copper type mineralization with which gold is closely associated at the McIntyre Mine and a number of less significant properties. However, the required level of information regarding the character of felsic rocks within greenstone belts in the study area is generally not available. For this reason, and also because the areas most favourable for these deposits have been rated as high potential for gold deposits of types 1 and 2, no specific effort has been made to assess the area for this deposit type. This does not mean, of course, that such deposits are not likely to be found.

Gold deposits of this association may consist of dikes or other bodies that are extensively fractured, and mineralized with pyrite, or other minerals, and gold. Other deposits may consist of sets of major veins, or vein stockworks.

One deposit within the mineralized dike at Indin Lake, N.W.T., contains 13,000,000 tons at a grade of 0.086 oz/ton, and a second one 20,000,000 tons at a grade of 0.053 oz/ton Au. The Sigma Mine produced 17,262,311 tons of ore with a recovery of 3,024,945 ounces of gold during the period 1937 to 1978, and the Lamaque Mine 22,984,070 tons and 4,309,370 ounces of gold during the period 1935 to 1978.

Placer and Paleoplacer Gold Deposits

The prime requirement for the formation of placer deposits is a source area containing significant gold either in disseminated form or concentrated into economically interesting bedrock deposits. In the present study area information is not available on background gold values, so it is not known, for example, whether or not rusty graphitic schist of the Piling and Penrhyn Groups (Baffin Island and Melville Peninsula) contain higher than normal background levels of gold in association with sulphides and/or carbonaceous material. Thus, in this study, known gold occurrences and deposits are the most positive evidence for favourable source areas. In the absence of these, Archean greenstone belt terranes that normally provide suitable environments for gold deposits are considered to be potential sources.

Gold concentration takes place during fluvial transport and deposition. The gold is deposited, often in association with other heavy minerals, in stream gravels or channel bar sands. In some cases where stream channels are cut in bedrock the gold is concentrated on, or even in cracks in, the bedrock. Continental glaciation, such as occurred over much of the study area, would be expected to completely disperse any previous placer accumulations of gold. For this reason paleoplacer, rather than present-day placer, deposits deserve the most consideration.

Paleoplacer deposits are to be expected (a) in continental fluviatile sedimentary rocks, especially where these (b) are of very mature character. Thus quartz-pebble conglomerate and orthoquartzite are considered to be the most favourable rock types. These sedimentary rocks probably have the greatest potential where (c) they form basal units to sequences overlying major unconformities, and (d) where suitable source terranes for gold were obviously present nearby below the unconformity. The presence of (e) heavy mineral concentrations in rocks of favourable lithology must be considered as a positive criterion. In rock sequences of Early Aphebian age the presence of (f) pyrite in quartz-pebble conglomerate is also a very favourable factor by analogy with the fantastically large Witwatersrand, South Africa gold deposits.

Because the above characteristics are most often found in basal units of Aphebian and Helikian sequences in the study area, these are considered to have potential for paleoplacer deposits.

Deposits Associated with Subaerial Felsic Volcanic Rocks

Although there may certainly be Precambrian representatives of this class, and possibly deposits at Wekusko Lake and Favourable Lake are of this type, the type deposits are in the Cordillera of the United States and Canada. These deposits may be of bonanza vein type, with or without major silver and base metal contents, or of metasomatic or many other types. For the present purpose, however, it is convenient to group these as one class. Many deposits of this type appear to be associated not only with felsic volcanic centres, but with major caldera structures as well.

This deposit type is considered because in the Baker Lake area, Keewatin District, there may be some potential for such deposits in association with Aphebian rocks of the Christopher Island and Pitz Formations.

CRITERIA FOR ESTIMATION OF SILVER POTENTIAL

R.I. Thorpe

Silver is currently being produced in the study area at the Nanisivik zinc-lead mine on northern Baffin Island. This is symptomatic of silver in general, namely that a very high proportion of the silver produced is recovered as a byproduct of production of other metals. Thus within the study area silver, other than in minor amounts, is most likely to be produced jointly with other metals, from deposits of volcanogenic massive sulphide type. Other types of silver deposits are also to be expected in the large region under study and the criteria for some of these are discussed below.

Volcanogenic massive sulphide deposits

Because of the polymetallic nature of deposits of this type, the areal assessments of potential for these deposits naturally represent an important part of the potential for silver. The general characteristics of this type of deposit are noted elsewhere in this Appendix. However, it should be noted that there is some evidence that volcanogenic massive sulphide deposits are richest in silver, and lead, when they are hosted in sequences that are rich in sedimentary or felsic volcanic components (Divi et al., 1979). In the case of the silver- and lead-rich Yava and Hackett River deposits of this type in the Slave Province, Mackenzie District, Frith and Roscoe (1980) have suggested that they are located in felsic-intermediate volcanic sequences that are (1) particularly thin, (2) in part of subaerial deposition, (3) rich in tuffaceous rocks, (4) probably related to caldera structures, and (5) possibly deposited over basement highs.

