GM 42192

WINTER 1985 COMBINED GEOPHYSIC PROGRAMME, MAGNETOMETER, VLF AND HLEM SURVEYS, BOUSQUET-FERRIS PROPERTY

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Énergie et Ressources naturelles
Québec

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DARIUS JOINT VENTURE

BOUSQUET - FERRIS PROPERTY

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Winter 1985 combined Geophysics Programme

Magnetometer, VLF and HLEM Surveys

Project 2140.04

NTS 32D/7

Ministère de l'Énergie et des Ressources
Service de la Géoinformation
Date: 1 AOUT 1985
No G.M.: 42192

DE L'ASSISTANCE AUX RÉGIONS MINIÈRES
REÇU
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TABLE OF CONTENTS

Page

SUMMARY 1

INTRODUCTION 2

PROPERTY; DESCRIPTION and LOCATION 2

ACCESS 3

PREVIOUS WORK 3

WORK by SULPETRO MINERALS LIMITED 5

LINECUTTING 5

GENERAL GEOLOGY 5

PROPERTY GEOLOGY 5

KNOWN MINERALIZATION 6

POTENTIAL 6

SURVEY PROCEDURE 7

- Magnetometer Survey 7
- Very Low Frequency (VLF) Electromagnetic Survey 8
- Horizontal Loop Electromagnetic (HLEM) Survey 8

INTERPRETATION 10

- Magnetometer Survey 10
- Very Low Frequency (VLF) Electromagnetic Survey 11
- Horizontal Loop Electromagnetic (HLEM) Survey 12

CONCLUSIONS and RECOMMENDATIONS 13

APPENDIX A - Specifications for EDA Instruments OMNI IV Magnetometer
- Specifications for EDA Instruments PPM 350 Magnetometer

APPENDIX B - Specifications for Geonics EM-16

APPENDIX C - Specifications for Apex Parametrics Max-Min II

APPENDIX D - Assessment Forms

MAP POCKETS
- Magnetometer Survey 1:5000
- VLF Survey - Dip Angle 1:5000
- VLF Survey - Fraser Plot 1:5000
- HLEM Survey - 444 Hz 1:5000
- HLEM Survey - 1777 Hz 1:5000

S U M M A R Y
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Magnetometer, very low frequency (VLF) electromagnetic and horizontal loop electromagnetic (HLEM) surveys were completed over all or a portion of the Bousquet Ferris property (project 2140.04). Structural and lithologic relationships are derived from the magnetics with substantial corroboration from the VLF and HLEM surveys. Several sulfide iron formations are delineated and locations for gold mineralization identified. Further geologic and geophysical work is strongly recommended.

INTRODUCTION

Preliminary geophysical surveys were completed over all or most, depending on survey technique, of the Bousquet - Ferris Property (project 2140.04). Magnetometer, very low frequency (VLF) electromagnetic, and horizontal loop electromagnetic (HLEM) surveys were conducted. The magnetic technique is well suited as an aid to geologic mapping, detection of magnetic units of direct economic interest, and possible delineation of alteration zones. A combination of VLF and HLEM surveys provides rudimentary broadband coverage suitable for detection of a variety of conductors. These can span geologic sources such as shear zones to massive sulfides..

Gold and/or base metals are the anticipated target mineralization. The following report reviews the geophysical surveys with application to detection of such commodities.

