

REPORT ON THE 1970 MINERAL EXPLORATION PROGRAM

PRINCESS AND DUCHESS CLAIM GROUPS

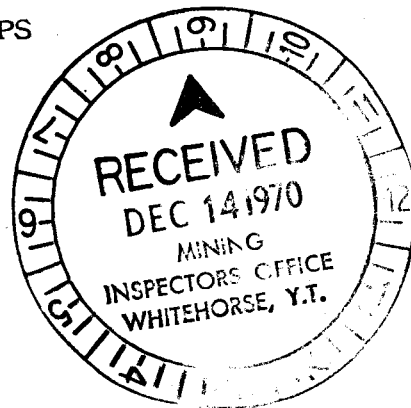
YUKON TERRITORY

FOR

BOREALIS EXPLORATION LIMITED

BY

NORMAN H. URSEL ASSOCIATES LIMITED



This report has been reviewed by the Geological Evaluation Unit and is recommended to the Commission to be considered as representative work under the act of 1963.

*J. R. Cray*  
Geological Evaluation Unit

Considered to be representative work under Section 53 of the Yukon Mining Act.

*Mr. Miller*  
Commissioner

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REPORT ON THE 1970 MINERAL EXPLORATION PROGRAM

PRINCESS AND DUCHESS CLAIMS GROUPS

YUKON TERRITORY

BOREALIS EXPLORATION LIMITED

SUMMARY

The Princess and Duchess Claim Groups, Yukon Territory were examined during the 1970 field season by Norman H. UrseI Associates Limited for Borealis Exploration Limited.

These claim groups are located on the crest of the Dawson Range which is underlain by a granitic batholith and numerous granitic plugs. Porphyry copper deposits may be found in this geologic environment and, in fact, the Casino Mines Limited deposit is located 18 miles east of the claim groups.

A geochemical soil survey and stream sediment survey were completed on the claim groups. The claims were also prospected and a geologic map of the property was prepared.

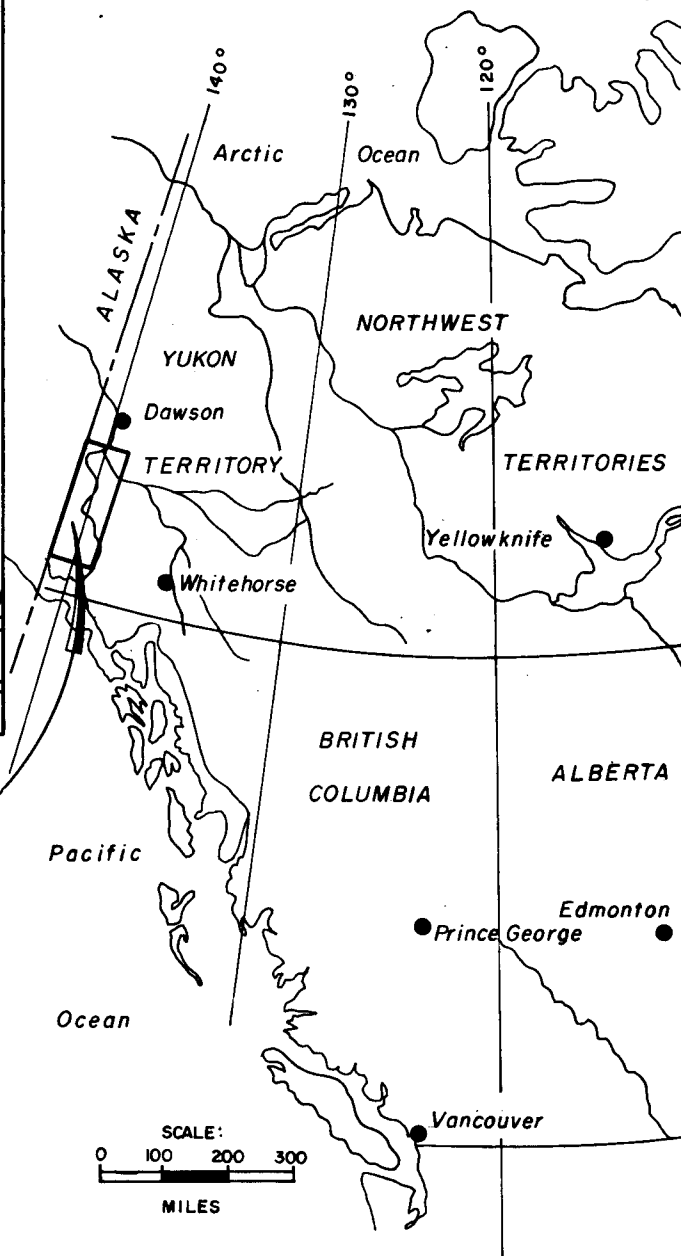
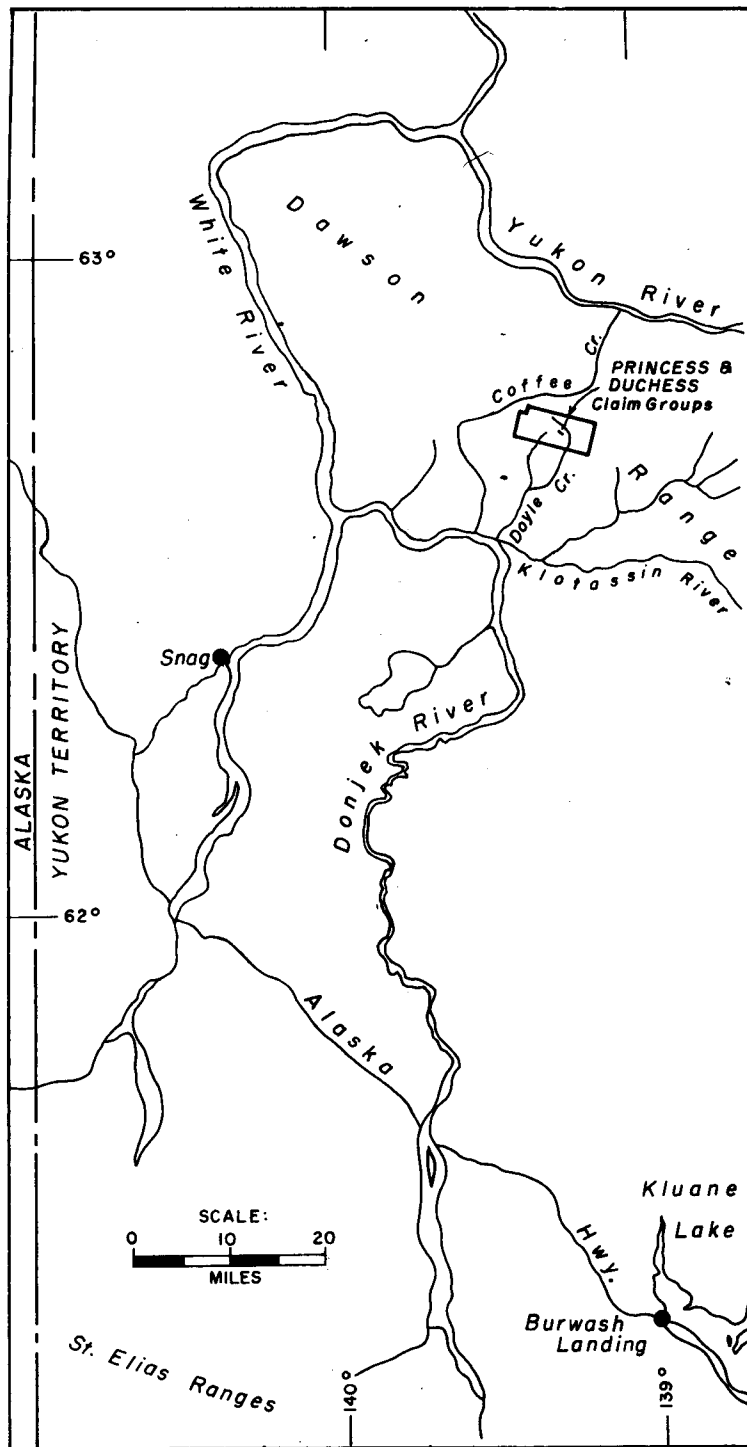
No anomalous samples were detected by the soil survey and stream sediment survey, and no evidence of porphyry copper mineralization, such as intense fracturing or alteration, was found during the geologic mapping. Prospecting revealed traces of sulphide mineralization; however, selected grab samples of mineralized rock assayed no more than 0.05% copper, 0.002% MoS<sub>2</sub>, 0.10 ounce per ton silver, trace gold and trace lead.

