

# ARCHER, CATHRO

AND ASSOCIATES LTD.

CONSULTING GEOLOGICAL ENGINEERS

Box 4127, WHITEHORSE, Y.T. Y1A 3S9 667-4415

STANDARD BUILDING, VANCOUVER, B.C. 688-2568

1016 STANDARD BUILDING  
510 WEST HASTINGS STREET  
VANCOUVER, B.C.  
V6B 1L8

REPORT ON  
GEOLOGICAL MAPPING  
AND  
GEOCHEMICAL SURVEYS

OHNO 1-24 CLAIMS  
ITSI JOINT VENTURE

WATSON LAKE MINING DISTRICT, Y.T.  
CLAIM SHEET 105I/12

Latitude 62°36'N

Longitude 129°35'W

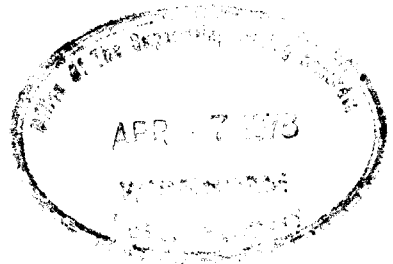
R.J. CATHRO, P.Eng.,

January 15, 1978

090312



GEOLOGY AND GEOCHEMISTRY  
OHNO 1-24 CLAIMS  
WATSON LAKE MINING DISTRICT  
CLAIM SHEET 105I/12



Lat. 62°36'N

Long. 129°35'W

R.J. Cathro, P.Eng.

APR 10 1978

TABLE OF CONTENTS

	<u>Page</u>
Introduction -----	1
Property, Location and Access -----	2
Geology and Geomorphology -----	2
Table of Formations -----	4
Upper Cambrian and Lower Ordovician -----	5
Ordovician, Silurian, Lower and Middle Devonian -----	5
Middle and/or Upper Devonian -----	9
Upper(?) Devonian, Mississippian and Younger(?) -----	11
Structure -----	11
Geochemistry -----	12
Summary -----	13
Recommendations -----	13

Appendix

~~Report on a Test EM Survey on the Anniv Zone~~

*Indexed separately*

<u>Figures</u>	<u>In Text Following Page</u>
Figure 0-1 Property Locations, Howard Pass Belt	2
Figure 0-2 Geology	2
Figure 0-3 Geochemistry	12

## INTRODUCTION

The OHNO claims were staked by Itsi Joint Venture (Union Oil Co. of Canada Ltd., Aquitaine Co. of Canada Ltd., and St. Joseph Exploration Ltd.) as part of a two year program of regional exploration for shale-hosted stratiform mineralization in the Selwyn Basin of Yukon and N.W.T. Heavy emphasis was given to regional stratigraphic mapping and to identifying and tracing the various lithological units in the project area, distinguishing facies relationships in the favourable Road River Formation and mapping the facies and structural factors in the older rocks that may have influenced the localization of mineralization.

The known, potentially economic, lead-zinc deposits in the Howard Pass (Summit Lake) district occur within a narrow west-northwesterly trending belt called the Howard Pass Belt in this report (See Figure 01). The belt is remarkably similar in structural and stratigraphic style throughout its length. The OHNO claims were staked to cover an interpreted occurrence of Road River argillite in an area of very poor exposure near Canex Placer's Anniv deposit. The staking followed preliminary geological mapping, prospecting and geochemical sampling between July 1 and August 15. This work was performed by an Archer, Cathro crew under the direct supervision of the writer that was led by Grant Abbott and which included geologists Trevor Bremner and Rob Carne and assistants Frank Gish, John Gibson and Mike Maser. The work was conducted from a camp at Wishbone (Wye) Lake, 5 km to the east, on behalf of Itsi Joint Venture. Since the field work preceded the recording of the claims, only the office compilation costs have been used for calculating assessment credit.

### PROPERTY, LOCATION AND ACCESS

The OHNO property consists of 24 contiguous claims that form a west-north-westerly trending block about 6 km long and 1 km wide. It is situated between Cominco and Wishbone (Wye) Lakes at latitude 62°36'N and longitude 129°35'W. The claims have tag numbers YA25700 to YA25723, expire in September/78, and are registered in Watson Lake Mining District in the name of Archer, Cathro and Associates Ltd.

Fixed wing, float equipped aircraft can be landed on Cominco and Wishbone Lakes. Otherwise, access is only possible by helicopter. The nearest float plane base is located at Ross River, 160 km to the southwest. Jeff Lake, located 60 km to the northwest, on the Canal Road, can be used as a float plane base to ferry supplies. Gravel airstrips, which will accommodate light aircraft on wheels, are located at MacMillan Pass on the Canal Road, 70 km to the north and at Howard Pass, 20 km to the southeast. The Nahanni Range Road is presently being extended north-westwards from Tungsten to this strip and will be completed in 1978.

