# *The Canada - Northwest Territories Mineral Development Agreement - Summary Of G.n.w.t. - Mda Mapping Project*

***Type of Study: Analysis/review***

***Mining/oil/energy, Nwt Minerals General***

***Date of Report: 1989***

***Author: G.n.w.t. - Energy, Nines & Petroleum Resources***

***Catalogue Number: 6-3-75***

6-3-75

# THE CANADA - NORTHWEST TERRITORIES

# MINERAL DEVELOPMENT AGREEMENT

Summary of GNWT - MDA Mapping Projects

1988-89 No.1

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Preface

Before reading the results of this year's geoscience programs, it is appropriate to look at the role and importance of geological research in the history of the Northwest Territories. Namely, how the Geological Survey of Canada (GSC), influenced the discovery of the Yellowknife Gold camp.

In 1934, prospectors originally on their way to the Great Bear Lake area, made a number of interesting discoveries near Yellowknife. This prompted the GSC to send a crew into the Yellowknife area in 1935.

The crew was headed by A.W. Jolliffe. A number of areas were identified to be favorable for gold mineralization. In early September, Jolliffe advised two prospectors, the McLaren brothers, to visit one of the Survey's sub-parties. Unknown to Jolliffe this group had made a significant gold discovery about which they later told these men. Jolliffe in an attempt to make the information widely available, informed the companies working in the area about the gold discovery. One of these was Bill Jewitt of Cominco. In the early winter, based totally on the GSC information, Cominco staked a block of claims. The result was the Con Mine, a mainstay of the Yellowknife economy ever since. Currently the Con Mine employs 400 people.

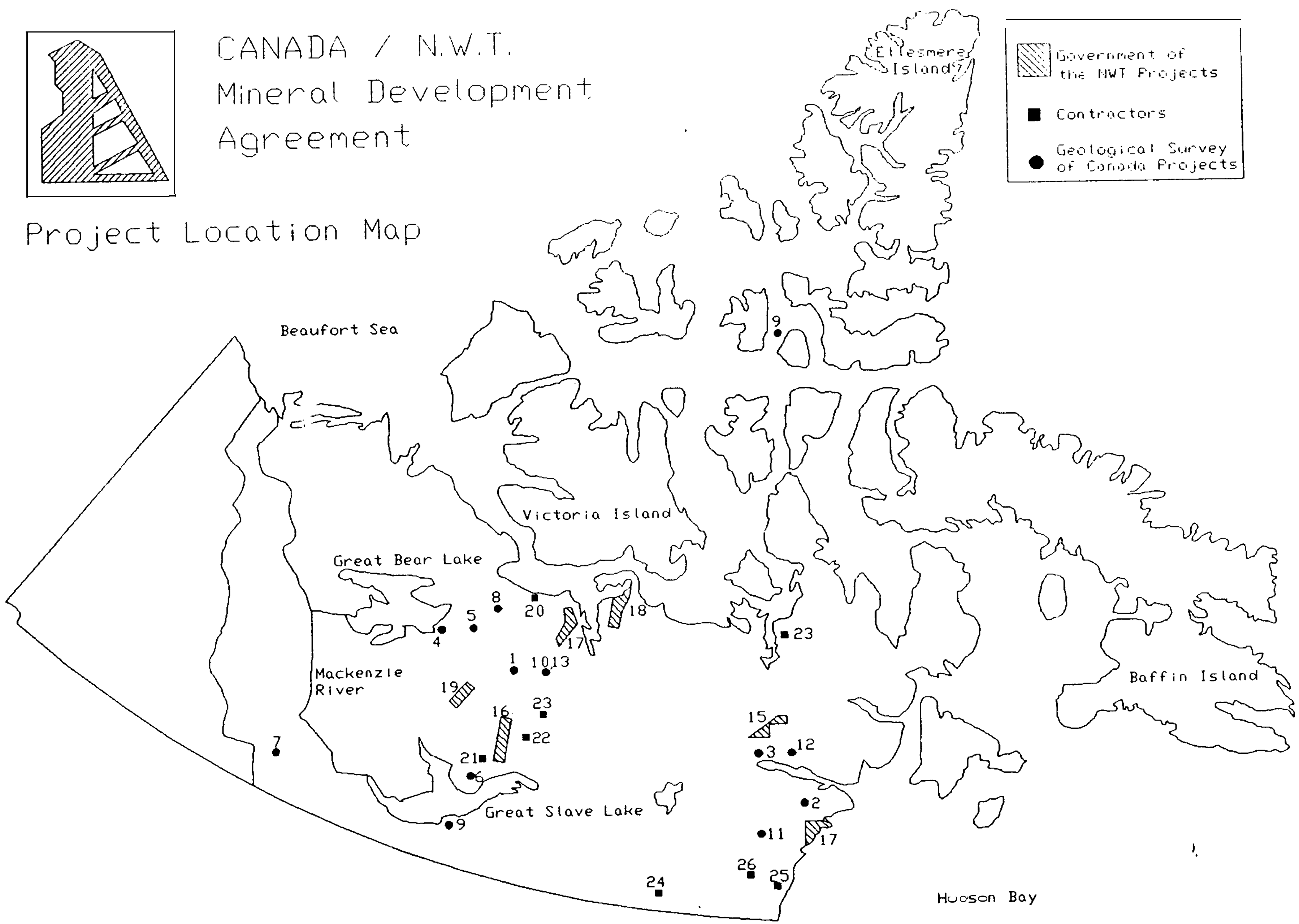
As most of you will recognize, this story is not unique as episodes similar to the Yellowknife discovery have been repeated across Canada. It also illustrates two reasons why the government has conducted these geoscience studies and published the results.

First, information collected through Government funded geoscience programs plays a significant role in the exploration cycle. This basic research forms the foundation on which many major industry investments are made.

Secondly, for the information to be effective it must be distributed quickly and effectively among the private sector investors.

The Government of the Northwest Territories in partnership with the Canadian Government recognizes the significance of the geosciences in providing information to the exploration industry. We hope that the results of the geoscience programs reported here will lead to new discoveries which will benefit us all just as those, some 50 years ago, contributed to the founding of the city of Yellowknife.

Honourable Nellie Cournoyea
Minister of Energy, Mines
and Petroleum Resources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## Introduction

The Canada - NWT Mineral Development Agreement, or MDA, is one of the six sub-agreements of the Canada - NWT Economic Development Agreement. The MDA is a four year program terminating in March, 1991. A total budget of $7 million dollars is cost shared between the Federal and Territorial governments on a 70:30 ratio.

There are three programs under the MDA. Each program was designed after consultation with the Geological Survey of Canada, the NWT Geology Division of the Department of Indian Affairs and Northern Development and with the mineral industry, through the NWT Chamber of Mines.

## Geoscience Program

The objective of this program is to assist and encourage mineral exploration in the NWT, by improving and increasing the geological data base. Projects consist of: the mapping of selected areas with high mineral potential, detailed studies of significant mineral deposits and the compilation and publication of index maps, bibliography and data files.

All projects under this program are coordinated with the A-base projects of the Geological Survey of Canada (GSC) and the NWT Geology Division of Indian Affairs and Northern Development (DIAND - Geology). The program will support over 30 multi-year projects across the NWT during the four year term of the MDA (Figure 1). The GSC has eighteen multi-year projects, delivered by GSC staff and contractors (Table 1). These projects are organized and maintained from Ottawa.

Through the MDA, the Government of the NWT is playing an active role in, the collection of geological data. Thirteen multi-year projects are being implemented by the GNWT. Five full-time geologists have been hired to work in Yellowknife on the projects. These geologists have established a territorial government presence within the mineral industry. The projects are being run with the scientific, logistical and organizational support of DIAND - Geology.

This booklet contains the initial reports on the five multi-year projects run by GNWT - MDA geologists. The results from this past season's work and the plans for the next two years are reviewed.

## Northern Technological Assistance Program (NTAP)

The objective of this program is to assist the private sector in the development of innovative technologies, to improve mining and processing operations and adapt new technology to northern conditions.

**TABLE 1**

**'Geological Survey of Canada - MDA Projects 1988/89 (See Figure 1)**

| | |
|---|---|
| Regional Geology | |
| Contwoyto Lake/Nose Lake - King/LCSD | 1 |
| Tavani Greenstone - Tells/LCSD | 2 |
| Baker Lake - Lecheminant/LCSD | 3 |
| Mystery Island - Hildebrand/LCSD | 4 |
| Muskox Intrusion - Baragar/LCSD | 5 |
| Cameron River- Lambert/LCSD | 6 |
| Mineral Deposits | |
| 'Gold Metallogeny/Slave - Jefferson/MRD | Various |
| Gold Metallogeny/Churchill -- Miller/MRD | Various |
| South Nahanni - Jefferson/MRD | 7 |
| PGE in Ultramafics/Muskox - Hulbert/MRD | 8 |
| Rare Metals - Slave/Churchill/Bear - Sinclair/MRD | Various |
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**TABLE 2**

Government of the NWT - MDA Projects
(see **Figure** 1)

| | |
|---|---|
| **GNWT Geologists** | |
| Pistol Bay/Whale Cove - S. Goff | 14 |
| Tehek Lake - S. Goff | 15 |
| Upper Beaulieu - M. Stubley | 16 |
| Lower Hood/James River - R. JohnStone | 17 |
| Hope Bay - J. Gebert | 18 |
| Indin Lake - J. Morgan | 19 |
| **Contractors** | |
| Anialik River - E. Spooner, University of Toronto | 20 |
| Gordon Lake M. Zentilli, Dalhousie University | 21 |
| Beniah Lake - W. Fyson, University Of Ottawa | 22 |
| south Slave Pegmatites - P. Cerny, University of Manitoba | 23 |
| Kiyak/Windy Lakes - L. Aspler | 24 |
| Hurwitz Group - J. Patterson, University of Toronto | 25 |
| Kaminak Lake – P. Cavell, University of Alberta | 26 |

The Canada Centre for Minerals and Energy Technology (CANMET) is providing the scientific advice for the program. Proposals originating from the mineral industry are reviewed 'and projects are directed towards assisting northern mining operators to adapt technology to the northern environment, improving present mining techniques and developing new technologies for mining and exploration.

Projects with Nanisivik Mines and Giant Yellowknife Mines are now underway. Work is being done on post-pillar recovery processes, computer analysis of an ore-body and the construction of computer models of an ore-body.

Northern Mining Information Program **(NMIP)**

The objective of this program is to promote greater awareness of the economic importance of the mining industry to the residents of the NWT.

NMIP supports projects that will reach the residents of the NWT and inform them of the economic importance of the industry. The projects are to educate and inform NWT residents of the important role that the mineral industry plays in the NWT and the many business and employment opportunities available in the industry.

Under this program, the NWT Chamber of Mines has produced two monthly newsletters. The first, Mining Issues, presents the mineral industry's opinion of current affairs in the NWT and provides current information for the industry. The second newsletter, The Mining News, provides information about geology, mining and the industry to the general public.

NMIP is also funding a series of teaching aids (maps, brochures, slide shows etc...) for the educational system in the NWT. These projects emphasize the role of the mineral industry in the NWT and the opportunities available within the industry.

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We would be happy to hear from you concerning any of our programs or projects.

# T'IE PISTOL BAY - WHALE COVE **PROJECT**

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## Introduction

The Kaminak - Ennadai belt is one of the largest volcanic - sedimentary terrains in Canada but has seen only limited exploration for copper, nickel and gold. A segment of this belt (NTS55K/7 & 10, 2NE, 1 1E and parts of 6 & 9), over "700 $km^2$ in area, which lies approximately 50 km southwest of Rankin Inlet was mapped at a scale of 1:31, 680 during 1988.