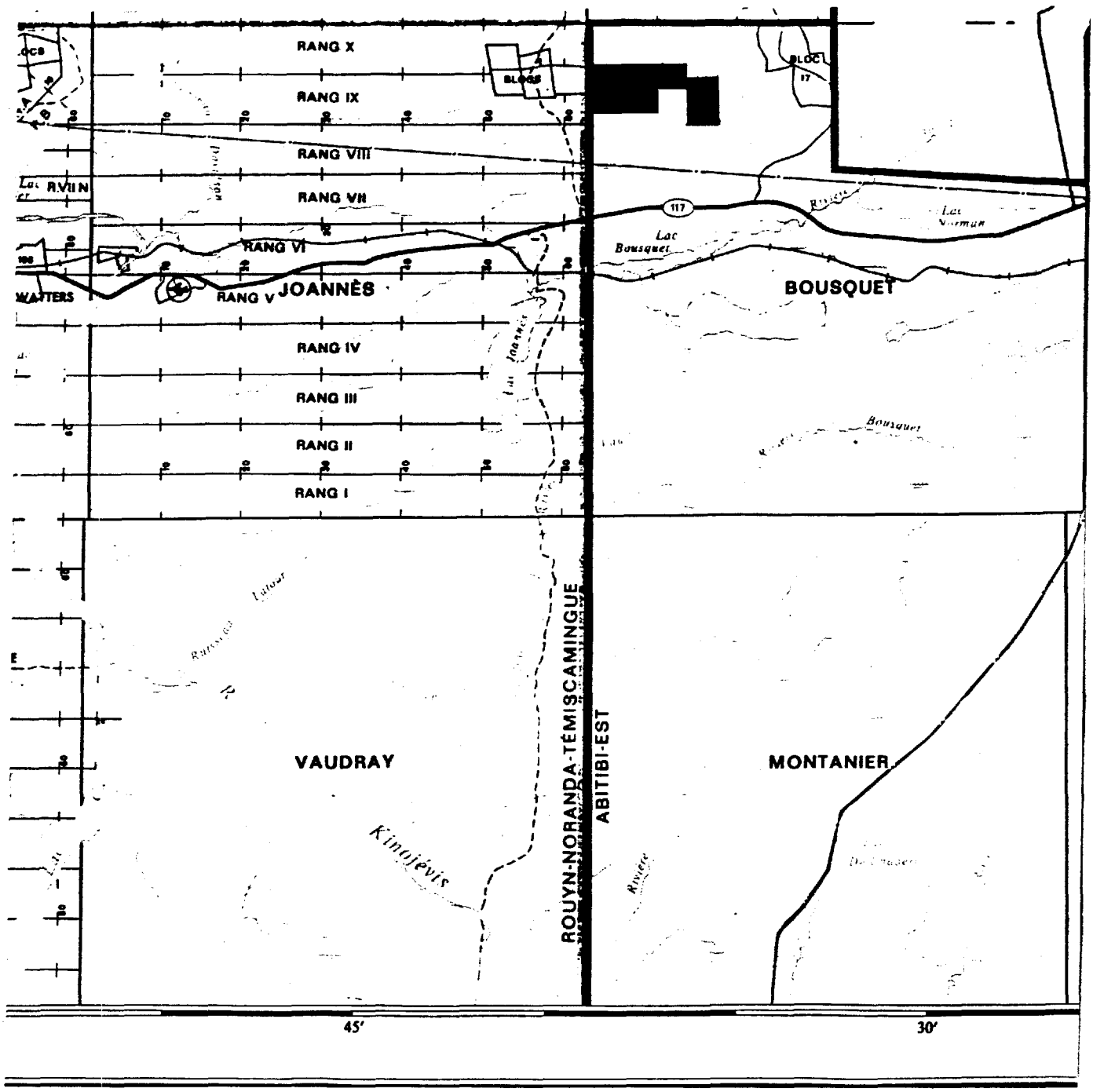
PROPERTY; DESCRIPTION AND LOCATION

The Bousquet - Ferris property consists of thirty-five (35) claims, totalling 560 hectares, held under seven (7) licences in Bousquet Township, Quebec. These claims form part of the Sulpetro Minerals "Darius Joint Venture" with the claims being held in the name of Sulpetro Minerals Limited, Suite 301, 2161 Yonge Street, Toronto, Ontario, M4S 3A6.

This claim group consists of the following claims:

Licence	Claim	Township	Date Staked
360728	1-5 (incl.)	Bousquet	Sept. 10, 1976
360729	1-5 (incl.)	Bousquet	Sept. 10, 1976
360730	1-5 (incl.)	Bousquet	Sept. 9, 1976
360731	1-5 (incl.)	Bousquet	Sept. 9, 1976
360733	1-5 (incl.)	Bousquet	Sept. 13, 1976
360734	1-5 (incl.)	Bousquet	Sept. 14, 1976
360735	1-5 (incl.)	Bousquet	Sept. 14, 1976

The claim group is located in the northwest corner of Bousquet Township, NTS 32D/7a,b with the Joannes-Bousquet Township Line forming the western boundary. The northern edge of the property lies approximately 1200 metres south of the Bousquet-La Pause boundary (see fig. 1a).



