NORCEN ENERGY RESOURCES LIMITED
ASSESSMENT REPORT

AIRBORNE MAGNETOMETER SURVEY<br>LARDER LAKE MINING DIVISION<br>ONIARIO

CLAIMS: Halliday Township (129)
Hutt Township (1)
Midlothian Township (13)
LOCATION: 65 km south of Timmins, Ontario
NTS: 41 pl4+15; 42A $2+3$

April, 1981

R.J. Laird

This report contains my interpretation of the results of an airborne magnetometer survey flown in the Timmins area of Ontario. The field portion of the work, including installation, was begun on January 16,1981 and completed on February 3.

The survey area is centered approximately 65 kilameters ( 40 miles) south of Timmins, Ontario (see Figure 1). The survey covered an area in and around Halliday Township (Figure 2). Total coverage including two magnetic tie lines was 1545 line kilometers (or 1451 line kilometers when measuring from survey boundary to survey boundary only). The operations base was the United Asbestos mine site located on Lloyd Lake, approximately 30 kilometers west, by road, from Matachewan. The survey aircraft was a Bell 206B helicopter.

The survey crew consisted of:

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Pilot John Hall/John Ahlstrom
Operator 1 John Glover
Operator 2 Evan Veroni
Dataman Paul Conroy
Geophysicists Ian Johnston/Vince Tanzini
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Mike Lewis, Operations Manager of Scintrex, maintained overall supervision from the Scintrex office, Toronto.

The core of this report is Scintrex's "Airborne Geophysical Survey Report" which is included here as Appendix I.
LOCATION MAP
NORCEN ENERGY RESOURCES LIMITEDhalliday township areaONTARIO
AIRBORNE GEOPHYSICAL SURVEY
SCALE : 1:2,000,000


## SURVEY AREA MAP

NORCEN ENERGY RESOURCES LIMITED
HALLIDAY TOWNSHIP AREA
ONTARIO

## AIRBORNE GEOPHYSICAL SURVEY

-:- transpanders $T_{1} \& T_{2}$
xilometers $\xrightarrow[\text { Scole }: 1: 250,000]{10}$ Kilometers
Scole : 1:250,000

The flight path was machine plotted on the base maps at a scale of 1: 10 000. The flight path film was used to outline all significant topographic features on the photomosaic base (photo - enlarged to a scale of 1: 10000 ). Such topographic features were then transferred in outline to the flight path map by comparing fiducials.

## SURVEY PROCEDURE

Sensor terrain clearance was kept at 100 to 150 feet; aircraft speed was 70 mph . Lines 1 to 123 inclusive were flown with a 125 m ( 410 feet) line spacing. Lines 123 to 155 inclusive were flown with a 250 m ( 820 feet) line spacing.

A Del Norte Flying Flagman electronic navigational system was used to provide a position fix of the aircraft. This system operates on the principal of pulse radar. Actual location accuracy is probably $\pm 5$ meters.

## INTERPRETATION

BLOCK A
The higher intensity magnetic features in central Halliday Township (north-west of Annie Lake) appear to be related to interbedded felsic and intermediate metavolcanics. The strike in this area is generally east-west.

The three isolated magnetic highs north of Annie Lake appear to be related to rhyolite outcrops.

The remaining part of the block is magnetically uniform and featureless. No apparent dikes or faults are indicated by the magnetic features. The magnetic intensity in Block A ranges from 59040 to 59300 gammas.

## BLOCK B

Block B covers the northwest part of Midlothian Township.
The dominant magnetic feature in this block is the moderate magnetic high ( 60 gammas) just east of Bluebottle Lake. This anomaly appears to be related to the contact between metasediments (conglomerates and arkose) and felsic metavolcanics. The strike is generally east-west in this area.

No apparent dikes or faults are indicated by the magnetic features in this block. The magnetic intensity in Block B ranges from 59020 to 59150 gammas.