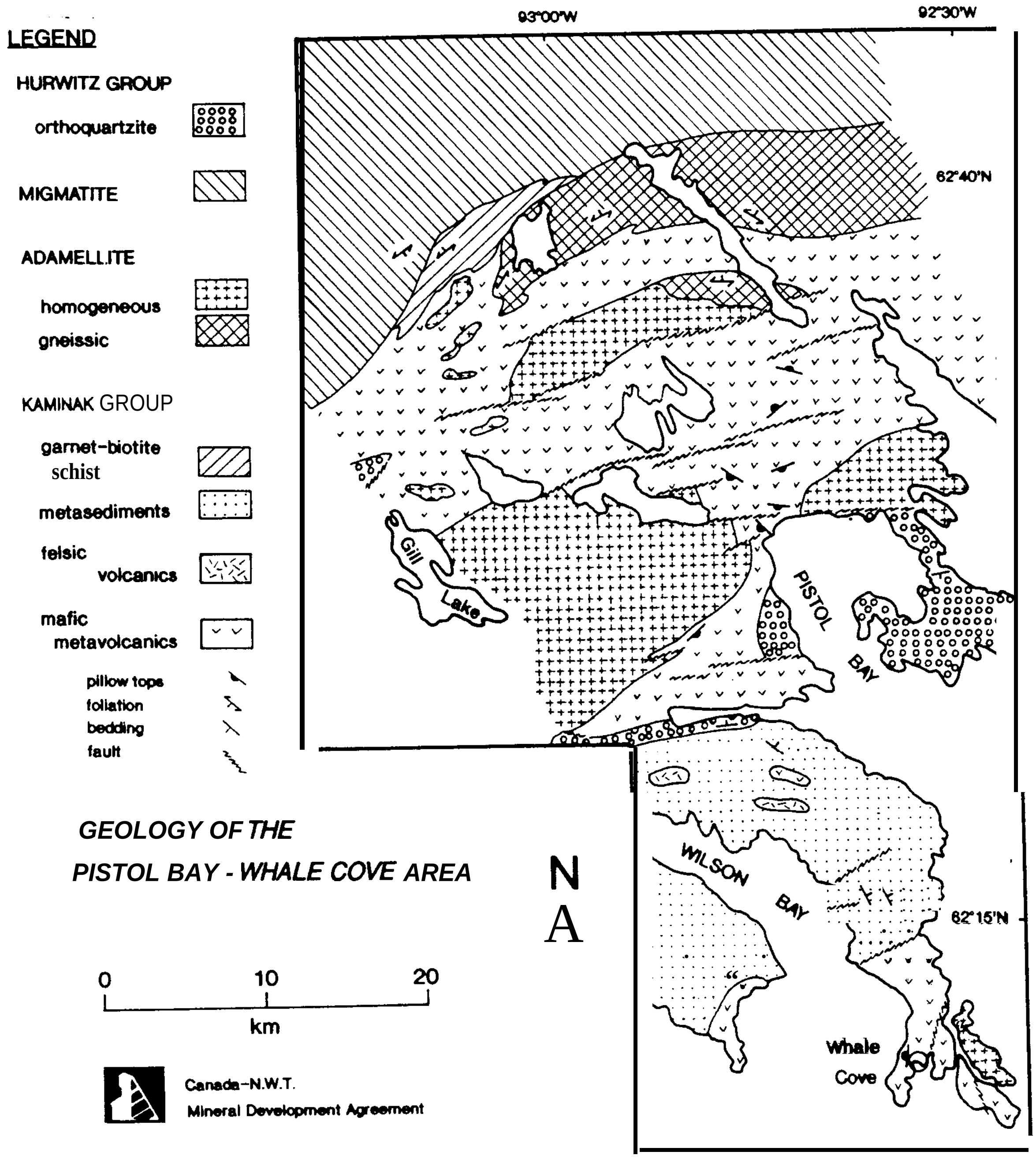
"The object of the program is to update the lithological relationships, stratigraphy and structure of the 1:250,000 survey of HeyWood (1973); to document and provide gold assays of mineral showings and gossans; and to provide geological framework which would assist mineral explanation in the District of Keewatin. Peripheral areas of this segment of-the Kaminak - Ennadai belt, i.e. Pork Peninsula (55 K/8), Corbett Bay (55K/9 'SW) and Wilson Bay - Mistake Bay (55 K/2 NW and part of 55K/7 SW) will be mapped in 1989. in addition, a new project will be started in 1989: mapping of the metasedimentary belt at" Tehek Lake, 150 km north of Baker Lake.

## Geology

The generalized geology of a 60 km long section across the northeast end of the Kaminak - Ennadai belt, from Whale Cove to the north of Pistol Bay is displayed in Figure 2. The area is underlain by the Archean Kaminak Group which comprises two mafic metavolcanic units and two metasedimentary units. These units, which are not in stratigraphic contact, are described in order from south to north.

1) A westward younging metavolcanic unit at Whale Cove is composed predominantly of pillow basalts with ubiquitous plagioclase phenocysts, 'minor pillow breccia and minor, interlayered, one-metre-thick chert beds containing thin magnetite bands.

2) Northeast of Wilson Bay, a southwesterly-dipping homoclinal sequence of turbiditic metasediments comprises two main lithologies: a repetitive sequence of graded units of lithic-arenite, wacke, siltstone and slate with rip-up clasts, intraformational conglomerate and magnetite-chert bands plus a unit of thickly-bedded massive lithic arenite. Minor chert-magnetite bands, mafic volcanic flows and felsic agglomerates occur in the upper part of the sequence.



93°00'W
92°30'W
62°40'N
62°15'N
LEGEND
HURWITZ GROUP
orthoquartzite
MIGMATITE
ADAMELLITE
homogeneous
gneissic
KAMINAK GROUP
garnet-biotite schist
metasediments
felsic volcanics
mafic metavolcanics
pillow tops
foliation
bedding
fault
Gill Lake
PISTOL BAY
WILSON BAY
Whale Cove
GEOLOGY OF THE
PISTOL BAY - WHALE COVE AREA
N
0
10
20
km
Canada-N.W.T.
Mineral Development Agreement


Fig. 2

3) A 35 km-long belt of westward to southwestward younging, non-porphyritic mafic metavolcanic flows occurs north of Pistol Bay. This is predominantly pillowed with subsidiary massive flows and minor variolitic massive flows. No pillow breccia was observed. Subvolcanic lenticular domes of quartz-feldspar and feldspar-porphyritic rhyodacite are common. The regional metamorphic grade increases from low (greenschist facies) to medium (amphibolite facies) towards the north and west.

4) A northeasterly trending belt of schists shows fine-scale interlayering of quartz-feldspathic and garnet-biotite schists (plus or minus kyanite and sillimanite), suggesting medium-grade metamorphism of a turbidite sequence. However, this metasedimentary sequence contains numerous, thin magnetite bands and therefore differs, from that at Whale Cove.

Porphyritic biotite-adamellite to biotite-hornblende-granodiorite plutons, Up to 10 km across, intrude this supracrustal sequence, displaying sharp contacts, stoping and veining. Further north, with increasing metamorphic grade, these plutons become foliated and sheared and, at the north margin of the belt, form a migmatite zone with biotite-quartz gneiss and later veins of pink granite.

Ripple-marked, white to pink orthoquartzite of the Proterozoic Hurwitz Group unconformably overlies the Kaminak Group in the centre of the mapped region.

In the Pistol Bay area, two pervasive phases of brittle to ductile shear occur with accompanying chloritization and silicification. A set trending 155" and dipping 75" W (S1), is offset sinistrally by a set trending 085° and dipping 65" N (S2). The latter also postdates the adamellite intrusions. Both phases of shearing have an associated, parallel fracture cleavage.

**Economic Potential**

1) In the Whale Cove area, the thin magnetite-chert beds at the top of the metabasalt sequence are potential hosts for syngenetic gold. Quartz veins, less than one metre thick, commonly associated with shear zones or the margins of granitoid intrusions, contain molybdenite or gold in association with chalcopyrite or pyrite. Pyrite-chalcopyrite and pyrrhotite-chalcopy rite assemblages are associated with numerous gossans.

2) Within the metasedimentary rocks of Wilson Bay, gold exploration should focus on closely-grouped magnetite-chert beds as well as pyrite, arsenopyrite and iron carbonate bearing shear zones in small gabbro stocks.

3) North of Pistol Bay, numerous gossans in mafic and felsic metavolcanic rocks mark pyrite-chalcopyrite and pyrrhotite-chalcopyrite mineralization associated with S1 and S2. Quartz-calcite, quartz-dolomite and quartz-iron carbonate pods and veins display a variety of trends but are closely associated with S2. These may contain pyrite, chalcopyrite, galena or gold. Several phases of quartz veining occur but pyrite and chalcopyrite mineralization tends to be associated with quartz veins showing an 060° trend. Pods of magnetite-pyrite are observed in metasedimentary screens within the metabasalts.

Exploration Activity

1) At Whale Cove, molybdenite and chalcopyrite showings were staked as the CAT and JAN claims for Tavane Exploration Ltd. in 1961, as the MAR claims for Marouba Holdings Ltd. in 1969, and as the HI and MINE claims by J. Antoshkiw in 1973; whereupon, they were transferred to Mount Alta Projects Ltd. The ANITA and MB claims were staked in 1976. On Term Point Island, an estimated 120 oz of gold was produced from a one metre wide quartz vein in 1918. The BSX claims were staked in 1986 and 1987 by Borealis Exploration Ltd. The AU claims were staked in 1988 by J. Antoshkiw.

2) 55 K/7 S, which is underlain by the metasediments of Wilson Bay, was acquired in 1984 as prospecting permits 1020 and 1021 by Canadian Nickel CO. Ltd. and the IGLOO claims were staked in 1986 to cover anomalous gold concentrations first discovered during 1983. The PD claims were staked by P. Duhamel in 1988.

3) The metabasalts north and west of Pistol Bay were prospected by "North Rankin Nickel Mines Ltd., who held 55 K/7 as Prospecting Permit 18 from 1961 to 1963. Development included the staking, sampling and trenching of pyrite-pyrrhotite and chalcopyrite bearing quartz veins and gossans, which showed low gold concentrations. The area was restaked as the MAR claims in 1969 for Maroubra Holdings Ltd. Further work included trenching and sampling of some gossan zones in 1.969 and 1970 (45 ppm gold in quartz vein 34), a ground EM survey in 1971 and a magnetic survey and drilling of EM anomalies in 1972. Some of the MAR claims were obtained by Five Star Petroleum and Mines Ltd. in 1971 and the PAIN and SCM claims were staked for Silver Chief Minerals Ltd. in 1981. The zones explored in 1970 were prospected in 1982 (up to 9 ppm gold in vein 31) and sampled by Laporte (1985; 20 ppm gold in vein 34). The ANT and SON claims were staked in 1985 by J. Antoshkiw and further assays were carried out (65 ppm gold in the Luke Sic Sic quartz-carbonate shear zone). These claims were transferred to Borealis Exploration Ltd. in 1987 who also staked the BSX claims to the north.

## Acknowledgments

Bill Padghàm and Ko Griep of Indian and Northern Affairs Canada, Geology Division were instrumental in initiating the project and have given consistent support in a consultative and expediting capacity. Land Resources, Indian and Northern Affairs Canada, and the Polar Continental Shelf Project are thanked for helicopter support. Excellent field assistance was provided by my senior assistant geologist, Doug Irwin, and by Aline Mongrain, Grace Fortowski and Fern Heitcamp.

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# THE UPPER BEAULIEU RIVER PROJECT

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## Project Definition and Previous Work

The Beaulieu River volcanic belt comprises an irregular shaped north-south zone centred approximately 150 km northeast of Yellowknife, NWT (Figure 3). South of 63oN latitude, the geology of this belt and adjacent rocks has been well defined (Henderson, 1985; Lambert, 1988). The recent discovery of massive sulphide deposits by Aber Resources/Hemisphere Developments and Silver Hart Mines/Ark La Tex Industries near Sunset Lake in the southern portion of the belt has revitalized exploration in the area. A three year MDA project has been undertaken to examine economic and structural aspects of the northern portions of the belt. The area between 63oN and 64°N latitude will be mapped at a scale of 1:50,000. Small parts of this area will be mapped in greater detail.

To the north of 63°N, major geological divisions are known from the 1:250,000 mapping of Miller et al. (1951). The geology of the Beniah Lake area (85 P/8) is reported by Padgham (1987, regional compilation) and by Covello et al. (1988). No other geological maps of the northern portions of the Beaulieu River supracrustal belt have been published.

Exploration has been remarkably limited during the last few decades considering the close proximity to Yellowknife and excellent water access in many areas. Hence, few detailed assessment reports are available for descriptions of mineral occurrences. The most significant gold showing is on the Wolf Claims (Figure 3). Exploration has increased within the southern portions of the belt in recent years due to the Sunset Lake discoveries. Figure 3 outlines claims in good standing in the area.