MINÉRAUX SULPETRO LIMITÉE
ROUYN, QUÉBEC, CANADA

BOUSQUET FERRIS: Bousquet Twp Québec

LOCATION MAP

PROJET 2140.04	ÉCHELLE	FEUILLE ____ DE ____
DESSIN Fig. 1a	1:200000	S.N.R.C. 32D/7

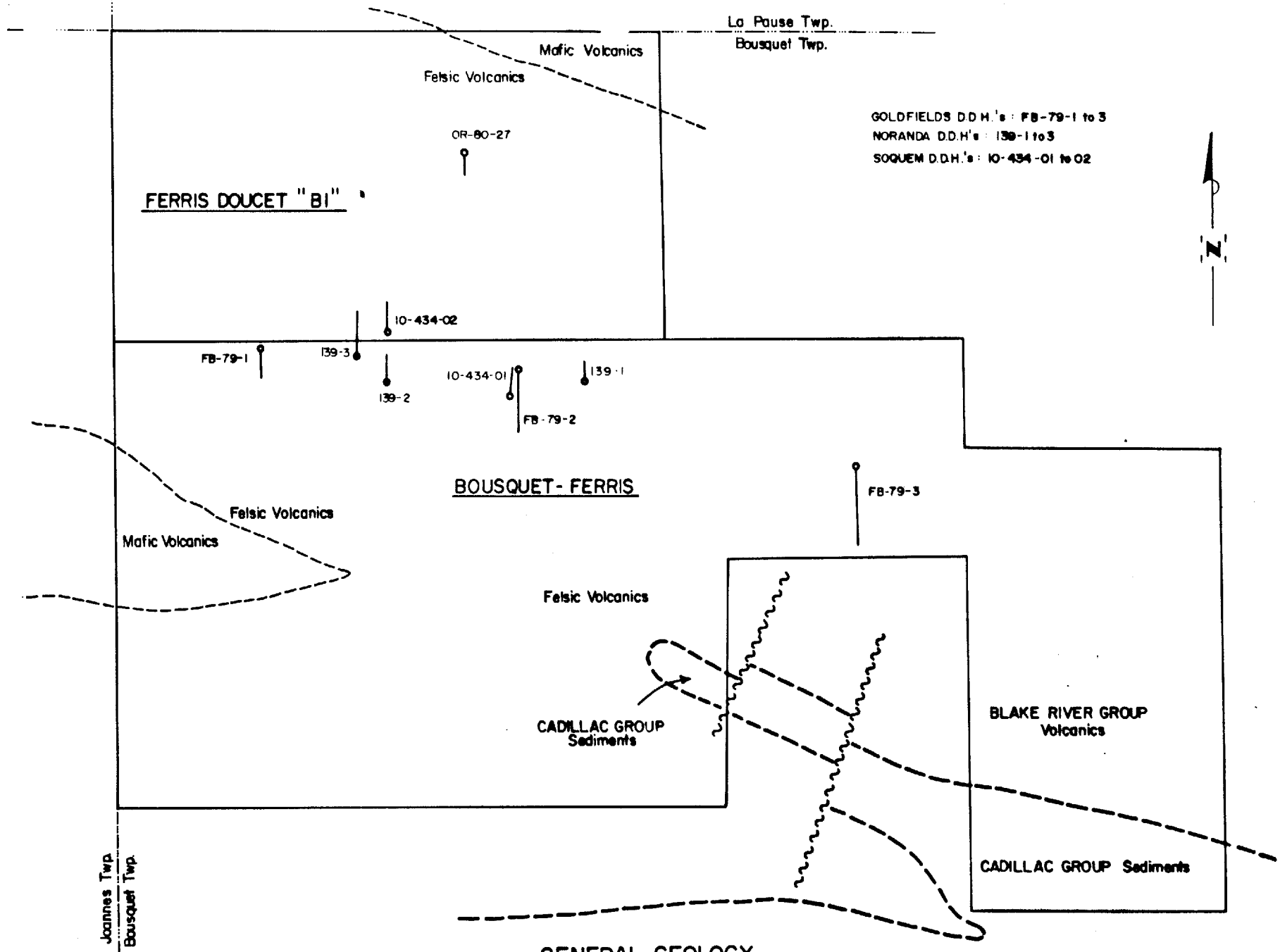


Fig. 2 - GENERAL GEOLOGY

FERRIS DOUCET "BI" & BOUSQUET-FERRIS PROPERTIES

BOUSQUET TOWNSHIP

SCALE 1:20,000

METRES 500 0 500 METRES

B3 April 19/85

ACCESS

Access to the property is provided by trails from a sand and gravel road from Hwy. 117, which runs through the Arrowhead gold prospect in Joannes Twp. and from trails and old logging roads which run westwardly from the all-weather Clericy-Mont Brun Road, in the vicinity of the Doyon Mine.

PREVIOUS WORK

Records of exploration activities carried out on the property commence at circa 1930. What follows is a set of exploration summary notes, as determined from various government publications and files available at the M.E.R.Q. office in Noranda, Quebec:

pre 1930 — Perriard-Continental Claims (L.V. Bell 1930, H.C. Gunning, 1941):
-staked by D. Perriard.
-2 claims examined by Continental Diamond Drilling Co. (circa 1928-29?) resulting in trenching and 3 ddh's (approximately 1,500 ft east of Joannes-Bousquet Twp. Line and 6,500 ft south of La Pause-Bousquet Twp. Line) = 5 qv's/stringers of few inches to 3½ ft in andesite with drilling values returned in $1.00 range (ie < 0.5 oz/ton Au) with 1 reported instance of V.G.

1936 ± 1941: — Gibeau Claims (GM 5917, H.G. Gunning, 1941)
- core examined by S.H. Ross in 1941
- 4 x-ray holes (+135 ft) and 3 standard ddh's (369 ft) - no assays

circa 1937 (?): — Norgold Mines Ltd. (GM 5934B, C)
- partial coverage on eastern claims
- drilled 5 ddh's near Micmac shaft

1939: — Cassels Daval Mines Ltd. (GM 6988)
-possible partial coverage of S.E. corner of property

1940: — Greater Malartic Gold Mines Ltd. (GM 5911)
- drilled 5 ddh to test surface showing with best assay of 0.3 oz Au/ton/4ft

1946: — Magnum Gold Mines Ltd. (GM 5929, 25770):
- magnetometer survey

1946: — Micmac Mines Ltd. (GM 5928B):
-extreme eastern claim may have been held by this company

Previous Work (cont'd)

1947: Dome Exploration Co. Ltd. (GM 6991):
-geology and 5 ddh's (G1 to G5)

1956: Indian Lake Mines Ltd. (GM 4547):
- at far east claim(s), EM survey

1960: Abadex Mines Ltd. (GM 10769)
- no reported work available

1963: Norlex Mines Ltd. (GM 13310, 13555):
- 1200 ft H.E.M. conductor tested by 6 ddh's (2042 ft)
- no assays

1967: Noranda Exploration Co. Ltd. (GM 19322, 19323, 31141 - for drill results)
- magnetometer and J.E.M. surveys, 3 ddh's (139-1 to 3) with gf, py, po, tr cp, in tuffs, neg. Au. (?)

1969 - 1976: SOQUEM (GM 25741, 26385, 31141 for dd's)
- multi EM survey screened with magnetometer, 2 ddh's (11-434-01, 11-434-02) = gf, py, po ± tr cp (?) in tuffs, neg. Au (?)

1970 - 1971: Q.D.N.R. (DP 763):
- INPUT airborne E.M. by Questor Surveys Ltd.

1970 - 1971: Val Nor Exploration Ltd. (GM 25833, 26808):
-possible coverage at east edge, magnetometer and EM surveys

1974 - 1975: Royal Agissiz Mines Ltd. (GM 30249, 31141, 31142, 31143):
- compilation, EM, 3 ddh's and trenching with best assay results of 0.19 oz Au/ton

1977: Darius Gold Mine Inc. (in company files)
-linecutting, magnetometer and EM-17 surveys
-only partial coverage of claim group

1978 - 1979: La Mine d'Or Darius Inc. (in company files)
-geology, magnetometer, ± H.L.E.M., V.L.F., compilation
- 6 VLF conductors located, 1 conductor screened by HLEM, geology indicates anticlinal structure in volcanics and weakly mineralized shear in V5 (Au = 99 ppb, Cu = 0.38%, Zn = 560 ppm)
- 3 ddh on EM conductors, (FB-79-1 to 3) (2,132 ft)

WORK BY SULPETRO MINERALS LTD.

