A GEOPHYSICAL REPORT
ON THE
DOROTHY CLAIMS
"3.

OMINECA MINING DIVISION
$55^{\circ} 126^{\circ} S E$
50 MILES NORTHEAST OF SMITHERS, B_C.

FOR


TWIN PEAK MINES LIMITED
AND
DUCANEX RESOURCES LIMITED

BY
R. W. WOOLVERTON, P. ENG.

EVERGREEN EXPLORATIONS LTD.
BETWEEN
AUGUST 1 AND OCTOBER 15, 1970

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## APPENDICES

## 1 MAGNETOMETER SPECIFICATIONS

II DECLARATION OF EXPENDITURES

## INTRODUCTION

LOCATION

The Dorothy Group lies on the east side of the Hautete Valley about 6 miles northwest of Natowite Lake and about 50 miles northeast of Smithers, B. C. The claim group is most easily reached by float plane from Tyhee (Maclure) Lake near Telkwa to one of several small lakes adjacent to the claims. The nearest road is a jeep access road from Hatchery Arm on Babine Lake to Nakinilerak Lake about 8 miles northwest of the claim group.

Maximum relief on the claims is about 500 ft . Bedrock is locally exposed on the ridges but otherwise the overburden is quite extensive. The undergrowth is relatively thick among the balsam and hemlock. Some areas are swampy, particularly along the edges of the smaller lakes.

## AIM OF PROGRAM

The tertiary porphyry copper deposits of the Babine Camp characteristically contain varying amounts of disseminated magnetite associated with biotite alteration of the host pluton. Both the Newman and Morrison deposits were test flown by the writer in 1969 using a helicopter-mounted Gulf Mark III (Lockwood) magnetometer. Mag highs

were located in both cases; however, the Government high level aeromag maps ( $7,000 \mathrm{ft}$. terrain clearance) are relatively featureless around these deposits.

Following a structural analysis of the Babine Camp, a zone of possible interest was selected lying southeasterly from Noranda's porphyry copper deposit at Nakinilerak Lake, about 20 miles north of the current development of their Bell Copper Division on Newman Peninsula in Babine Lake. A helicopter-mounted aeromagnetic survey of this zone was planned. Subsequently, however, the Government announced the pending release of high level aeromagnetic sheets for the area. Consequently, the Dorothy Claims, which are the subject of this report, were staked over those areas which were structurally most appealing.

During the late summer and fall of 1970, about 418 line miles of helicopter aeromagnetic surveying was completed and is the subject of this report.

## GEOPHYSICS

## AIRBORNE MAGNETOMETER SURVEY

## EQUIPMENT AND SURVEY

An Elsec (Type 592) Proton Precession Magnetometer (for specifications, please refer to Appendix I), was mounted in an Alpine Helicopters' Bell G-3B helicopter. The sensing head for the magnetometer was mounted in a bird and towed below the helicopter on a 50 ft . rope. The hellcopter was flown at about $60 \mathrm{~m} . \mathrm{p} . \mathrm{h}$. with the bird height maintained where possible at about 150 ft . above mean terrain. Readings from the magnetometer were automatically recorded on a Bausch and Lomb continuous chart recorder.

Approximately parallel east-west lines were flown about $1 / 4$ of a mile apart. Fill-in flight lines at $1 / 8$ of a mile spacing were planned over anomalous areas but were found to be unnecessary in most cases. A photo mosaic was used for navigating. When a recognizable feature, such as a swamp or lake was flown over, it was located on the mag tapes by the operator triggering an event marker and then numbering both the resulting identity (fiducial) point on the mag tape and the recognizable feature on the mosaic. A one second polarization time for the magnetometer was used so that at an air speed of $60 \mathrm{~m} . \mathrm{p} . \mathrm{h} .$, readings were recorded at ground intervals of about 100 ft .

The equipment was operated by the writer and the data was reduced and drafted by Versatile Drafting Ltd., Smithers, B. C. The Government haif-mile topographic series were enlarged to quarter-mile scale and each identity (fiducial) point was replotted from the photo mosaic on to this base map. Where the location of fiducial points are questionable, dashed flight lines have been plotted.

RESULTS

Two contour maps, a north sheet and a south sheet, at $]^{11}$ to $1 / 4$ mile showing the variations in the earth's magnetic field recorded by the survey, are enclosed in the pocket of this report. The contour interval of this map is 100 gammas. Several features stand out above the 1,000 gamma general background.

