REPORT ON THE
COMBINED AIRBORNE MAGNETIC
AND ELECTROMAGNETIC SURVEY
QUEST LAKE CLAIM GROUP
PATRICIA MINING DIVISION, ONTARIO
FOR
ARCTIC YELLOWKNIFE MINES LIMITED
1. INTRODUCTION

During December, 1969, a combined airborne magnetic and electromagnetic survey was carried out on the Quest Lake Claim Group, Patricia Mining Division, Ontario, for Arctic Yellowknife Mines Limited.

The purpose of the survey was to map any anomalous electromagnetic and/or magnetic responses that might be indicative of the presence of base metal sulphide mineral deposits.

2. SURVEY DETAILS

The area surveyed is located between Princess Lake and Quest Lake approximately 20 miles due south of Savant Lake Station on the CNR.

The flight lines are oriented east-west and a flight line interval of 1/8 mile was maintained throughout. A total of 39.7 line miles of airborne survey was carried out, of which 10.0 line miles lie within the boundary of the Arctic Yellowknife Mines Limited claim group. A standard terrain clearance of 450
feet was maintained wherever topographic conditions permitted.

The electromagnetic and magnetic system employed in carrying out the survey is described in the notes preceding this report.

3. PRESENTATION OF RESULTS

The results of the combined electromagnetic and magnetic survey are shown on the accompanying map AE7004, at a scale of one inch equals 1,320 feet in the standard manner described in the notes preceding this report and indicated in the legend. Line-to-line correlation of conductor axes has been indicated and anomalies of particular interest indicated by a star. A corresponding map AM7005 is a contoured presentation of the total magnetic intensities with a contour interval of 20 gammas.

Based upon the information supplied by Arctic Yellowknife Mines Limited, the contiguous claim group of 20 claims has been indicated in Figure 1 as well as the outside boundary being indicated on maps AE7004 and AM7005.

4. REGIONAL GEOLOGY

The geology of the area surveyed is covered by Ontario Department of Mines preliminary geology map P353, Minnitaki-Sturgeon Lakes sheet. Based upon this map, the Quest Lake claim group is mainly underlain by metasedimentary rocks (conglomerate, arkose, greywacke, siltstone, argillite, phyllite, slate, and derived schists). A narrow belt of basic and ultrabasic igneous rocks trends approximately north-south along
the extreme western boundary of the claim group. Syenitic rocks and basic metavolcanic rocks are located in the extreme northwest and northeast portions respectively of the survey area.

Regional magnetic coverage of the area is provided by GSC Aeromagnetic Map 1117G Bell Lake. These results indicate that the Quest Lake claim group is located on the northeast slope of a distinct magnetic low feature located just north of Quest Lake. A magnetic high of moderate magnitude is located due west of Princess Lake which would lie outside of the Arctic Yellowknife Mines Limited claim group.

5. DISCUSSION OF RESULTS

The contoured magnetic results are limited to the area of the Arctic Yellowknife Mines Limited claims and correlate with the government maps. Lower values of magnetic response trend northeast-southwest through the claim group with areas of higher response in the northwest and southeast corners.

Several anomalous EM responses have been indicated, some of which warrant further investigation on the ground. The more interesting are as follows:

**Zone #1**

These two "A" category EM responses of good magnitude and conductivity are located within the metasediments. They correlate with a distinct magnetic high feature and further work is warranted.
Zone #2

These "B" and "A" category EM responses may correlate with Zone #1 forming a continuous trend. They are associated with a magnetic high and further investigation on the ground is warranted.

Zone #3

Forming two near parallel linear s on either side of a narrow lake immediately east of the Arctic Yellowknife Mines Limited claims, this zone of "C" and "D" category EM responses may represent a single broad conductive source. The eastern of the two anomalous linear s appears to lie on the western flank of the same magnetic feature associated with Zone #1 and Zone #2. The anomalies on Line 20 at fiducial 2009 and on Line 19 at fiducial 2315 are particularly interesting since they are associated with an isolated magnetic high. Further investigation on the ground is warranted.

Zone #4

This zone of multiple, near parallel, short EM anomalies is located within the Quest Lake claim group in the metasediments immediately to the east of the ultrabasic intrusives. Although only of moderate magnitude, they exhibit good conductivity ratios and further investigation on the ground is warranted.

