MASSIVE SULPHIDE DEPOSITS

YUKON TERRITORY

R.C. Carne

March 10, 1980

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont.)

LIST OF MAPS

Map A - Tectonic Assemblage Map of Yukon Territory

Map B - Environments of Massive Sulphide Deposition (overlay)

Map C - Massive Sulphide Deposits of Yukon Territory (overlay)

Map D - Claim Ownership in Massive Sulphide Camps (overlay)

Map E - Mineral Resources of Yukon Territory

Map F - Infrastructure, Yukon Territory

Missing in file Feb 1988

INTRODUCTION

Information on known potential massive sulphide deposits in Yukon Territory, Canada is submitted in three forms:

(i) on maps and overlays;

(ii) in short written descriptions; and,

(iii) on itemized short answer questionnaires or data sheets.

Tectonic assemblages of Yukon Territory are shown on Map A which forms the basis of the study. Sedimentary and volcanic rocks have been grouped into litho-stratigraphic units which reflect their tectonic environment of deposition. Plutonic and ultramafic rocks are categorized according to age and style of emplacement. The legend on Map A shows the assemblage name, age and map symbol; its characteristic lithology, the geologic belt or belts in which the assemblage is found, as well as local formation terminology.

Known and probable environments of massive sulphide deposition are shown on Map B as an overlay to Map A. Six main massive sulphide deposit types are represented in Yukon Territory. Five deposit types occur in more than one belt based on tectonic assemblages outlined on Map A. The legend on Map B lists the tectonic assemblage in which the deposits occur, as well as the probable or possible plate tectonic environment in which the deposits formed. Important massive sulphide camps in the Hart River area, Anvil Range area, Seagull Creek area, Coal River area and Howard Pass area are shown.

Map C is an overlay locating known massive sulphide deposits in Yukon Territory, subdivided according to deposit type and size. Individual deposits are referenced according to NTS map sheet and an Occurrence Number. This refers

to the Northern Cordillera Mineral Inventory, distributed to subscribers and updated annually by Archer, Cathro and Associates Ltd. The Mineral Inventory served as the basis for this compilation.

Major claim ownership in massive sulphide camps identified on Map B is shown on Map D. Holdings and option agreements to December 31, 1979 are shown.

Mineral Resources of Yukon Territory (Map E), available from Yukon Chamber of Mines, was prepared by Archer, Cathro and Associates Ltd. in May 1979 from the Northern Cordillera Mineral Inventory. The map shows significant prospects, commercially important deposits, former producers and current producers for all metals and commodities.

Infrastructure for mining operations in Yukon Territory is shown on Map F. Included are major highways, locations of charter and scheduled aircraft operations and hydro-electric facilities and transmission lines.

Short descriptive statements are included with the data sheets for each type of massive sulphide environment.

Generalized geology, mineralization and exploration history are included with a cross-section for each important massive sulphide camp.

Respectfully submitted,

ARCHER, CATHRO AND ASSOCIATES LTD.

R. C. Carne /mc

/mc

R.C. Carne, M.Sc.

A. PRIMITIVE MASSIVE SULPHIDE DEPOSITS

A-1: Description

Massive sulphide environment A-1 is entirely underlain by unit RJT, upper Triassic to lower Jurassic Takla-Nicola Group. The assemblage consists of augite porphyry basalt, basalt, siltstone, shale and conglomerate. Trace metal and regional structural studies suggest that the Takla-Nicola assemblage was deposited in a Sumatra-type Arc setting. No stratiform massive sulphide deposits are known but potential is high.

DESCRIPTION OF MASSIVE SULPHIDE ENVIRONMENTS

Computer Code

1. Are (were) there operating mines in the area? NO

   How many?

   Approximate size in millions of tons—largest?

   smallest?

   Higher-grade Example

   Approximate grade % Cu

   % Zn

   % Pb

   oz. Ag/ton

   oz. Au/ton

   Lower-grade Example

   Approximate grade % Cu

   % Zn

   % Pb

   oz. Ag/ton

   oz. Au/ton

2. If no operating mines, are there massive base metal sulphide occurrences/prospects in the area? NO

   How many?

   Higher-grade Example

   Approximate metal content

   % Cu

   % Zn

   % Pb

   oz. Ag/ton

   oz. Au/ton

Computer Code

Lower-grade Example

Approximate metal content

% Cu

% Zn

% Pb

oz. Ag/ton

oz. Au/ton

3a. Is "massive" heavy sulphide mineralization present?

Is its distribution stratigraphically controlled within a single lithological unit?

--within several different lithological units?

Does mineralization occur within the same units in different localities?

What it its approximate mineralogical composition?

Example 1 % pyrite

% pyrrhotite

% chalcopyrite

% galena

Example 2 % pyrite

% pyrrhotite

% chalcopyrite

% sphalerite

% galena

4. Is there any metal or mineral zoning in the mines or prospects?

Vertical zoning, stratigraphic base to top--describe briefly

Computer Code

Top

Bottom

Lateral zoning, proximal to distal--describe briefly

Proximal

Distal

5. Are chemical sedimentary rocks or siliceous tuffs associated with the mineralization?

--in specific deposits?

--if so, in what stratigraphic with respect to the mineralization?

Computer Code

--regionally, at or near the mineralized horizon?

What is their composition?

cherty tuff

iron formation

what facies: oxide

silicate

carbonate

sulfide

barite

carbonaceous or graphitic schist

6. What type of alteration is present in the host rocks?

--is the stratigraphic hanging wall altered?

--if so, what type of alteration, what intensity

silicification

chloritization

tourmalinization

albitization

other--describe briefly

Is the stratigraphic footwall altered?

--if so, what type of alteration, what intensity?

Compute Code

silicification

chloritization

tourmalinization

albitization

other--describe briefly

Is the stratigraphic footwall altered?

--if so, what type of alteration, what intensity?

silification

chloritization

tourmalinization

albitization

other--describe briefly

7. What is the regional metamorphic rank?

zeolite facies--specify mineral assemblage if possible

greenschist facies--specify mineral assemblage if possible

less common albite, chlorite, actinolite, epidote, muscovite, biotite, quartz

Computer Code

amphibolite facies--specify mineral assemblage if possible

granulite facies--specify mineral assemblage if possible

8. What is the regional style of deformation?

tight isoclinal folding: steep dips

open folding, moderate dips

open folding

normal faults

little deformation, relatively flat dips?

9. What type of pre-metamorphic volcanic rocks were present?

--differentiated basalt-andesite-rhyodacite?

--bimodal basalt-rhyodacite

Computer Code

--abundant felsic fragmental-pyroclastic rocks near the ore?

--mafic volcanic or subvolcanic rocks only? basalt, andesite

--minor mafic volcanic or intrusive rocks and less abundant than (meta)sedimentary types?

--no significant volcanic or igneous rocks?

--other

10. What type of prematamorphic clastic sedimentary rocks are present?

--greywackes and volcanoclastics of varying composition? volcanic breccias, conglomerate, greywacke tuffs, minor argillite.

--felsic volcaniclastics, with epiclastic sandstone, shale, carbonate?

--minor clastic sedimentary rocks: only pelagic shales?

--argillite-siltstone-shale of turbiditic type?

--shelf clastics and carbonates: sandstone-stilstone-shale-carbonate-evaporite limestone reefs

--other

A-2: Description

Massive sulphide environment A-2 is underlain by Pennsylvanian to Permian argillite, sandstone, limestone and submarine basic to acidic volcanic rocks of the Taku-Skolai group. No massive sulphide deposits have been discovered in Yukon Territory and the plate tectonic setting is not known.

VI

DESCRIPTION OF MASSIVE SULPHIDE ENVIRONMENTS

		Computer Code
1. Are (were) there operating mines in the area?	NO	
How many?		
Approximate size in millions of tons—largest?		
smallest?		
Higher-grade Example		
Approximate grade % Cu		
% Zn		
% Pb		
oz. Ag/ton		
oz. Au/ton		
Lower-grade Example		
Approximate grade % Cu		
% Zn		
% Pb		
oz. Ag/ton		
oz. Au/ton		
2. If no operating mines, are there massive base metal sulphide occurrences/prospects in the area?	YES	
How many?	ONE	
Higher-grade Example		
Approximate metal content		
% Cu	2 %	
% Zn	5 %	
% Pb	0.5 %	
oz. Ag/ton	1.25 oz	
oz. Au/ton	0.00[illegible] oz	

Computer Code

Lower-grade Example

Approximate metal content

% Cu

% Zn

% Pb

oz. Ag/ton

oz. Au/ton

3a. Is "massive" heavy sulphide mineralization present? YES

Is its distribution stratigraphically controlled within a single lithological unit? not known

--within several different lithological units?

Does mineralization occur within the same units in different localities? not known

What it its approximate mineralogical composition?

Example 1 % pyrite

% pyrrhotite

% chalcopyrite

% galena

Example 2 % pyrite <4%

% pyrrhotite

% chalcopyrite 5%

% sphalerite 10

% galena 1%

4. Is there any metal or mineral zoning in the mines or prospects? not known

Vertical zoning, stratigraphic base to top--describe briefly

Computer Code

Top

Bottom

Lateral zoning, proximal to distal--describe briefly

Proximal

Distal

5. Are chemical sedimentary rocks or siliceous tuffs associated with the mineralization? not known

--in specific deposits?

--if so, in what stratigraphic with respect to the mineralization?

Computer Code

--regionally, at or near the mineralized horizon?

What is their composition?

cherty tuff

iron formation

what facies: oxide

silicate

carbonate

sulfide

barite

carbonaceous or graphitic schist

6. What type of alteration is present in the host rocks?

--is the stratigraphic hanging wall altered? not known

--if so, what type of alteration, what intensity

silicification

chloritization

tourmalinization

albitization

other--describe briefly

Is the stratigraphic footwall altered? not known

--if so, what type of alteration, what intensity?

Compute Code

silicification

chloritization

tourmalinization

albitization

other--describe briefly

Is the stratigraphic footwall altered?

--if so, what type of alteration, what intensity?

silification — not known

chloritization

tourmalinization

albitization

other--describe briefly

7. What is the regional metamorphic rank?

zeolite facies--specify mineral assemblage if possible

greenschist facies--specify mineral assemblage if possible — [illegible] chlorite [illegible] not known

Computer Code

amphibolite facies--specify mineral assemblage if possible

granulite facies--specify mineral assemblage if possible

8. What is the regional style of deformation?

tight isoclinal folding: steep dips 2 phases penetrative

open folding, moderate dips

little deformation, relatively flat dips?

9. What type of pre-metamorphic volcanic rocks were present?

--differentiated basalt-andesite-rhyodacite? andesite-rhyodacite?

--bimodal basalt-rhyodacite

Computer Code

--abundant felsic fragmental-pyroclastic rocks near the ore?

--mafic volcanic or subvolcanic rocks only?

--minor mafic volcanic or intrusive rocks and less abundant than (meta)sedimentary types?

--no significant volcanic or igneous rocks?

--other

10. What type of prematamorphic clastic sedimentary rocks are present?

--greywackes and volcanoclastics of varying composition?

--felsic volcaniclastics, with epiclastic sandstone, shale, carbonate? calcareous tuff, limestone phyllite, siltstone, greywacke

--minor clastic sedimentary rocks: only pelagic shales?

--argillite-siltstone-shale of turbiditic type?

--shelf clastics and carbonates: sandstone-stilstone-shale-carbonate-evaporite

--other

Compute Code

11. What was the probable tectonic-sedimentary depositional environment in terms of "current" plate tectonic configurations?

--oceanic rift-ridge: spreading center?

--volcanic island arc off craton margin? ✓

--fore-arc trench or trough?

--back-arc, post-arc or inner-arc basin?

--continental or cratonic rift?

--shallow cratonic shelf or basin?

--other

12. Describe the soil profile in each area delineated:

Top	% total thickness
Immature cracked soil	5%
Locally derived Talus	95%
alluvial deposits in valley floors	

Bottom

Bottom

Computer Code

Soil thickness-- Meters or feet

greatest 10

average

smallest 0

13. Describe the weathering profile in each area delineated:

Top % of total thickness

[illegible]
subarctic minimum
elevated.

Bottom

Weathering profile thickness-- Meters or feet

greatest

average

smallest

14. Cover rocks if massive sulphide environment is subsurface

Top % of total thickness

Bottom

B. POLYMETALLIC MASSIVE SULPHIDE DEPOSITS

B-1: Description

Massive sulphide environment B-1 consists of dominantly middle Devonian to upper Mississippian clastic and volcanic rocks showns as units DRT (in part) and mRC (in part) on Map A. Polymetallic lead-zinc-silver deposits occur above rhyolite to rhyodacite domes in pyroclastic rocks which mark the abrupt transition to andesitic volcanism. Trace metal and regional geologic studies suggest a continental margin rift environment of deposition in a trailing edge tectonic setting.

GENERALIZED GEOLOGY, SEAGULL CREEK AREA

Three structurally separate packages comprise the bedrock geology of the Seagull Creek area. In descending order, they consist of:

Cambrian to Ordovician - tuffaceous phyllite, calcareous phyllite;

Silurian to lower Devonian - orthoquartzite, dolomite, calcareous and dolomitic siltstone;

upper Devonian to Mississippian - chert pebble conglomerate, black slate, meta-basalt, meta-rhyolite and pyroclastic rocks; bedded barite and stratiform lead-zinc-barite deposits.

The entire upper Devonian to Mississippian sequence has undergone weak thermal metamorphism to the amphibolite facies. Three distinct periods of deformation have resulted in polyphase isoclinal folding. Rhyolite, basalt, trachyte and related volcaniclastic rocks form a north-west trending volcanic belt 90 km long and up to 25 km wide. The submarine volcanic rocks range in composition from calc-alkalic to alkalic.

MINERALIZATION, SEAGULL CREEK AREA

Six stratiform sulphide-barite deposits and ore barren stratiform barite deposits have been discovered to date in the Seagull Creek area. Sphalerite, galena, pyrite and pyrrhotite occur as massive, crudely banded deposits in lenses with lengths of up to 40 m and thicknesses of as much as 10 m. Individual lenses show a concentration of copper and zinc at the base with increasing lead, silver and barite values towards the top.