Of economic significance is the 2500 gamma high (or 1500 gamma anomaly) near the west side of the central portion of the map, which is the magnetic expression of Noranda's Nakinilerak deposit. The smaller 1300 gamma mag high ( 300 gamma anomaly) 2 miles north of the Nakinilerak anomaly, may also reflect a porphyry environment.

The extreme magnetic complex in the north central portion of the survey area is probably part of a regional geological change, such as a tongue of the Omineca Batholith. If this is the case, the edge of this complex would be worthy of ground prospecting. The 2400 gamma high immediately southeast of the centre of the map sheet and northeast
of the Dorothy Group is also probably formational. Columnar-jointed, dark-colored outcrops within this mag high were noted by the writer during the survey suggesting the presence of upper tertiary volcanics.

The Dorothy Group approximately covers the most complex magnetic trend within the survey area. Much of this magnetic activity could be attributed to formational features; however, the 400 to 500 gamma anomaly partially covered by Dorothy 111, 112, 136 and 186 claims and the magnetic complex on Dorothy 102, 103, 125, and 126 claims may be expressions of porphyry mineralization.

## CONCLUSIONS AND RECOMMENDATIONS

The Dorothy Group covers a structurally significant area of the Babine porphyry copper camp. Three magnetic anomalies within the claim group may reflect porphyry mineralization and should be investigated further by ground geophysical surveys. A ground magnetometer and soil sampling survey and geological mapping of the claim group followed by an induced polarization survey of the most interesting areas would adequately test its economic potential.

The 1300 gamma magnetic feature 2 miles north of the Nakinilerak deposit should be staked as a potential porphyry environment. This anomaly should also be tested by ground magnetics, solls, and geological mapping with follow-up I.P. if warranted.

The borders of the regional magnetic complex in the north central portion of the map sheet warrant investigating for possible Craigmont-type mineralization. If the cover is fairly shallow, a helicopter mag EM survey should be flown over the mag complex.

Respectfully submitted,
R. W. WOOLVERTON, P. ENG.

## APPENDIX I

## MAGNETOMETER SPECIFICATIONS

- R. WOOLVERTON GEOLOGIST, P.ENG.
- R. C. O'BRIEN FIELD SUPERVISOR
- JOHN C. OSWALD \& CO., C.A.'s ACCOUNTANTS:

635 - 789 W. PENDER ST.
VANCOUVER 1, B.C., CANADA

CONTRACT EXPLORATION
$\omega 5424$ HALIFAX ST., BURNABY 2, B.C., CANADA, PHONE - 299-6998
๓P.O. BOX 604, SMITHERS, B.C., CANADA PHONE - 847-3523

Two additional techniques have been added to our exploration services in the Smithers area.

AIRBORNE MAGNETOMETER

The ELSEC PROTON PRECESSION (Type 592-F.S.) magnetometer measures the total magnetic field to better than one part in 100,000 . It can be used in either a helicopter or light aircraft. At a flying speed of 60 mph and using a one second polarization time, readings are recorded automatically on a Bausch and Lomb continuous chart recorder at ground intervals of approximately 100 feet. Ground location points are visually located by the operator, plotted on a photo or map, and located on the mag tapes by an event marker. For low level helicopter surveys photo mosaics are desirable. 'Data reduction and interpretation can also be provided.

Spocification \& Operating Instructions

## PROTON MACNETOMETER

Typo 592/J

Tho Littlomoro Scientific Enginocring Company,
Railway Lane, Litthemore, OXFORD.
Telophone: Oxford 78563 Cables: ELSEC, Oxford, U.K.


Dimensions of instrument without batteries:
Dimensions of instrument with standard battery pack in carrying case:
$13^{\prime \prime}$ wide $\times 43^{\prime \prime}$ deep $\times 8 \frac{3}{4}$ high。
$13 \frac{1}{2}$ " wide $\times 5 \frac{1}{2}$ " deep $\times 14^{\prime \prime}$ high.

Top panel Light Grey stove enamel. Cover box Hammer Grey stove enamel. All water-proofed and contained in a brown leather case with lock and key.
$-10^{\circ}$. C. to $+40^{\circ} \mathrm{C}$.

