M. N. CHERNOFF, P.GEOL.

GEOLOGY

Of The

RUSTY SPRINGS MINERAL PROSPECT,

PORCUPINE RANGES, YUKON TERRITORY

by

M. N. CHERNOFF, P. GEOL.

SEPTEMBER 30, 1976

CALGARY, ALBERTA

This report has been examined by the Geological Evaluation Unit and is recommended to the Commissioner to be considered as representation work in the amount of $ 20,785.00

W D Lindsay
a/ Duly Qualified Geologist or
~~Resident Mining Engineer~~

Considered as representation work under Section 58 (4) Yukon Quartz Mining Act.

B.R. BAXTER
Superwising Mining Recorder

for Commissioner of Yukon Territory

LIST OF CONTENTS

FIGURES

PHOTOGRAPHIC PLATES

MAPS *IN POCKET*

MAP 1, SURFACE GEOLOGY

MAP 2, GEOCHEMICAL SURVEY: COPPER

MAP 3, GEOCHEMICAL SURVEY: LEAD

MAP 4, GEOCHEMICAL SURVEY: ZINC

MAP 5, GEOCHEMICAL SURVEY: SILVER

MAP 6, GEOCHEMICAL SURVEY: COPPER, LEAD, ZINC, SILVER; COMBINED

STRUCTURAL CROSS-SECTION; GEOLOGICAL

CLAIM MAP

INTRODUCTION

An interesting mineralized locality in the northern Yukon was claim staked by RIO ALTO EXPLORATION LTD. during the fall of 1975 and winter of 1976. Two separate and independent areas of mineralization approximately four miles (6.4 km) apart have been staked with 92 quartz claims and 15 iron claims. The quartz claims cover an area of 4,752 acres (7.43 sq. miles; 19.24 sq. km) and the iron claims comprise 2,400 acres (3.75 sq. miles; 9.71 sq. km).

The quartz claims blanket an area of exposure, or near exposure, of Middle Devonian dolomite which hosts copper, zinc, silver and lead mineralization at four showings. The iron claims are centered about an exposure of magnetite (after oolitic hematite) which occurs near the base of the Mesozioc System. The extent and richness of copper, zinc, silver and lead mineralization has not been determined since bedrock has not been exposed by work to date. Extensive mineralized float has been found, however, in an area which can be enclosed by an equilateral triangle whose sides are approximately ½ mile (0.8 km).

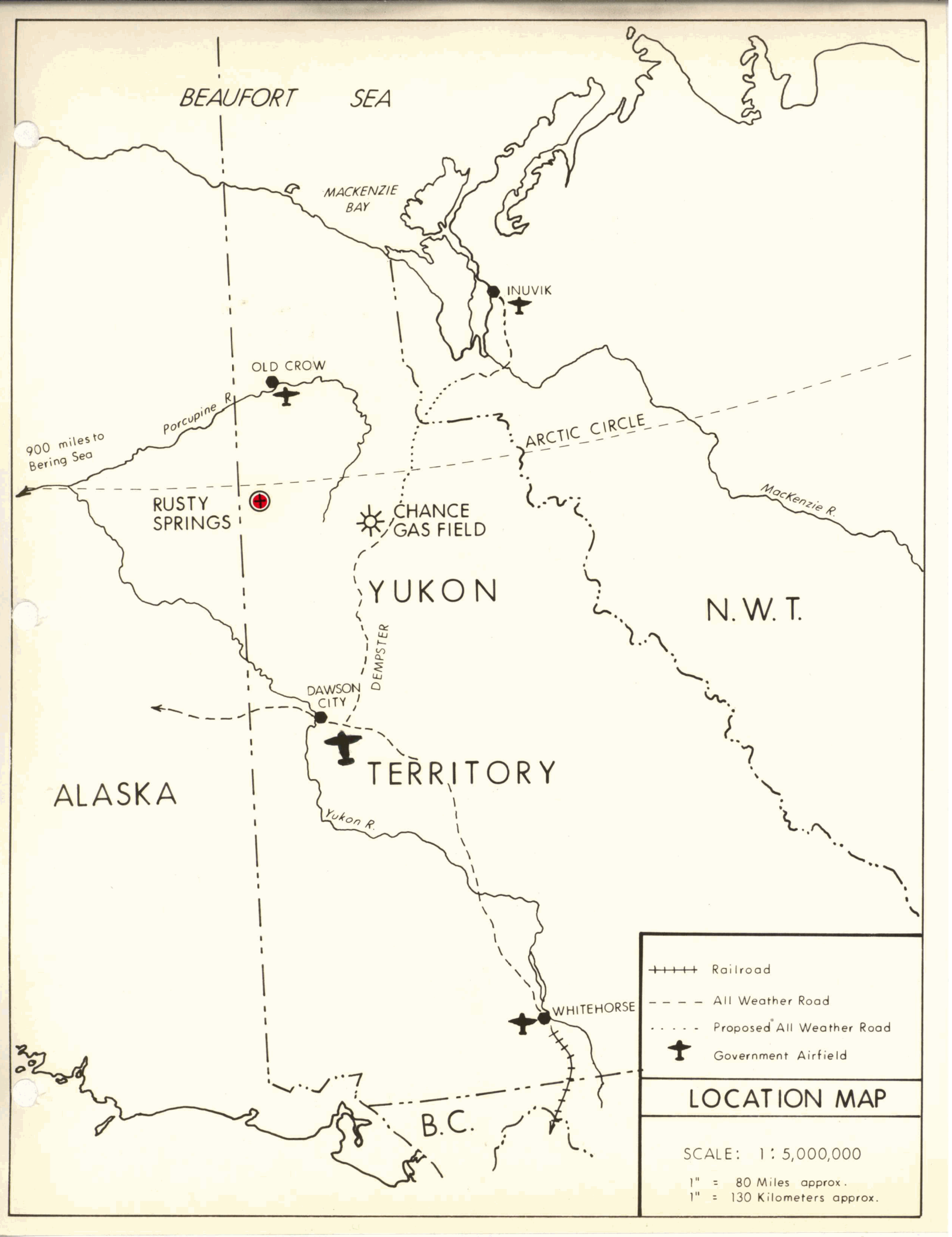
A conservative estimate of tonnage, as determined from evaluating surface data, for the iron deposit is 30 million tons of 55% Fe ore.

The copper, zinc and silver showings are extremely significant, in that this area of Yukon has not been glaciated and the possibility of the existence of an enriched or "bonanza" ore body above a sulphide zone is attractive. Also, our work confirmed the existence of significant tetrahedrite mineralization and since this mineral is recognized as the primary ore of most commercial silver deposits, the potential of the property is enhanced significantly.

LOCATION, ACCESS & CLIMATE (Ref. Figure 1, Location Map)

The mineralized localities are situated in the north-west part of the Yukon Territory, Canada. The showings are approximately 5 miles (8 km) south of the Arctic Circle and 18 miles (29 km) east of the Alaska - Yukon border (66^{o} 31'N. Lat.; 140^{o} 20' W. Long.). The localities are approximately 175 air miles (280 km) north of Dawson City, Yukon and 70 air miles (112 km) south of the settlement of Old Crow.

Presently, the only access to the area is by air (helicopter) from M.O.T. maintained airstrips at Dawson City and Old Crow which are serviced


BEAUFORT SEA
MACKENZIE BAY
INUVIK
OLD CROW
Porcupine R.
900 miles to Bering Sea
ARCTIC CIRCLE
MacKenzie R.
RUSTY SPRINGS
CHANCE GAS FIELD
YUKON
N.W.T.
DEMPSTER
DAWSON CITY
TERRITORY
ALASKA
Yukon R.
WHITEHORSE
B.C.
Railroad
All Weather Road
Proposed All Weather Road
Government Airfield
LOCATION MAP
SCALE: 1 : 5,000,000
1" = 80 Miles approx.
1" = 130 Kilometers approx.

by a commercial airline (Northward Aviation) on a daily basis. The properties are situated 95 miles (151 km) northwest of the Dempster Highway which connects with the highway and rail systems of the southern Yukon. They are also 55 miles (88 km) south of the Porcupine River which is capable of handling barge traffic during the summer months. The Porcupine River is a tributary of the Yukon River which empties into the Pacific Ocean near the Bering Strait.

Winter trails (roads), which may be travelled by regular trucks, exist to with a few miles of the properties. In addition, an unmaintained airstrip (Mallard) lies 50 miles (80 km) south of the properties. An upgraded, but also unmaintained airstrip is located at Parkin (Lat. 66° 14'N; Long. 137° 17'W) in the Eagle Plain. The airstrip is 5,030 feet long, 125 feet wide at an elevation of 1,750 feet and is adjacent to the Dempster Highway.

The area enjoys typical Arctic weather with cold winters and warm summers. The snow free period is generally 120 days during the months of June, July, August and September, a period during which most surface exploration is done.

The mineral localities are 95 miles (151 km) west of proven oil and gas reserves beneath the Eagle Plain and 55 miles (88 km) south of one of the proposed routes of the Arctic Systems Gas Line from the Alaskan Prudhoe Bay Field.

PHYSIOGRAPHY (Ref. Figure 2, GSC map 1254 A)

The mineral properties are located within the Porcupine Ranges which are a set of northerly trending ranges paralleling the geological strike of the major structures. Topographic relief is in the order of 3,000 feet (1,000 meters) with maximum elevations of approximately 5,000 feet (1,562 meters). The terrain is definitely mountainous; however, the ranges are generally subdued and rounded. Low passes provide low altitude routes in all directions.

REGIONAL GEOLOGY

The Porcupine Ranges are situated in that part of the Yukon which was NOT GLACIATED during the Pleistocene Period (Figure 3, GSC map 1253 A). The northerly trending ranges generally follow the geological strike of resistant formations which form the cores of large anticlinal structures.

The exposed sedimentary section ranges in age from Proterozoic to Lower Cretaceous with a maximum thickness of ± 60,000 feet (± 18,750 meters).

FIGURE 2

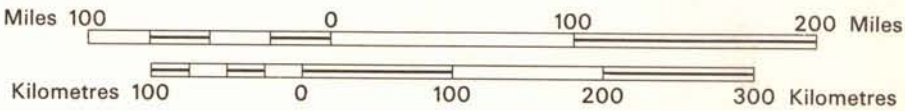
PHYSIOGRAPHIC REGIONS

GEOLOGICAL SURVEY OF CANADA
DEPARTMENT OF ENERGY, MINES AND RESOURCES

1254A

PHYSIOGRAPHIC REGIONS OF CANADA

Scale 1:5,000,000



LAMBERT CONFORMAL CONIC PROJECTION, STANDARD PARALLELS 49°N. AND 77°N.; MODIFIED POLYCONIC PROJECTION NORTH OF LATITUDE 80°

LEGEND

SHIELD

- *Highlands, Mountains*
- *Uplands*
- *Plateaux*
- *Hills*
- *Lowlands, Coastal Lowlands*
- *Plains of Proterozoic strata*
- *Plains and Lowlands of Palaeozoic strata*

BORDERLANDS

- *Mountains*
- *Highlands*
- *Uplands*
- *Hills, Foothills*
- *Plateaux*
- *Basins*
- *Lowlands*
- *Plains*
- *Coastal Lowlands*
- *Coastal Plains*
- *Deltas*
- *Trenches*
- *Major Cenozoic volcanoes*

Shield and Borderlands boundaries ..... Shield / Borderlands

Region boundary (Shield, Borderlands) ...

System boundary .....

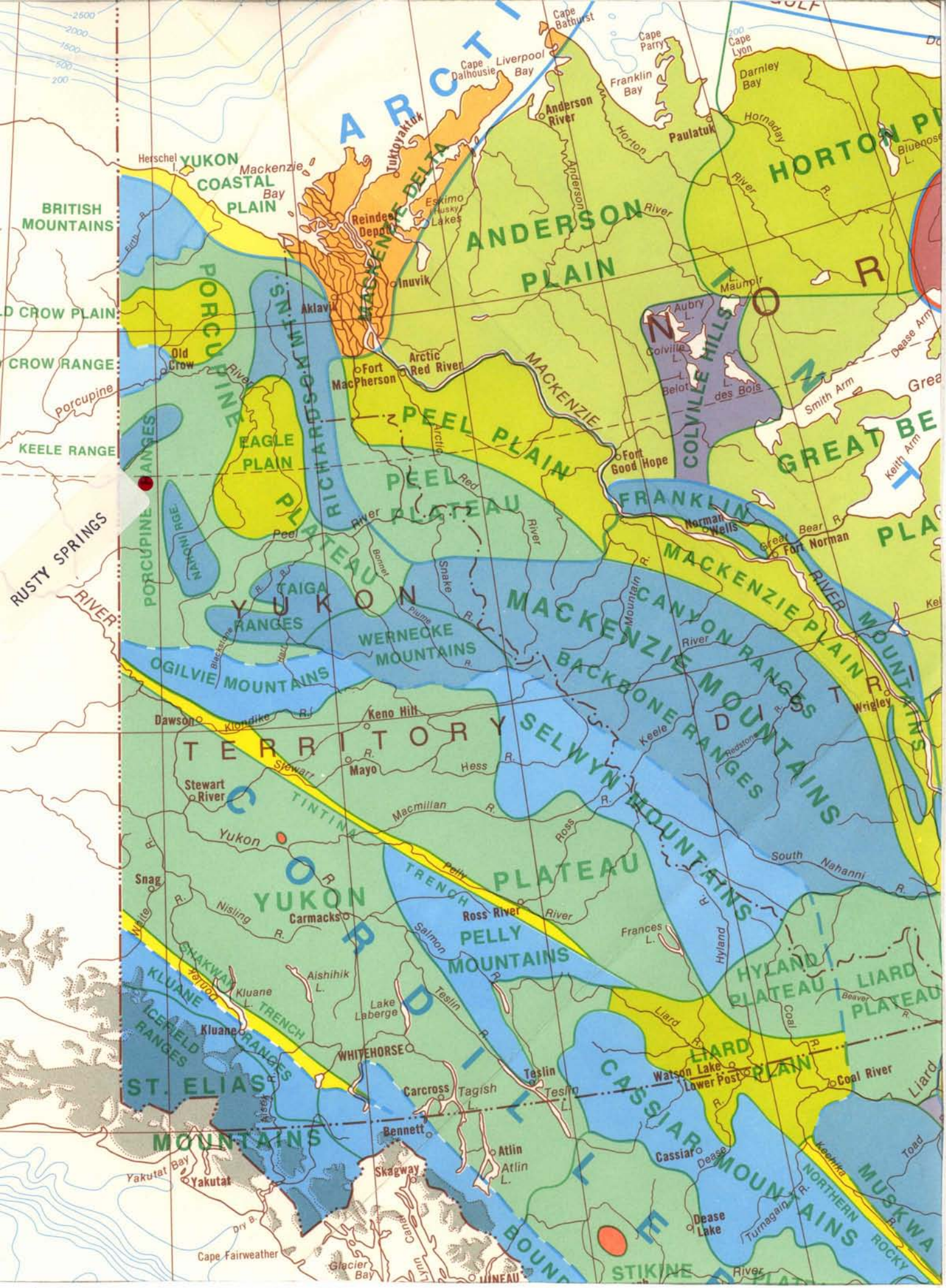
Division boundary (Shield, Borderlands) ..