Mineralization is hosted by pyritic quartz-eye sericite schists, interpreted as a tuffaceous horizon, which occurs at the contact between rhyolite and overlying andesite. Minor amounts of mineralization are contained within tuffaceous black slates which flank rhyolite accumulations. Weakly mineralized alteration pipes have been identified beneath individual deposits.

No grade or tonnage figures have been released for any of the deposits in the area. Grades are thought to average around 5% combined lead and zinc with 30 to 50 grams per tonne silver, although much higher assays have been reported from individual specimens.

EXPLORATION HISTORY, SEAGULL CREEK AREA

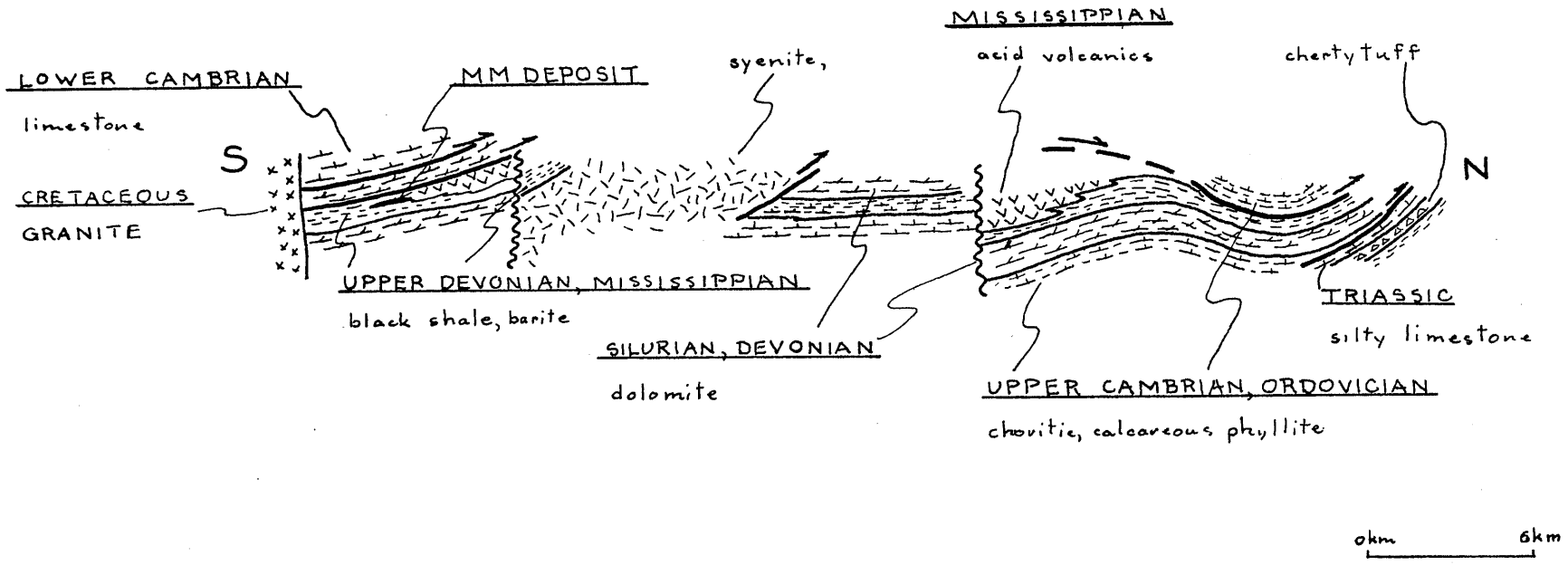
Conwest Exploration Ltd. staked the first claims in the Seagull Creek area in 1963 over the Box showing. After preliminary sampling, the claims were abandoned until 1960 when they were restaked by Tay River Mines Ltd. After initial prospecting Tay River also dropped the claims.

The Arnold deposit, 10 km south, was staked and prospected in 1970 by Spartan Exploration Ltd. in a joint venture with Mitsui Mining and Smelting Co. Ltd. The claims lapsed and were restaked in 1973 by Anvil Mining Co. Ltd. as the MM claims. Anvil carried out mapping, geochemical, magnetic and gravity surveys with some diamond drilling in 1973 and 1974. The claims were then transferred to Cyprus Anvil Mining Corp. which carried out additional geophysical surveys and diamond drilling in 1975, 1976, 1977 and 1978 in a joint venture with Hudson's Bay Oil and Gas Ltd. The joint venture also carried out regional exploration during the period, staking several new occurrences.

The Box showing was restaked in 1974 by Nithex Exploration and Development Ltd. after news of Anvil's drilling on the nearby Arnold claims became public. The property was optioned by Dupont, which joint ventured with Aquitaine and Rosario Resources Canada Ltd. to conduct geophysical, geochemical and diamond drilling surveys during 1976 and 1977. The Dupont joint venture and Utah Mines Ltd. were also active in regional exploration in the area during 1976 and 1977. Several new occurrences resulted from this work about which little is known.

SCHEMATIC CROSS-SECTION

SEAGULL CREEK AREA



AREA

DESCRIPTION OF MASSIVE SULPHIDE ENVIRONMENTS

		Computer Code
1. Are (were) there operating mines in the area?	NO	
How many?		
Approximate size in millions of tons—largest?		
smallest?		
Higher-grade Example		
Approximate grade % Cu		
% Zn		
% Pb		
oz. Ag/ton		
oz. Au/ton		
Lower-grade Example		
Approximate grade % Cu		
% Zn		
% Pb		
oz. Ag/ton		
oz. Au/ton		
2. If no operating mines, are there massive base metal sulphide occurrences/prospects in the area?	YES	
How many?	8	
Higher-grade Example		
Approximate metal content		
% Cu	0.2	
% Zn	0.1	
% Pb	9.9	
oz. Ag/ton	15.4	
oz. Au/ton	0.05	

Computer Code

Lower-grade Example

Approximate metal content

% Cu	0.5 %
% Zn	3 %
% Pb	2 %
oz. Ag/ton	2
oz. Au/ton	/

3a. Is "massive" heavy sulphide mineralization present? YES

Is its distribution stratigraphically controlled within a single lithological unit? YES

--within several different lithological units? NO

Does mineralization occur within the same units in different localities? YES

What it its approximate mineralogical composition?

Example 1	% pyrite	
	% pyrrhotite	
	% chalcopyrite	
	% galena	
Example 2	% pyrite	20
	% pyrrhotite	5
	% chalcopyrite	2
	% sphalerite	10
	% galena	8

4. Is there any metal or mineral zoning in the mines or prospects? YES

Vertical zoning, stratigraphic base to top--describe briefly

Computer Code

Top

BARITE

GALENA

GALENA + SPHALERITE

SPHALERITE

SPHALERITE + CHALCOPYRITE

PYRITE + PYRRHOTITE

Bottom

Lateral zoning, proximal to distal--describe briefly

Proximal

PYRITE + PYRRHOTITE

SPHALERITE + GALENA

BARITE

Distal

5. Are chemical sedimentary rocks or siliceous tuffs associated with the mineralization? YES

--in specific deposits? YES

--if so, in what stratigraphic with respect to the mineralization? HANGINGWALL

Computer Code

--regionally, at or near the mineralized horizon? YES, AT THE MINERALIZED HORIZON

What is their composition?

cherty tuff CHERTY TUFF

iron formation

what facies: oxide OXIDE IRON FORM.

silicate

carbonate CARBONATE IRON FORM

sulfide PYRITIC CHERT

barite BEDDED BARITE

carbonaceous or graphitic schist

6. What type of alteration is present in the host rocks?

--is the stratigraphic hanging wall altered? YES

--if so, what type of alteration, what intensity

silicification

chloritization WEAKLY CHLORITIZED

tourmalinization

albitization

other--describe briefly

Is the stratigraphic footwall altered? YES

--if so, what type of alteration, what intensity?

Compute Code

silicification — STRONGLY SILICIFIED

chloritization

tourmalinization

albitization

other--describe briefly — STRONGLY SERICITIZED

Is the stratigraphic footwall altered?

--if so, what type of alteration, what intensity?

silification

chloritization

tourmalinization

albitization

other--describe briefly

7. What is the regional metamorphic rank?

zeolite facies--specify mineral assemblage if possible

greenschist facies--specify mineral assemblage if possible — QUARTZ, SERICITE, CHLORITE

Computer Code

amphibolite facies--specify mineral assemblage if possible

granulite facies--specify mineral assemblage if possible

8. What is the regional style of deformation?

tight isoclinal folding: steep dips — RECUMBENT ISOCLINAL FOLDING

open folding, moderate dips

little deformation, relatively flat dips?

9. What type of pre-metamorphic volcanic rocks were present?

--differentiated basalt-andesite-rhyodacite? — DIFFERENTIATED BASALT TO RHYOLITE

--bimodal basalt-rhyodacite

Computer Code

--abundant felsic fragmental-pyroclastic rocks near the ore? YES

--mafic volcanic or subvolcanic rocks only?

--minor mafic volcanic or intrusive rocks and less abundant than (meta)sedimentary types?

--no significant volcanic or igneous rocks?

--other SYNVOLCANIC SYENITE STOCKS

10. What type of prematamorphic clastic sedimentary rocks are present?

--greywackes and volcanoclastics of varying composition?

--felsic volcaniclastics, with epiclastic sandstone, shale, carbonate? FELSIC VOLCANICLASTICS AND SHALE

--minor clastic sedimentary rocks: only pelagic shales?

--argillite-siltstone-shale of turbiditic type?

--shelf clastics and carbonates: sandstone-stilstone-shale-carbonate-evaporite

--other

Compute Code

11. What was the probable tectonic-sedimentary depositional environment in terms of "current" plate tectonic configurations?

--oceanic rift-ridge: spreading center?

--volcanic island arc off craton margin? back-arc side of volcanic island arc off craton margin

--fore-arc trench or trough?

--back-arc, post-arc or inner-arc basin?

--continental or cratonic rift?

--shallow cratonic shelf or basin?

--other

12. Describe the soil profile in each area delineated:

Top	% total thickness
IMMATURE ORGANIC SOIL	<5%
VOLCANIC ASH	<1%
IMMATURE ORGANIC SOIL	<1%
GLACIAL TILL	0-99%

Bottom

Bottom

Computer Code

Soil thickness-- Meters or feet

greatest 100 m

average 10 m

smallest 0 m.

13. Describe the weathering profile in each area delineated:

Top % of total thickness

unweathered subarctic environment; glaciated.

Bottom

Weathering profile thickness-- Meters or feet

greatest

average

smallest

14. Cover rocks if massive sulphide environment is subsurface

Top % of total thickness

Tertiary volcanics 25

Tertiary conglomerate 25

Triassic and Jurassic sediments 25

Triassic limestone. 25

Bottom

B-2: Description

The Alexander Terrane, defined by a thick sequence of volcanic and sedimentary rocks ranging in age from Cambrian or older to Triassic, comprises massive sulphide environment B-2. Basic volcanic rocks are dominant in the Cambro-Ordovician whereas sedimentary rocks with prominent, thick limestones characterize the younger, mainly Silurian and Devonian, part of the section. Volcanics within the younger part of the section host the Telluride Creek prospect, the only deposit known in Yukon. Significant deposits occur in correlative rocks in the Alaska Panhandle and within the Sicker Group on Vancouver Island.

DESCRIPTION OF MASSIVE SULPHIDE ENVIRONMENTS

Computer Code

1. Are (were) there operating mines in the area? NO

   How many?

   Approximate size in millions of tons--largest?

   smallest?

   Higher-grade Example

   Approximate grade % Cu

   % Zn

   % Pb

   oz. Ag/ton

   oz. Au/ton

   Lower-grade Example

   Approximate grade % Cu

   % Zn

   % Pb

   oz. Ag/ton

   oz. Au/ton

2. If no operating mines, are there massive base metal sulphide occurrences/prospects in the area? NO

   How many?

   Higher-grade Example

   Approximate metal content

   % Cu

   % Zn

   % Pb

   oz. Ag/ton

   oz. Au/ton

Computer Code

Lower-grade Example

Approximate metal content

% Cu

% Zn

% Pb

oz. Ag/ton

oz. Au/ton

3a. Is "massive" heavy sulphide mineralization present? NO

Is its distribution stratigraphically controlled within a single lithological unit?

--within several different lithological units?

Does mineralization occur within the same units in different localities?

What it its approximate mineralogical composition?

Example 1 % pyrite

% pyrrhotite

% chalcopyrite

% galena

Example 2 % pyrite

% pyrrhotite

% chalcopyrite

% sphalerite

% galena

4. Is there any metal or mineral zoning in the mines or prospects?

Vertical zoning, stratigraphic base to top--describe briefly

Computer Code

Top

Bottom

Lateral zoning, proximal to distal--describe briefly

Proximal

Distal

5. Are chemical sedimentary rocks or siliceous tuffs associated with the mineralization?

--in specific deposits?

--if so, in what stratigraphic with respect to the mineralization?

Computer Code

--regionally, at or near the mineralized horizon?

What is their composition?

cherty tuff

iron formation

what facies: oxide

silicate

carbonate

sulfide

barite

carbonaceous or graphitic schist

6. What type of alteration is present in the host rocks?

--is the stratigraphic hanging wall altered?

--if so, what type of alteration, what intensity

silicification

chloritization

tourmalinization

albitization

other--describe briefly

Is the stratigraphic footwall altered?

--if so, what type of alteration, what intensity?

Compute Code

silicification

chloritization

tourmalinization

albitization

other--describe briefly

Is the stratigraphic footwall altered?

--if so, what type of alteration, what intensity?

silification

chloritization

tourmalinization

albitization

other--describe briefly

7. What is the regional metamorphic rank?

zeolite facies--specify mineral assemblage if possible

PREHNITE-

PUMPELLYITE

greenschist facies--specify mineral assemblage if possible

Computer Code

amphibolite facies--specify mineral assemblage if possible

granulite facies--specify mineral assemblage if possible

8. What is the regional style of deformation?

tight isoclinal folding: steep dips — upright isoclinal

open folding, moderate dips

little deformation, relatively flat dips?

9. What type of pre-metamorphic volcanic rocks were present?

--differentiated basalt-andesite-rhyodacite? — differentiated basalt-rhyolite

--bimodal basalt-rhyodacite

Computer Code

--abundant felsic fragmental-pyroclastic rocks near the ore?

--mafic volcanic or subvolcanic rocks only?

--minor mafic volcanic or intrusive rocks and less abundant than (meta)sedimentary types?

