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EMPRESS PROJECT

YUKON TERRITORY

February 1967

Alan R. Archer Consultant Vancouver, B.C.

INDEX

FIGURES IN TEXT

<u>APPENDIX</u>

<u>MAPS IN POCKET</u>

INTRODUCTION

The primary objective of the Empress Project was to locate mineralized areas of interest, within a large project area, on the basis of regional silt geochemistry and geological reconnaissance. The secondary objective of the project was to accumulate geochemical and geological data plus first hand information on known showings to allow detailed evaluation of a government airborne magnetic survey that was expected to be released to the public at the end of the summer season.

The project area is approximately 3,600 square miles in size and lies between latitudes 61° 00′ N and 62° 00′ N and longitudes 136 00′ W and 138° 00′ W. This area was selected for the following reasons:

1. Several copper deposits were known to exist at widely spaced locations and the available geological data suggested that a repetition of the Whitehorse copper belt was possible.
2. The area is unmapped by the Geological Survey of Canada and it was assumed that possession of geological data would enable the project group to be in the best position to evaluate the expected government airborne magnetometer release.
3. The area is relatively unglaciated with over-

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burden conditions and terrain ideally suited for a geochemical reconnaissance type exploration program.

4. Major transportation routes parallel the area to the south and east.

5. The area encompasses the eastern contact of the coast range batholith, a geological setting that has proven favorable for mineralization in both British Columbia and Yukon.

Details of the interpretation of the government aeromag surveys, released in late October, 1966, and the subsequent staking program are not discussed in this report. The reader is referred to reports of November 8th. and November 3rd., 1966, by R.E. Chaplin for information on this aspect of the project.

FIELD PROGRAM

General

The project was jointly supervised by Archer, Cathro and Associates Ltd. and Professional Geologic Services Ltd. Archer, Cathro and Assoc. supervised most of the preseason requirements which included detailed planning of areas to be covered, sampling techniques, photo interpretations,

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preparation of field base-maps, distribution of fuel, aircraft charters and camp equipment purchases. Professional Geologic Services Ltd. provided accounting control and R.E. Chaplin did most of the reconnaisance geological mapping.

Geochemical analysis was contracted to Atlas Explorations Ltd. Ross River labatory. A Bell G2 helicopter was contracted under a two month charter from Klondike Helicopters Ltd.

Preparation

Air photos were obtained for the entire project area and rough interpretation was made in late May. All structural lineaments and outcrop areas were plotted on the photos and a filing system set up for rapid access to individual photos.

Topographic maps on a scale of 1 to 50,000 were available for most of the project area. Blowups to the same scale were prepared from 1" equals 4 mile topographic maps for the remainder of the area. A large wall map of the project area was constructed by joining the 1 to 50,000 maps together. All available data was plotted on the wall map. Such data included known geology, location of mineral claims in good standing and mineral claims that had expired, surface lineaments and mineral showings. All significant lakes were named to provide reference points. Recommended travers-

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es were pre-plotted on the base map in such a way that a maximum number of silt samples could be obtained with minimum of walking and flying. Location of base-camps and fuel caches were predetermined according to the density of traverses required in any particular section in order to minimize Helicopter support time. second copy was made of the base map and the individual segments separated to provide work sheets for the field crew.

Geochemical data sheets were designed and printed to specifically provide for the type of samples being taken (see Appendix A.) A list of field equipment was prepared and sent to Professional Geologic Services for purchase. Arrangements were made in Whitehorse for communications and expediting, helicopter charter, geochemical analysis and office space.

Avgas was purchased and distributed by truck and fixed-wing aircraft to the predetermined locations.

Crew Orientation

It was realized at the start of the program that most of the crew would not be familiar with the area or their duties. In fact, most of the crew had no bush experience whatsoever.

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During the period June 1 - 11 the crew and equipment were assembled at a camp ground near Whitehorse and demonstrations were given of geochemical sampling techniques. Informal lectures were given to familiarize the students with the nature of the project, to emphasize the need for secrecy and to train the students to read airphotos, take field notes and pan. An outline of bush safety procedures was given to each student to be read and signed.

A summary of the petrology and showings in or near the project area was distributed to the senior students and an outline of prospecting and sampling techniques given to each student. Copies of these outlines are included in the appendix and details in their text are referred to throughout this report.

Several field trips were organized to familiarize the crew with local geology, overburden conditions and mineral deposits.

Logistics

Statistical analysis of helicopter and fixed wing utilization are not included in this report as the pertinent records are not immediately available to the writer.

The field crew consisted of two senior students, four student samplers, a cook and helper plus a Klondike

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Helicopters Ltd. pilot and mechanic. One of the senior students was only available for a portion of the summer.

The base-camp was designed to be transported as a unit or to be broken into several units so the crew could be segmented if necessary. Three major camps were maintained during the summer,

1. South Aishihik camp from June 11 to 25.
2. North Aishihik camp from June 25 to July 14.
3. Little Buffalo camp from July 15 to August 15.

Fly camps were established at Cooper Lake, Long Lake and in the Macks Copper area. The North and South Aishihik camps were supplied by road while the Little Buffalo camp was supplied by fixed wing aircraft from Whitehorse. The fly camps were supplied by helicopter.

A super-cub was used from June 11 to June 23 and again from July 12 to July 14 to collect silt samples from streams that flowed into or near lakes and for geological reconnaissance. One student working with the Super-cub managed to collect 20% of the total silt samples.

