MAP NO: 115O/10

ASSESSMENT REPORT: X

PROSPECTUS:

CONFIDENTIAL: X

OPEN FILE:

DOCUMENT NO: 093242

MINING DISTRICT: Dawson

TYPE OF WORK: Geochemistry, Geophysics

REPORT FILED UNDER: Faith Mines and Calais Resources Ltd.

DATE PERFORMED: June 14,24 & July 20-24, 1994

DATE FILED: February 10, 1995

LATITUDE: 63 39

AREA: Sulpher Creek

LONGITUDE: 138 40

VALUE: $4000

CLAIM NAME AND #: Flug 1-12

WORK DONE BY: Phil Southam

WORK DONE FOR: Hastings Management Corporation

DATE TO GOOD STANDING	

REMARKS: Soil sampled north end of property and did a magnetometer-VLF survey in the southern portion which is covered by placer tailings. No significant results were obtained from geochemistry while the VLF identified several north trending conductors. 80 soils were collected and 8.55 line km of VLF/mag.

YUKON ASSESSMENT REPORT

PROPERTY: **FLUG CLAIMS**

NTS MAP SHEET: **115 O/10**

LATITUDE: **63° 39'N** LONGITUDE: **138° 40'W**

CLAIMS AND GRANT NUMBERS WORKED:

FLUG 1 - 12 **YB45415 - 27**

OWNER OF PROPERTY: **Faith Mines Ltd. and Calais Resources Ltd.**

ADDRESS: **#1000 - 675 West Hastings Street**
Vancouver, B.C.
V6B 1N2

and

#1100 - 675 West Hastings Street
Vancouver, B.C.
V6B 1N2

TELEPHONE: **(604) 685-2222**

OPERATOR: **Faith Mines Ltd.**

TYPE OF WORK: **Geochemical sampling, magnetometer and VLF surveys**

DATE WORK WAS DONE: **June 14, 24, July 20-24, 1994**

AUTHOR OF REPORT: **Philip Southam, P. Geo.**

LIST OF PERSONNEL:
Philip Southam, Hastings Management Corp.
Lee Persinger, Hastings Management Corp.

GEOCHEMICAL REPORT
ON THE
FLUG CLAIMS

Dawson Mining Division, Yukon

NTS 115 O/10

Latitude: 63° 39'N

Longitude: 138° 40'W

OWNERS:
Faith Mines Ltd.
#1000 - 675 West Hastings Street
Vancouver, B.C.
V6B 1N2

AND

Calais Resources Ltd.
#1100 - 675 West Hastings Street
Vancouver, B.C.
V6B 1N2

OPERATOR:
Faith Mines Ltd.
#1000 - 675 West Hastings Street
Vancouver, B.C.
V6B 1N2

BY:
P. SOUTHAM, P. Geo.

February 3, 1995

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LOCATION AND ACCESS

The property is located 56 kilometers southeast of Dawson City, Yukon (figure 1) at the confluence of Sulfur Creek into Dominion Creek, centered on 63° 39' north latitude and 138° 40' west longitude on NTS sheet 115 O/10. It is accessible by gravel road from spring to fall or by helicopter from Dawson City in the winter.

TOPOGRAPHY AND VEGETATION

The topography is rolling hills ranging in elevation from 520 meters (1700 ft.) above sea level (ASL) to 760 meters (2490 ft.) ASL covered with spruce, poplar and birch trees. The area escaped glaciation, thus the valleys are V-shaped and there is less than 1% natural outcrop exposure. The best exposure of bedrock is usually found in placer mine cuts and along road cuts.

On north facing slopes and shaded areas the vegetation consists of spruce trees and thick moss due to permafrost in the underlying soil. Spruce trees are also found in damp soil conditions on the property, such as recessive fault zones or creek gullies. Poplar and birch trees grow on the dry, thawed south, east and west facing slopes . Alder thickets are commonly found along creeks and gullies.

PROPERTY STATUS

The property consists of 40 quartz claims staked as the Flug claims (figure 2). They are:

Table 1 - Claims List

CLAIM NAME	GRANT NUMBER	EXPIRY DATE*	OWNER
Flug 1 - 40	YB45415 - 54	24 Aug. 95	Faith Mines (50%) Calais Res. (50%)

* With acceptance of this report.

HISTORY

The property is located in the historic Klondike region where more than eleven million ounces of gold has been mined from placer deposits in existing creeks and former river channels. Placer gold was discovered in 1896 and mining of the creek and bench deposits still continues today.

The junction of Sulphur and Dominion Creeks was thoroughly

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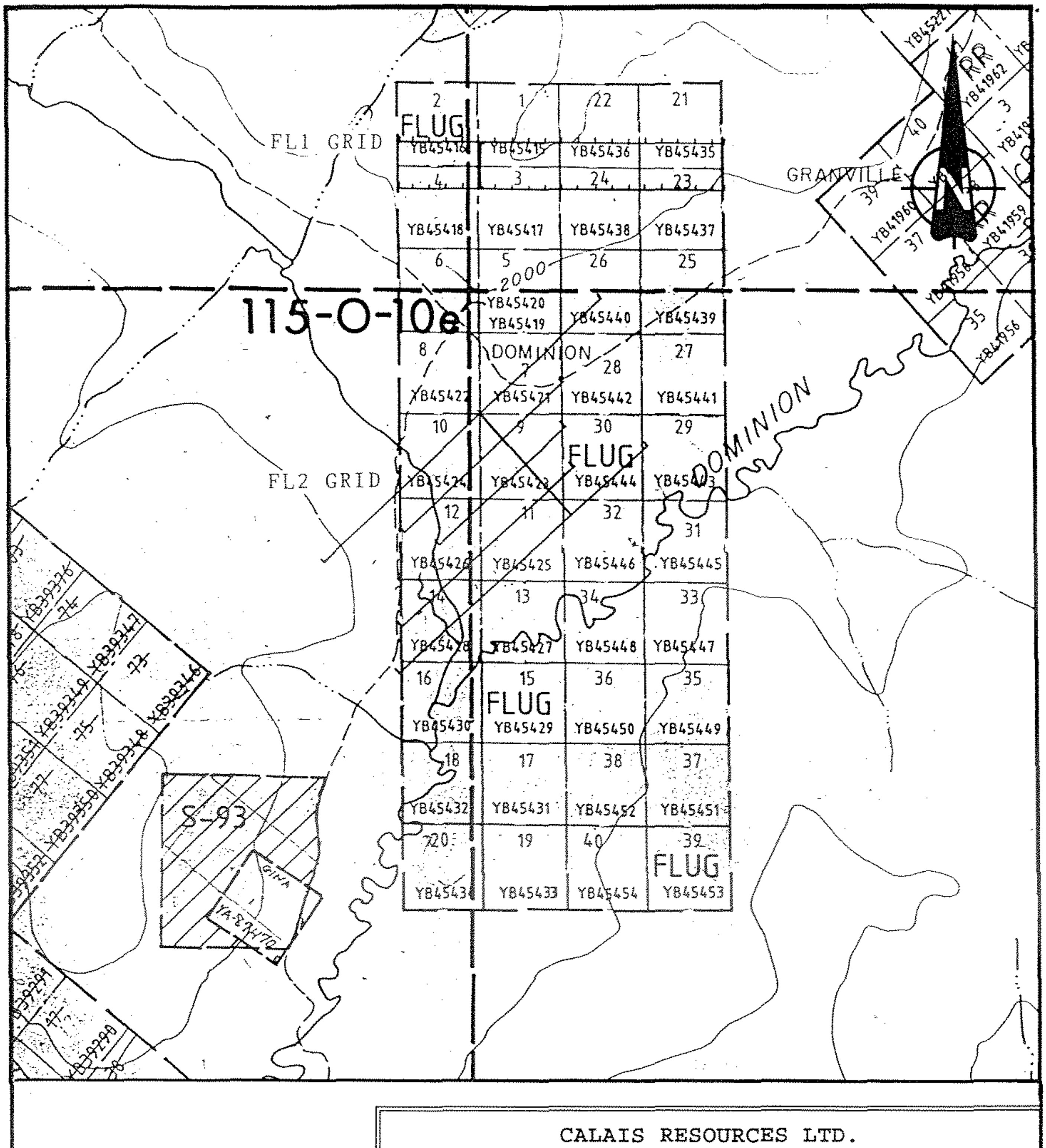
FLUG PROPERTY

DAWSON M.D., YUKON — NTS 115-O-10

LOCATION MAP

DATE: JAN. 95
BY: P.S. — FIGURE 1



0 1
KILOMETERS

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FLUG PROPERTY
DAWSON M.D., YUKON NTS 115-O-10

CLAIM AND GRID LOCATION MAP

SCALE 1 : 31,680

DATE: JAN. 95
BY: P.S.

FIGURE 2

mined by dredge and reportedly hosted large quantities of placer gold. The area was recently staked as quartz claims called the Gulf claims, but initial prospecting results were discouraging and the property was allowed to lapse. In 1993 a smaller portion of the original Gulf claims were restaked as the Flug claims.

REGIONAL GEOLOGY

The Klondike region is underlain by a group of moderately metamorphosed rocks of late-Paleozoic age known as the Klondike Series and Nasina Series (represented as Klondike schist and Yukon Group in figure 3). They form part of the Yukon-Tanana Terrane (YTT) on the SW side of the Tintina Trench. The YTT is formed from the merging of the Omineca Crystalline Belt and the Coast Plutonic Complex into the Intermontane Belt (Tempelman-Kluit, 1977). The Tintina Trench is a major transcurrent fault along which at least 450 km of dextral offset has occurred (Mortensen, 1990).

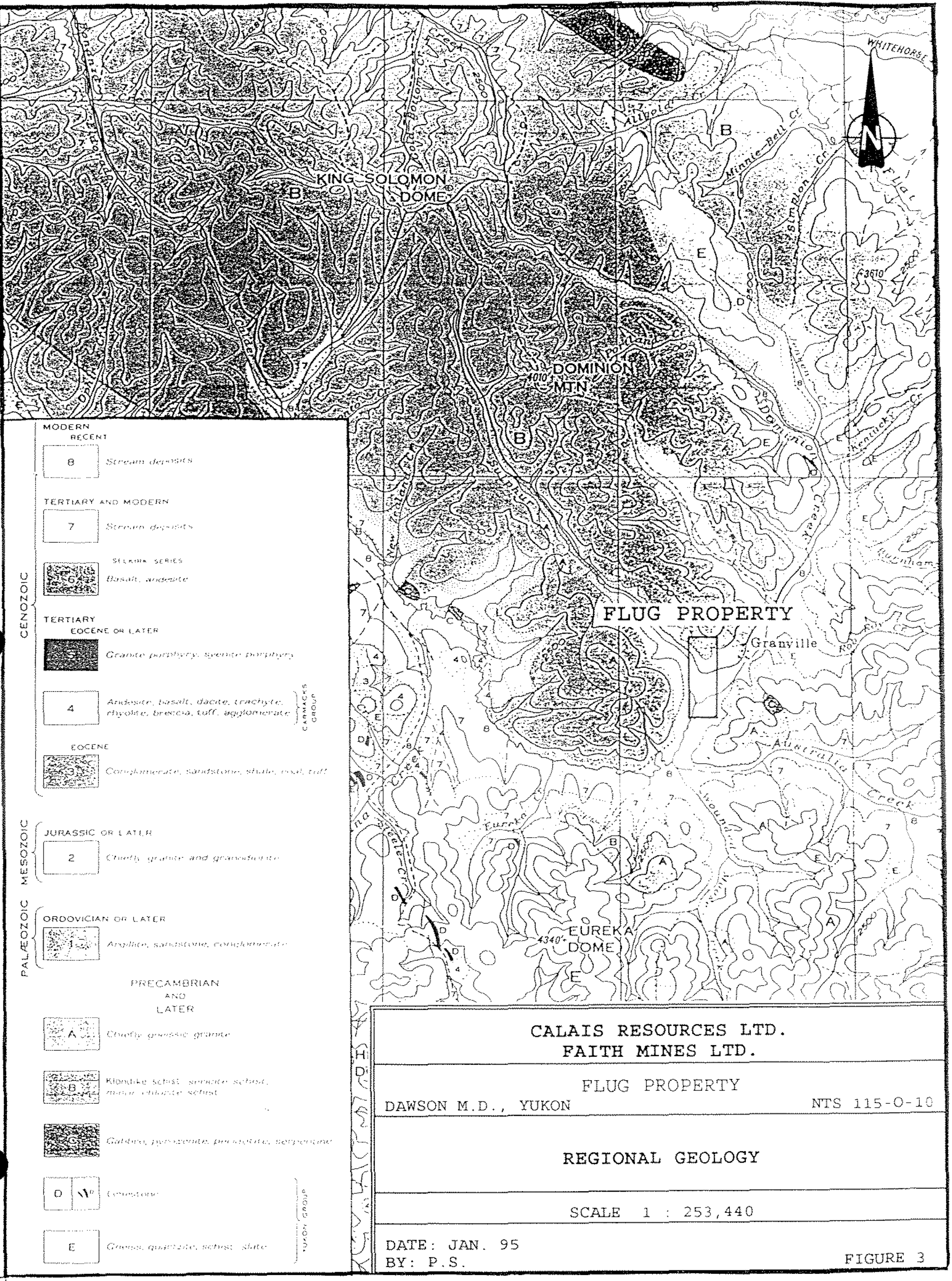
The gross lithologic assemblages within the YTT consist of Proterozoic and Paleozoic strata which can be correlated with the Omineca Crystalline Belt (OCB). The OCB includes a succession of clastic and carbonate rocks equivalent to miogeoclinal sequences to the east. The western part of the belt is overlain by upper Paleozoic mafic and felsic volcanic rocks with intercalated chert and slate (Tempelman-Kluit, 1977).

Mortensen (1990) describes the Klondike and Nasina geology as several imbricated thrust panels of polydeformed metavolcanics and metasediments of a buried island arc which can be subdivided into three assemblages. Assemblage I, the uppermost and more widely extensive thrust panel, is metamorphosed mid-Permian felsic plutonic, subvolcanic, and tuffaceous rocks. Assemblage II is mid-Paleozoic or older metasedimentary and mafic and felsic metavolcanic rocks intruded by a large body of latest Devonian - Early Mississippian granitic augen orthogneiss. Assemblage III underlies I and II structurally in the northern and southwestern part of the study area and consists of carbonaceous schists and phyllite.

PROPERTY GEOLOGY

The area is underlain by schistose rocks of quartzofelspathic to mafic affinity (figure 4; from Debicki, 1985). The quartzofelspathic unit is described as buff weathering well foliated muscovite-feldspar-quartz schist; the mafic material is light to medium green and buff weathering chlorite-quartz schist (table 2).