--no significant volcanic or igneous rocks?

--other

10. What type of prematamorphic clastic sedimentary rocks are present?

--greywackes and volcanoclastics of varying composition? greywackes and volcanoclastics

--felsic volcaniclastics, with epiclastic sandstone, shale, carbonate?

--minor clastic sedimentary rocks: only pelagic shales?

--argillite-siltstone-shale of turbiditic type?

--shelf clastics and carbonates: sandstone-stilstone-shale-carbonate-evaporite

--other

Compute Code

11. What was the probable tectonic-sedimentary depositional environment in terms of "current" plate tectonic configurations?

--oceanic rift-ridge: spreading center?

--volcanic island arc off craton margin? island arc

--fore-arc trench or trough?

--back-arc, post-arc or inner-arc basin?

--continental or cratonic rift?

--shallow cratonic shelf or basin?

--other

12. Describe the soil profile in each area delineated:

Top % total thickness

recent glaciation (continuing)
- poorly developed immature soil

Bottom

Bottom

Computer Code

Soil thickness-- Meters or feet

greatest 2 m

average <1m

smallest <1m

13. Describe the weathering profile in each area delineated:

Top % of total thickness

unweathered

Bottom

Weathering profile thickness-- Meters or feet

greatest <1m

average <1m

smallest <1m

14. Cover rocks if massive sulphide environment is subsurface

Top % of total thickness

no deposits known

Bottom

C. CUPROUS MASSIVE SULPHIDE DEPOSITS

C-1: Description

Massive sulphide environment C-1 consists of unit mRC (in part) on Map A. Lithologies which consist of chert, argillite, basalt, diabase, gabbro and alpine ultramafics are considered to form ophiolite sheets emplaced allochthonously on parts of Yukon Territory in late Cenozoic time. Oceanic floor material probably formed after or coincident with rifting in upper Devonian to Mississippian time. No mineral deposits are known in C-1 other than asbestos.

DESCRIPTION OF MASSIVE SULPHIDE ENVIRONMENTS

		Computer Code
1. Are (were) there operating mines in the area?	No	
How many?		
Approximate size in millions of tons—largest?		
smallest?		
Higher-grade Example		
Approximate grade % Cu		
% Zn		
% Pb		
oz. Ag/ton		
oz. Au/ton		
Lower-grade Example		
Approximate grade % Cu		
% Zn		
% Pb		
oz. Ag/ton		
oz. Au/ton		
2. If no operating mines, are there massive base metal sulphide occurrences/prospects in the area?		
How many?		
Higher-grade Example		
Approximate metal content		
% Cu		
% Zn		
% Pb		
oz. Ag/ton		
oz. Au/ton		

Computer Code

Lower-grade Example

Approximate metal content

% Cu

% Zn

% Pb

oz. Ag/ton

oz. Au/ton

3a. Is "massive" heavy sulphide mineralization present?

Is its distribution stratigraphically controlled within a single lithological unit?

--within several different lithological units?

Does mineralization occur within the same units in different localities?

What it its approximate mineralogical composition?

Example 1 % pyrite

% pyrrhotite

% chalcopyrite

% galena

Example 2 % pyrite

% pyrrhotite

% chalcopyrite

% sphalerite

% galena

4. Is there any metal or mineral zoning in the mines or prospects?

Vertical zoning, stratigraphic base to top--describe briefly

Computer Code

Top

Bottom

Lateral zoning, proximal to distal--describe briefly

Proximal

Distal

5. Are chemical sedimentary rocks or siliceous tuffs associated with the mineralization?

--in specific deposits?

--if so, in what stratigraphic with respect to the mineralization?

Computer Code

--regionally, at or near the mineralized horizon?

What is their composition?

cherty tuff

iron formation

what facies: oxide

silicate

carbonate

sulfide

barite

carbonaceous or graphitic schist

6. What type of alteration is present in the host rocks?

--is the stratigraphic hanging wall altered?

--if so, what type of alteration, what intensity

silicification

chloritization

tourmalinization

albitization

other--describe briefly

Is the stratigraphic footwall altered?

--if so, what type of alteration, what intensity?

Compute Code

silicification

chloritization

tourmalinization

albitization

other--describe briefly

Is the stratigraphic footwall altered?

--if so, what type of alteration, what intensity?

silification

chloritization

tourmalinization

albitization

other--describe briefly

7. What is the regional metamorphic rank?

zeolite facies--specify mineral assemblage if possible

prehnite pumpellyite

greenschist facies--specify mineral assemblage if possible

Compute Code

amphibolite facies--specify mineral assemblage if possible

granulite facies--specify mineral assemblage if possible

8. What is the regional style of deformation?

tight isoclinal folding: steep dips — isoclinal upright folds.

open folding, moderate dips

little deformation, relatively flat dips?

9. What type of pre-metamorphic volcanic rocks were present?

--differentiated basalt-andesite-rhyodacite?

--bimodal basalt-rhyodacite

Computer Code

--abundant felsic fragmental-pyroclastic rocks near the ore?

--mafic volcanic or subvolcanic rocks only? mafic volcanic or subvolcanic only.

--minor mafic volcanic or intrusive rocks and less abundant than (meta)sedimentary types?

--no significant volcanic or igneous rocks?

--other

10. What type of prematamorphic clastic sedimentary rocks are present?

--greywackes and volcanoclastics of varying composition?

--felsic volcaniclastics, with epi-clastic sandstone, shale, carbonate?

--minor clastic sedimentary rocks: only pelagic shales? pelagic shale and chert.

--argillite-siltstone-shale of turbiditic type?

--shelf clastics and carbonates: sandstone-stilstone-shale-carbonate-evaporite

--other

Compute Code

11. What was the probable tectonic-sedimentary depositional environment in terms of "current" plate tectonic configurations?

--oceanic rift-ridge: spreading center?

oceanic rift-spreading centre

--volcanic island arc off craton margin?

--fore-arc trench or trough?

--back-arc, post-arc or inner-arc basin?

--continental or cratonic rift?

--shallow cratonic shelf or basin?

--other

12. Describe the soil profile in each area delineated:

Top		% total thickness
	glaciated	
	Immature organic soil	2%
	Muskeg	8%
	Glacial till - permafrost	90%

Bottom

Bottom

Computer Code

Soil thickness-- Meters or feet

greatest 10

average 2

smallest <1

13. Describe the weathering profile in each area delineated:

Top % of total thickness

unweathered, glaciated

Bottom

Weathering profile thickness-- Meters or feet

greatest <1 m

average

smallest

14. Cover rocks if massive sulphide environment is subsurface

Top % of total thickness

Bottom

C-2: Description

Massive sulphide environment C-2 consists of basalt, limestone and argillite of the Karmutsen-Nikolai assemblage shown as unit TRk on Map A. Tectonic environment of this assemblage is debatable, some workers suggest a post-arc basin environment although evidence is not conclusive. Cuprous massive sulphide deposits are known in correlative rocks in B.C. although only disseminated and fracture-filled copper deposits in basic volcanic rocks are known in Yukon Territory.

DESCRIPTION OF MASSIVE SULPHIDE ENVIRONMENTS

		Computer Code
1. Are (were) there operating mines in the area?	NO	
How many?		
Approximate size in millions of tons—largest?		
smallest?		
Higher-grade Example		
Approximate grade % Cu		
% Zn		
% Pb		
oz. Ag/ton		
oz. Au/ton		
Lower-grade Example		
Approximate grade % Cu		
% Zn		
% Pb		
oz. Ag/ton		
oz. Au/ton		
2. If no operating mines, are there massive base metal sulphide occurrences/prospects in the area?	YES	
How many?		
Higher-grade Example		
Approximate metal content		
% Cu	4%	
% Zn	/	
% Pb	/	
oz. Ag/ton	Trace	
oz. Au/ton	/	

Computer Code

Lower-grade Example

Approximate metal content

% Cu	1%
% Zn	/
% Pb	/
oz. Ag/ton	trace
oz. Au/ton	/

3a. Is "massive" heavy sulphide mineralization present? NO

Is its distribution stratigraphically controlled within a single lithological unit?

--within several different lithological units?

Does mineralization occur within the same units in different localities?

What it its approximate mineralogical composition?

Example 1
- % pyrite
- % pyrrhotite
- % chalcopyrite
- % galena

Example 2
- % pyrite
- % pyrrhotite
- % chalcopyrite
- % sphalerite
- % galena

4. Is there any metal or mineral zoning in the mines or prospects? ND

Vertical zoning, stratigraphic base to top--describe briefly

Computer Code

Top

Bottom

Lateral zoning, proximal to distal--describe briefly

Proximal

Distal

5. Are chemical sedimentary rocks or siliceous tuffs associated with the mineralization? NOT KNOWN

--in specific deposits?

--if so, in what stratigraphic with respect to the mineralization?

Computer Code

--regionally, at or near the mineralized horizon?

What is their composition?

cherty tuff

iron formation

what facies: oxide

silicate

carbonate

sulfide

barite

carbonaceous or graphitic schist

6. What type of alteration is present in the host rocks?

--is the stratigraphic hanging wall altered? NOT KNOWN

--if so, what type of alteration, what intensity

silicification

chloritization

tourmalinization

albitization

other--describe briefly

Is the stratigraphic footwall altered? YES

--if so, what type of alteration, what intensity?

Compute Code

silicification

chloritization — CHLORITIZED, WEAKLY

tourmalinization

albitization

other--describe briefly

Is the stratigraphic footwall altered?

--if so, what type of alteration, what intensity?

silification

chloritization

tourmalinization

albitization

other--describe briefly

7. What is the regional metamorphic rank?

zeolite facies--specify mineral assemblage if possible

CHLORITE - EPIDOTE - PREHNITE - PUMPELLYITE

greenschist facies--specify mineral assemblage if possible

Computer Code

amphibolite facies--specify mineral assemblage if possible

granulite facies--specify mineral assemblage if possible

8. What is the regional style of deformation?

tight isoclinal folding: steep dips

open folding, moderate dips

little deformation, relatively flat dips? FAULTED AND SHEARED

9. What type of pre-metamorphic volcanic rocks were present?

--differentiated basalt-andesite-rhyodacite?

--bimodal basalt-rhyodacite

Computer Code

--abundant felsic fragmental-pyroclastic rocks near the ore?

--mafic volcanic or subvolcanic rocks only?

--minor mafic volcanic or intrusive rocks and less abundant than (meta)sedimentary types?

--no significant volcanic or igneous rocks?

--other AMYGDALOIDAL ANDESITES

10. What type of prematamorphic clastic sedimentary rocks are present?

--greywackes and volcanoclastics of varying composition?

--felsic volcaniclastics, with epiclastic sandstone, shale, carbonate?

--minor clastic sedimentary rocks: only pelagic shales? MINOR INTER-FLOW PELAGIC SHALES

--argillite-siltstone-shale of turbiditic type?

--shelf clastics and carbonates: sandstone-stilstone-shale-carbonate-evaporite

--other

Compute Code

11. What was the probable tectonic-sedimentary depositional environment in terms of "current" plate tectonic configurations?

--oceanic rift-ridge: spreading center?

--volcanic island arc off craton margin?

--fore-arc trench or trough?

--back-arc, post-arc or inner-arc basin? POST-ARC BASIN

--continental or cratonic rift?

--shallow cratonic shelf or basin?

--other

12. Describe the soil profile in each area delineated:

Top	% total thickness
POST-GLACIAL VOLCANIC ASH	5%
ALLUVIUM AND PERMAFROST	35%
GLACIAL TILL AND PERMAFROST	60%

Bottom

Bottom

Computer Code

Soil thickness-- Meters or feet

greatest 100 metres

average 3 metres

smallest 1 metre

13. Describe the weathering profile in each area delineated:

Top % of total thickness

unweathered, glaciated.

Bottom

Weathering profile thickness-- Meters or feet

greatest

average

smallest

14. Cover rocks if massive sulphide environment is subsurface

Top % of total thickness

Bottom

D. KIESLAGER MASSIVE SULPHIDE DEPOSITS

D-1: Description

Massive sulphide environment D-1 consists mainly of sheared and metamorphosed siliceous sedimentary rocks of upper Paleozoic and Mesozoic age. The rocks are thought to have been deposited mainly with a fore-arc trench bounded by the North American craton to the east and a volcanic arc to the west. Cataclasis and metamorphism resulted from subduction and subsequent collision of the arc and craton. These rocks are allochthonous and probably overlie Paleozoic platformal sedimentary rocks and are overlain by thrust sheets of ophiolite and granitic rocks.

DESCRIPTION OF MASSIVE SULPHIDE ENVIRONMENTS

		Computer Code
1. Are (were) there operating mines in the area?	NO	
How many?		
Approximate size in millions of tons—largest?		
smallest?		
<u>Higher-grade Example</u>		
Approximate grade % Cu		
% Zn		
% Pb		
oz. Ag/ton		
oz. Au/ton		
<u>Lower-grade Example</u>		
Approximate grade % Cu		
% Zn		
% Pb		
oz. Ag/ton		
oz. Au/ton		
2. If no operating mines, are there massive base metal sulphide occurrences/prospects in the area?	YES	
How many?	3	
<u>Higher-grade Example</u>		
Approximate metal content		
% Cu	2.3% Cu	
% Zn	0.3% Zn	
% Pb		
oz. Ag/ton	0.03 T	
oz. Au/ton	Tr	

Computer Code

Lower-grade Example

Approximate metal content

% Cu	.25% Cu
% Zn	.22% Zn
% Pb	
oz. Ag/ton	0.25 oz/t
oz. Au/ton	Tr

3a. Is "massive" heavy sulphide mineralization present? YES

Is its distribution stratigraphically controlled within a single lithological unit? not known

--within several different lithological units? not known

Does mineralization occur within the same units in different localities? not known

What it its approximate mineralogical composition?