Thirty element semi-quantitative analyses of rock samples apparently leached of sulphide mineralization did not detect residual metals.

No further work is recommended on Princess and Duchess Claim Groups.

# LOCATION OF PRINCESS & DUCHESS Claim Groups

Fig. 1



## INTRODUCTION

The Princess Claim Group (310 claims) and the Duchess Claim Group (32 claims) cover approximately 28 square miles in the Dawson Range, Yukon Territory. These claims are plotted on Department of Northern Affairs and Natural Resources claim maps 115-J-11, Doyle Creek and 115-J-14, Coffee Creek. Borealis Exploration Limited held these claims under an option to purchase.

The geologic environment of the Dawson Range is favourable for exploration for porphyry copper deposits. The Casino Mines Limited porphyry copper deposit, 18 miles east of the Princess Claim Group, contains an estimated 1,164,000,000 tons averaging 0.30% copper and 0.04%  $\text{MoS}_2$  (Northern Miner, December 25, 1969). This deposit covers an area 6,000 feet by 3,500 feet. Archer and Main (1970) carried out an orientation geochemical survey on the Casino deposit and concluded that soil sampling for copper was an effective exploration method and that prospecting and geologic mapping would have limited usefulness due to the scarcity of outcrop.

The primary purpose of the 1970 field program was to search for a porphyry type copper deposit and to evaluate the overall mineral potential of the area. Soil samples were collected at an average spacing of 1,000 feet and analyzed for copper in the base-camp. During the course of the soil survey, it became apparent that "float" (boulders) in the soil was usually derived from the underlying bedrock, and prospecting and

geologic mapping of float were carried out along all soil sample traverse lines.

The possibility that other types of mineralization occur in the area was checked by a stream sediment survey. Samples were analyzed for Total Heavy Metal content (lead, zinc, copper.)

#### LOCATION AND ACCESS

The Princess and Duchess claim groups are located in the Yukon Territory, 200 miles N.W. of Whitehorse, at 139°20'W longitude, 62°45'N latitude. These claims are located on the crest of the Dawson Range Mountains which lie between the Alaska Highway and the Yukon River.

Whitehorse can be reached by daily scheduled airline flights from Edmonton, Prince George and Vancouver.

The Polaris airstrip, constructed and maintained by the Polaris Syndicate, is located at an elevation of 3,000 feet on the Princess claim group. The airstrip is approximately 3,000 feet long and 100 feet wide and is long enough to handle DC-3 aircraft.

Alternate access is provided by a tractor road from the Casino Mines property, which is 18 miles east of the Princess group. The Casino Mines property has a gravelled airstrip capable of handling DC-3 aircraft and is also accessible by a tractor road from the Yukon River.

#### 1970 FIELD PROGRAM

The field party consisted of a party chief/geologist, two geological assistants, two field assistants and a cook. The

party arrived in the field on June 5, 1970 and left on August 15, 1970.

Base camp was established at the Polaris airstrip. The property was mapped and sampled from this camp with transportation provided by a tracked vehicle, a J-5 Bombardier.

During the field season, the following programs were completed: claim tags were attached to all claim posts on the Princess and Duchess claim groups; a geologic map of the claim groups was completed and a small area south of the claim groups was mapped in a reconnaissance manner; prospecting was carried out throughout these areas; a geochemical soil survey of the claims was completed; stream sediments on the claim groups were sampled for geochemical analysis and, wherever possible, stream sediments were panned and the heavy-mineral residues were examined.

The geologic and geochemical surveys were tied into a base line by pace and compass traverses. The base line was chained and surveyed by Brunton compass. The tractor road, which extends across the property, was also surveyed by Brunton compass and chain. The pace and compass traverses were also tied into the tractor road.

For convenience, the grid coordinates given in this report are the U.T.M. coordinates shown on the base map, rather than the coordinates of the base line and traverse lines.