The feature of primary interest is a NW-SE trending southwest-dipping thrust fault which bisects the property. The thrust may be



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FLUG PROPERTY

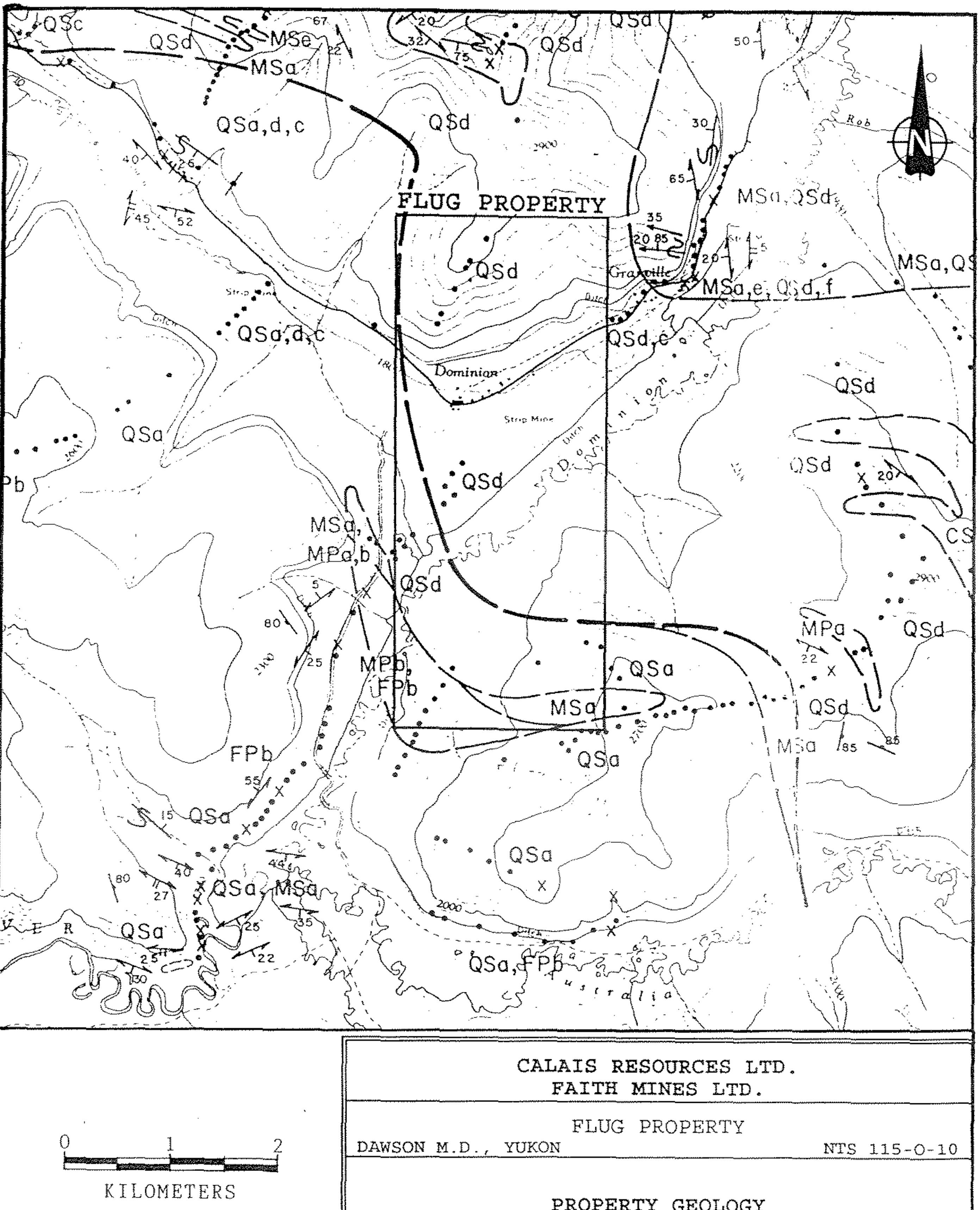
DAWSON M.D., YUKON — NTS 115-O-10

REGIONAL GEOLOGY

SCALE 1 : 253,440

DATE: JAN. 95
BY: P.S.

FIGURE 3



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FLUG PROPERTY

DAWSON M.D., YUKON | NTS 115-O-10

PROPERTY GEOLOGY

(From Debicki, 1985)

SCALE 1 : 50,000

DATE: JAN. 95
BY: P.S.

FIGURE 4

Table 2 - Property Geology Legend
(from Debicki, 1985)

LATE CRETACEOUS TO EARLY TERTIARY

Felsic intrusive and volcanic rocks

FI

- FIa light coloured quartz-feldspar rhyolite porphyry and rhyolite

TRIASSIC OR OLDER

Rocks of varying metamorphic grade and degree and style of deformation

Felsic plutonic rocks

FP,QS

- QSa blocky weathering light grey to pinkish feldspar-quartz schist

Quartzofeldspathic schistose rocks

QS

- QSc buff weathering well foliated muscovite-feldspar-quartz schist with quartz porphyroclasts
- QSd buff weathering well foliated muscovite-feldspar-quartz schist
- QSe light green weathering hornblende/muscovite-feldspar-quartz schist
- QSj muscovite-quartz schist with more than 5% garnet, and with or without chlorite
- QSk biotite-quartz schist, with or without calcite

Marble

MB

- MBa cream and grey banded marble, with or without minor quartz, muscovite and garnet

Mafic schistose rocks

MS

- MSa light to medium green and buff weathering chlorite-quartz schist
- MSc silvery green weathering actinolite-chlorite schist
- MSe light to medium green and buff weathering calcareous chlorite-quartz schist: calcite may be disseminated, in thin layers, or as small pink blebs
- MSf silvery green weathering muscovite-chlorite quartz schist with bluish quartz porphyroclasts

Ultramafic rocks

UM

- UMa massive dark green serpentinite
- UMb foliated dark green serpentinite

a potential conduit for mineralizing fluids from depth.

WORK PROGRAM

Two lines of soil samples (table 3) were completed to test for mineralization along the north end of the property. Further to the south in the tailings piles a grid was established and magnetometer and VLF surveys were conducted.

Table 3 - Sample Data

Grid Name	Line Kilometers	No. of Samples	Sample Spacing	Line Spacing
FL1	4.45	80	50 m	250 m
FL2	8.55	Mag/VLF	25 m	200 m

GEOCHEMICAL SURVEY METHOD

The two soil lines were taken across the ridge at the north end of the Flug claims (figure 5). Sample stations are at 50 meter intervals and are marked with flagging tape. Soil samples were taken from the B-horizon, found at depths of 5 to 40 centimeters, using a standard mattock. The samples were placed in kraft soil sample bags and dried prior to shipping to Chemex Labs for analysis. Each sample was tested by fire assay for gold and by 32-element ICP.

GEOPHYSICAL SURVEY METHOD

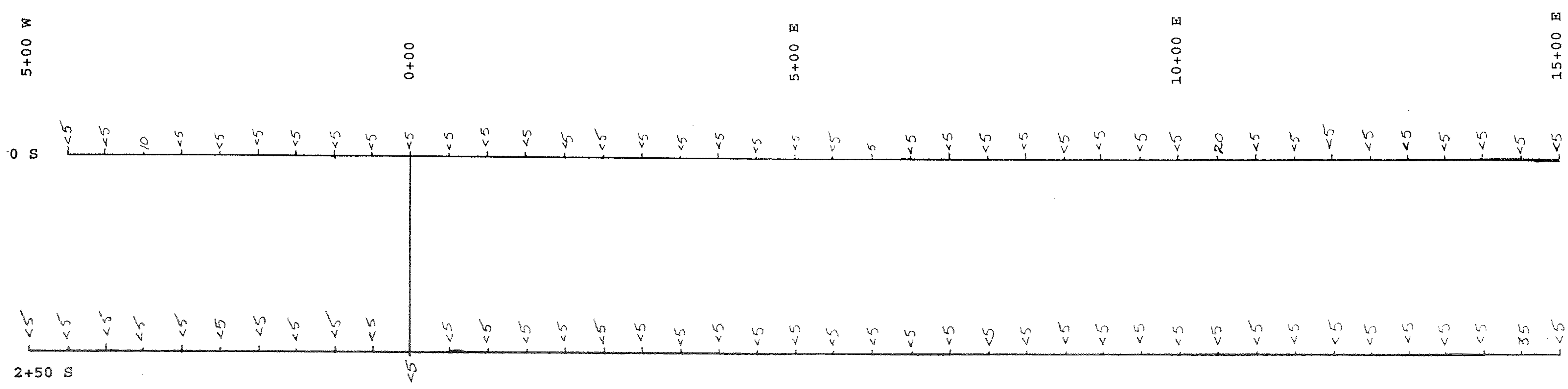
A Scintrex MP-2 proton precession magnetometer was used for the magnetic survey. The instrument measured the local magnetism but the data was not corrected for diurnal variation. The VLF survey was completed with a Geonics EM16 VLF-EM. The details of its operation and specifications are in the appendix.

GEOCHEMICAL SURVEY RESULTS

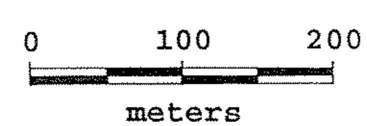
There are no significant results from the soil sampling program (figure 5).

GEOPHYSICAL SURVEY RESULTS

The VLF survey successfully identified several sub-parallel north-south trending conductors (figure 14). The strongest of these conductors occurs on line 8+00 S at 6+00 W and extends to



093242
DWG (1)



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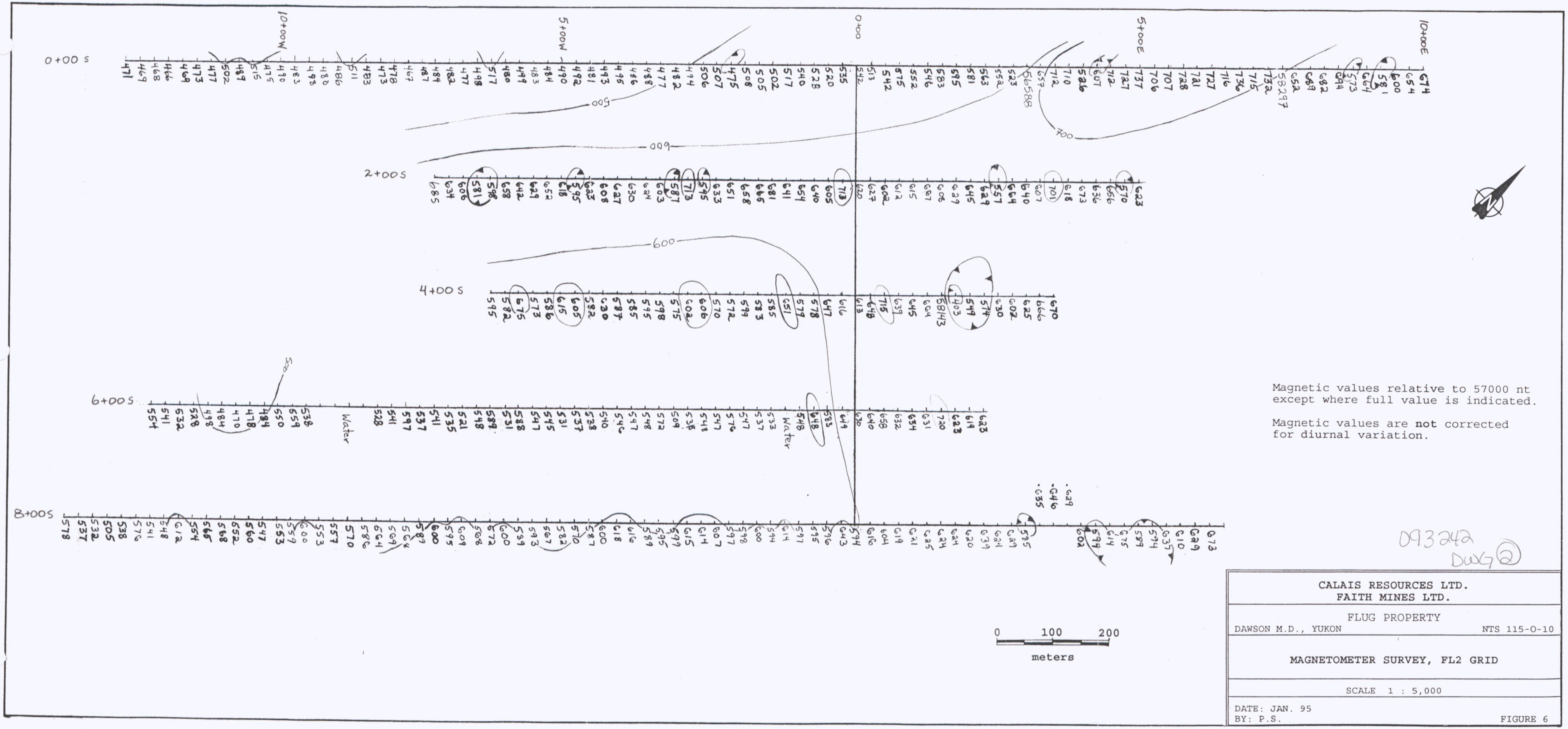
FLUG PROPERTY
DAWSON M.D., YUKON NTS 115-O-10

GOLD GEOCHEMISTRY, FL1 GRID
(ppb)

SCALE 1 : 5,000

DATE: JAN. 95
BY: P.S.