Bathymetric contours (depth in metres) ... 500

Glacier, ice-cap, ice-field .....

Physiography compiled by H.S. Bostock, 1967

Cartography by the Geological Survey of Canada, 1969


ARCTIC
Cape Bathurst
Cape Dalhousie
Liverpool Bay
Cape Parry
Franklin Bay
Cape Lyon
Darnley Bay
Anderson River
Tuktoyaktuk
Paulatuk
Hornaday River
Horton River
HORTON PLAIN
Herschel I.
YUKON COASTAL PLAIN
Mackenzie Bay
MACKENZIE DELTA
Reindeer Depot
Eskimo Lakes
ANDERSON PLAIN
Inuvik
BRITISH MOUNTAINS
Firth R.
PORCUPINE PLATEAU
RICHARDSON MTNS.
Aklavik
Old Crow
Fort MacPherson
Arctic Red River
MACKENZIE
PEEL PLAIN
COLVILLE HILLS
Aubry L.
Maunoir L.
Colville L.
Belot L.
des Bois
Dease Arm
Smith Arm
Great Bear
D CROW PLAIN
CROW RANGE
Porcupine River
KEELE RANGE
EAGLE PLAIN
PEEL PLATEAU
Arctic Red River
Peel River
Fort Good Hope
FRANKLIN MTNS.
Norman Wells
Fort Norman
MACKENZIE PLAIN
RIVER MOUNTAINS
Keith Arm
GREAT BEAR PLAIN
PORCUPINE RANGES
NAHOMIN RGE.
RUSTY SPRINGS
RIVER
TAIGA
YUKON RANGES
WERNECKE MOUNTAINS
Bonnet
Snake R.
Plume R.
Blackstone R.
Hart R.
Mountain R.
MACKENZIE MOUNTAINS
CANYON RANGES
BACKBONE RANGES
OGILVIE MOUNTAINS
Dawson
Klondike R.
Keno Hill
Wrigley
Redstone R.
TERRITORY
SELWYN MOUNTAINS
Stewart R.
Mayo
Hess R.
Keele R.
Stewart River
TINTINA TRENCH
Macmillan R.
Yukon R.
Ross R.
South Nahanni R.
CORDILLERA
YUKON PLATEAU
Pelly R.
Snag
Nisling R.
White R.
Carmacks
Ross River
PELLY MOUNTAINS
Salmon R.
Frances L.
Hyland R.
HYLAND PLATEAU
LIARD PLATEAU
Beaver R.
Coal R.
SHAKWAK TRENCH
Aishihik L.
Kluane L.
Kluane
KLUANE RANGES
ICEFIELD RANGES
Lake Laberge
Teslin R.
Liard R.
WHITEHORSE
Watson Lake
Lower Post
LIARD PLAIN
Coal River
ST. ELIAS MOUNTAINS
Carcross
Tagish L.
Teslin
Teslin L.
CASSIAR MOUNTAINS
Bennett
Atlin
Atlin L.
Cassiar
Dease
Yakutat Bay
Yakutat
Skagway
Dry B.
Cape Fairweather
Glacier Bay
Lynn Canal
JUNEAU
Dease Lake
Turnagain R.
NORTHERN ROCKY
Keechika R.
Toad R.
MUSKWA
STIKINE
River

Proterozoic rocks are generally variecoloured clastic sediments with occasional intervals of carbonate rocks. The overlying lower Paleozoic section, which is non-conformable with the Proterozoic, is mainly dolomite ranging in age from Cambrian through Ordovician, Silurian and Devonian. Upper Paleozoic rocks include Upper Devonian and Mississippian shales, Mississippian and Pennsylvanian carbonates and Pennsylvanian and Permian shales. Mesozoic clastic sediments represent the Triassic, Jurassic and Cretaceous Systems. The structural cross-section (in pocket) displays the approximate thickness of geological units mapped in the area. Major unconformities are recognized at the base of the Paleozoic and at the base of the Mesozoic. The Laramide (late Cretaceous, early Tertiary) Orogeny appears to have played the dominant role in the formation of existing geologic structures.

The area is "Alpino-structured" in that we recognize the following family of structural elements:

i) the concentric fold

ii) the thrust fault

iii) the tear fault

iv) the normal or extension fault

In recognition of this type of structure, we would not expect the observed faults and structures to be basement controlled. The area has experienced an extreme form of "Alpino-structuring" since well developed cleavage planes are observed at most structures. Structural assymetry may be either to the east (dominant) or to the west. Easterly trending tear faults are a common occurrence which tends to compartmentalize the geologic structure of the area.

Igneous intrusive rocks are known to occur in proximity to the mineral properties and in the general area. Acidic crystalline rocks intrude Mississippian strata locally, whereas, late Devonian and Permo-Triassic granite masses are known to occur in the British Mountains and at Old Crow.

<u>LOCAL GEOLOGY</u> (Ref. Map 1, Surface Geology)

The copper, zinc and silver mineralization was recognized in highly silicified and brecciated Middle Devonian dolomites which are exposed in the core of a large unnamed anticlinal feature, hereinafter referred to as

the "Rusty Springs" structure. The iron formation occurs along the east flank of this fold where the beds are overturned. The anticlinal structure trends due north and has a complex west limb of late Paleozoic sediments. The east limb of the fold is formed by vertical and overturned late Paleozoic, Jurassic and Cretaceous strata. Close examination of the axial portion of the fold reveals that the axis of culmination is displaced several times by easterly trending tear faults.

Middle Devonain rocks, which are generally limestone throughout the Northwest Territories and the Yukon, are dolomitized and silicified at this locality. Quartz veins in association with calcite and breccia zones carry copper, zinc, silver and minor lead minerals. The extent of known mineralization, as determined by examing scree slopes, may be bounded by an equilateral triangle whose sides are approximately ½ mile (0.8 km). Brecciated and silicified zones are known to extend beyond the mineralized "triangle". In addition to carrying mineralized zones, the porous dolomite carries abundant pyrobitumen and is fetid when struck by a hammer. Pyrobitumen also occurs in vuggy quartz masses. The southern part of Middle Devonian outcrop (Ref. Map 1) is generally a non-mineralized fossiliferous limestone with minor silicification and brecciation.

The Middle Devonian dolomites are overlain by black silicified (cherty) shales of the Unnamed Shale Unit (Canol Shale?) of probable late Middle Devonian or Upper Devonian age. These shales appear to have less quartz veins and exhibit better bedding surfaces than the underlying dolomites. The Unnamed Shale Unit is flanked by a thick covered interval of Hart River shales (Mississippian) and a rimrock of resistant weathered limestones of the Ettrain formation (Miss - Penn). Vertical Jungle Creek (Permo-Penn) limestones and Mesozoic shales and sandstones form the east flank of the fold.

It is important to note that this area has not been glaciated (Ref. Figure 3) by Pleistocene ice masses, therefore, the mineralized zone(s) has been exposed to a very long period of weathering (oxidation, leaching, etc.) and the products of weathering remain insitu.

FIGURE 3

GLACIAL MAP

GEOLOGICAL SURVEY OF CANADA
DEPARTMENT OF ENERGY, MINES AND RESOURCES

1253A

GLACIAL MAP OF CANADA

Scale 1:5,000,000

Miles 100 0 100 200 Miles

Kilometres 100 0 100 200 300 Kilometres

LAMBERT CONFORMAL CONIC PROJECTION, STANDARD PARALLELS 49°N. AND 77°N.; MODIFIED POLYCONIC PROJECTION NORTH OF LATITUDE 80°

Existing glacier; includes ice-cap, montane, piedmont and valley glacier, local areas of permanent snow

Unglaciated area

Area of Wisconsin (last or classical) glaciation; mainly ground moraine (other features shown as geomorphic subdivisions)

Area of pre-Wisconsin glaciation beyond the limit of last glaciation [1]; mainly ground moraine (other features shown as geomorphic subdivisions)

Area in part unglaciated, in part covered by ice of one or more glaciations

GEOMORPHIC SUB-DIVISIONS

Area of maximum marine overlap [2]

Area of maximum glacial lake coverage (confined largely to areas of mapped lake deposits on the Interior Plains but locally omitted in hummocky terrain)

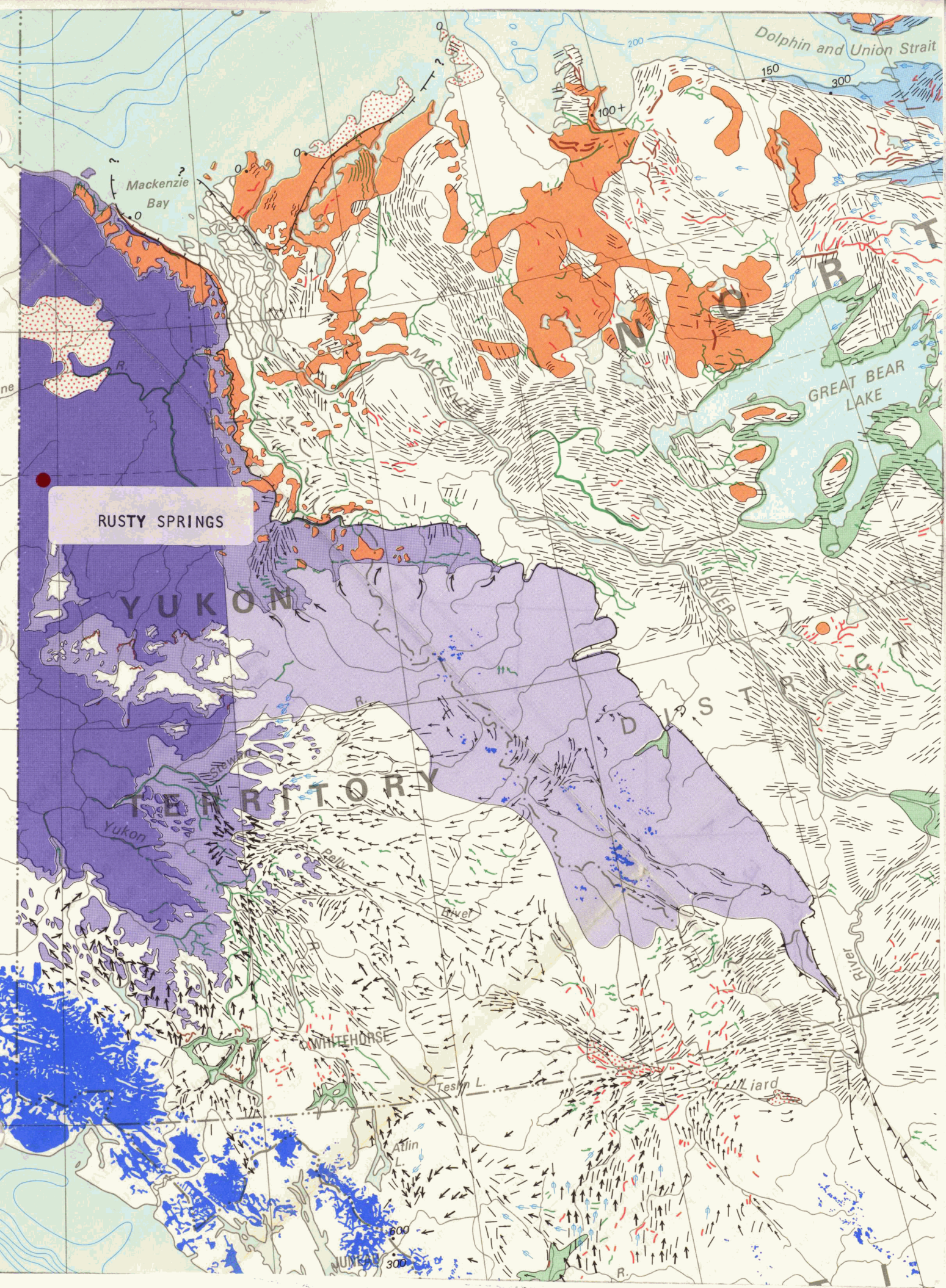
Outwash area — commonly dune-covered; includes outwash plain, valley train, delta

Esker, kame, kame-complex

Ribbed moraine [3] — areas with irregular to arcuate ribbed pattern more or less transverse to ice-flow direction

Hummocky terrain [4] - hummocky, dead-ice and disintegration moraine; includes prairie mounds and some transversely lineated ground moraine; local pitted lacustrine deposits

End moraine [5,6]; includes interlobate, lateral, marginal and kame moraines


RUSTY SPRINGS
YUKON
TERRITORY
MACKENZIE
DISTRICT
Dolphin and Union Strait
Mackenzie Bay
GREAT BEAR LAKE
MACKENZIE RIVER
Yukon
Pelly
River
WHITEHORSE
Teslin L.
Liard
River
Atlin L.
JUNEAU
200
150
300
100+
600
300

MINERALIZATION

1. IRON FORMATION

Massive bedded magnetite (after oolitic hematite) occurs in near vertical beds along the east flank of the Rusty Springs Anticline. The occurrence forms a prominent resistant ridge which strikes almost due north. The iron formation has a measured strike length of 1,200 feet (366 meters) and an approximate thickness of 150 feet (46 m). The formation disappears beneath the muskeg, therefore, the total strike length, thickness and depth of the deposit cannot be determined from surface mapping. It is fair to assume, however, that the formation will extend as far down as it is long, namely 1,200 feet (366 m).