- DETECTOR BOTTLE (STANDARD)

Dimensions: $\quad 5 \frac{1}{2} " \times 3 \frac{1}{2}$ " diameter
Welght: $\quad 5 \frac{1}{2} \mathrm{lbs}$.
Connected to Control Panel of instrument by up to 200 ft . Coaxial Cable.
Freezing point of detector fluid: $-70^{\circ} \mathrm{C}$.

Maximum heading errox: $\quad 1 \gamma-$ type MS

## DETECTOR BOTTLE ("FAST")

This is advised for repetition rates faster than 1 per two seconds, and is only supplied on special request. It can also be used for slower rates, but the highest sensitivity is not then available.

Dimensions, weight and cable details are as for the standard detector bottle.

Freezing point of detector fluid: $-20^{\circ} \mathrm{C}$.

Maximum heading error: $\quad 1 \gamma$ - type MF
Note: Type MS detectors are supplied as standard unless another type is specified by the customer.
Special Note For simplicity, Sections I - III and Section VI of thas
handbook have been written for manual operation and a
count duration of 1024 proton pulses (i。o. with lower part
of concentric switch, $S 3$, set to "F" and upper part to

count durations is described in Sections IV and $V$.

## I INTRODUCTION

The ELSEC Proton Magnetometer type 592;J has been designed for measuring the total magnetic field to better than 1 part in 100,000 over the entire range of field strengths normally found on the earth's surface. The instrument itself measures the total magnetic - vector; but when utilized in conjunction with Heimholtz coils the indavidual components may be determined.

The instrument is transistorised throughout and is arranged in package form for easy maintenance. The power supply is normally provided by an accumulator pack which fixes to the bottom of the instrument. This standard instrument plus accumulators is supplied in a stout leather case with carrying strap. However, any external supply (two 6 volt batteries or one 12 volt battery) may be plugged into the instrument if this is desired.

## II PRINCIPLE OF OPERATION

The purpose of a magnetometer is to measure 'magnetic intensity ${ }^{\dagger}$ and for some applications an accuracy approaching 1 part. in 50,000 is required. The magnetic intensity at any point may best be - visualised as the force (strictly the torque) which tends to turn a magnetized needle placed at that point into line with the magnetic direction. A conventional magnetometer consists of just such a needle and with a delicately constructed instrument the necessary accuracy can be achieved. However, such an instrument requires levelling before making each measurement and the speed of operation attainable is consequently rather limited. The proton magnetometer, on the other hand,
requires no such setting up and, its incomparably greater speed leaves no doubt of its superiority for geological and archaeological surveying.

The proton is an elementary particle identical with the nucleus of the hydrogen atom. Its behaviour in the proton magnetometer can be understood by regarding it as a tiny bar magnet spinning rapidly about its longitudinal axis; it therefore has the properties of both a magnetısed needle and a gyroscope. Because of the former it tries to point along the lines of force, but its gyroscopic property prevents this temporarily and it performs gyrations while in the gradual process of achieving this direction. These gyrations are similar to those of a spinning top under the influence of gravity. The important thing is that the speed of gyration (or frequency of precession) is exactly proportional to the magnetic intensity. This frequency is about 2000 gyrations per second for an intensity of 48,000 gamma. For example; if it is exactly $2000,00 \mathrm{c} / \mathrm{s}$ at one measuring station, then at another station where the magnetic intensity is higher by 1 gamma the precession frequency there wiil be $2000.04 \mathrm{c} / \mathrm{s}$.

Since hydrogen is a constituent part of water and organic liquids a large number of protons (about $10^{25}$ ) are conveniently obtainedin a quarter-pint bottle and this forms the detecting element. The gyrating protons induce an e.m.f. of about a microvolt in a coil wound around the bottle and this e.m.f. is passed to the instrument for amplification and frequency measurement. The gyrating protons will only induce an e.m.f. if there is a preferred phase and this is obtained by preceding each measurement by a polarizing period (autcmatically sequenced after pressing the start button), During this period a current of an amp is passed through the measuring coil thereby creating a magnetic field of several hundred gauss along its axis, and this produces a net proton magnetic moment in that direction; when the polarizing current is cut off the gyration of these protons en masse induce the detectable e.m.f. already mentioned. The axis of the coil should be very roughly East-West.