#### TOPOGRAPHY

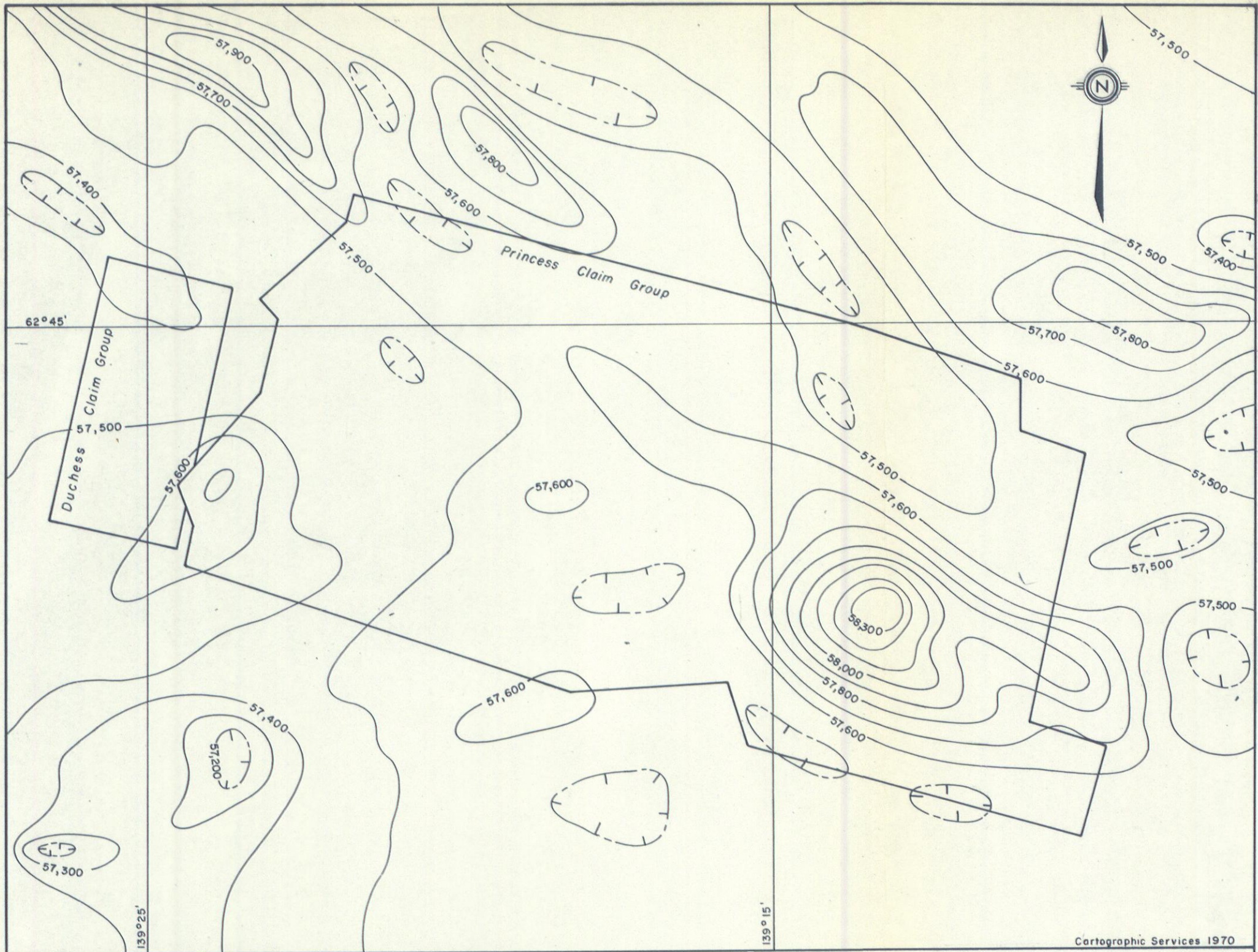
The Dawson Range is essentially a series of high ridges. In the past it was a plateau, but has since been elevated and is

now thoroughly dissected by stream valleys (Cairnes, 1916). Elevations range from 1,500 feet to 7,000 feet above sea level.

On the Princess and Duchess claim groups the maximum topographic relief is 2,500 feet. Steep slopes 1,000 to 1,500 feet high are common, but there are few cliffs. The tree line is irregular and varies between 2,800 and 4,000 feet in elevation. Between the tree line and about 4,500 feet elevation, the ground is covered by 'buck-brush' (a dwarf birch). Above 4,500 feet there are only low bushes and grass. Frost boils due to permafrost are only found above 4,500 feet.

The stream valleys have overlapping spurs and V-shaped profiles. Outcrops often have a peculiar castellated appearance. This evidence suggests that the country has not been glaciated. Geochemical soil surveys are more reliable in unglaciated terrain than in glaciated terrain.

At lower elevations the major stream valleys have wide, flat floors. This is due to a layer of frozen alluvial material. This material tends to accumulate in the major streams as it is washed into these valleys by the tributaries and is frozen before it can be washed away (Cairnes, 1916). Such an accumulation of alluvial material would tend to obscure geochemical anomalies from sources at the bottom of the valley. Fortunately, very little alluvial material occurs on the claim groups.

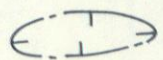


Cartographic Services 1970

L E G E N D

— 57,300 —

ISOMAGNETIC CONTOUR: ABSOLUTE TOTAL MAGNETIC FIELD IN GAMMAS.



MAGNETIC DEPRESSION

NOTE FIGURE 2 traced from Geological Survey of Canada  
Geophysics papers 43046, 43056