Vein deposits of complex Ag-Co-Ni-As-S (Bi, U, Cu) type

Vein deposits of this type are known in the Cobalt area, Ontario, at Great Bear Lake, Northwest Territories, not far southwest of the boundary of the study area, and at a number of other localities in the world. It has been postulated that deposits of this type are related to major continental rift (tensional) faults. In many cases deposits of this type are also spatially associated with gabbroic sills or sheets of moderate or major size. In addition to these features, other possible criteria are:

1. the presence of felsic pyroclastic sequences or of possibly metal-rich sedimentary units;
2. a nearby unconformity between Archean basement rocks or deformed Early Proterozoic rocks and younger relatively undeformed Proterozoic rocks.

In some cases (Cobalt, Ontario, and the simple silver veins of the Hope Bay area that may be genetically related — see below) the veins are located where Archean basement consists of mafic volcanic rocks that include thin interflow sedimentary units. In the Cobalt area these interflow units are highly mineralized in some locations. The veins of the Cobalt and Gowganda districts, Ontario, are restricted to within 700 ft (215 m) vertically of the Nipissing Diabase sheet.

The Echo Bay Mine in the Great Bear Lake area to the end of 1976 produced about 26,500,000 ounces of silver from 433,000 tons of ore. All reserves in known veins had been mined as of November, 1976. The adjacent Eldorado property produced an estimated 1,500,000 ounces of silver from 1,100,000 tons of ore up to 1960, and Echo Bay Mines Limited produced an additional 4,520,000 ounces from 72,000 tons of ore in 1977 and 1978.

The Terra Mine on the Camsell River, approximately 55 km south of Port Radium, to the end of 1978 had produced about 12,350,000 ounces of silver from roughly 375,000 tons of ore.

Vein silver deposits of simple mineralogy

Deposits of this type are known in the Slave Province in the Hope Bay area east of Bathurst Inlet, and these may serve as examples (see Section 6 for more description). The controls of these veins are not entirely obvious but could include:

1. small tensional (?) fractures in the host metavolcanic rocks;
2. nearby diabase sheets for which the projected lower contacts pass only a short distance (75 metres or less) above the vein sites;
3. mafic metavolcanic nature of the host rocks;
4. the presence of nearby felsic crystalline (granitic and gneissic) rocks, felsic volcaniclastic, or possibly metal-rich black shale interflow units.

The suggested genetic association between the veins and a diabase sill or sheet is apparently supported by correspondence between the age indicated by lead isotope data for the veins and an age of about 1500 Ma obtained for a similar sill farther to the west.

A negative feature of this deposit type is that the individual veins, based in this case, it must be noted, only on the few veins known in the Hope Bay area, are very small in size. From 1973 to 1975 production from the two veins at Hope Bay was about 123,635 ounces of silver from 1565 tons of ore.

Vein silver deposits associated with felsic subaerial volcanic rocks

Deposits of this type are best known from examples in the North American Cordillera in the United States, Canada and Mexico. These deposits are very variable in their characteristics. They range from high grade simple veins or vein sets to low grade irregular zones of minor mineralized fractures, from deposits formed in subvolcanic, often porphyritic intrusive bodies, to those formed in felsic tuffaceous or sedimentary rocks, and from deposits mined primarily for silver to those mined for both silver and gold and to others in which base metals are important products as well.

These deposits, and in particular those in felsic pyroclastic rocks and felsic subvolcanic intrusions, are characterized by hydrothermal alteration that may include argillization and, along the mineralized veins or fractures, silicification. In some cases caps of silica (jasperoid) and barite have apparently formed where the mineralizing fluids debouched onto the surface.

Some of the criteria for this type of deposit, although this is an incomplete list for the class as a whole, are as follows:

1. the presence of subaerial felsic volcanic rocks or of associated subvolcanic intrusions;
2. the presence of caldera structures;
3. evidence of hydrothermal alteration in association with (1.) or (2.);
4. the presence of known occurrences of this type.

Although most deposits of this type are of Phanerozoic age, the best probable example in the present study area is the lead-silver mineralization associated with Archean subaerial volcanic rocks in the Back River (41C) area, Mackenzie District. The mineralization here is in extensive fracture zones that are apparently related to major arcuate caldera faults (Lambert, 1976, 1978; Roscoe, personal communication, 1980).

As noted above, deposits with a wide range in form, size and grade are included within this class. It is thus not practical to give tonnage and grade figures that are considered to be "characteristic".

CRITERIA FOR ESTIMATION OF COPPER POTENTIAL

R.V. Kirkham

In Canada and the rest of the world only a few types of copper deposits are of major economic importance. In a very approximate decreasing order of importance these are as follows:

1. Porphyry (stockwork) deposits
2. Sedimentary deposits
3. Magmatic Ni-Cu deposits
4. Volcanogenic Cu-Zn (Pb-Au-Ag) deposits
5. Skarn (contact metasomatic) deposits
6. Miscellaneous vein and replacement deposits

Although a few other types might be important locally in some parts of the world, such as the Palabora carbonatite copper deposit in South Africa, the vast majority of economic copper deposits can be placed in the above classes.