The iron formation is dark bluish-black at outcrop, is blocky to massive bedded and is apparently free of any shale or sandstone interbeds. Hand specimens are visibly oolitic and variable in magnetic strength. Several assays of specimens taken at different localities along the strike length of the deposit indicate a range of 55% to 58% Fe. A continuous section was measured and sampled at 5 foot intervals across the deposit. Assays of these and other specimens are included in Appendix "A".

Our calculations, using observed data, indicate that a conservative estimate of the tonnage is 30 million tons of 55% Fe ore.

This locality has also been examined by D.K. Norris (GSC Paper 76-1A-p. 461) who describes the occurrence as follows:

"------the presence of an occurrence of oolitic magnetite in the northwest quarter of the Porcupine River map-area------.

It is interesting economically because it has the potential of recurring at the same stratigraphic level elsewhere in the Kandik Thrust belt.

The iron occurs as a bed estimated to be 30 m (100 ft.) thick and can be traced in outcrop for approximately 150 m (500 ft.) along the strike at a stratigraphic level about 150 m (500 ft.) above the base of the Jurassic and Lower Cretaceous Kingak Formation. It is dark grey to black, rusty brown weathering, massive, dense, oolitic magnetite that weathers into angular chunks and blocks. In thin sections, the oolites are packed densely and are commonly flattened with their long dimensions as much as 1 mm, but averaging about 0.5 mm. They are replaced locally by hematite and in many places are replaced by goethite."

2. *COPPER, ZINC, SILVER ZONE*

Several showings of sphalerite, smithsonite, aurichalcite, tetrahedrite, galena, malachite, azurite and pyrite occur at the north end of the Middle Devonian dolomites which form the core of the Rusty Springs Anticline (Ref. Map 1). The showings occur in scree or talus fans of brecciated, silicified and quartz veined dolomite. Although, bedrock has not been reached at excavations in the scree, we are certain that the scree is a representative sample of the underlying bedrock. The mineralized localities were named as follows: (locations on Map 1)

1. *TIM SHOW*
2. *TIP SHOW*
3. *BRUCE SHOW*
4. *C1 SHOW*
5. *C9 SHOW*
6. *DRYBED (BETWEEN TIM AND C9)*
7. *RUSTY SPRINGS*
8. *C13 (SPRINGS)*

1. *<u>TIM SHOW</u>*

The TIM SHOW represents the discovery locality for copper, zinc and silver. Initially, fist sized pieces of smithsonite float, assaying 30% - 38% zinc, 12% copper and up to 10 oz. of silver were found in the talus fan. Subsequent excavating and sampling was undertaken with the confirmation of the common occurrence of smithsonite and aurichalcite float. Pits up to 4 feet deep were dug without reaching bedrock. Pieces of smithsonite and aurichalcite float were usually found at a level of 6" to 18" below the surface. In addition to the zinc mineralization, rare pieces of cerussite and galena were found. Malaclite and azurite stained quartz-breccia fragments are also fairly common.

2. *<u>TIP SHOW</u>*

The TIP SHOW is approximately 500 - 700 feet east of the TIM SHOW and is also a scree slope of large dolomite blocks. At the base of the slope, large boulders of quartz-breccia were enearthed from moss cover by the use of a pick. These boulders contain patches of sphalerite and tetrahedrite; tetrahedrite in quartz is also common along the west side of the scree slope. Sphalerite was not noted at the top of the open fan.

3. BRUCE SHOW

The BRUCE SHOW is on the north bank of the main stream which drains the Rusty Springs Anticlinal structure. The show is approximately ½ mile (0.8 km) northeast of the TIM SHOW, and is an unstable scree fan of large dolomite-breccia blocks. One hundred yards upstream, black silicified shales of the overlying Unnamed Shale Unit, outcrop.

At this locality there is a streak down the centre of the fan, widening at the base, with abundant quartz and breccia float which contains calcite, sphalerite and tetrahedrite. Some large (8 inch diameter) specimens of massive sphalerite were found.

Upstream, near the dolomite/shale contact, rare pieces of green copper stained fragments were found.

4. C1 SHOW

The C1 SHOW is approximately ½ mile (0.8 km) east of the TIM SHOW and is a long slope (± 1,000 ft.) with intermittent open scree patches. The top of the show is marked by the occurrence of easterly dipping silicified black shale.

The entire slope was sampled and flagged where mineralization was noted. Dolomite breccia in association with white quartz carries malachite, azurite and tetrahedrite as well as galena. Near the top of the show, tetrahedrite and galena were found in quartz blocks situated near and within black chert/shale which overlies the dolomite breccia.

5. C9 SHOW

The C9 SHOW occurs in a band of outcropping brecciated and quartz veined dolomite along the south bank of the main stream as described in (3). The outcrop is a spectacular mixture of brecciated fragments that are set in a cement of white quartz and calcite. Quartz veins, 6" to 1 foot thick, cut the brecciated mess. These veins are near vertical and strike 032° to 040° true azimuth. The quartz veins appear to have grown towards the middle since large crystals meet at the centre of the veins. Bedding attitude is impossible to determine; however, we feel that the beds are almost horizontal at this locality.

The only mineralization noted here was extensive speckling of tiny pyrite crystals throughout the breccia.

6. DRYBED

This locality is an abandoned stream bed which is dry during the middle and late summer months. Large blocks of rusty and red quartz breccia impart a solid orange/red colour to the locality. Many of these blocks are mineralized with tetrahedrite, sphalerite and galena. The blocks are angular and are not expected to have been transported a large distance.

7. RUSTY SPRINGS

This locality was the "eye-catcher" that prompted further investigation of the area.

A large bright orange-red gossan has been formed by a spring which percolates cold clear water. The sediment that is being precipitated is also orange-red and is anomalously high in zinc content (+ 1,000 ppm). Water samples processed for metal content showed no anomalous values. Downstream of the spring, large boulders of quartz and dolomite breccia contain galena, sphalerite and tetrahedrite.

8. C13 SPRINGS

A spring similar to Rusty Springs occurs at C13 (see Map 1) at the northeast end of outcrop of Middle Devonian dolomite. Here again a cold water spring issues from the side of a hill in brecciated quartz/dolomite and forms several large ponds.

The ponds are spectacular orange-red in colour which is due to a precipitate similar to the one at Rusty Springs. No sample of the Water or the precipitate was taken for analysis.

The outcropping rocks downstream from C13 to C12 are a quartz-dolomite breccia with white quartz veins. No mineralization was noted.

We have noted that sulphide mineralization has been found over a fairly large area. Associated with this mineralization, extremely rich zinc-copper-silver occurrences of oxidized minerals have also been noted. As mentioned earlier, this area has not been glaciated during the Pleistocene and therefore has been exposed to a long period of weathering. Furthermore, the products of weathering have remained insitu, thus offering the potential of commercial supergene deposits.

Our research of the literature on known ore-bodies, shows that some of the richest ore-bodies in the world are of secondary origin as a result of extensive oxidation and supergene enrichment. Furthermore, all of these ore-bodies are in areas that have not been glaciated. One author emphasizes

the point that a very long period of oxidation is required before significant ore-bodies can result from this process. He emphatically states that the post Pleistocene period is NOT long enough for secondary deposits to become economically significant.

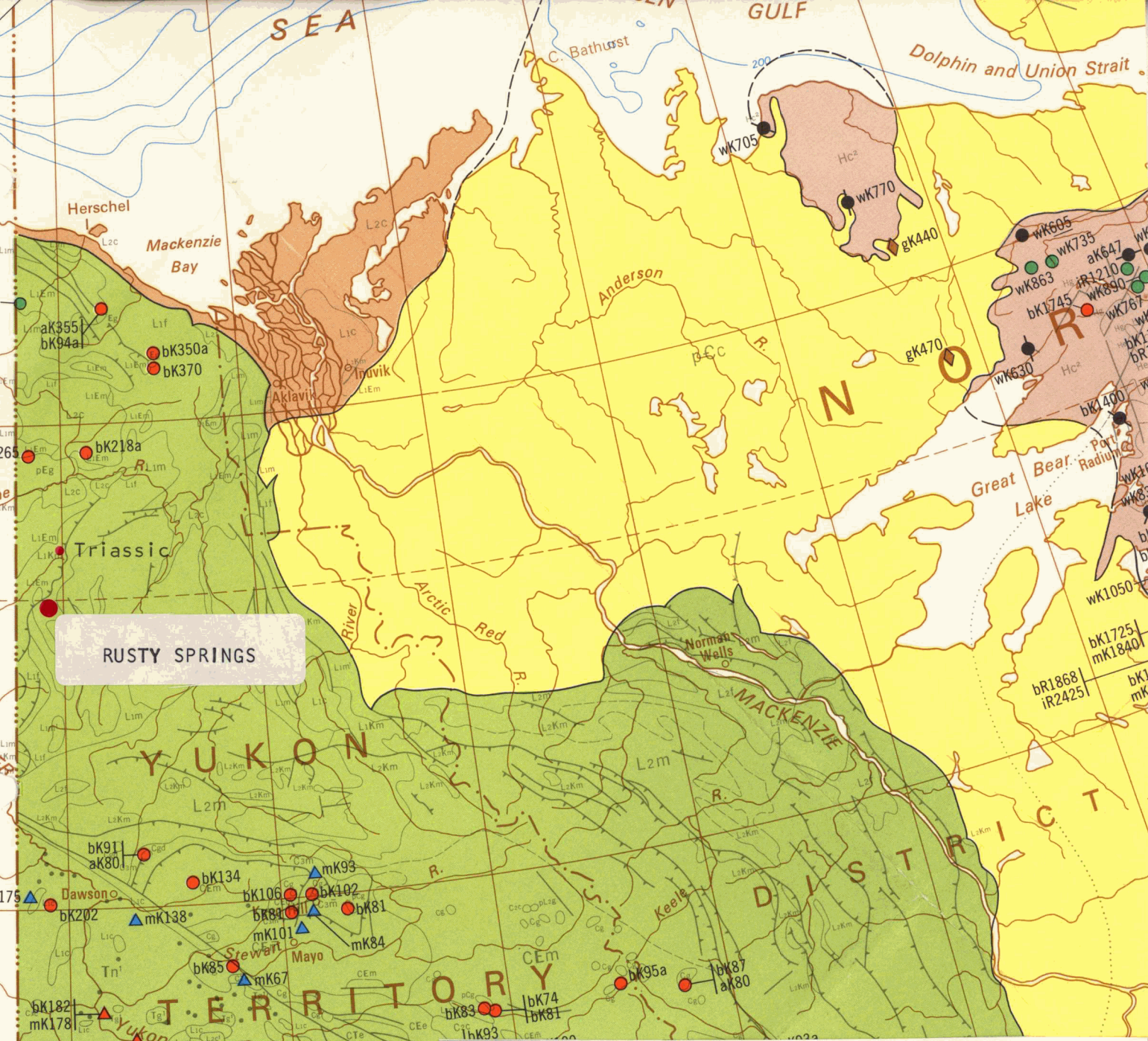
These authors agree that a dry and cool climate slows the process of oxidation and refrigeration by ground frost (perma frost) inhibits the oxidation process completely. In spite of these restrictions the commercial ore deposit at Kennecot, Alaska has one of the deepest (2,000 feet) oxidized zones known. An expert on the ore genesis at Kennecot states that oxidation occurred before Pleistocene time and the process has been inhibited ever since by 700 feet of perma frost.

Our research also indicated that most of the mining camps situated in the Cordilleran region of North America are characterized by ore-bodies which occur in highly brecciated and silicified country rock in contact or associated with an acidic intrusive. At Rusty Springs we have recognized extensive brecciation and silicification in association with mineralization; however, we have no local evidence for the presence of an intrusive. Nevertheless, Rusty Springs is located only 80 miles (128 km) south of the well documented late Paleozoic intrusive granites at OLD CROW (Ref. Fig. 4). Moreover, another intrusive body is known (personal knowledge) to occur only 30 miles north of Rusty Springs. The latter intrusive has been classed as a quartz monzonite porphyry and is of probable Triassic age. It is interesting to note that most of the mining camps that were researched are associated with monzonite porphyry intrusives.

Since we have recognized and mapped a highly anomalous area of brecciated, silicified and dolomitized Devonian rocks and since extensive mineralization has been noted and since intrusive acidic rocks are known to occur in the area, we have taken the liberty to interpret the geology of Rusty Springs as displayed by our cross-section AA' (in pocket). It should be noted that authors describing the occurrence of established mining camps in the Cordilleran region, often mention the fact that the deposits are mined in brecciated zones near the contact with the intrusive mass which is generally exposed at surface. These authors lament the fact that the cap of the intrusive has been eroded, for it is there that they would expect the richest and most extensive ore deposits.