Example 1	% pyrite	>90
	% pyrrhotite	—
	% chalcopyrite	4
	% galena	—
Example 2	% pyrite	45
	% pyrrhotite	45
	% chalcopyrite	<1
	% sphalerite	<1
	% galena	

4. Is there any metal or mineral zoning in the mines or prospects? not known

Vertical zoning, stratigraphic base to top--describe briefly

Computer Code

Top

not known

Bottom

Lateral zoning, proximal to distal--describe briefly

Proximal

not known

Distal

5. Are chemical sedimentary rocks or siliceous tuffs associated with the mineralization? YES

--in specific deposits? YES

--if so, in what stratigraphic with respect to the mineralization? [illegible]

Computer Code

--regionally, at or near the mineralized horizon? not known

What is their composition?

cherty tuff

iron formation magnetitic

what facies: oxide ✓

silicate

carbonate

sulfide

barite

carbonaceous or graphitic schist

6. What type of alteration is present in the host rocks?

--is the stratigraphic hanging wall altered? not known

--if so, what type of alteration, what intensity not known

silicification

chloritization

tourmalinization

albitization

other--describe briefly

Is the stratigraphic footwall altered? not known

--if so, what type of alteration, what intensity?

Computer Code

silicification

chloritization

tourmalinization

albitization

other--describe briefly

Is the stratigraphic footwall altered?

--if so, what type of alteration, what intensity?

silification — not known

chloritization

tourmalinization

albitization

other--describe briefly

7. What is the regional metamorphic rank?

zeolite facies--specify mineral assemblage if possible

greenschist facies--specify mineral assemblage if possible

talc

carbonate

Computer Code

amphibolite facies--specify mineral assemblage if possible

granulite facies--specify mineral assemblage if possible

8. What is the regional style of deformation?

tight isoclinal folding: steep dips — flatly ~~ing~~ foliation-parallel isoclinal folds

open folding, moderate dips

little deformation, relatively flat dips?

9. What type of pre-metamorphic volcanic rocks were present?

--differentiated basalt-andesite-rhyodacite?

--bimodal basalt-rhyodacite

Computer Code

--abundant felsic fragmental-pyroclastic rocks near the ore? possible, not certain

--mafic volcanic or subvolcanic rocks only? probable.

--minor mafic volcanic or intrusive rocks and less abundant than (meta)sedimentary types?

--no significant volcanic or igneous rocks?

--other

10. What type of prematamorphic clastic sedimentary rocks are present?

--greywackes and volcanoclastics of varying composition? probable.

--felsic volcaniclastics, with epiclastic sandstone, shale, carbonate?

--minor clastic sedimentary rocks: only pelagic shales?

--argillite-siltstone-shale of turbiditic type?

--shelf clastics and carbonates: sandstone-stilstone-shale-carbonate-evaporite

--other

Compute Code

11. What was the probable tectonic-sedimentary depositional environment in terms of "current" plate tectonic configurations?

--oceanic rift-ridge: spreading center?

--volcanic island arc off craton margin?

--fore-arc trench or trough? ✓

--back-arc, post-arc or inner-arc basin?

--continental or cratonic rift?

--shallow cratonic shelf or basin?

--other

12. Describe the soil profile in each area delineated:

Top	% total thickness
immature organic soil	<5%
alluvium and	>95%
glacial till	
Bottom	

Bottom

Computer Code

Soil thickness-- Meters or feet

greatest 60 m

average 5 m

smallest 1 m

13. Describe the weathering profile in each area delineated:

Top % of total thickness

unweathered

subarctic climate

glaciated

Bottom

Weathering profile thickness-- Meters or feet

greatest

average

smallest

14. Cover rocks if massive sulphide environment is subsurface

Top % of total thickness

all rock types subarctic + alpine with 70%

area + sericite schist, graphitic, 30

siliceous schist

Bottom

D-2: Description

Massive sulphide environment D-2 consists mainly of sheared and metamorphosed siliceous sedimentary rocks of upper Paleozoic and Mesozoic age. The rocks are thought to have been deposited mainly within a fore-arc trench bounded by the North American craton to the east and a volcanic arc to the west. Cataclasis and metamorphism resulted from subduction and subsequent collision of the arc and craton. These rocks now mark the Teslin suture zone and also allochthonously overlie platformal sedimentary rocks in places. Environment D1 and D2 are essentially the same but are separated by the Tintina Fault, which has 450 km of right lateral displacement.

D-6

DESCRIPTION OF MASSIVE SULPHIDE ENVIRONMENTS

		Computer Code
1.	Are (were) there operating mines in the area?	NO
	How many?	
	Approximate size in millions of tons--largest?	
	smallest?	
	<u>Higher-grade Example</u>	
	Approximate grade % Cu	
	% Zn	
	% Pb	
	oz. Ag/ton	
	oz. Au/ton	
	<u>Lower-grade Example</u>	
	Approximate grade % Cu	
	% Zn	
	% Pb	
	oz. Ag/ton	
	oz. Au/ton	
2.	If no operating mines, are there massive base metal sulphide occurrences/prospects in the area?	NO
	How many?	
	<u>Higher-grade Example</u>	
	Approximate metal content	
	% Cu	
	% Zn	
	% Pb	
	oz. Ag/ton	
	oz. Au/ton	

Computer Code

Lower-grade Example

Approximate metal content

% Cu

% Zn

% Pb

oz. Ag/ton

oz. Au/ton

3a. Is "massive" heavy sulphide mineralization present?

Is its distribution stratigraphically controlled within a single lithological unit?

--within several different lithological units?

Does mineralization occur within the same units in different localities?

What it its approximate mineralogical composition?

Example 1 % pyrite

% pyrrhotite

% chalcopyrite

% galena

Example 2 % pyrite

% pyrrhotite

% chalcopyrite

% sphalerite

% galena

4. Is there any metal or mineral zoning in the mines or prospects?

Vertical zoning, stratigraphic base to top--describe briefly

Computer Code

Top

Bottom

Lateral zoning, proximal to distal--describe briefly

Proximal

Distal

5. Are chemical sedimentary rocks or siliceous tuffs associated with the mineralization?

--in specific deposits?

--if so, in what stratigraphic with respect to the mineralization?

Computer Code

--regionally, at or near the mineralized horizon?

What is their composition?

cherty tuff

iron formation

what facies: oxide

silicate

carbonate

sulfide

barite

carbonaceous or graphitic schist

6. What type of alteration is present in the host rocks?

--is the stratigraphic hanging wall altered?

--if so, what type of alteration, what intensity

silicification

chloritization

tourmalinization

albitization

other--describe briefly

Is the stratigraphic footwall altered?

--if so, what type of alteration, what intensity?

Compute Code

silicification

chloritization

tourmalinization

albitization

other--describe briefly

Is the stratigraphic footwall altered?

--if so, what type of alteration, what intensity?

silification

chloritization

tourmalinization

albitization

other--describe briefly

7. What is the regional metamorphic rank?

zeolite facies--specify mineral assemblage if possible

greenschist facies--specify mineral assemblage if possible

Computer Code

amphibolite facies--specify mineral assemblage if possible

granulite facies--specify mineral assemblage if possible

8. What is the regional style of deformation?

tight isoclinal folding: steep dips — root less isoclinal folds

open folding, moderate dips

little deformation, relatively flat dips?

9. What type of pre-metamorphic volcanic rocks were present?

--differentiated basalt-andesite-rhyodacite?

--bimodal basalt-rhyodacite

Computer Code

--abundant felsic fragmental-pyroclastic rocks near the ore?

--mafic volcanic or subvolcanic rocks only? probable.

--minor mafic volcanic or intrusive rocks and less abundant than (meta)sedimentary types?

--no significant volcanic or igneous rocks?

--other

10. What type of prematamorphic clastic sedimentary rocks are present?

--greywackes and volcanoclastics of varying composition? probable.

--felsic volcaniclastics, with epiclastic sandstone, shale, carbonate?

--minor clastic sedimentary rocks: only pelagic shales?

--argillite-siltstone-shale of turbiditic type?

--shelf clastics and carbonates: sandstone-stilstone-shale-carbonate-evaporite

--other

Compute Code

11. What was the probable tectonic-sedimentary depositional environment in terms of "current" plate tectonic configurations?

--oceanic rift-ridge: spreading center?

--volcanic island arc off craton margin?

--fore-arc trench or trough? ✓

--back-arc, post-arc or inner-arc basin?

--continental or cratonic rift?

--shallow cratonic shelf or basin?

--other

12. Describe the soil profile in each area delineated:

Top	% total thickness
immature organic soil	< 5%
alluvium and glacial till	> 95%
Bottom	

Bottom

Computer Code

Soil thickness-- Meters or feet

greatest 1 cm

average 10 cm

smallest 1 cm

13. Describe the weathering profile in each area delineated:

Top % of total thickness

unweathered

subaerial climate

glaciated

Bottom

Weathering profile thickness-- Meters or feet

greatest

average

smallest

14. Cover rocks if massive sulphide environment is subsurface

Top % of total thickness

allochthonous volcanic ultramafic rock 70%

quartz sericite schist & graphitic 30%

calcareous schist

Bottom

E. CLASTIC HOSTED MASSIVE SULPHIDE DEPOSITS

E-1: Description

Massive sulphide environment E-1 consists of a thick sequence of early or middle Proterozoic clastic and carbonate rocks called the Wernecke Supergroup shown as unit PP_3 on Map A. The Hart River deposit, the only significant known showing, occurs near a facies boundary between dolomite and argillite near the top of the sequence. The host rocks suggest a rift environment along a passive continental margin.

GENERALIZED GEOLOGY - HART RIVER AREA

The Wernecke Supergroup, which comprises exploration area E-1, consists of a clastic and carbonate sequence possibly as thick as 10 km. Quartzite, black argillite and minor carbonate rocks of the Fairchild Lake and Quartet Groups comprise most of the sequence. Massive sulphides occur within the overlying Gillespie Lake Group, a sequence of flaggy, orange-weathering, argillaceous dolomite and lesser calcareous argillite, possibly as thick as 2 km. Mineralization occurs where the dolomite changes facies to calcareous argillite and black argillite. The stratigraphic position within the Gillespie Lake Group is not known. The Wernecke Supergroup is cut by volumnous diabase dykes and sills and is highly deformed. A major unconformity separates these rocks from the overlying, less deformed rocks of the middle or late Proterozoic Pinguicula Group.

MINERALIZATION - HART RIVER AREA

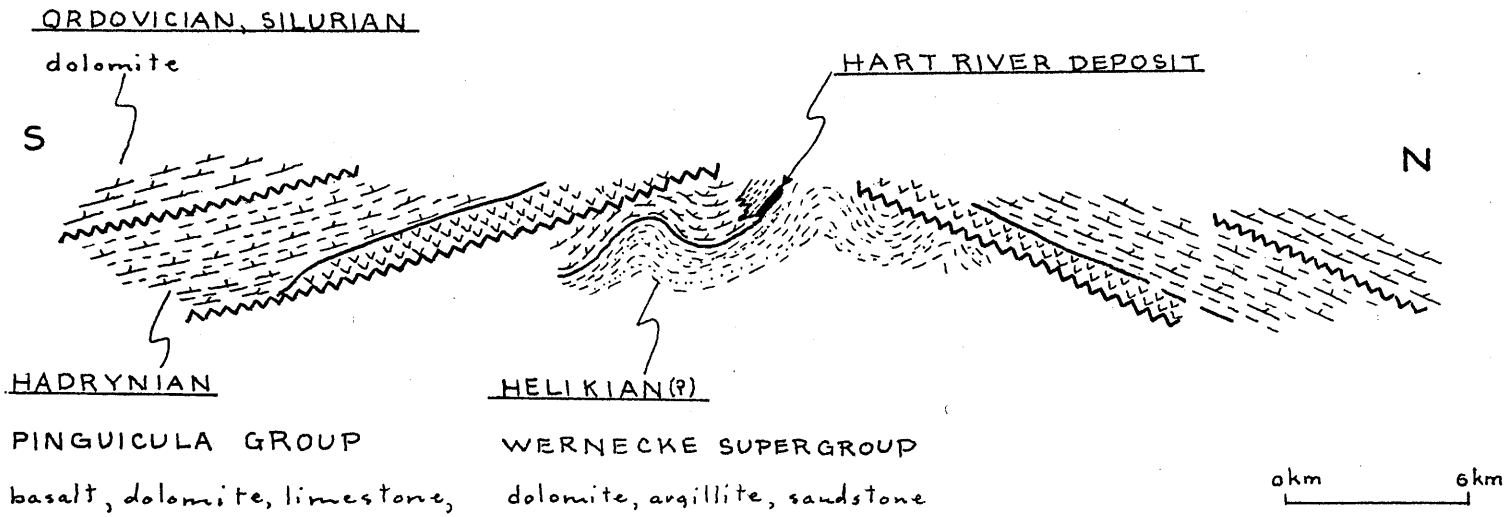
The Hart River deposit forms a vertical-to-moderately dipping pod completely enclosed within black argillite. It reaches 124 m in length and 19 m in thickness and has been traced for about 150 m downdip. The footwall side exhibits silicification and a stockwork of quartz-carbonate-chalcopyrite veinlets while the hanging wall is marked by a concordant, layered, chert-pyrite horizon. The deposit consists of thinly layered pyrite, pyrrhotite, sphalerite, galena and chalcopyrite with minor tetrahedrite, tennantite and the argyrodite-canfield sulphosalt series. Published reserves are 577,000 proven tons grading 3.6% Zn, 1.45% Cu, 0.9% Pb, 45.1 grams/tonne Ag and 1.28 grams/tonne Au plus 16,000 probable tons of similar grade. There is a crude metal zonation with lead and zinc concentrated in the central and western position and copper and gold in the eastern portion. The distribution of iron sulphides is such that pyrite is most common in the central and western portions and pyrrhotite in the eastern portion of the deposit.

EXPLORATION HISTORY - HART RIVER AREA

Claims were first staked in the area in 1955 and 1956 although copper mineralization had been reported by trappers as early as the 1930's. Asbestos Corporation optioned the property in 1956 and explored with mapping, hand trenching and sampling. Ventures Mining Ltd. and Anglo Western Minerals Ltd. explored with soil sampling, EM surveys and two packsack diamond drill holes (23 m) before forming a new company, Hart River Mines Ltd. in 1967 to finance further work. Hart River drilled 31 holes (2,214 m) and enlarged the property in 1968, then constructed a winter road and explored the main zone with 530 m of underground development plus 1,645 m of underground drilling (32 holes) and 1,028 m of surface drilling (9 holes) in 1969. A lower adit was also driven 67 m before operations terminated. A feasibility study was conducted in 1969 by Kaiser Engineering. Subsequent exploration consisted of detailed soil sampling, an EM survey and 823 m of underground drilling (2 holes) in 1970, and 278 m (4 holes) in 1971, and the restaking of a few lapsed claims in June, 1975. In 1976, the company changed its name to North Hart Resources Ltd.