### GEOLOGY AND GEOMORPHOLOGY

The OHNO property is situated along the western margin of the Selwyn Mountains. Within the core of this range, peaks commonly reach elevations of greater than 2000 m and locally greater than 3000 m. With the exception of the higher peaks, local relief is about 600 to 700 m or less and terrain is relatively subdued and gentle. Main valleys within the central part of the range are U-shaped with truncated spurs below elevations of about 1800 m. Valleys in low areas along the edge of the range are generally broad and poorly defined. The OHNO claims are situated below

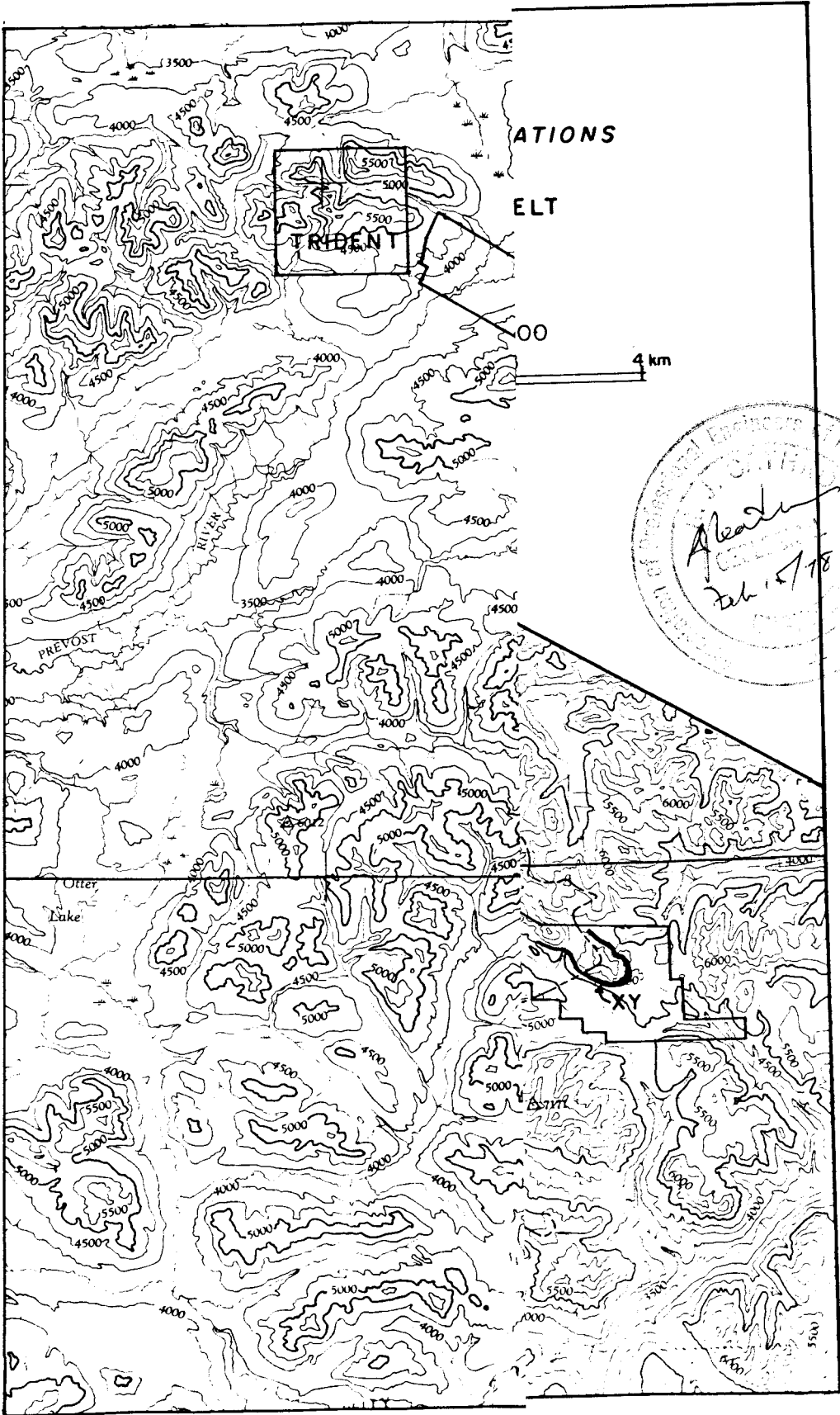
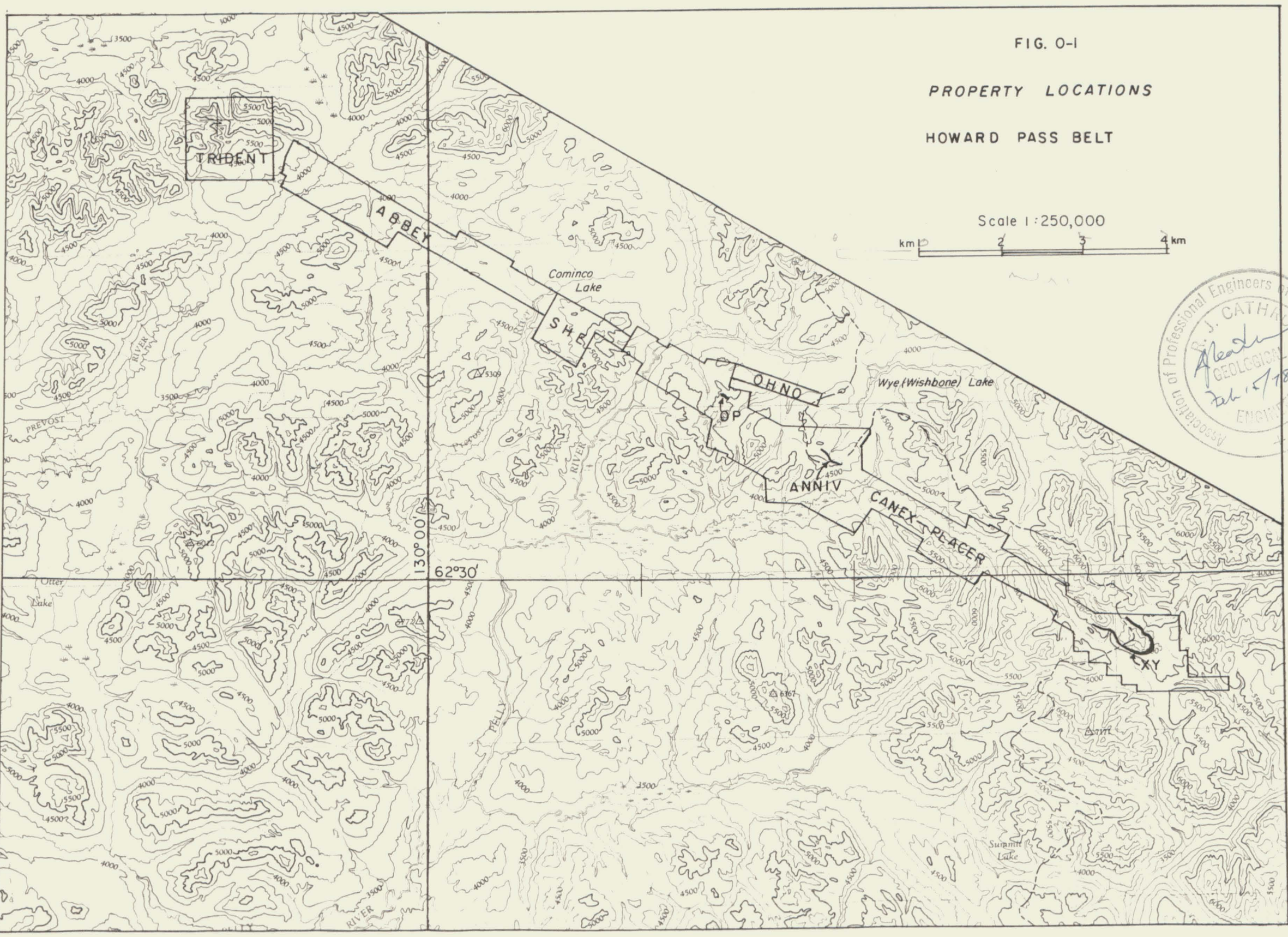
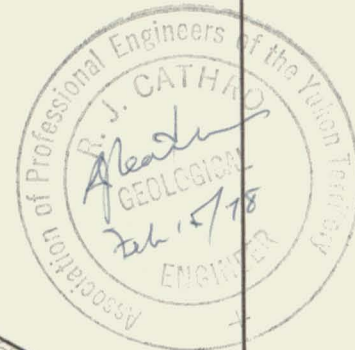