FIGURE 5


0+00 S
2+00 S
4+00 S
6+00 S
8+00 S
10+00W
5+00W
0+00
5+00E
10+00E
Water
Magnetic values relative to 57000 nt except where full value is indicated.
Magnetic values are **not** corrected for diurnal variation.
0 100 200
meters
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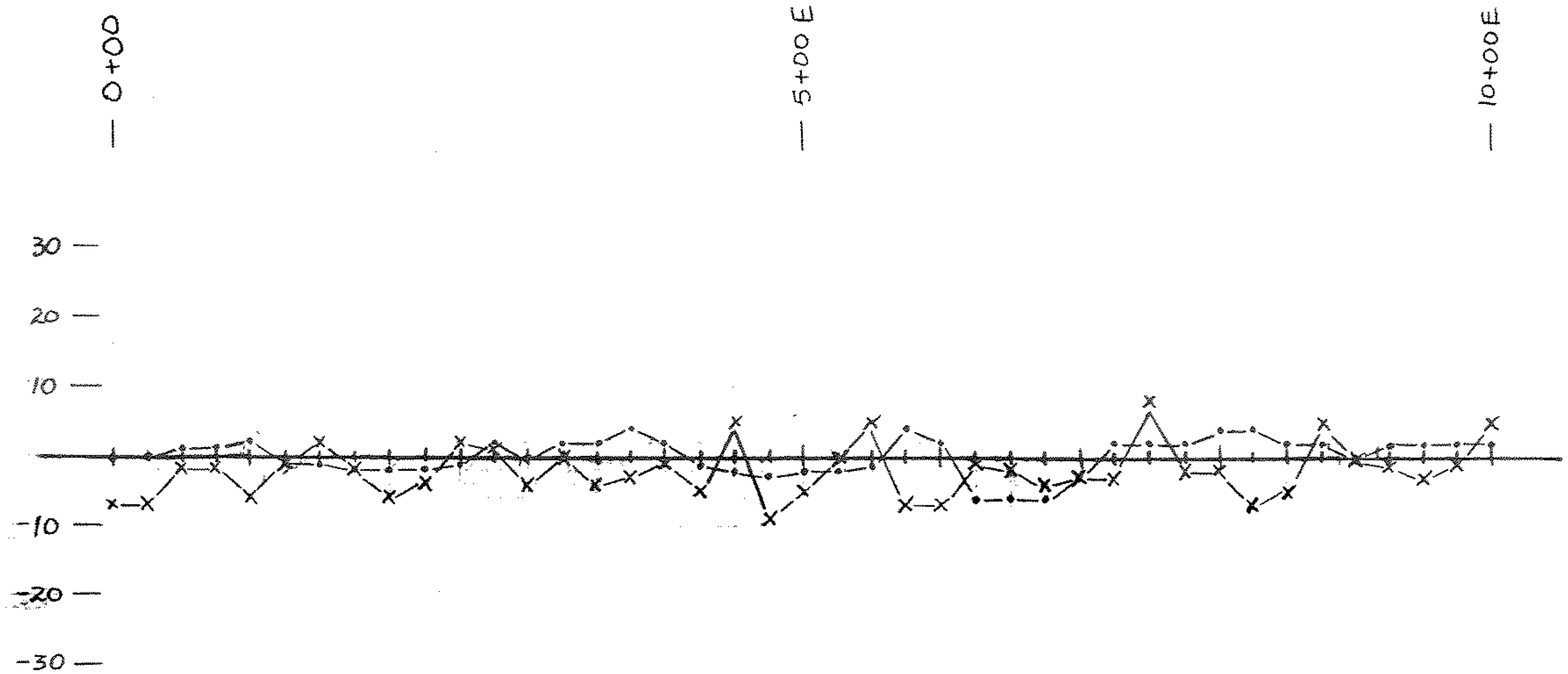
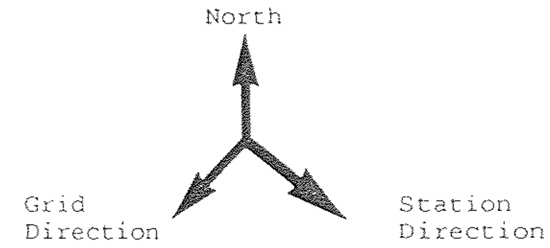
FLUG PROPERTY
DAWSON M.D., YUKON
NTS 115-O-10
MAGNETOMETER SURVEY, FL2 GRID
SCALE 1 : 5,000
DATE: JAN. 95
BY: P.S.
FIGURE 6
093242
DWG 2

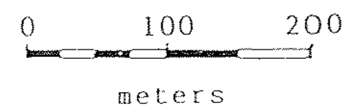


• Inphase
x Quadrature



Vertical Scale
1 centimeter = 10%

Station: Annapolis, Maryland (NSS)
Frequency: 21.4 kHz



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FLUG PROPERTY

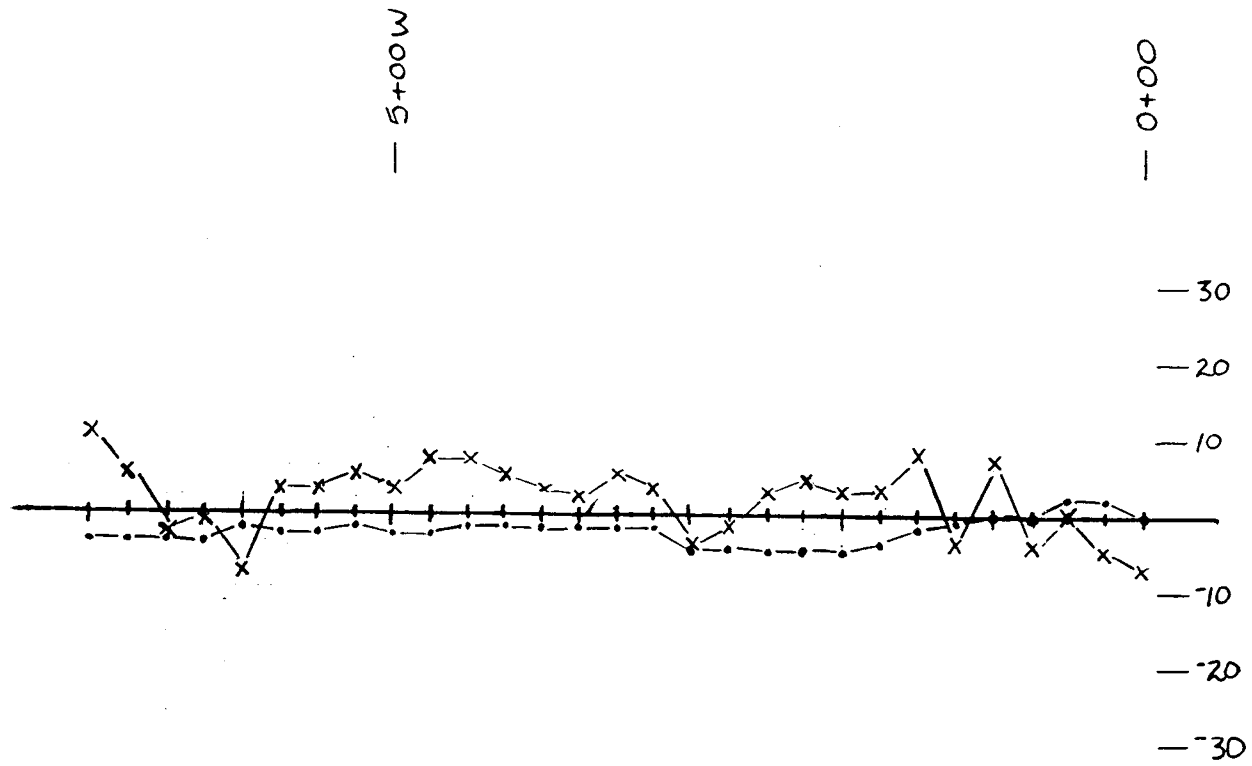
DAWSON M.D., YUKON NTS 115-O-10

VLF PROFILES, FL2 GRID
LINE 0+00 S, 0 to 10+00 E

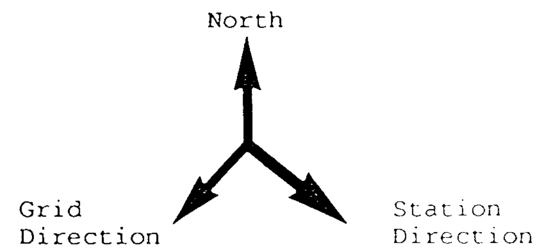
SCALE 1 : 5,000

DATE: JAN. 95
BY: P.S.

FIGURE 7

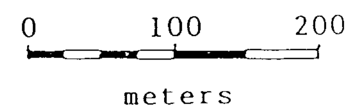


• Inphase
x Quadrature



Vertical Scale
1 centimeter = 10%

Station: Annapolis, Maryland (NSS)
Frequency: 21.4 kHz



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FLUG PROPERTY

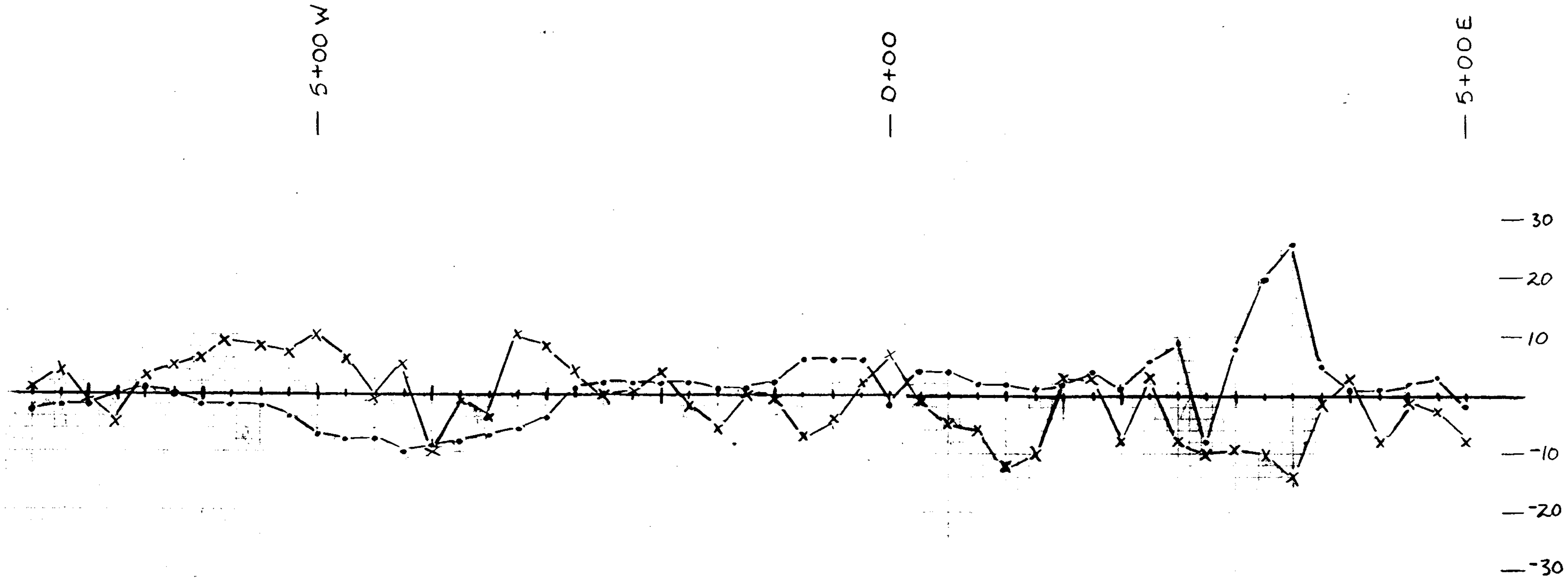
DAWSON M.D., YUKON — NTS 115-O-10

VLF PROFILES, FL2 GRID
LINE 0+00 S, 0 to 7+00 W

SCALE 1 : 5,000

DATE: JAN. 95
BY: P.S.

FIGURE 8



• Inphase
x Quadrature

North

Grid Direction

Station Direction

Vertical Scale
1 centimeter = 10%

Station: Annapolis, Maryland (NSS)
Frequency: 21.4 kHz

0 100 200
meters

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FLUG PROPERTY

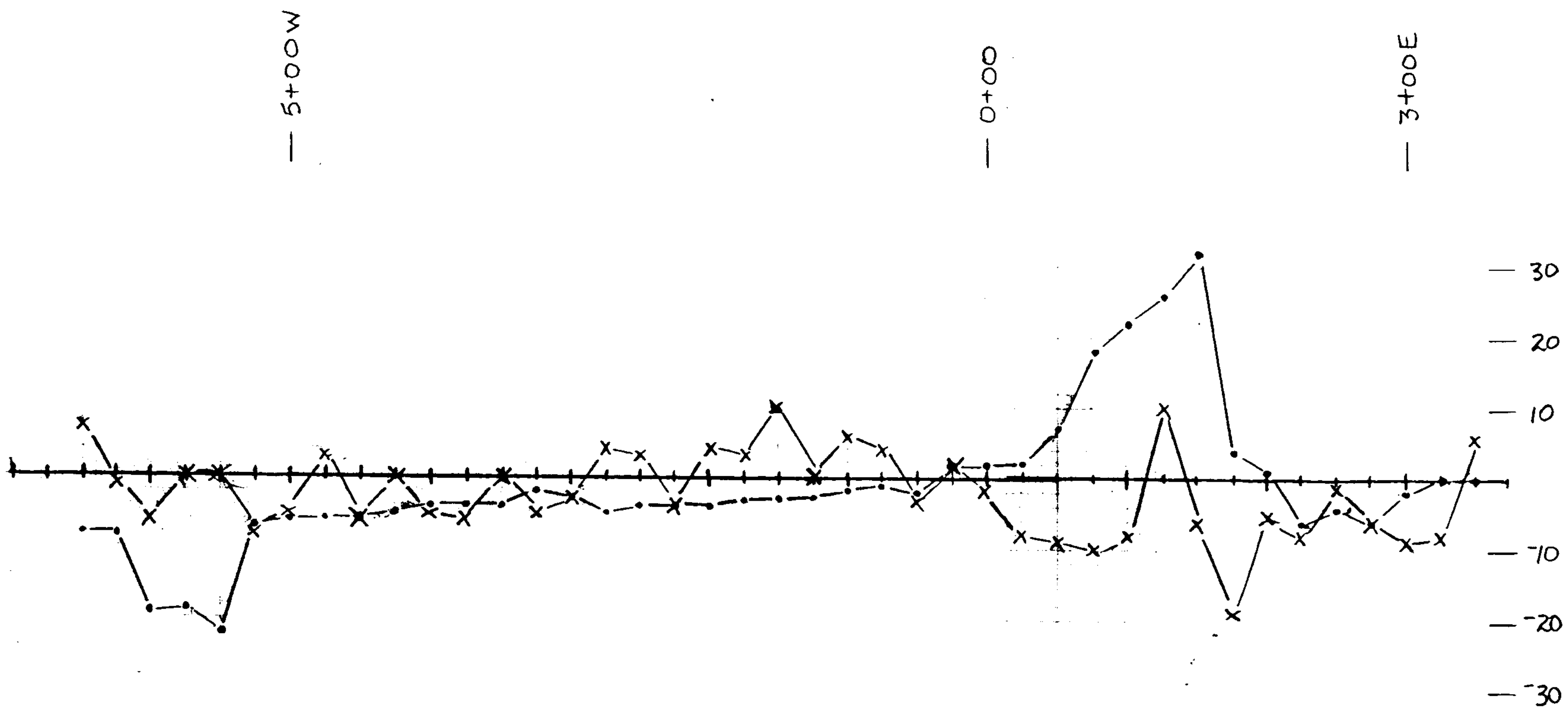
DAWSON M.D., YUKON NTS 115-O-10

VLF PROFILES, FL2 GRID
LINE 2+00 S, 5+00 E to 7+50 W

SCALE 1 : 5,000

DATE: JAN. 95
BY: P.S.