FIGURE 4

ISOTOPIC AGE MAP



GEOLOGICAL SURVEY OF CANADA
DEPARTMENT OF ENERGY, MINES AND RESOURCES

1256 A

ISOTOPIC AGE MAP OF CANADA

Scale 1:5,000,000

Miles 100 0 100 200 Miles

Kilometres 100 0 100 200 300 Kilometres

LAMBERT CONFORMAL CONIC PROJECTION, STANDARD PARALLELS 49°N. AND 77°N.; MODIFIED POLYCONIC PROJECTION NORTH OF LATITUDE 80°

If an intrusive body is associated with the mineralization at Rusty Springs, then the "bonanza" cap will be present at depth on the property.

CONCLUSIONS

The findings to date indicate that the property has the potential of becoming a commercial mining camp. We recognize the following positive factors:

1). Area unglaciated - potential for significant supergene ore-bodies.

2). Breccia, Quartz, Calcite, Dolomite - the nature of Middle Devonian rocks at outcrop in this area is highly anomalous.

3). Mineralization - has been found over a fairly large area; clearly not confined to a small "pocket".

4). Intrusives Known - acidic intrusive rocks are known to occur to within 30 miles of the property.

5). Comparison with known mining camps in the Cordilleran Region of North America indicates similar rock type, similar group of minerals.

Although a possible deterrent to exploration of the property is apparently its remote location, we feel that the potential of the property as a economic mineral producer is more dependent on grade and extent of mineralization than on access and transport consideration, therefore, we recommend that further exploration of the property should be undertaken.

RECOMMENDATION FOR FURTHER WORK

1. IRON FORMATION

It is our feeling that further surface geological investigations will not add much to our present knowledge of the occurrence as far as potential size is concerned. If the lateral and downward extent of the iron ore is to be determined, then the following program should be considered.

A combined gravity and magnetometer survey to define the lateral and downward extensions of magnetite mineralization. We estimate that a proper, well controlled survey on this property should take about three weeks in the field.

Our estimate of costs for such a survey are $30,000.00 with a further $30,000.00 required for mobilization, demobilization, camp and support.

2. SULPHIDE MINERALIZATION

There are several ways to further explore this property:

a). GRAVITY GEOPHYSICS - The Gravity method has been highly successful in mapping sulphide ore-bodies in the FARO-VANGORDA area of the Yukon. Here, tabular nearly flat lying ore-bodies have been mapped at depth. Unfortunately we, at present, do not have a model for the ore deposit which may occur at Rusty Springs. If the mineralization is confined to narrow veins which are near vertical then the gravity method would not be successful in defining drilling targets. Our feeling is that the gravity method may be applicable, but only after we can define the model that we could and should expect.

b). DIAMOND DRILLING - Random diamond drilling may be successful in locating ore deposits; however, if the ore shoots are confined to relatively narrow veins, at or near vertical, one would have to be very fortunate to intersect a mineralized vein with a random drilling program. Again, we are of the opinion, that at this stage we cannot define suitable drilling targets that would aid in evaluating this property.

c). SURFACE GEOLOGY, HAND TRENCHING - Our experience during the summer of 1976 indicates that very little additional knowledge could be gained by manual means. It is clear that the excessive depth of scree precludes hand trenching.

d). BULLDOZING, STRIPPING - It is our opinion, that before geophysical surveys can be conducted to define drilling targets, we should attempt to define the model of the ore-body(ies) by observation. In this regard, we recommend that extensive hillside stripping, through the use of a bulldozer be attempted in order to expose bedrock beneath the TIM and TIP SHOWS. If work progresses satisfactorily, similar stripping could be attempted at the C1 and BRUCE SHOWS.

For example, if stripping was initiated near the top of the TIM and TIP scree slopes and bedrock was exposed, then the "cat" could continue working down the slope (in traverse lines) until the entire hillside was exposed. It is probable that after stripping, hydraulic washing of the exposed face would be necessary to clean the finer

debris.

Once the face was exposed, surface investigations could be made to establish the type and extent of mineralization. Furthermore, zones of interest could be defined and shallow diamond drilling could be utilized to determine the depth of these zones.

If a model for mineralized zone(s) could be established, then geophysical programs could be used to define drilling targets in other areas which are presently covered.

If such a program was undertaken, we recommend that the "cat" should be walked-in during April. Other heavy equipment or materials required for the project could be towed by the "cat". The stripping of the shows should be done during the months of June, July, and/or August when long daylight hours are available.

The costs of such a program have not been worked out in detail; however, we have considered some of the logistics of such a program and estimate that the total costs could approach $200,000.00. Although the costs of the latter program far exceed the costs of alternate programs, we feel that the information derived from other programs would be insufficient to properly evaluate the potential of this property.

Before stripping is undertaken, it is advisable to determine the depth of the overburden in order that the extent of stripping operations can be predicted. We recommend that a portable drilling unit be used to drill several holes to bedrock on prospective slopes.

WORK TO DATE

1. BULK SAMPLING - IRON FORMATION

During the winter of 1976 a helicopter trip was made from Dawson City to the property to obtain a bulk sample of the iron formation. The sample was required for certain assay and other chemical tests.

2. GEOLOGICAL MAPPING

During the summer of 1976, extensive traversing of the property was undertaken to map outcrops and near-outcrops (scree). The mapping program produced evidence for four shows (C1, DryBed, Bruce, C9) which were previously unknown. The results of the mapping program were used to construct the surface geological map (Map 1) and accompanying cross-section.

3. GEOCHEMICAL SURVEY - SOIL SAMPLING

During the summer of 1976, a geochemical sampling survey was conducted in the vicinity of the TIM, TIP, RUSTY SPRINGS and DRYBED SHOWS. Approximately 60 stations spaced at 100 foot intervals and in a rectangular grid were sampled. Generally, the soil sample was obtained from the bottom of a hole 8" - 15" deep.

The results of the survey indicate that anomalous (Maps 2, 3, 4, 5, & 6) metal values occur across the TIM and TIP shows. Deep pits (4 feet) which were excavated at the TIM show were sampled at the deepest part of the excavation. The results of pit samples show much higher metal values than adjacent samples from shallow holes.

At this time we are unable to assess the results and value of the geochemical survey, since anomalous results cannot be correlated with bedrock information. After the area has been stripped and mapped in detail, the results of the geochemical survey can be considered again.

4. TRENCHING - BLASTING

a). Quartz Claims

Nine shallow pits (3-4 feet deep) on the TIP show were excavated with the aid of dynamite. None of the pits reached bedrock, nor was there any indication that bedrock was near.

The scree slope is fairly unstable and after reaching the three or four foot depth, the pits had a tendency to cave. Permafrost was encountered near the base of some of the pits. In addition, several shallow trenches were excavated along traverse lines across the TIM scree slope.

The purpose of trenching was to establish the frequency and mode of occurrence of smithsonite float which was initially found at this locality and prompted the staking program. The results of this program indicated that the highest concentration of smithsonite and aurichalcite float occurred in pits which were approximately half-way up the open-scree slope of the TIM show. The mineralized float was consistently found at a depth of 6-10 inches below the surface of the slope.

b). Iron Claims

Part of the exposed iron formation was blasted (dynamite) to confirm that the iron ore grade was consistent throughout. In

addition a short stratigraphic section was measured and sampled across the face of the exposed iron formation. Assay results of continuous sampling are recorded in the accompanying Appendix.

5. HELICOPTER MAPPING

Additional Geological mapping and prospecting of the claim groups was aided by the use of a Jet Ranger Helicopter. The area of the claim group and the adjacent area of the Rusty Springs Anticline were flown to determine the trend and extent of formations which were mapped during foot traverses. Information obtained from this program was used to compile the surface geological map (Map 1).

6. ASSAYS

Both mineralized specimens and country rock were chemically analysed and assayed for valuable minerals. The results of these analyses are tabulated in the accompanying Appendix.

7. X-RAY MINERAL IDENTIFICATION

A small project of x-ray work was undertaken, to determine the composition of certain grey sulphide minerals. The result of this research indicates that the mineral of interest is a tetrahedrite "type" mineral of varying composition. It is our assumption that high silver values, as determined by assaying, originate from the presence of silver the tetrahedrite "type" mineral.

PLATE 1

Iron Formation

View looking nortwest at back slope of Iron Formation, in foreground. The measured strike length of the Iron Formation outcrop is 1200 feet. In the background, grey limestones of the Ettrain Formation are nearly flat lying over the Hart River Formation and the Unnamed Shale Unit.

View looking north, along strike, of the exposed Iron Formation which dips 65° to 75° east. The stratigraphic thickness of the Iron Formation is estimated at 150 feet. The claimpost and helicopter rest on black shales of the Husky Formation which ranges in age from Jurassic to Lower Cretaceous.

PLATE 2

Rusty Springs

PLATE 3

Brecciated Devonian Dolomite

Photographic plates show the intense brecciation of a Middle Devonian dolomite outcrop at locality C9-76. The fragments are cemented with white quartz and white calcite. At this locality white quartz veins up to 18 inches thick cut the dolomite breccia which is locally mineralized with disseminated pyrite.

M. N. CHERNOFF, P.GEOL.

Location Key for Chip Samples

M-1 Smithsonite; Tim Show
M-2 Smithsonite; Tim Show
M-3 Smithsonite; Tim Show

R-1 Smithsonite; Tim Show
R-2 Smithsonite; Tim Show
R-3 Smithsonite; Tim Show
R-4 Dolomite, quartz cryastals; no Cu or Pb minerals; Tim Show
R-5 Dolomite, quartz; specs of azurite and malachite; Tim Show
R-6 Punky with azurite stain; Tim Show
R-7 Quartz crystals with buff stain; Tim Show
R-8 Quartz cryatals with visible galena, buff stain; Tim Show
R-9 As above with galena crystals; Tim Show
R-10 Quartz crystals, no Cu stain, fine xls galena and pyrite; Tim Show
R-11 Quartz crystals, buff satin, azurite; Tim Show
R-12 Quartz crystals, no visible metallic mineralization; Tim Show
R-13 As R-11
R-14 Smithsonite; Tim Show
R-15 Quartz with malachite, azurite, buff stain; Tim Show

S-1 Buff stain, pyrobitumen, quartz; C12 to C13
S-2 As above, lge. well formed quartz xls; C12 to C13
S-3 Calcite xls with shale inclusions; C12 to C13
S-4 Dolomite, buff stain, no visible sulphides; C12 to C13
S-5 Dolomite with grey brown inclusions; C12 to C13
S-6 Dolomite, brownish stain, no sulphides; C12 to C13
S-7 White quartz with pyrobitumen inclusions; C12 to C13

F-1 Iron formation; central part of exposure
F-1A As above
F-2 Iron formation; north end of exposure
F-2A As above

To: RIO ALTO EXPLORATION LTD.,
Fina Oil Bldg.,
36-8th Ave. S.W.,
Calgary, Alta.
ATTN: R. Trummundi

File No. 10411
Date September 9, 1975
Samples Chips

Certificate of ASSAY

LORING LABORATORIES LTD.

SAMPLE No.	OZ./TON GOLD	OZ./TON SILVER	% Cu	% Pb	% Zn	% WO3
M- 1	Trace	.08	8.96	.77	39.52	.02
M- 2	Trace	.32	14.48	1.29	36.60	.04
M- 3	Trace	.18	8.18	.80	39.91	.01
R- 1	.010	.03	13.65	1.75	35.91	.03
R- 2	.010	5.13	9.84	8.71	33.49	.03
R- 3	.010	4.17	5.75	.72	36.50	.01
R- 4	.020	Trace	.12	.07	.50	Trace
R- 5	Trace	.02	.22	.03	7.12	Trace
R- 6	Trace	4.50	.65	.05	.12	Trace
R- 7	Trace	Trace	.02	.02	.04	Trace
R- 8	Trace	Trace	.01	.18	.12	.01
R- 9	Trace	.22	.07	1.69	.28	.03
R-10	.020	Trace	.01	.02	.03	Trace
R-11	.020	8.04	1.42	.16	.07	Trace
R-12	.020	Trace	.02	.08	.04	Trace
R-13	.010	3.81	.48	.09	.25	Trace
R-14	.010	Trace	13.45	.30	38.48	.03
R-15	.010	1.61	.33	.05	.11	Trace
S- 1	Trace	Trace	.02	.02	.07	Trace
S- 2	Trace	Trace	.03	.02	.12	.02
S- 3	.010	.01	.01	.02	.04	.01

I Hereby Certify THAT THE ABOVE RESULTS ARE THOSE ASSAYS MADE BY ME UPON THE HEREIN DESCRIBED SAMPLES . . . .

Rejects Retained one month.

Pulps Retained one month unless specific arrangements made in advance.

A. L. McFadden

Licensed Assayer of British Columbia

To: RIO ALTO EXPLORATION LTD.,
Fina Oil Bldg.,
736-8th Ave. S.W.,
Calgary, Alta.
ATTN: B. Trummundi

File No. 10411
Date September 9, 1975
Samples Chips

Certificate of ASSAY

LORING LABORATORIES LTD.

SAMPLE No.	OZ./TON GOLD	OZ./TON SILVER	% Cu	% Pb	% Zn	% WO3
S- 4	.020	Trace	.01	.02	.05	Trace
S- 5	Trace	Trace	.01	.02	.03	Trace
S- 6	Trace	.02	.01	.02	.07	.01
S- 7	.020	.02	.01	.02	.04	.01

I Hereby Certify THAT THE ABOVE RESULTS ARE THOSE ASSAYS MADE BY ME UPON THE HEREIN DESCRIBED SAMPLES . . . .

Rejects Retained one month.

Pulps Retained one month unless specific arrangements made in advance.

A. Loring Jones

Licensed Assayer of British Columbia

To: RIO ALTO EXPLORATION LTD.,
Fina Oil Bldg.,
736-8th Ave. S.W.,
Calgary, Alta.
ATTN: B. Trummundi

File No. 10411
Date September 9, 1975
Samples Chips

Certificate of ASSAY

LORING LABORATORIES LTD.