FIG. 0-1

PROPERTY LOCATIONS

HOWARD PASS BELT

Scale 1:250,000



timberline along the southwest side of a wide glaciated valley. Local relief is more than 700 m but is less than 100 m on the property.

The region has been covered by two or more continental ice sheets, one of which reached a minimum elevation of about 2000 m. Younger, less extensive valley and alpine glaciers also covered much of the area. Small glaciers still occur on some of the higher peaks, notably the Itsi Range and Keele Peak.

Glacial deposits in the district tend to be rather thin and discontinuous in the mountains and are most common on the floor of the main valleys. Above timberline, particularly in places where the effects of younger glaciation are weak or absent, fissile rocks such as shale have been severely frost shattered into fine felsenmeer and talus. The OHNO property is covered by a blanket of fluvial and glacial till. Outcrop only occurs intermittently along widely spaced stream cuts and accounts for less than one per cent of the total area. The thickness of the till probably varies sharply from a few metres to several tens of metres depending on bedrock composition and glaciation.

The geology in the vicinity of the property is shown at a scale of 1:50,000 on Figure 0-2 (in pocket). The Table of Formations on the following page shows the various map units in the vicinity of the property.

The OHNO property is situated along the eastern margin of Selwyn Basin, which comprises a varied sequence of clastic and carbonate rocks that range in age from Upper Proterozoic through Upper Paleozoic. Carbonate rocks of the Cambro-Ordovician Rabbitkettle Formation are the oldest in the vicinity of the property. These are overlain by shales and chert of the Ordovician, Silurian and Devonian Road River Formation which are in turn overlain by shale, cherty argillite and chert conglomerate of the Canol Formation. Shale and coarse clastic rocks of the Imperial Formation are the youngest in the vicinity.

TABLE OF FORMATIONS

RECENT

Q

unconsolidated alluvial and fluvial till

CRETACEOUS

Kg

granitic stocks and quartz-feldspar porphyry dikes, mostly quartz monzonite in composition

UPPER DEVONIAN OR MISSISSIPPIAN

IMPERIAL FORMATION

Iss

resistant, brown weathering, shale, siltstone, sandstone, grit, chert pebble conglomerate

LOWER AND/OR UPPER DEVONIAN

CANOL FORMATION

Cs

light bluish-grey weathering, black sooty chert; cherty argillite; light bluish-grey and locally rusty-brown weathering dark grey and black silty shale; chert grit, chert pebble conglomerate; dark grey bedded barite near top of unit; may locally include younger clastic rocks of the Imperial Formation

ORDOVICIAN TO LOWER DEVONIAN

ROAD RIVER FORMATION

Rcm

resistant, orange to tan weathering, 'chippy' mudstone, variably dolomitic and pyritic silty mudstone, irregular 'flaser bedding characteristic