SCHEMATIC CROSS-SECTION

HART RIVER AREA



AREA.

DESCRIPTION OF MASSIVE SULPHIDE ENVIRONMENTS

		Computer Code
1. Are (were) there operating mines in the area?	NO	
How many?		
Approximate size in millions of tons—largest?		
smallest?		
Higher-grade Example		
Approximate grade % Cu		
% Zn		
% Pb		
oz. Ag/ton		
oz. Au/ton		
Lower-grade Example		
Approximate grade % Cu		
% Zn		
% Pb		
oz. Ag/ton		
oz. Au/ton		
2. If no operating mines, are there massive base metal sulphide occurrences/prospects in the area?	YES	
How many?	ONE	
Higher-grade Example		
Approximate metal content		
% Cu	1.45 %	
% Zn	3.6 %	
% Pb	0.9 %	
oz. Ag/ton	1.45	
oz. Au/ton	0.041	

Computer Code

Lower-grade Example

Approximate metal content

	% Cu	
	% Zn	
	% Pb	
	oz. Ag/ton	
	oz. Au/ton	

3a. Is "massive" heavy sulphide mineralization present? YES

Is its distribution stratigraphically controlled within a single lithological unit? YES

--within several different lithological units? NO

Does mineralization occur within the same units in different localities? NO

What it its approximate mineralogical composition?

Example 1	% pyrite	30 %
	% pyrrhotite	5 %
	% chalcopyrite	10 %
	% galena	5 %
	% sphalerite	20 %
Example 2	% pyrite	
	% pyrrhotite	
	% chalcopyrite	
	% sphalerite	
	% galena	

4. Is there any metal or mineral zoning in the mines or prospects? N/A

Vertical zoning, stratigraphic base to top--describe briefly

Computer Code

Top

Bottom

Lateral zoning, proximal to distal--describe briefly

Proximal

Distal

5. Are chemical sedimentary rocks or siliceous tuffs associated with the mineralization? YES

--in specific deposits? YES

--if so, in what stratigraphic with respect to the mineralization? HANGINGWALL

Computer Code

--regionally, at or near the mineralized horizon? N/A

What is their composition?

cherty ~~tuff~~ argillite — CHERTY ARGILLITE

iron formation

what facies: oxide

silicate

carbonate

sulfide — PYRITIC CHERT

barite

carbonaceous or graphitic schist

6. What type of alteration is present in the host rocks?

--is the stratigraphic hanging wall altered? YES

--if so, what type of alteration, what intensity

silicification — SILICIFIED WEAKLY

chloritization

tourmalinization

albitization

other--describe briefly

Is the stratigraphic footwall altered? YES

--if so, what type of alteration, what intensity?

Computer Code

silicification — AS STOCKWORK

chloritization

tourmalinization

albitization

other--describe briefly — CARBONATE STOCKWORK VEINLETS

Is the stratigraphic footwall altered?

--if so, what type of alteration, what intensity?

silification

chloritization

tourmalinization

albitization

other--describe briefly

7. What is the regional metamorphic rank?

zeolite facies--specify mineral assemblage if possible — ZEOLITE FACES MINERAL ASSEMBLAGE N/A

greenschist facies--specify mineral assemblage if possible

Computer Code

amphibolite facies--specify mineral assemblage if possible

granulite facies--specify mineral assemblage if possible

8. What is the regional style of deformation?

tight isoclinal folding: steep dips — TIGHT ISOCLINAL FOLDS STEEP LIMBS.

open folding, moderate dips

little deformation, relatively flat dips?

9. What type of pre-metamorphic volcanic rocks were present?

--differentiated basalt-andesite-rhyodacite?

--bimodal basalt-rhyodacite

Computer Code

--abundant felsic fragmental-pyroclastic rocks near the ore?

--mafic volcanic or subvolcanic rocks only?

--minor mafic volcanic or intrusive rocks and less abundant than (meta)sedimentary types?

--no significant volcanic or igneous rocks? NO SIGNIFICANT VOLC. ROCKS.

--other

10. What type of prematamorphic clastic sedimentary rocks are present?

--greywackes and volcanoclastics of varying composition?

--felsic volcaniclastics, with epi-clastic sandstone, shale, carbonate?

--minor clastic sedimentary rocks: only pelagic shales?

--argillite-siltstone-shale of turbiditic type? FINE GRAINED TURBIDITES AND SHALE

--shelf clastics and carbonates: sandstone-stilstone-shale-carbonate-evaporite

--other

Compute Code

11. What was the probable tectonic-sedimentary depositional environment in terms of "current" plate tectonic configurations?

--oceanic rift-ridge: spreading center?

--volcanic island arc off craton margin?

--fore-arc trench or trough?

--back-arc, post-arc or inner-arc basin?

--continental or cratonic rift? CRATONIC RIFT

--shallow cratonic shelf or basin?

--other

12. Describe the soil profile in each area delineated:

Top	% total thickness	Bottom
IMMATURE ORGANIC SOILS	30%	
ALLUVIUM AND COLLUVIUM	70%	
		Bottom

Computer Code

Soil thickness-- Meters or feet

greatest 2 metres.

average 1 metre

smallest less than one metre

13. Describe the weathering profile in each area delineated:

Top % of total thickness

UNWEATHERED — ARCTIC CLIMATE, DEEPLY GLACIATED.

Bottom

Weathering profile thickness-- Meters or feet

greatest

average

smallest

14. Cover rocks if massive sulphide environment is subsurface

Top % of total thickness

EXPOSED AT SURFACE

Bottom

E-2: Description

Rocks ranging in age from upper Proterozoic through middle Paleozoic and underlying large areas of southeastern, central and northern Yukon are included within massive sulphide environment E-2. This group of rocks is predominantly clastic but also includes minor volcanics and carbonates. The Paleozoic shales are laterally equivalent to platformal carbonate rocks and define two intracratonic basins called Selwyn Basin and Richardson Trough. Upper Proterozoic and possibly some lower Cambrian rocks belong to the "Grit Unit" and comprise sequences of shale, quartzite, quartz grit, limestone and dolomite up to several kilometers thick. The "Grit Unit" is widespread and varies little from place to place but is only known to host massive sulphide deposits in the Coal River area.

Lower and middle Plaeozoic black shales host the deposits of both the Anvil and Howard Pass districts. Most of these shales belong to the Road River Formation and range in age from upper Cambrian through Devonian, although those in Anvil Range are thought to be Lower Cambrian in age. The black shales undergo facies changes to ribbon chert towards the centre of Selwyn Basin and to platformal carbonate rocks towards the margins. Basic volcanic rocks are associated with the shales in Anvil Range but not elsewhere.

The Tectonic environment was either that of a passive continental margin or intracratonic basin. Local normal or rift faulting, although not documented, may have been an important control of sulphide deposition.

GENERALIZED GEOLOGY - ANVIL RANGE AREA

Sedimentary and volcanic rocks in Anvil Range are divided into two separate stratigraphic packages, both of which were uplifted into a broad arch by the intrusion Anvil Batholith, a Cretaceous porphyritic biotite quartz monzonite and granodiorite body. The lower package, which contains all lead-zinc mineralization, ranges in age from lower Cambrian to upper Ordovician. The upper package consists of several imbricate thrust slices ranging in age from middle Devonian to Mississippian and is composed of black phyllites, chert conglomerate, stratiform barite, chert and basalt flows.

The lower package is identified on the Tectonic Assemblage Map (Map A) as unit €Dm. Lithologies in descending order consist of:

mid-Ordovician - mafic metavolcanic rocks, dominantly breccias, tuffs and pillowed to massive flows;

middle Cambrian to lower Ordovician - calcareous phyllite (locally metamorphosed to calc-silicate phyllite), graphitic phyllite and metabasite;

lower Cambrian - stratiform lead-zinc deposits and within a graphitic phyllite uni

Proterozoic to Cambrian - non-calcareous phyllite to schist with minor calc-silicate phyllite, marble and minor metabasite.

All contacts appear to be unconformable. There is no consistent relationship between volcanism and ore deposits. Volcanism appears to have initiated at the time of ore deposition and most of the volcanic material is younger than mineralization. At most, basaltic magmatism supplied the heat which focused brine migration. Trace element analysis of volcanic rocks suggest a within-plate rift setting.

MINERALIZATION - ANVIL RANGE AREA

Seven potentially economic sulphide bodies have been discovered along the 25 km belt known as the Anvil Range district. All occur within the host lower Cambrian graphitic phyllite unit which marks the transition between calcareous and non-calcareous pelites. Characteristic vertical and lateral zonation seen in all deposits is (in descending order):

(i) baritic massive sulphide;

(ii) pyritic massive sulphide;

(iii) pyritic quartzite;

(iv) ribbon banded graphitic quartzite.

Most deposits are surrounded by an alteration envelope which may be best developed in the footwall. Chalcopyrite-pyrrhotite stringer zones are recognizable beneath some deposits.

The seven deposits together contain almost 225 million tonnes of total sulphide mineralization of which about 100 million tonnes of material grades 9.5% combined lead and zinc and about 50 grams per tonne silver.

EXPLORATION HISTORY - ANVIL RANGE AREA

First discoveries in the Anvil Range area were made by A. Kulan and native prospectors in 1953. Claims staked on two showings were optioned to Prospectors Airways Ltd., which conducted geochemical, gravity and ground magnetic surveys. Between 1953 and 1956, some drilling was carried out, especially on the discovery Vangorda showing. Prospectors Airways later merged with Kerr Addison Mines Ltd. which performed sporadic work in the area during the late 1950's and 1960's.

Activity was renewed in 1965 when Dynasty Exploration Ltd. and Cyprus Exploration Ltd. discovered the Faro orebody while drilling a coincident airborne magnetic, ground magnetic and gravity anomaly 10 km northwest of the Vangorda discovery. Dynasty continued drilling on the Faro deposit until 1969, when production commenced at 5,500 TPD. This was expanded in 1975 to the present rate of 10,000 TPD. Anvil Mining Corp. Ltd., formed by the joint venture in 1965 to develop the deposit, merged with Dynasty and Cyprus in 1975 to form Cyprus Anvil Mining Corp. Ltd.

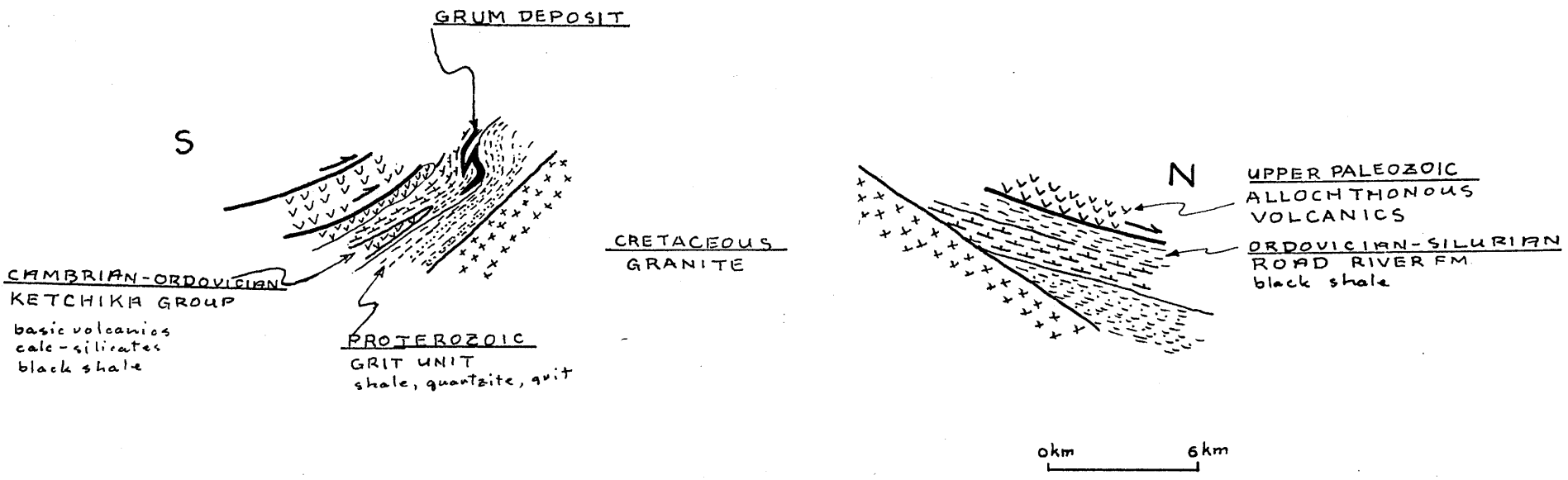
A subsidiary of Kerr Addison, Vangorda Mines Ltd., joint venturing with the AEX 73 syndicate (later Canadian Natural Resources Limited), conducted drilling and underground bulk testing on the Grum deposit, some 10 km west of the Vangorda discovery. After a 250 ton mill test in 1977, reserves of 27 million tonnes grading 10.5% combined lead and zinc with 50 grams per tonne silver were announced. Kerr Addison and Canadian Natural Resources holdings in the Anvil Range area including the Grum deposit, were sold to Cyprus Anvil in 1978.

Cyprus Anvil, conducting deep exploration drilling on the DY claims in 1976, intersected significant mineralization at depths greater than 500 m in what is thought to be an easterly extension of the Grum deposit. Drilling is presently

continuing on this discovery. Cyprus Anvil geologists estimate that the deposit could be as large as 50 to 80 million tonnes with grades similar to other deposits in the area. Cyprus Anvil now directly controls most of the potentially mineralized ground in the Anvil Range area. Their exploration in the area continues, utilizing deep drilling as the primary exploration tool.