A Bell G2 helicopter was chartered from Klondike Helicopters Ltd. for the two month period June 15 - August 15. During this period the pilot was changed three times and more than two weeks were lost due to breakdown.

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At the termination of the field season part of the camp equipment was cached at the east end of Little Buffalo Lake while the remainder was stored in the Atlas Explorations garage in Whitehorse. Itemised lists of equipment were prepared and distributed to all concerned. Airphotos, geochemical data sheets and panning concentrate samples are being stored in the Archer, Cathro and Associates Ltd. office in Whitehorse.

Data Reduction

Base maps on a scale of 1" equals 4 miles were prepared during the summer by Archer, Cathro and Associates Ltd. At the end of the field program the two senior students plotted the geological information and available geochemical assays on the base maps.

GEOLOGICAL MAPPING

General

The reader is referred to Appendix B for a summary of the petrology of the various formations within the project area and for historical data and descriptions of showings in and around the area. The reader is further referred to R. Chaplin's reports of July and November 8, 1966 for details of field examination of the Mack's Copper, Giltana Lake, Hopkins Lake and June Group copper showings.

Geological mapping was done mainly on the basis of super-cub and helicopter reconnaissance by R. Chaplin and A. Reinsbacken (senior student) during the later part of June and early July. Details of geologic boundaries and notes on magnetic deflections of the various rock types were later obtained by the students during their silt sampling traverses. The main purposes of the geological mapping were:

1. To locate the edges of the intrusives.
2. To locate areas of significant compositional changes within the intrusive.
3. To locate limestone horizons within the Mesozoic sediments.

Details

The Coast Range batholith covers a larger portion of the project area than expected. The major part is composed of granodiorite and diorite although the eastern edge of the batholith contains a significant core of quartz monzonite. The quartz monzonite has a magnetic susceptability that is significantly is lower than the diorites and granodiorites. Contacts with the surrounding rocks are usually sharp and distinct.

The Mesozoic volcanic and sedimentary rocks bounding the eastern edge of the batholith were found to contain more volcanics (Hutshi group) than expected. Sediments consist mainly of conglomerates, sandstones, siltstones and arkose (Tantalus and Laberge series) while limestone is almost completely absent. As limestone is one of the constituents of the Lewis River group it can be surmised that this group is poorly represented in the area.

The Yukon Group of metamorphic rocks is well represented in the northeast corner of the area and also forms a very large roof pendant within the batholith from latitude 61 00' through the Giltana and Aishihik Lake area. This pendant averages four to five miles in width except toward the north end of Aishihik Lake where it widens to over 15 miles. Most of the copper mineralization observed occured in this group, usually associated with massive, coarsely crystalline limestone. Limestone is prevalent throughout the group but only as narrow discontinuous horizons.

About 10% of the area is overlain by Tertiary rhyolitic to andesitic flows. Associated rhyolite dyke swarms are common. These rocks for the most part are found in areas of higher relief and exhibit considerable rusty gossan due to oxidation of accessory pyrite.

No significant areas of mineralization were discovered in the course of geological mapping.

Except along the eastern margin of the project area topography is gentle, the highest peaks being between 5,000 and 6,000 feet on a land base averaging 4,000 feet in elevation. Major lakes lie at an elevation of slightly over 3,000 feet.

Pleistocene glaciation has not been extreme and the northeastern part of the project area is unglaciated. Evidence of valley glaciation increases to the south where most of the major valleys are deeply covered with glacial till of local origin. The southern and eastern part of the project area exhibit numerous ice-marginal river channels that now have little connection to existing river courses. Nearly all drainage in this section is underfit due to lack of volume since the ice sheets have melted.

Overburden cover above 4,000 feet is composed mainly of decomposed and frost riven country rock. Solifluction has been accelerated by frost action and outcrop is not abundant.

Several major faults with a northeasterly strike have been postulated on the basis of drainage patterns and surface lineaments (see Figure 1). Folding in the Yukon Group has been extensive while the Mesozoic sediments and volcanics are less disturbed and generally exhibit broad gentle folds.

