# COMINCO LTD.

EXPLORATION NTS: 920 5E/6W

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WESTERN DISTRICT 14 December 1981

# ASSESSMENT REPORT OF AIRBORNE VLF-EM AND MAGNETOMETER SURVEY ON THE EKO 1 TO 9 MINERAL CLAIMS

# FISH LAKE AREA, CLINTON, M.D.

(Work performed April 20, 21 and 24th, 1981)

LATITUDE: 51<sup>0</sup>27'N

LONGITUDE: 123<sup>0</sup>36'

Report by:

E. Trent and Glen White, P.Eng.



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Glen E. White, B.Sc., P.Eng.,	
Consulting Geophysicist	13

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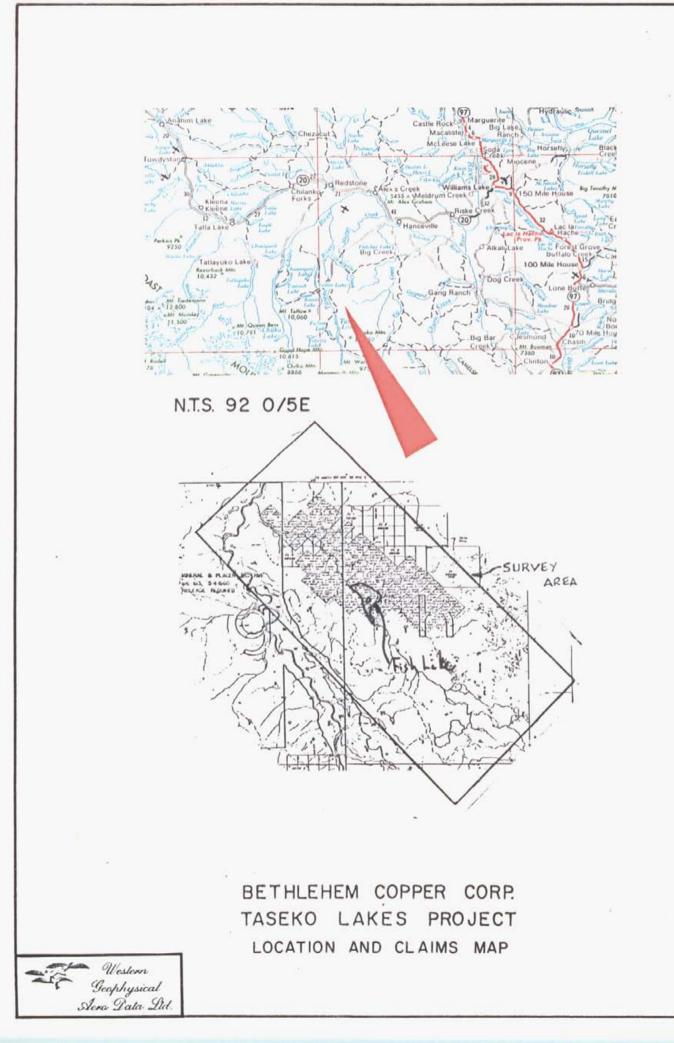


Fig. I

#### INTRODUCTION

Western Geophysical Aero Data Ltd. conducted approximately 850 kilometers of airborne VLF-Electromagnetometer and Magnetometer survey on behalf of Bethlehem Copper Corporation over their Taseko Lakes project area. The survey was flown on April 20, 21 and 24, 1981 utilizing a Bell 206B Jet Ranger II chartered from Okanagan Helicopters' Whistler base.

The main purpose of the survey was to delineate any regional magnetic trends or localized magnetic anomalies in an active exploration area with limited bedrock outcrop. In addition the VLF-EM field intensity was monitored in order to detect and locate any near surface conductivity anomalies in the area.