FIGURE 9



• Inphase
x Quadrature

North

Grid Direction

Station Direction

Vertical Scale
1 centimeter = 10%

Station: Annapolis, Maryland (NSS)
Frequency: 21.4 kHz

0 100 200
meters

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FAITH MINES LTD.

FLUG PROPERTY

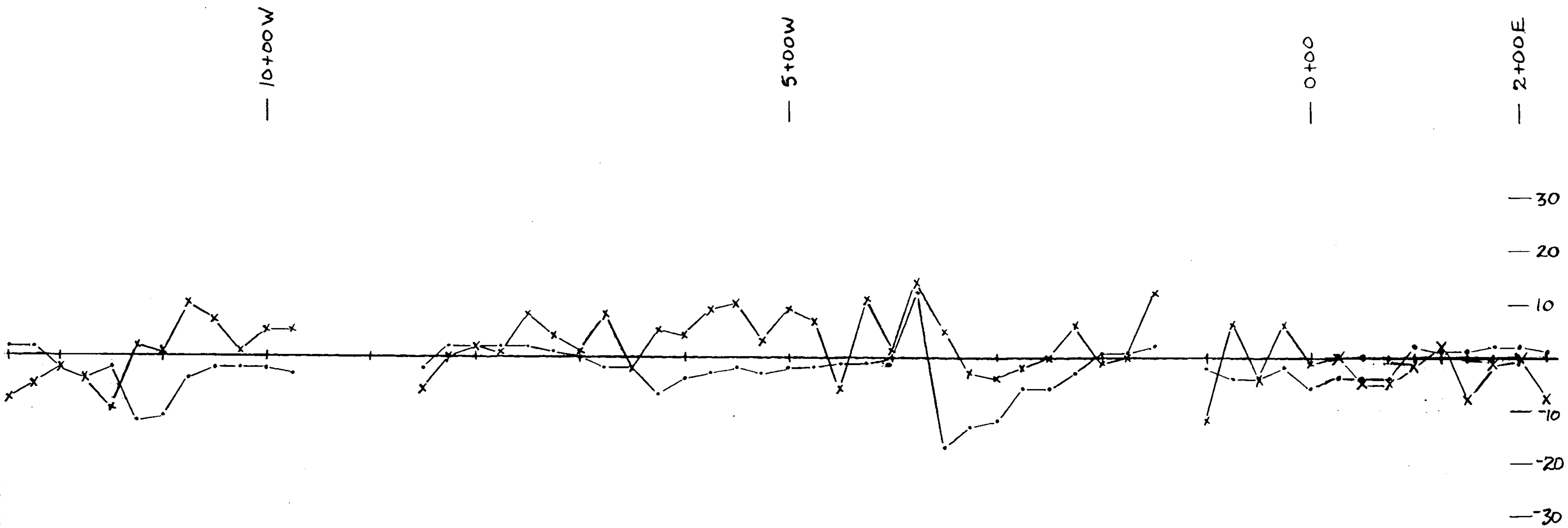
DAWSON M.D., YUKON NTS 115-O-10

VLF PROFILES, FL2 GRID
LINE 4+00 S, 3+50 E to 6+50 W

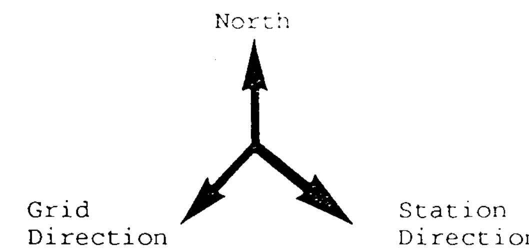
SCALE 1 : 5,000

DATE: JAN. 95
BY: P.S.

FIGURE 10

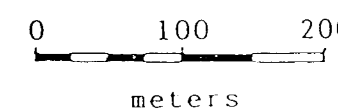


• Inphase
x Quadrature



Vertical Scale
1 centimeter = 10%

Station: Annapolis, Maryland (NSS)
Frequency: 21.4 kHz



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FAITH MINES LTD.

FLUG PROPERTY

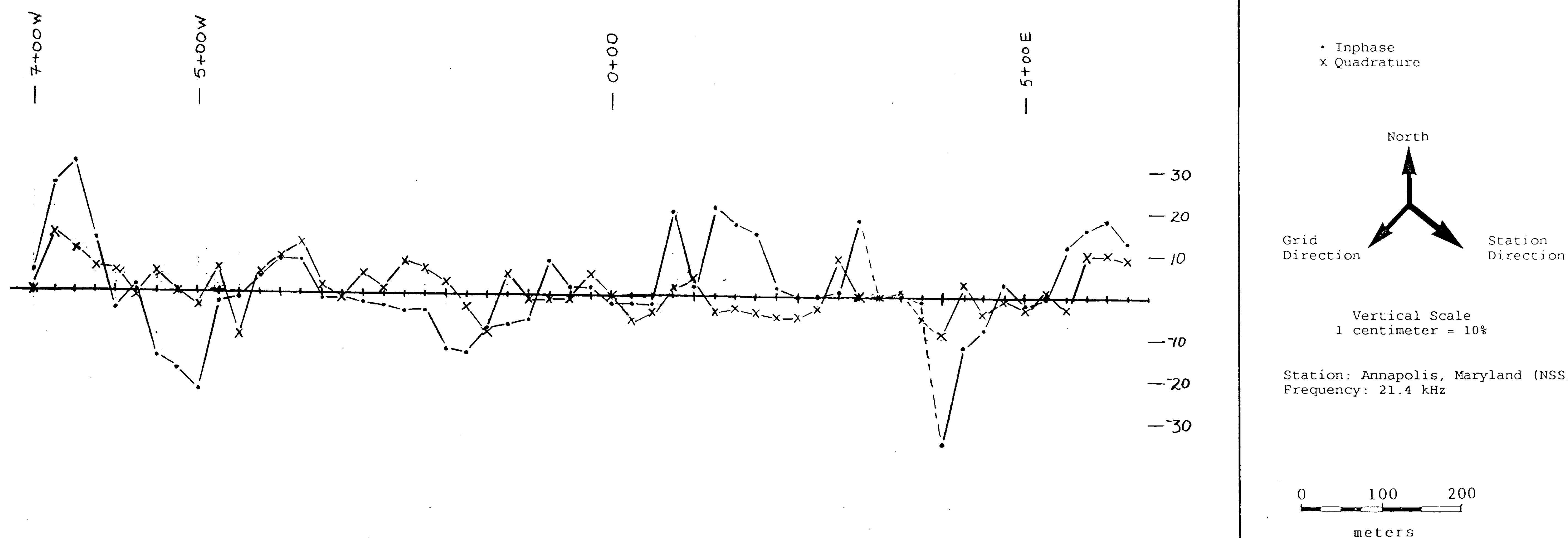
DAWSON M.D., YUKON — NTS 115-O-10

VLF PROFILES, FL2 GRID
LINE 6+00 S, 2+25 E to 12+50 W

SCALE 1 : 5,000

DATE: JAN. 95
BY: P.S.

FIGURE 11



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FAITH MINES LTD.

FLUG PROPERTY

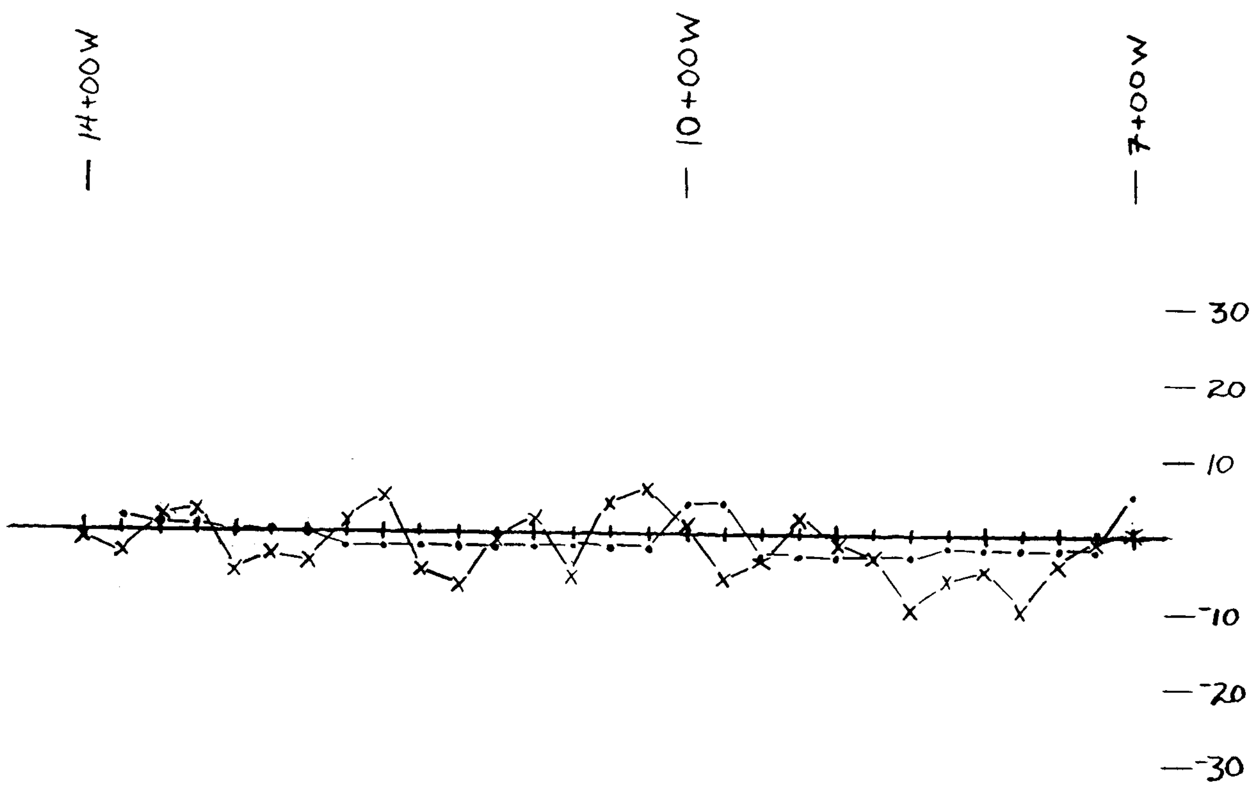
DAWSON M.D., YUKON NTS 115-O-10

VLF PROFILES, FL2 GRID
LINE 8+00 S, 6+50 E to 7+00 W

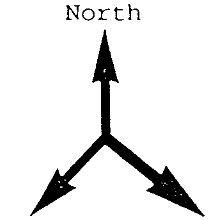
SCALE 1 : 5,000

DATE: JAN. 95
BY: P.S.

FIGURE 12

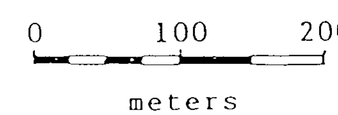


• Inphase
x Quadrature



Vertical Scale
1 centimeter = 10%

Station: Annapolis, Maryland (NSS)
Frequency: 21.4 kHz



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FLUG PROPERTY

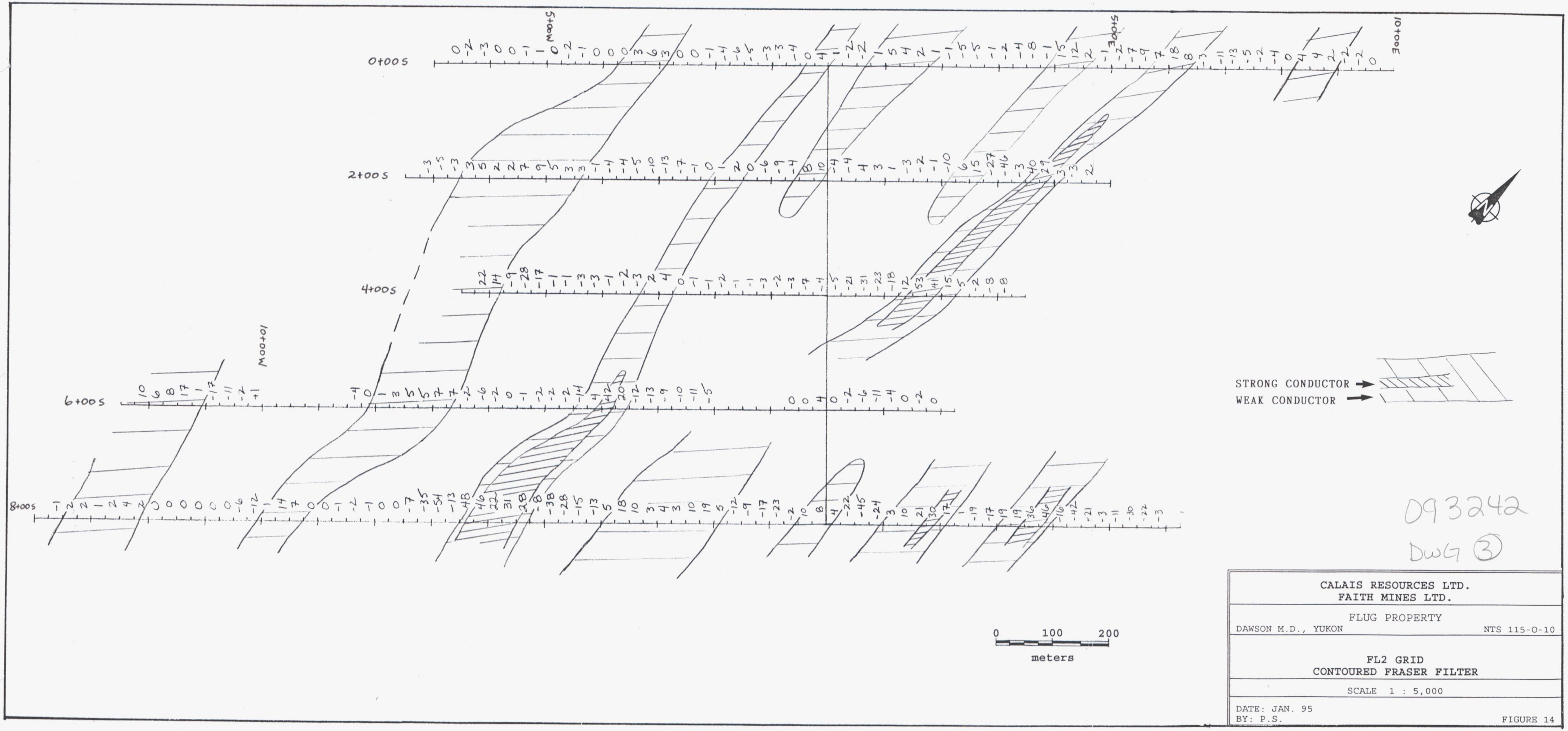
DAWSON M.D., YUKON — NTS 115-O-10

VLF PROFILES, FL2 GRID
LINE 8+00 S, 7+00 W to 14+00 W

SCALE 1 : 5,000

DATE: JAN. 95
BY: P.S.