Jan.-Feb. 1985: -linecutting (metric grid)

1985: -geophysical surveys (@ 1:5000) mag, VLF ± HLEM (in present report)

LINECUTTING

A metric grid consisting of 100 metre spaced lines with 25 metre chained and picketted stations was cut on the entire Bousquet-Ferris property by Pierre Ouellette Prospecting Enrg., C.P. 608, Amos, Quebec during the period January 21, 1985 to February 14, 1985. A total of 80,556 metres were cut of which 61,629 metres represent grid lines and the remainder baselines and tie-lines. Base line and sub-baselines are oriented at 110°.

GENERAL GEOLOGY (see also figure 2)

The Bousquet-Ferris property is underlain by Archean metavolcanics and minor metasediments of the Abitibi Supergroup of supercrustal rocks. These metavolcanics and interelated metasediments belong to the upper sequence of the Blake River Group, which in the Joannes to Malartic Townships area, are found on the north limb of the Malartic-Cadillac Syncline. The Blake River Group ranges in thickness from less than ½ km in southern Malartic Township to greater than 7 km in the western corner of Bousquet and La Pause Townships. Within Bousquet Township the Blake River Group is considered to consist of a basal sequence of pillowed mafic metavolcanics (basalt and andesite) which is capped by an upper 800 meter to 1,500 metre sequence of felsic to intermediate metavolcanics (primarily pyroclastics) and minor interelated metasediments (primarily cherts, iton formation, tuffaceous sediments and argillite).

PROPERTY GEOLOGY

The property is underlain primarily by Upper Sequence Blake River Group metavolcanics with Cadillac Group greywackes being found

in the S.E. corner of the property. The area appears to be folded, with fold axis trending to the N.W. as an apparent southward extension of the Clericy Synclinorium into Bousquet Twp.

Broadly speaking the lithologies on the property are arranged as a large "S" fold with an antiform structure found in the S.W. area of the property and a synform structure running from about the N.W. to S.E. corners. The stratigraphy of the property, going from the S.E. to the central western edge (youngest to oldest) is:

Cadillac Group: greywacke and conglomerate

Blake River Group:

- Upper Sequence II: intermediate pyroclastics with stratabound conductors (sulfides, graphitic tuffs and iron formation - oxide +/sulfide)
- Upper Sequence I: porphyritic rhyolite
- Basal Sequence: mafic volcanic flows (on property represented by andesites (=silicified basalt (?))

KNOWN MINERALIZATION

i) Quartz Veins: locally ± tourmaline, pyrite, trace V.G., thickness of veins from few centimetres to < 0.3m to +2m, generally low Au values found to date.

ii) Disseminated Sulfides in pyroclastics - py, po, tr cp intercalated with graphitic tuffs/schists, low Au values, limited drill testing on only 2 or 3 zones.

POTENTIAL

i) Quartz Veins: possible high grade, low tonnage targets of "Arrowhead-type", most outcropping veins were probably examined during the 1930's to 1950, however, large covered areas are still of prime interest.

ii) Strata bound +/ Strataform (?) Sulfides: possible "massive sulfide" targets and "auriferous disseminated pyrite" targets (ie Doyon Mine-type) - all "M.S." (ie. conductors) not drill tested, no known IP work to test for dissem. py deposits, but area is on strike with and probably hosts the Doyon Mine horizon.

iii) Iron Formation: nil iron potential, unknown gold potential. (if I.F. exists on property)

SURVEY PROCEDURE

Each survey technique is reviewed separately in the following.

Magnetometer Survey

Tabulated below are logistical details concerning the magnetometer survey.

Instrumentation: EDA Instruments OMNI IV
EDA Instruments PPM 350

Base Station Location: Sulpetro Mineral Ltd.
20 rue Doyon
Rouyn, Quebec

Base Station Value: 58465γ

Line Spacing: 100m

Station Spacing: 25m

Personnel: A. Smith, #9, 100 Margaret Ave.,
Kitchener, Ontairo, N2H 4H6

C. Zorzi, 3 Massey Sq., Apt 2904,
Toronto, Ontairo M4C 5L5

Survey Dates: February 15-19, 1985

Parameter Read: Amplitude of the total magnetic field vector in gammas (γ).

Production: 60.5 line-km/2466 Rdg.

The OMNI IV's and PPM 350 were hard linked to an OMNI IV configured as a base station reading the earth's field every 30 sec. Diurnal corrections were then automatically applied with output via a hard copy printer. At the time of diurnal correction a datum of 58600γ was subtracted from all data to maintain level consistency with surrounding properties (ie. Ferris Doucet 'B1' and Joannes North). Data quality was good in all respects. The diurnally corrected data were plotted on a base map at 1:5000 scale and contoured with an interval of 100γ $\leq$ 1000γ and 500γ $>$ 1000γ. A print of this map is located in a map pocket at the rear of the report. Equipment specifications are set forth in Appendix A.

Very Low Frequency (VLF) Electromagnetic Survey

Tabulated below are logistical details concerning the VLF survey.

Instrumentation: Geonics EM-16

Transmitter Station: Cutler, Maine, U.S.A.

Frequency: 24.0 KHz

Line Interval: 100m

Station Interval: 25m

Personnel: C. Zorzi, 3 Massey Sq., Apt. 2904, Toronto, Ontario. M4C 5L5

A. Smith, #9, 100 Margaret Ave., Kitchener, Ontario. N2H 4H6

J.L. Wright, 6568 Edonwood Dr., Mississauga, Ontario. L5N 3G1

T. Keith, 30 Melrose Dr., Niagara-on-the-Lake, Ontario. L0S 1J0

Survey Dates: February 14-21, 1985

Parameter Read: Dip in percent (%) of the total electromagnetic perpendicular to the transmitter station.