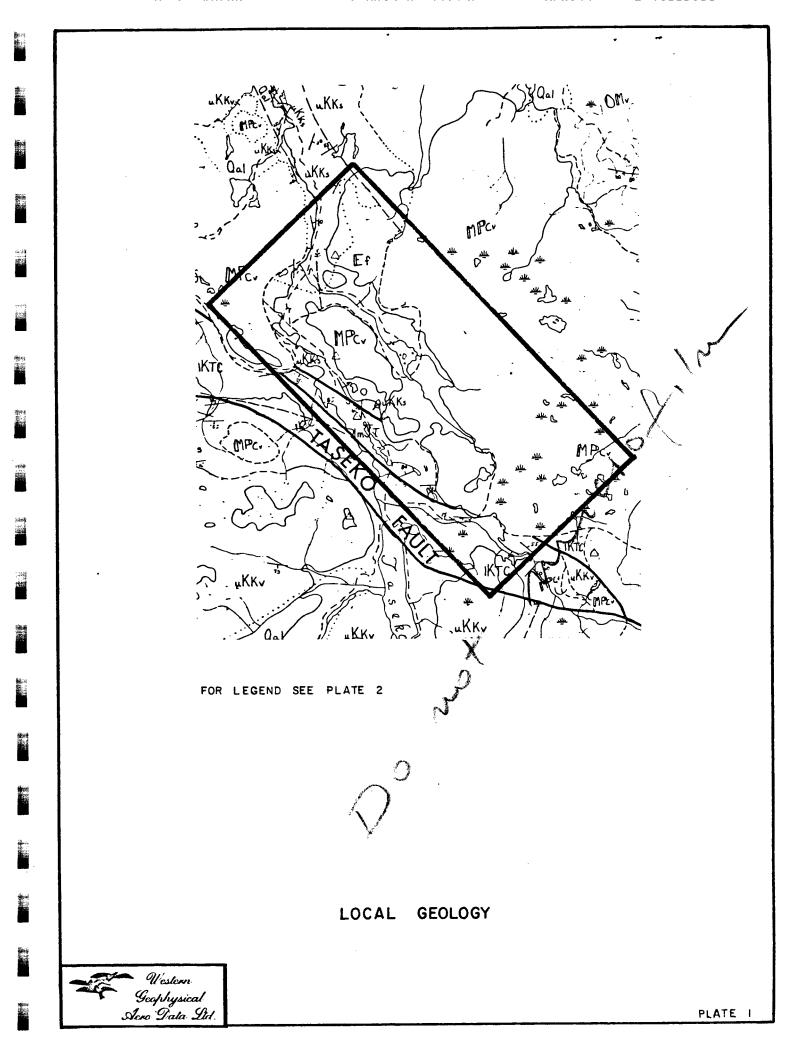
## LOCATION AND ACCESS

The survey area was a 19 kilometer by 7.5 kilometer block of ground centered roughly at latitude  $51^{\circ}27$ 'N and longitude  $123^{\circ}36$ 'W, located primarily in NTS 920/5E and the Clinton Mining Division (Figure 1).

The area is accessible by ground vehicle by travelling west from Williams Lake along highway 20 approximately 60 miles to Hanceville. From Hanceville a hardpacked road leads south to Taseko Lake and crosses the north-west portion of the survey area.

### LOCAL GEOLOGY

No details concerning the local geology of the survey area were provided for the authors. The regional geology is described on a Geological Survey of Canada published map and presented as Plate 1 in this report.



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### SURVEY GRID

Eighty-six survey lines, orientated N45<sup>O</sup>E and spaced at approximately 200 meter intervals were required to cover the proposed survey area. The actual flight lines as defined by the video flight path and data recovery system are illustrated on the magnetic contour maps, Figures 2a and 2b. One northwest-southeast trending survey line was flown across the survey area to tie the N45<sup>O</sup>E lines together.

2

## AIRBORNE VLF-ELECTROMAGNETIC AND MAGNETIC SURVEY

This survey system simultaneously monitors and records the output signal from a proton precession magnetometer and two VLF-EM receivers installed in a bird designed to be towed 50 feet below a helicopter. A gimbal and shock mounted TV camera, fixed to the helicopter skid, provides input signal to a video cassette recorder allowing for accurate flight path recovery by correlation between the flight path cassette and air photographs of the survey area. A Bonzer radar altimeter allows the pilot to continually monitor and control terrain clearance along any flight path.

З

Continuous measurements of the earth's total magnetic field intensity and of the total horizontal VLF-EM field strength of two transmission frequencies are stored in two independent modes: an analogue strip chart recorder and a digital video recovery system. A three-pen analogue power recorder provides direct, unfiltered recordings of the three geophysical instrument output signals. Correlation between the strip chart and the video flight path recovery tape is controlled via fiducial marks common to both systems. The magnetic and electromagnetic data is also processed through the onboard micro-computer, incorporating an analogue to digital converter and a character generator, then superimposed along with real time and terrain clearance upon the actual flight path video recording to allow exact correlation between geophysical data and ground location. An optional time-averaging filter of 1, 2, 3, 4 or 5 seconds is available on the VLF-EM data to provide more easily contourable values in noisy areas. The continuous input magnetic signal is processed at the maximum A/D converter rate, averaged and updated on the video display every second. Line identification, flight direction and pertinent survey information are recorded on the audio track of the video recording tape.

### DISCUSSION OF RESULTS

Approximately 850 line kilometers of airborne survey were required to cover the project area. The results of the magnetic and electromagnetic surveys are presented in contour form over a photomosaic base of the area as Figures 2a and 2b. The major purpose of the survey was to detect and delineate any magnetic or electromagnetic trends which could assist in the planning of a systematic geological mapping of the area.

#### I VLF-EM SURVEY

No strong conductive responses were obtained across the survey area, either as regional trends or localized anomalies. The anomalies observed are very weak (less than 20% total field intensity) and possibly a result of spurious electronic or atmospheric noise. If they are reflections of geologically induced conductivity contrasts the causitive bodies would be expected to be narrow, high conductivity units (possibly graphitic or pyrrhotitic) which are at or very near the surface. The anomalies occuring on lines 45 (Figure 3), 58 (Figure 4), 60 (Figure 5), 66 (Figure 6) and 70 (Figure 7) reflect such characteristics and should only be examined by ground inspection if additional encouraging information is available.

## **II MAGNETOMETER SURVEY**

The magnetometer survey has delineated a number of strong magnetic responses which undoubtedly reflect changes in the geological environment of the area. The geological information made available to the authors at this time consists of the compilation work done by H.W. Tipper, 1978 for the Geological Survey of Canada (G.S.C.). The G.S.C. published geology map of the area is too regional to allow for direct correlation between the magnetic responses observed and the known lithological units. Tipper indicates the majority of the survey area is underlain by olivine basalts of the Chilcotin Group (upper Miocene or Pliocene) however the extreme variations of the magnetic field, as dominated by a strong low (Line 66, Figure 8), obviously reflect a much more complex geology than the G.S.C. maps propose. As the video flight path recovery tapes demonstrate the G.S.C. conclusion was likely based on limited outcrop information.