PAGE # 4

SAMPLE No.	TOTAL % Fe
F-1	55.49
F-1A	56.97
F-2	55.64
F-2A	55.59

I Hereby Certify THAT THE ABOVE RESULTS ARE THOSE ASSAYS MADE BY ME UPON THE HEREIN DESCRIBED SAMPLES . . . .

Rejects Retained one month.

Pulps Retained one month unless specific arrangements made in advance.

A. L. McEwan

Licensed Assayer of British Columbia

To: RIO-ALTO EXPLORATION LTD.,
736-8th Ave. S.W.,
Calgary, Alta.

ATTN: B. Termuende

Rusty Spring

File No. 10496
Date September 24, 1975
Samples Pulps

Certificate of ASSAY

LORING LABORATORIES LTD.

SAMPLE No.	% MoS_2
M-1	.001
M-2	.001
M-3	.002
R-1	.001
R-2	.003
R-3	.002

I Hereby Certify THAT THE ABOVE RESULTS ARE THOSE ASSAYS MADE BY ME UPON THE HEREIN DESCRIBED SAMPLES . . . .

Rejects Retained one month.

Pulps Retained one month unless specific arrangements made in advance.

Licensed Assayer of British Columbia

can test ltd.

1650 PANDORA STREET, VANCOUVER, B.C. V5L 1L6 • TELEPHONE 254-7278
Telex 04-507737

To: Loring Laboratories Ltd.

SEMI QUANTITATIVE SPECTROGRAPHIC ANALYSES CERTIFICATE

File No. 1383 B

Date Oct. 20, 1975

We hereby Certify that the following are the results of semi quantitative spectrographic analyses made on Ore Pulp samples submitted.

		1	2	3	4	5
Aluminum	Al	0.5	0.3			
Antimony	Sb	0.1	0.1			
Arsenic	As	0.1	0.07			
Barium	Ba	ND	ND			
Beryllium	Be	ND	ND			
Bismuth	Bi	ND	ND			
Boron	B	ND	ND			
Cadmium	Cd	0.3	0.3			
Calcium	Ca	1.	1.			
Chromium	Cr	0.003	ND			
Cobalt	Co	ND	ND			
C :r	Cu	Major	Major			
Gallium	Ga	ND	ND			
Gold	Au	Trace	Trace			
Iron	Fe	2.	2.			
Lead	Pb	*	*			
Magnesium	Mg	0.1	0.1			
Manganese	Mn	0.01	0.01			
Molybdenum	Mo	ND	ND			
Niobium	Nb	ND	ND			
Nickel	Ni	0.001	0.001			
Potassium	K	ND	ND			
Silicon	Si	2.	2.			
Silver	Ag	0.01	0.01			
Sodium	Na	-	-			
Strontium	Sr	0.003	0.001			
Tantalum	Ta	ND	ND			
Thorium	Th	ND	ND			
Tin	Sn	0.007	0.007			
Titanium	Ti	0.01	0.007			
Tungsten	W	ND	ND			
Uranium	U	ND	ND			
V ium	V	0.004	0.003			
Zinc	Zn	Major	Major			

Sample Identification

Sample 1: M-1 - Tim Show

Sample 2: R-1 - Tim Show

Sample 3: File 10489
P. O. 1289

Sample 4:

Sample 5:

Percentages of the various elements expressed in these analyses may be considered accurate to within plus or minus 35 to 50% of the amount present.

Semi-quantitative spectrographic analytical results for gold and silver are normally not of a sufficient degree of precision to enable calculation of the true value of ores. Therefore, should exact values be required, it is recommended that these elements be assayed by the conventional Fire Assay Method. Quantitative and Fire Assays may be carried out on the retained pulp samples.

Silicon, aluminum, magnesium, calcium and iron are normal components of complex silicates.

MATRIX – Major constituent
MAJOR – Above normal spectrographic range
TRACE – Detected but minor amounts
N.D. – Not detected
* – Suggest assay (above 0.3%

All results expressed as Percent

Note: Pulps retained one week.

CAN TEST LTD.

DKG

Spectroscopist

Form No. 12 L

To: RIO-ALTO EXPLORATION LTD.,
Fina Oil Bldg.,
6-8th Ave. S.W.,
CALGARY, Alberta.

ATTN: Bob Termuende

File No. 10510
Date September 26, 1975
Samples Chip & Soil

Certificate of ASSAY

LORING LABORATORIES LTD.

SAMPLE No.	OZ./TON GOLD	OZ./TON SILVER	% Cu	% Pb	% Zn	% Sn
CHIP SAMPLES						
COM # 1	.010	1.39	.34	.01	12.03	Trace
COM # 2	Trace	4.12	.71	.34	4.51	Trace

Com # 1 -- Sample of ribbon sphalerite in Quartz breccia -- Tip Show

Com # 2 -- Sample of soil from shallow digging -- Tim Show

I Hereby Certify THAT THE ABOVE RESULTS ARE THOSE ASSAYS MADE BY ME UPON THE HEREIN DESCRIBED SAMPLES . . . .

Rejects Retained one month.

Pulps Retained one month unless specific arrangements made in advance.

Licensed Assayer of British Columbia

To: RIO-ALTO EXPLORATION LTD.,
Fina Oil Bldg.,
-8th Ave. S.W.,
CALGARY, Alberta.
ATTN: Bob Termeunde

File No. 10510
Date September 26, 1975
Samples Water

Certificate of ASSAY

LORING LABORATORIES LTD.

SAMPLE No.	PPB Cu	PPB Pb	PPB Zn	PPB Ag
WATER ANALYSIS				
COM # 3	1900	140	161	10
COM # 4	2040	190	233	15

Com # 3 -- Water sample from south tributary to main stream. Southwest of Tim Show

Com # 4 -- Water sample from spring at Rusty Springs

I Hereby Certify THAT THE ABOVE RESULTS ARE THOSE ASSAYS MADE BY ME UPON THE HEREIN DESCRIBED SAMPLES . . . .

Rejects Retained one month.

Pulps Retained one month unless specific arrangements made in advance.

A. Knez

Licensed Assayer of British Columbia

To: RIO-ALTO EXPLORATION LTD.,
Fina Oil Building,
6 - 8th Avenue S.W.,
Calgary, Alberta
ATTN: Bob Termuende

File No. 11745
Date July 29, 1976
Samples Chip

Certificate of ASSAY

LORING LABORATORIES LTD.

SAMPLE No.	OZ./TON SILVER	% Cu	% Pb	% Zn
"Chip Samples"				
Pit # 7	.28	.88	.04	30.51
T-1-10 (near 0N;0E)	2.24	.77	.04	.32
T-2-10 (near 0N;0E)	Trace	.04	.02	.10
100W-2N	Trace	Trace	.02	.01
400E-5N	4.92	.13	.90	.11
700E-4NA	Trace	.02	.03	.04
700E-4NB	Trace	.01	.02	.01

Locations of above chip samples refer to Geochem grid map.

I Hereby Certify THAT THE ABOVE RESULTS ARE THOSE ASSAYS MADE BY ME UPON THE HEREIN DESCRIBED SAMPLES . . . .

Rejects Retained one month.

Pulps Retained one month unless specific arrangements made in advance.

Licensed Assayer of British Columbia

To: RIO-ALTO EXPLORATION LTD.,
Fina Oil Building,
`6 - 8th Avenue S.W.,
Calgary, Alberta
ATTN: Bob Termuende

File No. 11745
Date July 29, 1976
Samples Soil Geochems

Certificate of ASSAY

LORING LABORATORIES LTD.

SAMPLE No.	PPM Cu	PPM Pb	PPM Zn	PPM Ag
"Soil Geochems"				
T-1-10	48	164	320	2.8
Rusty Spring	25	40	* +1000	2.6

T-1-10 near ON;0E --- refer to Geochem grid map

Rusty Spring -- sediment or precipitate from spring water at Rusty Spring

I Hereby Certify THAT THE ABOVE RESULTS ARE THOSE ASSAYS MADE BY ME UPON THE HEREIN DESCRIBED SAMPLES . . . .

Rejects Retained one month.

Pulps Retained one month unless specific arrangements made in advance.

A. Lime Jr.

Licensed Assayer of British Columbia

To: RIO-ALTO EXPLORATION LTD.,
Fina Oil Building,
- 8th Avenue S.W.,
Calgary, Alberta
ATTN: Bob Termuende

File No. 11887
Date August 23, 1976
Samples Previous Pulp

RECEIVED AUG 3 [illegible]

Certificate of ASSAY

LORING LABORATORIES LTD.

SAMPLE No.	% Zn	% Cd
"Pulp Sample"		
Rusty Spring	.13	Trace

Sample of dried precipitate from Rusty Springs water.

I Hereby Certify THAT THE ABOVE RESULTS ARE THOSE ASSAYS MADE BY ME UPON THE HEREIN DESCRIBED SAMPLES . . . .

Rejects Retained one month.

Pulps Retained one month unless specific arrangements made in advance.

A. Anne Isaac

Licensed Assayer of British Columbia

M. N. CHERNOFF, P.GEOL.

Locations and Descriptions for Chip Samples

Sample No.	Location	Hand Specimen Description	X-Ray Data
S-1-76	C9-76	Dolomite breccia, wh qtz and calcite. Dol, blk, dense; ribbons of wh dol in cav. abund. f to m xln pyrite dissem througout.	
S-2-76	Bruce Show	dk gy dol bx lined wi wh m to coarse xln dol and encrusted with small blk, soft "buggsy" mineral. Goethite/Limonite	
S-3-76	Bruce Show	dol bx encrusted. Eu wh qtz xls, gy sul min wi az and mal	gy min is tetrahedrite-tennantite solid sln.
S-4-76	Tip Show	dol and dk bn sphalerite	sphalerite- minor tetrahedrite
S-5-76	C1-76	mnly qtz wh wi patches of Cu stained gy met min. Also rare galena xls.	
S-6-76	C1-76 +400'	mnly qtz wi met patch (Cu stained.	
S-7-76	C1-76	smithsonite, mal stn	siderite, impure (?)
S-8-76	C1-76	wh mass qtz wi gy met min, tr Cu stn, bn dull ox min and yell stn assoc wi dull bn min	
S-9-76	C1-76 top	per S-8-76	qtz and tetrahedrite
S-10-76	C1-76 top	mnly mass wh qtz wi dissem patches gy met min	tetrahedrite

To: Mr. M.N. Chernoff,
520 Barron Bldg.,
10 - 8th Ave. S.W.,
Calgary, Alberta

File No. 11792
Date August 6, 1976
Samples Chip

Certificate of ASSAY

LORING LABORATORIES LTD.

SAMPLE No.	OZ./TON SILVER	% Cu	% Pb	% Zn	% Ni	% Fe	% Cd
"Chip Samples"							
S-1-76	.24	.08	-	.01	.01	5.83	-
S-2-76	.16	.02	-	.04	-	-	-
S-3-76	9.16	.95	.12	.28	-	-	-
S-4-76	.38	.08	.02	21.92	-	-	-
S-5-76	NSS*	14.65	18.57	4.37	-	-	-
S-6-76	17.10	1.51	.99	.28	-	-	-
S-7-76	3.22	3.26	.19	43.20	-	-	-
S-8-76 A	44.00	1.12	.78	.43	-	-	.01
S-8-76 B	31.60	2.10	.49	.39	-	-	.01
S-9-76	66.04	.33	1.75	.07	-	-	.01
S-10-76	49.42	3.51	.56	.47	-	-	.01

* Not Sufficient Sample

I Hereby Certify THAT THE ABOVE RESULTS ARE THOSE ASSAYS MADE BY ME UPON THE HEREIN DESCRIBED SAMPLES . . . .

Rejects Retained one month.

Pulps Retained one month unless specific arrangements made in advance.

A. J. McLeod

Licensed Assayer of British Columbia

To: UNION OIL COMPANY OF
CANADA LIMITED,
35-8th Avenue S.W.,
Calgary, Alberta.
ATTN: A. Tayllor

File No. 11228
Date April 5, 1976
Samples Magnetite

Certificate of ASSAY

LORING LABORATORIES LTD.

SAMPLE No.	Total % Fe	Magnetic % Fe	% Magnetics by Wt.	Conc. Ratio	% Fe in Magnetics	% Fe in Recovery	Screen Size 100 %
Representative Samples from Bulk Sample of Iron Formation.							
Sample # 1 *	52.48	43.13	75.28	1.3	57.30	82.18	-250
Sample # 1 *	53.08	40.75	69.65	1.4	58.51	76.77	-325
Sample # 2 *	54.49	48.02	80.96	1.2	59.31	88.12	-250
Sample # 2 *	54.18	44.81	74.29	1.3	60.32	82.70	-325
Sample # 3	55.39	49.98	85.13	1.2	58.71	90.23	-100
Sample # 4	54.08	47.48	82.58	1.2	57.50	87.79	-100

* Recovery varies proportionally with mesh size.

I Hereby Certify THAT THE ABOVE RESULTS ARE THOSE ASSAYS MADE BY ME UPON THE HEREIN DESCRIBED SAMPLES . . . .

Rejects Retained one month.

Pulps Retained one month unless specific arrangements made in advance.

Licensed Assayer of British Columbia

To: UNION OIL COMPANY OF
CANADA LIMITED,
335-8th Avenue S.W.,
Calgary, Alta.
ATTN: A. Taylor

File No. 11228
Date April 5, 1976
Samples Magnetite

Certificate of ASSAY

LORING LABORATORIES LTD.

SAMPLE No.	Ferrous % Fe
Represetative samples from bulk sample of Iron Formation	
Head Sample # 1	12.97
Con. Sample # 1 @ 100% -250M	12.92
Con. Sample # 1 @ 100% -325M	13.33

I Hereby Certify THAT THE ABOVE RESULTS ARE THOSE ASSAYS MADE BY ME UPON THE HEREIN DESCRIBED SAMPLES . . . .

Rejects Retained one month.