## Preliminary Results of MDA Mapping

### General Geology

The area of 1988 mapping is delineated in Figures 3 and 4 and covers portions of NTS map sheets 85 P/1&2. The rocks comprise granitoids, gneisses, volcanic rocks and minor metasediments, all of Archean age.

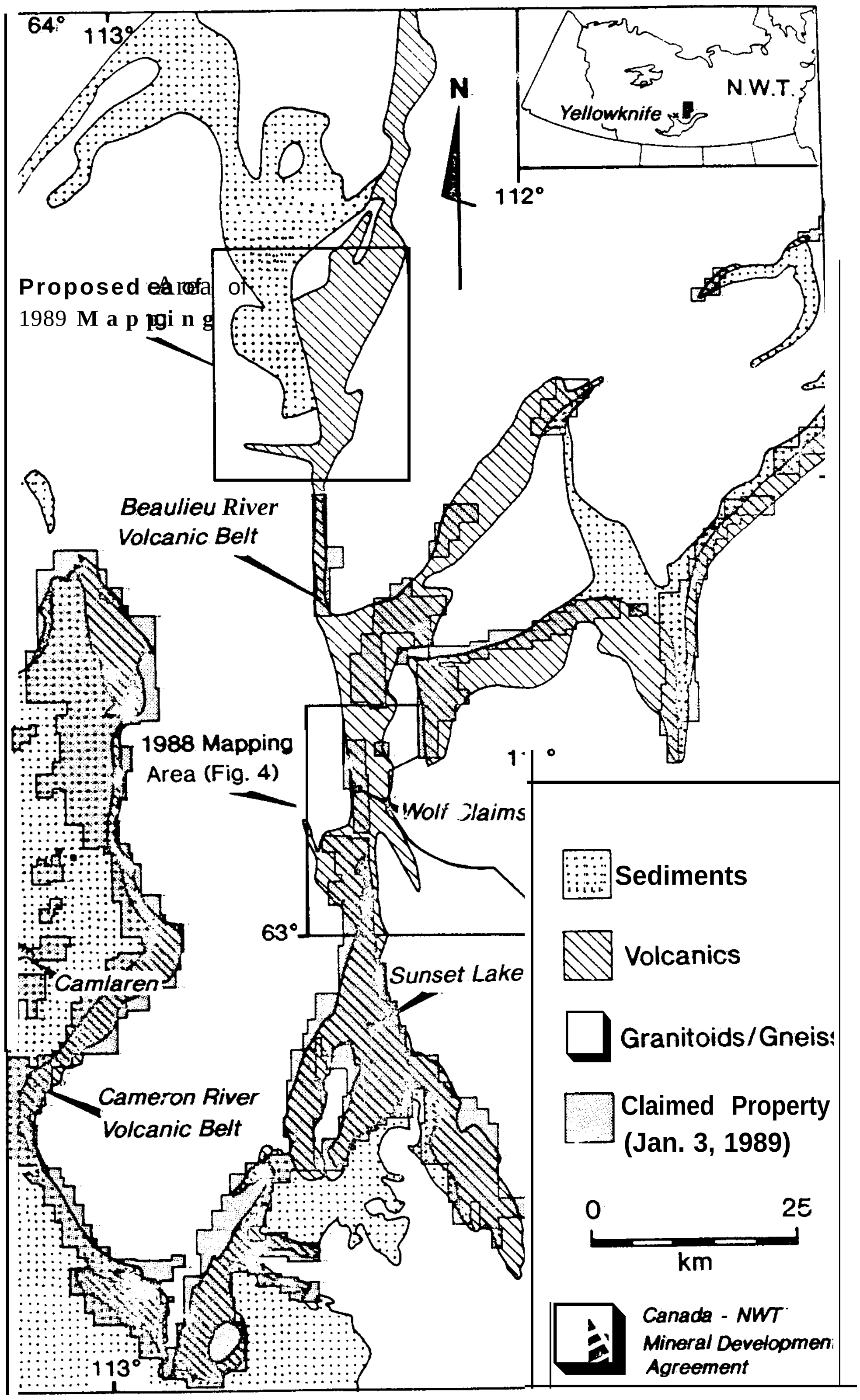


Figure 3. Location map and regional geology of the Beaulieu River area. Geology after J.B. Henderson (1985), J.F. Henderson (1941) and Miller et al. (1951).

Homogeneous and unfoliated granitoids are present as isolated intrusions and as a component in the more common heterogeneous granitoid complexes. The heterogeneous granitoids contain numerous inclusions of metamorphosed volcanic and sedimentary rock and, hence, are not considered basement. In general, a single foliation is apparent in 9outcrop and it remains consistent in orientation, although not in intensity, across various lithologies. Strongly gneissic rocks lacking visible inclusions are less common, the largest exposures are in the southwest of the map area (Figure 4).

Variably metamorphosed and strained intermediate to mafic pillows dominate the volcanic exposures. Their contact with the heterogeneous granitoids can be either transitional as in the northeast of the map area (Figure 4) or discrete and fault-bounded. Relatively rare felsic volcanics appear in three narrow (150 -200 m) zones and as minor interbeds within the mafic sequences. Ultramafic rocks are recognized only in one small and isolated zone east of the main volcanic belt.

Two metasedimentary formations have been identified (Figure *4).* The largest of these forms spectacular outcrops of weakly altered quartz arenites and polymictic conglomerates along the Beaulieu River system. The preserved thickness of this formation is estimated as 1,200 to 1,500 m and it is believed to unconformably overlie a thick 9sequence of mafic volcanic rocks. Paleoplacer deposition has resulted in anomalous concentrations of gold and other heavy elements throughout the sedimentary formation (Roscoe et al., 1989).

Structural Aspects

In general, only one foliation is evident in most outcrops of the map area. The dominant foliation is commonly consistent in orientation throughout a broad region. However, a complex folding history of the belt is revealed by three phases of folding within the uppermost metasedimentary formation (Roscoe et al., 1989).

A system of late-stage faults has delineated several "domains" within the volcanic and adjacent gneissic/granitoid rocks (Figure 4). Domain boundaries coincide with mapped fault or shear zones, or with strong photo lineaments, and separate blocks with distinct differences in a combination of the following: a) lithology/stratigraphy, b) fold style and 9orientation, c) strain history, d) younging directions and, less commonly, e) metamorphic grade and f) economic mineralization. The post-foliation boundary faults have typically northwest, northeast or north trends. The sense of major movement on the youngest north-trending set is subhorizontal and sinistral. The faults offset all lithologies and fold structures and are presumed to be of Proterozoic age. It is proposed that much of the irregular outline of the Beaulieu River volcanic belt (Figure 3) can be attributed to these late-stage faults.

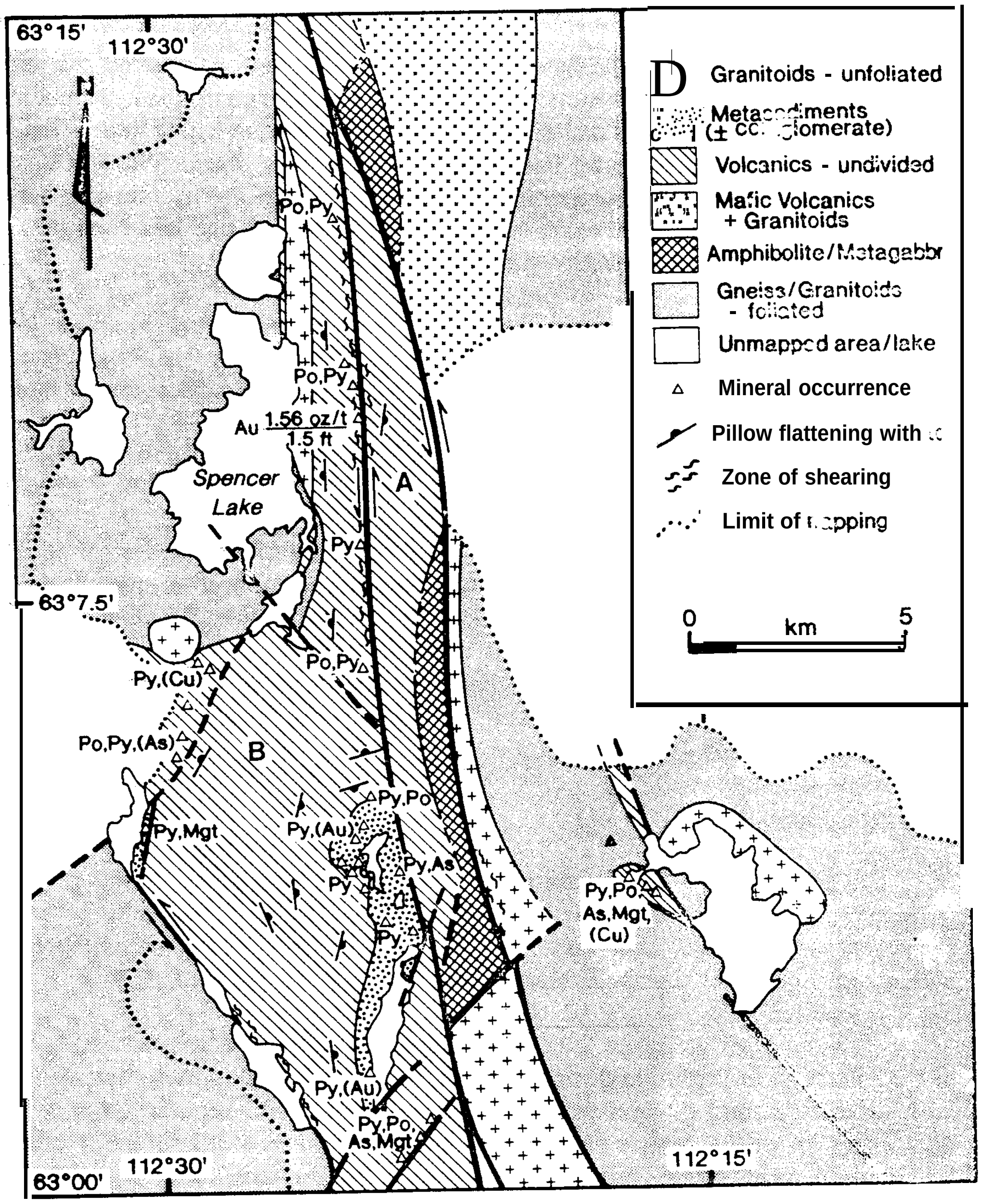


Figure 4. Generalized geology of the central Beaulieu River volcanic belt and adjacent area, NTS 85P/1&2, with major mineral showings.

The domain-boundary faults are variable in character. 1) Where bounding two granitoid domains, the faults commonly are wide (locally exceeding 150 m) zones of brecciation "and quartz infiltration. Specular hematite is a common accessory mineral. Small blocks or "islands" of highly altered volcanic rock may be incorporated in the widest breccia zones. 2) Where separating volcanic and granitoid domains, the faults are also scharacterized by abundant quartz. The quartz can occur in wide zones (50-100 m) of thin veinlets or in narrow zones (<10 m) of thick veins. 3) Boundary faults wholly within volcanic rocks have a variety of forms. Irregularly oriented quartz-epidote veins are common adjacent to some faults. Margins of a carbonatized mafic volcanic domain (A in Figure 4) exhibit spectacular shear fabrics including pervasive calcite-filled fractures.

A comparison of two volcanic areas reveals the discontinuity of domainal characteristics. In the south of the map area, a broad rhomb-shaped domain (B in Figure 4) is characterized by multiple folding, younging reversals and indivisible lithologies. To the north of this domain, the volcanic belt narrows abruptly into a zone of thin northerly-trending units with distinctive lithologies (Figure 4). Intense shearing and pervasive vein development are common locally. Pillowed lavas young away from the centre of the zone and towards the bounding gneisses and granitoids. This precludes interpretation of the supracrustal belt as a synclinal remnant between basement gneisses. The non-repetition of distinctive units across the zone also suggests a simple anticlinal structure is unlikely. sIt is proposed that this narrow zone comprises numerous fault slivers juxtaposed at a late stage in the tectonic history.