The magnetic contour maps, Figures 2a and 2b show a general northwest-southeast trend to the magnetic lineaments, roughly parallel to the Taseko and Yalakom fault systems mapped to the southwest. The lineaments display numerous discontinuties and displacements along their mapped strike length, likely reflecting north-south trending cross-faults, probably associated with the Taseko and Yalakom faults mentioned above. Interpretted cross-faults are located on the interpretation maps Figures 2a and 2b however, until a direct correlation between the geology and magnetic responses can be established any structural or lithological identification is considered questionable.

The magnetic field north of Fish Lake is much less variable than the field observed to the south, indicating a large area of magnetically similiar lithology. The most prominent magnetic features in the area are a number of randomly situated, isolated 500 gamma to 1000 gamma magnetic highs as shown on Figures 2a and 2b and illustrated in profile form on Line 52, Figure 9 and Line 13, Figure 10. In plan view these features appear roughly circular with irregularly shaped halos and likely reflect intrusions of more basic material than the country rocks. The Fish Lake deposit occurs along the contact between the country rock and one of the weaker magnetic anomalies. Many similiar magnetic environments occur across the northern portion of the survey area as illustrated on Figures 2a and 2b.

#### SUMMARY AND CONCLUSIONS

Western Geophysical Aero Data Ltd. conducted 850 km of airborne magnetometer and VLF-Electromagnetometer survey across the Bethlehem Copper Corporation Taseko Lake project during April, 1981.

A number of small weak VLF-EM anomalies were observed across the area. However, in the absence of any additional encouraging information, none of these anomalies warrant further investigation.

The magnetic survey clearly delineates a number of magnetic trends generally orientated northwest-southeast across an area mapped by the Geological Survey of Canada as olivine basalt. Numerous cross-striking features indicate probable cross-faults likely generated by the major Taseko and Yalakom faults to the southeast. The magnetic lineaments have not yet been correlated to any known geological horizons or structures henceforth have not been identified in this report.

To the north of Fish Lake the magnetic response stabilizes to a background value of approximately 59,000 gammas. Numerous isolated zones exhibiting a magnetic field intensity increase are observed across this area. The anomalies approximate circles in plan view and exhibit irregular shaped magnetic halos suggesting they originate from intrusives more basic than the country rock. The Fish Lake deposit is located along the contact of one of the weaker magnetic anomalies.

An attempt should be made to identify the magnetic anomalies by correlation between the results of this survey and any drill data, outcrop information and known geology of the area. Particular attention should be focused on identifying the isolated magnetic highs in the area of the Fish Lake deposit.

With limited outcrop available this regional magnetic map can be used as a general guide for tracing magnetically defined structures or geological environments.

Respectfully submitted,

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E. Trent Pezzot, B.Sc., Geophysicist erssio

Glen E. White Single C., P.Eng., Consulting Geophysicist

# Instrument Specifications

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# SABRE AIRBORNE MAGNETOMETER

100123

Type:	Proton Precession			
Range:	20,000 gammas to 75,000 gammas			
Repetition Rate	Approximately 1 second or 3 seconds selected by toggle switch			
Output:	Designed to operate into any potentiometric chart recorder with 0 to 0.1 volt scale			
Display:	Digital dial plus analogue meter			
Period:	Meter records last $1000 \lambda$ , $2000 \lambda$ , $5000 \lambda$ , of total field depending on scale selected. Zeroing system allows chart recording pen to be positioned anywhere on paper, so that if the pen is centred, the resulting scales that can be selected are $\pm 500 \lambda$ , $\pm 1000 \lambda$ , or $\pm 2500 \lambda$ . These scales are standard but virtually all others can be provided.			
REsolution:	Resolution of the instrument itself is better than 1 gamma. Ultimate resolution depends on the accuracy of the chart recorder.			
Detector:	Kerosene filled coil approximately 9 cm x 8 cm in diameter. Inductance - 60 millihenries Resistance - 7.5 ohms Weight - 2.2 Kg.			
Operating				
Temperature:	Instrument - $-10^{\circ}$ C to $+60^{\circ}$ C Detector - $-40^{\circ}$ C to $+60^{\circ}$ C			
Dimensions:	Instrument Console - 30 cm x 10 cm x 25 cmTowed Bird- 1.7 m x 21 cm diameter			
Weight:	Instrument Console - 3.5 Kg. Towed Bird - 30 Kg.			
	(VLF-EM antennae system housed in bird with magnetometer detector)			
Power Source:	Two 12 volt, 28 amp-hour lead acid batteries (gelled_electrolyte)			

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# Instrument Specifications

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# SABRE AIRBORNE VLF SYSTEM

Source of Primary Field	d: VLF radio stations in the frequency range of 14 KH to 30 KHz.
Type of Measurement:	- Horizontal field strength
Number of Channels:	- Two; Seattle, Washington at 18.6 $KH_{Z}$
	- Annapolis, Maryland at 21.4 KHz
Type of Sensor:	- Two ferrite antennae arrays, one for each channel, mounted in magnetometer bird.
Output:	<ul> <li>0 - 100 mV displayed on two analogue meters (one for each channel)</li> </ul>
	<ul> <li>recorder output posts mounted on rear of instrument panel</li> </ul>
Power Supply:	- Eight alkaline 'AA' cells in main instrument case (life 100 hours)
	- Two 9-volt alkaline transistor batteries in bird (life 300 hours)
Instrument Console:	- Dimensions - 30 cm x 10 cm x 25 cm
	- Weight - 3.5 Kg.