SCHEMATIC CROSS-SECTION

ANVIL RANGE AREA



E-2 RANGE AREA

DESCRIPTION OF MASSIVE SULPHIDE ENVIRONMENTS

		Computer Code
1. Are ~~(were)~~ there operating mines in the area?	YES	
How many?	ONE	
Approximate size in millions of tons—largest?	75	
smallest?		
Higher-grade Example		
Approximate grade % Cu	/	
% Zn	5.7%	
% Pb	3.4%	
oz. Ag/ton	1.2	
oz. Au/ton	/	
Lower-grade Example		
Approximate grade % Cu		
% Zn		
% Pb		
oz. Ag/ton		
oz. Au/ton		
2. ~~If no operating mines,~~ Are there other massive base metal sulphide occurrences/prospects in the area?	YES	
How many?	8	
Higher-grade Example		
Approximate metal content		
% Cu	/	
% Zn	6%	
% Pb	4%	
oz. Ag/ton	1.5%	
oz. Au/ton	/	

Computer Code

Lower-grade Example

Approximate metal content

% Cu	0.3 %
% Zn	5.0 %
% Pb	3.2 %
oz. Ag/ton	1.8
oz. Au/ton	0.02

3a. Is "massive" heavy sulphide mineralization present? YES

Is its distribution stratigraphically controlled within a single lithological unit? YES

--within several different lithological units? NO

Does mineralization occur within the same units in different localities? YES

What it its approximate mineralogical composition?

Example 1	% pyrite	25
	% pyrrhotite	7
	% ~~chalcopyrite~~ sphalerite	12
	% galena	6
Example 2	% pyrite	25
	% pyrrhotite	5
	% chalcopyrite	2
	% sphalerite	12
	% galena	6

4. Is there any metal or mineral zoning in the mines or prospects? YES

Vertical zoning, stratigraphic base to top--describe briefly :

Computer Code

Top

BARITE

GYPSUM

SPHALERITE

GALENA

PYRITE

PYRRHOTITE

Bottom

Lateral zoning, proximal to distal--describe briefly

Proximal

PYRRHOTITE

PYRITE

GALENA

SPHALERITE

GYPSUM

BARITE

Distal

5. Are chemical sedimentary rocks or siliceous tuffs associated with the mineralization? YES

--in specific deposits? YES

--if so, in what stratigraphic with respect to the mineralization? HANGINGWALL

Computer Code

--regionally, at or near the mineralized horizon? YES

AT THE HORIZON

What is their composition?

cherty ~~tuff~~ CHERTY SHALE

iron formation

what facies: oxide

silicate

carbonate

sulfide

barite

carbonaceous or graphitic schist CARBONACEOUS PHYLLITE

6. What type of alteration is present in the host rocks?

--is the stratigraphic hanging wall altered? YES

--if so, what type of alteration, what intensity

silicification MINOR

chloritization

tourmalinization

albitization MINOR

other--describe briefly BLEACHED CARBON

Is the stratigraphic footwall altered? YES

--if so, what type of alteration, what intensity?

Compute Code

silicification — MODERATE

chloritization — STRONG

tourmalinization

albitization

other--describe briefly — BLEACHED CARBON

PYRITIZED

Is the stratigraphic footwall altered?

--if so, what type of alteration, what intensity?

silification

chloritization

tourmalinization

albitization

other--describe briefly

7. What is the regional metamorphic rank?

zeolite facies--specify mineral assemblage if possible

greenschist facies--specify mineral assemblage if possible

Computer Code

amphibolite facies--specify mineral assemblage if possible

biotite
muscovite
andaluste

granulite facies--specify mineral assemblage if possible

8. What is the regional style of deformation?

tight isoclinal folding: steep dips

polyphase, isoclinal dips greater than 30°

open folding, moderate dips

little deformation, relatively flat dips?

9. What type of pre-metamorphic volcanic rocks were present?

--differentiated basalt-andesite-rhyodacite?

--bimodal basalt-rhyodacite

Computer Code

--abundant felsic fragmental-pyroclastic rocks near the ore?

--mafic volcanic or subvolcanic rocks only?

--minor mafic volcanic or intrusive rocks and less abundant than (meta)sedimentary types? minor mafic volcanic rocks.

--no significant volcanic or igneous rocks?

--other

10. What type of prematamorphic clastic sedimentary rocks are present?

--greywackes and volcanoclastics of varying composition?

--felsic volcaniclastics, with epiclastic sandstone, shale, carbonate?

--minor clastic sedimentary rocks: only pelagic shales? minor coarse clastics pelagic shales host.

--argillite-siltstone-shale of turbiditic type?

--shelf clastics and carbonates: sandstone-stilstone-shale-carbonate-evaporite

--other

Compute Code

11. What was the probable tectonic-sedimentary depositional environment in terms of "current" plate tectonic configurations?

--oceanic rift-ridge: spreading center?

--volcanic island arc off craton margin?

--fore-arc trench or trough?

--back-arc, post-arc or inner-arc basin?

--continental or cratonic rift? cratonic rift

--shallow cratonic shelf or basin?

--other

12. Describe the soil profile in each area delineated:

Top	% total thickness
Immature organic soil	20%
Muskeg	8%
Glacial till - permafrost	90%

Bottom

Bottom

Computer Code

Soil thickness-- Meters or feet

greatest 60

average 20

smallest 1

13. Describe the weathering profile in each area delineated:

Top % of total thickness

unweathered, heavily glaciated

Bottom

Weathering profile thickness-- Meters or feet

greatest less than one metre

average

smallest

14. Cover rocks if massive sulphide environment is subsurface

Top % of total thickness

Bottom

GENERALIZED GEOLOGY - COAL RIVER AREA

In the Coal River Area, two dissimilar clastic hosted sulphide deposits occur within late Proterozoic and lower Cambrian clastic and carbonate rocks. The McMillan deposit occurs within a thick sequence (≤2 km) of quartz grit, limestone, quartzite, limestone conglomerate and argillite of the Proterozoic "Grit Unit". The deposit is up to 50 feet thick, is generally conformable and has sharp contacts with hanging wall rocks of maroon and green argillite, limestone and limestone conglomerate and a footwall sequence of maroon and green argillite and limestone. The sediments are gently dipping and are cut by both normal faults and thrust faults.

The Mel deposit occurs within a thin band of phyllite that overlies lower Cambrian limestone. The phyllite is highly sheared and brecciated and the whole sequence occurs within the overturned limb of a broad syncline.

MINERALIZATION - COAL RIVER AREA

The McMillan deposit is up to 15 m thick with reserves of about 1.5 million tonnes grading about 6% Pb, 9% Zn and 90 grams/tonne Ag. Mineralization consists of galena, sphalerite, pyrite and arsenopyrite with siderite and ankerite and is surrounded by a halo of arsenopyrite and sulphosalt veinlets and siderite breccia zones.

The Mel mineralization reaches 18 m in thickness and consists of alternating bands of up to 0.5 m thick of pure barite and limy pyritic and baritic phyllite. The mineralization consists of laminar blebs of sphalerite and wisps and veinlets of galena and occurs as two bands, an East Zone 850 m long and 3 to 12 m thick, and a West Zone less than 120 m long and up to 6 m thick. Sphalerite tends to occur in bands with low barite content and is often surrounded by small rims of talc alteration, producing a rock that resembles a "sphalerite-augen-talc schist". The footwall of the zone consists of up to 1.5 m of brecciated white chert and interbedded brown phyllite. The drilling tested the deposit to depths of 120 to 180 m, indicating 3.94 million tonnes grading 1.9% Pb, 5.2% Zn and 61% $BaSO_4$.

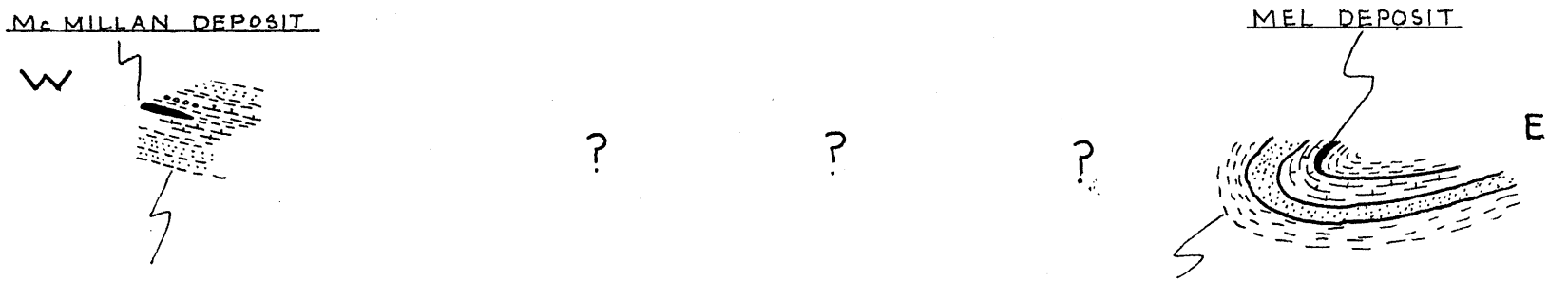
EXPLORATION HISTORY - COAL RIVER AREA

The McMillan deposit was first discovered in 1892 by prospectors from the Cassiar Gold Fields and was first staked in 1930. New Jersey Zinc and Noranda hand trenched and drilled 4 holes (200 m) in 1949-50. In 1951, Asarco entered the joint venture with a majority interest and drilled 93 holes totalling 7058 m between 1951 and 1973. Noranda optioned the property in 1975 and explored with 27 holes (2,560 m) and geophysics.

The Mel property was first staked by prospectors in 1967 and optioned to Newmont, which explored with geochemistry and bulldozer trenching. The property was restaked in 1973 by Sovereign Metals Corp. and optioned to Granby Mining, which drilled 8 holes (548 m) in 1974 and 10 holes (1,404 m) in 1975. St. Joseph Exploration entered the joint venture and explored with geochemical and gravity surveys in 1977 and 7 holes (1,050 m) in 1978.

SCHEMATIC CROSS-SECTION

COAL RIVER AREA



COAL RIVER AREA

DESCRIPTION OF MASSIVE SULPHIDE ENVIRONMENTS

		Computer Code
1. Are (were) there operating mines in the area?	NO	
How many?		
Approximate size in millions of tons—largest?		
smallest?		
Higher-grade Example		
Approximate grade % Cu		
% Zn		
% Pb		
oz. Ag/ton		
oz. Au/ton		
Lower-grade Example		
Approximate grade % Cu		
% Zn		
% Pb		
oz. Ag/ton		
oz. Au/ton		
2. If no operating mines, are there massive base metal sulphide occurrences/prospects in the area?	YES	
How many?	TWO	
Higher-grade Example		
Approximate metal content		
% Cu		
% Zn	9%	
% Pb	6%	
oz. Ag/ton	3.0	
oz. Au/ton		

Computer Code

Lower-grade Example

Approximate metal content

% Cu	—	
% Zn	5.2 %	
% Pb	1.9 %	
oz. Ag/ton	—	
oz. Au/ton	—	

3a. Is "massive" heavy sulphide mineralization present? YES

Is its distribution stratigraphically controlled within a single lithological unit? YES

--within several different lithological units? NO

Does mineralization occur within the same units in different localities? NO

What it its approximate mineralogical composition?

Example 1	% pyrite	N/A
	% pyrrhotite	
	% chalcopyrite	
	% galena	
Example 2	% pyrite	
	% pyrrhotite	
	% chalcopyrite	
	% sphalerite	
	% galena	

4. Is there any metal or mineral zoning in the mines or prospects? YES

Vertical zoning, stratigraphic base to top--describe briefly

Computer Code

Top

GALENA + SPHALERITE + BARITE

GALENA + BARITE

Bottom

Lateral zoning, proximal to distal--describe briefly

Proximal

GALENA + CHERT

GALENA + SPHALERITE + CHERT

GALENA + SPHALERITE + BARITE

SPHALERITE + BARITE

BARITE

Distal

5. Are chemical sedimentary rocks or siliceous tuffs associated with the mineralization? NOT KNOWN

--in specific deposits? NOT KNOWN

--if so, in what stratigraphic with respect to the mineralization?

Computer Code

--regionally, at or near the mineralized horizon?

What is their composition?

cherty tuff

iron formation

what facies: oxide

silicate

carbonate

sulfide

barite

carbonaceous or graphitic schist

6. What type of alteration is present in the host rocks?

--is the stratigraphic hanging wall altered? YES

--if so, what type of alteration, what intensity

silicification

chloritization

tourmalinization

albitization

other--describe briefly SIDERITIZATION

Is the stratigraphic footwall altered? NO

--if so, what type of alteration, what intensity?

Compute Code

silicification

chloritization

tourmalinization

albitization

other--describe briefly

Is the stratigraphic footwall altered?

--if so, what type of alteration, what intensity?

silification

chloritization

tourmalinization

albitization

other--describe briefly

7. What is the regional metamorphic rank?

zeolite facies--specify mineral assemblage if possible

NON-METAMORPHOSED

greenschist facies--specify mineral assemblage if possible

Computer Code

amphibolite facies--specify mineral assemblage if possible

granulite facies--specify mineral assemblage if possible

8. What is the regional style of deformation?

tight isoclinal folding: steep dips

open folding, moderate dips — OPEN FOLDS, THRUST FAULTING

little deformation, relatively flat dips?

9. What type of pre-metamorphic volcanic rocks were present?

--differentiated basalt-andesite-rhyodacite?

--bimodal basalt-rhyodacite

Computer Code

--abundant felsic fragmental-pyroclastic rocks near the ore?

--mafic volcanic or subvolcanic rocks only?

--minor mafic volcanic or intrusive rocks and less abundant than (meta)sedimentary types?

--no significant volcanic or igneous rocks? NO KNOWN VOLCANIC ROCKS.

--other

10. What type of prematamorphic clastic sedimentary rocks are present?

--greywackes and volcanoclastics of varying composition?

--felsic volcaniclastics, with epiclastic sandstone, shale, carbonate?

--minor clastic sedimentary rocks: only pelagic shales?

--argillite-siltstone-shale of turbiditic type?

--shelf clastics and carbonates: sandstone-stilstone-shale-carbonate-evaporite CARBONATE CLASTICS ARGILLITE

--other ALGAL LIMESTONE

Compute Code

11. What was the probable tectonic-sedimentary depositional environment in terms of "current" plate tectonic configurations?

--oceanic rift-ridge: spreading center?

--volcanic island arc off craton margin?

--fore-arc trench or trough?

--back-arc, post-arc or inner-arc basin? BACK ARC BASIN TO CONTINENTAL SHELF

--continental or cratonic rift?

--shallow cratonic shelf or basin?

--other

12. Describe the soil profile in each area delineated:

Top	% total thickness
IMMATURE ORGANIC SOIL	5%
MUSKEG	10%
ALLUVIUM	15%
GLACIAL TILL	70%

Bottom

Bottom

Computer Code

Soil thickness-- Meters or feet

greatest 30 metres

average 5 metres

smallest less than one metre.

