

004865

NEW IMPERIAL MINES LTD.

THE APPLICATION AND APPLICABILITY
OF
GEOCHEMICAL PROSPECTING TECHNIQUES
TO
WHITEHORSE COPPER BELT

AUGUST 1969

F.M. SMITH

TABLE OF CONTENTS

INTRODUCTION	1
SUMMARY OF PRELIMINARY PROJECT	2
PRELIMINARY SURVEY - COWLEY PARK 1968 GRID	3
Introduction	3
Sample Values and Statistics	4
Anomalous Areas	4
Conclusions and Recommendations	5
SUB REPORTS - BEAR CUB PROJECT	10
Summary	10
Introduction	10
Sample Values and Statistics	10
Interpretation	11
SUB REPORTS - BEST CHANCE PROJECT	12
Summary	12
Introduction	12
Sample Values and Statistics	13
Anomalies	13
Zone A	14
Zone B	14
Zone C	15
Zone D	16
Recommendations and Conclusions	17
RECONNAISSANCE SURVEY GEM 1969 GRID	18
RECONNAISSANCE SURVEY COWLEY PARK 1969 GRID	19
RECONNAISSANCE SURVEY COWLEY LAKE 1969 GRID	20
TEST PITS PROJECT	21
SAMPLE VARIANCE PROJECT	22
PLANT ASH SURVEY	23
APPENDIX A - PHOTOS OF PROJECT	24
APPENDIX B - TYPICAL SAMPLE SHEETS	25
APPENDIX C - HISTOGRAM AND CHARTS	26

INTRODUCTION

In October 1968, the writer proposed that New Imperial Mines Ltd., carry out an evaluation of applicability of Geochemistry to the "Whitehorse Copper Belt". Portions of the following report will discuss this preliminary project.

Involved in a thorough evaluation of a geochemical program are: a test pit survey, a sample variance survey, determination of all parameters influencing the concentration of elements being analyzed and statistical interpretation of the sample values.

The sampling itself was carried out according to standard procedures in the Yukon. Samples 400 ft. apart and 100 ft. stations were used as grid basis. Samples were taken below any layer of soil with humus, using a prospector's grub hoe (see photographs Appendix A). At the sample site, slope direction and magnitude, pH, soil colour and composition, water content of soil and predominate vegetation were noted on sample sheets (see Appendix B).

The samples were placed in numbered Kraft wet-strength bags strung according to sample day and sequence, boxed and sent to Chemex Labs in Vancouver.

Chemex Labs extracted the copper and molybdenum (molybdenum on first 536 only), using hot aqua-regia extraction of metals.

The parts per million (PPM) were determined using a Techtron AA-5 Absorption Spectrophotometer.

SUMMARY OF PRELIMINARY PROJECT

A comprehensive soil survey over the 1968 Cowley Park Grid was carried out during June of 1969. The survey outlined an anomalous area about 2,500 feet west of the known Cowley Park Orebody.

The anomaly is very significant both statistically and as compared to the known ore zone geochemical anomaly.

The anomalous area covers a region from 9 + 00S on line 120 + 00.E to beyond line 84 + 00E at 11 + 00 N and varies from 400 to 1000 feet wide over the length.

This is an important anomaly known to be associated with prophyritic diorite and requiring drilling to determine mineral extent.

PRELIMINARY SURVEY - COWLEY PARK 1968 GRID

Introduction

In the original recommendation (October 1968 report), the Best Chance 1968 Grid was selected as the test survey site. During further investigations, the Cowley Park 1968 Grid was selected as an additional possible survey area.

The Cowley Park Grid was selected as the initial site due to two reasons. The most important is, there is a known orebody in the grid (there are no showings on the 1968 Best Chance Grid) and if the survey works over known areas then it should be a successful tool. The other important fact is that the consultants for Lewes River Mines carried out a survey on their claim block immediately north of the Cowley Park Orebody and failed to find any significant copper mineralization in spite of an overlapping magnetic and induced polarization anomaly. If their survey failed, ours might, hence the Cowley Park Grid preliminary survey would answer almost all questions on applicability.