Economic Potential

Numerous gossans within the Beaulieu River volcanic belt of the study area suggest "detailed prospecting and sampling could yield favorable results. Promising polymetallic deposits near Sunset Lake, only 12 km to the south, illustrate the potential of the belt. The Aber Resources/Hemisphere Developments deposit at Sunrise Lake may contain more than two million tons with approximate grades of 13% combined lead/zinc, O. l% copper, 12 oz silver and 0.028 oz gold per ton (Northern Miner, 1989). Within the present study area, prime targets for exploration include:

1) The metasedimentary sequence along the Beaulieu River system described above offers potential as a source and host for epigenetic gold deposits. Limited analyses sof typical pyritic quartz-pebble beds and polymictic conglomerates reveal up to 630 ppb and 497 ppb gold, respectively. Further sampling may reveal economic concentrations.

2) A narrow northerly trending zone of highly sheared and silicified volcanic rocks (just west of A in Figure 4) is host to numerous gossans of pyrite, pyrrhotite, arsenopyrite, and less commonly, magnetite and copper minerals. Significant gold concentrations in this zone are also known; Terra Mining and Exploration Limited (1974] reports Au values of 1.56 oz/ton across 1.5 feet (approximately 53 ppm across 0.46m) on the Wolf Claims.

3) An isolated block of intermediate to highly altered ultramafic volcanics in the east of the study area (Figure 4) is host to locally abundant sulphides and magnetite and should be explored by close-spaced geophysical surveys. This area is presently not staked.

4) The quartz veins associated with the late-stage domain-boundary faults warrant extensive prospecting and sampling.

At present, mineral exploration (as measured by claimed area) diminishes towards the north with increasing distance from the Sunset Lake deposits (Figure 3). There are no claims north of 63°30'N within the Beaulieu River volcanic belt or in the adjacent metasedimentary rocks (Figure 3). This vast area ( >50 km length) offers great potential for exploration.

Future Studies

Two further mapping seasons are envisaged under the present MDA. These will concentrate on the northern portions of the Beaulieu River volcanic belt and adjacent metasediments (Figure 3). The detailed geology and economic potential of this area is presently unknown. Preliminary aerial photo interpretation suggests the presence of numerous major faults. The economic potential of this area could be considerable because of the presence of volcanic rocks, presumably similar to those further south in the belt, and metasedimentary rocks which may be similar to those known to host gold elsewhere in the Slave province.

The geology of the region between the 1988 and 1989 mapping areas (Figure 3) is being addressed by D. Roach (Beniah Lake area, 85 P/8) under an MDA-funded contract. In combination, these two projects will yield economically oriented 1:50,000 geological maps of the entire northern portion of the Beaulieu River supracrustal belt.

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# The Lower Hood/James River Project

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## Introduction

Two metasediment-dominated belts in the lower Hood River and James River areas of Arctic Sound (76N) are to be mapped under the NWT-MDA program because: (i) exploration at Turner and Pistol Lakes was showing good potential for the region and knowledge of these occurrences would aid exploration, (ii) little if any mapping of a scale useful to the industry had been done despite the gold potential of the area and, (iii) an assessment of mineral potential would be worthwhile.

Mapping in the Torp Lake Belt began in the second week of July of 1988. Approximately 200 $km^2$ were mapped at a scale of 1:31,000 and 40 rock samples. were assayed. In 1989 the remainder of the belt will be mapped with some reconnaissance mapping of the surrounding granitic terrain.

In 1989 our base camp will be at McAvoy Lake early in the season and at Gels Lake, next to the Bathurst Fault, in late summer. Explorationists are most welcome to visit the base camp to discuss the geology of the region and receive up-to-date information. We are implementing a computerized mapping system which will provide current geological data and maps as the mapping progresses.

## General Geology of the Torp Lake Area

The Torp Lake area in the northern Slave Province is underlain by Archean metasediments and granitoids and Proterozoic diabase dykes and sills. Previous mapping in this area was part of a GSC helicopter-assisted reconnaissance of the northeastern Mackenzie District, which produced a 1:506,880 scale map (Fraser, 1964). Torp Lake is on the western edge of a triangular belt of Yellowknife Supergroup metasedirnentary rocks that are bordered by a granitic terrain to the west and south and the north-northwest trending Bathurst Fault system to the northeast (Figure 5). The Proterozoic Goulburn Group underlies the area further east. The contact between the plutonic complex and the supracrustal rocks is extremely irregular with lobes of granite and granodiorite partly or completely enclosing slivers of country rock up to 1 km long along the western contact. The long axes of the enclosed slivers are oriented north, sub-parallel to bedding in the adjacent strata. Granitic magma appears to have intruded as sheets along bedding planes without rotating blocks of country rock. Rare xenoliths of metasedimentary rock and amphibolite tend to be more common close to the edges of the intrusive complex.

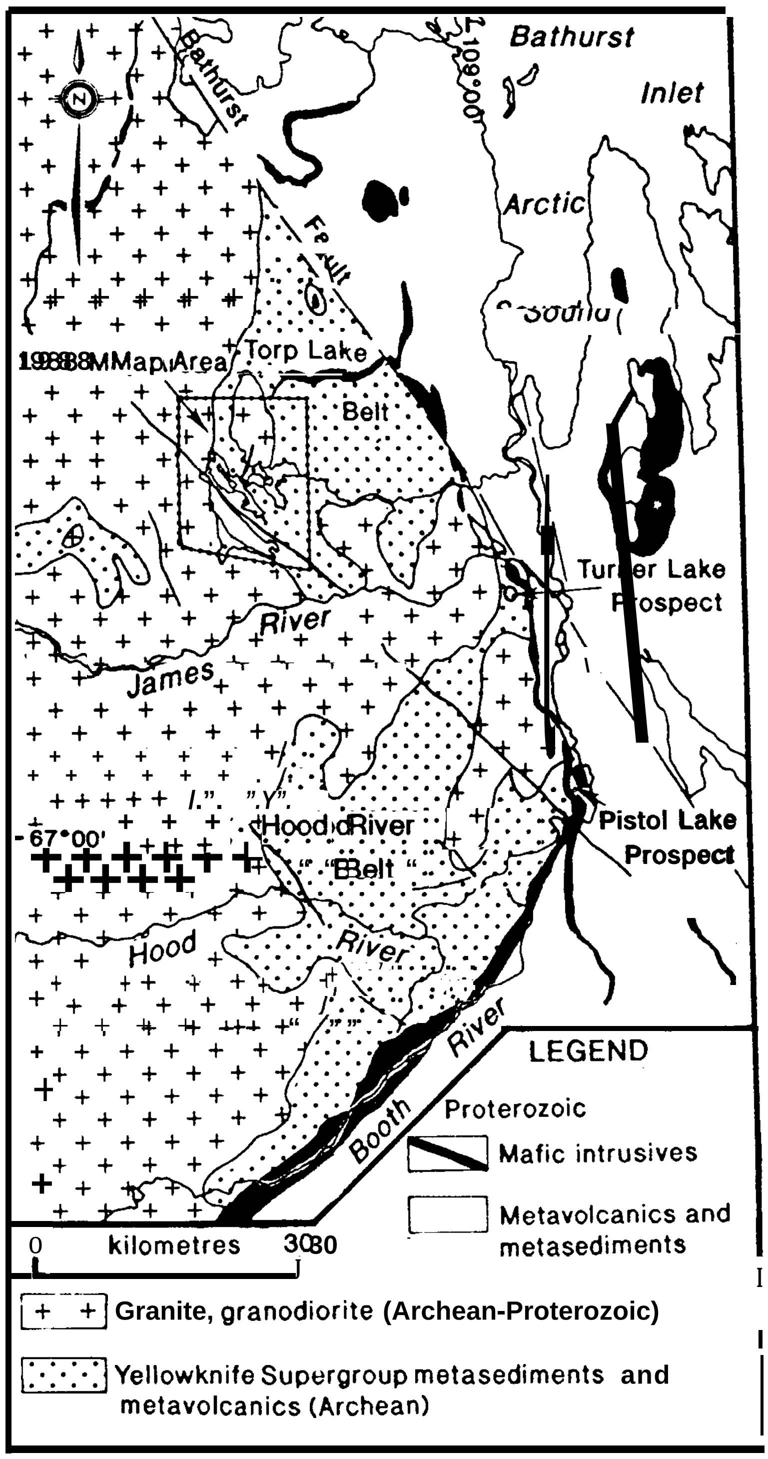


*Figure 5: Regional Geology*

The turbidites comprise thin to moderately bedded, fine-grained wackes, laminated and thin-bedded mudstone and siltstone and minor pebbly wacke. Sedimentary structures, including cross-laminations, cross-beds, slumps and scours, are common despite deformation and a high metamorphic grade (cordierite-amphibolite facies). Most metapelites contain porphyroblasts of cordierite or chiastolite or both.

A 1 to 4 km wide, northwest-trending gneiss belt, extending from the James River to Kunes Lake (Figure 6), is truncated by granite along its southern and western edges. The belt consists of discontinuous bands of paragneiss grading into metasediments typical of the rest of the region. An elongate granodiorite stock and tonalitic dykes have intruded parallel to bedding. Thoughout the belt, narrow tonalitic dykes intrude along bedding planes but younger pegmatite dykes, bearing muscovite, schorl, spodumene and rarely lepidolite, are usually more irregular and discordant.

The massive, fine-to medium-grained tonalitic dykes increase in number towards the western edges of the gneiss belt until these 0.1-10 m wide dykes account for over 40% of the rock. It is not clear whether these quartz-albite dykes represent products of metamorphic differentiation or anatexis; partial melting of the country rock and injection into a zone of brittle fracturing at the edge of the granite.

Strata in the northern half of the map area strike north to north-northwest and dip moderately to steeply on the limbs of tight to isoclinal, shallowly south-plunging $F_2$ folds that have sub-vertical to steeply-dipping axial planes. These folds appear to be several kilometres long but their continuity has yet to be confirmed. Strata in the southern half of the map area strikes northwest.

A bedding-parallel fracture cleavage/schistosity ($S_1$) that pre-dates these folds is deformed by fine crenelations and 1-5 cm amplitude open folds ($F_3$) with steeply-dipping, east-striking axial planes. The $F_3$ folds plunge within 15 degrees of vertical as does a faint stretching lineation defined by the long axes of deformed biotite porphyroblasts and pebbles. The pebbles are ellipsoidal with planes containing intermediate and major axes oriented sub-parallel to $S_1$. The minor folds and the lineation appear to post-date the end of the period of $F_2$ folding. An overprinting cleavage ($S_4$) in metapelite dips 45-60 degrees southeast and forms a sub-horizontal intersection crenelation on the $S_1$ cleavage planes.

A few steeply northeast to east-plunging open folds with 10-150 m amplitudes, rangular fold closures and northeast-striking, sub-vertical axial planes were found on the limbs of the $F_2$ folds. In addition, shallowly northeast-, east- and southeast-plunging, gentle to open folds with 1-20 m amplitudes were noted wherever shallow-dipping beds are exposed. The age relationships among the three different groups of post-$F_2$ folds as yet unresolved.