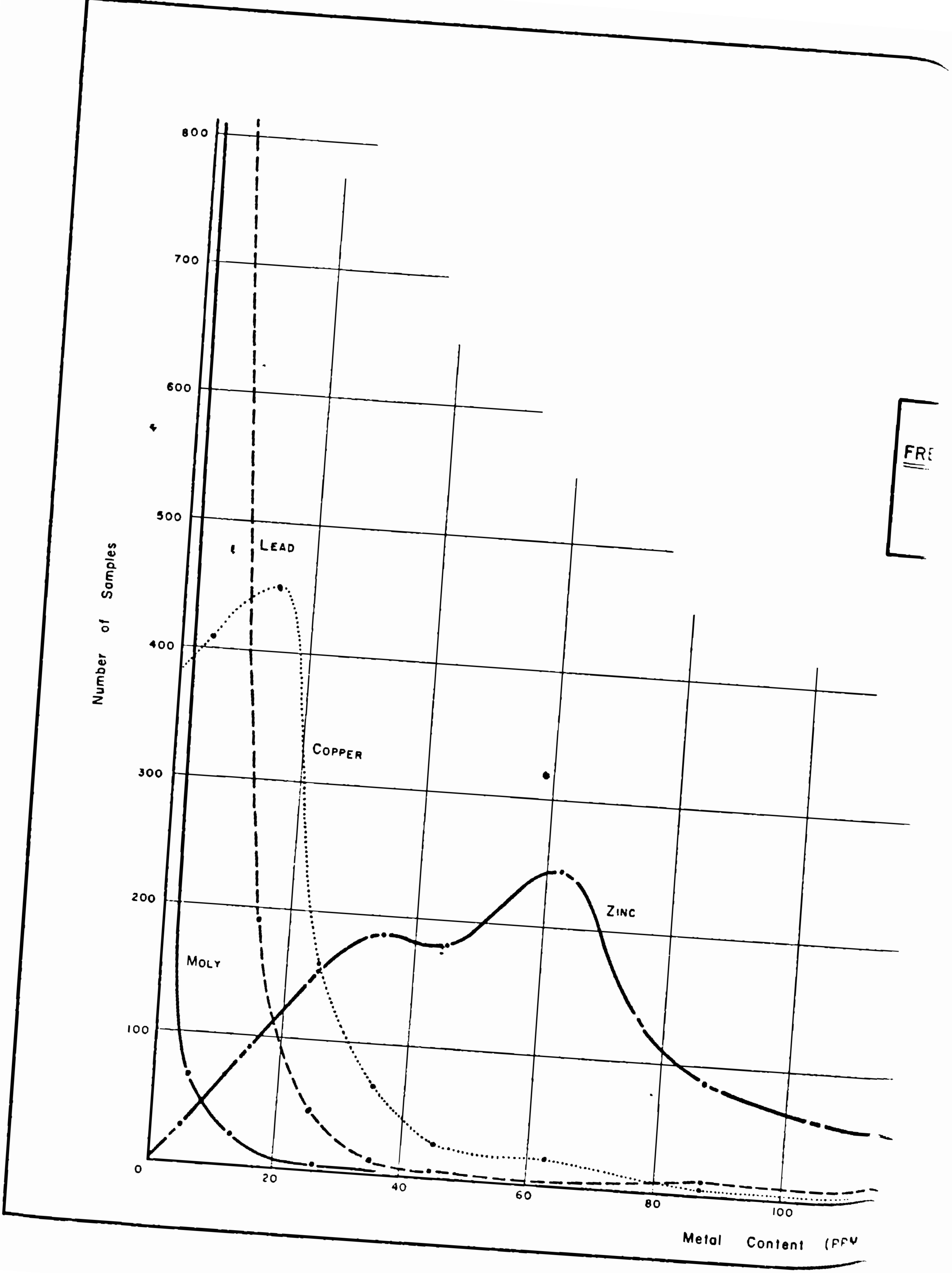
GEOCHEMICAL SAMPLING

General

Silt samples were taken from every major stream in the project area. Larger streams were panned and the concentrate tagged and saved for further reference. Soil samples were taken from gossan zones located during geological reconnaissance, from areas of known mineralization and from several interesting areas outlined by silt sampling. A total of 1,636 samples were taken of which 921 were silt samples, 240 soil samples and 475 panning concentrate samples. These samples were collected according to the methods outlined in Appendix C. The location of each sample was plotted on the 1 to 50,000 base maps carried in the field by the samplers.

Silt and soil samples were tested for total heavy metal content in base camp (using Trail Kits purchased from Jens Mogenson) in order to locate anomalous areas where more detailed sampling would be immediately warranted. After cold analysis, samples were sent to the Atlas Explorations Ltd. laboratory at Ross River for detection of lead, zinc and copper (using hot acid extraction techniques) and molybdenum (using fusion by potassium pyrossulfate).

The figure on the following page shows frequency distribution curves for parts per million lead, zinc, copper and molybdenum in the silt samples. These curves were used



800
700
600
500
400
300
200
100
0
20
40
60
80
100
Number of Samples
Metal Content
LEAD
COPPER
ZINC
MOLY