The copper potential of the study region was assessed considering the above copper deposit types and known regional geological characteristics favourable or permissive for the occurrence of these copper deposit types. In some places, such as the Coppermine River area, many minor copper occurrences of a globally unimportant type have been identified. Even though these occurrences do not fit into a globally or nationally important class, sufficient information exists on them to indicate that a few small copper mines eventually might be developed in the area. Other unusual metallogenic characteristics of parts of the study region also have been considered in the assessment.

Porphyry Deposits

Porphyry or stockwork type copper deposits are the most important class of copper deposit in the world and probably account for at least 60 percent of known copper reserves and resources. They tend to be large, low grade deposits related to felsic or intermediate, shallow intrusive rocks and generally are amenable to low cost, large scale mining methods. Minor amounts of molybdenum, gold, and silver often are extractable as byproducts. Most economic porphyry deposits occur in young mobile belts of the world (i.e., less than about 220 m.y. old). Nevertheless, some occurrences of this type have been found in older Paleozoic mobile belts and in Precambrian Shield areas. Since most economic porphyry deposits are relatively young, the entire study area would seem to be eliminated from having potential for this important class of copper deposits. On the other hand, since occurrences of this type have been found in Precambrian rocks of the Canadian Shield and Paleozoic rocks of the Canadian Appalachians, the study area should have some, albeit very poorly understood, potential for this important class of deposit. Areas such as Archean greenstone belts of the Shield, the Northern Ellesmere Fold Belt and the northern Yukon Territory with shallow (epizonal), felsic to intermediate intrusive rocks would seem to have the best potential for this type of deposit in Arctic Canada.

Porphyry deposits tend to support very large mining operations that require massive amounts of material and large sums of money to develop. Even under the most optimum conditions of high metal prices, tax incentives (e.g., previously a three year tax free period to return the capital investment), good location (e.g., Kamloops area in British Columbia /access, transportation, infrastructure, stable trained labour force, assured energy supply/), and good mining and metallurgical characteristics, porphyry deposits commonly are only marginally economic. For such reasons, unless it is a very good deposit, a porphyry deposit probably could not support a viable mining operation in most parts of this remote northern area. On the other hand, if a viable operation was initiated, because of its large size and considerable ore reserves, it could be the basis of a stable mining community for several tens of years. Most other types of copper mines in Canada tend to have much shorter life spans than typical "porphyry" operations.

Sedimentary Deposits

Sedimentary copper deposits account for approximately 15 to 20 percent of the world's copper production and reserves. They tend to occur where reduced marine rocks overlie continental redbeds. This type of deposit is more important in Africa and Asia than in North America but in many parts of North America no concerted exploration for them has been carried out. A few giant deposits and districts, such as the Zambian and Zairian Copperbelts of Africa, the Lubin district in Poland, and the Dzhezkazgan district in the Soviet Union, contribute most of the copper mined from this type of deposit. However, scattered significant deposits of this type are known in other parts of the world and might occur in the Canadian Arctic.

The regions assessed in this study contain many diverse sedimentary sequences of various ages, some of which contain rocks favourable for the occurrence of this type of deposit. Although exploration for this type of deposit has been minimal and occurrences are few, a reasonable probability exists that this large region contains economic sedimentary copper deposits.

Nevertheless, because of lack of firm indications of economic deposits, this conclusion is very preliminary and speculative. No sedimentary copper occurrences are known in Archean and early Proterozoic rocks and geological evidence supports the concept that they only formed after about 2250 m.y. ago. Hence, only some of the younger Proterozoic and Paleozoic sequences are considered to have potential.

Magmatic Ni-Cu Deposits

Magmatic Ni-Cu deposits tend to occur in association with differentiated mafic (gabbroic) intrusions. They can be high grade massive or low grade disseminated deposits. Platinum group elements and cobalt are important byproducts obtained from Ni-Cu ores in some areas. This type of deposit is important in parts of the Canadian Shield and occurrences are known in the study area. The unique, exceptionally large and rich Ni-Cu deposits in the Sudbury area of Ontario are still Canada's most important source of copper. Even though in the study region no major, rich deposits of this type are known that might be developed in the foreseeable future, a reasonable probability exists that some viable Ni-Cu deposits are present.

Volcanogenic Cu-Zn Deposits

Volcanogenic Cu-Zn (Pb-Au-Ag) deposits are particularly abundant in greenstone belts of the Canadian Shield. Because many extensive Precambrian greenstone belts and small metamorphic relics of them are present and some proven deposits of this type are known in the Slave Structural Province south of Bathurst Inlet, a very high probability exists that economic deposits of this type will be developed in the area.

These deposits tend to be polymetallic, relatively high grade, and tend to occur in clusters, hence they are particularly well suited for exploitation under Arctic conditions. Nevertheless, individual deposits are usually small and can be expected to have relatively short life spans (3 to 10 years). Mining operations based on this type of deposit probably will be centered on large rich deposits that warrant the establishment of expensive infrastructures and offer some permanence to mining communities.

Skarn (contact metasomatic) Deposits

This type of deposit tends to form in impure carbonate rocks adjacent to felsic and mafic intrusions. Calcium and magnesium silicate minerals, such as epidote, garnet, diopside, actinolite, tremolite, and wollastonite are characteristic of such deposits. These deposits tend to be highly varied both in terms of their size and metal contents. Most are small and erratic but a few are large, significant deposits. Copper, tungsten, iron, zinc, gold, and molybdenum are common metals found in skarns. About six percent of Canadian copper reserves occur in skarns.