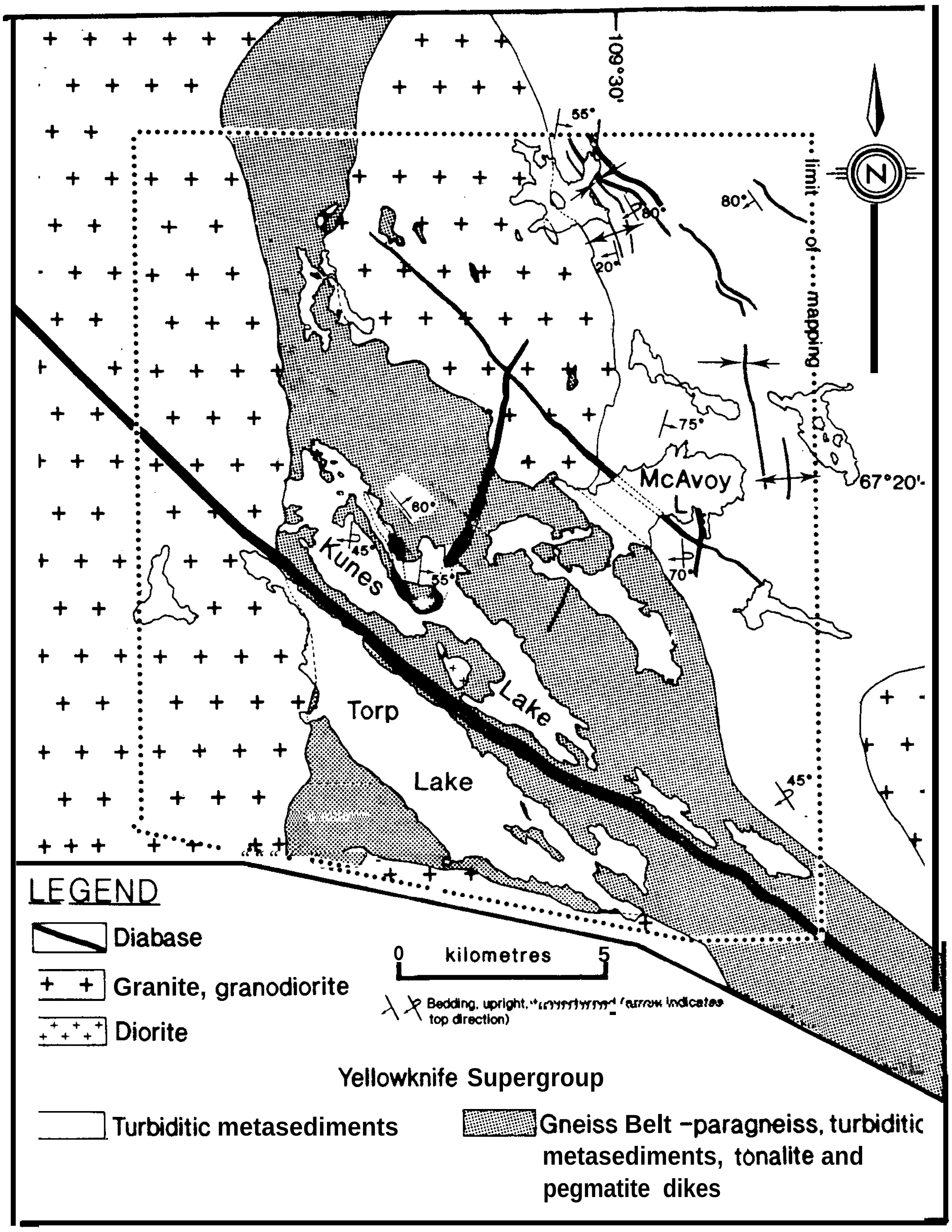


*Figure 6*: ***Generalized Geology of the Torp** Lake Area*

TABLE 3: PRELIMINARY DEFORMATION HISTORY

| MAJOR STRUCTURES | MINOR STRUCTURES |
|---|---|
| $D_1 F_1$? Folding in $D_1$ uncertain. | $S_0/S_1$ Bedding/fracture cleavage-schistosity. |
| $D_2 F_2$ Major tight to isoclinal folds plunging shallowly southward. | |
| $D_3 F_3$? 10-100m amplitude, steeply-plunging, open folds with either NE- or SE-striking, subvertical | $F_3$-$L_3$ Steeply-plunging stretching lineation, crenelation and 1-5 cm amplitude open folds with east-striking axial planes. |
| $D_4$ | $S_4$ Cleavage dipping 45-60 degrees SE and striking NNE to NE. |
| $D_5$? | $F_5$ 1-20m amplitude, shallowly-plunging gentle to open folds of variable orientation. |

Low concentrations of fine-grained pyrrhotite, arsenopyrite and chalcopyrite are disseminated in most of the area's metasedimentary rocks. However, narrow (<10 m) zones marked by gossans and enriched in pyrrhotite and particularly arsenopyrite can be found bordering quartz veins in the $S_{0/1}$-parallel fractures. Assays of 20 samples from such sulfide-enriched zones yielded no gold or silver values above 20 ppb.

Gold exploration in the Hood River Belt has concentrated on iron formations. However, the Turner Lake showings are not hosted by iron formation and the structural association cannot be overlooked. At both the Turner Lake and Pistol Lake properties, gold is concentrated in the hinge zones of steeply-plunging open folds with easterly-striking axial planes. Due to this, remaining emphasis will be placed on structural interpretation and the delineation and sampling of quartz veins within $F_3$ folds.

## Exploration Activity

### Hood River Belt

The Hood River Belt has been explored sporadically for gold since the early 1960's. Most of the activity and almost all of the diamond drilling has been in the Pistol Lake area. In brief, the work history is as follows:

1964-67: Roberts Mining Co.- defined 7 mineralized zones at Pistol Lake with two zones ("F" and Farney Lake) considered to have potential. The "F' zone was explored by 22 trenches an-d 8 diamond drill holes (2,257 feet) and the Farney Lake zone was investigated by 16 trenches. Significant assays from the trenches included 4.74 oz/t Au over 3 feet (Farney Lake) and in two "F" zone diamond drill holes, 4 intersections of 1.0-1.77 oz/t Au over 5 feet each. The company also prospected an area on the eastern side of belt and found gold in several places.

**1979-80:** Gold Fields Expl. Canada Ltd. - conducted a magnetic survey, mapped, enlarged trenches and blasted five new trenches at Pistol Lake.

1984-87: Silver Hart Mines Ltd. - conducted an airborne EM survey and 14 diamond drill holes were drilled at Pistol Lake which defined 18 intersections of Au mineralization. The combined reserves of the "F' and "G" zones are estimated to be 540,000 tons grading 0.406 oz/t Au.

1984-87: Echo Bay Mines Ltd. - staked the Dougall claims (3093 hect. on eastern side of belt), prospected, mapped and conducted magnetometer and VLF surveys. Four gold showings were identified with the most significant (Ted Showing) having values ranging up to 31.24 g/tonne (chip) over 139.18 m and grab samples of Up to 1389.18 g/tonne.

**1988:** Silver Hart-Chevron Joint Venture - Chevron Canada Ltd. enters into a $6.25 million option agreement with Silver Hart Mines Ltd. to explore the Pistol Lake and Turner Lake properties over the next three years.

The Turner Lake property has also been intermittently examined for Au potential since 1964. However, there has been a much lower level of activity here with diamond drilling by Silver Hart Mines Ltd. not starting until 1987. The Silver Hart-Chevron Joint Venture project, encouraged by the results of trench sampling and two holes with intersections of 0.375 oz/t Au over 29.1 feet and 0.432 oz/t Au over 15.6 feet respectively, intends to step up activity at the Turner Lake property believing in the potential of a large ore body.

Gold at both the Turner Lake and Pistol Lake properties is hosted by quartz veins with amphibolite or garnet-amphibolite margins. Associated sulfide minerals include arsenopyrite, pyrrhotite and pyrite. At the Pistol Lake property the aureferous veins are found along the base of an oxide iron formation and within a silicate iron formation. At the Turner Lake property they occur within an amphibolite, presently of uncertain primary lithology.

Torp Lake Belt

The Torp Lake Belt, although similar in lithologies and structure to the neighboring Hood River Belt, has seen virtually no exploration. Roberts Mining Co. prospected in the central part of the belt in 1964 and a small area (prospecting permit no. 358) in the eastern half of the belt was covered by airborne radiometric/magnetic and ground EM surveys by Uranerz Expl. and. Mining Ltd. in 1.975 and 1976. At that time, Uranerz conducted geological mapping along with bedrock and lak. sediment sampling Although prospecting found an arsenopyrite-rich quartz vein near the Bathurst Fault which ran 12.4 ppm Au and lake sediment samples with assays of up to 4100 ppm Zn, 700 ppm Pb, 1000 ppm Cu and 4.2 ppm Ag were obtained, the prospecting permit was dropped in 1978. Last summer, BHP-Utah Mines Ltd. commenced prospecting and mapping in the center of the belt on two prospecting permits.

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## Acknowledgements


We would like to thank Dr. W.A. Padgham and the Geology Division of the Dept. of Indian Affairs and Northern Development for assisting with logistical and technical support. A helicopter provided by the Polar Continental Shelf Project was very much appreciated as was its Associated Helicopters crew.

I was ably assisted in the field by Stan Beaubien (senior assist.), Susan Schaan, Valerie Arthur and Pat Messer (cook). Expediting from Yellowknife was well handled by Rod Stone (GSC), Lynn Parney (MDA) and Martin Irving (MDA Coordinator).

## Hope Bay Project

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### Introduction

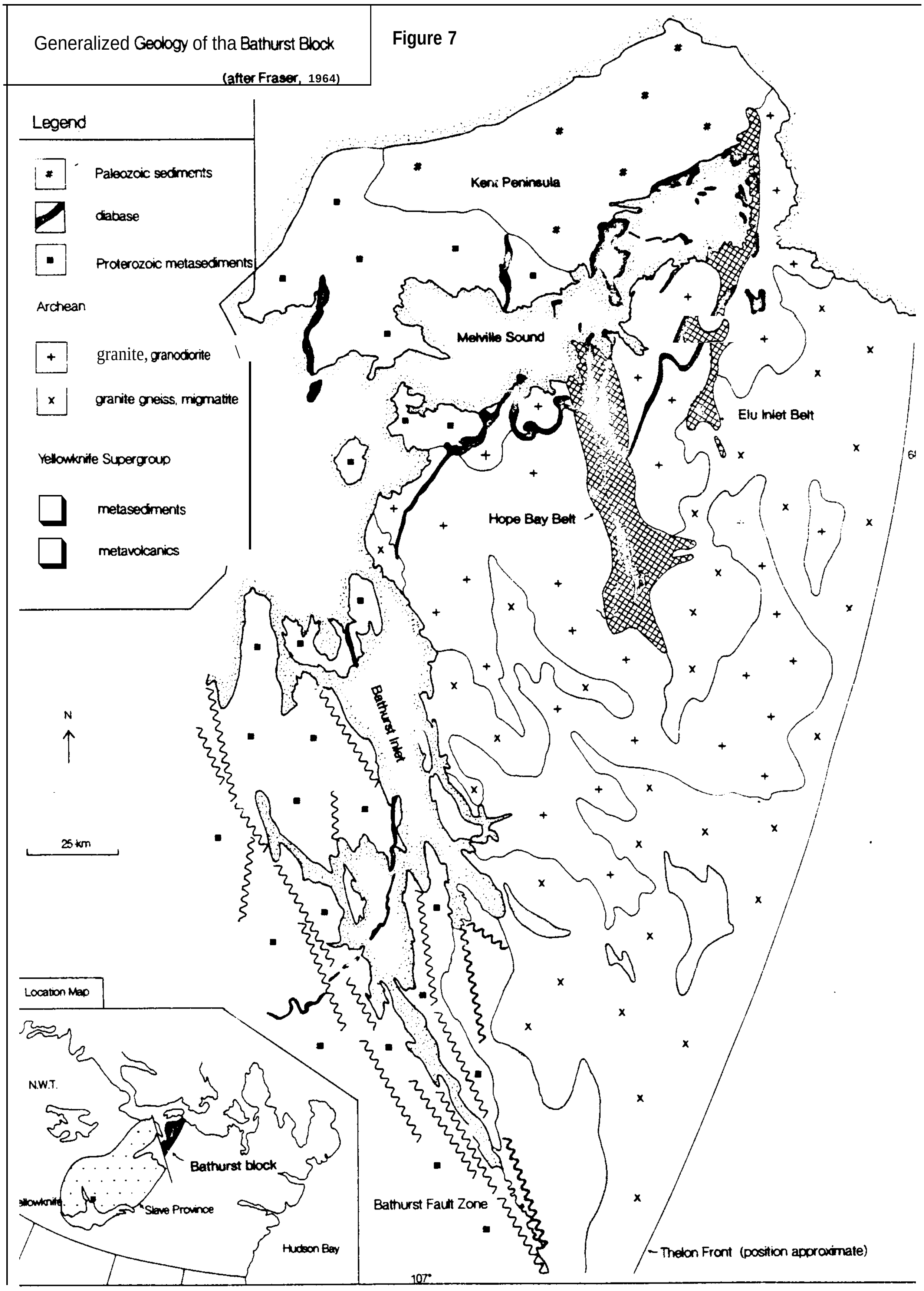
The metavolcanic belts of the Bathurst block (Figure 7: Hope Bay NTS 760, 77A, and Elu Inlet NTS 77A) were selected for an MDA study because their known geology compared favorably with other mineralized volcanic belts. Gold, silver and base metal showings have been recognized but systematic mapping has not yet been completed. This three year project undertakes to continue 1:50,000 scale mapping started by Gibbins (1987) in the northern Hope Bay metavolcanic belt. The project began in 1988 during which the southern portion of the Hope Bay metavolcanic belt was mapped. The central portion of the Hope Bay metavolcanic belt and the southern portion of the Elu Inlet metavolcanic belt will be mapped in the 1989 field season.