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AEROMAGNETIC MAP

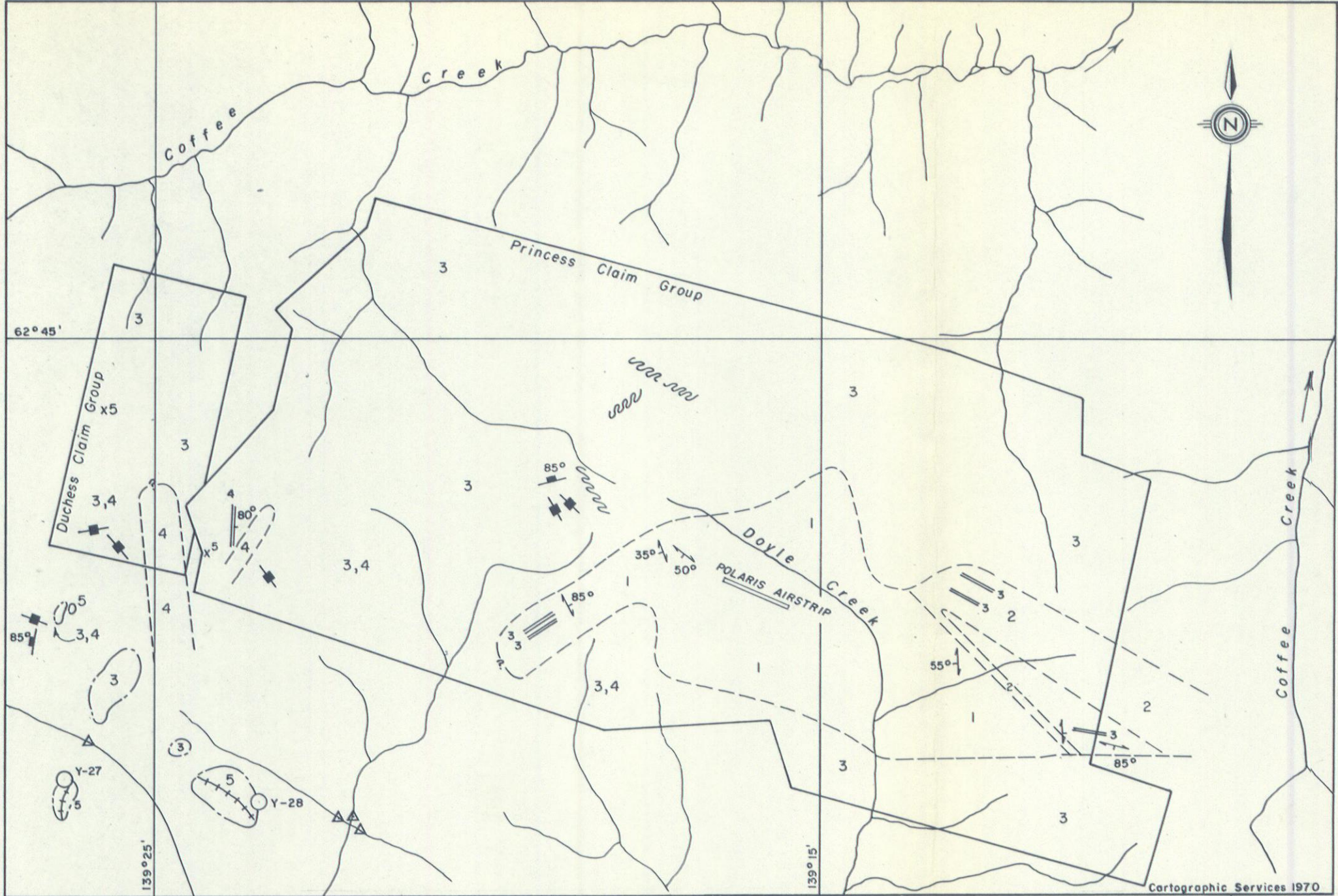
of

PRINCESS and DUCHESS

CLAIM GROUPS

YUKON TERRITORY





**SYMBOLS**

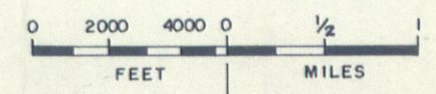
- Area containing outcrops or talus
- Joints: inclined, vertical
- Schistosity and gneissosity inclined, vertical.
- Dyke, inclined, vertical
- Fault
- Contact
- Grab sample from float, sample number
- Stream sediment sample
- Soil samples and traverse line
- Stream

**NOTE:** Sample locations within claim blocks are plotted on Figure 5

**LITHOLOGY**

- Volcanic rocks and quartz-feldspar porphyry
- Porphyritic diorite and porphyritic quartz diorite
- Granitic rocks: includes some (4)
- Metagabbro
- Metamorphic rocks

BOREALIS EXPLORATION LTD.  
 GEOLOGIC SKETCH MAP  
 of  
 PRINCESS and DUCHESS  
 CLAIM GROUPS  
 YUKON TERRITORY



## GEOLOGY

### Regional Geology

Information on the regional geology is mainly derived from the Geological Survey of Canada map 1048A, the Geological Map of the Yukon Territory, Cairnes (1916) and Archer and Main, (1970). The Princess and Duchess claim groups are located on a granitic batholith which is either part of the Coast Range batholith or possibly is a large similar feature parallel and north of the Coast Range batholith. Roof pendants of metamorphic rocks are contained within the feature and it is intruded by granitic stocks and gabbroic bodies. Unmetamorphosed volcanic rocks and dyke rocks are also found in this area.

Mineral deposits are found throughout the batholith. The Casino Silver Mines Limited porphyry copper molybdenum deposit, with supergene enriched zones is 18 miles east of the claim group.

### Geology of the Princess and Duchess Claim Groups

The geology of the claim groups is shown on the accompanying maps. The geology was mapped along all soil survey traverse lines, all outcrops visible on air photos were examined and prospecting was carried out throughout the claim groups. Because of the scarcity of outcrop, the geologic mapping was based mainly on the examination of float material. Float mapping is fairly reliable in terrain that has not been glaciated; however, the exact location of contacts is uncertain due to the downhill movement of the surface

material.

The oldest rocks in the area are metamorphic schists and gneisses contained in a roof pendant in the batholith. These rocks are intruded by quartz veins and aplite dykes, and contain most of the traces of sulphide mineralization found in the area.

The metamorphic rocks are intruded by gabbro. In a few places, the gabbro contains disseminated pyrite, pyrrhotite and traces of chalcopyrite. The field test for nickel sulphides in bedrock (dimethylglyoxine test) was used, but no nickel mineralization was detected.

The above rocks are intruded by fine grained granite and aplite. It is assumed that the fine grained granite and aplite is a contact phase of the coarse grained granitic rocks of the batholith.

Most of the claims are underlain by the rocks of the batholith, mainly coarse grained quartz monzonite or possibly coarse grained granite. A porphyritic diorite and porphyritic quartz diorite are also found in the batholith.

Unmetamorphosed volcanic rocks and quartz feldspar porphyry were found only in float and talus. Because they are not metamorphosed, these are apparently the youngest rocks in the area. The quartz feldspar porphyry, in a few areas, contained small patches of limonite. However, soil samples adjacent to the limonite bearing rocks were not anomalous.

## Field Description of Rock Units

The relative ages of the rock units are shown in the Table of Formations. Locations of grab samples from outcrops and float are shown on the geologic map. Rock types are described below.

TABLE 1

Table of Rock Formations

<u>Geological Unit</u>	<u>Lithology</u>
4	Volcanic Rocks (andesite, dacite, tuff) and Quartz Feldspar Porphyry
3	Granitic Rocks (coarse-grained granite, fine-grained granite, aplite, porphyritic diorite and porphyritic quartz diorite).
2	Metagabbro (may include mafic metavolcanics).
1	Metamorphic Rocks (biotite schist, chlorite schist, granite gneiss and quartzite).