Pulps Retained one month unless specific arrangements made in advance.

Licensed Assayer of British Columbia

To: UNION OIL COMPANY OF
CANADA LIMITED,
335-8th Avenue S.W.,
Calgary, Alberta.
ATTN: A. Taylor

File No. 11228
Date April 5, 1976
Samples Magnetite

Certificate of ASSAY

LORING LABORATORIES LTD.

SAMPLE No.	% Cu
ANALYSIS OF CONCENTRATE	Representative samples from bulk sample of Iron Formation
Sample # 1-250M	.010
Sample # 1-325M	.010
Sample # 2-250M	.010
Sample # 2-325M	.005
Sample # 3-100M	.005
Sample # 4-100M	.005

I Hereby Certify THAT THE ABOVE RESULTS ARE THOSE ASSAYS MADE BY ME UPON THE HEREIN DESCRIBED SAMPLES . . . .

Rejects Retained one month.

Pulps Retained one month unless specific arrangements made in advance.

A. Leitch

Licensed Assayer of British Columbia

C. M. CHENNOFF

CHEMEX LABS LTD.

212 BROOKSBANK AVE.
NORTH VANCOUVER, B.C.
CANADA V7J 2C1
TELEPHONE: 985-0648
AREA CODE: 604
TELEX: 043-52597

••ANALYTICAL CHEMISTS ••GEOCHEMISTS ••REGISTERED ASSAYERS

CERTIFICATE OF ASSAY

PROJECT 174-04-01
CERTIFICATE NO. 31029
INVOICE NO. 16239
RECEIVED March 1/76
ANALYSED March 11/76

TO: Union Oil Company of Canada Limited
335 - 8th Ave. S.W.
Calgary Alta.
T2P 1C3

ATTN: Al Taylor

Ref. 174-04-01

SAMPLE NO. :	% FeO	Total Fe as Fe_2O_3 (Fusion)	% SiO_2	% S	% P_2O_5	% TiO_2
1	17.0	77.11	8.42	0.24	1.74	0.60
2	20.2	78.49	7.74	0.15	2.54	0.58
3	19.4	79.24	7.79	0.15	2.10	0.67
4	19.1	77.14	8.06	0.13	2.26	0.63

Represntative samples from
bulk sample of Iron Formation

CTA MEMBER CANADIAN TESTING ASSOCIATION

B. Kwaitkowski
REGISTERED ASSAYER, PROVINCE OF BRITISH COLUMBIA

DATE July 26, 1976

FILE NO. 9613 - 20

ASSAY CERTIFICATE

WHITEHORSE ASSAY OFFICE LTD.
BOX 4518 WHITEHORSE Y. T.
PHONE 667 2694 Y1A 2R8

SAMPLE RECEIVED FROM RIO ALTO EXPLORATION

Copy to Paul White July 30

SAMPLE NO.	GOLD Oz. Per Ton	SILVER Oz. Per Ton	TOTAL IRON		MAGNETIC FRACTION $FeO.Fe_2O_3$
F-1			55.95		63.92
F-2			53.33		75.58
F-3			24.64		28.02
F-4			53.73		65.76
F-5			56.56		82.28
F-6			56.96		85.92
F-7			57.37		76.72
F-8			55.35		75.74
F-9			57.37		84.32
F-10			56.96		83.00
F-11			56.56		80.02
F-12			54.94		75.12
F-13			54.14		85.60
F-14			56.16		86.60
F-15			56.16		87.14
F-16			32.72		51.16
F-17			56.56		88.0
F-18			56.96		82.28
F-19			53.65		68.52
F-20			56.56		88.72

Samples from measured section across Iron Formation.
Samples taken at 5 foot intervals.

RECEIVED JUL 27 1976

RECEIVED JUL 29 1976

ASSAYER.

Geochemical Soil Sampling

Refer to Grid Map for locations.

WHITEHORSE ASSAY OFFICE
BOX 346
WHITEHORSE, YUKON

Rec'd July 27/36 [illegible]

Samples from: Rio Alto Exp. Ltd. Lot. No.: A-909-70

	COPPER	LEAD	ZINC	SILVER				
00N 00E/W	16	16	104	.6				
00E+100N	24	52	328	.4				
00E +200N	24	36	144	.4				
00E +300N	16	140	232	.8				
400N	88	116	2112	4.3				
500N	16	44	640	1.0				
600N	120	56	552	1.2				
700N	44	14	232	.4				
800N	32	20	224	.6				
900N	24	16	392	.4				
1000N	8	24	360	.8				
100E-1-N	12	76	232	.8				
200E-1-N	16	24	72	.6				
100W-1-N	36	52	608	.5				
200W 1N	88	108	816	1.0				
100E 2-N	12	52	128	.8				
200E 2-N	20	40	80	.8				
300E 2-N	20	96	264	.8				
100W 2-N	16	52	344	1.4				
200W 2N	52	64	432	1.0				
100E 3N	24	64	176	1.2				
200E 3N	56	176	672	7.8				
100W 3N	12	32	288	.5				
200W 3N	60	76	536	1.0				
300W N3	40	60	488	.8				
100E 4N	18	78	284	1.9				
300E 4N	12	28	176	.6				
400E 4N	16	52	304	1.0				
500E 4N	28	72	256	.8				
600E 4N	12	24	256	.5				
700E 4N	12	80	408	.6				
100W 4-N	56	92	376	.7				
200W 4-N	60	92	600	.8				
100E 5-N	20	52	544	.6				
200E 5-N	12	40	216	.6				
300E 5-N	56	160	784	2.4				
200E 4N	64	32	216	1.8				
400E 5N	20	28	184	.6				
500E-5N	56	56	408	1.0				
600E-5N	100	28	256	.6				

Date: ______________ Assayer: K. Hoyland

71-350 BP

Geochemical Soil Sampling

Refer to Grid Map for locations

WHITEHORSE ASSAY OFFICE
BOX 346
WHITEHORSE, YUKON

Samples from: Red Alta Exp. Ltd. Lot. No.: A-909-70

	COPPER	LEAD	ZINC	SILVER				
700E 5-N	28	40	328	.6				
100W 5-N	192	580	1216	4.0				
200W 5-N	48	68	424	1.0				
300W 5-N	72	26	448	.6				
400W 5-N	72	4	136	.6				
500W 5-N	164	68	944	1.6				
E100 10N	16	24	568	1.2				
E200 10N	20	32	408	1.0				
E300 10N	24	32	216	.8				
E400 10N	8	16	48	.4				
E500 N10	20	20	168	.8				
E600 N10	20	40	152	.6				
E700 N10	16	28	120	.6				
P-1 SOIL	28	124	1120	1.2				
P-2	28	100	1312	.8				
P-3	20	52	312	.8				
P-4	156	320	1984	11.0				
PIT-5	28	68	376	.8				
P-8	68	136	2848	3.2				
c/c BRUCE SHOW	20	20	144	.4				
c/c R10 33,34, 35, 36	20	192	328	.4				
R10 37, 38, 39, 40	56	20	288	.6				
39, 40, 41, 42	24	20	128	.4				
47, 48, 49, 50	24	120	488	1.0				
49, 50, 51, 52	36	36	400	.6				
51, 52, 53, 54	24	28	328	.4				
NO NUMBER TAG ON	16	52	264	.6				
TIM SHOW SOIL	160	136	1728	6.8				
TIM SHOW EAST	400	192	2400	8.6				
T-2-10 SOIL	20	72	296	.8				

Date: July 23/76 Assayer: K. Hoyland

71-350 BP

WHITEHORSE ASSAY OFFICE
BOX 346
WHITEHORSE, YUKON

(A-909-70)

Samples from: Rose Alla Explorations Lot. No.: A-909-19

	CADMIUM						
00E 400N	18						
500N	6						
600N	6						
100W 1-N	14						
200W 1-N	14						
200E 3-N	8						
200W 3-N	8						
200W 4-N	8						
100E 5N	6						
300E 5N	8						
100W 5N	8						
500W 5N	16						
E100 10N	8						
P-1 Soil	8						
P-2	10						
P-4	24						
P-8	8						
TIM SHOW SOIL	10						
TIM SHOW EAST	18						

Samples of soil taken during geochem. survey. Refer to Geochem. grid map for locations

RECEIVED OCT 4 1976

Date: July 26/76

Assayer: K. Hoyland

71-350 BP

APPENDIX "B"

DESCRIPTIVE NOTES FROM TRAVERSES

July 10, 1976

Crew: M.N. Chernoff and M.B. Chernoff

C1-76 Limestone outcrop, fossiliferous (corals) at base of large clearing ± 100 yards east of cut line. Scree slope of limestone blocks with scattered white quartz. Rare malachite, azutite and tetrahedrite marked by flagginf. Sample C1-76.

C1-76 Near Top Near contact of black chert with carbonate. Contact appears to be on strike to north across creek with carbonate and shale contact.On traverse upslope-- several localities of Galena, Malachite, Azurite, Tetrahedrite bearing quartz. Quartz blocks in black chert carry yellow stained grey metallic mineral (tetrahedrite?). Samples C1-76 Top.

C2-76 Ledge on northeast side of mountain -- rubble outcrops of grey weathered, black silicified shale and chert. No quartz float.

C3-76 Top of mountain. Flat lying, silicified black shale and black chert. "Clinks' beneath heel. No quartz.

C4-76 Slope across gully to west from main mountain. Near headwaters of gully -- black silicified shale and black chert, rusty weathered.

C5-76 Dolomite, light grey, blocky; med. xln. No quartz. Between shale and dolomite is a blocky/massive weathered unit of black brecciated and silicified shale and dolomite.

C5A-76 Carbonate scree on either side of creek. Limestone, black, fossiliferous.

July 11, 1976

Crew: M.N. Chernoff and M.B. Chernoff

C6-76 Locality a t scree of grey weathered dolomite blocks,fossiliferous (horn corals, colonial corals). Occ. thin bands of barren white quartz. Rare blocks of orange/brown stained quartz blocks (barren)

C7-76 Locality to northwest of C6 along travers line. Black silicified shale with occ. blocks of white barren quartz. Outcrop slumped; however, strike appears to be NNW and beds dip 10° west. Contact between carbonate and shale must be faulted since one passes from carb. to shale abruptly and there does not appear to be enough room for all of the carbonate beds to plunge beneath the shale. It is assumed that such a fault would run easterly towrds the "Tim show".

C8-76 Locality on creek just below mouth of "Carb" Creek-- south bank of river. Soft black shale -- thinly bedded/cleaved 020°/50° West. Looks like Hart River Shale.

C9-76 Outcrop of dolomite breccia at creek level -- highly brecciated black dolomite/ fine to med. xln--- abundant white quartz veins and cement. Vugs in quartz veins and breccia. Larger quartz veins (6" - 10") wide appear to have grown towrds middle since large xls meet at centre. Small disseminated xls of pyrite in dol. bx.. Bedding attitude impossible to determine. Quartz works strike 032° to 040° and dip vertical and up to 15°-20° on either side of vertical. Breccia beds appear to be near flat lying and plunging to north.

C10-76 Scree slope of grey carbonate on north bank of stream-- 100 yards downstream from contact with overlying black shale. Dolomite breccia talus with streak down centre and widening at base with quartz xls and breccia with vugs lined with calcite, SPHALERITE, TETRAHEDRITE -- some large specimens of yellow/gn/bn sphalerite. Also encrusted coatings (looks like the backs of many black bugs) -- thin coating of rusty wthg mineral on faces of dolomite fragments. Coating is goethite/limonite. Collection of samples packed to camp and stock piled at base of slope.

July 14, 1976

Crew: M.N. Chernoff and M.B. Chernoff

C11-76 North side of creek. Outcrop of black silicified shale (Unnamed Shale Unit), hard. Outcrop strikes approx. 090° and dips ± 30° north. No mineralization noted.

C12-76 North bank of creek. Outcrop of dolomite, quartz, calcite breccia. Attitude indeterminable -- outcrop chewed up -- struck with quartz veins. No mineralization noted.

C13-76 North bank of creek. Spring issues from dolomite/quartz/ calcite breccia outcrop. No mineralization noted. Spring deposits a bright red/orange sediment forming a large brilliant gossan in swamp.

LEGEND

CRETACEOUS

Kg — GOODENOUGH FORMATION; mainly shale and siltstone with resistant weathered bands of quartzitic sandstone.

Kmc — MARTEN CREEK FORMATION; mainly quartzitic sandstone.

JURASSIC AND CRETACEOUS

Kh — HUSKY FORMATION; mainly recessive weathered, black shale with siltstone bands.

Fe — IRON FORMATION; oolitic magnetite, massive bedded.

PERMIAN

Pic — JUNGLE CREEK FORMATION; mainly clastic sediments. Sandstone, shale with occasional limestone bands.

PENNSYLVANIAN

Pe — ETTRAIN FORMATION; mainly fossiliferous limestone. Resistant weathering.

PENNSYLVANIAN (?) AND MISSISSIPPIAN

Mhr — HART RIVER FORMATION; mainly black shale, argillaceous limestone.

DEVONIAN

Du — UPPER ?
UNNAME SHALE UNIT; mainly silicified black shale and banded black chert.

Dm — MIDDLE
OGILVIE FORMATION; fossiliferous limestone.