### Bathurst Block

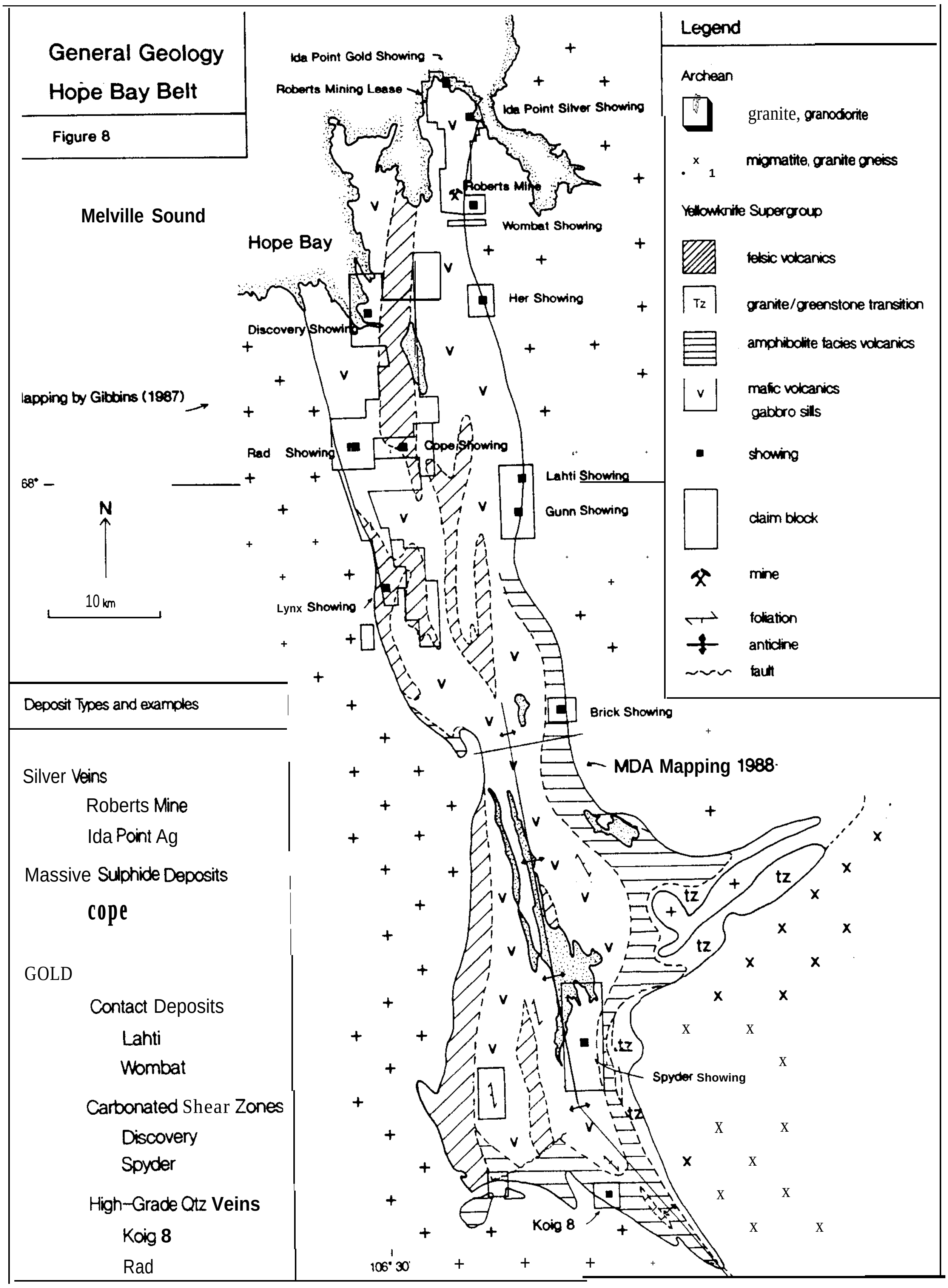
The Bathurst block (Figure 7) forms the northeast portion of the Slave Province. It is separated from the main portion of the Slave Province to the southwest by the Bathurst Fault Zone and by the Proterozoic sediments of the Kilohigok Basin. It is separated from the Churchill Province to the east by the TheIon Front and is covered by Proterozoic and Paleozoic sedimentary rocks on the Kent Peninsula to the north. The geology is known from 1:506,880 scale helicopter supported recconaissance conducted by the GSC during Operation Bathurst (Fraser, 1964). The majority of the Bathurst block is a granitoid and gneissic terrane with supracrustal rocks of the Yellowknife Supergroup occurring along the northeast and southwest margins. Exploration has focused on the base and precious metal potential of the metavolcanic belts, although since 1984 most exploration has been for gold in iron formations that occur in the metasedimentary units in the Tinney Hills area (NTS 76J).

### Mapping 1988: Southern Hope Bay Belt

The predominantly volcanic rocks of the Hope Bay area form a linear belt that extends southward for 80 km from tide-water at Melville Sound (Figure 8). This belt forms the drainage basin for the Koignuk River and is surficially expressed as a series of NNW-trending ridges separated by broad, drift covered valleys. The belt is enclosed by flat granitoid plains to the west, south and east. Outcrop exposure is good in the northern portion of the belt but decreases to less than 20% in the south.



Generalized Geology of tha Bathurst Block
(after Fraser, 1964)
Figure 7
Legend
Paleozoic sediments
diabase
Proterozoic metasediments
Archean
granite, granodiorite
granite gneiss, migmatite
Yellowknife Supergroup
metasediments
metavolcanics
N
25 km
Kent Peninsula
Melville Sound
Elu Inlet Belt
Hope Bay Belt
Bathurst Inlet
Location Map
N.W.T.
Bathurst block
Slave Province
Hudson Bay
Bathurst Fault Zone
Thelon Front (position approximate)
107°


General Geology
Hope Bay Belt
Figure 8
Melville Sound
Hope Bay
Ida Point Gold Showing
Roberts Mining Lease
Ida Point Silver Showing
Roberts Mine
Wombat Showing
Her Showing
Discovery Showing
lapping by Gibbins (1987)
Rad Showing
Cope Showing
Lahti Showing
Gunn Showing
68°
N
10 km
Lynx Showing
Brick Showing
MDA Mapping 1988
tz
Spyder Showing
Koig 8
106° 30'
Legend
Archean
granite, granodiorite
migmatite, granite gneiss
Yellowknife Supergroup
felsic volcanics
granite/greenstone transition
amphibolite facies volcanics
mafic volcanics
gabbro sills
showing
claim block
mine
foliation
anticline
fault
Deposit Types and examples
Silver Veins
Roberts Mine
Ida Point Ag
Massive Sulphide Deposits
cope
GOLD
Contact Deposits
Lahti
Wombat
Carbonated Shear Zones
Discovery
Spyder
High-Grade Qtz Veins
Koig 8
Rad

Greenschist facies mafic volcanic rocks and associated gabbro sills comprise some 70% of the outcrop exposure in the southern Hope Bay metavolcanic belt. Typical outcrops consist of deformed pillow lavas interlayered with massive flows and gabbro sills, In domains of low strain, pillow lavas display a complete range of volcanic textures including varioles, hyaloclastite, concentric cooling rims, drainage cavities, and amygdules. Along the eastern side of the belt glomeroporphyritic varieties of pillow basalt and gabbro are present. Shear fabrics in mafic volcanics are preferentially developed in pillow lavas and are accompanied by carbonate, chloritic and silicic alteration. A single ultramafic sill of peridotite occurs in the southern Hope Bay metavolcanic belt although ultramafic sills are common in the northern portion of the belt.

Many varieties of felsic volcanic rocks are present in the Hope Bay metavolcanic belt. Most common are feldspar porphyritic flows and sub-volcanic intrusions of dacite and rhyolite. Coarse volcaniclastic rocks, representing proximal facies are intermixed with the felsic volcanics. More distal facies of volcaniclastics including tuff, lapilli tuff and sandstones of volcanic origin are interbedded with both mafic and felsic volcanic rocks. Although felsic volcanic rocks are intercalated with mafic volcanic rocks, thick sequences of mafic and felsic volcanics are generally separated by drift covered valleys which may cover faults or shear zones. Shearing where present in felsic volcanic rocks is accompanied by sericitic and silicic alteration.

Sedimentary rocks consisting of conglomerates, arenites, wackes, shales and cherts outcrop at the northern end of the Hope Bay metavolcanic belt. At the southern end of this belt graphitic argillites containing iron-sulphides occur as thin lenses within pillowed mafic volcanic flows. Thicker sedimentary units consisting of graphitic and siliceous argillites and greywacke are known from diamond drilling of drift covered valleys.

Contacts between the metavolcanic belt and the adjacent granitoid terranes range from structural to intrusive. Structural contacts occur along. the northwest margin where felsic volcanic rocks are in fault contact with granitoid rocks to the west- Further to the south this contact becomes intrusive as the felsic volcanic rocks are cut by granite intrusions. The eastern margin of the southern Hope Bay metavolcanic belt is marked by a broad zone in which mafic volcanics are progressively transformed into amphibolites. Further to the east the amphibolites are intruded by granitic to granodioritic dykes in a transition zone.

## Structure

The southern Hope Bay metavolcanic belt is characterized by a strong, subvertical, NNW-trending regional foliation which generally parallels the long axis of the belt. Deviations from NNW occur along the eastern margin of the belt adjacent to a granitic intrusion and also along the southern contact of the belt. Pillow elongations, shearing and lithologic contacts are mostly parallel to the regional foliation. Pervasive shearing and elongation of pillows has obscured many top indicators, however, available data suggests an anticline occurs at the centre of the southern belt (Figure 8). Large-scale fold closures are not apparent in outcrop, although minor folds which fold the regional foliation and plunge moderately to the north or south are locally developed. It is probable that structural breaks underlie NNW-trending valleys. Parts of the southern belt exhibit a weak set of east- to northeast-trending, subvertical fractures. This fracture set becomes stronger in the northern portion of the belt where it is a plane of weakness exploited by auriferous quartz veins. The outline of the Hope Bay metavolcanic belt has been modified by late northwest- and northeast-trending faults that are responsible for offsets of the contact of the belt.

## Annotated Exploration History: (refer to Figure 8 **for property locations)**

1962: Hope Bay and Elu inlet metavolcanic belts are first mapped by the GSC during Operation Bathurst.

1963-1966: Exploration and prospecting in the Hope Bay metavolcanic belt by Roberts Mining Company discovers several gold (Discovery, Angie, Her, Brick, Noel) and silver (Ida Point Ag, Roberts Lake) showings.

1967-1969: Further deposit evaluation and prospecting is carried out in the Hope Bay metavolcanic belt by Duncan R. Derry for the Hope Bay Syndicate. The E-claims are staked in the Elu Inlet metavolcanic belt, but at the end of this period of exploration the most promising showings were at the northern end of the Hope Bay metavolcanic belt.

1972-74: The Hope Bay Mining Company acquires a mining lease for the area around the Roberts Lake Silver Showing from the Roberts Mining Company and the Hope Bay Syndicate. Limited silver production (10,000 oz) from the Roberts Mine occurred in 1973-74.

1980: Ida Point Minerals through Derry, Mitchener and Booth begin a two year exploration program in the Hope Bay metavolcanic belt. Silverhoarde Resources Ltd. re-evaluates the E-claims of the Elu Inlet metavolcanic belt for Cu-Mo.

**1981-1983:** Noranda Exploration Ltd. begins an exploration program in the Hope Bay metavolcanic belt. Initial work includes an aeromagnetic survey and claim staking. Through a joint venture with Lynx Canada Exploration/ Ida Point Minerals Noranda acquires the rights to most base metal claims in the Hope Bay metavolcanic belt. Three years of exploration, geophysics and drilling fail to find a significant deposit.

1987-1988: Abermin Corporation Ltd. begins a gold exploration program in the northern Hope Bay metavolcanic belt. This program later expands to cover the southern portion of the belt and results in the discovery of the Spyder showing.