Ra1

dark grey, brown, blue or black weathering, recessive, carbonaceous black shale; mudstone; cherty argillite; coarse grained black limestone

UPPER CAMBRIAN TO ORDOVICIAN

RABBITKETTLE FORMATION

u€0c

wavy banded silty limestone, resistant, light grey, yellowish or brownish grey weathering, thinly and irregularly bedded

### Upper Cambrian and Lower Ordovician

#### Rabbitkettle Formation

The oldest rocks in the vicinity of the OHNO claims belong to the Upper Cambrian and Lower Ordovician Rabbitkettle Formation, which consists mainly of a distinctive rock type informally called the "wavy banded" limestone. The wavy banded limestone is typically light grey or yellowish grey, blocky and resistant weathering. Bedding is usually defined by irregularly shaped or boudin-like strings of purer limestone nodules up to several centimetres in diameter. Although the nodules themselves are quite irregularly shaped, beds as a whole are fairly continuous and reach thicknesses of several centimetres. In places, the wavy banded texture is absent and the limestone is more massive and homogenous.

The wavy banded limestone is the best exposed of all the sedimentary rocks in the vicinity of the OHNO claims and is therefore an extremely useful marker horizon. Thicknesses cannot be estimated here but to the southeast, near Howard Pass, equivalent rocks reach thicknesses of 300 m.

The Rabbitkettle Formation and equivalent strata are widespread within most of the Nahanni map area and most parts of southeastern Yukon. These rocks unconformably overlie Middle Cambrian and older rocks and are overlain by Middle Ordovician shales of the Road River Formation or carbonates of the Sunblood Formation. A few widespread fossil localities also suggest an Upper Cambrian and Lower Ordovician age for these rocks.

### Ordovician, Silurian, Lower and Middle Devonian

#### Road River Formation

Of all the formations in the region, the Road River is the most difficult

to map because it is extremely recessive and structurally incompetent. Also, subtle internal changes in lithology are common and parts of the formation are indistinguishable in hand specimens and outcrop from the overlying Canol Formation. The Road River Formation (unit R) includes both lower (Ra1) and upper (Rcm) units. The lower unit is host to the stratiform zinc-lead mineralization at Canex Placer - U.S. Steel's Main (XY) and Anniv deposits, where Morganti has called the Road River Formation the Howard Pass Formation. Unit Ra1 is no more than 200 m thick within the Howard Pass Belt but is at least 1000 m thick further west, particularly in the vicinity of Summit Lake.

Unit Ra1 rarely forms outcrop except locally along stream cuts or when it consists of chert and, in many places, the distribution of the unit can only be inferred by the presence of the Rabbitkettle Formation which underlies it and unit Rcm which overlies it. Both of these bounding units form good markers because they are distinctive and relatively more resistant. The OHNO claims are apparently underlain only by unit Ra1. In this area, it forms a narrow belt bounded on both sides by the Rabbitkettle Formation but it is not certain if it forms the core of a syncline or part of a fault bounded block.

The dominant lithologies within unit Ra1 are dark grey, brown, blue or black weathering, very recessive, variably carbonaceous, calcareous and siliceous argillite or mudstone. Thin bedded, dark blue or black weathering chert is also characteristic of the unit and forms thick, extensive sequences in the southwestern part of the Nahanni map area although it is a minor constituent in most other areas.

Minor beds of distinctive, coarse-grained, black limestone have been seen within the Howard Pass Belt. This rock type seems to form intermittent lenses less than one metre thick and is characterized by a peculiar fabric composed of

radiating aggregates of rod-shaped calcite(?) crystals up to 10 m or so long. This unique rock, which occurs within the mineralized zone in trenches at the Anniv Zone, is apparently a local phenomenon and may be an indicator of both the time horizon and the sedimentary environment in which the mineralization occurs.

The upper part of the Road River Formation (unit Rcm) consists almost entirely of a distinctive rock type that has been given the informal name "chippy mudstone" in this report. Other geologists have referred to it as the orange mudstone, wispy mudstone or flaggy mudstone. The "chippy mudstone" is fairly resistant, tan to orange weathering, fine grained and light greenish grey to medium grey on fresh surfaces and varies from about 20 to 60 m in thickness. It is also hard, siliceous and variably dolomitic. Pyrite is common and takes the form of crystals and nodules up to 5 mm across. In the southwestern part of the Nahanni map-area, the rocks become more shaley and argillaceous and less dolomitic. The term "chippy" refers to peculiar and ubiquitous flaser bedding which is defined by wispy, discontinuous, darker layers, generally a centimetre or less in length, that are enclosed in a lighter coloured matrix. The wispy orientation of the bands are sometimes oriented parallel to bedding but elsewhere are oriented in a more random fashion. The origin of this texture is not known, but worm burrows were recognized in several localities and it may be a result of bioturbation. Coarse grained, grey limestone lenses up to about a metre across are also interbedded with the "chippy mudstone", particularly at the northwest end of the Howard Pass Belt.

The "chippy mudstone" is present in most areas except for a few places south of Howard Pass, southeast of Wishbone Lake and northeast of the South Nahanni River where it has apparently been removed beneath an unconformity.

The widespread, uniform extent of unit Rcm suggests that it is wholly sedimentary in origin although it has a volcanic or tuffaceous appearance in places.