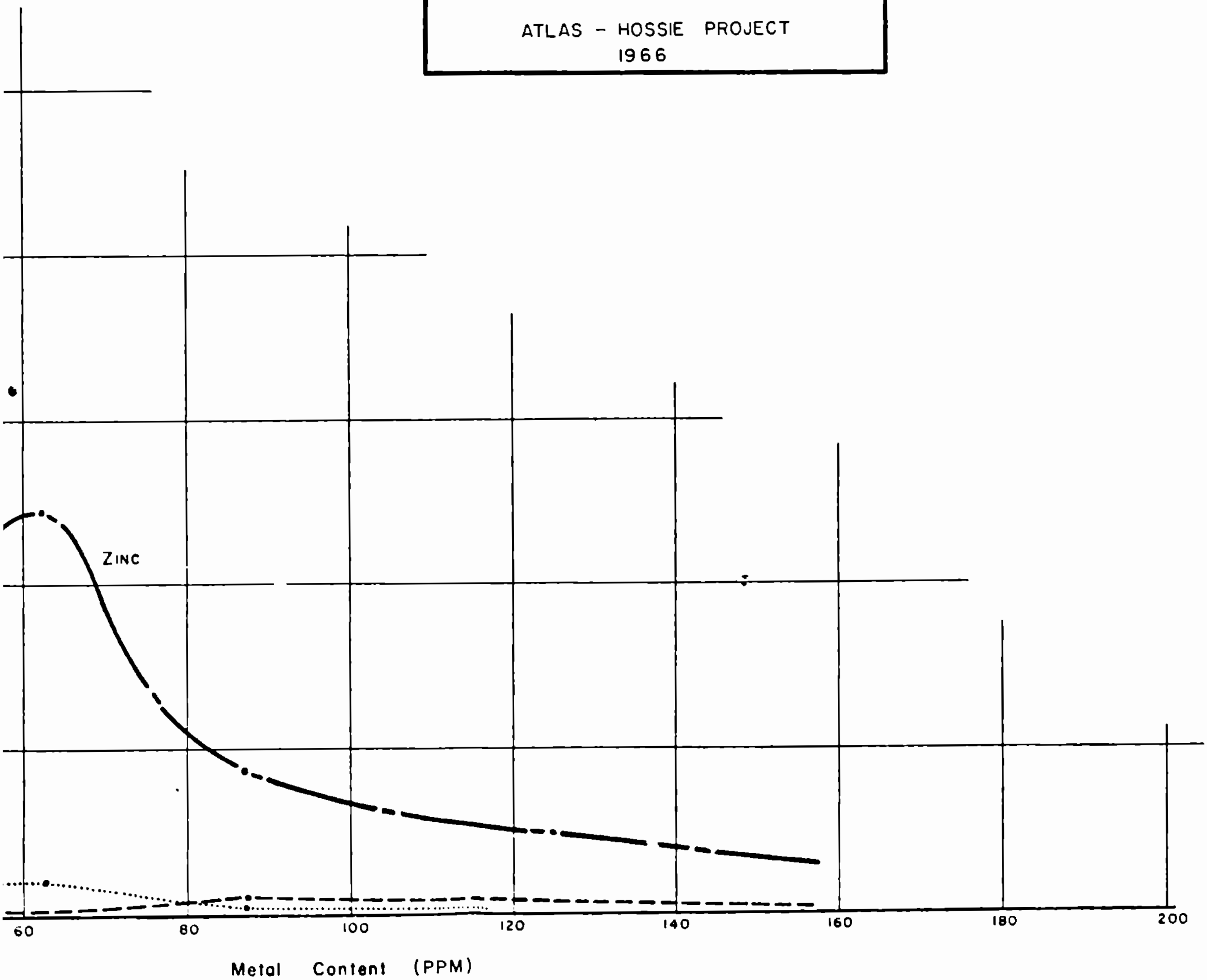
ARCHER CATHRO & ASSOC. LTD.

FREQUENCY DISTRIBUTION CURVE

Geochem Sampling

ATLAS - HOSSIE PROJECT

1966



to determine background of the project area and to provide a basis for choosing the range of values that might be considered anomalous. The curves are remarkably uniform considering that an area containing three major geological formations was covered.

Results

The cold testing was not successful and generally produced misleading results. Little correlation was found between results of the cold testing and the final analysis. In certain areas, samples with a higher than average zinc content reacted most strongly to cold testing but even this factor could not be relied upon.

Copper values in the silts are generally higher in the Mesozoic sediments and volcanics. The highest values are found in the vicinity of the known copper showings indicating that silt sampling could have located these areas and that other areas anomalous in copper are worth further investigation. Lead values are well distributed with a slightly higher background in the intrusives. Zinc values are also well distributed with a slightly lower background in the Mesozoic sediments and volcanics. Molybdenum has a significantly higher background in the intrusives.

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Areas of Interest

A. Copper

1. Sob-Leg Lake (61° 09′ N, 136 08′ W) - Values of 35 and 70 p.p.m. in an area where background is about 10 p.p.m. Streams flow through Tertiary volcanics overlying granodiorite where extensive glaciation~~s~~ has occured.
2. Sick Lake (61° 14′ N, 137° 9′ W) - Values of 34 and 46 p.p.m. where background is less than 10 p.p.m. Streams flow through diorite in a glaciated area that has a fair amount of outcrop.
3. Aishihik Lake Area - Three isolated anomalous values are worth investigating even though the background in this area is quite high. Values are 54 p.p.m. at Slop Lake (61° 30′ N, 137° 05′ W), 64 p.p.m. at Staph Lake (61° 21′ N, 136° 55′ W) and 148 p.p.m. near Hopkins Lake (61° 16′ N, 136 55′ W). The value at Slop Lake occurs in a stream flowing along a contact between Tertiary volcanics and diorite. The values at Staph Lake and Hopkins Lake are found in streams which flow near the contact of diorite with the Yukon Group. All three areas are glaciated and

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outcrop is scarce.

4. <u>Nistling River Area</u> - A value of 50 p.p.m. is found in a westerly branch of Shist Creek (61 58 N, 137 41' W) where reconnaissance mapping was not completed. Background in this unglaciated area is about 10 p.p.m.

5. <u>Blink Lake Area</u> - (61° 48' N, 137° 08' W) value of 64 p.p.m. is found in a small creek draining Yukon Group sediments where background is about 20 p.p.m.

6. <u>Mack's Copper Area</u> - Detailed silt sampling in the Mack's Copper area returned anomalous values as high as 74 p.p.m. An area to the north of Mack's Copper (61° 41' N, 136° 08' W) where a number of values from 32 p.p.m. to 66 p.p.m. are found along the same linear that cuts Mack's Copper is worth investigation.

B. <u>Lead</u>

There are no significant anomalous areas for lead in the project area. The highest silt value are 60 p.p.m. and these are isolated highs within the batholith.

C. <u>Zinc</u>

1. <u>Moraine Lake</u> (61° 00 N, 136° 47' W) - Values

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of 175 and 106 p.p.m. in an area where background is about 90 p.p.m. Drainage may originate near contact of Yukon Group and diorite.