The initial survey consisted of 536 samples. These were sent June 7, 1969, and returned to us on June 12, 1969. The results were plotted and an initial interpretation indicated we had successfully delineated the known Cowley Park Orebody and had defined an additional anomaly to the north of the Orebody. Since this second anomaly was open to the west, the remainder of the Cowley Park Grid was sampled.

A total of 1,256 samples were taken on the whole grid. Due to the definition of a new anomalous area due west of the Orebody, the area was laid out for line cutting at 200 ft. intervals and samples were taken at all 100 ft. stations including between the cut lines (Cowley Park II Grid).

During the initial project it became clear the pH paper supplied was not sensitive enough for this survey. Hence, we brought in a La Motte-Morgan pH kit and resampled all lines at 400 ft. intervals.

The resulting copper sample value map was sent to Toronto for statistical interpretation and computer contouring.

SAMPLE VALUES AND STATISTICS

The survey was very effective in differentiating background to anomalous areas. The plot of frequency of occurrence of the values shows the survey to be "well behaved". This means that the values approximate a log normal curve, (see Appendix C), with areas inside the anomalous region in the possibly anomalous conditional (statistical evaluation).

The mean of the values is 13.2 PPM Copper with the mode (most common value) of 8.6. This shows the area is generally flat and the anomalous values represent a small per cent of the total values. The standard deviation of the values is low with a value of 29.86 PPM Copper. Thus, any value greater than 43.06 is considered possibly anomalous and any value greater than 72.92 PPM Copper is probably anomalous. The actual peak height over the Cowley Park Orebody is 3.7 standard deviations above the mean and the two peaks over the anomalies to the west of the Cowley Park Orebody have peak heights of 29.7 and 14.3 standard deviations over the mean.

From the above information it is clear that the new anomalous areas are very significant statistically.

ANOMALOUS AREAS

There are basically three anomalous areas other than the Cowley Park Orebody. These will be described as Zone A, B and C.

Zone A lies between 12 + 00 N and 18 + 00 N on line 108 + 00 E and overlaps onto line 104 + 00 E at 14 + 00 N to 18 + 00 N. It is not a significant anomaly in that ^{the} peak height is isolated and no values other than the peak get over one-third standard deviation above the mean. It is important that this anomaly be looked at as it seems a part of a system of isolated heights along line 108 + 00 E.

Zone B is a much more interesting anomaly lying north of Zone A. It consists of one isolated very high value (like the orebody) and very few associated highs. It warrants further work as mineralized diorite has been noted near the sample site.

Zone C consists of three or possibly four peaks running in a line NNE and centered on the base line at line 100 + 00 E. The peak heights are extraordinary and they are associated with very high peripheral values. Anomaly '1' lies at 1 + 00 N on line 100 + 00 E. It is the smaller of the two anomalies and no idea of the source of copper ions has been seen in the field.

Anomaly '2' lies at 10 + 00 N on line 92 + 00 E. It has been shown to be associated with porphyry copper (in diorite). The mineralization noted so far seems to be associated with shears, but very little surface outcrops occur near the peak center.

There are a series of other small isolated anomalous values which do not warrant further work.

CONCLUSIONS AND RECOMMENDATIONS

The preliminary survey has delineated an anomalous area worth further investigation. The sum of all knowledge on the area should be gathered and correlated before further work.

It is suggested that as long as the geophysics collaborates the geo-chemistry and geology an overburden drill program be initiated on this area. The zones should be laid out on 200 ft. centers and drilled 100 ft. into bedrock. Since United Keno Hill Mines was able to do their own overburden drill work at \$1.21 per foot, we should tackle a project to carry out a total of 6,000 feet on initial spacing with 4,000 feet for detail and complete the job for less than \$20,000.