The depositional environment of the Road River Formation is speculative although it must have been significantly different from that of older rocks in the Howard Pass area. In general, the Road River Formation is a deeper water facies than both shallow water carbonates of the same age, that occur about 80 to 100 km to the east, and underlying Rabbitkettle Formation limestone. It probably represents local deepening rather than widespread continental subsidence, as indicated by the presence of graptolites of different ages from place to place at the base of the formation, the presence of a mid-Ordovician unconformity in parts of the Mackenzie Mountains, and the fact that the facies-equivalent carbonate rocks to the east were probably deposited in water of comparable depth to carbonates that underlie the shale. The abundance of carbonaceous material and chert, lack of significant clastic debris and thinness of the unit as a whole, suggests that sedimentation rates were extremely slow. The black colour, lack of most macrofossils other than graptolites, and the presence of only small amounts of black limestone, indicates a stagnant euxinic environment that was particularly unfavourable to life. These types of rocks are also considered to be indicative of very deep water but precise depths cannot be determined. Other factors which possibly influenced the depositional environment are: restricted circulation of sea water, climatic conditions and low rate of clastic sedimentation.

The central part of the Selwyn Basin is underlain by enormous thicknesses of chert, which are at least partially equivalent to the Road River shale. This type of rock is usually deposited in extremely deep water and the lack of associated limestone suggests that it was too deep for carbonate stability. The transition

to the thick chert sequence seems to occur in the vicinity of Summit Lake, which suggests that the shales in the vicinity of Howard Pass were deposited in relatively deep water.

### Middle and/or Upper Devonian

#### Canol Formation

The Canol Formation (unit Cs) overlies the Road River Formation. The unit is characteristically light grey, blocky weathering and talus-forming although it locally weathers rusty brown as well. The main rock types are black "sooty" chert, "sooty" cherty argillite, bluish grey silty shale, dark grey chert grit and pebble conglomerate. Bedded barite is a distinctive, though minor, component.

Isolated exposures of Canol chert, cherty argillite or shale that lack distinctive, underlying lithologies are almost impossible to distinguish from similar rocks in the Road River Formation. Coarse clastic parts of the unit are, in turn, difficult to distinguish from the same rock types within the Imperial Formation unless they are associated with blue weathering, sooty rocks or barite. However, clastic rocks of the Canol Formation generally have a black "sooty" matrix, and the coarse component usually consists entirely of subangular chert grains less than about 2 cm across. Unlike the conglomerates of the Imperial Formation, which form sequences hundreds of metres thick, those in the Canol Formation appear to form massive beds less than a few tens of metres thick.

In one locality 13 km east of Cominco Lake, a medium grey limestone band up to several metres thick occurs in a structurally complex area adjacent to both graptolitic shale and younger shale, siltstone and chert of the Canol Formation. The limestone contains crinoids with double axial canals ("two hole crinoids") that occur only within Middle Devonian rocks. The limestone is tentatively included

within the Canol Formation because similar limestone occurs at the base of this unit in the MacMillan Pass area and because regional evidence indicates that this correlation is the most probable.

The Canol Formation varies greatly in both thickness and internal stratigraphy. The cherty argillaceous rocks apparently occur at any position within the unit and are interbedded with chert grit and sandstone. The coarser grained conglomerate seems to occur fairly high in the section and forms only one main bed at any one locality. Whether this is a continuous bed or a series of separate lenses is not known. Southwest of Summit Lake, coarse clastic rocks are apparently completely absent and the entire unit consists of black chert and cherty argillite with a thickness of more than 300 m, much thicker than elsewhere. Extensive areas farther to the northwest are also underlain by similar chert sequences but there it cannot be determined if they belong to the Canol or Road River Formations.

Bedded barite is an invaluable marker horizon that invariably occurs within a few metres of the top of the unit and is bounded by blue weathering, black cherty argillite. The barite is resistant, well bedded, dark grey, locally rusty weathering and varies from a few centimetres or less to more than 5 m thick. Locally, barite nodules or blebs up to 1 cm across also occur in this horizon within cherty argillite. This form of barite may occur at the same stratigraphic position as the bedded barite. Barite also forms coarsely crystalline veins within black, cherty argillite and in this form is epigenetic in origin. No evidence has been seen to suggest that more than one major period of barite sedimentation occurred in this district.

The Canol Formation commonly produces rusty ferricrete gossans, even in areas where there is no outcrop. The gossans are not as large and extensive as those which occur north of the Canol Road.

Upper Devonian(?), Mississippian and Younger(?)

Imperial Formation

In this report, the name Imperial Formation is loosely applied to the thick and variable group of clastic rocks in the map-area that are younger than the Canol Formation. This assemblage is characterized by its rusty brown, tan and greenish brown weathering colour, relatively resistant nature and great thickness and clastic composition (except for minor chert) with silt-size or larger clasts. The greater part of the Imperial Formation within the surrounding area is made up mainly of thick bedded to massive sandstone, grit, pebble and, locally, cobble conglomerate, which are interbedded with lesser amounts of thinly laminated "pin-stripe" shale. The dominant rock type varies in places from shale to coarser grained rocks, apparently due to abrupt lateral facies changes. The unit is commonly more than 700 m thick and probably much greater in places.

Structure

The structural and stratigraphic setting of the various deposits and properties are remarkably similar throughout the Howard Pass Belt. Strata becomes progressively younger from northeast to southwest and one or more broad, open folds are the dominant structural elements. The Howard Pass Belt is bounded on the southwest side by a complex, parallel zone of steep faults whereas the other margin consists of steep faults or folds that juxtapose older rocks within the belt against younger rocks to the northeast.