FIGURE 13



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FAITH MINES LTD.

FLUG PROPERTY

DAWSON M.D., YUKON NTS 115-O-10

FL2 GRID
CONTOURED FRASER FILTER

SCALE 1 : 5,000

DATE: JAN. 95
BY: P.S.

FIGURE 14

6+00 S, 4+00 W. A second strong conductor of interest occurs between 4+00 S, 1+50 E and 2+00 S, 3+75 E. Additional anomalies occur on line 8+00 S at 1+75 E and 3+50 E.

The Mag survey (figure 6) was generally quite flat with average values ranging from 57466 nt to 57736 nt.

SUMMARY AND CONCLUSIONS

The Flug property is located in the Klondike Gold Camp over an area which had significant quantities of placer gold. The geologic interpretation suggests that a major thrust fault occurs in this area and may have been a source for the placer gold.

Current work has attempted to define targets for more advanced exploration using magnetic and VLF-EM surveys and a soil sampling survey. The VLF-EM survey identified several conductive zones within the dredge tailings that warrant follow-up work. Some form of drilling will be required to test bedrock beneath the extensive tailings.

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APPENDIX I

STATEMENT OF EXPENDITURES

FLUG CLAIMS - EXPENDITURES

<u>SALARIES</u>	
Phil Southam - 1 mandays @ $180/day	180
Lee Persinger - 7 mandays @ $150/day	1050
Report preparation - P. Southam - 3 mandays @ $180/day	540
<u>GEOCHEMICAL ANALYSIS</u>	
80 soil samples @ $17.17/sample	1374
<u>LOGISTICAL COSTS</u>	
Food and lodging - 6 mandays @ $50/day	300
Sample shipping	40
Vehicle fuel and maintenance	100
<u>FILING FEES</u>	200
SUBTOTAL	3784
Administration Fee (15%)	568
GST on Administration (#129350518)	40
TOTAL	**$4392**

APPENDIX II

STATEMENT OF QUALIFICATIONS

STATEMENT OF QUALIFICATIONS

I, Philip James Southam of 103 - 6615 Telford Avenue, Burnaby, British Columbia, do hereby certify:

1. I am a geologist registered with the Association of Professional Engineers and Geoscientists of British Columbia.

2. I graduated from Brandon University in 1987 with a Bachelor of Science degree majoring in geology.

3. I have practised my profession continuously since graduation in British Columbia, Manitoba, Yukon Territory and California in the field of mineral exploration.

4. I am employed by Hastings Management Corporation to provide geological services for Faith Mines Ltd. and Calais Resources Ltd.

5. All work completed for the purpose of this report was done under my supervision.

Philip Southam

PROFESSIONAL GEOSCIENTIST
PROVINCE OF BRITISH COLUMBIA
P. J. SOUTHAM

APPENDIX III

ANALYTICAL METHOD

Screening Procedure

Chemex Code: 201

Geochemical samples (soils,silts) are dried at 50 deg C and then sieved through an 80 mesh stainless steel screen. If insufficient material is obtained, the sample is sieved through a 35 mesh screen (code 203) and the -35 mesh material is ring pulverized (code 205).

If there is still insufficient material for analysis after sieving to -35 mesh, then the whole sample is recombined and ground (code 217).

Screening Procedure

Chemex Code: 203

Geochemical samples (soils,silts) are dried at 50 deg C. and then screened through a 35 mesh stainless steel screen. The -35 mesh material is then ring pulverized using a ring mill with either a chrome steel ring set (code 205) or a zirconia ring set (code 248). If there is insufficient -35 mesh material for analysis, then the entire sample is ground (code 217).

Gold

Fire Assay Collection/ Atomic Absorption Spectroscopy (FA-AA)

Chemex Code: 100

A 10g sample is fused with a neutral lead oxide flux inquarted with 6mg of gold-free silver and then cupelled to yield a precious metal bead.

These beads are digested for 30 mins in 0.5ml concentrated nitric acid, then 1.5ml of concentrated hydrochloric acid are added and the mixture is digested for 1 hr. The samples are cooled, diluted to a final volume of 5ml, homogenized and analyzed by atomic absorption spectroscopy.

Detection limit: 5 ppb

Upper Limit: 10,000 ppb

32-Element Geochemistry Package (32-ICP)
Inductively-Coupled Plasma-Atomic Emission Spectroscopy (ICP-AES)

A prepared sample (1.0g) is digested with concentrated nitric and aqua regia acids at medium heat for two hours. The acid solution is diluted to 25ml with demineralized water, mixed and analyzed using a Jarrell Ash 1100 plasma spectrometer after calibration with proper standards. The analytical results are corrected for spectral inter-element interferences.

Chemex Codes	Element	Detection Limit	Upper Limit
229	Digestion		
2119	* Aluminum	0.01 %	15 %
2118	Silver	0.2 ppm	0.02 %
2120	Arsenic	2 ppm	1 %
2121	* Barium	10 ppm	1 %
2122	* Beryllium	0.5 ppm	0.01 %
2123	Bismuth	2 ppm	1 %
2124	* Calcium	0.01 %	15 %
2125	Cadmium	0.5 ppm	0.05 %
2126	Cobalt	1 ppm	1 %
2127	* Chromium	1 ppm	1 %
2128	Copper	1 ppm	1 %
2150	Iron	0.01 %	15 %
2130	* Gallium	10 ppm	1 %
2132	* Potassium	0.01 %	10 %
2151	* Lanthanum	10 ppm	1 %
2134	* Magnesium	0.01 %	15 %
2135	Manganese	5 ppm	1 %
2136	Molybdenum	1 ppm	1 %
2137	* Sodium	0.01 %	10 %
2138	Nickel	1 ppm	1 %
2139	Phosphorus	10 ppm	1 %
2140	Lead	2 ppm	1 %
2141	Antimony	2 ppm	1 %
2142	* Scandium	1 ppm	1 %
2143	* Strontium	1 ppm	1 %
2144	* Titanium	0.01 %	10 %
2145	* Thallium	10 ppm	1 %
2146	Uranium	10 ppm	1 %
2147	Vanadium	1 ppm	1 %
2148	* Tungsten	10 ppm	1 %
2149	Zinc	2 ppm	1 %
2131	Mercury	1 ppm	1 %

* Elements for which the digestion is possibly incomplete.

APPENDIX IV

ASSAY RESULTS

Chemex Labs Ltd.
Analytical Chemists * Geochemists * Registered Assayers
212 Brooksbank Ave., North Vancouver
British Columbia, Canada V7J 2C1
PHONE: 604-984-0221

FAITH MINES LTD.

1000 - 675 W. HASTINGS ST.
VANCOUVER, BC
V6B 1N6

INVOICE NUMBER I 9 4 1 9 0 7 1

BILLING INFORMATION

Date: 5-JUL-94
Project: FLUG
P.O. No.:
Account: HUC

Comments:

Billing: For analysis performed on Certificate A9419071

Terms: Payment due on receipt of invoice
1.25% per month (15% per annum) charged on overdue accounts

Please Remit Payments to:

CHEMEX LABS LTD.
212 Brooksbank Ave.,
North Vancouver, B.C.
Canada V7J 2C1

# OF SAMPLES	ANALYSED FOR CODE - DESCRIPTION		UNIT PRICE	SAMPLE PRICE	AMOUNT
80	201 - Dry, sieve to -80 mesh		1.10		
	202 - save reject		0.75		
	ICP-32		6.25		
	100 - Au ppb	FA+AA	7.95	16.05	1284.00

Total Cost $ 1284.00
(Reg# R100938885) GST $ 89.88

TOTAL PAYABLE (CDN) $ 1373.88

Chemex Labs Ltd.
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1000 - 675 W. HASTINGS ST.
VANCOUVER, BC
V6B 1N6

A9419071

Comments: ATTN: P. SOUTHAM

CERTIFICATE A9419071

FAITH MINES LTD.

Project: FLUG
P.O. # :

Samples submitted to our lab in Vancouver, BC.
This report was printed on 5-JUL-94.

SAMPLE PREPARATION

CHEMEX CODE	NUMBER SAMPLES	DESCRIPTION
201	80	Dry, sieve to -80 mesh
202	80	save reject
229	80	ICP - AQ Digestion charge

* NOTE 1:

The 32 element ICP package is suitable for trace metals in soil and rock samples. Elements for which the nitric-aqua regia digestion is possibly incomplete are: Al, Ba, Be, Ca, Cr, Ga, K, La, Mg, Na, Sr, Ti, Tl, W.

ANALYTICAL PROCEDURES

CHEMEX CODE	NUMBER SAMPLES	DESCRIPTION	METHOD	DETECTION LIMIT	UPPER LIMIT
100	80	Au ppb: Fuse 10 g sample	FA-AAS	5	10000
2118	80	Ag ppm: 32 element, soil & rock	ICP-AES	0.2	200
2119	80	Al %: 32 element, soil & rock	ICP-AES	0.01	15.00
2120	80	As ppm: 32 element, soil & rock	ICP-AES	2	10000
2121	80	Ba ppm: 32 element, soil & rock	ICP-AES	10	10000
2122	80	Be ppm: 32 element, soil & rock	ICP-AES	0.5	100.0
2123	80	Bi ppm: 32 element, soil & rock	ICP-AES	2	10000
2124	80	Ca %: 32 element, soil & rock	ICP-AES	0.01	15.00
2125	80	Cd ppm: 32 element, soil & rock	ICP-AES	0.5	100.0
2126	80	Co ppm: 32 element, soil & rock	ICP-AES	1	10000
2127	80	Cr ppm: 32 element, soil & rock	ICP-AES	1	10000
2128	80	Cu ppm: 32 element, soil & rock	ICP-AES	1	10000
2150	80	Fe %: 32 element, soil & rock	ICP-AES	0.01	15.00
2130	80	Ga ppm: 32 element, soil & rock	ICP-AES	10	10000
2131	80	Hg ppm: 32 element, soil & rock	ICP-AES	1	10000
2132	80	K %: 32 element, soil & rock	ICP-AES	0.01	10.00
2151	80	La ppm: 32 element, soil & rock	ICP-AES	10	10000
2134	80	Mg %: 32 element, soil & rock	ICP-AES	0.01	15.00
2135	80	Mn ppm: 32 element, soil & rock	ICP-AES	5	10000
2136	80	Mo ppm: 32 element, soil & rock	ICP-AES	1	10000
2137	80	Na %: 32 element, soil & rock	ICP-AES	0.01	5.00
2138	80	Ni ppm: 32 element, soil & rock	ICP-AES	1	10000
2139	80	P ppm: 32 element, soil & rock	ICP-AES	10	10000
2140	80	Pb ppm: 32 element, soil & rock	ICP-AES	2	10000
2141	80	Sb ppm: 32 element, soil & rock	ICP-AES	2	10000
2142	80	Sc ppm: 32 elements, soil & rock	ICP-AES	1	10000
2143	80	Sr ppm: 32 element, soil & rock	ICP-AES	1	10000
2144	80	Ti %: 32 element, soil & rock	ICP-AES	0.01	5.00
2145	80	Tl ppm: 32 element, soil & rock	ICP-AES	10	10000
2146	80	U ppm: 32 element, soil & rock	ICP-AES	10	10000
2147	80	V ppm: 32 element, soil & rock	ICP-AES	1	10000
2148	80	W ppm: 32 element, soil & rock	ICP-AES	10	10000
2149	80	Zn ppm: 32 element, soil & rock	ICP-AES	2	10000

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To: FAITH MINES LTD.