Report On A
Helicopter Borne Geophysical Survey
Halliday Township Area
Timmins, Ontario

On Behalf of
NORCEN ENERGY RESOURCES LIMITED

## 1. Introduction

A helicopter-borne geophysical survey was carried out by Scintrex Limited on behalf of Norcen Energy Resources Limited in the Timmins area of Ontario. The field portion of the work, including installation, was begun on January 16, 1981 and completed by February 3.

The survey covered an area in and around Halliday Township, Ontario (see Figures 1 and 2). Total coverage, including two magnetic tie lines was 1545 line kilometers (or 1451 line kilometers when measuring from survey boundary to survey boundary only). Principal geophysical sensors were an electromagnetic system (HEM-802) measuring in-phase and quadrature secondary field components at 735 and 3220 Hz and a proton precession magnetometer (Scintrex MAP-4). Navigation was controlled by a 'Flying Flagman' radar ranging navigational system.

Results were compiled in Toronto with contoured magnetics and drafted EM anomaly centers at a scale of $1: 10,000$ being the principal presentation styles.

This report describes the survey procedures, instrumentation and production, in-field compilation and final compilation. Maps showing the results of
the work are included outside this report.

This report was prepared by Scintrex Limited, Concord, Ontario, Canada.
2. Survey Area

The survey area is centered approximately 60 miles south of Timmins (or 25 miles west of Matachewan) (see Figures 1 and 2). The operations base for the survey was the United Asbestos mine site located on Lloyd Lake, approximately 20 miles west, by road, from Matachewan.

## 3. Survey Equipment

The survey equipment consisted of the following:
a) A Scintrex HEM-802 electromagnetic system measuring in-phase and quadrature (out-of-phase) secondary field components at frequencies of 735 and 3220 Hz . (See Appendix I for details). The analog output of the EM system was prefiltered with a low-pass filter. The rise time on said filter (Rise time $=$ the time required for an impulse response to go from $10 \%$ to $90 \%$ of the impulse value) was 0.50 seconds. The digital recording rate of all HEM data was 0.5 seconds.
b) A Scintrex MAP-4 Proton Precession Magnetometer with the sensor mounted in the HEM bird. (See Appendix II for details).
c) A Scintrex RCM-8 eight channel analog recorder (hot-pen type).
d) A Sonotek SDS-1200 digital data acquisition system.
e) A Bonzer MK-10 radar altimeter.

## LOCATION MAP

NORCEN ENERGY RESOURCES LIMITED HALLIDAY TOWNSHIP AREA ONTARIO

## AIRBORNE GEOPHYSICAL SURVEY



B1-T 2082


## SURVEY AREA MAP

## NORCEN ENERGY RESOURCES LIMITED

HALLIDAY TOWNSHIP AREA<br>ONTARIO

# AIRBORNE GEOPHYSICAL SURVEY 

- :- transpanders $T_{1}$ a $T_{2}$

Scale : 1:250,000

FIGURE 2
f) A 60 Hz monitor.
g) A Scintrex IITC-2 intervalometer.
h) A Vinten 16 mm camera.
i) A Del Norle Flying Flagman transponder-based navigational system. (See Appendix III for details).
j) Instrument mounting rack, base station magnetometer, test equipment, tools and spare parts.
4. Survey Specifications and Survey Crew

The survey specifications were as follows:
Line Spacing - 125 meters ( 410 feet) and 250 meters ( 820 feet)
Sensor terrain clearance - 100 to 150 feet
Aircraft speed - 70 mph
The survey crew consisted of:
Geophysicists - Ian Johnson/Vince Tanzini
Operator 1 - John Glover
Operator 2 - Evan Veroni
Dataman - Paul Conroy
Pilot - John Ha11/John Ah1strom
Mike Lewis, Operations Manager of Scintrex, maintained overall supervision
from the Scintrex office, Concord (Toronto).

John Gillan of Norcen Energy was on site at the start and end of the project.

The helicopter, C-GGUB, a Bell 206B, was owned and operated by Huisson Aviation Ltd., Timmins, Ontario.
5. Field Procedures and Production Summary

If all were to proceed without failures or interruptions, the field work would advance according to:
a) Install equipment in helicopter, assemble HEM 'bird', set-up base station magnetometer. Install the two fixed transponders.
b) Ground-test and HEM warm-up.
c) Fly survey.
d) Check and edit all analog traces, develop flight-path film and plot back the flight-path (as a check against the Flying Flagman operation).

