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A GEOPHYSICAL REPORT
ON
A TIME DOMAIN INDUCED POLARIZATION SURVEY
ON
THE FORD PROPERTY
GRAY CREEK AREA
NELSON MINING DIVISION
N.T.S. 82F/10W
49°36'06" 116°45'30"

FOR

Operator: AMARADO RESOURCES LIMITED

Owner(s): P.L. COOKE
AMARADO RESOURCES LIMITED

BY

John Lloyd M.Sc., P. Eng.
LLOYD GEOPHYSICS LIMITED
VANCOUVER, BRITISH COLUMBIA

MAY, 1987

LLOYD GEOPHYSICS LIMITED

SUMMARY

During the period May 13 to 23, 1987, Lloyd Geophysics Limited carried out a time domain Induced Polarization (IP) Survey for Amarado Resources Limited on their FORD property near Nelson, British Columbia.

Six vertical holes, for a total of 475 metres of drilling, has been recommended to test the more interesting anomalies.

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1. INTRODUCTION

During the period May 13th to May 23rd, 1987, Lloyd Geophysics Limited carried out a time domain Induced Polarization (IP) Survey for Amarado Resources Limited on their FORD property, Gray Creek, Nelson Mining Division, British Columbia.

The survey was carried out by Mr. D. Hall B. Sc., Mr. J. Warne B.Sc., one geophysical operator and two field assistants.

2. PROPERTY LOCATION AND ACCESS

The property is located about 50 kilometres east of Nelson, British Columbia and lies between elevations of 1050 and 1525 metres on the east side of Kootenay Lake, between Birkbeck and McFarlane Creeks, see figure 1. The terrain is well timbered and is moderately rugged to steep. Soil cover is well developed.

The property can be reached by driving 13 kilometres south along highway 3A from Crawford Bay. Access to the property from this point is by way of a network of gravel logging roads.

3. GEOLOGY AND MINERAL OCCURRENCES

A small quartz monzonite plug occurs in the southwest part of the property. The remainder of the area is characterized by foliated quartz muscovite schists interbedded with meta-andesite, amphibolite, conglomerate and quartzite, belonging to the Horsethief Creek form-