Production: 60.5 line-km/2464 Rdg.

The raw dip angles expressed as a percent (%) dip were plotted in profile form on a base map at 1:5000 and profile scale 1 cm = 20%. These dips were subsequently processed with the well-known Fraser filter. The results were also plotted on a base map at 1:5000 scale. Finally, contouring completed using an interval of 20 units. Prints of both the dip angle and Fraser plot are located in a pocket at the rear of this report. Equipment specifications are presented in Appendix B.

Horizontal Loop Electromagnetic (HLEM) Survey

Tabulated below are logistical details concerning the survey.

Instrumentation: Apex Parametrics Max-Min II

Frequency: 444 Hz & 1777 Hz

Coil Separation: 100m

Station Interval: 25m

Line Spacing: 100m

Personnel: A. Smith, #9, 100 Margaret Ave., Kitchener, Ontario. N2H 4H6

C. Zorzi, 3 Massey Sq., Apt. 2904, Toronto, Ontario. M4C 5L5

J.L. Wright, 6568 Edenwood Dr., Mississauga, Ontario. L5N 3G1

T. Keith, 30 Melrose Dr., Niagara-on-the-Lake, Ontario. L0S 1J0

Survey Dates: February 20-27, 1985

Parameter Read: In-phase and out-of-phase components of the vertical secondary electromagnetic field expressed as a percent (%) of the primary field.

Production: 51.1 line-km/1997 Rdg.

The raw in-phase and out-of-phase percentages (%) were plotted in profile form on a base map at 1:5000 map scale and 1 cm = 20% profile scale. Two plots exist, one for each of the two frequencies (ie. 444 & 1777 Hz). Coil tilts were maintained at a horizontal orientation (ie. zero tilt). This is in variance to the standard procedure for operation of the Max-Min II. It was felt the two frequency data allows adequate identification of misorientation errors. Since the coils were not allowed to tilt, the tilt errors become relatively large compared to short cable errors. In fact, it appears as if the poor tilts dominated as negative in-phase values invariably fall in areas of rough terrain. This is not a detriment as the two frequency data allows identification and rudimentory correction of misorientation problems. Coverage for the HLEM survey did not extend south of the 1300S B.L.

Prints of both the 444 Hz and 1777 Hz plots are located in a map pocket at the rear of this report. Equipment specifications are presented in Appendix C.

INTERPRETATION

Each survey technique is reviewed separately in the following. Unification of the results takes place in the conclusions section.

Magnetometer Survey

Background on the property is approximately 58700 γ with a total relief in excess of 4000 γ . Cultural contamination appears to be totally absent. A regional trend is not discernible, at least with a wave length exceeding 4-5 km. Magnetic features with wave lengths on the order of 2 km are present and are related to possible geologic sources in the following discussion. The property is predominantly underlain by volcanics of the Blake River Group and, to a lesser extent, sediments of the Cadillac Group. These sediments are reflected magnetically as highs traversing the southern ends of lines 23E-to-30E south of approximately 1025S. Amplitudes exceed 4000 γ indicating iron formation to be a major component. It is inferred to extended through the "hole" within the property to eventually terminate as a short magnetic linear extending from L9E, 750S - to - L12E, 850S. This interpretation is tenuous without the intervening magnetic data. Mafic volcanics are indicated in an area bounded by L11W, 1000S-1400S connecting to L2W, 1200S-1500S. This rectangular area displays numerous isolated responses with amplitudes, on the average of +200 γ above background. At least two similinear highs traverse the greater part of the property at the O.B.L. level. These are complex and indicate a number of fault discontinuities. Three such fault traces have defining loci of L8E, 200N - to - L1E, 1400S; L17E, 100N - to - L10E, 600S; and L25E, 200N-to-L20E, 300S. All bear roughly N 45° E, a prominent structural orientation for the area. These linears are known from work on adjacent ground to represent oxide and sulfide iron formations within the volcanic sequence. Pyrrhotite is a commonly noted constituent, thus the magnetic response. Areas of structural complexity are noted at L1E-L2E, 100S; L8W-L5W, 500S; and L23E-L29E, 500S. This last area is interesting in that several linear features appear to transect the surmised strike and with a number of isolated responses as well. The largest feature on the property is a semicircular low outlining the "hole" in the claim group on lines 13E-to-20E. Superimposed on this low are the magnetic

responses of the Cadillac Sediments and mafic volcanics to the west. The centre of the semicircle would be located south of the property at an extrapolated position of L16E, 1700S. Radius is roughly 1500m. This could be indicating a large buried felsic intrusive south of the property. This could be related to the Mooshla Intrusive which is situated about 3-4km to the east.

Geologic mapping of the property is schedule for the summer of 1985. Input of this information will aid greatly in unravelling these complex magnetic features.

Very Low Frequency (VLF) Electromagnetic Survey

The following discussion is confined to the Fraser plot.

As is invariably the case, the VLF results reveal profuse anomalism scattered over the entire property. Most are low amplitude longer wave length responses indicative of an overburden source. However, five (5) conductors or zones indicate magnetic correlation and high frequency, large amplitude anomaly character which are indicative of a bedrock source. These are designated Zones A-to-E with each being reviewed individually below.

Zone A: End point line locations are L1E, 75S-to-L8E, 65S. This demonstrates good magnetic correlation and a relatively large response on L2E (ie. 135 units). A sulfide iron formation is strongly suggested.

Zone B: End point line locations are L3W, 150S-to-L20E, 175S. Good magnetic correlation and relatively large amplitudes are noted. The response is definitely formational in character. Again, a sulfide iron formation is indicated.

Zone C: End point line locations are L27E, 515S-to-L28E, 535S. Magnetic correlation is somewhat loose but the amplitude and frequency suggest a bedrock source. Some degree of structural complexity is also indicated. This must be considered a target for gold mineralization.