The acceptable data was produced on eighteen survey flights. (See Table I for details).

Any given flight would normally proceed as follows:
a) Ground system and magnetometer check.
b) Take off
c) Airborne systems check (including Flying Flagman) and pre-flight analog/digital calibration sequence.
d) Fly Lines
e) Post-flight analog/digital calibration sequence.
f) Land

TABLE I

Survey Production Summary

Flight
1
2
3
4
5
6
7
8
9
10
11
12
13

14
15
16
17
18

## Date

January 23
January 24
January 25
January 27
January 28
January 28
January 28
January 29
January 29
January 30
January 31
January 31
January 31
January 31
February 1
February 3
February 3
February 3

Lines Survey \& Accepted
$1-6$
$7-11$
$12-17$
$18-29$
$32-42$
$42-55$
$56-67$
$68-70$
-
-
$71-82$
$83-91$
$94-105$
$108-115$
$116-127$
$129-155$, MTL 1
$30,31,92,93,106,107$, MTL 2
N.B. Lines 1 to 123 inclusive were flown with a 125 m line spacing. Lines 123 to 155 inclusive were flown for odd numbered lines only (giving an effective line spacing of 250 m ).

The one technical procedure requiring special attention was the installation and operation of the Flying Flagman navigational system. This system operates with two ground (remote or slave) transponders and one airborne (master) transponder. The master communicates with both remotes in order to establish the distances from master to both slaves. (The communication signal is transmitted at approximately 9 Gigahertz and then only during short 'on' periods separated by approximately 1 millisecond).

The two distances, master to remote ( $\mathrm{T}_{1}$ ) and master to remote ( $\mathrm{T}_{2}$ ) are internally compared with the base line distance ( $T_{1}$ to $T_{2}$ ) which was entered earlier by flying across the base line, the Flying Flagman system automatically recognizing the minimum distance point. Triangulation gives the $x-y$ co-ordinate at a given point in time. The pre-programmed grid is compared with actual position to provide direction to the pilot. $X$ and $Y$ co-ordinates are recorded on the digital data acquisition system with updates every 0.5 seconds. Positional information is recorded to the nearest 0.1 meter: actual accuracy is probably $\pm 5$ meters.

The two fixed transponders were set up A) in the fire tower on Mount Collins and B) on Mount Sinclair (See Figure 2). These locations permitted line-of-site coverage for the entire survey area. Having fixed these ground stations, the system was initialized by setting the start and end points of line zero (just outside, to the East of and parallel to the North-South boundary line of the survey area (Eastern Edge) ). As the system programs the flight plan as a rectangular grid, all line stop-starts, except those in the North-East corner, were controlled manually using the photomosaic.

The survey work proceeded in most part without incident. A few points should however be mentioned.
A) Flight number two was aborted due to dropping the HEM bird. The sensor was repaired and used to complete the survey. A noticeable and yet acceptable increase in EM noise levels ensued.
B) A power line running approximately North-South through the center of the area rendered the EM data useless for at lease one line spacing ( 125 m ) on either side.
6. Data Recording
6.1 Analog Records

The analog records display the following:

Channel
1
2
3
4

5

6

7
8

Content
60 Hz Monitor
735 Hz In-Phase
735 Hz Quadrature
3220 Hz In-Phase
3220 Hz Quadrature
Magnetometer
Magnetometer
Altimeter

Approximate Full Scale Gain

130 ppm
130 ppm
130 ppm
130 ppm
100 gammas
1000 gammas
500 feet

Fiducial (one per second) counters are shown above channel one and below channel 8. Chart speed is 2 mm per second. Lines and fiducial numbers are manually labelled. Where the fiducial trace is seen the system is on line and all recording systems on.

The analog records for the survey have been fan folded and stored in envelopes: one per flight.

At the start and end of each flight are calibration sequences. The four EM channels are calibrated by activating pre-set 100 ppm (parts per million) calibration pulses. The magnetometer channels are calibrated on analog only as the digital records read directly in gamma. The same holds true of the radar altimeter record.