1000 - 675 W. HASTINGS ST.
VANCOUVER, BC
V6B 1N6

Project : FLUG
Comments: ATTN: P. SOUTHAM

Certificate Date: 05-JUL-94
Invoice No. : I9419071
P.O. Number :
Account : HUC

CERTIFICATE OF ANALYSIS A9419071

SAMPLE	PREP CODE		Au ppb FA+AA	Ag ppm	Al %	As ppm	Ba ppm	Be ppm	Bi ppm	Ca %	Cd ppm
FL1 0S 00+50E	201	202	< 5	0.4	1.70	12	290	< 0.5	2	0.28	< 0.5
FL1 0S 01+00E	201	202	< 5	< 0.2	1.34	12	200	< 0.5	2	0.23	< 0.5
FL1 0S 01+50E	201	202	< 5	< 0.2	1.85	< 2	360	< 0.5	2	0.31	< 0.5
FL1 0S 02+00E	201	202	< 5	0.4	1.89	18	420	< 0.5	< 2	0.19	< 0.5
FL1 0S 02+50E	201	202	< 5	0.4	2.40	12	570	< 0.5	< 2	0.34	1.5
FL1 0S 03+00E	201	202	< 5	< 0.2	2.03	14	640	< 0.5	2	0.35	< 0.5
FL1 0S 03+50E	201	202	< 5	0.2	1.45	10	420	< 0.5	4	0.18	< 0.5
FL1 0S 04+00E	201	202	< 5	< 0.2	1.64	14	300	< 0.5	< 2	0.40	< 0.5
FL1 0S 04+50E	201	202	< 5	< 0.2	1.37	8	300	< 0.5	< 2	0.33	< 0.5
FL1 0S 05+00E	201	202	< 5	< 0.2	1.87	12	470	< 0.5	< 2	0.35	< 0.5
FL1 0S 05+50E	201	202	< 5	< 0.2	2.28	4	600	< 0.5	< 2	0.52	< 0.5
FL1 0S 06+00E	201	202	5	< 0.2	1.77	24	340	< 0.5	< 2	0.85	< 0.5
FL1 0S 06+50E	201	202	< 5	< 0.2	1.95	12	630	< 0.5	< 2	0.38	< 0.5
FL1 0S 07+00E	201	202	< 5	< 0.2	1.86	12	540	< 0.5	< 2	0.40	< 0.5
FL1 0S 07+50E	201	202	< 5	< 0.2	2.49	8	380	< 0.5	2	0.33	< 0.5
FL1 0S 08+00E	201	202	< 5	< 0.2	1.86	12	390	< 0.5	< 2	0.48	< 0.5
FL1 0S 08+50E	201	202	< 5	< 0.2	2.03	10	280	< 0.5	< 2	0.59	< 0.5
FL1 0S 09+00E	201	202	< 5	< 0.2	2.74	< 2	320	< 0.5	4	0.43	< 0.5
FL1 0S 09+50E	201	202	< 5	< 0.2	1.84	16	340	< 0.5	< 2	0.44	< 0.5
FL1 0S 10+00E	201	202	< 5	< 0.2	1.40	10	250	< 0.5	< 2	0.37	< 0.5
FL1 0S 10+50E	201	202	20	< 0.2	1.86	16	300	< 0.5	2	0.40	< 0.5
FL1 0S 11+00E	201	202	< 5	< 0.2	1.77	12	360	< 0.5	< 2	0.28	< 0.5
FL1 0S 11+50E	201	202	< 5	< 0.2	2.00	14	420	< 0.5	< 2	0.43	< 0.5
FL1 0S 12+00E	201	202	< 5	< 0.2	1.57	10	360	< 0.5	2	0.64	< 0.5
FL1 0S 12+50E	201	202	< 5	< 0.2	0.91	8	150	< 0.5	< 2	0.55	< 0.5
FL1 0S 13+00E	201	202	< 5	< 0.2	2.10	4	180	< 0.5	2	0.82	< 0.5
FL1 0S 13+50E	201	202	< 5	< 0.2	2.06	12	180	< 0.5	< 2	0.72	< 0.5
FL1 0S 14+00E	201	202	< 5	< 0.2	2.65	16	210	< 0.5	< 2	0.24	< 0.5
FL1 0S 14+50E	201	202	< 5	< 0.2	1.74	6	140	< 0.5	< 2	0.19	< 0.5
FL1 0S 15+00E	201	202	< 5	< 0.2	1.74	12	280	< 0.5	< 2	1.17	< 0.5
FL1 0S 00+00W	201	202	< 5	< 0.2	1.58	14	230	< 0.5	< 2	0.25	< 0.5
FL1 0S 00+50W	201	202	< 5	< 0.2	1.39	10	410	< 0.5	2	0.59	< 0.5
FL1 0S 01+50W	201	202	< 5	< 0.2	1.23	12	420	< 0.5	< 2	0.88	0.5
FL1 0S 02+00W	201	202	< 5	< 0.2	1.02	12	320	< 0.5	< 2	0.82	< 0.5
FL1 0S 02+50W	201	202	< 5	< 0.2	1.21	10	430	< 0.5	< 2	1.02	0.5
FL1 0S 03+00W	201	202	< 5	< 0.2	0.84	4	290	< 0.5	< 2	1.49	< 0.5
FL1 0S 03+50W	201	202	10	< 0.2	1.22	8	460	< 0.5	< 2	1.19	< 0.5
FL1 0S 04+00W	201	202	< 5	< 0.2	1.32	8	350	< 0.5	< 2	0.51	< 0.5
FL1 0S 04+50W	201	202	< 5	< 0.2	1.43	6	380	< 0.5	2	0.53	< 0.5
FL1 2+50S 00+00E	201	202	< 5	< 0.2	1.43	14	560	< 0.5	< 2	0.27	< 0.5

SAMPLE	PREP CODE		Co ppm	Cr ppm	Cu ppm	Fe %	Ga ppm	Hg ppm	K %	La ppm	Mg %	Mn ppm
FL1 0S 00+50E	201	202	9	32	29	2.64	10	< 1	0.22	20	0.69	260
FL1 0S 01+00E	201	202	8	26	20	2.16	10	< 1	0.08	10	0.40	180
FL1 0S 01+50E	201	202	9	42	33	3.21	10	< 1	0.41	< 10	0.89	315
FL1 0S 02+00E	201	202	15	34	13	2.88	10	< 1	0.09	10	0.51	820
FL1 0S 02+50E	201	202	18	53	19	2.98	10	< 1	0.07	10	0.62	1070
FL1 0S 03+00E	201	202	9	47	14	2.63	10	< 1	0.10	10	0.59	550
FL1 0S 03+50E	201	202	6	22	15	2.00	10	< 1	0.11	10	0.34	375
FL1 0S 04+00E	201	202	11	43	18	2.66	< 10	< 1	0.22	10	0.55	460
FL1 0S 04+50E	201	202	8	25	13	2.18	< 10	< 1	0.14	10	0.46	305
FL1 0S 05+00E	201	202	9	35	18	2.59	10	< 1	0.09	10	0.69	630
FL1 0S 05+50E	201	202	11	38	16	2.78	10	1	0.09	10	0.69	525
FL1 0S 06+00E	201	202	10	32	36	2.82	10	< 1	0.08	20	0.86	490
FL1 0S 06+50E	201	202	9	28	14	2.47	10	< 1	0.09	10	0.68	320
FL1 0S 07+00E	201	202	11	31	17	2.44	10	< 1	0.08	10	0.51	420
FL1 0S 07+50E	201	202	14	150	26	3.24	10	< 1	0.06	< 10	1.61	540
FL1 0S 08+00E	201	202	10	54	24	2.44	10	< 1	0.06	< 10	0.75	550
FL1 0S 08+50E	201	202	13	16	47	3.03	< 10	< 1	0.07	< 10	1.16	375
FL1 0S 09+00E	201	202	17	65	19	3.99	< 10	< 1	0.06	< 10	1.68	745
FL1 0S 09+50E	201	202	11	53	22	2.96	< 10	< 1	0.04	10	0.98	625
FL1 0S 10+00E	201	202	10	41	32	2.83	< 10	< 1	0.04	10	0.52	370
FL1 0S 10+50E	201	202	7	34	18	2.70	10	< 1	0.06	10	0.61	240
FL1 0S 11+00E	201	202	9	30	12	2.61	10	< 1	0.05	10	0.47	260
FL1 0S 11+50E	201	202	9	29	30	3.02	10	< 1	0.07	20	0.65	365
FL1 0S 12+00E	201	202	9	25	31	2.61	10	< 1	0.06	10	0.63	330
FL1 0S 12+50E	201	202	6	18	12	1.60	< 10	< 1	0.03	< 10	0.43	200
FL1 0S 13+00E	201	202	16	131	39	3.03	< 10	< 1	0.02	< 10	1.63	545
FL1 0S 13+50E	201	202	14	73	41	3.26	< 10	1	0.03	< 10	1.33	585
FL1 0S 14+00E	201	202	8	15	103	4.61	< 10	< 1	0.02	< 10	1.56	565
FL1 0S 14+50E	201	202	8	17	41	3.04	< 10	< 1	0.06	< 10	0.84	305
FL1 0S 15+00E	201	202	11	32	36	2.85	10	< 1	0.03	< 10	0.89	345
FL1 0S 00+00W	201	202	6	32	20	2.37	< 10	< 1	0.09	10	0.61	175
FL1 0S 00+50W	201	202	9	29	34	2.39	10	< 1	0.07	10	0.56	285
FL1 0S 01+50W	201	202	9	27	26	2.15	10	< 1	0.06	10	0.52	480
FL1 0S 02+00W	201	202	7	22	21	1.73	< 10	< 1	0.06	10	0.44	255
FL1 0S 02+50W	201	202	9	25	33	1.99	10	< 1	0.06	10	0.48	630
FL1 0S 03+00W	201	202	5	20	16	1.36	< 10	< 1	0.04	< 10	0.43	350
FL1 0S 03+50W	201	202	8	24	26	1.99	< 10	< 1	0.05	10	0.45	370
FL1 0S 04+00W	201	202	11	28	18	2.34	10	< 1	0.09	10	0.52	640
FL1 0S 04+50W	201	202	9	30	24	2.42	10	< 1	0.08	10	0.58	405
FL1 2+50S 00+00E	201	202	10	20	10	2.21	10	< 1	0.13	10	0.38	955

CERTIFICATION: Hart Bichler

Chemex Labs Ltd.
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Project : FLUG
Comments: ATTN: P. SOUTHAM

Page Number : 1-B
Total Pages : 2
Certificate Date: 05-JUL-94
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CERTIFICATE OF ANALYSIS A9419071

SAMPLE	PREP CODE		Mo ppm	Na %	Ni ppm	P ppm	Pb ppm	Sb ppm	Sc ppm	Sr ppm	Ti %	Tl ppm	U ppm	V ppm	W ppm	Zn ppm
FL1 0S 00+50E	201	202	1	0.01	21	440	4	6	6	21	0.09	< 10	< 10	44	< 10	80
FL1 0S 01+00E	201	202	1	0.01	18	410	2	4	3	17	0.07	< 10	< 10	45	< 10	46
FL1 0S 01+50E	201	202	1	< 0.01	22	900	4	< 2	3	29	0.16	< 10	< 10	50	< 10	108
FL1 0S 02+00E	201	202	1	0.01	15	1150	4	2	3	15	0.06	< 10	< 10	61	< 10	162
FL1 0S 02+50E	201	202	1	0.01	29	490	14	4	4	24	0.10	< 10	< 10	74	< 10	232
FL1 0S 03+00E	201	202	1	0.01	16	400	< 2	6	4	23	0.10	< 10	< 10	63	< 10	120
FL1 0S 03+50E	201	202	< 1	< 0.01	10	220	10	4	2	15	0.04	< 10	< 10	40	< 10	66
FL1 0S 04+00E	201	202	1	0.01	22	440	2	4	4	20	0.08	< 10	< 10	57	< 10	60
FL1 0S 04+50E	201	202	1	0.01	13	190	2	4	3	20	0.07	< 10	< 10	46	< 10	44
FL1 0S 05+00E	201	202	1	0.01	18	260	6	4	5	20	0.08	< 10	< 10	60	< 10	56
FL1 0S 05+50E	201	202	2	0.01	18	270	8	< 2	5	25	0.08	< 10	< 10	63	< 10	64
FL1 0S 06+00E	201	202	< 1	0.01	26	650	8	4	4	31	0.03	< 10	< 10	46	< 10	78
FL1 0S 06+50E	201	202	1	0.01	15	320	4	6	4	23	0.08	< 10	< 10	53	< 10	96
FL1 0S 07+00E	201	202	1	0.01	18	290	2	4	4	25	0.08	< 10	< 10	57	< 10	54
FL1 0S 07+50E	201	202	< 1	0.01	60	170	< 2	6	7	17	0.08	< 10	< 10	69	< 10	100
FL1 0S 08+00E	201	202	1	0.01	23	180	< 2	6	4	23	0.11	< 10	< 10	56	< 10	58
FL1 0S 08+50E	201	202	< 1	0.01	9	200	< 2	4	2	23	0.15	< 10	< 10	69	< 10	76
FL1 0S 09+00E	201	202	< 1	< 0.01	23	210	< 2	4	4	16	0.06	< 10	< 10	67	< 10	92
FL1 0S 09+50E	201	202	< 1	0.01	26	260	2	4	6	17	0.04	< 10	< 10	58	< 10	70
FL1 0S 10+00E	201	202	1	< 0.01	25	270	6	4	9	14	0.04	< 10	< 10	54	< 10	56
FL1 0S 10+50E	201	202	1	0.01	18	340	6	6	4	20	0.07	< 10	< 10	61	< 10	64
FL1 0S 11+00E	201	202	1	0.01	15	320	4	2	3	18	0.07	< 10	< 10	59	< 10	52
FL1 0S 11+50E	201	202	1	0.01	18	490	10	6	6	22	0.04	< 10	< 10	52	< 10	62
FL1 0S 12+00E	201	202	< 1	0.01	24	480	6	4	4	26	0.06	< 10	< 10	47	< 10	86
FL1 0S 12+50E	201	202	< 1	0.01	12	600	< 2	4	2	22	0.04	< 10	< 10	32	< 10	42
FL1 0S 13+00E	201	202	1	0.01	55	580	< 2	6	7	24	0.06	< 10	< 10	59	< 10	70
FL1 0S 13+50E	201	202	< 1	0.01	34	600	< 2	8	6	21	0.04	< 10	< 10	56	< 10	80
FL1 0S 14+00E	201	202	1	< 0.01	13	650	< 2	6	6	7	0.02	< 10	< 10	52	< 10	86
FL1 0S 14+50E	201	202	1	< 0.01	10	360	8	4	4	10	0.01	< 10	< 10	38	< 10	58
FL1 0S 15+00E	201	202	< 1	0.01	19	660	< 2	4	4	34	0.03	< 10	< 10	50	< 10	68
FL1 0S 00+00W	201	202	1	0.01	18	460	8	2	4	16	0.07	< 10	< 10	42	< 10	86
FL1 0S 00+50W	201	202	1	0.01	24	520	6	2	4	30	0.06	< 10	< 10	43	< 10	98
FL1 0S 01+50W	201	202	1	0.01	22	740	4	4	3	46	0.06	< 10	< 10	43	< 10	112
FL1 0S 02+00W	201	202	1	0.01	18	670	< 2	4	3	41	0.04	< 10	< 10	37	< 10	68
FL1 0S 02+50W	201	202	< 1	0.01	26	670	4	4	3	46	0.04	< 10	< 10	40	< 10	78
FL1 0S 03+00W	201	202	1	0.01	14	800	2	4	2	68	0.03	< 10	< 10	30	< 10	48
FL1 0S 03+50W	201	202	< 1	0.01	19	550	2	< 2	3	53	0.04	< 10	< 10	41	< 10	70
FL1 0S 04+00W	201	202	1	0.01	18	420	4	6	3	27	0.06	< 10	< 10	49	< 10	82
FL1 0S 04+50W	201	202	1	0.02	22	390	6	4	4	32	0.06	< 10	< 10	51	< 10	62
FL1 2+50S 00+00E	201	202	1	< 0.01	10	350	4	2	2	21	0.06	< 10	< 10	42	< 10	46