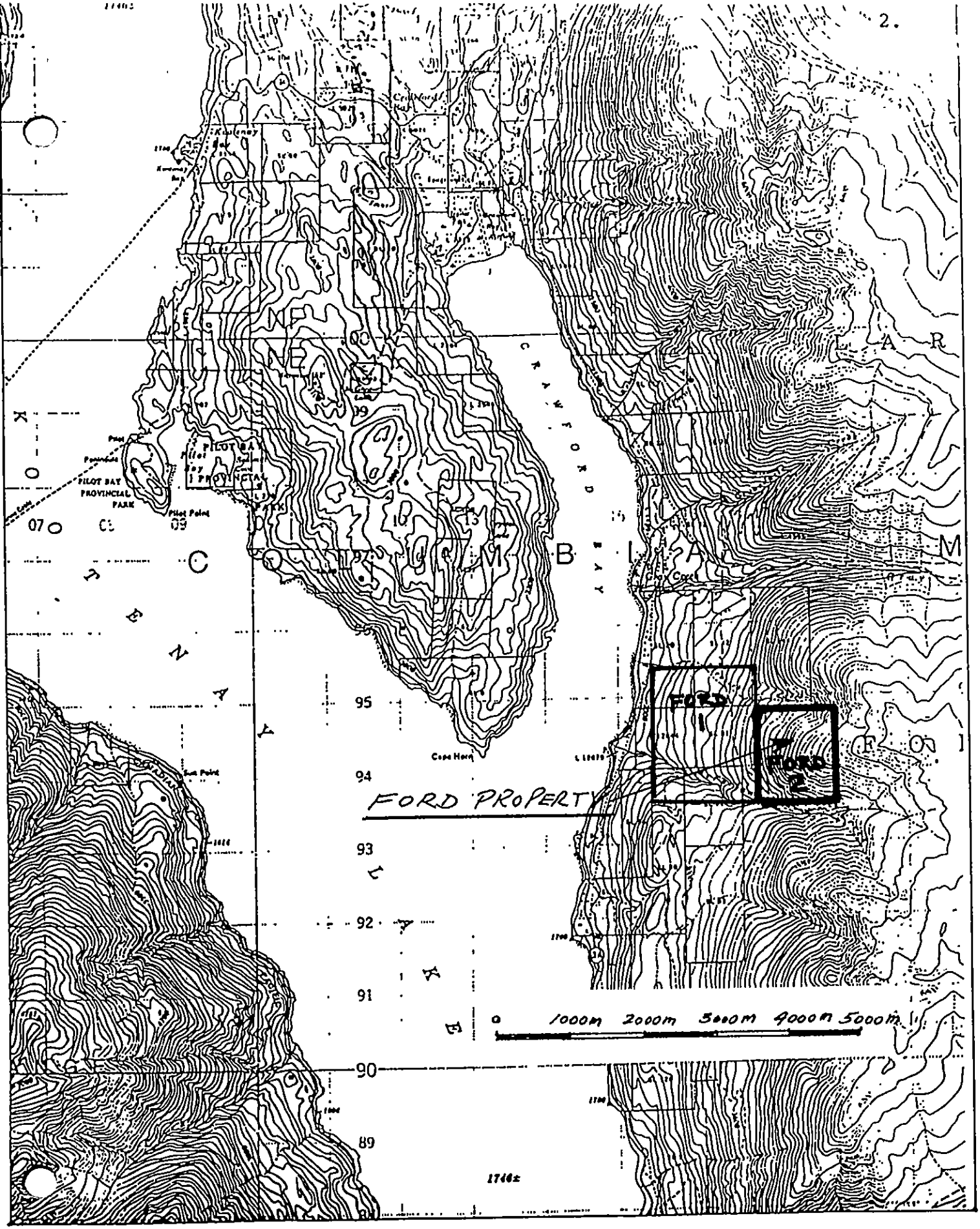


Figure 1 Property Location

ation of Palaeozoic age. Foliation is generally north-south, and dips are moderate to the east.

Locally the meta-volcanic and meta-sedimentary rocks have been altered to garnet and epidote bearing skarns where they occur adjacent to the quartz monzonite plug in the southwest section of the property.

Mineral occurrences consist of pyrite and molybdenite in quartz veins and veinlets, and as disseminations within the quartz muscovite schists and the marginal phases of the intrusive plug.

4. PURPOSE OF THE IP SURVEY

The purpose of the IP survey was to outline any sulphide zones (pyrite-molybdenite) which are expected to occur within intrusions and schists close to the margins of the intrusions.

5. INSTRUMENT SPECIFICATIONS

The IP system used to carry out this survey was a time domain measuring system manufactured by Huntec Limited of Toronto, Ontario.

The system consists of a 400 hertz Bendix alternator, driven by an 8 horsepower Briggs and Stratton engine, a Mark I transmitter and two Mark IV microprocessor controlled receivers. The Briggs and Stratton engine supplies up to 3 kilowatts of power to the ground. The cycling sequence of the transmitter was 2 seconds current ON and 2 seconds current OFF with consecutive pulses reversed in polarity.

The Mark IV receiver takes full advantage of the microprocessor's capabilities, featuring automatic calibration, gain setting, SP cancellation, fault diagnosis and filter tuning. In high noise areas, a 60 hertz rejection filter may be selected through the programming sub-panel. The software automatically corrects for the use of the rejection filter.

The instrument can be used for the detailed measurement of all significant IP and resistivity phenomena or adjusted to perform single measurements of chargeability (or % F.E.) at reduced bandwidth for high speed reconnaissance surveying. Detailed measurements of selected anomalies at expanded bandwidth can also be performed. Similarly, the delay time T_d, the integrating interval t_p and the total integrating time T_p may also be adjusted to accommodate a wide range of geological conditions.

The instrument has 10 equal chargeability channels, M_0, M_1, M_2, M_3, M_4, M_5, M_6, M_7, M_8 and M_9 as shown in Figure 2.

These may be recorded individually, selectively or summed up automatically to obtain the total chargeability. The apparent resistivity (ρ_a) in ohm-metres is calculated on the field computer. If required 10 point moving averages of chargeability, resistivity, metal factor and alteration product are similarly calculated.