Zone D: End point locations are L24E, 765S-to-L29E, 815S. The magnetics correlate well but may flank to the south. Strike of the conductor appears to be roughly 10°-15° to the interpreted lithologic strike. This must also be considered a prime gold target.

Zone E: This is a double response with two sets of end point limiters: L2E, 1450S-to-L7E, 1475S and L2E, 1635S-to-L6E, 1535S. The two limbs may merge nean L7E, 1500S. Both reveal good magnetic correlation and modest amplitudes. These are likely of bedrock origin.

The remaining conductors are not striking but should be reviewed when detailed geologic data becomes available.

Horizontal Loop Electromagnetic (HLEM) Survey

As mentioned previously, the decision to fix tilts at zero resulted in misallignment errors in rough terrain, this is quite evident on the southern portions of lines 6E-to-L11W.

Two conductors are noted in the HLEM results. The first is a large formational response with strike length in excess of 2 km. It literally swarms along most of the property at the 200-400S level with a number of bifurcations to produce multiple responses. Line locations are listed below.

L9W, 400S
L8W, 400S
L7W, 365S & 265S
L6W, 215S (approx.)
L5W, 200S (approx.)
L4W, 200S (approx.)
L3W, 175S (approx.)
L2W, 200S
L1W, 175-225S
L0, 150S & 250S
L1E, 75S & 175-250S
L2E, 100S & 200S & 350S
L3E, 100 -150S & 365S
L4E, 110-160S
L5E, 150S
L6E, 125S
L7E, 125S
L8E, 175S
L9E, 175S
L10E, 175S
L11E, 175S
L12E, 175S
L13E, 150S

This corresponds closely to VLF Zones A and B and to one of the prominent magnetic linears noted previously. A sulfide iron formation is the presumed source. Structural complexity is indicated over lines 2W-to-3E. In gold exploration the quality of the conductor usually has little relationship to gold mineralization. However, desirable base metal targets general demonstrate a large conductivity-width product. The best conductivity-width products occur on the L9W-to-L7W intercepts and range about 15-20 mhos. On line 13E a conductivity-width of about 3 mhos is indicated but this assumes an infinite strike length, an obviously bad assumption at this location. The true product is much larger.

The second conductor is also semiformational and roughly correlates with VLF Zone D. Line intercepts are listed below.

L21E, 525S
L22E, 585S
L23E, 610S
L24E, 710S (broad)
L25E, 750S (broad)
L26E, 850S (broad)
L27E, 800S
L28E, 785S
L29E, 775S

This is a poor conductor which only produces a faint out-of-phase response on the 1777 Hz plot. Best response is on L23E. It could indicate a possible extension of the first conductor discussed. However, the strike is skewed to the southeast indicating either folding or faulting to be involved. This must be considered a potential horizon for gold mineralization.

CONCLUSIONS AND RECOMMENDATIONS

The magnetic data outline lithologic relationships, particularly between the Cadillac sediments and Blake River Volcanics. At least two iron formations are traced from adjoining ground on to the Bousquet Ferris property. Several fault traces are indicated where these magnetic linears are offset and/or supplanted. A possible felsic intrusive is suggested south of the property and perhaps extending on to a portion of the claim group. This could be related to the Mooshla Intrusive to the east. This intrusive, if present, could well have provided a heat pump for mobilization of gold bearing solutions. Fault traces in the vicinity would be natural conduits for such solutions. Either these fault planes and/or their intersection with iron rich lithologic units (ie. iron formations) could be loci for gold mineralization. Three such faults were recognized and reviewed earlier. Indeed, any reducing environment on the property such as sulfide horizons should be investigated thoroughly. The VLF and HLEM data indicate a number of conductors of possible sulfide origin. All of these should receive detailed analysis.

Recommendations for further work are tabulated below.

1) Detailed geologic mapping of the property.
2) Codification of the geologic and geophysical results.

3) Detailed magnetometer, (square grid) and induced polarization surveys along sulfide horizons and the intersection of such horizons with fault traces.

4) Detailed magnetometer surveys in areas of alteration to help establish their magnetic signiture.

This programme should yield targets for drilling.

Respectfully submitted

James L. Wright

J.L. Wright
Senior Staff Geophysicist

R.V. Zalnieriunas
Geologist

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A P P E N D I X A

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EDA INSTRUMENTS
OMNI IV MAGNETOMETER
Specifications

Dynamic Range	18,000 to 110,000 gammas. Roll-over display feature suppresses first significant digit upon exceeding 100,000 gammas.
Tuning Method	Tuning value is calculated accurately utilizing a specially developed tuning algorithm
Automatic Fine Tuning	± 15% relative to ambient field strength of last stored value
Display Resolution	0.1 gamma
Processing Sensitivity	± 0.02 gamma
Mathematical Truncation Error	± 0.02 gamma
Statistical Error Resolution	0.01 gamma
Absolute Accuracy	± 1 gamma at 50,000 gammas at 23°C ± 2 gamma over total temperature range
Standard Memory Capacity	
Total Field or Gradient	1,200 data blocks or sets of readings
Tie-Line Points	100 data blocks or sets of readings
Base Station	5,000 data blocks or sets of readings
Display	Custom-designed, ruggedized liquid crystal display with an operating temperature range from -40° to + 55°C. The display contains six numeric digits, decimal point, battery status monitor, signal decay rate and signal amplitude monitor and function descriptors.