Structures in the vicinity of the OHNO claims appear to be simple but there is little data and more than one interpretation is possible. The Road River argillite that underlies the OHNO claims form a narrow belt bounded on both sides

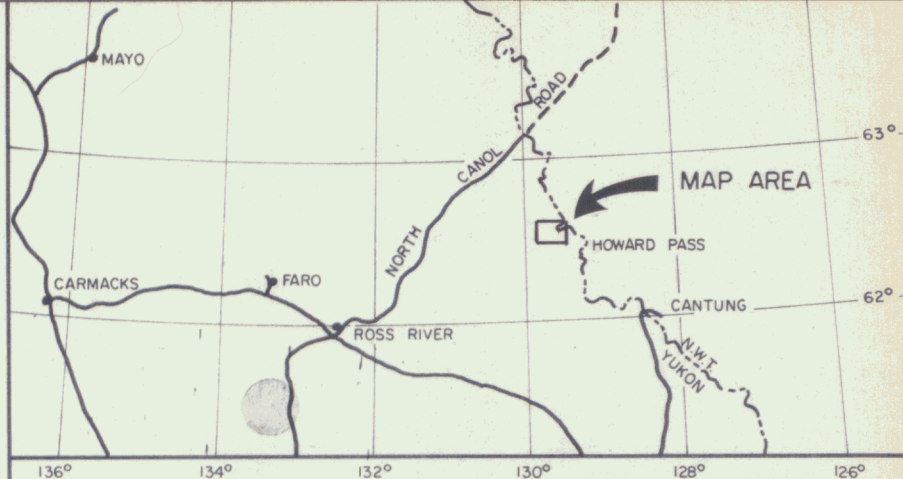
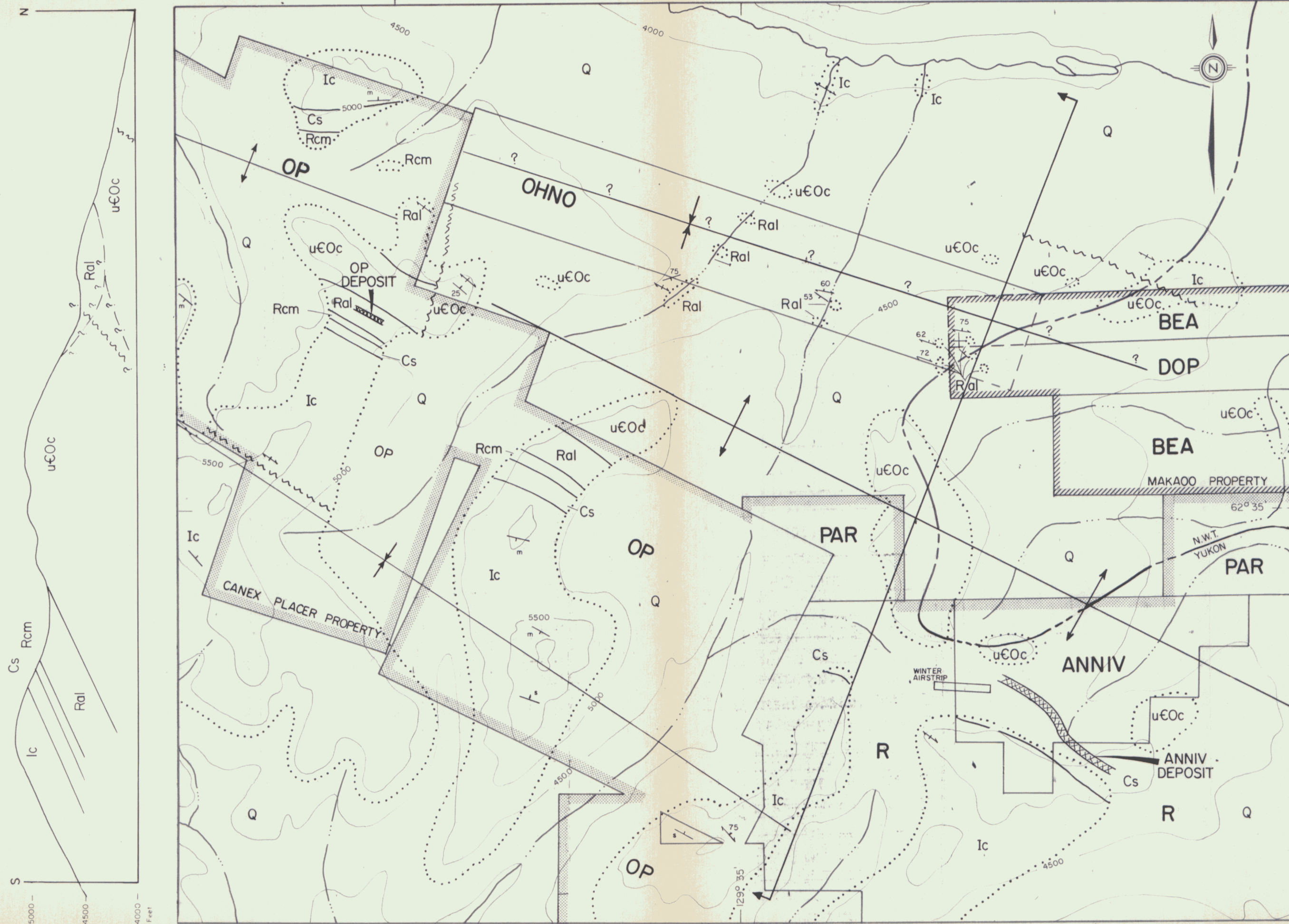
by limestone of the Rabbitkettle Formation. The argillite is interpreted in Figure 0-2 to occur within the core of a syncline and is separated by an anticline from the subparallel belt of argillite that hosts the Anniv and OP zones. It is also possible to interpret the argillite underlying the OHNO as a part of a tilted fault block rather than the core of a fold. In either case, the OHNO claims were probably originally separated from the OP occurrence by a horizontal distance of only some 1500 m and from the Anniv deposit by only about 3000 m.