The actual area for carrying out this project, the estimates of costs, etc., will be discussed in later sub reports.

SUB REPORTS

BEAR CUB PROJECT

Summary

A sample program was carried out over the Bear Cub Grid area in conjunction with Magnetometer, EM-16 and Induced Polarization survey. The purpose was to evaluate the geochemical program in conjunction with geology and geophysics over a high priority target area.

The geochemistry did not give co-incident anomalies with the geophysics. The basic reason for this is the pH of the soil precluded geochem working in this type of an area. The only way the survey can be done is to use an auger and take samples close to bedrock.

Introduction

During July 1969 approximately 560 samples were taken on the Bear Cub Grid cut south of the present Gem ore zone. The samples were taken at the geophysical survey stations on lines 200 ft. apart at 100 ' stations.

The purpose of the survey was to evaluate geochemistry in conjunction with geophysics over a high potential target area.

The samples were taken using standard procedures as outlined in the report on the Cowley Park area.

Sample Values and Statistics

The sampling distinguished background from anomalous value very well in this area. The distribution is typically log normal with a mean sample value of 8.6 and a standard deviation of 7.8 PPM Copper.

The distribution appears to be mono modal unlike the Cowley Park and Best Chance distributions. This attribute can be easily explained by the fact there is no continuous anomaly. No area has more than two values over

1S near each other. Thus statistically there are a few scattered highs but no anomalous "area". The contouring of this area was not attempted except by hand means. No obvious trends occur over the sample surface.

Interpretation

The geochemical survey did not show any anomalies over the survey area. The basic reason for this is the till was too thick for there to be any normal soil conditions for ion mobility. The soil at the surface had an average pH of 6.2 on the upper surface (grid east of the lake). The pH along the valley, that the lake is on, was about 7.5 or greater.

The sub crop is limy and hence basic over most of the area, especially where any mineralization will occur. Since the surface is acidic the copper mobility is high and hence any copper getting into this portion will be rapidly leached away. Since the basal portion is basic and calcic the mobility of copper is very low. Thus there is no chance of finding this type of skarn from surface soil samples.

The only time the copper became anomalous in the soil occurred near the lake or on the slope down to the lake. This is due to the sample being taken at or near the surface soil - bedrock interface where there is outcropping and where groundwater from up slope (and hence, in this case, from mineralized areas), has percolated down to the ground water-soil interface.

Thus any sampling to be done in this type of area must be done at or near the soil-sub crop interface to make sure the pH problem will not interfere with samples reflecting bedrock copper content.

SUB REPORTS

BEST CHANCE PROJECT

Summary

Four anomalous zones worth further investigation have been noted on the Best Chance 1968 grid by the exploration geochemistry program during 1969.

These anomalies are of two types. The A and D anomalies show sediments between diorite intrusives with associated moderate magnetic highs. Zone D shows also an associated IP anomaly suggesting sulfides. No IP was attempted over the A zone.

The B and C zones are less interesting, tending to be either within sediments (B) or diorite (C), with little magnetic relief and no chargeability. But they do have anomalous copper and this must be investigated before being eliminated.

Further work should be to define the anomalies with IP, Magnetics, EM-16 and close spaced geochemistry, before any drilling is attempted.

Introduction

Since the Cowley Park geochemistry survey was successful, the Best Chance area was sampled. The grid resulted in over 3000 samples, including some fine grid work once high values were noted.

The sampling was much slower than Cowley due to the terrain and swamps. Quite a large portion of the area remains unsampled because of these swamps and slow moving rivers.

The crews averaged about 70 samples per day. The pH was only determined along selected lines and the base line. From the little work done it has become clear that more of this work should be attempted in the future.

For a description of sampling techniques, etc., consult the introduction to the Cowley Park project.

Sample Values and Statistics

The Best Chance area showed a high variation of background to anomalous but not as marked as the Cowley Park region. The distribution was typically log normal with the high tail of the distribution having a small lump suggesting bimodal distribution (like the Cowley Park distribution) at about 70 PPM Copper.