As is the case for porphyry deposits, most skarns are found in relatively young Paleozoic and Mesozozic orogenic belts. Only a few have been identified in Precambrian terranes. For this reason most of the study region would seem to have a low potential for skarns. Northwestern Ellesmere Island and the northern Yukon Territory would seem to have the best potential. LeCheminant (personal communication, 1980) mentioned that barren skarns are known in the Dubawnt Group in the District of Keewatin but other Precambrian occurrences have not been identified. Nevertheless, skarns in Precambrian rocks should not be ruled out completely.

Miscellaneous Vein and Replacement Deposits

Significant copper deposits are known that do not fit well into the other five classes of deposits. These have been lumped into a general diverse class of "vein and replacement deposits". Although on a global or national scale this "type" of copper deposit is not very important, it is important in some districts, such as the Chibougamau area in Quebec. So little is known about the regional controls on the distribution of this class of deposits that reasonable assessment of their potential is difficult. Nevertheless, the study area is so large, contains many small copper occurrences, and has such diverse geology that economic miscellaneous vein and replacement copper deposits and perhaps even camps of this type can be expected in the region. Some copper deposits of this type contain appreciable amounts of gold which would enhance their development possibilities in the Canadian Arctic.

CRITERIA FOR ESTIMATION OF NICKEL POTENTIAL

O.R. Eckstrand

Virtually all significant nickel sulphide deposits occur in, or are associated with, mafic and/or ultramafic magmatic rocks. The favourable host rocks fall into three categories with the following characteristics:

1. Layered, differentiated, quasi-conformable mafic plutons, (e.g. Sudbury, Ontario; Norilsk, U.S.S.R.; Duluth complex, Minnesota). The plutons are usually large, in the order of tens of kilometres long. Deposits in these rocks are characterized by ores having similar nickel and copper contents; various geological ages; pre- or early syn-tectonic emplacement; and large size. The size of individual deposits is usually in the tens and possibly hundreds of millions of tons of ore, and grades generally fall in the 1 to 3 percent range for nickel, and variable but comparable copper content. Much of the sulphur in these nickel deposits appears to have been assimilated from other rocks with which the host magma came in contact. Consequently, sulphide- or sulphate-rich rocks in the stratigraphic section below the differentiated pluton are regarded as a favourable criterion.
2. Weakly-differentiated ultramafic flows and subvolcanic sills and dykes (e.g. Kambalda, Australia; Thompson (?), Manitoba; Perseverance, Australia). Deposits in these rocks are characterized by ores having nickel usually greatly in excess of copper; Precambrian age (associated or host flows are Archean); pre- or early syn-tectonic emplacement; and, small to moderate size. Deposits in volcanic hostrocks generally contain one to several million tons of ore having grades of 1 to 5 percent

nickel. Deposits in intrusive sills can contain many tens of millions of tons of ore having grades up to greater than 2 percent nickel, but usually significantly less copper. Some submarginal examples contain hundreds of millions of tons of material having less than one percent nickel. The ultramafic hostrocks are characterized by "komatiitic" (high magnesium) compositions, and by association with mafic submarine volcanic rocks, iron formation (usually sulphide) and a variety of thin cherty or siliceous volcaniclastic intercalated sedimentary rocks, assemblages that are typically encountered in Archean greenstone belts and Aphebian volcano-sedimentary fold belts.

3. Pipe-like or lens-like differentiated mafic plutons (e.g. Lynn Lake, Manitoba; Carr Boyd, Australia; Empress, Rhodesia). Deposits in these rocks are characterized by ores having similar nickel and copper contents; various geological ages; post-, syn- or pre- (?) tectonic emplacement; and, small to moderate size. They are on the whole less important than deposits of types 1 and 2. Individual deposits range from less than one million to a few tens of millions of tons of ore, having grades generally between 1 and 2 percent nickel and comparable contents of copper. Because of the variety of tectonic environments and lithologic associations in which these deposits and their hosts are found, the identification of areas favourable to their occurrence is highly uncertain. The only useful guide is the presence of mafic plutons. It may also be speculated that sulphur-rich rocks lower in the crustal section may have provided a source of the sulphur necessary to generate the nickel sulphide deposits.

In the case of ultramafic plutonic rocks, those of ophiolitic, Alpine, kimberlitic, and carbonatitic affiliation appear to have little or no economic potential for nickel. As for mafic plutonic rocks, only those of ophiolitic affiliation are relatively safely excluded from consideration. Beyond that, positive criteria for their nickel potential are uncertain, and all should be regarded as having some potential.

Vein occurrences of nickel and nickel-copper sulphides, unless closely associated with rocks of categories 1, 2 or 3 tend to be of little economic significance.

Lateritic or paleo-lateritic nickel deposits of economic significance are unknown in Canada.