### Metamorphic Rocks

The metamorphic rocks occur as roof pendants and are intruded by the fine grained phases of the batholith. The metamorphic rocks are not differentiated on the map. They include biotite schist, chlorite schist, granitic gneiss and quartzite.

The metamorphic rocks do not form large outcrops; outcrops are small and usually elongated in the direction of the fabric of the metamorphic rock. The rocks are not magnetic in hand specimens nor do they show a distinct expression on the aeromagnetic map.

The gneisses and schists in many localities contain numerous narrow quartz veins and lenses which were sampled. Selected grab samples assayed no more than the following values: 0.05% copper, 0.002% MoS<sub>2</sub>, 0.01 ounce per ton silver, and traces of gold and lead.

The quartzite contained fewer quartz veins; however, these were wider and more continuous. The quartzites were often rusty-weathering and locally were estimated to contain up to 1% disseminated pyrite. Grab samples from the rusty zones gave similar values to those above.

#### Metagabbro

The metagabbro is a very fine grained to coarse grained rock made up of feldspar and chloritized amphibole. Coarse grained phases are often gneissic. Some of the rocks included under this heading may very well be mafic metavolcanics although no volcanic structures were recognised in the field.

Small bodies of the metagabbro intrude the meta-sediments and, in turn, the metagabbro appears to be intruded in places by aplite dykes, however, this relationship was seen only in float.

This rock type usually forms outcrops near the tops of hills, with distinctive blocky talus slopes. The metagabbro is magnetic in the hand specimen and it is thought to be the cause of the large aeromagnetic anomaly on the eastern half of the Princess claim group.

A few outcrops of this rock type contain traces of disseminated pyrrhotite and very rarely traces of disseminated chalcopyrite. The outcrops were sampled and assayed only traces of copper and nickel. The dimethylglyoxine test for nickel sulphide in bedrock was used frequently but was always negative.

Boulders of carbonate-rich altered metagabbro, brecciated metagabbro with epidote and calcite, porphyritic diorite, biotite schist and chloritic schist, containing up to about 1% disseminated pyrrhotite and traces of chalcopyrite, were found in a tributary of Doyle Creek (approximate coordinates 300,000E, 22,835,000N). A number of these boulders were sampled and were found to contain no nickel and no more than 0.05% copper. Thirty element semi-quantative spectrographic analyses did not indicate any economic mineralization associated with these boulders.

#### Granitic Rocks

Most of the Princess and Duchess claim groups are underlain by granitic rocks.

The most common rock type is coarse grained granite or perhaps quartz monzonite or granodiorite. The coarse grained "granite" is largely made up of feldspar and quartz, with 5 to 10% biotite and/or amphibole and is occasionally intruded by aplite dykes.

The granite forms distinctive castellated outcrops, the shape of which are controlled by widely spaced joints. This rock is not magnetic in the hand specimen nor does it form a distinctive

expression on the aeromagnetic maps. Traces of pyrite are found in a few areas.

Fine grained granite and aplite are also found on these claim groups. These rocks usually are found only in float but they are also found as narrow dykes intruding the metamorphic rocks, the metagabbro and coarse grained granite. It is assumed that these are a contact phase of the granitic rocks.

The fine grained granite is made up of quartz feldspar and 5% to 10% biotite. It is stained throughout by limonite and occasionally contains traces of residual pyrite.

The aplite is a fine grained pink rock made up of quartz, feldspar and traces of biotite or chlorite.

It is possible that the fine grained granite is a quartz-sericite-pyrite alteration of the coarse grained granite; however, samples of fine grained granite and aplite did not contain copper and soil samples in the vicinity of these rocks were not found to be anomalous.

Porphyritic diorite and porphyritic quartz diorite are found along with the granitic rocks, usually as boulders associated with boulders of granitic rock. In the few outcrops seen, the porphyritic diorite occurs as dykes in coarse grained granite. Close examination did not rule out the possibility that these bodies of porphyritic diorite were dyke-shaped inclusions in the granite. In other areas of float there were rocks transitional in appearance between coarse grained granite and porphyritic diorite or porphyritic

quartz diorite. The age relationship between the porphyrytic diorite and quartz diorite and the coarse grained granite is ambiguous; however, the dioritic rocks were always found with the coarse grained granite and it is assumed that they are a phase of the granitic batholith.

In the southwestern corner of the Princess claim group and on the southern border of the Duchess claim group, the porphyrytic diorite and quartz diorite are found as outcrops which form distinctive hills covered with blocky talus.

In the hand specimen the porphyrytic diorite and quartz diorite are slightly magnetic. A low intensity aeromagnetic anomaly in the same area as the outcrop is probably caused by these rocks.

Often these rocks, in outcrop, have a rusty appearance which is due to magnetite. In general, there are no sulphides associated with them; however, one boulder of porphyrytic diorite, found in Doyle Creek, contained traces of chalcopyrite (assay 0.05% copper). The source of this boulder is probably the tributary of Doyle Creek described under the section on metagabbro.

#### Volcanic Rocks and Quartz Feldspar Porphyry

These rock types were found only in frost heaved talus on the southwestern corner of the Princess claim group, on the western edge of the Duchess claim group and 1.5 to 2 miles south of Duchess claim group. The occurrences on the claim groups are confined to two small areas.

The occurrence south of Duchess claim group was found on several large hills which were carefully examined. Because of the circular shape of the hills and the circular nature of an associated negative aeromagnetic anomaly, this occurrence appears to be an intrusive plug.

There are a wide variety of volcanic rocks within the area; however, in the hand specimen the most predominant types appear to be andesite or dacite. A few specimens are finely laminated and are probably tuff. Approximately 10% of the talus is quartz-feldspar porphyry. This is a fine grained quartz-feldspar rock with very few mafic minerals, and quartz and feldspar phenocrysts. In the occurrences in the southwestern corner of Princess claim group and south of Duchess claim group, the quartz-feldspar porphyry contains small patches of limonite. It is possible that these represent leached sulphides, however, copper assays were never higher than 0.05%. A number of samples were taken for thirty element semiquantitative spectrographic analysis, however, there was no indication of residual metals such as molybdenum. Although detailed geochemical soil sampling was carried out in the vicinity of these occurrences, no values higher than 15 parts per million copper were obtained.

The volcanic rocks and quartz-feldspar porphyry are not metamorphosed and it is assumed that they are the youngest rocks in the area. These rocks have a very limited occurrence on the claim groups; however, coarse grained granite float in some areas had purple films on the joint bases, the colour of which is very

similar to the colour of some of the volcanic rocks. This indicates that the volcanic rocks may have been eroded from large areas.