The mean for this area is 17 PPM and the standard deviation is 21 PPM. The commonest value is 12 PPM Copper. Thus any value larger than 59 PPM is considered anomalous.

The values over 59 PPM Copper tend to be scattered over defined anomalous areas. The regions described as anomalous all have more than five stations within the one standard deviation line; thus, the apparent anomaly is supported significantly by the values. There are a few 1S lines with one or two values inside; these are not supported and thus represent random highs of little or no significance. The values supporting an apparent anomaly does not necessarily mean that the sub crop is mineralized economically. The only relationship that can be stated is the sub cropping rocks should have significantly higher than background values of copper.

Anomalies

There are basically four anomalous areas. These are the A, B, C and D zones. Some of the anomalies are complex consisting of more than one peak in a high plateau area.

Zone A: Between 164 + 00 S, 6 to 8 West and 138 + 00 S, 9 to 14 East.

The anomaly lies within rocks consisting of interbedded limestone quartzite with the eastern contact of diorite and granodiorite. The rocks are reasonably well defined by outcrops and EM-16. The IP survey further defined the contact and suggested that sulfides are of the very disseminated type.

The till cover in this portion of the grid varies from very thin to 35 feet thick. The only expander run with the IP equipment suggested a thickness, just to the west of the anomaly of 35 feet of soil.

The pH traverses run along some lines indicate that the pH in the northern portion is about 6.4 and over the southern anomaly is about 7.0. This suggests a siliceous skarn or dioritic rock for sub crop. The vegetation and water, soil composition, etc. verify the acidic to neutral soil character as previously noted. The limestones in this area tend to be very high in silica and more like the War Eagle in composition than Little Chief or Gem.

The peak height in the trend surface contour map suggests the northern (and larger anomaly) is very significant statistically (2.1 standard deviations above the mean) and the southern anomaly smaller and less significant. The important thing with this zone is the area within the 1S line has very many values equal to or greater than 59 PPM Copper. Thus this area is very well supported by the geochemistry. The only problem is the values are very scattered and the trend is only discernible by the computer.

Zone B: Southern: between 120 + 00 S at base line and 114 + 00S at base line with a maximum width of 700'.

Northern: between 108 + 00 S, 6 to 10 W and 96 + 00 S, 5 to 8 west, maximum width 700'.

These two areas lie between the two portions of granodiorite in limestone (possibly graphitic). The northern anomaly lies deep inside the area suggested to be limestone by the EM-16. There does not appear to be any magnetometer anomaly associated with either of these areas. The geology of the southern anomaly is less clear but it probably is in the vicinity of sediment-diorite contacts.

The pH on the northern anomaly is 8.0 with the southern having a pH of about 7.5 with the west side 6.2 and the east 6.4. This suggests that both anomalies are in relatively basic rocks (limy sediments) and that the southern is between two pieces of diorite.

The till in this area has been suggested by IP "expanders" to be over 35' thick. There are no outcrops in the area.

The peak height of the anomalies is 1.8 standard deviations with a much more defined, less random scattering of values over 1S inside the 1S line (i.e. there are very few values below 1S inside this line). Thus these seem to represent well justified anomalies.

The IP in the area has a high resistivity 350 ohm-meters and low chargeability. This would tend to suggest a diorite or similar rock. Due to this problem more effort will be necessary with the IP to better define the anomaly type and pattern.

Zone C: Between 96 + 00 E and 76 + 00 E, 2 West to 5 East

This anomaly lies totally with the diorite as postulated from the EM-16 survey. There are no outcrops in the area and the magnetics show a flat plateau for the region.

The pH in the northern portion of the anomaly is 7.2, while the southern part is 6.4. The tills are over 35 feet thick in this area.

The peak heights are 1.8 S on the south and 1.2 S in the north. The high values inside the 1S line are scattered and thus the anomaly is not as well justified by the copper content as Zone B.