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Instrument Specifications DATA RECORDING SYSTEM i) Chart Recorder Type: Esterline Angus Miniservo III Bench AC Ammeter -Voltmeter Power Recorder Model: MS 413 B Specification: S-22719, 3-pen servo recorder Amplifiers: Three independent isolated DC amplifiers ( 1 per channel) providing range of acceptable input signals Chart: 10 cm calibrated width 2-fold chart Chart Drive: Multispeed stepper motor chart drive, Type D850, with speeds of 2, 5, 10, 15, 30 and 60 cm/hr. and cm/min. Controls: Separate front mounted slide switches for power onoff, chart drive on-off, chart speed cm/hr - cm/min. Six position chart speed selector. Individual front zero controls for each channel. Power Requirements: 115/230 volts AC at 50/60 H<sub>2</sub> ( Approximately 30 VA) Writing System: Disposable fibre tipped ink cartridge (variable colors) Dimensions: 38,6 cm x 16,5 cm x 43,2 cm Weight: 9.3 Kg. ii) Digital Video Recording System Type: L.M. Microcontrols Ltd. Microprocessor Control Data Acquisition System Model: DADG - 68 Power Requirements: 10 - 14 volts dc, Maximum 2 amps Input Signal: 3, 0 - 100 mvolt d c signals 1. 0 - 25 volt d c signal Microprocessor: Motorola MC-6800 CRT Controller: Motorola MC-6845 Character Generator: Motorola MCM-6670 Analogue/Digital Convertor: Intersil 7109 Multiplexer: Intersil IH 6208 Digital Clock: National MM 5318 chip 9 volt internal rechargeable nickle-cadmium battery

Fiducial Generator: internally variable time set controls relay contact and audio output Dimensions: 30 cm x 30 cm x 13 cm

Weight: 3 Kg

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#### Instrument Specifications

#### FLIGHT PATH RECOVERY SYSTEM

i) T.V. Camera:

Model: RCA TC2055 Vidicon Power Supply: 12 volt dc Lens: variable, selected on basis of expected terrain clearance Mounting: Gimbal and shock mounted to housing - housing bolted to helicopter skid

ii) Video Recorder:

Model: Sony SLO - 340 Power Supply: 12 volt dc / 120 volt AC (60 H\_)

Tape: Betamex  $\frac{1}{2}$ " video cassette - optional length Dimensions: 30 cm x 13 cm x 35 cm Weight: 8.8 Kg Audio Input: Microphone in - 60 db low impedance microphone Video Input: 1.0 volt P-P, 75  $\Omega$  unbalanced, sync negative

from camera

iii) <u>Altimeter</u>:

Model: Bonzer Mk 10 Radar Altimeter Power Supply: 12 - 25 volts de Output: 0 - 25 volt ( 1 volt / 1000 feet ) de signal split to microprocessor and analogue meter Mounting: fixed to T.V. camera housing, attached to helicopter

skid

### STATEMENT OF QUALIFICATIONS

NAME: PEZZOT, E. Trent

PROFESSION: Geophysicist - Geologist

EDUCATION: University of Brisish Columbia -B.Sc. - Honors Geophysics and Geology

PROFESSIONAL

ASSOCIATIONS: Society of Exploration Geophysicists

EXPERIENCE: Three years undergraduate work in geology - Geological Survey of Canada, consultants.

Three years Petroleum Geophysicist, Senior Grade, Amoco Canada Petroleum Co. Ltd.

Two years consulting geophysicist, Consulting geologist - B.C., Alberta, Saskatchewan, N.W.T., Yukon, western U.S.A.

Two years geophysicist with Glen E. White Geophysical Consulting & Services Ltd.

#### STATEMENT OF QUALIFICATIONS

NAME:

WHITE, Glen E., P.Eng.

Geophysicist

PROFESSION: EDUCATION:

B.Sc. Geophysics - Geology University of British Columbia

PROFESSIONAL ASSOCIATIONS:

Registered Professional Engineer, Province of British Columbia

Associate member of Society of Exploration Geophysicists.

Past President of B.C. Society of Mining Geophysicists

EXPERIENCE:

Pre-Graduate experience in Geology -Geochemistry - Geophysics with Anaconda American Brass

Two years Mining Geophysicist with Sulmac Exploration Ltd. and Airborne Geophysics with Spartan Air Services Ltd.