Zone #5

This zone of "C" category EM responses of moderate magnitude and good conductivity ratio lies within, and follows the trend of, the gabbro, metagabbro, and metadiorite rocks. Further investigation on the
Zone #6

This zone of "B" and "C" category EM responses lies along the western contact of the basic and ultrabasic rocks and may be related to Zone #5. The largest magnitude response occurs on Line 29 and Line 30 with good conductivity ratios indicated. Further investigation on the ground is warranted.

Zone #7

These two "C" category EM responses of moderate magnitude and good conductivity ratio are located within the metavolcanics. Further ground followup would be warranted.

6. SUMMARY AND CONCLUSIONS

The results of the combined airborne magnetic and electromagnetic survey have indicated seven zones of particular interest on which further work is warranted in the form of ground followup. Zone #4 and Zone #5 lie within the boundaries of the Arctic Yellowknife Mines Limited claim group. Portions of Zone #2 and Zone #6 may lie within, or on the boundary of, the claim group.

Dated: February 17, 1970.
A. Equipment

The electromagnetic and magnetic units are the primary instruments used in the McPhar combined survey system which is designed for use in a de Havilland DHC-2 Beaver aircraft. Ancillary equipment consists of a radio altimeter, a frame camera, an intervalometer-fiducial numbering system and a light beam recorder.

1) F-400 Electromagnetic Unit

The F-400 is a sequential dual frequency unit (340 Hz and 1070 Hz) that measures the quadrature response of a conductor. In the absence of a conductor the quadrature response is zero. Two iron cored coils mounted beneath the wings of the aircraft are used to create the primary field which is essentially a forward pointing dipole. A 450 foot cable is used to tow a receiver bird and gives a transmitter-receiver separation of approximately 400 feet. The dipole of the receiver system is vertical and flown in the proper position to be maximum coupled to the primary field. Thus the coil configuration can be designated as an X-Z
skew system which is flown In-Line. Sequential dual-frequency EM operation is employed together with time sharing for a proton magnetometer. The cycle consists of one third second at each frequency and one third magnetic readout. The quadrature response at each frequency is recorded on two channels of the recorder.

II) Proton Magnetometer

A Varian V-4937, airborne proton free precession magnetometer is used to record the variations in the earth's magnetic field. The sensing head of this unit is conveniently mounted inside the port wing tip. This instrument has a sensitivity of 1 gamma when pulsed at 1 second intervals or 2 gamma when more frequent readings are required. The proton magnetometer has the advantage of reading the absolute value of the earth's magnetic field and is almost completely free of drift or variations due to temperature or environmental changes. The magnetic data is recorded on the same trace as the electromagnetic response for ease of correlation.

III) Ancillary Equipment

A Bonzer doppler radio altimeter provides a continuous ground clearance profile. Flight path coverage is obtained by a frame camera driven by the intervalometer-fiducial unit which synchronizes the individual frames with the time events on the recorder. At the standard flying height of 450 feet the camera is programmed to provide 20%
overlap on each frame, which results in a continuous record of the flight path. At greater heights, there is proportionally more overlap.

B. DATA RECORDING & COMPILATION

A light-beam recorder employing a photo-sensitive paper is used to record the data. High-sensitivity galvanometers give almost instantaneous response to the incoming signals and the recorder time log is essentially zero. The recorder normally employed is the Century 444 six channel recorder.

With the actual flight record oriented so that the fiducial numbers increase from left to right, the 3.5 inch trace width has been divided into 100 units with zero at the bottom and 100 at the top. Fifty horizontal grid lines are used to mark 2 unit intervals. The ten unit intervals are indicated by the thicker grid lines. Except where noted on individual records the traces are identified as follows:

1) 340 & 1070 Hz Quadrature EM Response

These two primary information traces are centred at 20 and 40 units respectively. Upward excursions represent positive quadrature response, which is normally indicative of the presence of conductors. Negative deflections usually have no interpretational significance.

