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GEOPHYSICAL FIELD REPORT

on an

AIRBORNE MAGNETOMETER SURVEY

of

Oil and Natural Gas Permits 2128 - 2130

Situated in the

Quesnel Basin Oil and Natural Gas Play

Fraser Plateau

Central Interior Plateau

Province of British Columbia

On behalf of

PONDERAY EXPLORATION COMPANY LIMITED

by

GEO-X SURVEYS LTD
Vancouver, B.C.
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INTRODUCTION

During the Epoc. 1969.84 Geo-X Surveys Limited conducted an Airborne Magnetometer Survey in the central region of British Columbia on behalf of Ponderay Exploration Company Limited.

LOCATION

The area surveyed consists of Oil and Natural Gas permits 2128 - 2130 situated on the Quesnel Basin, Oil and Natural Gas Play, located on the Fraser Plateau, a geographical subdivision on the central west side of the Interior Plateau Region in the Province of British Columbia (Fig. I).

AIRCRAFT AND INSTRUMENTS

A Twin Beechcraft based at Williams Lake, British Columbia, was used throughout the survey. This aircraft was equipped with the following instruments:

(1) Airfoil Sensor (towed bird configuration 100 foot cable)

(2) Varian 4937A proton precession magnetometer

(3) Varian SDV 4991 digital (punch paper tape) recording system.

(4) Bonzar altimeter (terrain clearance)

(5) Neyhart Automax G-2 tracking camera

(6) Varian G-2000 analog recorder (dual channel)

(7) Quartz crystal clock.

(8) Sony 323 oscilliscope (signal monitor)

The base station with a Barringer AM - 104 ± 1 gamma proton precession magnetometer was operated at the Williams Lake airport away from all electrical disturbances. The sensor element and cable were elevated some 20 feet off the ground to eliminate ground gradients.

SURVEY PLAN

The traverse lines were spaced at 1 mile intervals and flown in an east-west direction. Control lines were spaced at 10 mile intervals and flown in a north-south direction. Two survey areas were flown, permits 2128 at 5,000' A.S.L. and permits 2129 and 2130 at 6,500' A.S.L. to maintain an approximate mean terrain clearance of 1,000 feet (Figure 2). The surveying was mainly conducted early in the morning when the air was stable, to facilitate maintenance of a constant barometric altitude to within plus or minus 100 feet. A constant air speed of 125 miles per hour was maintained.

AIRBORNE PROCEDURE

Each day before flight the synchronization of the chronometers was checked and the analog records for the previous 12 hours from the magnetic base station were examined and correlated with the Solar flare predictions from Boulder, Colorado. The survey was not flown if the terrestrial magnetic field was not stable. Reflights were undertaken when the base station indicated a gradient of more than 5 gammas peak to trough.

The magnetometer and chart recorder measured and recorded the total magnetic field intensity. At one second intervals the field amplitude and fiducial number were recorded on punch tape by the digital recording system. At thirty second intervals the time and line number were punched on the tape. At four second intervals a split image camera simultaneously photographed:
(1) the terrain, and (2) the clock and fiducial display panel. Thus each terrain photograph is bordered by a photograph of the clock and fiducial number.

The terrain clearance was measured with a Bonzar pulse type radar altimeter and recorded in analog mode by a G-2000 chart recorder.

Flight line control was maintained by following pre-plotted lines on mosaics made up from government photographs. As the flight line progressed the navigator roughly positioned the actual flight line on the mosaic. This aids the flight line plotters in the office who track the path of the aircraft by comparing the terrain photographs with the air photograph mosaic.

DATA PROCESSING

The data processing consisted of several steps discussed under the following headings:

(1) Flight line positioning.

(2) Paper tape editing and magnetic tape generation.

(3) Line intersection tying, grid interpolation, contouring.

1. FLIGHT LINE POSITIONING

(a) Photographic Location Data

Terrain photographs taken in flight are bordered by an image of the clock-fiducial display. On each line certain prominent topographical features are recognized by comparing the terrain photograph with an air-photograph mosaic. The fiducial numbers associated with these features are marked on the line and data points evenly distributed along the line between these known positions.

(b) X-Y Location

A rectangular coordinate system was superimposed on the flight line data observed by (a) above, with +Y north and +X east. The position of each data point is uniquely described by X (distance east of origin) and Y (distance north of origin).

2. PAPER TAPE EDITING AND MAGNETIC TAPE GENERATION

A listing of the contents of the paper tapes was made using an IBM computer as the data were transferred from paper tape to magnetic tape. The listing was examined and machine and operator errors corrected. A unique "sequence number" was given to each data point for future reference.

The field data consists of one sample of the geomagnetic field taken each second, which at the survey flight speed is equivalent to approximately 200 feet along the flight line. The grid cell specified for processing this data is 2000 feet. For the purposes of interpolation, points were chosen to give a mean data separation of approximately 2000 feet.