ESTIMATION OF LEAD-ZINC AND COPPER-ZINC POTENTIAL

D.F. Sangster

General statement

Because of the mainly reconnaissance nature of geological mapping in the study region, identification of potentially favourable geology for the occurrence of lead-zinc, and copper-zinc, deposits must, of necessity, be graphically displayed in terms of broad areas. This is not meant to imply, however, that the favourable geology referred to is equally spread over each area so displayed. In all likelihood each area will contain within it smaller sub-areas of more favourable geology and perhaps somewhat larger sub-areas of much less favourable geology. At the present level of geological, geophysical, and geochemical knowledge, however, these detailed sub-areas could not be distinguished and, consequently, only areas of "general favourability" are identified in this report.

The same concept applies to the ratings assigned to each area. A rating of "medium" potential for an area to contain lead-zinc (or copper-zinc) deposits merely means that, at the very best, the area is considered to contain within it, somewhere, only moderately-favourable geology. It does not mean that the potential is uniformly "medium" throughout or that the average potential is "medium". In other words, the assigned potential rating is the maximum regarded as applicable to that area.

Geological criteria used in estimating the "potential-to-occur"

The lead-zinc (and copper-zinc) potential of the areas under consideration has been assessed by comparing the reported geology, and reported or interpreted geological environments, of these areas with those of selected similar deposits elswhere in the world. Most of the selected deposits, and their surrounding geology, have been personally examined by the writer. These deposits have been conceptually integrated into composite "deposit types", thereby becoming models against which the geology of the area being assessed is compared.

Four such composite "deposit types" were used to assess the lead and zinc (and to a minor extent, copper) potential in the study region. These have been given a short name reflecting the major rock type encompassing each of the four "deposit types". The four types are: "shale-type", "sandstone-type", "carbonate-type", and "volcanic-type". The major geological characteristics of these four types, their surrounding geology, and Canadian examples are presented below.

1. "Shale-type" lead-zinc deposits

Deposits of this type are found within thick accumulations of sedimentary rocks. The basins containing these sediments are commonly long and narrow, suggesting structural or fault control of the shape and orientation of the basin. Rocks enclosing the lead-zinc deposits are characteristically fine-grained clastics (shale); cherts, carbonates, and minor amounts of volcanic rocks may also be present.

"Shale-type" deposits are relatively uncommon in the world, only about two dozen being known to date, mainly in Australia and Canada. Canadian examples are the Sullivan mine, B.C. and the Faro (Anvil) mine, Yukon. The deposits themselves are usually thin, sheet-like bodies consisting of fine-grained, well-layered sulphides of lead-zinc and iron. Barite is present in some deposits. Average size of these deposits tends to be in the 60-70 million tonne range with grades of combined lead-zinc running normally from 5 to 12%. Average silver content ranges from nearly zero to about 180 g/tonne (about 5.6 oz/ton).

The obviously attractive tonnage and grade characteristics of this type of lead-zinc deposit are, to some extent, counter-balanced by another feature, namely the tendency for the sulphide minerals to be extremely fine-grained. This presents as-yet-unresolved metallurgical problems resulting in reduced metal recovery characteristics.

2. <u>"Sandstone-type" lead-zinc deposits</u>

These deposits are found in geological situations where clean, quartzitic sandstones rest on a previously-weathered basement of granitic composition.

The sulphide minerals, generally galena with nil or minor amounts of sphalerite, occur as disseminations or small clusters of grains, thereby imparting a normally low average grade of about 4-6% Pb and 0-0.7% Zn. Silver content is generally low. Tonnages of individual deposits range from a few hundred thousand up to 70 million tonnes with an average of perhaps 2-8 million tonnes. Examples exist in Canada, Sweden, France and Morocco. The Yava deposit currently under development in Cape Breton Island, Nova Scotia, is a typical example of this kind of deposit.

3. <u>"Carbonate-type" lead-zinc deposits</u>

Two significant examples of this deposit-type are already known in the study region - Arvik (Polaris) and Nanisivik.

On a world scale, lead-zinc deposits of this type are found in carbonate rocks, generally dolomite, in three main geological situations: i) adjacent to an abrupt carbonate-shale facies change; ii) beneath a paleo-unconformity; or iii) a combination of the two. Both the Arvik and Nanisivik deposits are found in situation ii), i.e. beneath an unconformity.

"Carbonate-type" lead-zinc deposits are relatively common in the world with major examples occurring in Canada and the United States. The Pine Point area , N.W.T. is perhaps the best known Canadian example. The deposits are characterized by their generally low average grade (6-8% combined Pb and Zn), low Ag content (usually less than 30 g/tonne – 1 oz/ton), the coarse-grained nature of the ore, and their tendency to occur as relatively small bodies scattered over what is sometimes a considerable area. For example, the Pine Point "deposit", consisting of about 75 million tonnes, is actually a district comprised of more than thirty individual orebodies distributed over an area approximately 52x16 km.