2. Satasha Lake Area (61° 32′ N, 136° 23′ W) - Values of 179 and 110 p.p.m. in an area where background is about 50 p.p.m. Drainage flows from the Mesozoic sediments near one of the strong regional lineaments.

3. Biset Lake Area (61° 36′ N, 137° 07′ W) - Values of 153 and 250 p.p.m. in an area where background is about 40 p.p.m. Drainage is from diorite near contact with the Yukon Group.

4. Schist Creek Area (61° 58′ N, 137° 41′ W) - Value of 126 p.p.m. coincident with a high copper value described under NISTLING RIVER AREA.

D. Molybdenum

1. Arc Lake Area (61° 26′ N, 136° 53′ W) - Values of 10 and 12 p.p.m. with an additional value of 15 p.p.m. about 7 miles northwest. Drainage is from the contract of the diorite and quartz monzonite near one of the major lineaments.

2. Stevens Creek Area(61° 44′ N, 137° 47′ W) - An area of values ranging from 6 to 12 p.p.m. with

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all drainage in diorite and/or Tertiary volcanics. Molybdenum values from other Tertiary volcanics areas are very low and presumably the diorite in this area of about 20 square miles contains a higher than average content of molybdenum.

3. Blink Lake Area (61° 51′ N, 136° 54′ W) - An isolated value of 14 p.p.m. from drainage that flows near contact of diorite and quartz monzonite.

4. Little Buffalo Lake Area (61° 55′ N, 136° 34′ W) Values of 23 and 25 p.p.m. from two creeks draining a contact area between diorite and quartz monzonite. This area is unglaciated and several cliffs along the lower part of one of the creeks exihibits considerable limonite gossan.

AIRBORNE MAGNETIC SURVEY

Results of an airborne magnetic survey of the project area on a scale of 1 mile equals 1 inch, flown by Canadian Aero Service Ltd., were released by the Department of Mines and Technical Surveys on October 26, 1966. These maps were examined concurrently by Archer, Cathro and Associates Ltd., Professional Geologic Services and Atlas Explorations in order to locate magnetic anomalies that could possibly

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represent deposits of magnetite. ~~It was hoped that magnetite.~~ It was hoped that magnetite deposits in the project area might have associated copper mineralization as in the case of the Mack's Copper deposit~~s~~. Particular attention was paid to the contacts of the intrusive and the Mack's Copper area. The reader is referred to R. Chaplin's report of November 3, 1966 for descriptions of the anomalies that were staked and suggested areas requiring follow-up work on the ground.

PROPERTY

Figure No. 10 (see Envelope 4 in Appendix) shows the location of claims in good standing in the project area as of February 15, 1967.

A total of 232 claims are owned by Empress. The 74 AC claims were staked in August 1966 to cover a structurally favourable area near Mack's Copper. The 16 Dericon claims were staked in August 1966 in order to cover a gossan that had weakly anomalous soil sample values. The remaining 142 claims were staked in October 1966 to cover favourable areas interpreted from the government airborne magnetic release.

Expiry dates for the claims are:

AC 1 - 74.............September 1, 1967

Dericon 1 - 16........September 1, 1967

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AH 1 - 126....................November 18, 1967

HA 1 - 16.....................November 18, 1967

COMMENTS

1. Too much value has been given to the airborne magnetic survey. Of all the copper deposits examined in the project area only the Macks Copper deposit had sufficient associated magnetite to respond and, this, only weakly. The Whitehorse copper belt deposits did not show anomalous response in a similar survey. The more interesting types of deposits sought in the project area (porphyry copper and molybdenum) would not be expected to respond to a high level airborne magnetic survey.

2. The regional silt sampling program did not have sufficient density to produce more than one or two anomalous values from possible areas of mineralization. Many of the single value anomalies are therefore of interest. Several obvious areas requiring more detailed sampling have been described. However, a complete interpretation of the results incorporating air photo studies and panning concentrate analysis is required to extract the maximum information from the existing data.

3. Considering the geological setting along with

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the geochemical sampling the following generalization can be made:

a. The best areas to further explore for molybdenum are those where anomalous values were found in streams draining from or near the contact of the diorite and grano-diorite.

b. Further exploration for copper deposits may be most productive along the eastern contact of the intrusives and the Yukon Group roof pendent and along the regional lineament in the Mack Copper area.

c. The geological setting is not particularly favourable for lead-zinc mineralization. If silver-gold-lead deposits (similar to those in the Carmacks area) were present, they should have been indicated by a higher geochemical response for lead.

4. It is unlikely that the Empress claim groups encompass the areas of prime exploration potential. Further planning for the project area must be done with the understanding that the claims may only be of secondary importance.

5. Further exploration should be primarily directed toward ~~exploring~~ areas of interest outlined by the regional geochemical program. Initial exploration of the claim groups

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should consist of rapid geochemical and geological reconnaissance to determine which group, if any, require detailed exploration. A dip needle should be used on the claims staked on the basis of the airborne magnetic survey to determine if small strongly magnetic overburden covered zones occur.

RECOMMENDED PROGRAM

1. Hire a geologist on April 1 to organize and supervise the 1967 field program. Primary duties during April and May will be photo interpretation of areas with above background geochemical assays to determine overburden and structural conditions. All creek panning concentrates should be logged with a binocular microscope, examined with an ultra-violet light, tested for radioactivity and, for certain areas, be assayed.

2. Hire two senior and two junior students on June 1 (the senior students may have to be paid from May 15). Obtain the cached field equipment and establish a base camp in the Aishihik Lake area.