One year Mining Geophysicist and Technical Sales Manager in the Pacific north-west for W.P. McGill and Associates

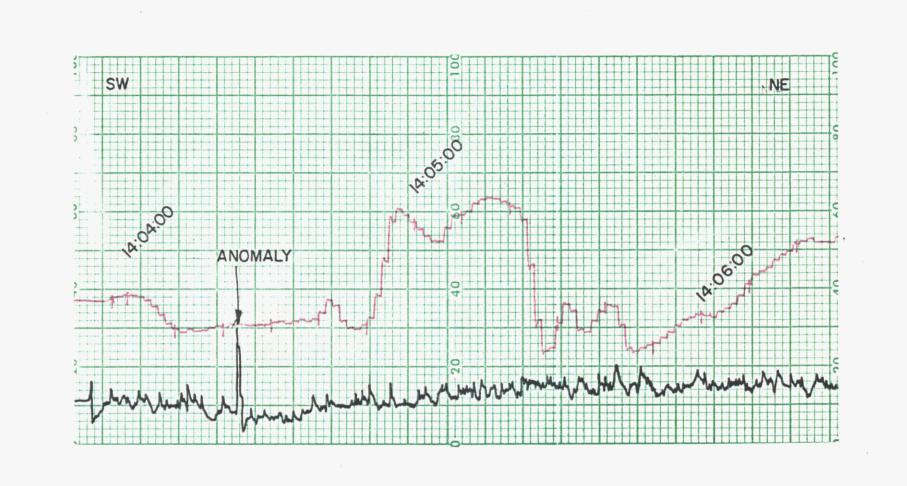
Two years Mining Geophysicist and supervisor Airborne and Ground Geophysical Divisions with Geo-X Surveys Ltd.

Two years Chief Geophysicist Tri-Con Exploration Surveys Ltd.

Ten years Consulting Geophysicist

Active experience in all Geologic provinces of Canada

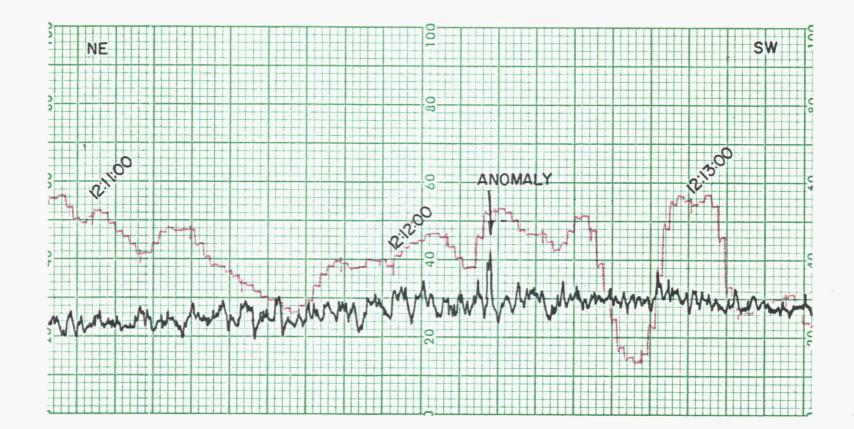
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BETHLEHEM COPPER CORP. TASEKO LAKES PROJECT LINE - 45 -

WESTERN GEOPHYSICAL AERO DATA LTD. MAGNETOMETER BASE VALUE = 57,800 gammas MAGNETOMETER + VERTICAL SCALE | cm = 200 gammas VLF - EM + VERTICAL SCALE | cm = 10%