The base station magnetometer recorder was run with 100 gamma full scale and at a chart speed of 10 cm per hour. Throughout the production survey work, the base station magnetometer showed no anomalous external field magnetic activity.

Flight logs, maintained by the operator, show all lines surveyed, start and end fiducial points, initializing information and any non-standard events.
6.2 Digital Records

All airborne survey data were recorded on the digital data acquisition system. Fiducials and magnetometer readings were updated every one second. All time EM, altimeter and positioned $X-Y$ data were sampled every 0.5 seconds. All EM data was digitally sampled after electronic filters of rise times $0.5,1.1$ and 2.2 seconds.

Recording was on 9 track magnetic tape, 800 bpi format.
7. In-Field Compilation

The analog records were studied for quality and consistency. All lines were labelled and fiducials marked. The flight path film was developed and edited. The flight path was recovered on photomosaics (scale $1^{\prime \prime}=1$ mile) to ensure area coverage at agreed line spacings. Prominent electromagnetic anomalies were identified and plotted on an overlay ("red-ball" map) at the scale of the photomosaics. These maps were presented to Norcen at the end of the field work.

## 8. Presentation <br> 8.1 Base Map

The flight path was machine plotted at a scale of $1: 10,000$. The flight path film was used to outline all significant topographic features on the photomosaic base (Photo-enlarged to a scale of approximately $1: 10,000$ ). Such topographic features were then transferred in outline to the flight path map by comparing fiducials. Such a scheme was adopted as the photomosaics was of uncertain quality; a gross scaling error of approximately $2 \%$, and possibly more severe local offsets were apparent.
8.2 Electromagnetic Anomaly Selection and Plotting

The analog records were studied for :anomalous responses, all of which were analysed and plotted. Those responses which were considered as due to "Lake bottom" sediments (typified by a broad, low amplitude response primarily in the 3220 Hz quadrature channel) are identified by a 'bar' indicated bredth of the anomalous response.

All selected anomaly amplitudes were analysed by computer and the interpreted conductance and depth to source estimates listed. The results are shown in Appendix IV.

All selected anomalies have been plotted on the flight path map at the scale of $1: 10,000$. Appearing with the anomaly center are the anomaly label, conductance estimate and depth of burial estimate (both for the Vertical Half Plane Model).

### 8.3 Magnetic Contour Map

All magnetic data was machine contoured at the scale of $1: 10,000$. The minimum contour interval is 10 gamms. Magnetic contouring was done by Dataplotting Services Limited, Toronto.

Lines one to twenty-nine inclusive showed a digital magnetic record of uncertain quality. As a result, magnetic data for these lines was manually digitized from the analog records before entering the machine contouring process.

In the North-West corner of the survey area, magnetic anomalies were encountered which caused, for certain line segments, the magnetometer to go 'off-lock' with a consequent loss of data. Magnetic contours appearing in this area are shown as dashed lines as the contouring has been done manually by "sticking" together available data. A measured confidence in the contoured magnetics is recommended in this area.

## 9. Conclusions

A helicopter borne electromagnetic and magnetic survey of approximately 1500 line kilometers has been completed on behalf of Noreen Energy Resources Limited in the Holiday Township area of Ontario. Results, including the radar ranging flight path have been plotted at a scale of $1: 10,000$. Numerous high conductance EM targets are indicated. Comparison with the contoured magnetics would guide the assignment of conductor axes and priorities thereof. The interpreted results should be of high quality, as the survey flown was of the "high-resolution" type.

Respectfully submitted,


Ian Johnson, Ph.D., P.Eng.