Gradient Tolerance	6,000 gammas per meter (field proven)
Test Mode	A. Diagnostic testing (data and programmable memory) B. Self Test(hardware)
Sensor	Optimized miniature design. Magnetic cleaniness is consistent with the specified absolute accuracy.
Gradient Sensors	0.5 meter sensor separation (standard), normalized to gammas/meter. Optional 1.0 meter sensor separation available. Horizontal sensors optional
Sensor Cable	Remains flexible in temperature range specified, includes strain-relief connector
Cycling Time (Base Station Mode)	Programmable from 5 seconds up to 60 minutes in 1 second increments
Operating Environmental Range	-40°C to + 55°C;0-100% relative humidity;weatherproof
Power Supply	Non-magnetic rechargeable sealed lead-acid battery cartridge or belt;rechargeable NiCad or Disposable battery cartridge or belt;or 12V DC power source option for base station operation
Battery Cartridge/Belt Life	2,000 to 5,000 readings, for sealed lead acid power supply, depending upon ambient temperature and rate of readings

Weights and Dimensions

Instrument Console Only	2.8 kg, 238 x 150 x 250mm
NiCad or Alkaline Battery Cartridge ...	1.2 kg, 235 x 105 x 90mm
NiCad or Alkaline Battery Belt	1.2 kg, 540 x 100 x 40 mm
Lead-Acid Battery Cartridge	1.8 kg, 235 x 105 x 90 mm
Sensor	1.2 kg, 56mm diameter x 200mm
Gradient Sensor (0.5 m separation-standard)	2.1 kg, 56mm diameter x 790 mm
Gradient Sensor (1.0 m separation-optional)	2.2 kg, 56mm diameter x 1300mm
Standard System Complement	Instrument console, sensor, 3-meter cable, aluminum sectional sensor staff, power supply, harness assembly, Operations manual.
Base Station Option	Standard system plus 30 meter cable
Gradiometer Option	Standard system plus 0.5 meter sensor

SPECIFICATIONS

EDA Instruments PPM 350 Magnetometer

Description: The EDA OMNIMAC PPM-350 is a high-technology, proton precession total field magnetometer that measures and records the earth's magnetic field at the touch of a key. It identifies and records the location, time of each measurement, computes the statistical error, and records the decay and strength of the signal being measured.

The PPM-350 is a microprocessor-based system and employs a memory magnetometer concept.

Packaged in a compact, lightweight, rugged housing, The PPM-350 incorporates ergonomic-design features that provide maximum comfort and ease-of-operation in the field. It is used in a chest-mounted mode with a shoulder-harness. It has a large Liquid Crystal Display for easy reading, even in direct sunlight, and its oversized touch-sensitive keyboard permits cold-weather operation without having to remove gloves.

Functions: In a typical field survey operation, the PPM-350 performs all of the following functions:

- A visual readout and storage of the following information in an absolutely secure memory that prevents data loss or tampering:
  - total magnetic field magnitude
  - time of measurement
  - grid coordinates for every reading
  - statistical error of total field reading
  - signal strength and decay measurement
- Users have a choice of three input, or data storage, modes:
  - manual record
  - spot record
  - automatic update record
- Users also have a choice of three output modes:
  - to a DCU-200 magnetic cassette recorder
  - to a DCU-040 or DCU-400 thermal printer
  - to any RS-232C-compatible microcomputer
- Each reading is automatically assigned a record number

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which can also be used to identify locations of measurements taken off the grid. This also serves to recall data, as well, simply by keying in the record number.

- Sub-grid coordinates and position up-date are given permitting more detailed study within the main grid, without altering main grid data.
- Many readings can be taken at one point to verify a reading, without updating the position.

Specifications:

Dynamic Range - 18,000 to 93,000 gammas

Sensitivity - +/- 0.02 gamma

Statistical Error Resolution - 0.01 gamma

Standard Memory Capacity - 1383 data blocks or readings

Absolute Accuracy - +/- 15 ppm at 23°C, 50 ppm over the operating temperature range

Display Resolution - 0.1 gamma

Capture Range - +/- 25% relative to ambient field strength of last stored value

Display - Custom-designed, ruggedized liquid crystal display with an operating temperature range from -35°C to +55°C

Gradient Tolerance - 5,000 gammas per meter

Sensor - Optimized miniature design. Magnetic cleanliness is consistent with the specified absolute accuracy

Sensor Cable - Remains flexible in temperature range; includes low strain connector

Operating Environmental Range - -35°C to +55°C; 0-100% relative humidity; weather-proof

Power Supply - Non-magnetic rechargeable sealed lead acid battery cartridge or belt; or, Disposable "C" cell battery cartridge or belt

Battery Cartridge Life - 2,000 to 5,000 readings, depending upon ambient temperature and rate of readings

Weight and Dimensions

Instrument Console only - 3.4 kg, 238 x 150 x 250 mm

Lead Acid Battery Cartridge - 1.9 kg

Sensor - 1.2 kg, 56 mm diameter x 200 mm

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A P P E N D I X B

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GEONICS LIMITED

EM-16 SPECIFICATIONS and DESCRIPTION

The VLF method uses the military and time standard VLF transmissions as primary field. Only a receiver is then used to measure the secondary fields radiating from the local conductive targets. This allows a very light, one-man instrument to do the job. Because of the almost uniform primary field, good response from deeper targets is obtained.

The EM-16 system provides the in-phase and quadrature components of the secondary field with the polarities indicated.

PRINCIPLE OF OPERATION

The VLF transmitters have vertical antennas. The magnetic signal component is then horizontal and concentric around the transmitter location.

By selecting a suitable transmitter station as a source, the EM-16 user can survey with the most suitable primary field azimuth.

The EM-16 has two receiving coils, one for the pick-up of the horizontal (primary) field and the other for detecting any anomalous vertical secondary field. The coils are thus orthogonal, and are mounted inside the instrument "handle".