MAGNETOMETER : RED VLF-EM (ANNAPOLIS) : BLACK FIG. 3



BETHLEHEM COPPER CORP. TASEKO LAKES PROJECT

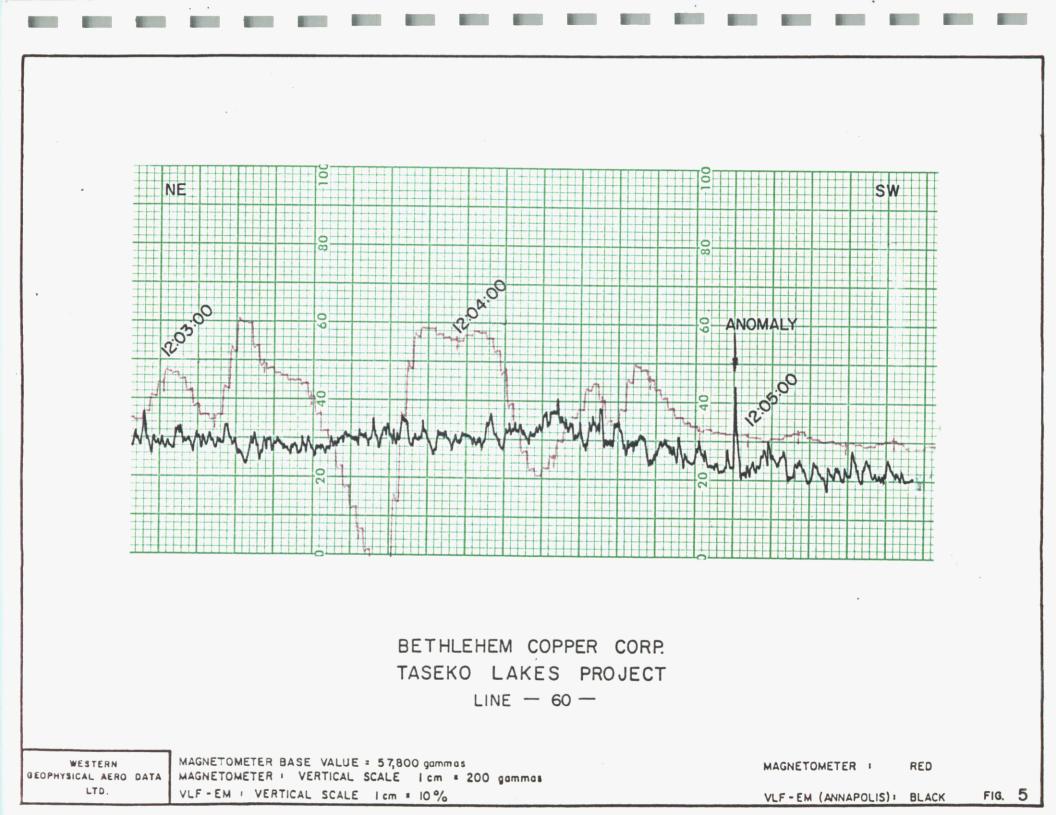
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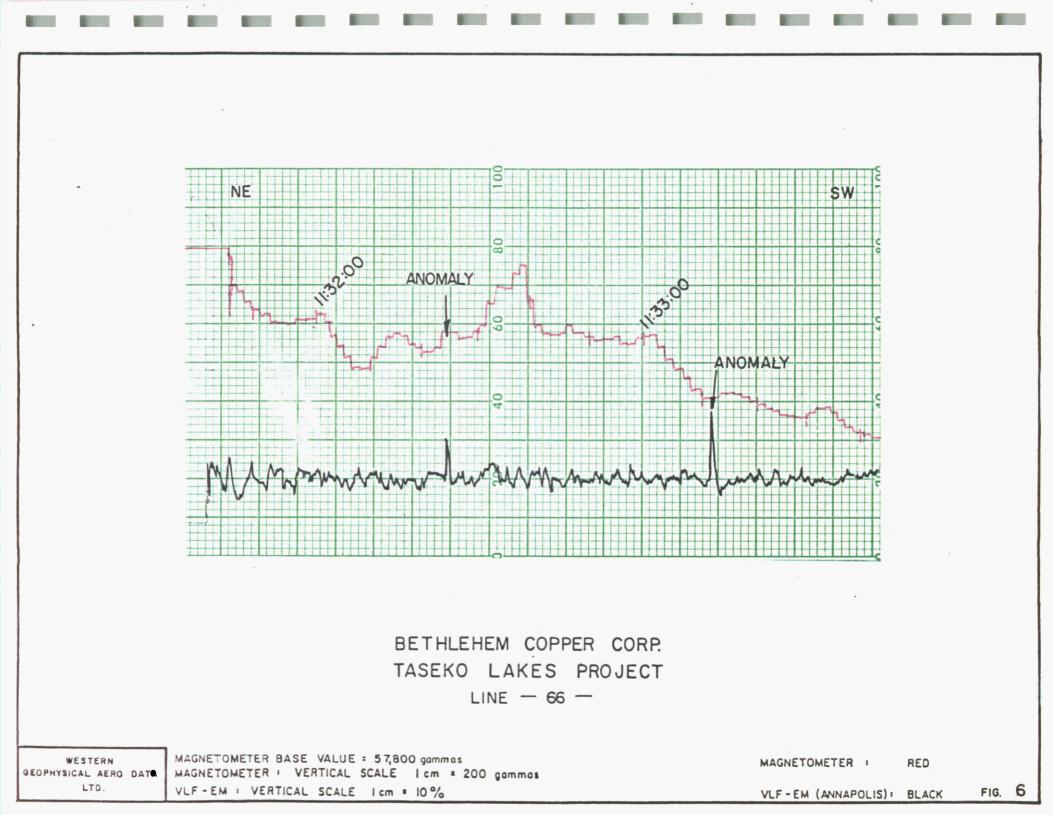