**Current Activity: Many** of the gold showings found by Roberts Mining Company in the northern Hope Bay metavolcanic belt are staked. However, many of the claims in the central and southern Hope Bay metavolcanic belt have lapsed leaving large areas of open ground. There are no claims 'in good standing in the Elu Inlet metavolcanic belt.

Mineral Deposit Types and Mineral Potential

Gold

**Granite/Greenstone Contact Deposits:** Several gold showings (Wombat, Her, Lahti, Gunn, Brick) are localized along the northeastern granite/greenstone contact. Best gold assays come from narrow quartz and quartz-carbonate veins which cut shear zones along the granite-greenstone contact.

**Carbonated Shear** Zones **in Mafic Volcanics**: Several large, NNW-trending carbonated shear zones occur in mafic volcanic rocks in the Hope Bay belt. The shear zone which hosts the Discovery showing is 500 m long and up to 30 m wide. Gold is associated with quartz and quartz-carbonate veins up to 30 cm wide. Gold assays of 0.39 oz/ton over 1.9 m and silver assays of 2.72 oz/ton over 1.1 m have been obtained (Everett and Hase, 1965).

**High-Grade Quartz Veins:** Several small, high-grade auriferous quartz vein showings are noted in the Hope Bay belt (Rad and Koig 8). The quartz vein on the Koig 8 showing is 5 cm wide and 50 m in length. Grab samples from this vein have assayed as high as 16 oz/ton gold (Everett, 1982). These high-grade quartz veins may be part of larger unrecognized shear zones.

Gold showings occurring at the granite/greenstone contact have so far been found near the eastern contact in the northern half of the Hope Bay belt. The broad transition zone of the southeastern contact may preclude this deposit type from this portion of the belt. Carbonated shear zones that are cut by auriferous quartz veins have been found in both the southern and northern Hope Bay belt. It is likely that more of these potentially auriferous zones are hidden by drift covered valleys. High-grade auriferous quartz veins are not economically important because of their small size. It is possible that these veins may mark the peripheries of larger unrecognized shear zones.

Silver

High-grade native silver veins occur in an east-trending fracture set in mafic metavolcanics. Sulphide mineralization is reported to occur in the mafic metavolcanics and the silver veins were once capped by a Proterozoic diabase sill. At the Roberts Silver Mine native silver occurs in pockets in a carbonate vein up to 1 m wide (Hase, 1966).

Silver veins are a small but attractive exploration target. Past exploration for silver veins was hampered by their small size, and by the lack of geophysical and geochemical survey responses. If silver veins are related to diabase sills they will most likely be restricted to the northern portion of the metavolcanic belts where diabase sills occur.

Volcanogenic Massive Sulphide (VGMS) Deposits

The Hope Bay metavolcanic belt is considered to have good exploration potential for VGMS because of the presence of felsic volcanic rocks. The Cope showing, a distal VGMS deposit discovered during the 1981-83 phase of exploration, assayed 0.53% Cu, 1.8% Zn, 0.16 oz/ton Ag and 0.008 oz/ton Au over 1.1 m (Wark, 1983).

Volcanogenic massive sulphide deposits were not noted in the southern part of the Hope Bay metavolcanic belt. This may reflect the separation of mafic and felsic volcanic rocks by faults or shear zones. The potential for this type of deposit may be higher in the central part of the belt where the primary inter-bedding of mafic and felsic volcanic rocks is preserved.

Co~Per-Molybdenum

Several Cu-Mo showings occur along the eastern contact of the Elu Inlet metavolcanic belt. At Kip Lake, granodiorite is cut by a pegmatitic phase of granite. Quartz veins associated with the pegmatitic phase carry py-mo-cpy. Several high Mo grades are reported from grab samples (up to 3.45 % $MoS_2$), however the distribution of the mineralization is erratic (Senkiw and Weir, 1980).

Cu-Ni-PGE

High-magnesium peridotite sills are most common in the northern third of the Hope Bay metavolcanic belt and may have Cu, Ni, PGE potential. To date significant sulphide minerals have not been identified in these sills. Altered phases may be suitable for carvingstone.

Acknowledgements

The Hope Bay project would like to acknowledge the scientific, logistical and organizational support provided by DIAND geology. This project is particularly indebted to Walter Gibbins (DIAND) who concieved the project after mapping in the northern Hope Bay metavolcanic belt (Gibbins, 1987), and who generously contributed this time ant! experience during the 1988 field season. The project was also assisted by Simon Leclair, Robert Wright and Bill Van Breugal.

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# Indin Lake Project

## Introduction and Previous Work

The Indin Lake Supracrustal Belt is located 200 km NNW of Yellowknife near the western margin of the Slave Province (Figure 9). The geological setting of the Indin Lake Belt has been described in the preliminary report of R.A. Frith (1988) and is covered by GSC maps by M.S. Stanton et al. (1954), L.P. Tremblay et al. (1953), G.M. Wright (1954) and C.S. Lord (1942). Assessment reports by companies referred to below have been helpful in assembling the material presented here. In 1988 the north-central part of the Indin Lake Supracrustal Belt was studied (Figure 9); this part contains about three-quarters of the known mineral occurrences in the belt. At present gold is the most economically important mineral in the area by far.

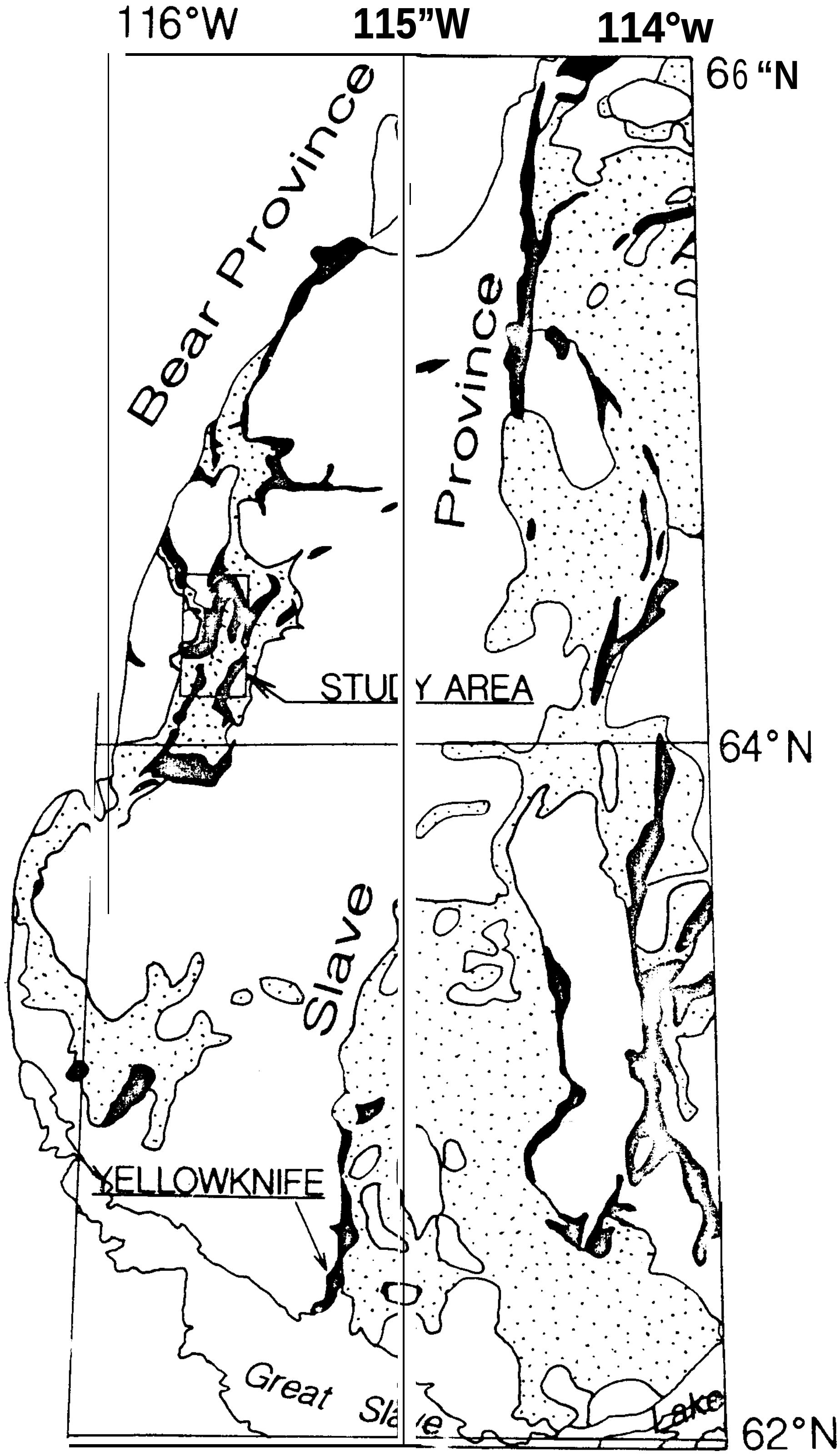
## Exploration and Mining Overview

Gold was first discovered near Indin Lake in 1937; in the mid to late 1940's the Diversified, North Inca and Colomac deposits were explored underground by, respectively, Diversified Mining Interests Canada, North Inca Gold Mines and Colomac Yellowknife Mines.

The following summary covers the largest deposits (locations in Figure '1 O); company name given in each case is most pivotal or most recent developer.

1. Spider Lake Property (Treasure Island Resources): Gold was discovered here in 1945 by A. Gamble and others; 18000 feet of drilling in the late 1940's (Spinet) was followed by 14000 feet in the 1980's (Treasure Island & Mahogany Minerals). Several zones were estimated to contain in total 110000 tons averaging 0.41 oz/ton. Taiga Consultants recently carried out a drilling program on the property.

2. Colomac Deposit (Neptune Resources Corp.): Gold was first found in 1945 in quartz veinlets within the Colomac Dyke. Between 1945 and 1947, 47000 feet were drilled and 2500 of underground workings were developed. In 1974 Cominco (option from Discovery & Hydra) carried out 9400 ft of surface drilling around the entrance to the underground workings. A decade later, Neptune Resources Corp. optioned the property and drilled closely spaced holes over a large portion of the Colomac Dyke, bringing development to a point where an open pit mine is planned for 1989. Reserves total approximately 27 million tons at a grade of 0.056 oz/ton.




# Figure 9: Regional Geology

Archean: volcanic- dark, sediment– stipple, granitoid– white

0 km 100

3. Cass Deposit (Echo Bav Mines): Immediately following discovery by surface prospecting, intensive drilling by Echo Bay Mines in 1986 and 1987 outlined a 6000-ft-long by 300-ft (max) wide metagabbro unit with gold mineralization over a strike length of 985 ft averaging 16 ft wide. Drilling indicated that mineralizaation persists to a depth of at least 690 ft.

4. Kim Main Deposit (Echo Bav Mines): Originally trenched and drilled by Lexindin Gold Mines, the claims lapsed in 1951 and were developed by Comaplex after 1981. The property was optioned by Echo Bay Mines in 1984; their drilling indicated that mineralization persists to a depth of 1200 ft and established reserves of 3 million tons at a grade of 0.24 oz/ton.

5. Diversified (Lintex): First discovery was in July 1945 and 19000 ft drilled in 1945-47 indicated 118000 tons at 0.45 oz/ton. A 525-ft shaft was sunk in 1947-1949, however the deposit was found to be too small to justify continued exploration.

6. North Inca (Lintex): The Main Zone under Indin Lake was found by drilling south from the Diversified mine's Number 3 Deposit. Gold-bearing quartz veins were felt to be sufficiently abundant to justify digging a 320-ft shaft and 200 ft of lateral workings in 1948-49; grades proved to be erratic and the mine never got past the development stage. Golden Rule Resources was active on the property in 1987/88.

**General Geology**

There are two major units of metavolcanic rock trending north to north-northeast through the study area (Figure 10). Each unit is composed mainly of mafic volcanics; a significant amount of felsic volcanics is also present, including several units of volcaniclastics.

Mapping and compilation has indicated that each of the major metavolcanic units is at the axial trace of a major anticline (defined by younging directions mainly in the volcanics). The axial surface in the more easterly of the two units approximately coincides with that unit's western margin; the anticline in the other (western) unit follows its eastern margin.