Mike Lewis, M.Sc., P.Eng.
Manager - Geophysical Surveys Divison



BLOCK "A"
Halliday Township

| Claim No. | Days | Claim No. | Days | Claim No. | Days | Claim No. | Days |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| L 475748 | 40 | L 450719 | 40 | L 499361 | 40 | L 500681 | 40 |
| L 475747 | 40 | L 450712 | 40 | L 499362 | 40 | L 500680 | 40 |
| L 576816 | 40 | L 584230 | 40 | L 499363 | 40 | L 522074 | 40 |
| L 475746 | 40 | L 584231 | 40 | L 479500 | 40 | L 522075 | 40 |
| L 576820 | 40 | L 567402 | 40 | L 450751 | 40 | L 528833 | 40 |
| L 576819 | 40 | L 504966 | 40 | L 450748 | 40 | L 528838 | 40 |
| L 576818 | 40 | L 420650 | 40 | L 450747 | 40 | L 528840 | 40 |
| L 576817 | 40 | L 420655 | 40 | L 450755 | 40 | L 525986 | 40 |
| L 450704 | 40 | L 450723 | 40 | L 499364 | 40 | L 525985 | 40 |
| L 475745 | 40 | L 450718 | 40 | L 499365 | 40 | L 525983 | 40 |
| L 443594 | 40 | L 450713 | 40 | L 499366 | 40 | L 525984 | 40 |
| L 443593 | 40 | L 567403 | 40 | L 522079 | 40 | L 516175 | 40 |
| L 443592 | 40 | L 504965 | 40 | L 522080 | 40 | L 522474 | 40 |
| L 450707 | 40 | L 576821 | 40 | L 528732 | 40 | L 528832 | 40 |
| L 450705 | 40 | L 576822 | 40 | L 499367 | 40 | L 528839 | 40 |
| L 504969 | 40 | L 450744 | 40 | L 499368 | 40 | L 525982 | 40 |
| L 504970 | 40 | L 450717 | 40 | L 499369 | 40 | L 525981 | 40 |
| L 450708 | 40 | L 450714 | 40 | L 522078 | 40 | L 525980 | 40 |
| L 450709 | 40 | L 504961. | 40 | L 522077 | 40 | L 528825 | 40 |
| L 450710 | 40 | L 504964 | 40 | L 528835 | 40 | L 528823 | 40 |
| L 567378 | 40 | L 420652 | 40 | L 528836 | 40 | L 528822 | 40 |
| L 504967 | 40 | L 576823 | 40 | L 528842 | 40 | L 528830 | 40 |
| L 504971 | 40 | L 450745 | 40 | L 479261 | 40 | L 528829 | 40 |
| L 450721 | 40 | L 450716 | 40 | L 479262 | 40 | L 528826 | 40 |
| L 450720 | 40 | L 450715 | 40 | L 479263 | 40 | L 528824 | 40 |
| L 450711 | 40 | L 479258 | 40 | L 522073 | 40 | L 528821 | 40 |
| L 584232 | 40 | L 479259 | 40 | L 522076 | 40 | L 528831 | 40 |
| L 567379 | 40 | L 479260 | 40 | L 528834 | 40 | L 528828 | 40 |
| L 479284 | 40 | L 479499 | 40 | L 528837 | 40 | L 528827 | 40 |
| L 504974 | 40 | L 576825 | 40 | L 528841 | 40 | L 528819 | 40 |
| L 504973 | 40 | L 576824 | 40 | L 500682 | 40 | L 528820 | 40 |
| L 504972 | 40 | L 450746 | 40 |  |  | L 528818 | 40 |
| L 450722 | 40 | L 450752 | 40 |  |  |  |  |
|  |  |  |  |  |  |  |  |

Hutt Township Claim No. Days L 450772

CLAIM SCHEUDLE
BLOCK "B"
Midlothian Township

Claim No. Days
L 501316
L 500742
L 500739
L 500738
L 501315
L 500741
L 500740

Claim No.
L 50131440
L 50131240
L 501309 40
L 50131340
L $501311 \quad 40$
L 50131040

## GEOPHYSICAL - GEOLC TECHNICAL D/



900

## TO BE ATTACHED AS AN APPENDIX TO TECHNICAL REPORT FACTS SHOWN HERE NEED NOT BE REPEATED IN REPORT TECIINICAL RFPORT MUST CONTAIN INTERPRETATION, CONCLUSIONS ETC.