The other major structural features near the OHNO claims are two faults. One is located along the north side of the claim block and trends parallel to it. This fault marks the northeastern margin of the Howard Pass belt and juxtaposes the Rabbitkettle Formation to the southwest against the Imperial Formation to the northeast. The other fault trends northerly and shows apparent vertical movement which brings rocks to the east up relative to those on the west. The OHNO syncline cannot be traced across this fault.

Smaller scale structures include steeply dipping penetrative cleavage which is axial planar to the large scale folds. Small scale upright isoclinal folds with orientation parallel to larger scale folds are common in the less competent shales.

#### GEOCHEMISTRY

Soil and silt samples were taken in the vicinity of the OHNO claims as part of a regional reconnaissance geochemical exploration program. Silt samples were taken from the major streams draining the property and six widely spaced lines of soil samples were taken across the trend of the Road River Formation. Samples were analyzed for copper, lead and zinc and the results are shown on Figure 0-3.



LOCATION MAP

TABLE OF FORMATIONS

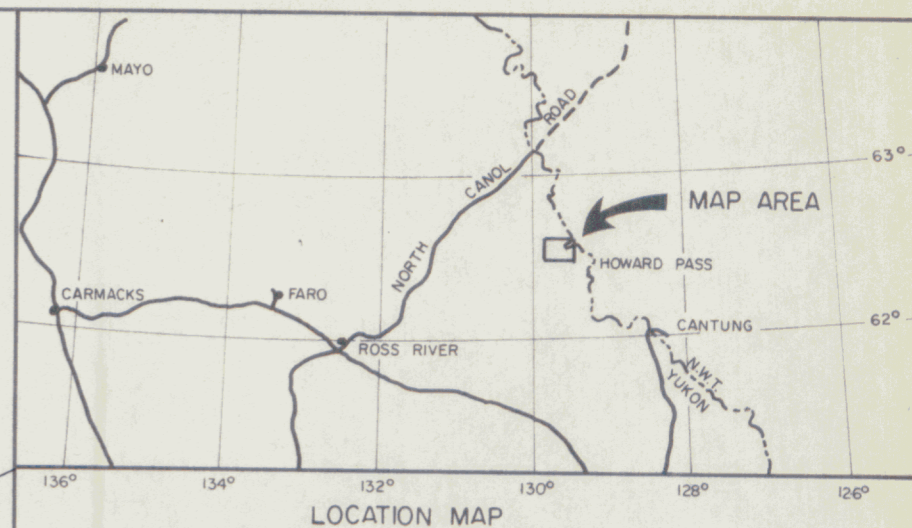
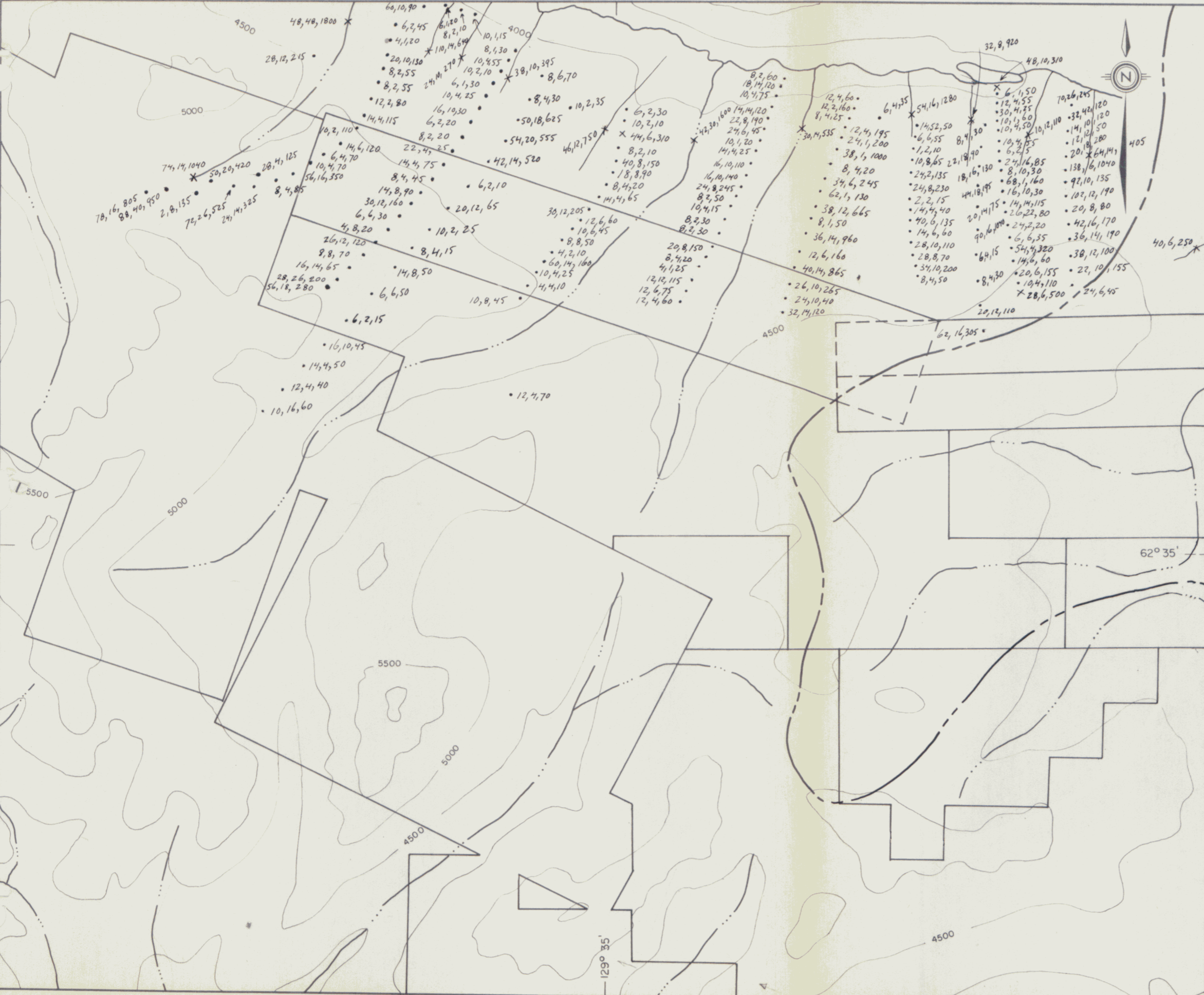
<b>RECENT</b>	
<b>Q</b>	unconsolidated alluvial and fluvial till
<b>UPPER DEVONIAN OR MISSISSIPPIAN IMPERIAL FORMATION</b>	
<b>Ic</b>	resistant, brown weathering chert grit, sandstone, shale
<b>MIDDLE AND/OR UPPER DEVONIAN CANOL FORMATION</b>	
<b>Cs</b>	chert, cherty argillite, silty shale; chert grit; chert pebble conglomerate; minor barite
<b>ORDOVICIAN TO MIDDLE DEVONIAN ROAD RIVER FORMATION</b>	
<b>Rcm</b>	orange to tan weathering, chippy mudstone
<b>Ral</b>	black shale, mudstone, cherty argillite
<b>UPPER CAMBRIAN TO ORDOVICIAN RABBITKETTLE FORMATION</b>	
<b>uEOc</b>	wavy banded silty limestone