The actual measurement is done by first tilting the coil assembly to minimize the signal in the vertical (signal) coil and then further sharpening the null by using the reference signal to buck out the remaining signal. This is done by a calibrated "quadrature" dial.

The tangent of the tilt angle is the measure of the vertical in-phase component and the quadrature reading is the sign at right angles to the total field. All readings are obtained in percentages and do not depend on the absolute amplitude of the primary signals present.

The "null" condition of the measurement is detected by the drop in the audio signal emitted from the patented resonant loudspeaker. A jack is provided for those preferring the use of an earphone instead.

The power of the instrument is from 6 penlight cells. A bat-tester is provided.

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SPECIFICATIONS

SOURCE OF PRIMARY FIELD	VLF transmitting stations.
TRANSMITTING STATIONS USED	Any desired station frequency can be supplied with the instrument in the form of plug-in tuning units. Two tuning units can be plugged in at one time. A switch selects either station.
OPERATING FREQUENCY RANGE	About 15-25 KHz.
PARAMETERS MEASURED	1) The vertical in-phase component (tangent of the tilt angle of the polarization ellispoid). 2) The vertical out-of-phase (quadrature) component (the short axis of the polarization ellipsoid compared to the long axis).
METHOD OF READING	In-phase from a mechanical inclinometer and quadrature from a calibrated dial. Nulling by audio tone.
SCALE RANGE	In-phase $\pm$150%; quadrature $\pm$40%.
READABILITY	$\pm$1%.
READING TIME	10-40 seconds depending on signal strength.
OPERATING TEMPERATURE RANGE	-40 to 50°C
OPERATING CONTROLS	ON-OFF switch, battery testing pushbutton, station selector, switch, volume control, quadrature, dial $\pm$40%, inclinometer dial $\pm$150%.
POWER SUPPLY	6 size AA (penlight) alkaline cells. Life about 200 hours.
DIMENSIONS	42 x 14 x 9cm (16 x 5.5 x 3.5 in.)
WEIGHT	1.6 kg (3.5 lbs.)
INSTRUMENT SUPPLIED WITH	Monotonic speaker, carrying case, manual of operation, 3 station selector plug-in tuning units (additional frequencies are optional), set of batteries.
SHIPPING WEIGHT	4.5 kg (10 lbs.)

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APPENDIX C

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MAXMIN EM II SYSTEM

The MAXMIN II is a two-man continuously portable EM system. It is designed to measure both the vertical and horizontal in-phase (IP) and quadrature (QP) components of the anomalous field from electrically conductive zones.

The plane of the transmitter (Tx) is kept parallel to the mean slope between the transmitter and receiver (Rx) at all times. The MAXMIN II is a horizontal loop (HL) system when the receiver measure anomalous components perpendicular to the mean slope between the coils. It is a minimum coupled (Min C) system when the receiver measure anomalous components parallel to the mean slope between the coils.

APEX MAXMIN II EM SYSTEM SPECIFICATIONS

OPERATING FREQUENCIES	222, 444, 888, 1777 and 3555 Hz.
MODES OF OPERATION	a) Transmitter coil plane and receiver coil plane horizontal (Max-coupled; Horizontal loop mode). Used with reference cable. b) Transmitter coil plane horizontal and receiver coil plane vertical (Min-coupled mode). Used with reference cable. c) Transmitter coil plane vertical and receiver coil plane horizontal, tilted for null in the receiver output. (Vertical loop mode). Used without reference cable, in parallel lines.
COIL SEPARATIONS (Modes a and b)	25, 50, 100, 150, 200 and 250mm (MM II) or 100, 200, 300, 400, 600 and 800 ft. (MM II F). Coil separations in Mode c) not restricted to fixed values.
PARAMETERS MEASURED	a) In-Phase and Quadrature components of the secondary field in modes a) and b). b) Tilt-angle of the total field in mode c).

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READOUTS	a) Automatic, direct readout on 90 mm (3½") edgewise meters in modes a) and b) nulling or compensation necessary. b) Tilt-angle and null on 90mm (3½") edgewise meters in mode c).
SCALE RANGES	In-phase: ±20% normal, ±100% by switch Quadrature: ±20% normal, ±100% by switch Tilt: ±75% slope Null: Null sensitivity adjustable by separation switch.
READING REPEATABILITY	±½% to ±% normally, depending on conditions, frequency and coil separation used.
TRANSMITTER DIPOLE MOMENT	150 Atm^2 @ 222 Hz, 150 Atm^2 @ 444 Hz, 90 Atm^2 @ 888 Hz, 40 Atm^2 @ 1777 Hz and 30 Atm^2 @ 3555 Hz.
RECEIVER BATTERIES	9V transistor radio type, 4 batteries Life: approx. 35 hrs. continuous duty (alkaline; .5Ah), less in cold weather.
TRANSMITTER BATTERIES	a) 12V7.5Ah Gel-Cell rechargeable batteries (2 x 6V in series) b) 18V21Ah alkaline lantern batteries (3 x 6V in series). Transmitter current drain 0.5A to 2.2A depending on operating frequency.
REFERENCE CABLE	Lightweight, special teflon cable for minimum friction. Unshielded. All reference cables option at extra cost. Please specify. Built-in intercom system for voice communication between receive and transmitter operators.
INDICATOR LIGHTS	Built-in signal and reference warning lights to indicate erroneous readings.
OPERATING TEMPERATURE	-40°C to +60°C (-40°F to +140°F)
WEIGHT OF RECEIVER UNIT	6 kg (13 lbs.)
WEIGHT OF TRANSMITTER UNIT	Typically 65 kg (143 lbs.), depending on quantities of reference cable and batteries included. Shipped in two shipping/field cases.
VOICE LINK	Built-in intercom system for voice communication between receiver and transmitter operators.