### Structural Geology

Because of the scarcity of rock outcrop, very little structural information was recorded.

From the limited exposure available, the structure of the metamorphic rock appears complex. In general, cleavage is roughly parallel to the axis of the roof pendant. The metagabbro and coarse grained granite are well jointed and these joint systems are reflected in the alignment of the streams.

Several small faults, striking at 120°, were mapped in the granitic outcrop near 285,000E, 22,835,000N. These faults are adjacent and parallel to a topographic lineament, in part represented by the upper valley of Doyle Creek. Aeromagnetic anomalies are also aligned along this trend. This probably represents a fault zone with associated intrusive gabbros.

### Economic Geology

Traces of mineralization found on the property are described under the field description of rock units above.

Because of the proximity of the claim groups to Casino Mines Limited porphyry copper deposit, the occurrence of intrusive granitic rock, favourable mineralogical indications and the possibility of supergene enrichment, this area was considered favourable for exploration for porphyry copper deposits.

Such deposits are usually characterized by intense fracturing and alteration of the host rock; however, fractured and altered rock was very rare on the claim groups. A few boulders of fractured granite with epidote and carbonate concentrations were found near 300,200E, 22,820,150N, but no economic mineralization was associated with these rocks. This fractured granite is on the projection of a fault zone and is probably related to the fault.

No porphyry copper mineralization was found.

## GEOCHEMISTRY

### Introduction

The Princess and Duchess claim groups were covered by a geochemical soil survey and a stream sediment survey. The soil survey was carried out along traverse lines that were tied into a base line and a tractor road. In general, the spacing between sample lines and sample sites was 1,000 feet; however, spacing varied to suit the economic potential of the geologic environment. The portion of the roof pendant of metamorphic rocks which contained traces of sulphide mineralization in quartz veins was sampled at 500-foot line and sample spacing. On the northern half of the property the steep sides of large stream valleys, below the 3,000-foot contours, were not soil sampled; however, stream sediments in these valleys were sampled. This was considered to be an adequate reconnaissance method, since active solifluction on the valley slopes carries the soils into the streams.

Soil samples were taken immediately adjacent to outcrops or to talus that contained limonite or leached sulphides. These samples were analysed immediately to expedite follow-up on potentially anomalous areas. These samples are not included on the soil sample map.

The sediments in all streams in the area were sampled. Wherever possible, the streams were sampled immediately below tributaries and the sediments panned to obtain the heavy mineral residue, which was examined under a hand lense and under an ultra-violet light.

All soil samples were tested in the field for cold extractible copper (cx:Cu) and total heavy metals (THM). The field analyses were checked by sending samples to the Whitehorse Assay Office.

The purpose of the soil survey was largely to explore for porphyry copper deposits, while the stream sediments survey served as a reconnaissance check for other types of mineralization in the area. No anomalous values were found in either survey.

### Soils

The Princess and Duchess claim groups are located in a portion of the Yukon Territory that has not been glaciated. The topography is characteristic, having V-shaped valleys, overlapping spurs, and castellated outcrops. No evidence of local mountain glaciation, such as cirques, valley moraines, etc., was found nor was there any glacial overburden on the property. All the

soils are residual.

These residual soils are in places recognized by the distinctive flour-like texture of the alteration product-clay, while in the vicinity of the coarse grained granite, the soil is composed of coarse grains of quartz and feldspar and flakes of biotite.

The soils have readily recognizable horizons. The thickness of the horizons and of the total soil profile varies greatly throughout the property. Soils are thickest at the bottom of slopes due to downslope movement caused by permafrost, thinnest on the upper parts of slopes and of intermediate depth on the crest of ridges.

The soil horizons are described below:

A-0 Horizon - This horizon is composed of organic material and black humus.

A-1 Horizon - This is a light brown soil containing roots, organic debris and some clay.

B Horizon - The B horizon is a distinctive darker brown colour and may be composed of sand, silt, clay or a mixture of these. There are often rusty lenses and streaks. The contact between the A and B horizons is sharp.

C Horizon - The C horizon is composed of rock fragments usually mixed with sand, silt or clay. The C horizon is transitional between the B horizon above and the bedrock below.

Discontinuous permafrost is found throughout the claim groups and is common on all north-facing slopes and under most muskegs. Except at the highest elevations, above 4,500 feet, the permafrost does not cause frost boils, polygonal patterns, etc; however, this feature does increase the rate of downslope movement due to solifluction on the sides of valleys and other steep slopes. The permafrost does not cause mixing and homogenization of the soil horizons except possibly at the highest elevations.

#### Soil Sampling Procedure

In unfrozen ground, soil samples were obtained with an auger. In permafrost, it was necessary to dig a hole with a pick. The samples were all taken from the B horizon, which was recommended for sampling by Archer and Main (1970), in their study of the geochemistry of the Casino Mines Limited porphyry copper deposits. The samples were placed in polyethylene bags, and these bags were placed in brown paper envelopes and labeled. The polyethylene bags retained the moisture so that the original condition of the sample was maintained.

#### Analytical Procedure

All soil samples were analyzed for cold extractible copper in the base camp. The samples were analyzed with a 'trail kit' purchased from Scintrex Limited. Approximately thirty soil samples were sent to the Whitehorse Assay Office for check analyses and these analyses compared well with the field analyses. (See Appendix 1)

A standard size pellet was removed from the sample and placed in a graduated test-tube. Five millilitres of copper buffer solution and one millilitre of Geosol-dithizone-chloroform solution were added to the test tube. The test tube was shaken vigorously for thirty seconds, and was then allowed to sit until the solvent phase separated from the aqueous phase. The colour of the solvent was noted and compared to standard colours obtained by the use of a copper test solution. The sensitivity of the method is five parts per million copper. The results can be reported in the following ranges: less than 15 ppm; 15 to 20 ppm; 20 to 40 ppm; 40 to 60 ppm; 60 to 120 ppm; greater than 120 ppm copper.

#### Interpretation of Results

No anomalous soil samples were found. Almost all of the samples contained less than 15 ppm copper with a few samples from an area near 295,000E and 22,825,500N containing 20 ppm copper. The slight increase in the copper content of the soils in this area is probably due to trace copper mineralization in quartz veins in the metamorphic rocks of the area.