CERTIFICATION: Hart Bichler

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VANCOUVER, BC
V6B 1N6

Project : FLUG
Comments: ATTN: P. SOUTHAM

Certificate Date: 05-JUL-94
Invoice No. : I9419071
P.O. Number :
Account : HUC

CERTIFICATE OF ANALYSIS A9419071

SAMPLE	PREP CODE		Au ppb FA+AA	Ag ppm	Al %	As ppm	Ba ppm	Be ppm	Bi ppm	Ca %	Cd ppm	Co ppm	Cr ppm	Cu ppm	Fe %	Ga ppm	Hg ppm	K %	La ppm	Mg %	Mn ppm
FL1 2+50S 00+50E	201	202	< 5	< 0.2	1.49	8	510	< 0.5	< 2	0.32	< 0.5	6	19	10	2.39	< 10	< 1	0.12	< 10	0.51	315
FL1 2+50S 01+00E	201	202	< 5	< 0.2	1.88	14	500	< 0.5	< 2	0.20	< 0.5	9	27	11	2.67	10	< 1	0.08	< 10	0.50	675
FL1 2+50S 01+50E	201	202	< 5	< 0.2	1.61	6	520	< 0.5	4	0.27	< 0.5	7	27	8	2.44	< 10	< 1	0.08	< 10	0.61	315
FL1 2+50S 02+00E	201	202	< 5	0.2	2.03	6	680	< 0.5	< 2	0.37	1.5	11	33	20	2.65	10	< 1	0.15	< 10	0.68	580
FL1 2+50S 02+50E	201	202	< 5	< 0.2	1.17	6	450	< 0.5	< 2	0.29	< 0.5	8	23	10	1.97	< 10	1	0.15	< 10	0.40	605
FL1 2+50S 03+00E	201	202	< 5	< 0.2	1.85	8	530	< 0.5	< 2	0.35	< 0.5	10	36	24	2.73	10	< 1	0.24	10	0.66	520
FL1 2+50S 03+50E	201	202	< 5	< 0.2	2.15	22	450	< 0.5	< 2	0.37	< 0.5	12	42	24	3.14	10	< 1	0.27	10	0.81	465
FL1 2+50S 04+00E	201	202	< 5	< 0.2	1.51	14	830	< 0.5	4	0.41	< 0.5	11	29	12	2.33	10	< 1	0.20	10	0.44	745
FL1 2+50S 04+50E	201	202	< 5	< 0.2	1.82	8	630	< 0.5	< 2	0.41	< 0.5	13	49	16	2.51	10	1	0.10	< 10	0.62	725
FL1 2+50S 05+00E	201	202	< 5	< 0.2	1.43	10	400	< 0.5	< 2	0.26	< 0.5	7	25	13	2.28	10	< 1	0.06	10	0.36	170
FL1 2+50S 05+50E	201	202	< 5	< 0.2	0.88	6	620	< 0.5	< 2	1.20	< 0.5	4	20	29	1.32	10	< 1	0.09	30	0.38	170
FL1 2+50S 06+00E	201	202	< 5	< 0.2	1.23	8	280	< 0.5	< 2	0.68	< 0.5	8	26	20	2.29	10	< 1	0.08	10	0.56	250
FL1 2+50S 06+50E	201	202	< 5	< 0.2	0.74	6	160	< 0.5	< 2	0.56	< 0.5	6	19	11	1.50	< 10	< 1	0.04	10	0.36	140
FL1 2+50S 07+00E	201	202	< 5	< 0.2	1.42	16	480	< 0.5	< 2	0.86	< 0.5	9	26	34	2.38	< 10	< 1	0.04	10	0.66	895
FL1 2+50S 07+50E	201	202	< 5	< 0.2	1.51	4	530	< 0.5	4	0.97	0.5	9	30	33	2.40	< 10	1	0.04	10	0.78	365
FL1 2+50S 08+00E	201	202	< 5	< 0.2	1.67	6	420	< 0.5	< 2	0.81	< 0.5	9	31	27	2.55	< 10	< 1	0.03	< 10	0.86	290
FL1 2+50S 08+50E	201	202	< 5	< 0.2	1.87	8	300	< 0.5	< 2	0.75	< 0.5	11	50	37	2.91	10	< 1	0.04	10	0.97	300
FL1 2+50S 09+00E	201	202	< 5	< 0.2	1.57	6	230	< 0.5	4	0.96	< 0.5	9	55	43	2.52	< 10	< 1	0.04	10	0.89	235
FL1 2+50S 09+50E	201	202	< 5	< 0.2	1.79	14	400	< 0.5	< 2	1.25	< 0.5	11	34	37	2.97	10	< 1	0.08	10	0.83	335
FL1 2+50S 10+00E	201	202	< 5	< 0.2	1.74	14	350	< 0.5	< 2	0.97	< 0.5	12	35	33	3.02	10	< 1	0.08	10	0.77	310
FL1 2+50S 10+50E	201	202	< 5	< 0.2	1.77	6	420	< 0.5	< 2	1.03	0.5	11	36	45	2.89	10	< 1	0.06	10	0.77	630
FL1 2+50S 11+00E	201	202	< 5	< 0.2	2.09	6	380	< 0.5	< 2	0.83	< 0.5	14	62	51	3.38	10	< 1	0.07	10	1.03	605
FL1 2+50S 11+50E	201	202	< 5	< 0.2	2.30	20	260	< 0.5	< 2	1.31	< 0.5	18	30	61	3.62	< 10	< 1	0.04	10	1.43	995
FL1 2+50S 12+00E	201	202	< 5	< 0.2	1.81	16	480	< 0.5	2	1.27	< 0.5	8	35	40	2.72	< 10	< 1	0.04	10	0.65	265
FL1 2+50S 12+50E	201	202	< 5	< 0.2	1.31	10	390	< 0.5	2	0.87	< 0.5	7	26	28	2.33	< 10	< 1	0.04	10	0.57	360
FL1 2+50S 13+00E	201	202	< 5	< 0.2	1.41	12	520	< 0.5	< 2	0.92	< 0.5	7	28	37	2.30	10	< 1	0.03	10	0.51	330
FL1 2+50S 13+50E	201	202	< 5	< 0.2	1.09	10	250	< 0.5	< 2	0.74	< 0.5	7	23	18	1.89	< 10	< 1	0.03	10	0.46	270
FL1 2+50S 14+00E	201	202	< 5	< 0.2	1.12	14	230	< 0.5	< 2	0.42	< 0.5	7	27	20	2.07	< 10	< 1	0.05	10	0.52	240
FL1 2+50S 14+50E	201	202	35	< 0.2	1.35	16	400	< 0.5	< 2	0.28	< 0.5	8	27	18	2.16	< 10	< 1	0.04	10	0.41	250
FL1 2+50S 15+00E	201	202	< 5	< 0.2	1.72	10	450	< 0.5	< 2	0.46	< 0.5	9	36	13	2.53	< 10	< 1	0.06	10	0.56	365
FL1 2+50S 00+50W	201	202	< 5	< 0.2	1.23	8	370	< 0.5	< 2	0.39	< 0.5	7	23	14	2.13	< 10	< 1	0.14	10	0.45	415
FL1 2+50S 01+00W	201	202	< 5	0.2	2.94	18	1150	< 0.5	< 2	0.77	< 0.5	8	46	55	3.88	< 10	< 1	0.36	350	0.52	890
FL1 2+50S 01+50W	201	202	< 5	< 0.2	2.01	14	780	< 0.5	< 2	0.30	< 0.5	10	33	15	2.92	< 10	< 1	0.16	10	0.49	725
FL1 2+50S 02+00W	201	202	< 5	< 0.2	1.73	12	520	< 0.5	< 2	0.33	< 0.5	10	26	11	2.36	10	< 1	0.16	10	0.42	500
FL1 2+50S 02+50W	201	202	< 5	< 0.2	2.09	8	620	< 0.5	2	0.29	< 0.5	11	28	10	2.61	10	< 1	0.14	10	0.51	675
FL1 2+50S 03+00W	201	202	< 5	< 0.2	1.63	8	780	< 0.5	2	0.44	< 0.5	9	26	12	2.38	10	< 1	0.21	20	0.41	965
FL1 2+50S 03+50W	201	202	< 5	< 0.2	1.74	4	800	< 0.5	< 2	0.39	< 0.5	12	29	15	2.53	10	< 1	0.11	10	0.56	755
FL1 2+50S 04+00W	201	202	< 5	< 0.2	1.43	12	540	< 0.5	< 2	0.45	< 0.5	10	30	19	2.61	< 10	< 1	0.28	10	0.64	515
FL1 2+50S 04+50W	201	202	< 5	< 0.2	1.47	8	560	< 0.5	4	0.23	< 0.5	10	24	16	2.27	< 10	< 1	0.06	10	0.42	535
FL1 2+50S 05+00W	201	202	< 5	0.2	1.68	12	1170	< 0.5	< 2	0.58	< 0.5	10	24	47	2.39	10	1	0.07	60	0.40	840

CERTIFICATION: Hart Bichler

Chemex Labs Ltd.

Analytical Chemists * Geochemists * Registered Assayers
212 Brooksbank Ave., North Vancouver
British Columbia, Canada V7J 2C1
PHONE: 604-984-0221

FAITH MINES LTD.

1000 - 675 W. HASTINGS ST.
VANCOUVER, BC
V6B 1N6

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SAMPLE	PREP CODE	Mo ppm	Na %	Ni ppm	P ppm	Pb ppm	Sb ppm	Sc ppm	Sr ppm	Ti %	Tl ppm	U ppm	V ppm	W ppm	Zn ppm
FL1 2+50S 00+50E	201 202	1	< 0.01	12	780	4	2	2	23	0.04	< 10	< 10	38	< 10	70
FL1 2+50S 01+00E	201 202	1	< 0.01	15	510	< 2	4	3	15	0.06	< 10	< 10	54	< 10	82
FL1 2+50S 01+50E	201 202	1	< 0.01	16	450	6	2	2	18	0.06	< 10	< 10	45	< 10	130
FL1 2+50S 02+00E	201 202	1	< 0.01	17	360	6	4	3	26	0.06	< 10	< 10	52	< 10	492
FL1 2+50S 02+50E	201 202	< 1	< 0.01	12	250	8	4	2	18	0.06	< 10	< 10	39	< 10	70
FL1 2+50S 03+00E	201 202	2	0.01	19	430	8	< 2	4	26	0.08	< 10	< 10	51	< 10	108
FL1 2+50S 03+50E	201 202	1	< 0.01	27	410	10	4	6	26	0.11	< 10	< 10	57	< 10	104
FL1 2+50S 04+00E	201 202	1	0.01	16	750	2	4	3	29	0.08	< 10	< 10	47	< 10	88
FL1 2+50S 04+50E	201 202	1	0.01	20	470	2	4	4	26	0.09	< 10	< 10	50	< 10	106
FL1 2+50S 05+00E	201 202	1	< 0.01	14	330	8	4	2	19	0.07	< 10	< 10	51	< 10	50
FL1 2+50S 05+50E	201 202	1	0.01	18	530	4	2	2	68	0.03	< 10	< 10	28	< 10	44
FL1 2+50S 06+00E	201 202	< 1	0.01	20	700	6	6	4	32	0.07	< 10	< 10	46	< 10	76
FL1 2+50S 06+50E	201 202	< 1	0.01	12	750	2	4	2	25	0.04	< 10	< 10	30	< 10	46
FL1 2+50S 07+00E	201 202	1	0.01	24	510	8	6	4	34	0.03	< 10	< 10	40	< 10	86
FL1 2+50S 07+50E	201 202	1	0.01	25	340	8	2	4	41	0.03	< 10	< 10	40	< 10	70
FL1 2+50S 08+00E	201 202	< 1	0.01	23	410	8	2	4	37	0.04	< 10	< 10	40	< 10	80
FL1 2+50S 08+50E	201 202	< 1	0.01	27	340	4	2	6	29	0.10	< 10	< 10	47	< 10	84
FL1 2+50S 09+00E	201 202	< 1	0.01	26	380	< 2	4	6	32	0.09	< 10	< 10	58	< 10	70
FL1 2+50S 09+50E	201 202	1	0.02	26	660	2	6	6	42	0.09	< 10	< 10	60	< 10	100
FL1 2+50S 10+00E	201 202	1	0.01	23	650	< 2	6	6	36	0.09	< 10	< 10	66	< 10	92
FL1 2+50S 10+50E	201 202	1	0.01	29	620	2	6	6	40	0.06	< 10	< 10	56	< 10	106
FL1 2+50S 11+00E	201 202	1	0.01	35	430	2	4	9	33	0.07	< 10	< 10	69	< 10	100
FL1 2+50S 11+50E	201 202	1	0.01	24	750	< 2	4	7	38	0.03	< 10	< 10	65	< 10	78
FL1 2+50S 12+00E	201 202	1	0.01	26	610	8	4	4	50	0.05	< 10	< 10	52	< 10	70
FL1 2+50S 12+50E	201 202	1	0.01	21	690	2	2	3	40	0.04	< 10	< 10	43	< 10	70
FL1 2+50S 13+00E	201 202	< 1	0.01	28	760	6	4	3	45	0.04	< 10	< 10	45	< 10	56
FL1 2+50S 13+50E	201 202	< 1	0.01	16	700	2	6	3	32	0.04	< 10	< 10	39	< 10	44
FL1 2+50S 14+00E	201 202	1	0.01	18	690	2	6	3	24	0.06	< 10	< 10	44	< 10	48
FL1 2+50S 14+50E	201 202	< 1	< 0.01	16	350	< 2	< 2	3	16	0.06	< 10	< 10	49	< 10	40
FL1 2+50S 15+00E	201 202	1	< 0.01	19	480	2	6	4	26	0.05	< 10	< 10	56	< 10	46
FL1 2+50S 00+50W	201 202	< 1	< 0.01	15	250	4	2	3	24	0.06	< 10	< 10	42	< 10	44
FL1 2+50S 01+00W	201 202	1	0.01	26	760	14	6	17	53	0.01	< 10	< 10	43	< 10	74
FL1 2+50S 01+50W	201 202	1	0.01	19	390	4	6	4	24	0.07	< 10	< 10	57	< 10	70
FL1 2+50S 02+00W	201 202	1	0.01	13	860	4	4	3	27	0.07	< 10	< 10	49	< 10	70
FL1 2+50S 02+50W	201 202	< 1	0.01	15	830	6	6	3	24	0.08	< 10	< 10	55	< 10	86
FL1 2+50S 03+00W	201 202	1	0.01	14	430	12	6	3	32	0.07	< 10	< 10	49	< 10	60
FL1 2+50S 03+50W	201 202	1	0.01	14	510	4	2	3	31	0.09	< 10	< 10	49	< 10	68
FL1 2+50S 04+00W	201 202	1	< 0.01	20	370	< 2	2	3	39	0.10	< 10	< 10	41	< 10	64
FL1 2+50S 04+50W	201 202	1	< 0.01	17	310	8	4	2	21	0.04	< 10	< 10	42	< 10	52
FL1 2+50S 05+00W	201 202	1	0.01	25	430	16	4	5	49	0.02	< 10	< 10	37	< 10	74

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APPENDIX V

EM 16 SPECIFICATIONS, OPERATION AND FRASER FILTER

EM16 SPECIFICATIONS

MEASURED QUANTITY	In-phase and quad-phase components of vertical magnetic field as a percentage of horizontal primary field. (i.e. tangent of the tilt angle and ellipticity).
SENSITIVITY	In-phase : ±150% Quad-phase : ± 40%
RESOLUTION	±1%
OUTPUT	Nulling by audio tone. In-phase indication from mechanical inclinometer and quad-phase from a graduated dial.
OPERATING FREQUENCY	15-25 kHz VLF Radio Band. Station selection done by means of plug-in units.
OPERATOR CONTROLS	On/Off switch, battery test push button, station selector switch, audio volume control, quadrature dial, inclinometer.
POWER SUPPLY	6 disposable 'AA' cells.
DIMENSIONS	42 x 14 x 9cm
WEIGHT	Instrument: 1.6 kg Shipping : 4.5 kg

PRINCIPLES OF OPERATION

The VLF-transmitting stations operating for communications with submarines have a vertical antenna. The Antenna current is thus vertical, creating a concentric horizontal magnetic field around them. When these magnetic fields meet conductive bodies in the ground, there will be secondary fields radiating from these bodies. (See Figures 3 & 4). This equipment measures the vertical components of these secondary fields.