The proton magnetic moment builds up to saturation in about 5 seconds of polarisation. During the subsequent gyrations the protons gradually get out of phase and the induced e.m.f. decays away also in about 5 seconds. Strong magnetic gradients (100 gamma per foot and upwards) cut down this decay ime seriously and because of this possibility the frequency measurement is made within the first second of gyration.

After selective amplification (see Fig.1) the signal is squared and then frequency-divided by 1024 (10 binary stages). The resultant square wave is used to open and close a gate, which once closed remains locked untal the 'START' button is next pressed. When the gate is open the output of a $100 \mathrm{kc} / \mathrm{s}$ crystal-controlled osciliator is allowed through to the decade chain and the final states of the five decade units, shown on the respective meters, indicate the number of oscillator cycles occurring during 1024 gyrations.

The only action required of the operator is to press a push button momentarily; the polarizing period is automatically sequenced and after about 5 seconds the meters indicate a five figure number which is a measure of the magnetic intensity wherever the water-bottle is placed. The magnetic intensity equals $\frac{24051.1}{m e t e r} \operatorname{com}$ oersted. For most uses it is more convenient to know the field intensity increase that corresponds to a decrease of 1 unit on the most sensitive meter. This is easily worked out; typical values are:-
$\mathrm{H}=0.6$ oersted, 1 unit $\equiv 1.5$ gamma
$\mathrm{H}=0.5$ oersted, 1 unit $\equiv 1.04$ gamma
$H=0.24$ oersteds 1 unit $\equiv 0.24$ gamma
Electrical power is obtained from an 8 ampere-hour 12 volt accumulator and this lasts for 12 hours continuous operation and up to 4000 polarisations before recharging is necessary. Recharging can be done either from a 12 volt car battery or indirectly from the mains.


Fig 1. MAGNETOMETER BLOCK DIAGRAM.


Fig 3. SENSITIVITY VS INTENSITY FOR DIFFERENT COUNT DUFATIONS.


Fig 4. ESTIMATED TOLERABLE EXTERNAL GRADIENT.


(Range reters to setting of CTl. the rigint hand tuning centrel)


E SEC S/N 294 :- Fine tuning ior Botile (CT3) the chart shows the optimum setting of CT 3 for various proton counts. Accurate measurements will be obtained as long as the setting ts within 2 or 3 positions of optimum. "Range* refers to the setting of CTI.


APPENDIX II

DECLARATION OF EXPENDITURES

## SUMMARY OF EXPENSES

Alpine Helicopters Ltd., August Invoice ..... \$2,295.83
1 11 * October Invoice ..... 525.00
" " " November Invoice ..... 907.50
Evergreen Explorations Ltd., January Invoice 418 line mfles at $\$ 10 / 1$ ine mile ..... 4,180.00
Data reduction, mosaic preparation, and report ..... 1,500.00TOTAL\$9,408.33

EVERGREEN EXPLORATION LTD..
$635-789$ WEST RENDER ST." VANCOUVER 1, B.C.
invoice $\therefore \quad \leqslant 1902$
Date AUGUST 12; 1970
contract no: K800
Work order no.:

TO: CHARGE FOR HIRE OF BELL 47G3B HELICOPTER IN THE HOUSTON AREA

| CF-NOR | AUG. 3/70 | FLIGHT REPORT NO. 3375 | $6: 30 \mathrm{hr} .$. |
| :--- | :--- | :--- | :--- |
| CF -NOB | AUG. $6 / 70$ | FLIGHT REPORT NO. 2977 | $9: 20 \mathrm{r}$ |
|  |  |  | $15: 50 \mathrm{hrs}$. |

$15 \mathrm{hrs}$..50 mins.e $\$ 145.00$ per $\mathrm{hr} . \mathrm{i} \$ 2,295.83$

TOTAL AMOUNT DUE THIS INVOICE
$\$ 2,295.83$

AL: + COUNTS PAYABLE WITHIN $15+Y$ OF INVOICE DATE.

$d 9^{*}(19)^{629}$



EVERGREEN EXPLORATION LTD.,
c/O JOHN C. OSWALD, 635 - 789 W . SENDER ST., VANCOUVER 1, B.C.