The two volcanic units converge and almost join together at the north end of the map area, where they are separated by a narrow strip (fault block?) of metasediments. The two units appear to have been one unit that in the plane of the erosional surface have been separated and have also acquired a "U" shape convex to the north. This interpretation is supported by the position of the major anticlinal trace consistently along the inner margin of both sides of the U. The exact sequence of events to arrive at the observed geometry is unknown. The curvature of the "U" could be due to either buckle folding or drag folding.

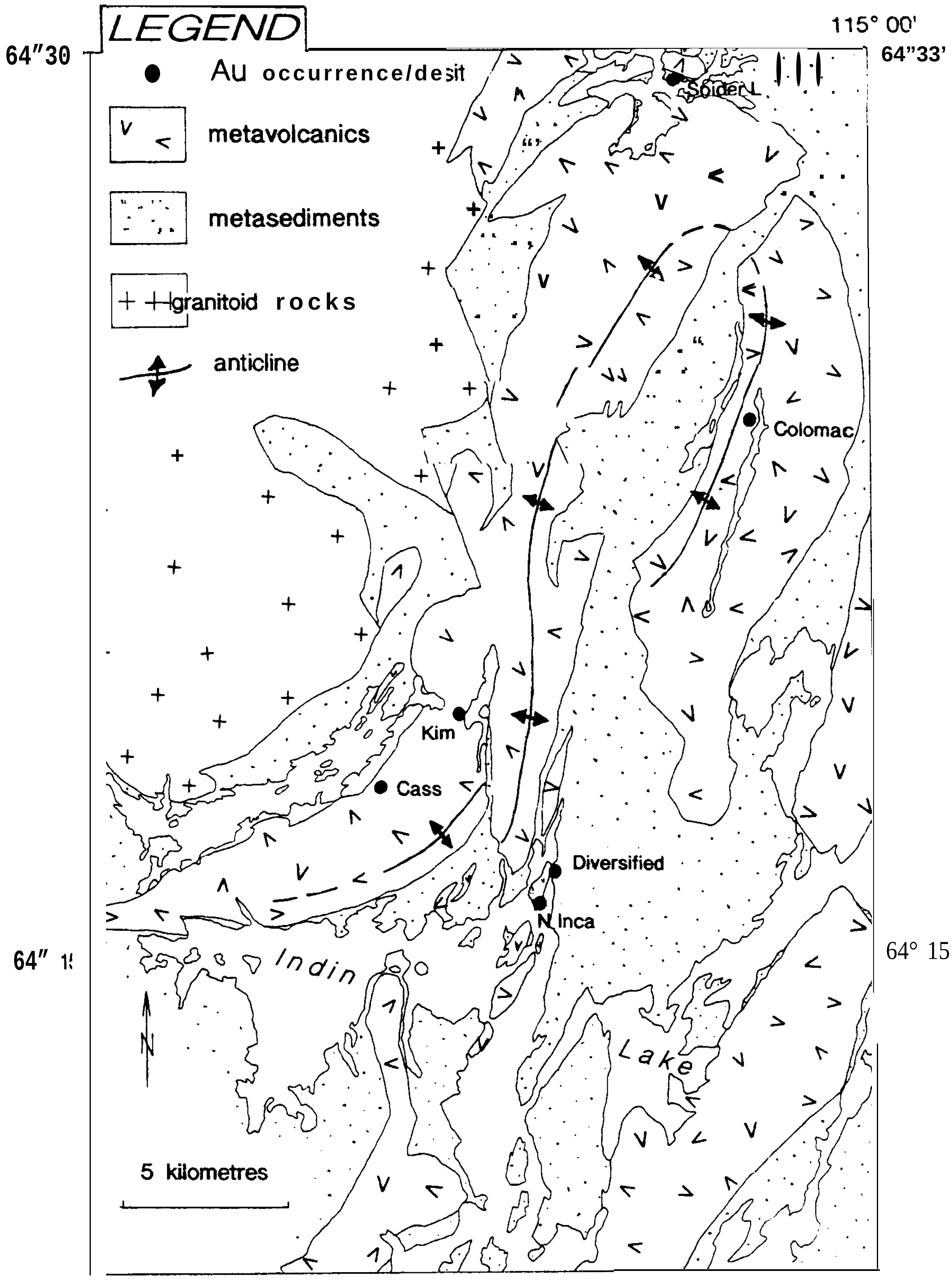



**Figure 10: Sketch map of northern part of Indin Lake Supracrustal Belt**

Sedimentary and volcanic rocks interfinger on a variety of scales ranging from metres to kilometres. At least some of the units are in fault contact. Top reversals in the sedimentary rocks are more closely spaced than in the volcanic rocks (this is probably a result of relatively closely spaced layering; in the volcanics there are typically no layers able to buckle on scales less than 100's of metres). The deformation style in the metasediments is complex and involves not only buckle-folding but also disruption and brecciation of psammitic beds and other competent units. This complexity has made it difficult to identify major anticlines and synclines in the sedimentary units.

In the central part of the study area, two sets of syn- to late-metamorphic faults have been identified: relatively early, variably striking, steeply dipping faults (Set 1) which follow lithologic contacts; and later north-northeast striking vertical faults (Set 2). The two sets are difficult to distinguish where lithologic contacts strike north-northeasterly. Down-dip stretching lineations are present in both fault sets, indicating steep to vertical slip vectors. In the first set the lineation intensity tends to be subequal to foliation; in the late set lineation is typically less intense than foliation.

Set-2 shear zones contain areas with weak to non-existent lineations; even where well developed, lineations in Set-2 shear zones are often not obviously stretching lineations. It is possible that a late stage of motion on the Set-2 faults was horizontal, taking over from earlier vertical motions. Set-1 faults have evidence of vertical movements only.

**Economic Geology**

The gold deposits examined to date fall into two main classes; the distinction is made on the basis of structure, The first type (Type 1 and Sec. 1 below) consists of networks of quartz veins in and adjacent to relatively brittle rock bodies. Examples are the Colomac Dyke (an intrusive sheet of intermediate composition in mafic volcanics and intrusive) and the Gamble Dyke (rhyolite or other fine-grained felsic rock in turbidites; referred to as rhyolite here for convenience).

Deposits of the second type are in quartz-carbonate vein systems associated with faults. This class may be subdivided according to the lithology in which the mineralization and attendant shear zones occur. Two of the deposits introduced above, the Kim and Cass, are in or near Set-1 shear zones in the SW part of the western volcanic unit (Sec. 2A). Two other deposits, the Diversified and North Inca, are near a Set-2 shear zone on either side of a volcanic-sedimentary contact (Sec. 2B).

1. Vein Systems associated with Brittle Rock Bodies

The most spectacular example is the Colomac Dyke, the largest of several felsic to intermediate intrusive sheets that occur in an 8-km by 0.6-km intrusion that ranges in composition from gabbro/diorite to "tonalite" (exact confirmation of this composition awaits cutting of thin sections). Along most of its length, the dyke forms the eastern margin of the intrusion; the intrusion as a whole approximately coincides with the hinge zone of the major anticline in the volcanics.

Numerous planar, slightly deformed white and smoky/white quartz veins cut the tonalite. Gold appears to be concentrated in the tonalite along the margins of relatively narrow veins; these consist in part of smoky quartz. Thick ( greater than 5 cm) white veins are barren. The veins that contain smoky quartz also contain bands and veinlets of white quartz at random orientations; many contain chlorite seams and selvages parallel to the length of the veins. The most numerous veins dip to the northeast; these show evidence of vein-parallel shear with the down-dip component having a thrust sense.

A second example of this type of vein system is the Gamble Dyke, a "rhyolite" sheet within metasediments at Spider Lake. Cm-scale quartz veins are present within the sheet; they cross into the metasediments on either side and at the same time branch out and become finer in the direction away from the rhyolite; further in the progression they disapper (become microscopic?) in the metasediments (see Phendler 1983). The volume of introduced quartz is high even in places where the quartz is extremely fine (Phendler 1983). One possible interpretation is that a pressure shadow adjacent to the block of mafic metavolcanics on Treasure Island has caused or localised the dilation, with different results in the metasediments and rhyolite, owing to differences in deformation properties (cf. Ramsay 1980).

In both cases above, ductility contrast has played a role in the localization of the quartz veins and zones of alteration. In the case of the Gamble Dyke, the rhyolite is more brittle than the surrounding pelitic metasediments. In the case of the Colomac Dyke, both the diorite west of the dyke, as well as the mafic volcanics to the east, are more amphibole-rich, and hence more ductile, than the dyke itself. Although in the both cases, the rocks on either side of the respective brittle or competent unit are strongly deformed, neither case involves a regional-scale fault.

2A. Vein Networks in Shear Zones in Mafic Volcanics

Examples are the Kim and Cass Zones, as well as numerous deposits on the north shore of Indin Lake. Kim and Cass are in or near Set-1 shear zones; some other occurrences are in Set-2 shear zones. Emplacement and deformation of the gold-bearing quartz veins in these deposits has obvious connections to the "regional" deformation. The most highly deformed veins are characterized by: ribbon structure, typically folded on a scale of centimetres with subvertical axes and highly variable axial planes; strong subvertical mineral and mineral-aggregate lineations within and on either side of the vei ns; and, finally, serrated, crenelated and/or grooved contacts between the vein material and the host rock as well as between different phases (quartz/sulphide; quartz/white carbonate; white/rusty carbonate etc.) that exist within each vein. The veins are steep to vertical, and linear features associated with them plunge down dip.

The Kim zone is somewhat similar to the Cass zone, but is more irregular, having for example no clearly predominant strike of shear zones associated with the quartz veins. The least deformed quartz/carbonate veins are less deformed than at Cass and are also shallower dipping; this applies to both the ore zone and to the surrounding rocks around Lex Lake. Virtually undeformed tension veins in the volcanics (and associated subvolcanic intrusions) are easy to find around the Kim Main Zone, but rare around Cass. Therefore the area of the Kim Zone includes less deformed rocks than the Cass.

2B. Vein Networks in Late Shear Zones

The deposits at the Diversified and North Inca mines are the most developed gold occurrences on Indin Lake. Several non-contiguous ore bodies are accessible from each mine or have been drilled within a few 100 metres of each of the shafts; "none of the bodies appear to be as continuous as the Kim or Cass deposits. This may be an indication of the fact that the gold distribution is highly fragmented in three dimensions. A subsidiary deposit accessible from the North Inca mine ("A" Zone) is located in the volcanics immediately west of the sedimentary contact and outcrops on the surface at the tip of the peninsula south of Leta Arm.

The main mineralized body in each mine is located in metasediments a few 1 0's of metres east of the eastern contact of a small volcanic unit (satellite to main U-shaped volcanic unit described above). The mineralization is associated with a group of interbraided Set-2 shear zones which together comprise the Leta Fault and its branches. The shear zones are typically oblique to older features such as penetrative foliation. Subsidiary faults within larger-scale Set-2 zones tend to weave in and out of older structures. The zone of faulting extends from Leta Arm southward through islands in Indin Lake.

The shear zones have vertical lineations which are typically weak compared to foliation ("L less than S"), however rigorous strain analysis has yet to be done over most of the zone of faulting. On regional geology maps the Set-2. faults are parallel to northerly and NNE-trending sinistral transcurrent faults. The Set-2 faults and associated shear zones are not to be confused with the younger sinistral NW- to NNW-trending faults that are shown on the G-SC maps of the area.

## Conclusions

In the final two seasons (1989 and 1990) of the Indin Lake Project,. the southern half of the Indin Lake Supracrustal Belt will be studied and gaps in data in the northern part will be filled in. The eventual goal is to map small the areas around. all the major deposits, and to study and map minor showings that may be important to a classification scheme for the region's gold. deposits. The final series of maps and reports will have a structural emphasis.

Future work should be rewarding, in part because relatively little work has been done on the structure of the Indin Lake Belt; or on the structure of all the major deposits at one time with a common set of questions to be asked. The regional synthesis is intended to help exploration personnel make better decisions, thereby increasing the efficiency with which the mineral potential of the area will be developed.

## Acknowledge.rnen ts

The Geology Division of Indian and Northern Affairs Canada provided technical and logistic support. J.A. Brophy and W.A. Padgam visited Indin Lake Project fly camps and ,provided their insights. Tad Bartkiewicz of Neptune Resources was especially helpful in providing access to and information on the Colomac Property.

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