Dmc — OGILVIE FORMATION; brecciated and dolomitized, fossiliferous limestone; abundant quartz veins, crystals and pockets; also abundant white calcite. Mineralization associated with this unit.

x — Outcrop

s — Scree slope

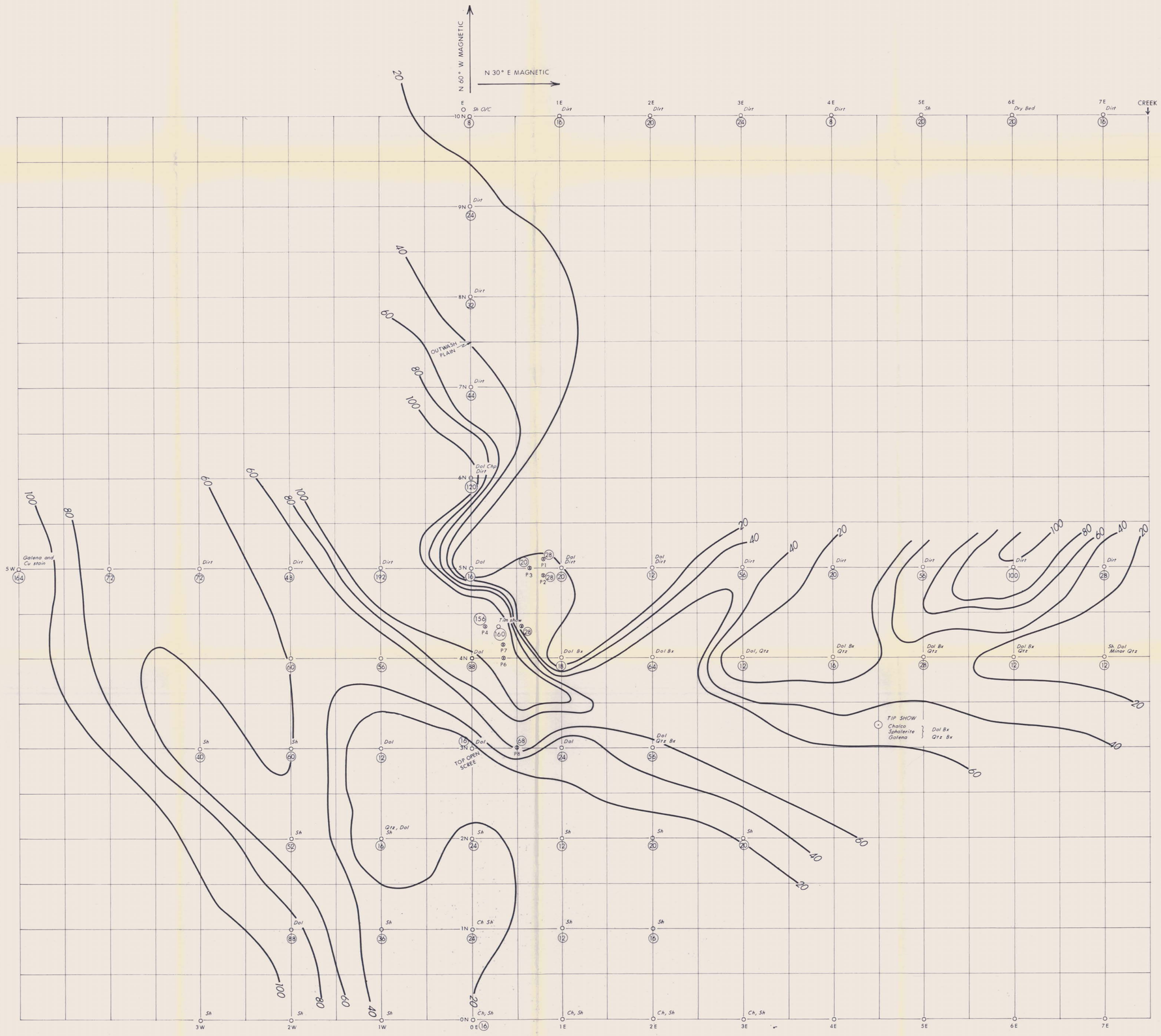
m — Mineral locality

x — Location of mineral showing

x — Location of traverse point; field description

——, – – – Geological contact, defined, assumed

~~~, ~ ~ ~ Fault contact, defined, assumed

Fault, thrust, dot side down

Anticline, Syncline, plunge indicated

DA — DISTINCT ALIGNMENT or LINEAMENT

30 — 70 — Bedding attitude, inclined, overturned, ± 45° (Photo)

— vertical, — flat

A — A' — LOCATION OF CROSS-SECTION

IRON CLAIM BLOCK

AREA OF GEOCHEMICAL SURVEY

QUARTZ CLAIM BLOCK

RUSTY SPRINGS, YUKON

SURFACE GEOLOGY

COMPILED FROM TRAVERSES, HELICOPTER RECONNAISSANCE, HELICOPTER STOPS AND AIR PHOTO INTERPRETATION

SCALE: 1" — 1400 feet (in centre of map at 2000 elevation)	Cont. Int: 500 ft.	M.N. CHERNOFF

NOTE: THIS MAP HAS BEEN MADE FROM AIR PHOTO A13231 — 131

The map is uncontrolled and should not be used for legal locations. The positioning of the Claim Blocks and the location of elevation contours are, at best, an approximation.

MAP 1
~~~



LEGEND

COPPER

(120) PARTS PER MILLION

INTERESTING

ANOMALOUS

Contour Interval: 20 PPM

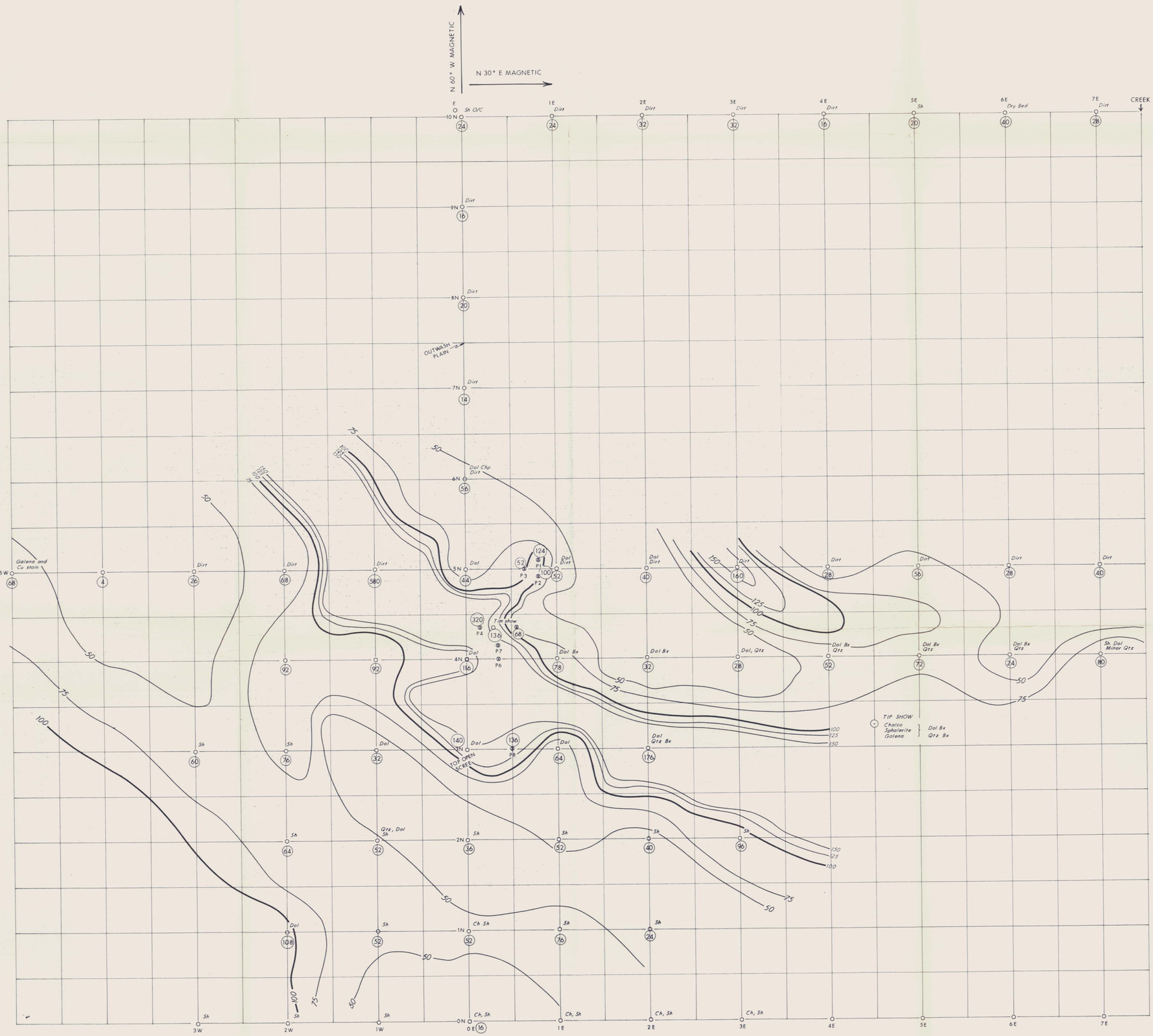
RUSTY SPRINGS, YUKON

LOCATION OF GRID
GEOCHEMICAL SURVEY
(CLAIM RIO 52)

Dol	Dolomite	○ Location of Geochem sample
Sh	Shale	⊗ Location of excavated pit
Bx	Breccia	⊙ Location of show
Qtz	Quartz	

Scale: 1" = 50 feet JULY 1976

MAP 2



LEGEND

LEAD

(52) PARTS PER MILLION

25
50
75
100
125 INTERESTING
150 ANOMALOUS

Contour Interval: 25 PPM

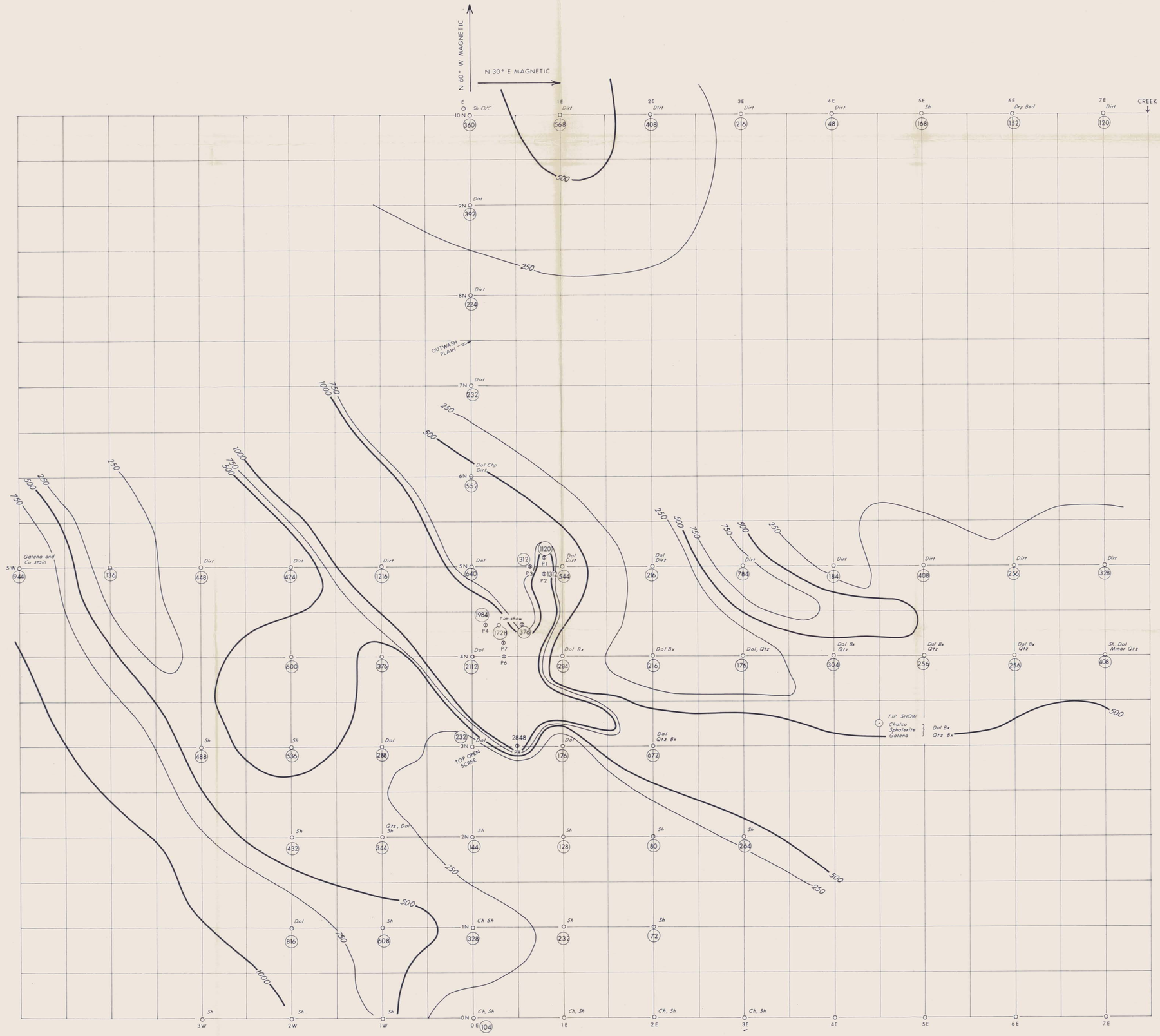
RUSTY SPRINGS, YUKON

LOCATION OF GRID
GEOCHEMICAL SURVEY
(CLAIM RIO 52)

Dol	Dolomite	⊙	Location of Geochem sample
Sh	Shale	⊗	Location of excavated pit
Bx	Breccia	⊙	Location of show
Qtz	Quartz		