#### Stream Sediment Survey

Streams on the claim group were sampled, preferably below tributaries, and the sample sites were marked with flagging tape. Wherever possible, silt size sediments were taken for the sample; however, the general high elevation of the area, the small size of the streams and the swiftness of the streams made silt and finer material difficult to obtain, and many samples are coarser than

silt. The samples were placed in polyethylene bags, then in brown paper envelopes which were labelled. The samples were analyzed in the base camp for cold extractible total heavy metals. The analytical method is the same as described above for copper with the substitution of total heavy metal buffer and zinc test solution for copper buffer and copper test solution.

No samples were found to be anomalous. (See Appendix 1)

### Panning

Stream sediments in the larger streams in the area were panned and the heavy mineral residues were examined. Magnetite and epidote were found in the heavy mineral residues from Doyle Creek. These were probably derived from the gabbro found to the east of Doyle Creek.

No economic minerals or indicator minerals were noted.

### CONCLUSIONS

The Princess and Duchess claim groups are located in an area favourable for exploration for porphyry copper deposits. The soil survey conducted was of the type that detected anomalous copper values at the nearby Casino porphyry copper deposits; however, no anomalous values were discovered on the above claim groups.

The claim groups were prospected and geologic mapping did not reveal features characteristic of porphyry copper deposits.

Traces of sulphide mineralization found on the property were sampled and were found to contain no more than 0.05% copper; 0.002% MoS<sub>2</sub>; 0.10 ounce per ton silver and traces of gold and lead.

Thirty element semiquantative spectrographic analyses of limonite-rich areas and leached sulphides did not detect residual metals.

A reconnaissance stream sediment survey did not detect anomalous values of copper, lead or zinc.

The results of the 1970 field season indicate that the possibility of locating a large porphyry copper deposit on Princess or Duchess claim groups is remote, and that there is very little likelihood that economic mineralization of any type occurs in the area examined.

The possibility of small vein-type deposits cannot be completely excluded; however, due to the lack of outcrop, any such deposit would be very hard to find and detailed exploration is not warranted.

#### RECOMMENDATIONS

No further work is recommended on the Princess and Duchess claim groups.

All of which is respectfully submitted.

A handwritten signature in cursive script, appearing to read "F.C. Charlton".

October 28, 1970.

F.C. Charlton, M.Sc.

## SOURCES OF INFORMATION

### References

Bostock, H.S.

1966: Notes on Glaciation in Central Yukon Territory.  
Geological Survey of Canada Paper 65-36.  
Department of Energy, Mines and Resources, 18  
pages, 1 figure.

Cairnes, D.D.

1917: Investigations and Mapping in Yukon Territory.  
Geological Survey of Canada Summary Report for  
1916, pages 12 to 14 in Bostock H.S. (1957).  
Yukon Territory. Geological Survey of Canada  
Memoir 284.

Archer, A.R. and Main C.A.

1970: Casino, Yukon - A Geochemical Discovery of an  
Unglaciaded Arizona - Type Porphyry.

### Claim Maps

Department of Northern Affairs and Natural Resources.  
Sheet 115-J-11, Doyle Creek, Yukon Territory  
(1 inch to  $\frac{1}{2}$  mile)  
Sheet 115-J-14, Coffee Creek, Yukon Territory  
(1 inch to  $\frac{1}{2}$  mile)

### Topographic Maps

Department of Energy, Mines and Resources  
Map 115J and 115K ( $B\frac{1}{2}$ ); Snag, Yukon Territory  
(1:250,000)

### Aeromagnetic Maps

Department of Energy, Mines and Resources  
Map 4304G, Doyle Creek, Yukon Territory  
(1 inch to 1 mile)  
Map 4305G, Coffee Creek, Yukon Territory  
(1 inch to 1 mile)

Geologic Map

Department of Energy, Mines and Resources  
Map 1048A, Geological Map of Yukon Territory  
(1 inch to 20 miles)

Aerial Photographs

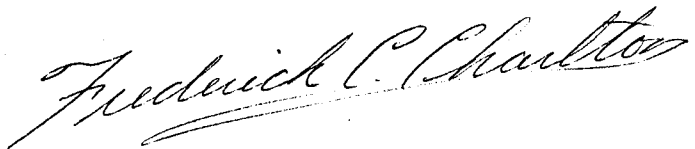
National Air Photo Library, Department of Energy,  
Mines and Resources.

Photographs numbers: A12267-18 to A12267-23, inclusive  
A12264-412 to A12264-415, inclusive  
A12789-320 to A12789-324, inclusive  
A12264-220 to A12264-225, inclusive

Certificate

I, Frederick C. Charlton, 629 Camelot Drive, Sudbury, Ontario  
hereby certify that:

1. I am a graduate geologist, having received the B.Sc. (University of Toronto, 1962) and M.Sc.(Applied) (McGill University, 1965).
2. From 1966 to 1968 I was employed by Nass River Mines Limited, mapping mineral deposits and supervising geophysical surveys and diamond drilling programs. During the summer of 1968 I was employed by Spectroair Explorations Limited, mapping mineral deposits. Since 1968 I have been employed by Cambrian College of Applied Arts and Technology teaching field geology and rock and mineral identification.
3. During June, July and August of 1970, I was employed by Norman H. Ursel Associates Limited as party chief in charge of mineral exploration on the Princess and Duchess claim groups, Yukon Territory.
4. I do not have any direct or indirect beneficial interest in the property described herein, nor in the shares of Borealis Exploration Limited.
5. This report is based on information gathered by myself and other members of the field party during 1970, except where noted.



Frederick C. Charlton, M.Sc. (Applied)

Dated at Sudbury, Ontario this 28th day of October, 1970.

SAMPLE ASSAY RESULTS

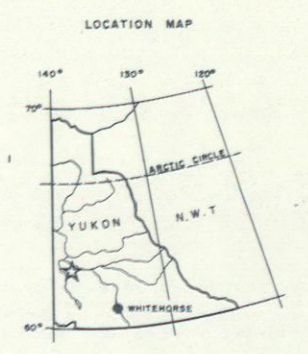
Sample Number	Au oz/ton	Ag oz/ton	Cu %	Pb %	Ni %	MoS <sub>2</sub> %
Y - 1	TR	TR				
Y - 2					TR	
Y - 3				TR		TR
Y - 4	TR	.10				
Y - 5	TR	.10				
Y - 6			.02			
Y - 7			.02			TR
Y - 8	TR	.08				
Y - 9						.002
Y - 10			.04			TR
Y - 11			.05			
Y - 12			.04			
Y - 14	TR	.10	.02			
Y - 15 *						
Y - 16	TR	.10				
Y - 17			.05			
Y - 18 *			.04			
Y - 19			.05			
Y - 20			.05			
Y - 21			.03			
Y - 22			.03			
Y - 23 *			.05			
Y - 24		.02	.04			
Y - 25		.04	.04			
Y - 26		.04	.04			
Y - 27 *						
Y - 28 *						

\* These 5 samples underwent 30 element semi-quantative spectrographic analyses. No significant metal values were detected.