3. Spend two weeks from the Aishihik Lake camp doing silt and soil sampling reconnaissance of geochemically positive areas in the west half of the project area. At the same time do reconnaissance soil sampling and geology on the

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AH 1 -16, AH 79 - 94, AH 95 - 102 and Dericon claim blocks.

4. Move camp (by truck) to the Mack Copper property and spend 2 weeks soil and silt sampling geochemically positive areas in the east half of the project area.

5. Spend a further 3 weeks in the Mack Copper area doing reconnaissance soil sampling and geology of remaining claim blocks. Most of these claim blocks can be reached by walking from the road.

6. Exploration during the remaining 5 weeks of the summer season will depend on results of the initial work and will probably consist of detailed soil sampling and ground magnetometer surveys of specific areas.

7. Have the geologist make all final reports after the students have returned to university. It might be necessary to do some bulldozing or even diamond drilling in September and the geolgist could supervise this additional work.

BUDGET

Expenses (other than labour and camp supplies) that will be incurred should specific areas of interest be explored after August, are not included in the budget.

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Labour

Geologist (assume 6 months).................$6,000.

Senior students (assume 4 months)............ 4,800.

Junior students (assume 3 months)............ 2,700.

add 15% for airfares, c.p.p.

holiday pay, etc........................ 2,000.

Mobilization

Bell G2 helicopter - June 1 - 30

(assume 150 hours)......................$15,000.

Bell G2 helicopter - July 1 - Aug. 1

(assume 35 hours)...................... 3,500.

Fixed wing - June 1 - Aug. 1................. 2,000.

Fuel... 2,500.

Truck rental................................. 1,500.

Camp Costs

Additional equipment........................$1,000.

Comsumable supplies......................... 3,000.

Expediting.................................. 900.

Geochemical Analysis

Assume 500 silt samples (assayed

for copper and molybdenum and/or

zinc....................................$1,500.

Assume 2,000 soil samples (assayed for

copper and/or molybdenum)............... 6,000.

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Miscellaneous

Head office supervision.....................	$3,000.
Administration, accounting..................	1,000.
Whitehorse expenses (room and board students, office space).................	1,800.
Panning assays (assume 50)..................	1,000.
Binocular microscope and light..............	300.
Blueprinting and drafting...................	1,500.
Total Cost..................	$61,000.
add 10% contingencies........	6,000.
TOTAL....	$67,000.00

Respectfully submitted,

ARCHER, CATHRO & ASSOC. LTD.

Alan R Archer

Alan R. Archer.

A.R.A:m.a.

ARCHER, CATHRO AND ASSOCIATES LTD.

GEOCHEMICAL SOIL AND SILT SURVEY DATA

Project: Empress
Area: Long Lake

Date: June 30, 1966
Name: D. Lyman

SAMPLE NO.	LOCATION	SILT	SOIL	PANNING	STREAM SIZE C. F. S.	Gradient or Slope			HORIZON AND DEPTH	CLAY	SANDY	ORGANIC	STREAM CHANNEL		REMARKS (Include Physiography, Creek Float Panning Data, Vegetation, Colour of sample and Gossan)		ANALYSIS (P.P.M		
						Meander (Flat)	SLOW (Gentle)	FAST (Steep)					ACTIVE	IN ACTIVE		THM	Pb	Zn	Cu
217	61°16′N 136°44′W	✓			10.0			✓		✓	✓		✓		sampled near outlet to Long lake	low	12	35	40
218	As above			✓	10.0			✓					✓		concentrate mainly magnetite 2 tsp. - granite float, local origin				
219	61°16′N 136°45′W		✓						B 12″	✓	✓				above timber line, buckbrush and moss, diorite float	low	25	70	45

Appendix - Ac

SUMMARY OF PETROLOGY AND MINERAL DEPOSITS

(Distributed to senior students in June 1966)

The following notes are intended as an introduction to the regional and economic geology of the project area. Since only scattered portions of this area have been mapped by the G.S.C., only the broad outlines of the regional geology are known and these are based mainly on the geology of the surrounding areas.

In 1908 and 1914, D.D. Cairnes mapped a samll area around Braeburn Lake and between Aishihik Lake and Victoria and Nansen Creeks. He also examined the Macks Copper and Giltana Lake copper showings which had just been discovered, as well as the Williams and Merrice Creek copper showings a few miles northeast. Cockfield of the G.S.C. mapped the southeast corner of the area in 1926 and nothing further was done by the G.S.C. until 1963 when some aerial reconnaissance mapping done by L.H. Green and C.I. Godwin.

Within a few months the results of an airborne magnetometer survey conducted by the G.S.C. will be released and the present program is designed to collect sufficient geological, geochemical, and geophysical data to make the airborne results meaningful. As in all exploration programs the results are highly confidential and the members of the exploration crew will be given a small financial interest in the success of the project to insure that they do not jeopordize its secrecy.

The area lies along the eastern margin of the Coast Range batholith and the following are the rock types which will probably be encountered, with a brief description of their physical characteristics in neighboring areas.

1. Yukon Group - This term has been used to describe metamorphic rocks of undetermined age which occur with and and have been intruded by the Coast Range batholith. With the exception of quartite and crystalline limestone, these rocks are all strongly foliated siliceous schists and gneisses. The age is probably Palaeozoic but may be, in part, Precambrian. In decreasing order of abundance, the Yukon Group is comprised of:

Schist - micaceous, chloritic, sericitic, with minor amounts of garnet, magnetite, sphene, apatite, tourmaline, cordierite, and andolusite.