Scale: 1" = 50 feet JULY 1976

MAP 3



LEGEND

ZINC

(104) PARTS PER MILLION

250

500

750

INTERESTING

1000

ANOMALOUS

Contour Interval: 250 PPM

RUSTY SPRINGS, YUKON

LOCATION OF GRID

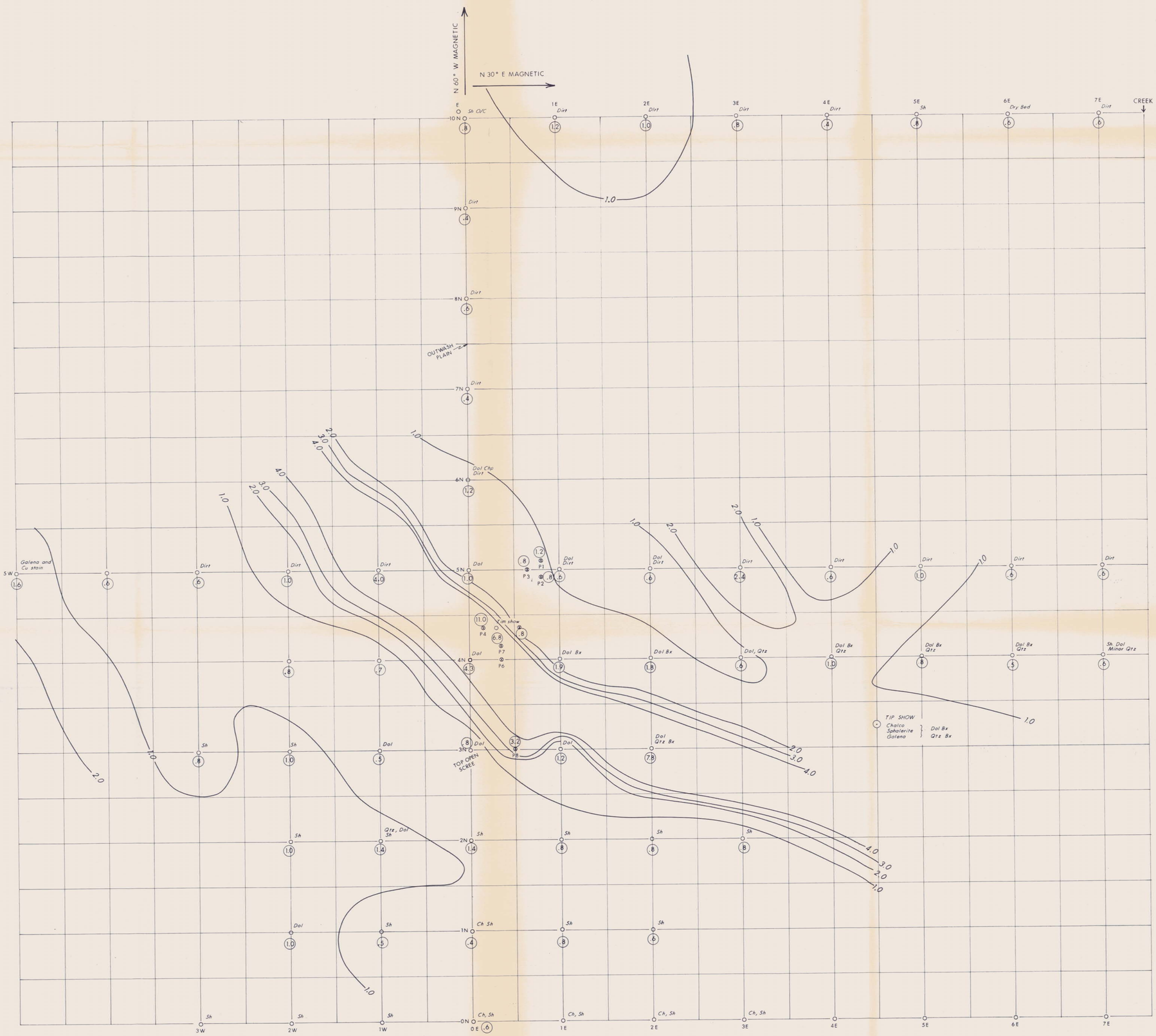
GEOCHEMICAL SURVEY

(CLAIM RIO 52)

Dol	Dolomite	○	Location of Geochem sample
Sh	Shale		
Bx	Breccia	⊗	Location of excavated pit
Qtz	Quartz	⊙	Location of show

Scale: 1" = 50 feet JULY 1976

MAP



LEGEND

SILVER

(.6) PARTS PER MILLION

1.0

2.0

3.0 INTERESTING

4.0 ANOMALOUS

Contour Interval: 1.0 PPM

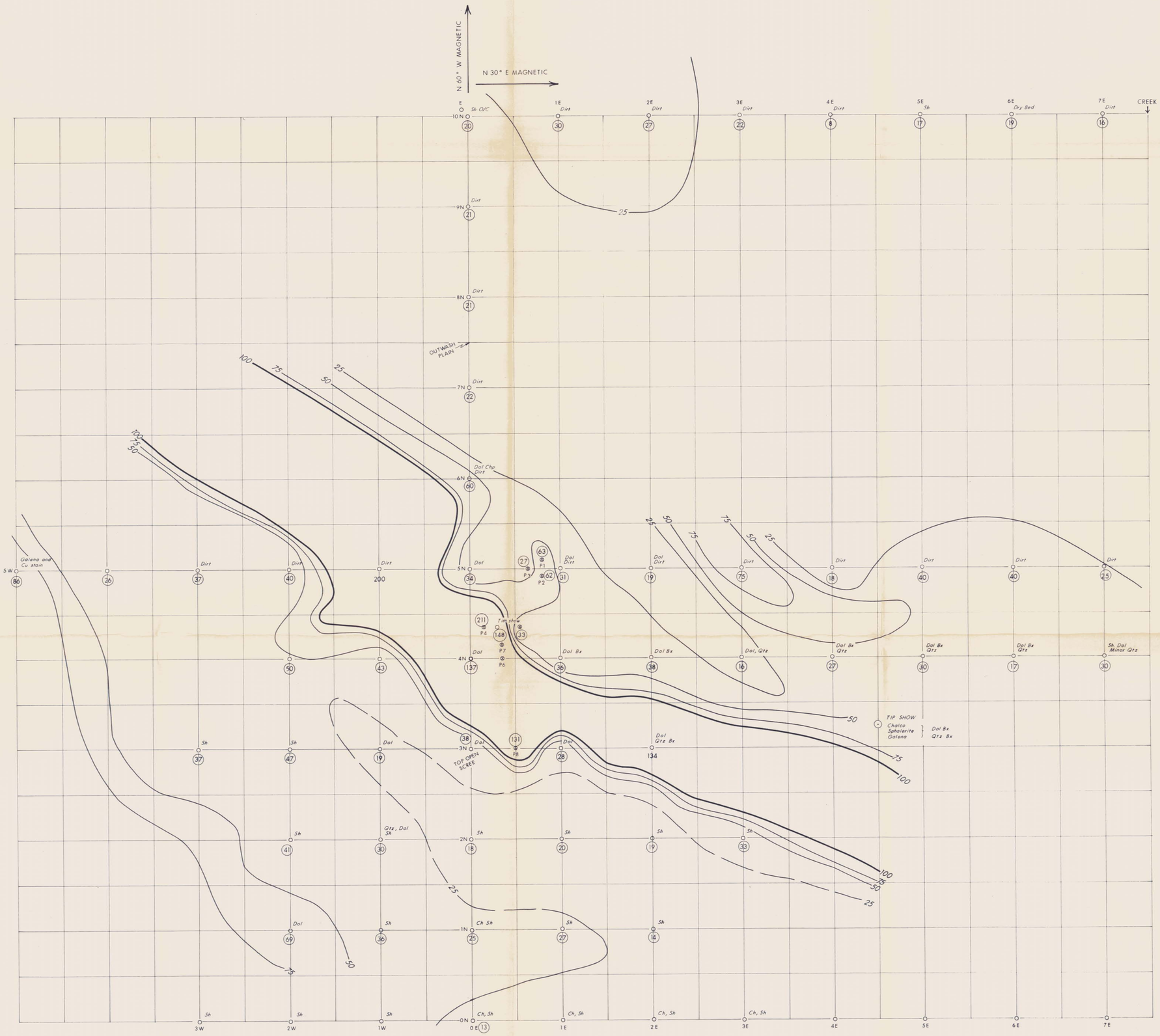
RUSTY SPRINGS, YUKON

LOCATION OF GRID
GEOCHEMICAL SURVEY
(CLAIM RIO 52)

Dol	Dolomite	○	Location of Geochem sample
Sh	Shale	⊗	Location of excavated pit
Bx	Breccia	⊙	Location of show
Qtz	Quartz		

Scale: 1" = 50 feet JULY 1976

MAP 5



LEGEND

COPPER, LEAD, ZINC, SILVER

V = PERCENT OF TARGET VALUE (TARGET VALUE = 100 %)

$$V = \frac{\left[\frac{Cu(PPM)}{100} + \frac{Pb(PPM)}{150} + \frac{Zn(PPM)}{1000} + \frac{Ag(PPM)}{4}\right]}{4} \times 100\,\%$$

25

50

75

INTERESTING

100

ANOMALOUS

Contour Interval: 25 %

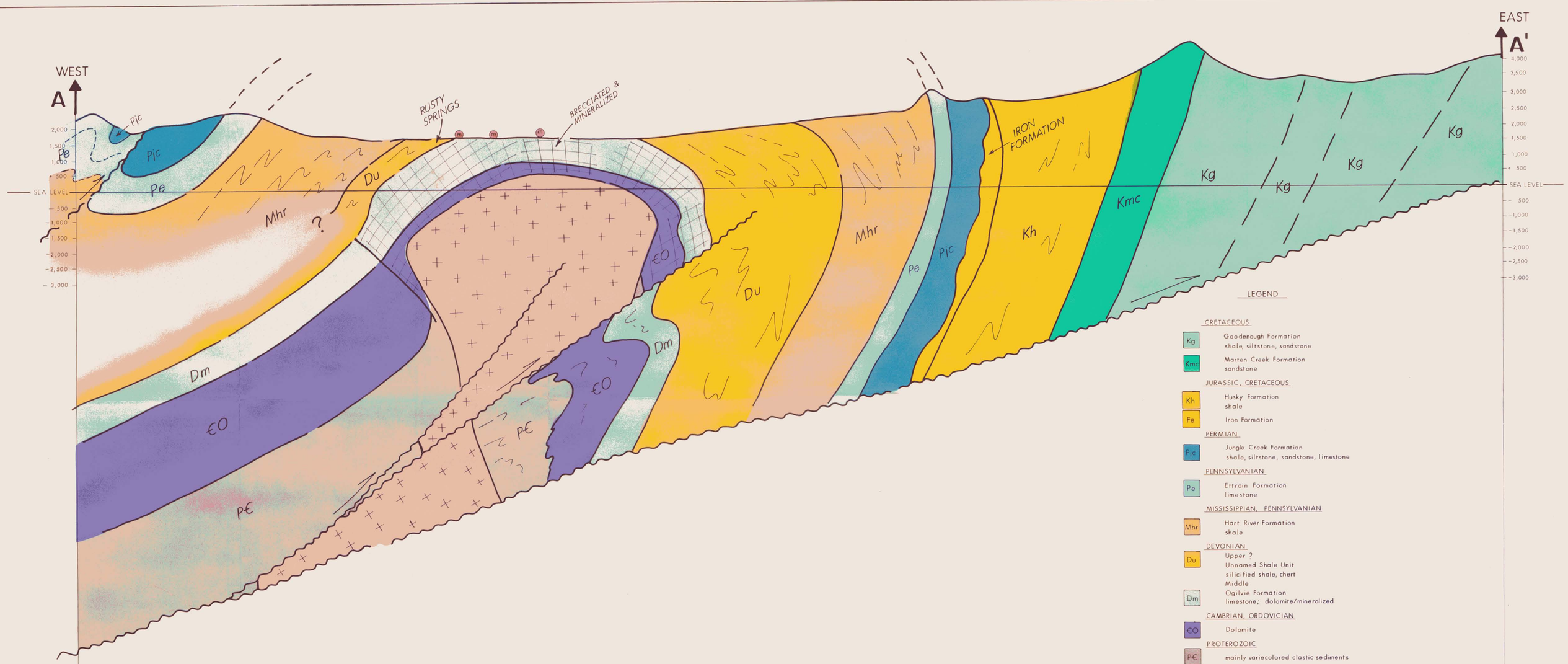
RUSTY SPRINGS, YUKON

LOCATION OF GRID
GEOCHEMICAL SURVEY
(CLAIM RIO 52)

Dol	Dolomite	○ Location of Geochem sample
Sh	Shale	
Bx	Breccia	⊗ Location of excavated pit
Qtz	Quartz	⊙ Location of show

Scale: 1" = 50 feet JULY 1976

MAP 6


WEST
A
EAST
A'
RUSTY SPRINGS
BRECCIATED & MINERALIZED
IRON FORMATION
SEA LEVEL
2,000
1,500
1,000
500
500
1,000
1,500
2,000
2,500
3,000
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
Pic
Pe
Du
Mhr
?
Dm
€O
p€
Kg
Kmc
Kh
LEGEND
CRETACEOUS
Kg Goodenough Formation
shale, siltstone, sandstone
Kmc Marten Creek Formation
sandstone
JURASSIC, CRETACEOUS
Kh Husky Formation
shale
Fe Iron Formation
PERMIAN
Pjc Jungle Creek Formation
shale, siltstone, sandstone, limestone
PENNSYLVANIAN
Pe Ettrain Formation
limestone
MISSISSIPPIAN, PENNSYLVANIAN
Mhr Hart River Formation
shale
DEVONIAN
Du Upper ?
Unnamed Shale Unit
silicified shale, chert
Middle
Dm Ogilvie Formation
limestone; dolomite/mineralized
CAMBRIAN, ORDOVICIAN
€O Dolomite
PROTEROZOIC
P€ mainly variecolored clastic sediments
ACIDIC INTRUSIVE (Postulated)
Probably Triassic or older
BRECCIA (Fact)
Dolomite, Quartz, Calcite. Mineralized
Mineralized localities
Thrust Fault
SCALE: Vertical & Horizontal: 1" = 1500 feet
M.N. CHERNOFF
August ,1976