There is a resistivity low of 40 ohm-meters and a moderate chargeability of 6.5 millisecs.

This anomaly is the lowest priority, of the four discussed as far as further work is concerned.

Zone D: Between 54 + 00 S and 42 + 00 S, 3 East to 14 East

This anomaly is probably the most interesting of the four described. The peak area appears to lie within limestone between (east to west) two pieces of diorite. The interpretation of contacts here is all by geophysics as there are no outcrops.

The pH supports the geophysics on rock types as far as acidity is concerned. The two diorites are less than 6.5 and the central portion, within the anomaly, has a pH of 7.4

The peak height in the anomaly is only 1.5S but the definition of anomaly and justification is there. There appears to be a realistic low plateau anomaly and since the tills are known to be thick here, i.e. over 60', this suggests that there is a good chance for interesting mineralization.

This is also the only anomaly with a chargeability high (14 milliseconds) and a resistivity low (30 ohm-meters). Thus the possibility of sulfides here is much greater than in any of the other anomalies.

The magnetics in the area are not well defined but there does appear to be a high near the geochem anomaly (about 2S over background).

Recommendations and Conclusions

Four interesting anomalies have been defined by the geochemistry. These should be laid out for greater detail work by IP, EM-16, magnetometer and geochemistry before any drilling is attempted.