Appendix 2

PERSONNEL EMPLOYED ON FIELD PROGRAM

- F. Charlton; 629 Camelot Drive, Sudbury, Ontario.
- J. Barker; Geology Department, McMaster University,  
Hamilton, Ontario.
- B. Wright; 2 Webster's Falls Road, Dundas, Ontario.
- H. Helbig; Kettleby, Ontario.
- H. Buckley; C/o. Mr. Jordan, 103 East 37th Street,  
New York, N.Y. 10016, U.S.A.
- T. Jones; Dawson City, Yukon Territory.
- P. Lepage; General Delivery, Whitehorse, Yukon Territory.
- D. Hennison, General Delivery, Whitehorse, Yukon  
Territory.



LEGEND

- Soil sample site
- Soil sample less than 10 p.p.m. copper
- Soil sample, 20 p.p.m. copper
- ▲ Stream sediment sample site
- ▲ Stream sediment sample less than 50 p.p.m. total heavy metals

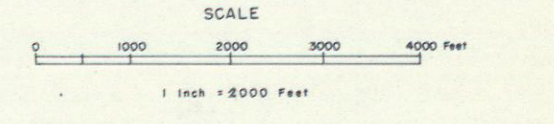
SYMBOLS

- Area covered by outcrops and talus (location approx.)
- Traverse lines
- Tractor road
- Contour lines; contour interval 50 feet
- Spot elevation
- Stream

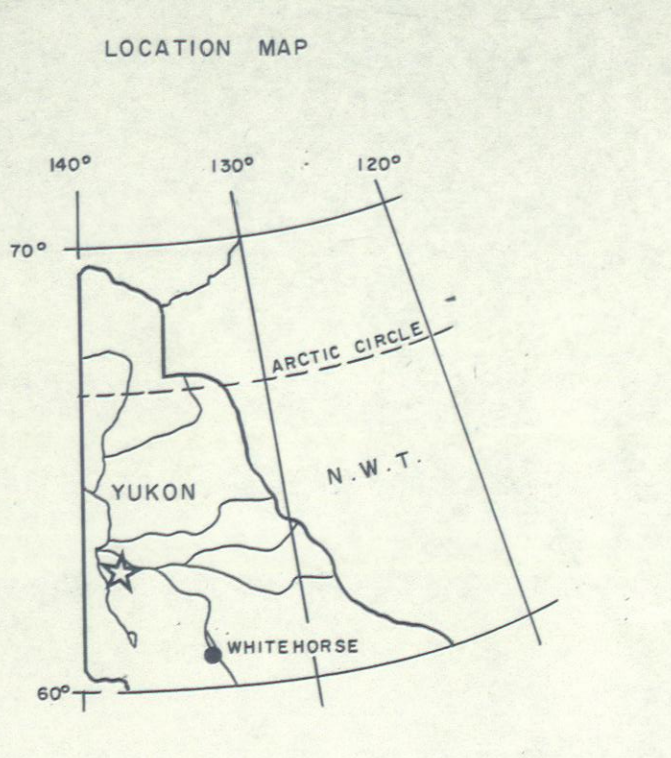
Note: Topographic map compiled by NORTHWEST SURVEY CORP. LTD.

BOREALIS EXPLORATION LIMITED  
**GEOCHEMICAL MAP**  
 PRINCESS AND DUCHESS CLAIM GROUPS  
 YUKON TERRITORY

Copper in soils and Total Heavy Metals in stream sediments



Compiled by  
 F. Charlton / J. Barker / R. Wright  
 NORMAN H. URSEL ASSOCIATES LTD.



**LEGEND**

**LITHOLOGY**

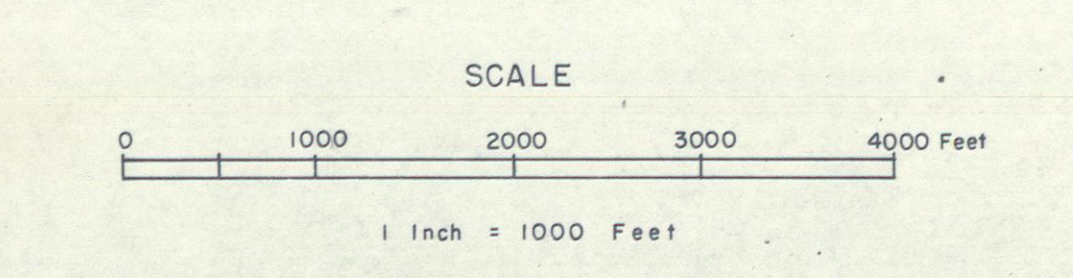
- 5 Volcanic rocks and quartz-feldspar porphyry
- 4 Porphyritic diorite and porphyritic quartz diorite
- 3 Granitic rocks: includes some (4)
- 2 Metagabbro
- 1 Metamorphic rocks

**SYMBOLS**

- Outcrop, small outcrop
- Area with many small outcrops
- Area with abundant float or talus
- ↕ Joint: inclined, vertical
- ↕ Schistosity and gneissosity: inclined, vertical
- ↕ Dyke: inclined, vertical
- Fault: observed, assumed
- Contact: observed
- Contact: approximate
- Contact: assumed
- Grab sample from outcrop, sample number
- Grab sample from float, sample number (see also V-27 and V-28 shown only on Fig. 3)
- Tractor road
- Contour lines: contour interval 50 feet
- 2195 Spot elevations
- Stream
- Claim post
- Location line with direction of travel
- Claim boundaries and claim number

Note: Topographic map compiled by NORTHWEST SURVEY CORP. LTD.

**BOREALIS EXPLORATION LIMITED**  
**GEOLOGIC MAP**  
 OF  
**PRINCESS AND DUCHESS CLAIM GROUPS**  
 ALSO SHOWING LOCATION OF CLAIM  
 POSTS AND BOUNDARIES  
 YUKON TERRITORY



Compiled by  
 F. Charlton / J. Barker / R. Wright  
 For  
**NORMAN H. URSEL ASSOCIATES LTD.**