13. Describe the weathering profile in each area delineated:

Top % of total thickness

UNWEATHERED, GLACIATED.

Bottom

Weathering profile thickness-- Meters or feet

greatest

average

smallest

14. Cover rocks if massive sulphide environment is subsurface

Top % of total thickness

ALGAL LIMESTONE 60 %

LIMESTONE CONGLOMERATE 40 %

Bottom

HOWARD PASS AREA - GENERALIZED GEOLOGY

The Ordovician and Silurian Road River Formation is host to stratabound sulphide mineralization in the Howard Pass Area. Two major deposits and one small occurrence, all owned by Placer Development and one other small occurrence have been discovered to date. All are situated within a narrow belt that is exposed along the southwest flank of a west-northwest plunging anticlinorium over 75 km long. Cambrian and Ordovician shale and carbonate rocks underlie the Road River Formation and a thick sequence of Devonian and Mississippian argillite, shale grit and chert pebble conglomerate overlie it. Specific structural and stratigraphic controls of mineralization have not been established but the setting of the various deposits and properties is similar throughout the area. Mineralization occurs within the lower part of the Road River Formation and is hosted by black graphitic, siliceous argillite and minor black limestone. Similar rocks, together with black chert, comprise the rest of the lower member and are characteristic of the Road River Formation throughout Selwyn Basin. The total thickness of the Road River Formation in the Howard Pass Area is consistently less than 300 m and the lower member is less than 200 m.

Within the mineralized belt, broad open folds, accompanied by steep cleavage are the dominant structures. The southwest side of the belt is bounded by a complex, parallel zone of steep faults.

HOWARD PASS - MINERALIZATION

The known mineralized zones in the Howard Pass are called the XY deposit, Anniv deposit and OP occurrence of Placer Development and two prospects owned by Vestor Explorations and Cyprus Anvil, respectively. The XY deposit is the largest and most completely explored deposit. The area explored is about 7600 m long and 2,400 m wide and the deposit averages about 10% combined Pb and Zn and 15 grams/tonne Ag across an average thickness of 17 m. High-grade drill intersections have assayed up to 25.0% Zn and 23.1% Pb across 7.5 m. Mineralization consists of fine-grained sphalerite, galena and minor pyrite. The Anniv occurrence is reported to be of comparable grade but somewhat smaller. The OP zone is significantly smaller.

HOWARD PASS AREA - EXPLORATION HISTORY

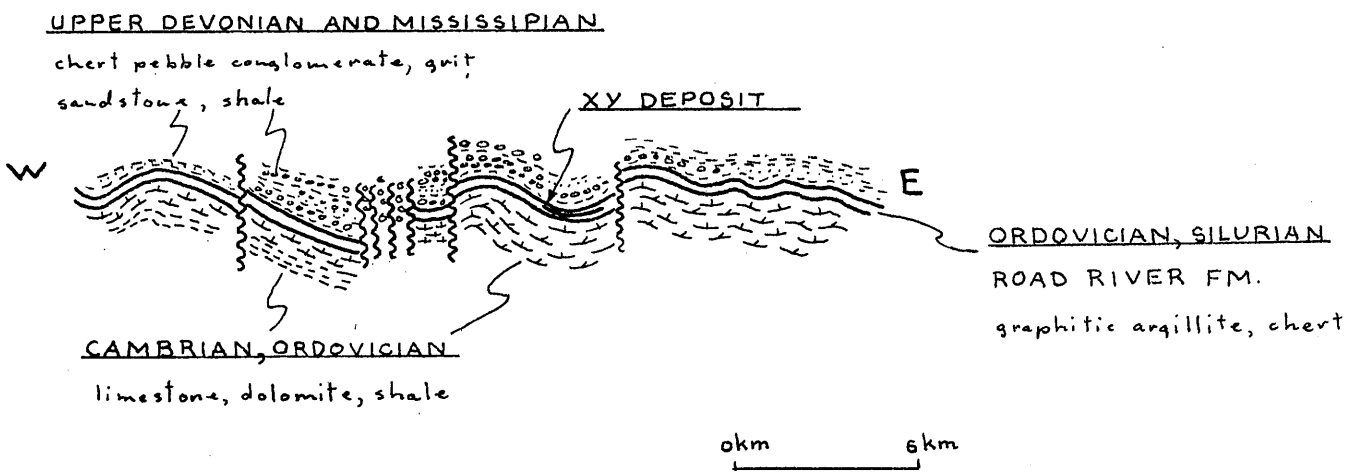
The XY, Anniv and OP occurrences were discovered in 1972 by Placer Development Ltd. with reconnaissance geochemistry. The XY deposit was explored in 1973 with bulldozer trenching, mapping, grid soil sampling and 26 holes (4,265 m) and in 1974 with 12 holes (1,980 m). Placer then entered a joint venture with Essex Minerals (U.S. Steel) and drilled 10 holes (3,660 m) in 1975, 37 holes (6,242 m) in 1976 and 14 holes (5,060 m) in 1977. An access road was built to the property in 1977, and an exploration adit is scheduled to be started in 1980.

The Anniv deposit was explored with mapping and grid geochemistry in 1973 bulldozer trenching in 1974, 4 holes (305 m) in 1975, 30 holes (3,050 m) in 1976, 20 holes (5,456 m) in 1978 and extensive drilling in 1979.

The OP occurrence was explored with mapping and grid geochemistry in 1973, and 1974, 2 holes (250 m) in 1976 and 7 holes (584 m) in 1978.

SCHEMATIC CROSS-SECTION

HOWARD PASS AREA



DESCRIPTION OF MASSIVE SULPHIDE ENVIRONMENTS

		Computer Code
1. Are (were) there operating mines in the area?	NO	
How many?		
Approximate size in millions of tons—largest?		
smallest?		
Higher-grade Example		
Approximate grade % Cu		
% Zn		
% Pb		
oz. Ag/ton		
oz. Au/ton		
Lower-grade Example		
Approximate grade % Cu		
% Zn		
% Pb		
oz. Ag/ton		
oz. Au/ton		
2. If no operating mines, are there massive base metal sulphide occurrences/prospects in the area?	YES	
How many?	THREE	
Higher-grade Example		
Approximate metal content		
% Cu	—	
% Zn	6	
% Pb	4	
oz. Ag/ton	0.7	
oz. Au/ton	—	

Computer Code

Lower-grade Example

Approximate metal content

		Computer Code
% Cu	—	
% Zn	5	
% Pb	4	
oz. Ag/ton	0.5	
oz. Au/ton	—	

3a. Is "massive" heavy sulphide mineralization present? YES

Is its distribution stratigraphically controlled within a single lithological unit? YES

--within several different lithological units? NO

Does mineralization occur within the same units in different localities? YES

What it its approximate mineralogical composition?

Example 1	% pyrite	
	% pyrrhotite	
	% ~~chalcopyrite~~ sphalerite	30 %
	% galena	20 %
Example 2	% pyrite	5 %
	% pyrrhotite	
	% chalcopyrite	
	% sphalerite	40 %
	% galena	30 %

4. Is there any metal or mineral zoning in the mines or prospects? YES

Vertical zoning, stratigraphic base to top--describe briefly:

Computer Code

Top

UNZONED VERTICALLY

Bottom

Lateral zoning, proximal to distal--describe briefly

Proximal

GALENA AND MINOR SPHALERITE

GALENA AND SPHALERITE EQUAL SPHALERITE AND MINOR GALENA

SPHALERITE

Distal

5. Are chemical sedimentary rocks or siliceous tuffs associated with the mineralization? YES

--in specific deposits? YES

--if so, in what stratigraphic with respect to the mineralization? HANGINGWALL

Computer Code

--regionally, at or near the mineralized horizon? YES

AT THE HORIZON

What is their composition?

cherty ~~tuff~~ shale CHERTY SHALE

iron formation

what facies: oxide

silicate

carbonate DOLOMITIC SHALE

sulfide PYRITIC SHALE

barite

carbonaceous or graphitic schist CARBONACEOUS SHALE

6. What type of alteration is present in the host rocks?

--is the stratigraphic hanging wall altered? YES

--if so, what type of alteration, what intensity

silicification STRONG

chloritization

tourmalinization

albitization

other--describe briefly

Is the stratigraphic footwall altered? NO

--if so, what type of alteration, what intensity?

Computer Code

silicification

chloritization

tourmalinization

albitization

other--describe briefly

Is the stratigraphic footwall altered?

--if so, what type of alteration, what intensity?

silification

chloritization

tourmalinization

albitization

other--describe briefly

7. What is the regional metamorphic rank? UNMETAMORPHOSED

zeolite facies--specify mineral assemblage if possible

greenschist facies--specify mineral assemblage if possible

Compute Code

amphibolite facies--specify mineral assemblage if possible

granulite facies--specify mineral assemblage if possible

8. What is the regional style of deformation?

tight isoclinal folding: steep dips

open folding, moderate dips — OPEN FOLDING, MODERATE DIPS

little deformation, relatively flat dips?

9. What type of pre-metamorphic volcanic rocks were present?

--differentiated basalt-andesite-rhyodacite?

--bimodal basalt-rhyodacite

Computer Code

--abundant felsic fragmental-pyroclastic rocks near the ore?

--mafic volcanic or subvolcanic rocks only?

--minor mafic volcanic or intrusive rocks and less abundant than (meta)sedimentary types?

--no significant volcanic or igneous rocks? NO KNOWN VOLCANIC OR IGNEOUS ROCKS

--other

10. What type of prematamorphic clastic sedimentary rocks are present?

--greywackes and volcanoclastics of varying composition?

--felsic volcaniclastics, with epiclastic sandstone, shale, carbonate?

--minor clastic sedimentary rocks: only pelagic shales? PELAGIC SHALES

--argillite-siltstone-shale of turbiditic type?

--shelf clastics and carbonates: sandstone-stilstone-shale-carbonate-evaporite

--other

Compute Code

11. What was the probable tectonic-sedimentary depositional environment in terms of "current" plate tectonic configurations?

--oceanic rift-ridge: spreading center?

--volcanic island arc off craton margin?

--fore-arc trench or trough?

--back-arc, post-arc or inner-arc basin?

--continental or cratonic rift? INTRACRATONIC RIFT

--shallow cratonic shelf or basin?

--other

12. Describe the soil profile in each area delineated:

Top % total thickness

IMMATURE ORGANIC SOIL 15%

GLACIAL TILL & PERMAFROST 80%

BROKEN SHALE BEDROCK 5%

Bottom

Bottom

Computer Code

Soil thickness-- Meters or feet

greatest 10 metres

average 1 metre

smallest less than one metre

13. Describe the weathering profile in each area delineated:

Top % of total thickness

unweathered, sub-arctic environment, deeply glaciated.

Bottom

Weathering profile thickness-- Meters or feet

greatest

average

smallest

14. Cover rocks if massive sulphide environment is subsurface

Top % of total thickness

calcareous black carbonaceous shale 100 %

Bottom

E-3: Description

Upper Devonian and Mississippian clastic rocks comprise massive sulphide environment E-3. These rocks are widespread in eastern, central and northern Yukon and comprise a distinctive assemblage of black shale, chert grit, chert pebble conglomerate and bedded barite. The assemblage has been informally called the "Black Clastic" unit but is also called the Canol Formation in northeast Yukon and Earn Group in central Yukon. The coarse clastic rocks are related to local black faulting.

Bedded barite is host to the only known significant mineralization, in the Macmillan Pass area, although barren barite is common and widespread.

The general tectonic environment is either a passive continental margin or intracratonic basin. Local black faulting is probably an important ore control.

GENERALIZED GEOLOGY - MACMILLAN PASS AREA

The Macmillan Pass area is underlain by a series of lower to middle Paleozoic clastic sedimentary rocks that is interally divided into two lithogic packages by a major unconformity. The basal Proterozoic to middle Devonian assemblage consists of both calcareous and noncalcareous shale, with minor limestone accumulations (unit uЄDm on Map A). The lower assemblage is unconformably overlain by a series of interbedded conglomerate, fanglomerates and siliceous, noncalcareous black shales (unit DMe on Map A).

Detailed geologic mapping and structural studies in the Macmillan Pass area by government and mining industry geologists have determined that the upper "Black Clastic" assemblage (unit DMe) was deposited in a graben-like trough or rift zone. Rifting is thought to be time correlative with rift volcanism in the Seagull Creek area. Genesis of stratiform barite and barite-lead-zinc mineralization was probably directly related to rifting, the basin margin faults providing fluid conduits for exhalative fluids.

MINERALIZATION - MACMILLAN PASS AREA

Mineralization in the Macmillan Pass area occurs in several localities within the limits of a theorized 10 km wide upper Devonian graben-like trough or rift. Barite-lead-zinc-silver mineralization forms two principal deposits on the Jason and adjoining Tom claims, as well as several barren bedded barite and weakly mineralized barite occurrences.

Mineralization on the Tom claims is contained within two west-dipping tabular bodies separated by a 100 m thickness of barren conglomerate. The two horizons have been delineated by diamond drilling to a depth of 260 m. Current published reserves are about 9 million tonnes grading 8.4% Zn, 8.6% pb, 96 grams per tonne silver and about 25% to 30% Ba. An additional 9 million tonnes of baritic mineralization has been outlined grading 4.6% Zn, 0.9% Pb and trace amounts of silver. The upper mineralized body is open at depth.

Mineralization in the 3 m to 60 m thick tabular bodies consists of finely interlaminated chert, pyrite, sphalerite, galena, barite and black shale. The deposits are well zoned both vertically and laterally. Basal and proximal sections tend to carry best lead and silver values while upper and lateral parts of the mineralization are zinc and barium-rich. Copper, lead and silver-rich stringer and alteration zones occur beneath the highest grade parts of the mineralized bodies.

Less information has been published on the Jason deposit, situated some 6 km west. Two mineralized horizons are present, apparently at the same stratigraphic horizons as the Tom showings. Tenor, style and extent of the stratiform barite-lead-zinc mineralization is also apparently similar.