Gneiss - commonly along contacts with granitic rocks and grades into gneissicgranite (augen sometimes developed).

Quartzite - massive; vague, thick bedding; grades sometimes into micaceous quartzite and quartz-mica schist.

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Amphibolite - grades into epidote-actinolite greenstone (andesite).

Limestone - massive, coarsely crystalline.

The rocks of the Yukon Group were probably derived from a sequence of sedimentary rocks containing minor amounts of basic igneous or volcanic rocks.

2. Mesozoic Sediments and Volcanics - These rocks lie in a belt along the east side of the Coast Range batholith. They are subdivided below:

Name	Age	Description
Hutshi group.	L.- U.cretaceous	Basalt, andesite, rhyolite flows, minor volcanic breccia, tuff, agglomerate, seds.
Tantalus formation	U.Jur L.Cret	Conglomerate, sandstone, siltstone, shale, coal.
Laberge series	L.Jurassic	Conglomerate, greywacke, arkose, quartzite, sandstone, argillite, coal, minor volcanics.

Lewes River group.	U.Tiassic	Greywacke, silt-stone, conglomerate, limestone, sandstone, minor volcanics.

The Tantalus can be distinguished from the Laberge by its cleaner nature - it is more siliceous and better sorted. The Laberge conglomerate contains granitic, volcanic, and metamorphic cobbles in an arkosic matrix whereas the Tantalus is a cleaner, finer conglomerate and resembles concrete made from quartz and chert pebbles and clean sand.

<u>3. Coast Range Batholith</u> (Mesozoic) - The batholith is of upper Cretaceous age and is composed mainly of granadiorite, but a complete range from ultrabasic to acid intrusives with related volcanic rocks is present. The margins of the Batholith are usually obsaured by overburden but, where seen, are steep. In places the batholith is in sharp intrusive contact, often containing angular inclusions, whereas in other places it grades into gneiss. Numerous small stocks occur separate from the main batholith and many dikes and lenses of various composition occur within the main pluton.

<u>Granodiorite</u> - medium to coarse grained, grey and light brown, equigranular, massive outcrops, biotite more common than hornblende, grades locally into diorite and quartz diorite, quartz usually clear.

Granite - often porphyritic with large, pale pink orthoclase phenocrysts, quartz smoky, rock is usually pale cream or brown, weathers brown with bold, coarsely jointed topography.

- intrudes granodiorite and cut by aplite dikes, granite is more susceptible to weathering than granodiorite due to larger pores.
- local gradations and isolated stocks of syenite quartz monzonite and quartz diorite occur.
- pegmatite rare or absent.

Ultramafics - gabbro and diorite stocks and dikes occur but are not common, dikes up to 3 miles long are known.

- serpentine, serpentinized peridotite and dunite are fairly common as dikes, lenses, and small plugs, usually sheared, rusty reddish brown to greenish brown weathering, serpentine often altered to talc with remnant olivine and pyroxene, accessory minerals chromite, spinal, magnetite.
- peridatite often coarse grained with pale green chrome pyroxene and black olivine.

4. Tertiary

Flows - flat lying, relatively fresh and undeformed.

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- common in Carmacks area.

- mostly andesite and basalt with some tuff and volcanic breccia.

Dikes - soda syenite towards Dezadeash, in some cases of small stock size.

- rhyolite dike swarms in corner toward Kluane and Carmacks map area.

Sediments - Conglomerate, sandstone, shale, flat-lying and fresh.

Our field program will be aimed at:

1. Locating the edges of the intrusives.
2. Detecting any significant changes in composition within the intrusives.
3. Prospecting and geochemically sampling for evidence of sulfide mineralization.
4. Testing the magnetic susceptibility of the rocks.

KNOWN MINERALIZATION

A brief description of the known mineral occurrences will assist in the search for new deposits.

1. Macks Copper.
2. Giltana Lake Copper.

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3. Williams and Merrice Creek.

4. Whitehorse Copper belt.

1. Macks Copper

This property was discovered sometime prior to 1900 and when visited by Cairnes in that year the workings consisted of a 38 foot adit on one hill and an open-cut on the adjoining hill. A sample taken by Cairnes from the face of the adit (probably 4 - 5 feet wide) assayed 1.8% Cu. and traces in Au and Ag. The best four feet in the open-cut assayed 5.55% Cu., 3.4 oz./ton Ag. and 0.025 oz./ton Au. The mineralization consisted chiefly or magnetite with some hematite, chalcopyrite, malachite and azurite and occures in andesite at or near a limestone contact. According to Cairnes (1910, page 55) "the main mass of mineral is in the form of a small hill of almost solid iron ore, about 200 feet wide, and from 300 to 400 feet long." It is this deposit which was recently traced magnetically and drilled by Artic and so far as is known the property lay idle for the entire intervening period.

2. Giltana Lake Claims

As in the case of Macks Copper occurence, Cairnes made the first and only published report on this property in 1908. The original claims were staked in 1907 and 1908.

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on both sides of what was then called Giltana Lake. This lake is now called Hopkins Lake and another lake six miles south is now named Giltana.