The equipment may be flown at sensitivity settings of 5 ppt, 10 ppt or 20 ppt as indicated by the local geology and topography. Nor-
mally a 10 ppt setting is employed where ppt represents parts per
thousand in terms of the primary field strength at the receiver.
Anomalies of 1000 ppm or 1 ppt are easily recognized in most condi-
tions. The sensitivity settings are recorded by the operator on the
Flight Report and should be noted prior to referring to the actual data
strips.

The ratio of the amplitude of the response at the two
frequencies is characteristic of the "apparent conductivity" (i.e.
size, conductivity-product) of the disturbing body; poor conductors
display LO/Hi ratios of 1.0 or less while good to excellent conductors
have ratios greater than 1.0.

II) Magnetometer

Positive magnetic anomalies (i.e. increase in magnetic
field strength) are indicated by upward excursions. The magnetic field
is sampled at intervals of approximately 1 second. The observed value
of the total magnetic field is then written out on two scales; the 2000 gamma
scale for 250 milliseconds followed by the 200 gamma scale for 750 milli-
seconds.

The absolute value of the magnetic field is a five digit
number; the first three of these are set on the zero line and recorded by
the operator at the beginning of each flight. The 2000 gamma scale
(coarse scale) is recorded in ten steps of 200 gammas (adjusted to the
10 unit lines) covering the entire 100 units; strong anomalies can be easily
traced by the short bars that occur on the record. Full scale deflection (i.e. 0 to 100 units) is adjusted to 200 gammas for the fine scale which is recorded as a longer bar. Thus the absolute value of the magnetic field may be read from the trace to an accuracy of 2 gammas.

III) Fiducials

Fiducials are shown in one of two ways and coincide with the shutter opening of the frame camera. Usually the fiducials appear as vertical lines on the trace. Occasionally these are supplemented by an interrupted galvanometer centred near 90 units, these interruptions correspond with the vertical fiducial lines.

IV) Altimeter

The altimeter scale is non-linear and a calibration scale is recorded periodically on the data strips.

Uncontrolled airphoto mosaics usually serve as the base maps for flying the survey and for compilation of the geophysical data. A common scale is 1/4 mile (i.e. 1320 feet) per inch.

Flight lines are oriented perpendicular to the direction of the expected strike of the target, except in special cases where detail is required in the orthogonal direction.

Copies of the photo mosaic are given to the flight crew with intended flight lines indicated and numbered. Navigation along these lines is done visually from the physical features of the area. The air-
Craft is flown with a terrain clearance of 450 feet or, in rough terrain, at the lowest altitude that is judged feasible for safe operation.

Flight path is recovered from the film as compared to the photo mosaic. Identifiable points are marked on the mosaic and designated by the fiducial numbers which synchronize the camera and the recorder.

C. DATA PRESENTATION

1) F-400 Dual Frequency EM Results

Electromagnetic anomalies result from areas on, or in, the ground which are electrical conductors. Geological sources of conductivity include sulphide mineralization, graphitic formations and fault or shear zones which often contain electrolytes. Other sources of conductivity include poorly conductive surficial materials such as saline waters, swamps and wet clays. The surficial anomalies sometimes extend over large areas and may obscure responses from underlying mineralized zones.

The presentation used on the plan maps has been developed to show the three primary characteristics of each individual response. This is accomplished by the numerals and letters adjacent to each anomaly symbol. For most purposes these characteristics are sufficient to describe the anomaly but for detailed interpretation it is best to study the actual flight trace.
a) **Shape**

The letters A, B, C and D are used to indicate the recorded shape of the EM response which approximates one of the following curve types. Often, to simplify presentation, the shape is indicated by symbols as shown in the legend of the plan map.

![Shape Diagram]

b) **Amplitude**

The amplitude of the peak response at 340 Hz is shown in parts per thousand (ppt). Although various sensitivity settings may be used, resulting in various amounts of deflection on the trace representing one ppt, the amplitude indicated on the map is always in units of parts per thousand.

c) **Apparent Conductivity Ratio**

The ratio of the response at 340 Hz compared to the response at 1070 Hz is shown as the third parameter. Generally ratios less than 1.0 indicate poor conductivity while those greater than 1.0 indicate good to excellent conductivity. However, it should be noted that this ratio is a measure of the "apparent conductivity" and varies with the product of the size and conductivity, where the size is usually a squared function. The significance of the calculated ratio is obviously dependent upon the ampli-
tude of the response, with the reliability decreasing with very small amplitudes.