EXPLORATION HISTORY - MACMILLAN PASS AREA

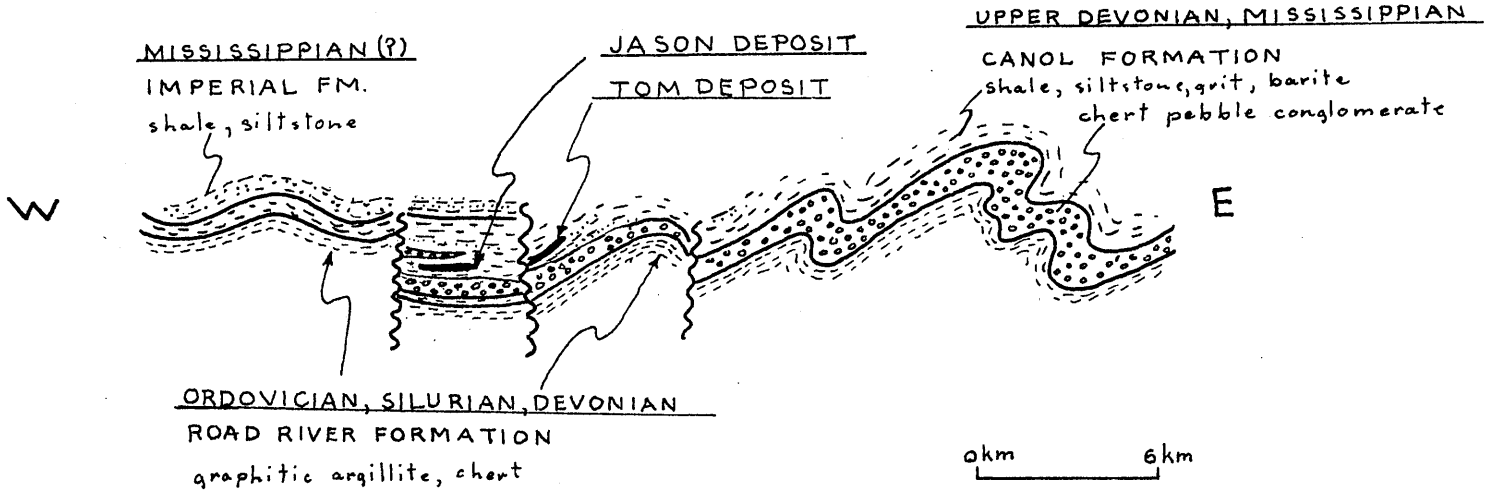
Stratiform barite-lead-zinc mineralization was first discovered in the Macmillan Pass area on the Tom claims by Hudson Bay Exploration and Development Co. Ltd. prospectors working off the Canol Road in 1951. Development by the company on the discovery or West Zone during the period 1951 to 1953 consisted of geological mapping, sampling and hand trenching, as well as diamond drilling. The property lay idle until 1966 when geochemical and magnetometer surveys were conducted prior to diamond drilling in 1967 and 1968 on the East Zone. Underground bulk sampling and diamond drilling carried out during 1970-72 delineated the current reserves.

The area was quiet until the 1975 discovery by Ogilvie Joint Venture of similar mineralization 6 km west of the Tom showing. Ogilvie Joint Venture carried out an ambitious gravity, Max-Min and geochemical survey program with overburden and diamond drilling on the claims during 1975-1978. Drilling resumed in 1979 under an option agreement with Pan Ocean Oil Co. Ltd.

Rumours of significant discoveries on the Jason claims prompted re-evaludtion of the Tom mineralization by Hudson Bay during 1976 to 1979. Results of this work, which apparently included additional geochemical, geophysical surveys and diamond drilling, have not been announced.

SCHEMATIC CROSS-SECTION

MACMILLAN PASS AREA



PASS AREA

DESCRIPTION OF MASSIVE SULPHIDE ENVIRONMENTS

		Computer Code
1. Are (were) there operating mines in the area?	NO	
How many?		
Approximate size in millions of tons—largest?		
smallest?		
Higher-grade Example		
Approximate grade % Cu		
% Zn		
% Pb		
oz. Ag/ton		
oz. Au/ton		
Lower-grade Example		
Approximate grade % Cu		
% Zn		
% Pb		
oz. Ag/ton		
oz. Au/ton		
2. If no operating mines, are there massive base metal sulphide occurrences/prospects in the area?	YES	
How many?	TWO	
Higher-grade Example		
Approximate metal content		
% Cu	0.2	
% Zn	5	
% Pb	4	
oz. Ag/ton	1.0	
oz. Au/ton	—	

Computer Code

Lower-grade Example

Approximate metal content

% Cu	—
% Zn	2%
% Pb	—
oz. Ag/ton	—
oz. Au/ton	—

3a. Is "massive" heavy sulphide mineralization present? YES

Is its distribution stratigraphically controlled within a single lithological unit? NO

--within several different lithological units? YES

Does mineralization occur within the same units in different localities? YES

What it its approximate mineralogical composition?

Example 1	% pyrite	5
	% pyrrhotite	0
	% ~~chalcopyrite~~ sphalerite	30
	% galena	30
Example 2	% pyrite	30
	% pyrrhotite	0
	% chalcopyrite	1
	% sphalerite	20
	% galena	20

4. Is there any metal or mineral zoning in the mines or prospects? YES

Vertical zoning, stratigraphic base to top--describe briefly :

Computer Code

Top

BARITE

SPHALERITE

GALENA

PYRITE

SIDERITE

Bottom

Lateral zoning, proximal to distal--describe briefly

Proximal

SIDERITE

PYRITE

GALENA

SPHALERITE

BARITE

Distal

5. Are chemical sedimentary rocks or siliceous tuffs associated with the mineralization? YES

--in specific deposits? YES

--if so, in what stratigraphic with respect to the mineralization? HANGINGWALL

Computer Code

--regionally, at or near the mineralized horizon? YES AT THE HORIZON

What is their composition?

cherty ~~tuff~~ CHERTY SHALE

iron formation

what facies: oxide

silicate

carbonate

sulfide PYRITE

barite NODULAR BARITE

carbonaceous or graphitic schist CARBONACEOUS SHALE

6. What type of alteration is present in the host rocks?

--is the stratigraphic hanging wall altered? YES

--if so, what type of alteration, what intensity

silicification STRONGLY SILICIFIED

chloritization

tourmalinization

albitization MINOR

other--describe briefly

Is the stratigraphic footwall altered? YES.

--if so, what type of alteration, what intensity?

Computer Code

silicification — STRONG

chloritization — MODERATE

tourmalinization — MINOR

albitization

other--describe briefly — BLEACHED ORGANIC CARBON

Is the stratigraphic footwall altered?

--if so, what type of alteration, what intensity?

silicification

chloritization

tourmalinization

albitization

other--describe briefly

7. What is the regional metamorphic rank? — NON-METAMORPHOSED

zeolite facies--specify mineral assemblage if possible

greenschist facies--specify mineral assemblage if possible

Computer Code

amphibolite facies--specify mineral assemblage if possible

granulite facies--specify mineral assemblage if possible

8. What is the regional style of deformation?

tight isoclinal folding: steep dips

open folding, moderate dips — OPEN FOLDS, SHALLOW TO MODERATE DIPS

little deformation, relatively flat dips?

9. What type of pre-metamorphic volcanic rocks were present? — NONE

--differentiated basalt-andesite-rhyodacite?

--bimodal basalt-rhyodacite

Computer Code

--abundant felsic fragmental-pyroclastic rocks near the ore?

--mafic volcanic or subvolcanic rocks only?

--minor mafic volcanic or intrusive rocks and less abundant than (meta)sedimentary types?

--no significant volcanic or igneous rocks? NO KNOWN VOLCANIC OR IGNEOUS ROCKS

--other

10. What type of prematamorphic clastic sedimentary rocks are present?

--greywackes and volcanoclastics of varying composition?

--felsic volcaniclastics, with epiclastic sandstone, shale, carbonate?

--minor clastic sedimentary rocks: only pelagic shales?

--argillite-siltstone-shale of turbiditic type? TURBIDITES, DEBRIS FLOWS AND PELAGIC SHALE

--shelf clastics and carbonates: sandstone-stilstone-shale-carbonate-evaporite

--other

Compute Code

11. What was the probable tectonic-sedimentary depositional environment in terms of "current" plate tectonic configurations?

--oceanic rift-ridge: spreading center?

--volcanic island arc off craton margin?

--fore-arc trench or trough?

--back-arc, post-arc or inner-arc basin?

--continental or cratonic rift? INTRACRATONIC RIFT

--shallow cratonic shelf or basin?

--other

12. Describe the soil profile in each area delineated:

Top	% total thickness
IMMATURE ORGANIC SOIL	5%
MUSKEG-SWAMP	15%
ALLUVIAL GRAVEL	30%
GLACIAL TILL	50%

Bottom

Bottom

Computer Code

Soil thickness-- Meters or feet

greatest 10

average less than 1 metre

smallest less than 1 metre

13. Describe the weathering profile in each area delineated:

Top % of total thickness

unweathered, sub-arctic environment, deeply glaciated

Bottom

Weathering profile thickness-- Meters or feet

greatest

average

smallest

14. Cover rocks if massive sulphide environment is subsurface

Top % of total thickness

carbonaceous black shale 100%

Bottom

F. CARBONATE HOSTED MASSIVE SULPHIDE DEPOSITS

F-1: Description

A carbonate-hosted massive sulphide environment has been tentatively assigned to a small area in central Yukon underlain by black fetid limestone and graphitic argillite of Ordovician to Devonian age. These rocks probably belong to the Road River Formation and are transitional between black shales within Selwyn Basin and platformal carbonate rocks along its southwestern margins. The extent and potential of this environment are not certain.

The Angie prospect is the only known occurrence. Mineralization consists of fine grained stratiform disseminations and fracture fillings of argentiferous sphalerite, pyrite and a trace of galena in Devonian carbonaceous limestone. Mineralization occurs in horizons up to 10 cm thick within a 25 m thick sequence and can be traced for a strike length of 90 m.

DESCRIPTION OF MASSIVE SULPHIDE ENVIRONMENTS

		Computer Code
1. Are (were) there operating mines in the area?	110	
How many?		
Approximate size in millions of tons—largest?		
smallest?		
Higher-grade Example		
Approximate grade % Cu		
% Zn		
% Pb		
oz. Ag/ton		
oz. Au/ton		
Lower-grade Example		
Approximate grade % Cu		
% Zn		
% Pb		
oz. Ag/ton		
oz. Au/ton		
2. If no operating mines, are there massive base metal sulphide occurrences/prospects in the area?	YES	
How many?	1	
Higher-grade Example		
Approximate metal content		
% Cu	—	
% Zn	8.4 %	
% Pb	—	
oz. Ag/ton	3.1 oz/Ton	
oz. Au/ton	—	

Computer Code

Lower-grade Example

Approximate metal content

% Cu	—	
% Zn	6.0	
% Pb	—	
oz. Ag/ton	0.85	
oz. Au/ton		

3a. Is "massive" heavy sulphide mineralization present? NO

Is its distribution stratigraphically controlled within a single lithological unit?

--within several different lithological units?

Does mineralization occur within the same units in different localities?

What it its approximate mineralogical composition?

Example 1	% pyrite	
	% pyrrhotite	
	% chalcopyrite	
	% galena	
Example 2	% pyrite	
	% pyrrhotite	
	% chalcopyrite	
	% sphalerite	
	% galena	

4. Is there any metal or mineral zoning in the mines or prospects? NOT KNOWN

Vertical zoning, stratigraphic base to top--describe briefly

Computer Code

Top

Bottom

Lateral zoning, proximal to distal--describe briefly

Proximal

Distal

5. Are chemical sedimentary rocks or siliceous tuffs associated with the mineralization? NO

--in specific deposits? —

--if so, in what stratigraphic with respect to the mineralization?

Computer Code

--regionally, at or near the mineralized horizon?

What is their composition?

cherty tuff

iron formation

what facies: oxide

silicate

carbonate

sulfide

barite

carbonaceous or graphitic schist

6. What type of alteration is present in the host rocks?

--is the stratigraphic hanging wall altered?

--if so, what type of alteration, what intensity

silicification

chloritization

tourmalinization

albitization

other--describe briefly

Is the stratigraphic footwall altered? NO

--if so, what type of alteration, what intensity?

Computer Code

silicification

chloritization

tourmalinization

albitization

other--describe briefly

Is the stratigraphic footwall altered?

--if so, what type of alteration, what intensity?

silification

chloritization

tourmalinization

albitization

other--describe briefly

7. What is the regional metamorphic rank? phyllite.

zeolite facies--specify mineral assemblage if possible

greenschist facies--specify mineral assemblage if possible

Computer Code

amphibolite facies--specify mineral assemblage if possible

granulite facies--specify mineral assemblage if possible

8. What is the regional style of deformation?

tight isoclinal folding: steep dips — small scale mesoscopic folds.

open folding, moderate dips

little deformation, relatively flat dips?

9. What type of pre-metamorphic volcanic rocks were present?

--differentiated basalt-andesite-rhyodacite?

--bimodal basalt-rhyodacite

Computer Code

--abundant felsic fragmental-pyroclastic rocks near the ore?

--mafic volcanic or subvolcanic rocks only?

--minor mafic volcanic or intrusive rocks and less abundant than (meta)sedimentary types?

--no significant volcanic or igneous rocks?

--other

10. What type of prematamorphic clastic sedimentary rocks are present?

--greywackes and volcanoclastics of varying composition?

--felsic volcaniclastics, with epiclastic sandstone, shale, carbonate?

--minor clastic sedimentary rocks: only pelagic shales?

--argillite-siltstone-shale of turbiditic type?

--shelf clastics and carbonates: sandstone-stilstone-shale-carbonate-evaporite

calcareous arenite

black shale

--other

Compute Code

11. What was the probable tectonic-sedimentary depositional environment in terms of "current" plate tectonic configurations?

--oceanic rift-ridge: spreading center?

--volcanic island arc off craton margin?

--fore-arc trench or trough?

--back-arc, post-arc or inner-arc basin?

--continental or cratonic rift?

--shallow cratonic shelf or basin? ✓

--other

12. Describe the soil profile in each area delineated:

Top % total thickness

Immature mean soil <5%

talus and colluvium >95%

Bottom

Bottom

Computer Code

Soil thickness-- Meters or feet

greatest 20 m

average 10 m

smallest 0 m

13. Describe the weathering profile in each area delineated:

Top % of total thickness

unweathered, subaerial glaciated

Bottom

Weathering profile thickness-- Meters or feet

greatest

average

smallest

14. Cover rocks if massive sulphide environment is subsurface

Top % of total thickness

not known

Bottom