The EM16 is simply a sensitive receiver covering the frequency band of the VLF-transmitting stations with means of measuring the vertical field components.

The receiver has two inputs, with two receiving coils built into the instrument. One coil has normally vertical axis and the other is horizontal.

The signal from one of the coils (vertical axis) is first minimized by tilting the instrument. The tilt-angle is calibrated in percentage. The remaining signal in this coil is finally balanced out by a measured percentage of a signal from the other coil, after being shifted by 90°. This coil is normally parallel to the primary field,(See instrument Block Diagram - Figure 2).

Thus, if the secondary signals are small compared to the primary horizontal field, the mechanical tilt-angle is an accurate measure of the vertical real-component, and the compensation $\pi/2$-signal from the horizontal coil is a measure of the quadrature vertical signal.

GEONICS LIMITED

1745 Meyerside Drive, Unit 8, Mississauga, Ontario, Canada L5T 1C5 Tel. (416) 676-9580 Cables: Geonics

CONTOURING OF VLF-EM DATA

By

D. C. Fraser

Reprinted From
GEOPHYSICS
Vol. XXXIV, No. 6, December 1969

GEOPHYSICS, VOL. 34, NO. 6 (DECEMBER 1969), P. 958-967, 6 FIGS., 1 TABLE

CONTOURING OF VLF-EM DATA†

D. C. FRASER*

Prospecting for conductive deposits with ground VLF-EM instruments has received considerable impetus with the recent development of lightweight receivers. The large geologic noise component, which results from the relatively high-transmitted frequency, has caused some critics to avoid use of the technique. Those who routinely perform surveys with a VLF-EM unit find that, in some areas, a 5-degree peak-to-peak anomaly can be significant, whereas anomalies having amplitudes in excess of 100 degrees may occur as well. Consequently, there is a dynamic range problem when presenting the results as profiles plotted on a field map.

A data manipulation procedure is described which transforms noisy noncontourable data into less noisy contourable data, thereby eliminating the dynamic range problem and reducing the noise problem. The manipulation is the result of the application of a difference operator to transform zero-crossings into peaks, and a low-pass smoothing operator to reduce noise. Experience has shown that field personnel can routinely perform the calculations which simply involve additions and subtractions.

INTRODUCTION

VLF-EM data can be exceedingly difficult to interpret because a large geologic noise component can result from the relatively high-transmitted frequency of about 20,000 Hz. Routine surveys can yield useless data unless special care is taken both in survey procedure and in data presentation.

The purpose of this paper is to describe the survey procedure and the method of data presentation in use by the Keevil Mining Group and to illustrate the advantages of this approach.

VLF-EM GROUND SURVEY PROCEDURE AND DATA TREATMENT

The primary field

VLF-EM transmitter stations are located at several points around the globe. They broadcast at frequencies close to 20,000 Hz, which is low compared to the normal broadcast band. The purpose of these stations is to allow governmental communication with submarines, and the low frequency allows some penetration of the conductive ocean water. Skin depth is approximately $3.6\sqrt{P}$ meters, where P is the resistivity of a homogeneous halfspace in ohm-m, on the assumption that the frequency is 20,000 Hz and that the halfspace is magnetically nonpolarizable. Consequently, depth of exploration is severely restricted for overburden resistivities less than 200 ohm-m.

Since the area to be prospected normally is of considerable distance from the transmitter stations, the primary field is uniform in the area, allowing rather simple mathematics to be used in anomaly prediction and analysis.

Survey procedure and data treatment

The survey procedure first consists of selecting a transmitter station which provides a field approximately parallel to the traverse direction, i.e., approximately perpendicular to the expected strike of a conductor. The following points relate to the method of data treatment.

1. Readings should be taken every 50 ft, as will be shown below.
2. Transmitter stations should not be changed

† Manuscript received by the Editor April 24, 1969; revised manuscript received August 18, 1969.

* Keevil Mining Group Limited, Geophysical Engineering & Surveys Limited, Teck Corporation Limited, Toronto, Ontario, Canada.

for a given block of ground, to avoid distortion in the contour presentation. Hence, fill-in lines should be run with the same transmitter station as other lines in the block. The field direction of this station should be shown on the data map.

3. List the dip angle[1] data in tabular form, as follows:
   a) list in the direction of north (top of paper) to south, or from west to east;
   b) designate south or east dips as negative; and
   c) perform calculations as shown in Table 1.

   Thus, the filtered output or contourable quantity simply consists of the sum of the observations at two consecutive data stations subtracted from the sum at the next two consecutive data stations. The theoretical basis for this procedure will be described below.
4. The right-hand column (filtered data) is suitable for contouring. Normally, negative values are not contoured since, being caused by dip angle flanks, they do not aid interpretation but only confuse the picture. The positive values generally are contoured at 10-unit intervals, and the zero contour is shown only when it brackets an anomaly. In quiet areas, 5-unit contours may be meaningful.

[1] This paper assumes that data is recorded as for the Crone Radem which defines a north-dipping field as a south "dip" on the instrument. This convention was chosen because a south reading is interpreted as arising from a conductor to the south.

Example

Figure 1 presents dip-angle data, according to the Crone convention, in the vicinity of the Temagami mine of Copperfields Mining Corporation Limited in Ontario. This figure illustrates that several conductors are present yielding large dip angles. A complex pattern has resulted which requires some thought to interpret properly.

Figure 2 presents the filtered data in contoured form where only the 0, 20, and 40 contours are shown for simplicity. The conductor pattern is immediately apparent, even to exploration personnel untrained in VLF-EM interpretation. The three anomalies correlate with a zone of nearly massive pyrite and two brecciated fault zones. Depth to bedrock is 15 ft.

In practice, all the data of Figures 1 and 2 are

Table 1. Example of calculations

Location	Measured dips	Apply sign and form the moving sum of pairs of entries		Take first differences of alternate entries		
3+00S	6S	−6				
			(−6)+(−7) =	−13		
3+50S	7S	−7				
			(−7)+(−8) =	−15	(−23)−(−13) =	−10
4+00S	8S	−8				
				−23	(−39)−(−15) =	−24
4+50S	15S	−15				
				−39		+ 7
5+00S	24S	−24				
				−16		+57
5+50S	8N	+ 8				
				+18		+38
6+00S	10N	+10				
				+22		+ 8
6+50S	12N	+12				
				+26		+ 6
7+00S	14N	+14				
				+28	(+34)−(+26) =	+ 8
7+50S	14N	+14				
			(14)+(20) =	+34		
8+00S	20N	+20				

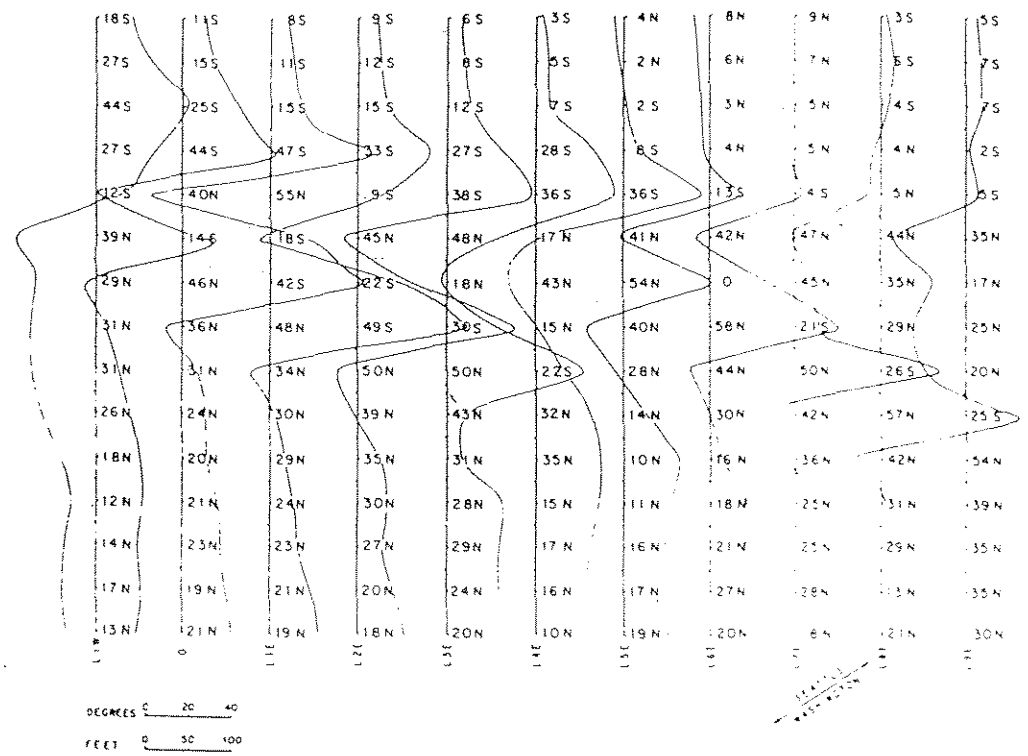

FIG. 1. Dip-angle data in the vicinity of the Temagami mine. The arrow defines the VLF-EM primary field direction from the transmitter at Seattle, Washington

placed on a single map. The above example illustrates that this very simple one-dimensional filtering scheme yields a practical and effective approach to VLF-EM data handling.

The filter improves the resolution of anomalies, thereby making them easier to recognize. An inflection on the dip profile from a conductor subordinate to a larger one yields a positive peak, thereby emphasizing the presence of such a conductor. Figure 3 illustrates this effect where nine lines were run over an SP (self-potential) anomaly in the Temagami area. The dip-angle anomaly is very poorly resolved due to the regional south dips produced by an areally large conductor to the south of the map area. The contoured VLF-EM data yields a clearly defined anomaly which was located over the negative center of the SP.

THE FILTER AND ITS EFFECT ON ANOMALIES

The filter operator

The filter operator was designed to meet the following criteria:

1. It must phase shift the dip-angle data by 90 degrees so that crossovers and inflections will be transformed into peaks to yield contourable quantities.
2. It must completely remove dc and attenuate long spatial wavelengths to increase resolution of local anomalies.
3. It must not exaggerate the station-to-station random noise.
4. It must be simple to apply so that field personnel can make the calculations without difficulty.

The first two criteria are met by using a simple difference operator, i.e.

$$M_2 - M_1,$$

where M_1 and M_2 are any two consecutive data points.

The third criterion is met by applying a smoothing or low-pass operator to the differences, i.e.

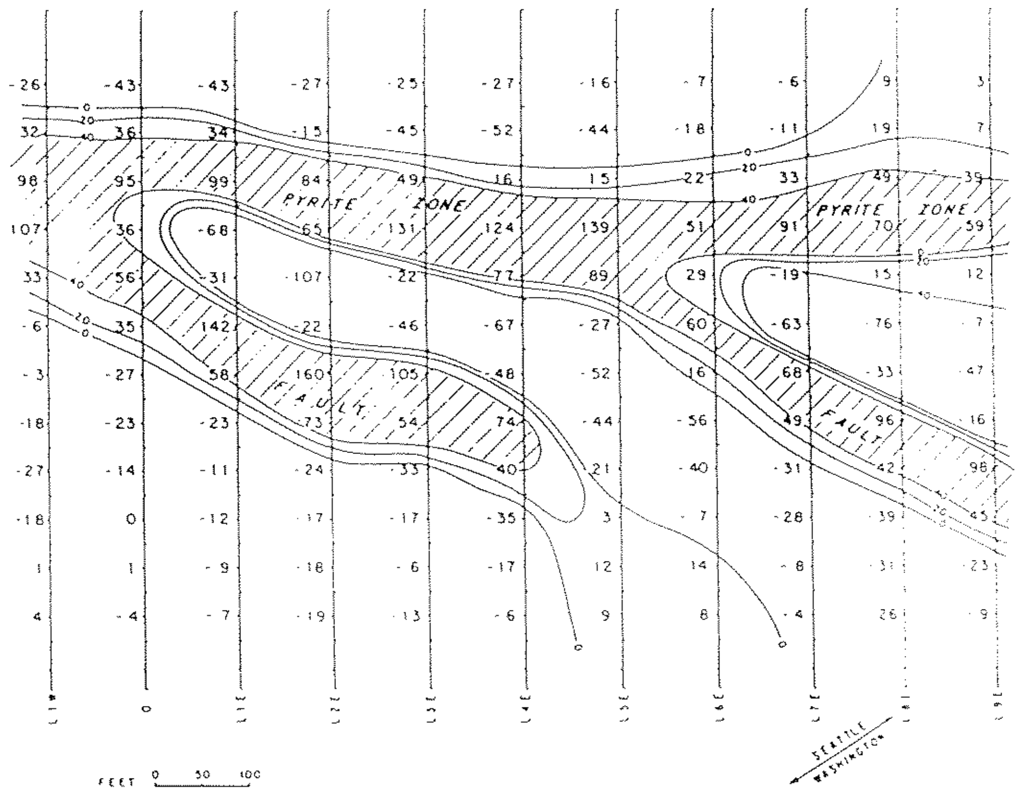

FIG. 2. Filtered data computed from the map of Figure 1.

$$\tfrac{1}{4}(M_2 - M_1) + \tfrac{1}{2}(M_3 - M_2) + \tfrac{1}{4}(M_4 - M_3),$$

where M_1, M_2, M_3, and M_4 are any four consecutive data points. The filtered output then is

$$\tfrac{1}{4}(M_2 - M_1) + \tfrac{1}{2}(M_3 - M_2) + \tfrac{1}{4}(M_4 - M_3) = \tfrac{1}{4}[M_3 + M_4 - M_1 - M_2].$$

The final criterion is enhanced by eliminating the constant, so that the plotted function becomes

$$\boxed{f_{2,3} = (M_3 + M_4) - (M_1 + M_2),}$$

which is plotted midway between the M_2 and M_3 dip-angle stations.

This filter has its frequency (wavenumber) response displayed in Figure 4, for a station spacing of 50 ft. Its characteristics are as follows:

1. All frequencies are shifted by 90 degrees.
2. Noise having a wavelength equal to the station spacing and dc bias are completely removed.
3. Maximum amplitude occurs for wavelengths of 250 ft, or five times the station spacing.

The frequency (wavenumber) response of the filter is shown for a station spacing of 50 ft, because this is the most suitable spacing for defining sulfide bodies within a few hundred feet of surface. This will be demonstrated below.