d) Evaluation

The response obtained from a conductive body is influenced by a variety of factors which include conductivity, permeability, size, depth, attitude of the body. In addition to the frequencies used, geometry and the angle of attack are also important variables. Consequently, the amplitude and shape of the response cannot be regarded as absolute interpretational gradings or classifications. However, they do have interpretational value as illustrated in the following examples.

i) A vertical sheet of highly conductive material (such as a vein of massive sulphides), striking perpendicular to the flight line, would give rise to a strong, sharp response with a high conductivity ratio. A typical characteristic would be: A, 15, 1.8.

ii) As the angle of attack decreased, the shape of the response from a vertical sheet would change from A to B to C; the magnitude of response could increase while the ratio may decrease (i.e. C, 20, 1.2).

iii) An extensive flat horizontal sheet will show a response similar to C or D. The amplitude and "apparent conductivity" will be a function of the size-conductivity product and can vary over a wide range. A typical response from poorly conductive overburden would be: D, 20, 0.4.
Because of the large number of parameters that influence EM response, the anomalies obtained from airborne surveys should be evaluated in the light of all geological, geophysical and physiographical data before embarking on field investigations and follow-up work.

II) Magnetic Results

In the standard presentation of the combined electromagnetic and magnetic survey results, the location and amplitude of magnetic highs which appear to be related to electromagnetic features are indicated on the plan map as illustrated in the legend. This is usually done in the form of a cross line which indicates the location of the peak (direct correlation or flank correlation) and the value of the amplitude of the response in gammas.

In some cases, it may be of value to present all the magnetic data in contour form. These contours represent lines of equal intensity of the earth's magnetic field and are termed 'isogams'.
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TECHNICAL ASSESSMENT WORK CREDITS

Recorder Holder: Mr. Ross Kidd
Township or Area: Quest Lake Area

Type of Survey and number of Assessment Days Credits per claim:

**GEOPHYSICAL**
- Airborne: 20 days
- Ground: [ ]

**Magnetometer** - 20 days
**Electromagnetic** - 20 days
**Radiometric** - [ ] days

**GEOLOGICAL** - [ ] days

**GEOCHEMICAL** - [ ] days

**SECTION 84 (14)** - [ ] days

**Special Provision** - [ ]
**Man days** - [ ]

NOTICE OF INTENT TO BE ISSUED:

☐ Credits have been reduced because of partial coverage of claims.
☐ Credits have been reduced because of corrections to work dates and figures of applicant.
☐ NO CREDITS have been allowed for the following mining claims as they were not sufficiently covered by the survey:

PA. 243873 to 92 Inclusive

The Mining Records may reduce the above credits if necessary in order that the total number of approved assessment days recorded on each claim does not exceed the maximum allowed as follows: Geophysical – 80; Geological – 40; Geochemical – 40;
February 5th, 1971.

Mr. W.A. Buchan,
Mining Recorder,
Court House,
Sioux Lookout, Ontario.

Re: Mining Claim No. PA. 243873 et al,
Quest Lake Area

Dear Sir:

The Geophysical (Electromagnetic) assessment work credits as shown on the attached list have been approved as of the date above. Please inform the recorded holder and so indicate on your records.

Yours very truly,

Fred W. Matthews,
Supervisor,
Projects Section.

c.c. Mr. Ross Kidd,
81 Highbourne Rd.,
Toronto, Ontario.

c.c. McPhar Geophysics Ltd.,
139 Bond Avenue,
Don Mills, Ontario.

c.c. Mr. H.L. King,
Resident Geologist,
808 Robertson St.,
Kenora, Ontario.

FWM/mr
ARCTIC YELLOWKNIFE MINES LTD.

QUEST LAKE CLAIM GROUP, PATRICIA M.D. ONTARIO

SCALE: 1" = 40 CHAINS.
SEE ACCOMPANYING MAP(S) IDENTIFIED AS 52G/15NE-0022.*1

*2

LOCATED IN THE MAP CHANNEL IN THE FOLLOWING SEQUENCE (X)