Invoice No: K 2077
Date: OCTOBER 21, 1970
contract No: K800
Work Order no

## TO: CHARGE FOR HIRE OF BELL 47G3Bl HELICOPTER IN THE HOUSTON AREA

| CF-RZT | OCT.6/70 | FLIGHT REPORT NO. 3072 | $6: 20 \mathrm{hrs}$. |
| :--- | :--- | :--- | :--- |
| CF-RZT | OCT.7/70 | FLIGHT REPORT NO. 3073 | $6: 55 \mathrm{hrs}$. |
|  |  |  | $13: 15 \mathrm{hrs}$. |

$13 \mathrm{hrs}$..15 mins . $\$ 140.00$ per hr .

TOTAL AMOUNT DUE THIS INVOICE
$\$ 1,855.00$


## HELCOP苜ERS LTD

POO. BOX ZOE. KELOWNA, BRITISH COLUMBIA

EVERGREEN EXPLORATION LTD. C/O JOHN OSWALD CO.. 635-789 W. PENDER STREET, VANCOUVER 1;'B.C.
invoice No: K 2112
DATE: NOVEMBER 24, 1970
CONtRACt NO.K800
WORK ORDER NO.:

$\square$
TO: CHARGE FOR HIRE OF BELL 47G3B1: HELICOPTER IN THE HOUSTON AREA

CF-RZT OCT.18/70 FLIGHT REPORT NO. $3287 \quad 5: 30 \mathrm{hrs}$.
5 hrs. . 30 ming. a $\$ 140.00$ per hr.
$\$ 770.00$


6 hrs. . 55 ming. e $\$ 150.00$ per hr.

$$
1,037.50
$$

$\$ 1,807.50$

TOTAL AMOUNT DUE THIS INVOICE
$\$ 1,807.50$



- R. WOOLVERTON GEOLOGIST, P.ENG.
- R. C. O'BRIEN FIELD SUPERVISOR
- JOHN C. OSWALD \& CO., C.A.'s ACCOUNTANTS:

635 - 789 W. PENDER ST.
Vancouver 1, B.c., CANADA

## CONTRACT EXPLORATION

- 5424 HALJFAX ST., BURNABY 2, B.C., CANADA, PHONE - $299-6998$
- P.O. BOX 604, SMITHERS, B.C., CANADA PHONE - 847-3523

Ewin Peak Mines Lid. . 232 - 56u liest Iroudway. Vancouver 9. B.C.

I VVOXCE \#8 (Babine Profect A/c)
CHARGES FOR DECEMER -

| Pergonnel | $\begin{aligned} & \text { No. of } \\ & \text { man days } \end{aligned}$ | Rate |  |
| :---: | :---: | :---: | :---: |
| Operetors | 36 | \$ 40 | \$ 1,440.00 |
| Helpers | 46 | 25 | 1,154.00 |
| Geologist | 15 | 75 | $\underline{12125.00}$ |
|  |  |  | 3,715,01 |
| Etutomant |  |  |  |
| Tinuck | 14 | 20 | 280.00 |
| Auto | 2 | 16 | 20.00 |
| Tractor | \% mo. | 30c/mo. | 150.00 |
| Field and office |  |  |  |
| Radio | 亲mo. | 100 | 50.003 |
| Parcoll Housing unit | $\frac{1}{2}$ mo. | 300/mo. | 150.00 |

## Arborne merr survey

710 line miles filu.00 per line mile
Less billed invoice $\mathrm{i}^{3} 3$ (Sept. 25/7U)
Diobirrements
Grocorles, expendsble hardward and supplicx, recommodation Cleena Muiliding kroducts 333
Russell Erulgment Sales $33 ?$
Likeside wotel
Eulkley notel
Sandinan liotel (Smithers)
Ast Johnsun kivencies - lioma 0il Goodacre's Stores

Aircraft and hehicopters is ans-Provincial Mirlines ukanzigen Helicopters
$\$ 7100.00$
3049.00

Chq. 苒

| 333 | 368.83 |
| :--- | ---: |
| 733 | 10.51 |
| 942 | 390.09 |
| 943 | 31.65 |
| 944 | 210.60 |
| 947 | 168.03 |
| 950 | 1.9 .23 |
|  | 1.276 .55 |
|  |  |
| 957 | 904.50 V |
| 959 | 1.897 .50 V |
|  |  |
| forward | 4.078 .95 |

## DECLARATION OF PROJECT CHARGES

The undersigned considers the preceding invoices applicable as assessment work.