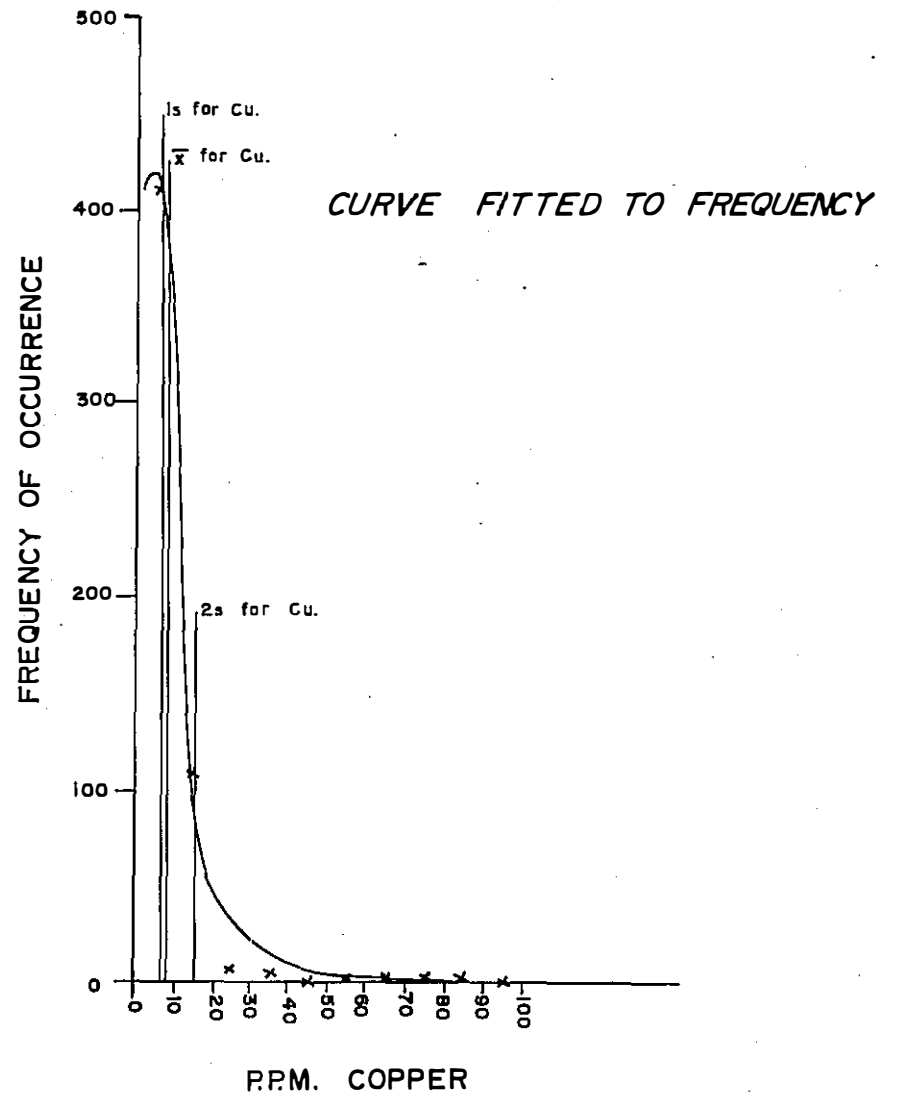
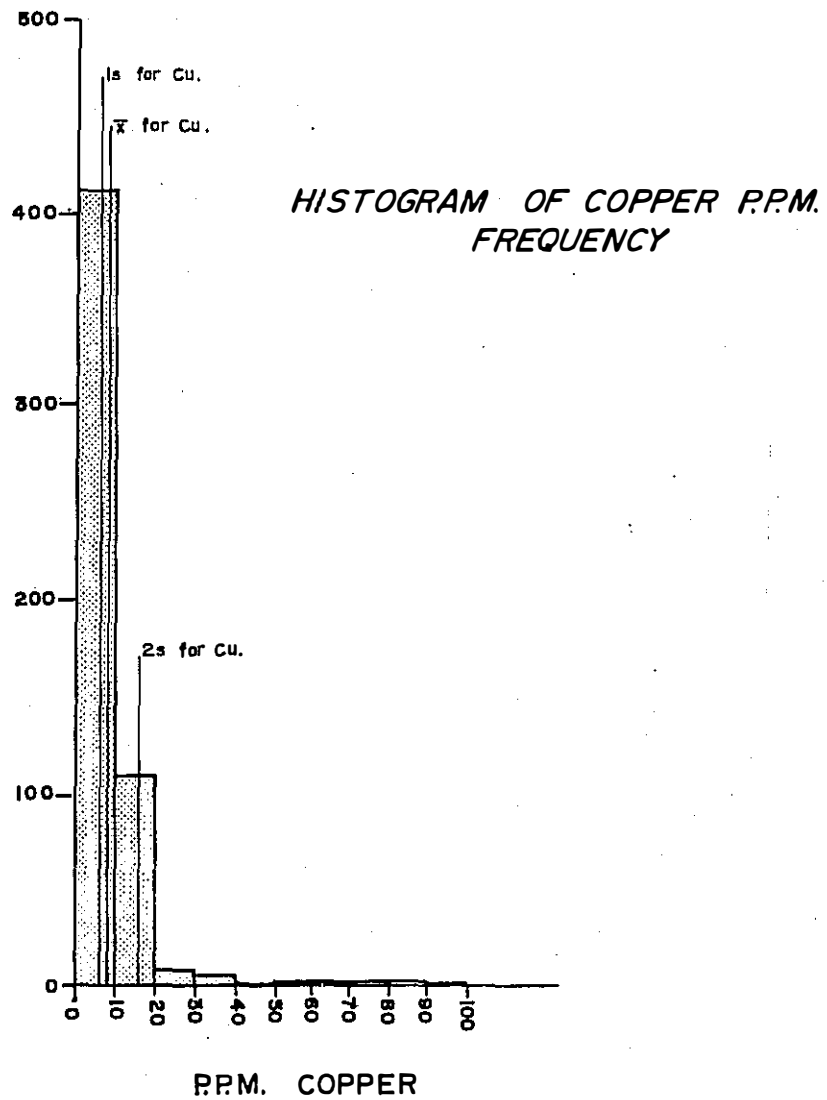
Geophysics should be done on lines 200' apart and with 100' and 200' electrode spacings. The magnetics and EM-16 should be run on all lines over the anomalies to define contacts better. The geochemistry should be done at 100' x 200' spacings to define the anomalies.