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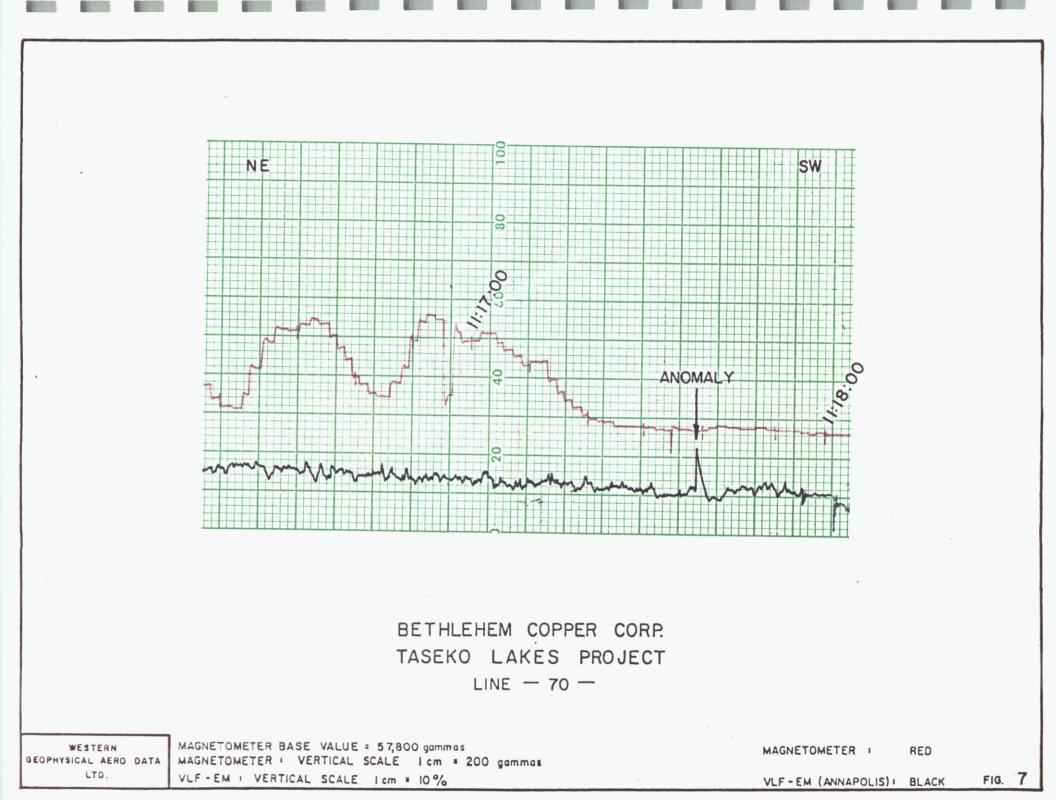
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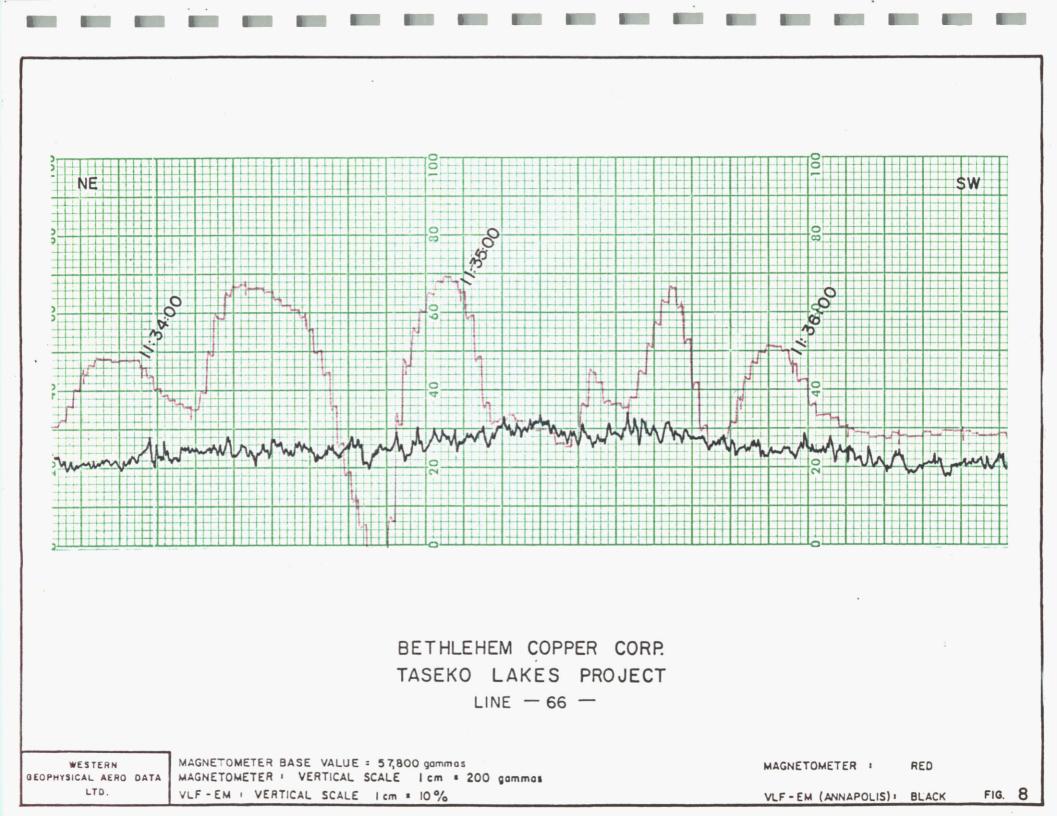
MAGNETOMETER : RED