Fig. 0-2  
ARCHER, CATHRO & ASSOCIATES LTD

**GEOLOGY**  
OHNO CLAIMS  
ITSI JOINT VENTURE

1 Inch = 1/2 Mile  
1500 0 1500 3000



**LEGEND**

- ✱ 54, 11, 75 silt sample in ppm Cu, Pb, Zn
- 54, 11, 75 soil sample in ppm Cu, Pb, Zn

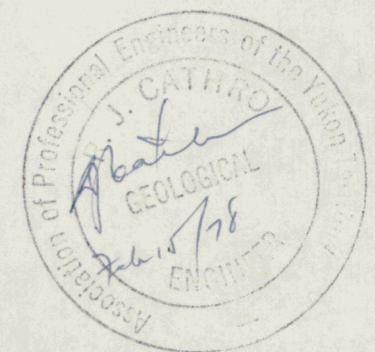
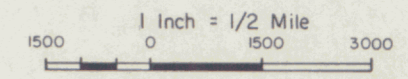


Fig. O-3  
 ARCHER, CATHRO & ASSOCIATES LTD  
**GEOCHEMISTRY**  
 OHNO CLAIMS  
 ITSJI JOINT VENTURE



No anomalous values were obtained although the thick glacial till which occurs on parts of the property may have masked geochemical response. Also, the spacing of soil samples was too wide to effectively rule out the possibility of anomalies.

#### SUMMARY

The OHNO group is a block of 24 claims staked at the close of the field season to cover a narrow belt of Road River argillite that subcrops immediately northeast of the OP and Anniv Zones. The claims are situated below timberline in an area of low topographic relief. The geological setting can only be inferred from intermittent outcrops along widely spaced stream cuts and regional trends because of the extensive cover of glacial drift. There are no geochemical anomalies and the property has been staked strictly for its positional value adjacent to the Anniv and OP deposits.

In 1977, a test EM survey was conducted by Grant Hendrickson of Aquitaine over Canex Placer's Anniv deposit. This survey utilized a five frequency Maxmin II, which is a horizontal coplanar loop instrument operated in the metric mode. The method proved to be a very useful mapping tool although it could not differentiate between the response from sulphides and graphitic shale. The results of this survey with profiles of the test lines are contained in a separate report by Hendrickson dated October, 1977.

#### RECOMMENDATIONS

Further exploration of the OHNO claims is warranted. Work should consist

mainly of a short program of detailed mapping, geochemistry and geophysics. Emphasis should be placed on determining the thickness and nature of the glacial till covering the property and on defining the structural setting more precisely. Geochemistry should consist of closely spaced lines of soil samples oriented perpendicular to the trend of the Road River Formation. A Maxmin-type EM survey should be used to map the position of the argillite beneath the overburden.

Respectfully submitted,

ARCHER, CATHRO & ASSOCIATES LTD.



R.J. Cathro, P.Eng.

/mc