It appears that there is a chance for finding siliceous skarn type mineralization in the Best Chance Grid area. The IP may eliminate Zones B and C due to lack of sulfides, but Zones A and D appear to have a good chance of having sulfides. Considering the till thickness and pH it is suggested that these anomalies (A and D) are very significant and warrant further investigation.

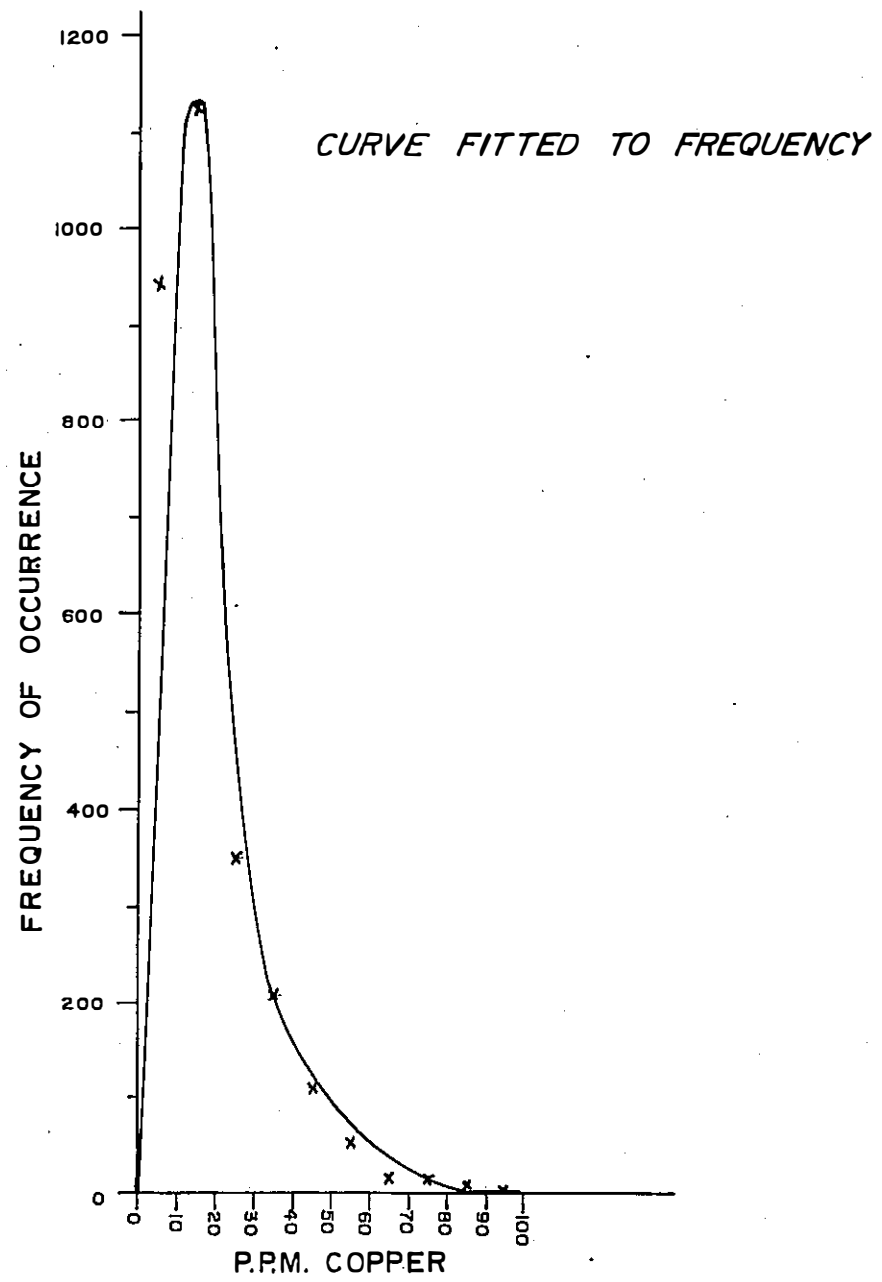
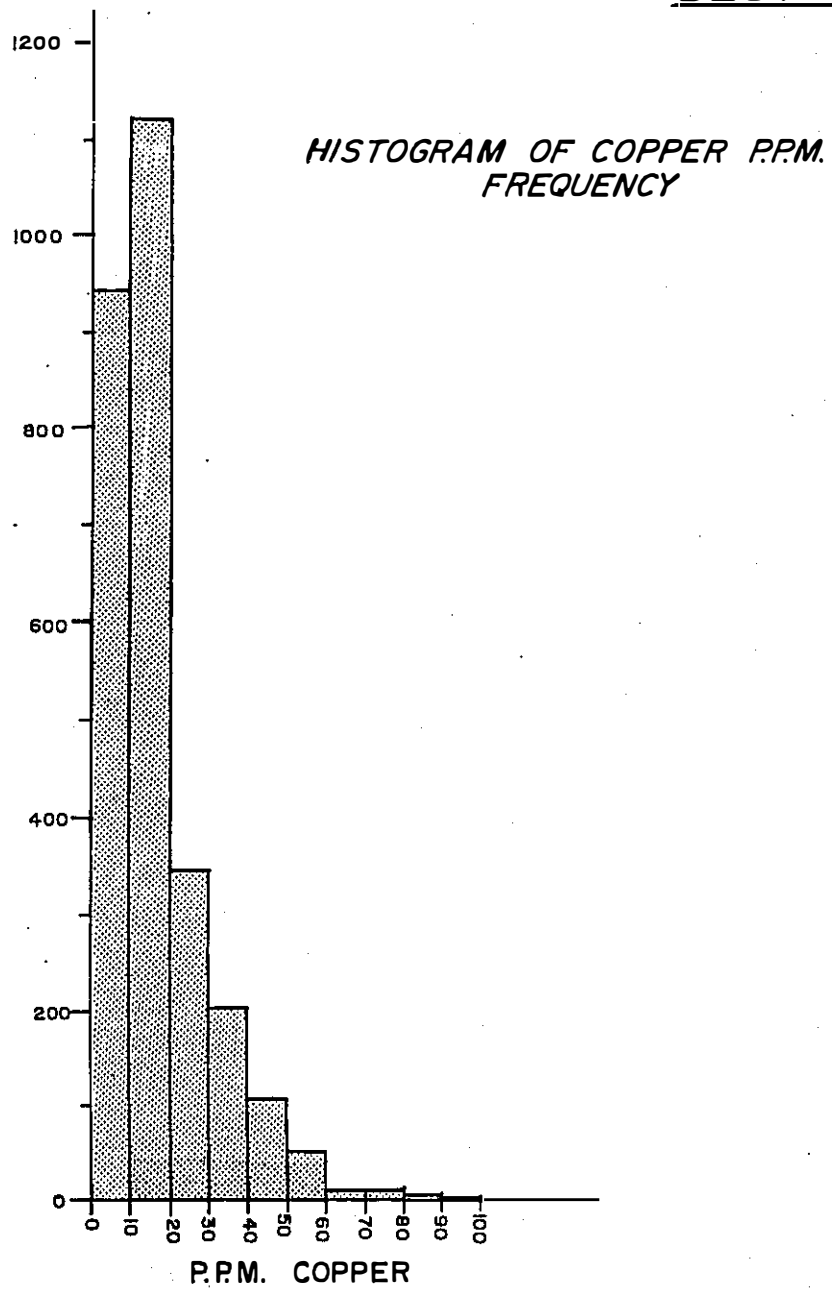
APPENDIX C

HISTOGRAM AND CHARTS

BEAR CUB AREA



BEST CHANCE



COWLEY PARK