The low average lead-zinc grades, negligible silver content, and characteristic scattered distribution may tend to make deposits of this type economically unattractive under most conditions existing in the study area. Arvik and Nanisivik are economic because of a number of somewhat unusual features: i) they both consist of substantial tonnages of ore contained in single orebodies instead of being distributed among several bodies over a large area; ii) Arvik's average grade (18-20% Pb and Zn) is about three times the "norm" for deposits of this type; iii) Nanisivik's average silver content (about 60 g/tonne – 2 oz/ton) is unusually high; and iv) both occur extremely close to navigable tidewaters with acceptable ice conditions. Thus, although the only two presently economically favourable lead-zinc deposits in the study area are of the carbonate lead-zinc type, the somewhat unusual features of these two deposits must be recognized and repetition of these features elsewhere in the region cannot automatically be assumed.

4. "Volcanic-type" copper-zinc deposits

Deposits of this type occur in submarine volcanic rocks in many parts of the world and are the major source of zinc in Canada, the world's leading zinc producer. Canadian examples would be the Kidd Creek deposit, Ontario and the Flin Flon deposit, Manitoba.

Submarine volcanic rocks, particularly those of felsic composition, are the dominant host rocks for "volcanic-type" copper-zinc deposits. Characteristically these orebodies consist of banded or layered ore of high total sulphide content, most of which is iron sulphide (pyrite and pyrrhotite). The ore minerals consist of sulphides of zinc and copper; lead is generally a very minor component in deposits of Precambrian age, the dominant age of volcanic rocks in the study region. Silver and gold can be important by-products of "volcanic-type" deposits. Expectable grades would be of the order: 4% Zn, 2% Cu, 40 g/tonne (1.2 oz/ton) Ag, and 0.64 g/tonne (0.02 oz/ton) Au. Ore tonnages might lie between 0.4 to 50 million tonnes, averaging about six million tonnes. Canadian experience has shown that Precambrian deposits of this type possess good milling and metallurgical characteristics and, as a consequence, yield good metal recoveries. An undesirable by-product, however, is the high iron sulphide content of the tailings. These tend to oxidize rather readily yielding acidic waters not easily neutralized because of the characteristically low carbonate content of the ores.

CRITERIA FOR EVALUATION OF IRON RESOURCES

G.A. Gross

General Factors

Iron "resources" is a general term that is used customarily for all kinds of natural material in the ground from which iron might be recovered. Resources are composed of "reserves" consisting of material that can be mined and processed economically, of which the quality is well known and the quantity has been established with a high degree of accuracy, and "additional resources" that include deposits of iron for which there are varying degrees of economic or technological constraints to development or that are not as well delineated in terms of quality and quantity, as well as some prognosticated material.

Two principal factors have been considered in classifying and evaluating iron resources: the accuracy of measurement of the quantity and quality of material in the ground; and the feasibility of developing and mining it.

Identification of suitable resource material in the ground for production and processing of a marketable product is obviously the first essential step in resource evaluation. Proper definition of the kinds of material and the size, shape, and character of the deposits depends on the quality of geological data available and on competent interpretation of this information. Iron ore resources occur in many different kinds of deposits in a variety of distinctive geological environments. Therefore the crude ore varies greatly in quality and grade and in its suitability for processing. Some ore is mined and shipped directly, but most ore requires processing to improve its quality and to satisfy specifications that are essential for the particular methods being used for making steel. The different kinds of resource material in the ground have to be defined and evaluated in relation to the quality specifications required by the steel industry that may use the ore.

Iron ore, unlike the ores of most other metals, must satisfy a complex range of specifications for its chemical and physical properties. These specifications vary depending on the methods being used for making steel, on the composition and quality of the particular coking coal and other raw materials to be used with the iron ore, and to some extent on the traditional practices or preference of different furnace operators.

Chemical properties of ore are defined within specific limits relating to the iron content, to proportionate amounts of constituents that form slag such as the oxides of silicon, aluminum, calcium, magnesium, and titanium, and to deleterious constituents like phosphorus and sulphur which may affect the quality of the steel produced or require special processing technology for the protection of the environment. The mineralogy of the ore, its moisture content, and physical properties such as hardness, porosity and fragment size have a major influence on the operating efficiency of blast furnaces.

Because iron ore is a bulk commodity of relatively low value per unit of weight, only the most economical mining methods can be used. In nearly all cases iron ore deposits are chosen that can be mined by open-pit methods and more than 97 percent of the iron ore produced in Canada is extracted from open pits. Some of the iron resources that occur in narrow bodies or in circumstances where only underground mining is feasible are not likely to be developed in the near future.

In the past, ore was selected from iron deposits which contained material in its natural state that satisfied chemical and physical specifications as closely as possible. Resources of natural high-quality, "direct-shipping" ore in North America have been largely depleted, and about 20 to 25 years ago the steel industry turned to the vast low-grade iron resources available on this continent. These could be processed to control the chemical and physical characteristics of the resultant products – pellets, sinter and agglomerates. The extra cost of mining and processing larger quantities of lower-grade ore have been offset by the marked improvement in the efficiency of blast furnace and steelmaking operations gained through the use of pelletized and processed ore products.

Production of a bulk commodity such as iron ore involves both large-scale mining and transportation facilities and transportation constitutes a major part of its total cost. Specialized rail, port and handling facilities are required. Canadian iron ore products have to compete with natural high-grade ores from other continents that are transported inexpensively in bulk marine carriers. Most domestic ore is of low grade and requires both upgrading and costly rail transportation over long distances. Consequently, the transportation of iron ore from one part of Canada to another is not economically feasible in all cases and for this reason the iron resources should be evaluated on a regional basis.