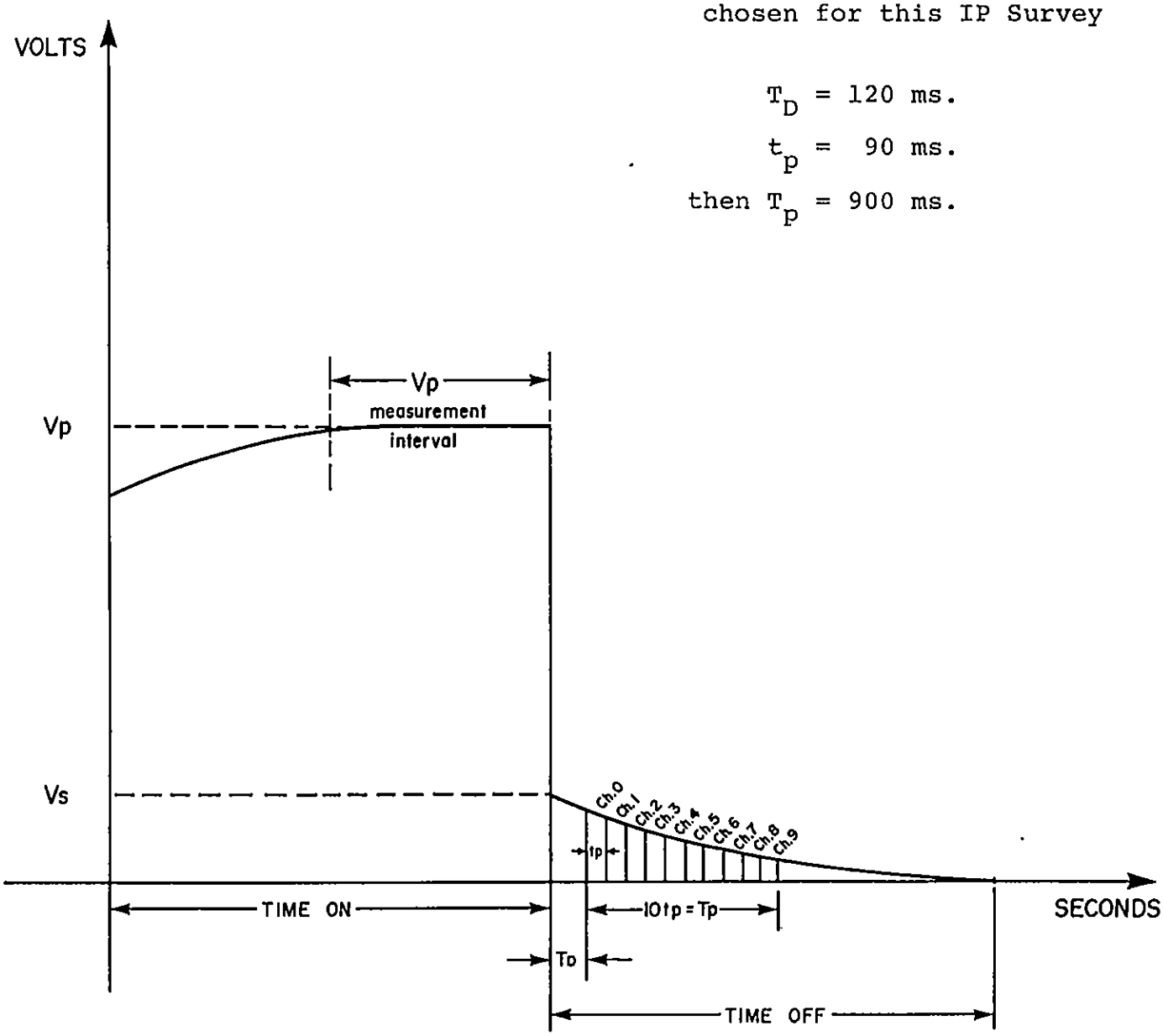
The instrument parameters chosen for this geological environment were T_D = 120 ms., t_p = 90 ms., giving a T_p = 900 ms., from 120 ms. to 1020 ms.

Instrument parameters
chosen for this IP Survey

T_D = 120 ms.

t_p = 90 ms.

then T_p = 900 ms.



Mark IV Receiver Measurement Parameters

Figure 2

6. SURVEY SPECIFICATIONS

The pole-dipole array was used for this survey. One current electrode C_1 and the two potential electrodes P_1 and P_2 are moved in unison along the survey lines. The second current electrode C_2 is grounded an "infinite" distance away, which is at least 10 times the distance between C_1 and P_1 for the largest electrode separation.