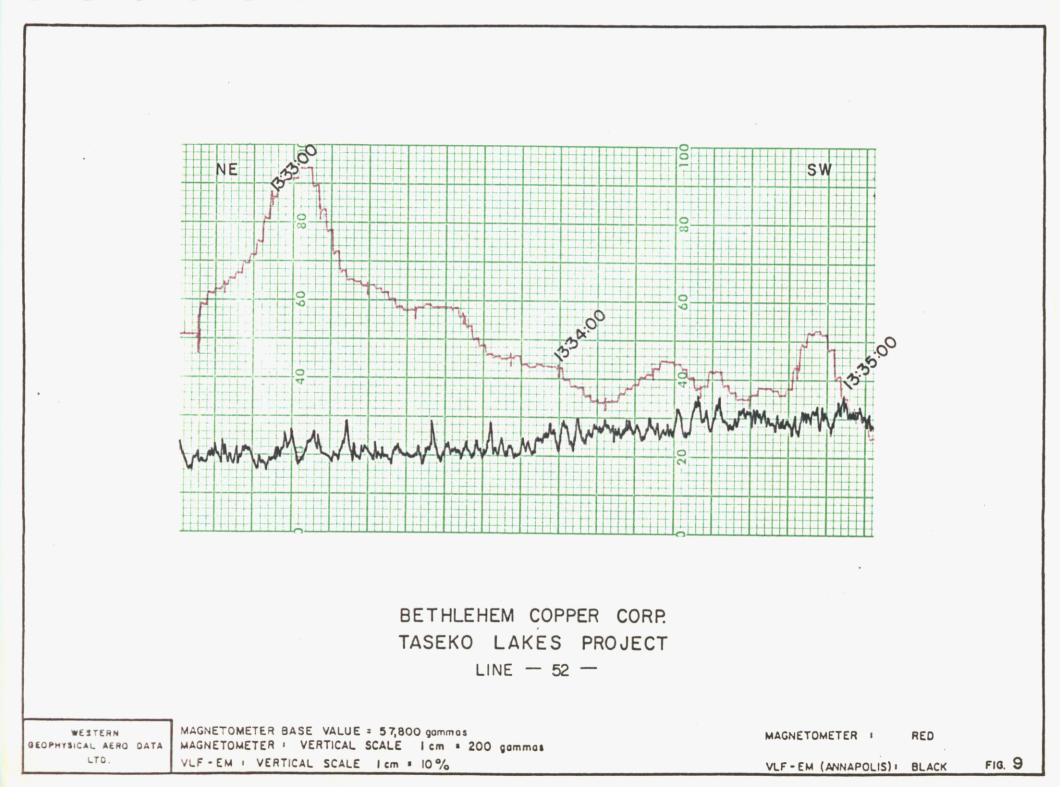
VLF-EM (ANNAPOLIS): BLACK FIG. 4

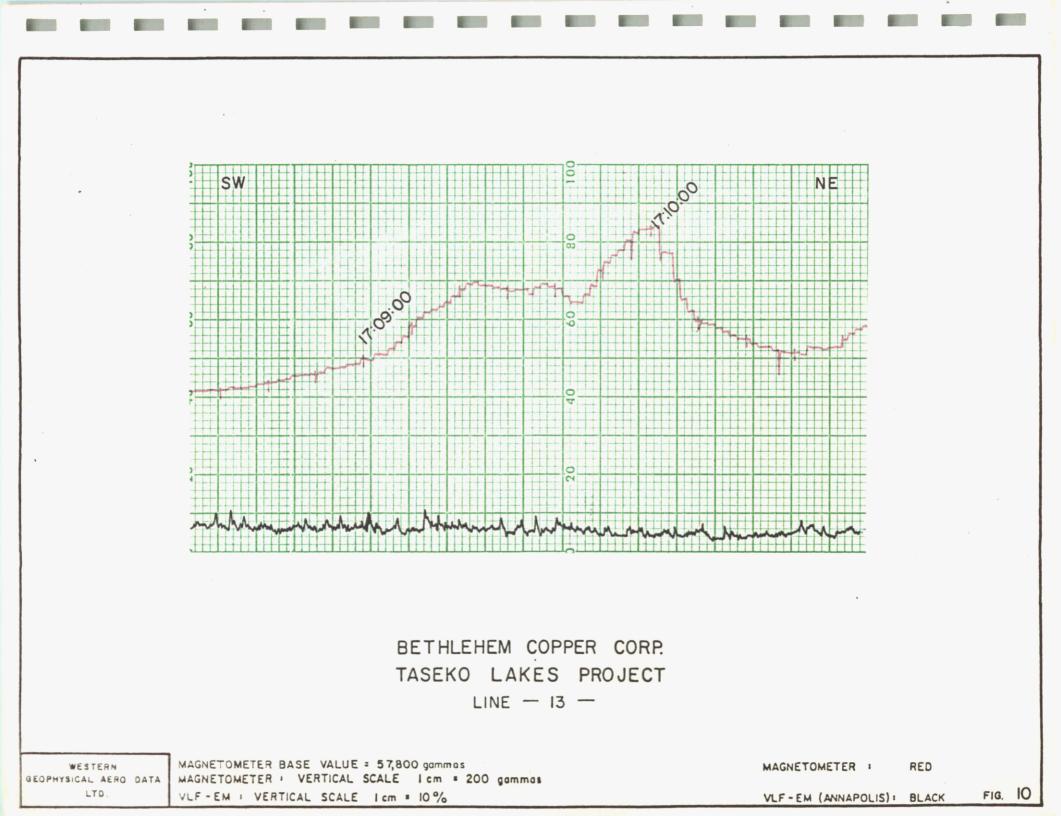












### INTRODUCTORY NOTE:

Airborne VLF and geochemical surveys were flown by Western Geophysical Aero Data Ltd. in April 1981. Results are contained in the enclosed report by Messers E. Trent Pezzot B.Sc. and G.E. White, P.Eng. The total cost of the program was \$19,980, as per invoices from Western Geophysical Aerodata Ltd.

The total area surveyed measured 14060 Ha (7.5 x 19 km) which includes Eko 1 to 9 mineral claims (4500 Ha). Work for a total of \$2,200 is earned for each Eko 1 to Eko 9 mineral claims. Enclosed is a location map (1/50,000) showing the location of the survey in relation to Eko 1 to 9 mineral claims.

Signed:

A.M. Pauwels, Project Geologist

Endorsed:

M.J. Osatenko Senior Geologist

Approved for N. N. Mache Release by: for

G.Harden, Manager, Exploration Western District