Steel companies prefer to have direct control of the sources of raw materials for their industries. The main purposes in doing this are to ensure a dependable long term supply of ore and to acquire the quality of iron ore most suitable for use with the combination of raw materials available to them.

Special Factors in the Assessment of Northern and Arctic Iron Ore Resources

Successful exploitation of iron resources requires that the ore deposits can sustain production for a long enough period to amortize the investment capital, pay for mining, processing and transportation costs and maintain a regular supply of ore to industry at a competitive price. The possibility of developing a bulk commodity in the study area is affected adversely by the remote location of the resources, distance from tidewater in some cases, difficult and seasonal shipping and mining conditions, general lack of appropriate transportation and infrastructure facilities, the distance from established steel plants, the current ample supply of iron ore, and related factors. Such adverse factors may, however, be offset somewhat in the future in cases where favourable ore characteristics and location of the deposits may be combined to improve their competitive situation or by major changes in technology and economics in the iron and steel industry.

Particular factors given special consideration in the evaluation of iron resources in the present study are noted briefly in the following sections.

1. Geological and mineralogical characteristics of deposits

Iron resources occur as stratigraphic units within different kinds of iron-formation. Generally, the grade, quality and mineralogy of the resources can be predicted with a relatively high degree of assurance from a limited number of samples. Since large quantities of iron ore are mined from similar deposits elsewhere in Canada, many aspects of evaluation of northern deposits can be considered by analogy with existing operating conditions and reference to established producing mines in the country.

2. Grade and quality of resources and the kind of product that may be produced

Natural high-grade iron resources of direct shipping ore are attractive because processing is not required and they may receive preference for use in blast furnaces, open hearth or direct reduction plants. The mineralogy, texture and iron content of the lower grade resources determine the suitability of the material for concentration and beneficiation and the quality of ore product that may be produced.

Magnetite iron-formation in which the grain size is enlarged through recrystallization during metamorphism can be concentrated most easily and can give the best quality concentrate. Of the very fine-grained resources, magnetite iron-formation will likely provide suitable quality concentrates through magnetic separation methods but the costs of grinding and processing the ore and the related energy consumption are much greater.

Concentrates are produced from highly metamorphosed, coarse-grained hematite iron-formation by using gravity spirals and fine grinding is not required. Concentrations of hematite from fine-grained iron-formations may be achieved by fine grinding of the crude ore and flotation separation methods. Fine-grained mixtures of magnetite and hematite are usually difficult to concentrate and may require complex and costly processing systems. Iron-formations that have a high proportion of iron present as carbonate are not beneficiated easily and the total amount of recoverable iron is usually very low. Massive siderite iron-formation is an exception as the material may be upgraded by sintering to give a suitable product.

3. Size and configuration of iron deposits

Favourable conditions for open pit mining include: a very low ratio of waste rock to crude ore; wide or thick ore bodies to enable use of large machinery at a broad mining face; stable or competent rock conditions to permit efficient pit design and mine safety; adequate drainage for control of the water table in mine areas; and, control or absence of permafrost conditions.

These conditions may be achieved where ore bodies occur within low-dipping strata and are fully exposed or are only lightly covered by waste rock and thus present broad areas for extraction of ore, in more steeply-dipping strata as thick tabular masses of ore, or in folded strata where the iron formation is repeated in the limbs and thickened in the crests of folds to provide a compact mass of ore in an equidimensional zone or ore body.

4. Amount of material that can be extracted from a deposit

It must be possible to extract sufficient ore from a deposit to amortize development costs and sustain a profitable mine operation for a required period of time.

5. Optimum rate at which the deposit can be mined

Study of predicted production costs in relation to the estimated value of the ore to be produced for different rates of mining should determine the minimum tonnage of ore that must be extracted in order to cover costs and operate profitably. Physical configuration of an ore zone and many technical factors also determine minimum and maximum rates of mining that are feasible. The inter-relationship of technical and economic factors should indicate minimum or optimum rates at which it is feasible to extract ore.

6. Uniformity and quality of ore that can be produced throughout the mine life

Mining and processing may be more complicated and costly where an orebody is not uniform in quality because selective mining of different grade zones may be required, more elaborate processing facilities may be necessary, and ore grading and quality control of the product may be very difficult. All these factors contribute to high costs and complex operational problems.

7. Suitability of ore products for available and anticipated markets

Specific quality of ore is required for the particular metallurgical processes used by a steel plant. Low-grade crude ores that are processed to provide ore concentrates offer some advantages and versatility for marketing as the grade, chemical composition and physical characteristics may be controlled within limits by agglomerating, pelletizing or sintering to provide the specified qualities in the product.

8. Location and environment of the deposits

Transportation being one of the major factors in the cost of ore delivered at a steel plant, it is evident that deposits located near good port sites where large ships can be accommodated have an advantage over deposits located inland. Pipe line transportation of ore concentrates in slurry form has become economically feasible in many parts of the world and is of considerable interest for possible application in northern regions. Any factors that reduce transportation costs are of special significance in determining mining feasibility.