The dipole length (x) is the distance between P_1 and P_2. The electrode separation (nx) is the distance between C_1, and P_1 and is equal to (n = 1) or some multiple (n = 2, 3 and 4) of the distance between P_1 and P_2. The dipole length (x) determines mainly the sensitivity of the array with respect to the size of the body, whereas the electrode separation (nx) determines mainly the depth of penetration of the array.

The survey was carried out on lines 100 metres apart. Measurements were taken with x = 50 metres for n = 1, 2, 3 and 4.

7. DATA PROCESSING

The field data collected was transferred to diskette for processing on a Compaq 286 Portable computer which has 640 k Ram, one 1.2 megabyte Disk Drive, one 360 k Disk Drive, 20 megabyte Hard Disk and a 802087 math co-processor.

The software used to contour the data is based on the mathematical solution known as krigging. The sections of apparent chargeability and resistivity are plotted using an FX-185 Epson Printer. These sections are transferred to vellum or mylar, from which standard

blackline prints can be made.

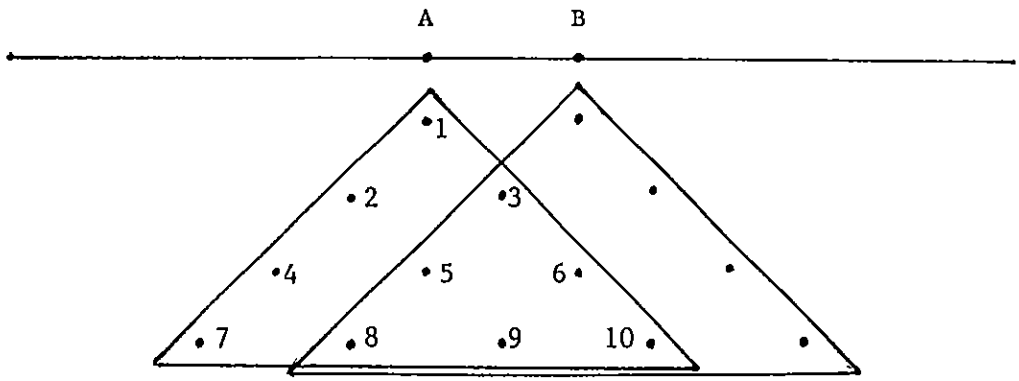
8. PRESENTATION OF DATA

The data obtained are presented on 11 pseudo-section plots and 3 maps as follows:

Pseudo-Sections	Dwg. No.
Line 20+00E	87263-1
Line 21+00E	87263-2
Line 22+00E	87263-3
Line 23+00E	87263-4
Line 24+00E	87263-5
Line 25+00E	87263-6
Line 26+00E	87263-7
Line 27+00E	87263-8
Line 28+00E	87263-9
Line 29+00E	87263-10
Line 30+00E	87263-11

Maps	Dwg. No.
Ten Point Moving Average Apparent Chargeability Contour Map	87263-12
Ten Point Moving Average Apparent Resistivity Contour Map	87163-13
Ten Point Moving Average Metal Factor Contour Map	87263-14

The ten point moving average is obtained by averaging ten data points continuously along each line and plotting and contouring the resulting averages in the form of plans or maps. The procedure is illustrated below.



The average of points 1 to 10 is plotted at point A. The average of a new set of data points is plotted at B and so on.....

9. DISCUSSION OF RESULTS

An IP response depends largely on the following factors:

1. The number of pore paths that are blocked by sulphide grains
2. The number of sulphide faces that are available for polarization
3. The absolute size and shape of the sulphide grains and the relationship of their size and shape to the size and shape of the available pore paths
4. The volume content of sulphide minerals
5. The electrode array employed
6. The width, depth, thickness and strike length of the mineralized body and its location relative to the array
7. The resistivity contrast between the mineralized body and the unmineralized host rock

Because of large variations in the above factors, it is difficult to determine the sulphide content of the underlying rocks from field measurements. Such deter-

minations are further complicated by the fact that rocks containing magnetite, hematite, graphite and clay minerals frequently give rise to an IP response. In the opinion of the writer, such determinations can be very misleading and are best left alone. Of much more importance in IP interpretation is the pattern of the IP data which can often lead to a much more significant evaluation of individual anomalies particularly where good geological mapping is available.