On the northwest side if the lake the copper occurred in narrow quartz lenses, up to four feet wide but generally only one to two feet wide, at a granite limestone contact. On the northeast side of the lake the mineralization occured in a sequence comprising mica schist, quartzite and limestone, belonging to the Yukon Group. Magnetite, associated with chalcopyrite and malachite, was found as disseminations, and, in places, as massive bands up to twenty feet thick and from 50 to 200 feet in length. On the Helen Claim, on Franklin Creek, "streaks of copper ore, i to 3 feet thick" were seen.

When visited by Cockfield in 1926 these showings had been idle for many years.

3. Williams and Merrice Creeks

This area is actually situated in the Carmacks Map-sheet, about 25 miles north of latitude 62 degrees N, and just west of the Yukon River. The first lode claims staked was the Bonanza King, on Williams Creek one mile and a half above its mouth. When visited by Cairnes in 1907 it was the only claim that had been developed and the workings consisted of a shaft twenty feet deep on a quartz vein six feet wide, and an adit fourty feet long. The copper minerals are bornite, chalcopyrite and malachite, and the vein occures in granite near the contact of an altered, schistose diabase. Average samples assayed 3.29 to 4.21% Cu and traces in Ag and Au.

Returning to the area in 1909, Cairnes (1910, page 57 - 60) found that prospectors had been quite active. The mineralization was found in all cases at or near contacts between granite and amphibolite (altered diabase). Very little outcrop was present and the mineralization that was found was confined to quartz veins.

4. Whitehorse Copper Belt

The copper deposits around Whitehorse were discovered in 1897 and first staked in 1898. Between 1900 and 1915 some 13 million pounds of copper were produced from high-grading operations. Little further interest was shown in the possibility of developing a milling operation until World War Two. Since early 1963, New Imperial Mines Ltd. have conducted a vigorous exploration program which has succeeded in proving a publihed reserve of 5.5 million tons grading 1.2% Cu, and construction of a 2,000 ton mill is currently underway.

The geology of the Whitehorse copper belt has been well described by McConnell (1909), Kindle (1964) and others.

The deposits are associated with the contact between a Cretaceous granitic stock and upper Triassic sediments of the Lewes River group. The Lewes River group consist of greywacke, arkose, limestone, quartzite, argillite and slate, all of which have undergone contact metamorphism.

The stock appears to be an outlier, 20 miles long and 10 miles wide, of the main Coast Range batholith from which it is separated by a distance of 8 miles. It is a grey, coarse-grained hornblende granite but locally ranges in composition from quartz monzonite to granodiorite to diorite.

Most of the significant deposits are associated with the east side of a northwest trending belt of limestone and associated strata, 11 miles long and a half mile wide, which is caught up as a roof pendent within the stock. This belt is folded and faulted along northwesterly trending axes. The deposits are probably from late lower Cretaceious to early upper Cretaceious in age. The limestone occurs as discontinuous lenses which locally reach widths up to 500 feet or more.

The copper deposits are of relatively samll size, with probably no more than two million tons available to open-pit mining methods in the largest. Most of the copper in the belt is in the form of contact metamorphic deposits,

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both in limestone and in granite. Some quartz-copper veins also occur and McConnell states that the granite also contains substantial disseminated copper. Also, according to McConnell, where limestone is absent the belt is practically barren.

The granite-limestone contact is in many places obliterated by skarn composed of epidote, garnet, clinopyroxene, tremolite, wollastonite, magnetite and specular-hematite.

The copper deposits can be divided into two types:
1. chalcopyrite and bornite associated with magnetite, and
2. chalcopyrite and bornite associated with skarn minerals and some magnetite, pyrite and pyrrhotite. Also present in small amounts are malachite, azurite, chrysocolla, and native copper with practically no gossan remaining since the last glaciation.

Thus, not all the copper deposits are strongly magnetic, nor are all the magnetic anomalies associated with copper deposits.

GEOCHEMICAL SAMPLING INSTRUCTIONS

Soil samples will usually be taken at regular intervals along traverses or in a grid fashion over interesting areas.

The soil sample must be taken below the layer of surface vegetation, peat, muskeg (or volcanic ash if present). Sometimes a hole several feet deep might have to be cut in order to get a sample. The sample does not have to be large (4 or 5 tablespoons will do) and should not contain any organic material or volcanic ash. The ideal sample will be composed of fine decomposed rocks or soil and will be taken from several points in the pit bottom.

The location of each soil sample will be marked with a piece of red flagging.

Soil sample analysis is much like assaying except it is more sensitive. The purpose of soil sampling is to "assay" a section of ground at regular intervals to see if any parts of it contain above average quantities of metals.

SILT SAMPLING

Silt sampling is much like soil sampling. Stream silts are sampled to determine if the area drained by the stream has an above average content of metals.

Samples need not be large but must be composed of

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fine, nonorganic, silt from the active part of the stream channel. The best sample is composed of small bits of silt from several points around the sample site. The best silt is often found on the tail end of a bar where the finer material has had an opportunity to settle out.

PANNING

Streams are panned in order to separate out the heavy minerals. Try to find a natural riffle in the stream (behind a boulder, just downstream from the top end of a bar) where the heavy minerals are already partially concentrated. Fill the pan with sand (remove all large pebbles) and pan until a black concentrate is produced (this will be magnetite, commonly called "black sand") but no further. Estimate the volume of concentrate in teaspoons (level) and record this figure on the sample record sheet.

When soil or silt sampling or when panning try to identify the various rock types in the soil or creek. Estimate their relative percentages and if possible determine if the rock is actual float or of glacial origin. Rocks of glacial origin will usually be very well rounded and worn.