9. Economic feasibility for mining, processing and transportation of ore

Each deposit area has to be evaluated as a separate operational model and all factors contributing to the costs of producing and delivering the ore have to be included in the final price paid at the steel plant.

CRITERIA FOR ESTIMATION OF MOLYBDENUM POTENTIAL

R.V. Kirkham

As for copper, porphyry or stockwork deposits are by far the most important type of molybdenum deposit. They account for greater than 99 percent of world reserves and resources of molybdenum. In this type of deposit the molybdenum can be the only important commodity, occur in approximately equal amounts with copper, or be a minor byproduct of copper production. Tin, tungsten, rhenium, and a few other commodities are extracted as minor byproducts from some porphyry molybdenum deposits.

Porphyry molybdenum deposits are found in close association with shallow (epizonal), felsic intrusions and, although most of the economic deposits of this type are of Mesozoic or Tertiary age, areas with shallow felsic intrusive rocks of any age may have potential. An important Mo-Cu deposit of this type has been identified in very ancient Archean rocks in Western Australia. Archean and Proterozoic felsic volcanic belts of the Shield, the Paleozoic northwestern Ellesmere Island Fold Belt, and Devonian intrusive areas in the northern Yukon Territory seem to have the best potential for porphyry molybdenum deposits in the study region.

Although porphyry molybdenum deposits currently dominate world molybdenum resources, other types of molybdenum deposits offer some hope for production. Simple quartz veins or sets of quartz veins, aplitic and pegmatitic bodies, and skarns have been the source of some molybdenum production. These types of deposits are similar to porphyry deposits in that they also typically show a close association with granitic rocks and, at a few localities, syenitic rocks.

The Knaben deposits in Norway, which produced molybdenum for many years, are more or less concordant zones in high grade, crystalline metamorphic rocks. Although the genesis of this type of deposit is very poorly understood, because they occur in crystalline metamorphic rocks, large parts of the northern Canadian Shield with similar rocks should not be prematurely assessed as having no potential for this or perhaps related types of deposits. Conformable regional pyritic-pyrrhotitic "skarns" with significant concentrations of molybdenum and uranium are widely distributed in high grade metamorphic rocks of the Grenville Supergroup of southern Ontario and Quebec. Some of these deposits have yielded small amounts of molybdenum in the past and some occurrences are currently being re-evaluated as possible sources of uranium and molybdenum. Although deposits of this rather unusual type do not seem to be widely distributed on a global scale, because they occur in highly metamorphosed Precambrian sedimentary sequences a possibility exists that similar deposits might exist in less explored crystalline terranes in northern Canada.

Significant concentrations of molybdenum are known in sedimentary rocks, but little work has been done to determine whether or not molybdenum can be commercially extracted from such sources. Periodically, minor amounts of molybdenum have been extracted from "roll front-type" uranium deposits in sandstones in Wyoming and from sedimentary copper deposits such as the Kupferschiefer in Eastern Europe. Significant concentrations of molybdenum also have been identified with vanadium, zinc, and selenium in organic-rich Paleozoic shales in western North America (e.g., Desborough et al., 1979). Too little is known about such deposits and of the geochemical behaviour of molybdenum in sedimentary environments to speculate much about the ultimate potential for this type of molybdenum deposit in Arctic Canada.

Compared to the southern Shield and Phanerozoic mobile belts, the study area contains very few molybdenum occurrences. Because Shield and mobile belt parts of the area have many similarities with their southern counterparts, it can be reasonably speculated that many molybdenum deposits remain to be found in northern Canada. Regardless of their geologic type at least a few such deposits should offer some hope for production.

APPENDIX 3

RELATIVE HYDROCARBON POTENTIAL OF LANDS IN NORTHERN CANADA

This map provides a broad scale evaluation of hydrocarbon potential in the Yukon and Northwest Territories and associated offshore regions. It is based upon the current assessments of all plays in the region, as of March, 1980.

The explanation of categories and the rationale behind them is as follows:

Category 1 – A region of essentially no oil or gas potential. These are primarily areas in which Precambrian rocks are exposed at the surface.

Category 2 – Areas of low or relatively insignificant oil or gas potential. In our opinion these areas will not be attractive from an exploration standpoint. They are underlain by a thin section of Lower Paleozoic rocks, most of which are exposed at the surface.

Category 3 – Areas of moderate oil or gas potential. These are areas which have thicker Paleozoic sections which are in some instances also covered with some Mesozoic sediments. They are areas in which exploration can be anticipated although they have not yet been the location for discoveries.

Category 4 – A very restricted area, including regions which have demonstrated discoveries and which in the opinion of the Geological Potential Subcommittee have a high potential for oil and gas. These areas will probably be the location for continued intensive exploration activity for some time.

Category 5 – This category is somewhat different from the other 4 gradations of potential in that it represents an area or areas that are essentially unexplored or for which very little information is available. At the same time, there is reason to know or to expect that there will be exploration in these areas and that they may constitute areas of moderate to very high potential.

OIL AND GAS POTENTIAL