Pseudo-sections are not sections of the electrical properties of the underlying rocks, and cannot be treated as such when determining the depth, width and thickness of any particular zone.

A detailed study has been made of the pseudo-sections and anomalies have been classified into 3 groups viz definite, probable and possible anomalies. This classification is based partly on the relative amplitudes of the chargeability and to a lesser degree on the resistivity response. Of equal importance in this classification is the overall anomaly pattern and the degree to which this pattern may be correlated from line to line, provided of course that the correlation is not so extensive along strike so as to represent only the subcrop of a geological formation. This in fact is most probably true of the large strong sprawling anomalies that occur on the majority of lines east of line 24+00E.

The more interesting anomalies occur on lines west of line 24+00E that is on lines 20+00E; 21+00E; 22+00E and 23+00E. From a geophysical viewpoint it is here that

additional exploration efforts should be concentrated.

To further evaluate the more interesting geophysical anomalies the following programme of drilling is recommended:

Drill Hole No.	Line No.	Station No.	Direction of Hole	Depth of Hole
1	22+00E	025S	Vertical	50m
2	20+00E	100S	Vertical	50m
3	23+00E	Baseline	Vertical	75m
4	22+00E	350N	Vertical	100m
5	20+00E	575N	Vertical	100m
6	21+00E	550N	Vertical	100m

The hole locations are also shown on Drawing No. 87263-12.

The completion of 475 metres of drilling on this property will be largely dependent on the results obtained from the first few holes.

10. CONCLUSIONS AND RECOMMENDATIONS

From a study of the data obtained on the survey described in this report, it has been concluded that the more interesting geophysical anomalies in or near the quartz monzonite intrusive are worthy of further evaluation by drilling.

As set out in Section 9, Page 8, a total of 475 metres of drilling in six vertical holes is recommended.

Respectfully submitted,
LLOYD GEOPHYSICS LIMITED

John Lloyd M.Sc., P. Eng.

Vancouver, B.C.
May 1987

LLOYD GEOPHYSICS LIMITED

APPENDIX

A. Personnel Employed on Survey

Name			
J. Lloyd	Geophysicist	Lloyd Geophysics Limited 1110-625 Howe Street Vancouver, B.C. V6C 2T6	May 27-29, 1987
D. Hall	Geophysicist	"	May 13-23, 1987
J. Warne	Geophysicist	"	May 13-23, 1987
M. Pearson	Instrument Operator	"	May 13-23, 1987
W. Jopson	Field Assistant	"	May 13-23, 1987
J. Lambert	Field Assistant	"	May 13-23, 1987
J. Zondag	Typist	"	May 29, 1987

APPENDIX

B. Cost of Survey

Lloyd Geophysics Limited undertook the data acquisition for this survey on a per diem charge basis. Data processing by computer, reproduction of maps, interpretation and report writing were extra.

The breakdown of these costs are shown below:

Field Data Acquisition	$ 16,791.34
Computer Plotted Sections, Hand drafted maps, Report preparation & writing	3,010.00
Total Cost of Project	$ 19,801.34

APPENDIX

C. Certification

I, John Lloyd, of 1110-625 Howe Street, in the City of Vancouver, in the Province of British Columbia, do hereby certify that:

1. I graduated from the University of Liverpool, England in 1960 with a B. Sc. in Physics and Geology, Geophysics Option.

2. I obtained the diploma of the Imperial College of Science and Technology (D.I.C.), in Applied Geophysics from the Royal School of Mines, London University in 1961.