## Type of Survey AIRBORNE MAGNETICS

Township or Area HALLIDAY TOWNSHIP

Claim holder(s)_NORCEN ENERGY RESOURCES LIMITED

Author of Report ROBERT LAIRD
Address C/O NORCEN ENERGY CALGARY
Covering Dates of Survey $\frac{\text { JAN } 16-\text { FEB } 3,1981}{\text { (linecutting to office) }}$
Total Miles of Line cut $\qquad$ NIL

| SPECIAL PROVISIONS | Geophysical $\begin{gathered}\text { DaYS } \\ \text { per claim }\end{gathered}$ |
| :---: | :---: |
| CREDITS REQUESTED |  |
| ENTER 40 days (inc | --Electromagnetic |
| line cutting) for first | --Magnetometer |
| survey. | -Radiometric |
| ENTER 20 days for each | -Other |
| additional survey using | Geological |
| same gr | Geochemical |


| MINING CLAIMS TRAVERSED |
| :---: |
| List numerically |$|$


| PROJECTS SECIION |  |
| :---: | :---: |
| Res. Geol. ___ Qualifications |  |
| Previous Surveys |  |
| Checked by________ date___ |  |
| GEOLOGICAI. BRANCI | .1 |
| Approved by | d |

Approved by

## GEOPHYSICAL TECHNICAL DATA

## GROUNI SURVEYS

Number of Stations $\qquad$ Number of Readings $\qquad$
Station interval. $\qquad$
$\qquad$
Line spacing $\qquad$
Profile scalc or Contour intervals $\qquad$

## MAGNETIC

Instrument $\qquad$
Accuracy - Scale constant $\qquad$
Diurnal correction method $\qquad$
Base station location $\qquad$

## ELLCTIROMAGNETIC

Instrument $\qquad$
Coil configuration $\qquad$
Coil separation $\qquad$
Accuracy
(specify for each type of survey)

Base station location_

Method:
Fixed transmitter
Shoot back
In line
Parallel line
Frequency(specify V.L.F. station)
Parameters measured $\qquad$
GRAVITY
Instrument
Scale constant $\qquad$
Corrections made $\qquad$

Base station valuc and location

Elevation accuracy
INIDUCED POI ARIZATION - RESISTIVITY
Instrument $\qquad$
Time domain____ Frequency domain
Frequency Range
Power
Electrode array $\qquad$
Electrode spacing
Type of electrode

## SELF POTENTIAL

## Instrument <br> Survey Method <br> Corrections made <br> RADIOMETRIC

 Range$\qquad$
$\qquad$

Instrument
Values measured
Energy windows (levels) $\qquad$
Height of instrument
Background Count $\qquad$
Size of detector
Overburden $\qquad$
OTHERS (SEISMIC, IDRILL WELL LOGGING ETC.)
Type of survey
Instrument
Accuracy
Parameters measured $\qquad$

Additional information (for understanding results)

## AIRBORNE SURVEYS

Type of survey(s) AIRBORNE MAGNETICS
Instrument(s) SCINTREX MAP-4 PROTON PRECESSION MAGNETOMETER
Accuracy 1 GAMMA
(specify for each type of survey)
Aircraft used_BELL 206B HELICOPTER
Sensor altitude_100 ft
Navigation and flight path recovery method _FLYING_FLAGMAN RADAR NAVIGATIONAI

$$
\text { SYSTEM; } 16 \mathrm{~mm} \text { FILM STRIPS }
$$

Aircraft altitude_200 feet 20 Line Spacing_._125 mand 250m
Miles flown over total arca 902 miles

Numbers of claims from which samples taken
-
$\qquad$

Total Number of Samples.
Type of Sample
(Nature of Material)
Average Sample Weight
Method of Collection $\qquad$

Soil Horizon Sampled $\qquad$
Horizon Development $\qquad$
Sample Depth
Terrain $\qquad$

Drainage Development
Estimated Range of Overburden Thickness $\qquad$
$\qquad$
$\xrightarrow{2}$

SAMPIL PREPARATION
(Includes drying, screcning, crushing, ashing)
Mesh size of fraction used for analysis. $\qquad$

General $\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$