Thus the magnetic data tape consists of a series of "field records", each field record comprising a sequence number, the X,Y coordinates of the point and the data from that point.

3. LINE INTERSECTION TYING AND GRID INTERPOLATION

At each intersection point of control line with traverse line there is a possible 'mistie' caused by two factors:

(1) Mis-positioning of Data

In areas where no easily recognizable topographic features exist photographic positioning (described previously) is not reliable and this may cause misties of data.

(2) Diurnal Variation

The base station showed less than 50 gammas total change in field during the survey. Thus no line mistie of greater than 100 gammas is ascribable to diurnal variation.*

(* See (a) Solar terrestrial physics, King & Newman 1967

(b) Natural electromagnetic phenomena below 30 K c/s Bleil (ED) 1963

(c) Phase characteristics of geomagnetic micropulsations Herron J.G.R. 1966)

The line-tie program enables lines to be first manually repositioned then corrected for the diurnal, by pro-rating correction values along lines to produce minimal misties. (less than 5 gammas).

The work tape was input to programs obtained from Varian Associates, Palo Alto, California. These programs take the flight line data and by mathematical manipulation interpolate the 'random linear' data points to the intersection points of a uniform grid covering the area.

Fitting of the data to the grid is the most important processing step and choice of parameters for this fitting is vital to interpretation of the data. The Varian programs fit data by means of a polynomial surface calculated from the data found within an ellipse, about the group of cells being evaluated. The order of the polynomial surface, and the radii of the ellipse are specifiable parameters. A specified number of data points must be found in each quadrant of the ellipse before the program will evaluate the grid intersections. The order of the polynomial chosen controls the amount of smoothing applied to the data.

Comparison profiles were made across certain chosen areas at different orders of polynomial fit. An order of fit was chosen to give the closest posible approximation to the field data along flight lines, in both "noisy" and "smooth" data areas.

The interpolated data were then input to the mapping program which produces a plot tape for off-line plotting. After drafting and addition of title blocks, etc. the plots become the final maps supplied.

SPECIFICATIONS OF THE V-4937A MAGNETOMETER SYSTEM

Performance

Range:	20,000 to 100,000 gamma (worldwide)
Sensitivity:	± 1/2 and ± 1 gamma in any field.
Sampling Rate:	manual and "clock" operation permits any timing sequence.

Power Requirements

22-30 V, 6 amps for magnetometer, 60 watts for analog recorder and 100 watt maximum for digital recorder.

Physical Specifications

Console:	size - 19 x 17 x 24 inches; Weight 68 lbs.
Analog Recorder:	dual channel - 15 x 10 x 10 inches, 30 lbs.
Scanner-coupler:	fucical counter, ident. control, 24 hr. clock, 40 lbs.
Recorder:	size - 14 x 11 x 28 inches; Weight 41 lbs.

Data Output

Digital Recording:	BCD 1-2-4-8 (four line output) "O" state - 18 to -30v through 100K ohms 1 state -1 to +3v through 100k ohms
Print Command:	Positive going 12 to 25v pulse; 15M second.
Auxiliary Channels:	A & B for radio altimeter and navigation equipment.
Analog Recording:	Galvanometric -1 mA full scale into 1500 ohms Potentiometric: 100mV full scale. Minimum load resistance 20K Full scale resolution of the least most significant digits of the total geomagnetic field 0-99, 0-999 at 1 gamma sensitivity; 0-49, 0-499 at 1/2 gamma sensitivity.

INSTRUMENT SPECIFICATIONS

Aircraft

Type and Model:	Excalibur 800 (Beechcraft Twin Bonanza modified by Swearingen Aircraft, San Antonio, Texas)
Power:	Two 400 H.P. Lycoming 10-720-AIA engines.
Gross Weight:	7900 pounds
Empty Weight:	5300 pounds
Useful Load:	2600 pounds
Fuel Capacity:	230 gallons (U.S.)
Performance at 7900 lbs. Gross:	Climb - 1535 feet per minute (at sea level) Cruise - 230 miles per hour. Range - 1200 miles.

Instrument Specifications

Camera

Type:	Neyhard Automax 35 m.m. pulse camera
Model:	G-2 with auxiliary data box
Pulse Rate:	Up to 10 frames per second
Film Format:	0.738" x 0.738" square picture with 0.200" x 0.738" data area.
Magazine:	Mitchell 400 foot 35 m.m.
Lenses:	(a) 17 m.m. F/14 Super-Takumar Fish-eye (b) 35 m.m. F/2.0 Super Takumar
Data Box:	(a) 24 hour Accutron Clock (b) Frame counter (c) Available for optional feature

Dimensions (less magazine): 8 3/8" high, 4 1/2" deep, 6 1/4" wide.

Weight (less lens and magazine): 12 lbs.