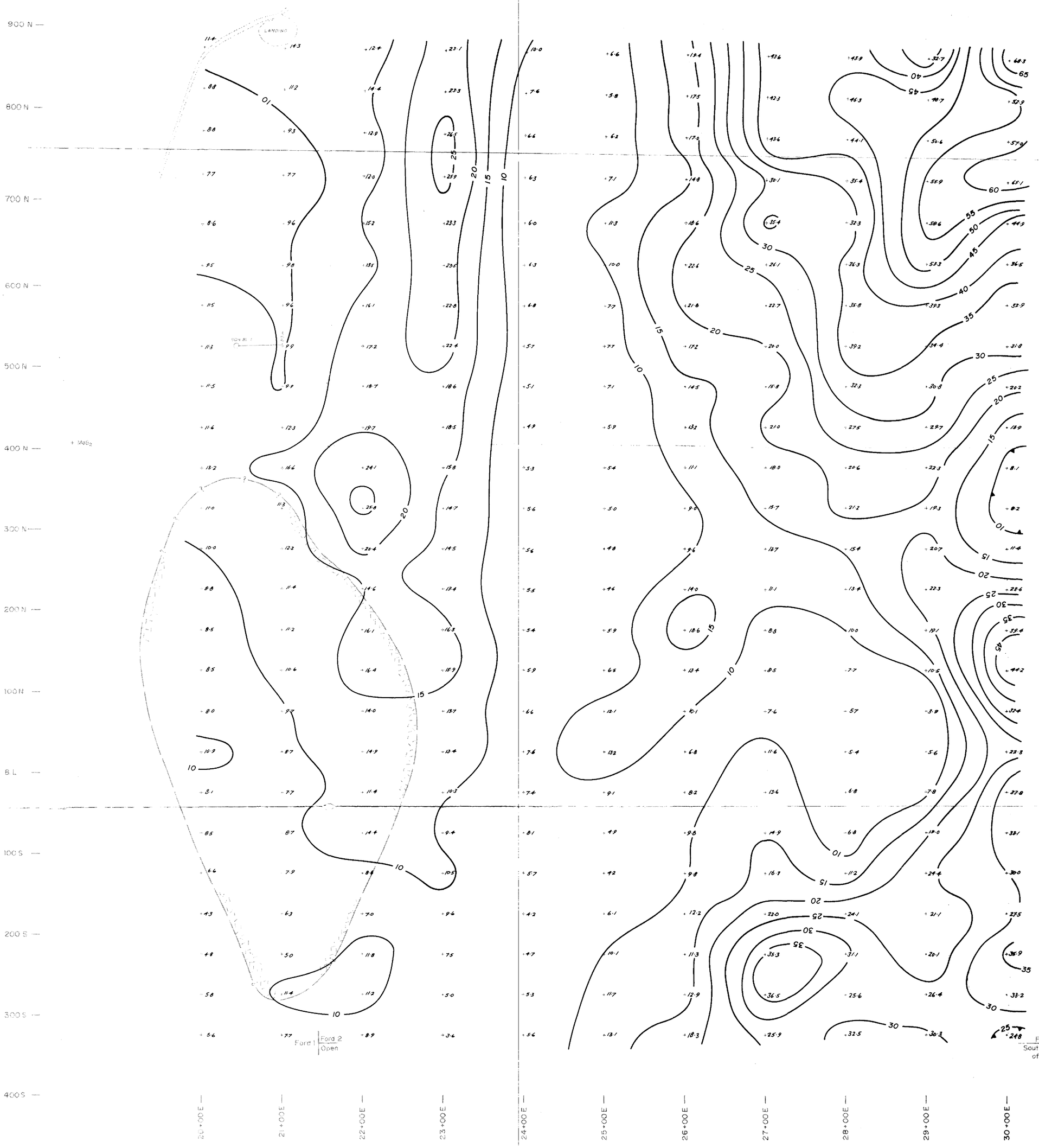
3. I obtained the degree of M. Sc. in Geophysics from the Royal School of Mines, London University in 1962.

4. I am a member in good standing of the Association of Professional Engineers in the Province of British Columbia, the Society of Exploration Geophysicists of America, the European Association of Exploration Geophysicists and the Canadian Institute of Mining and Metallurgy.

5. I have been practising my profession for over twenty years.

John Lloyd, P. Eng.

Vancouver, B.C.
May, 1987

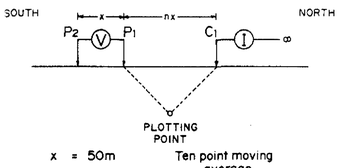


GEOLOGICAL BRANCH
ASSESSMENT REPORT

16,150

SCALE
50 0 50 100 150 200 METRES

POLE-DIPOLE ARRAY



x = 50m Ten point moving average

CURRENT ELECTRODE C_1 NORTH OF POTENTIAL DIPOLE P_1P_2

Contour interval: 5 units

Intrusive contact: approximate assumed

Road

To accompany report dated May 1987 by J. Lloyd M.Sc., P.Eng.

AMARADO RESOURCES LIMITED

FORD PROPERTY NELSON M.D., B.C.

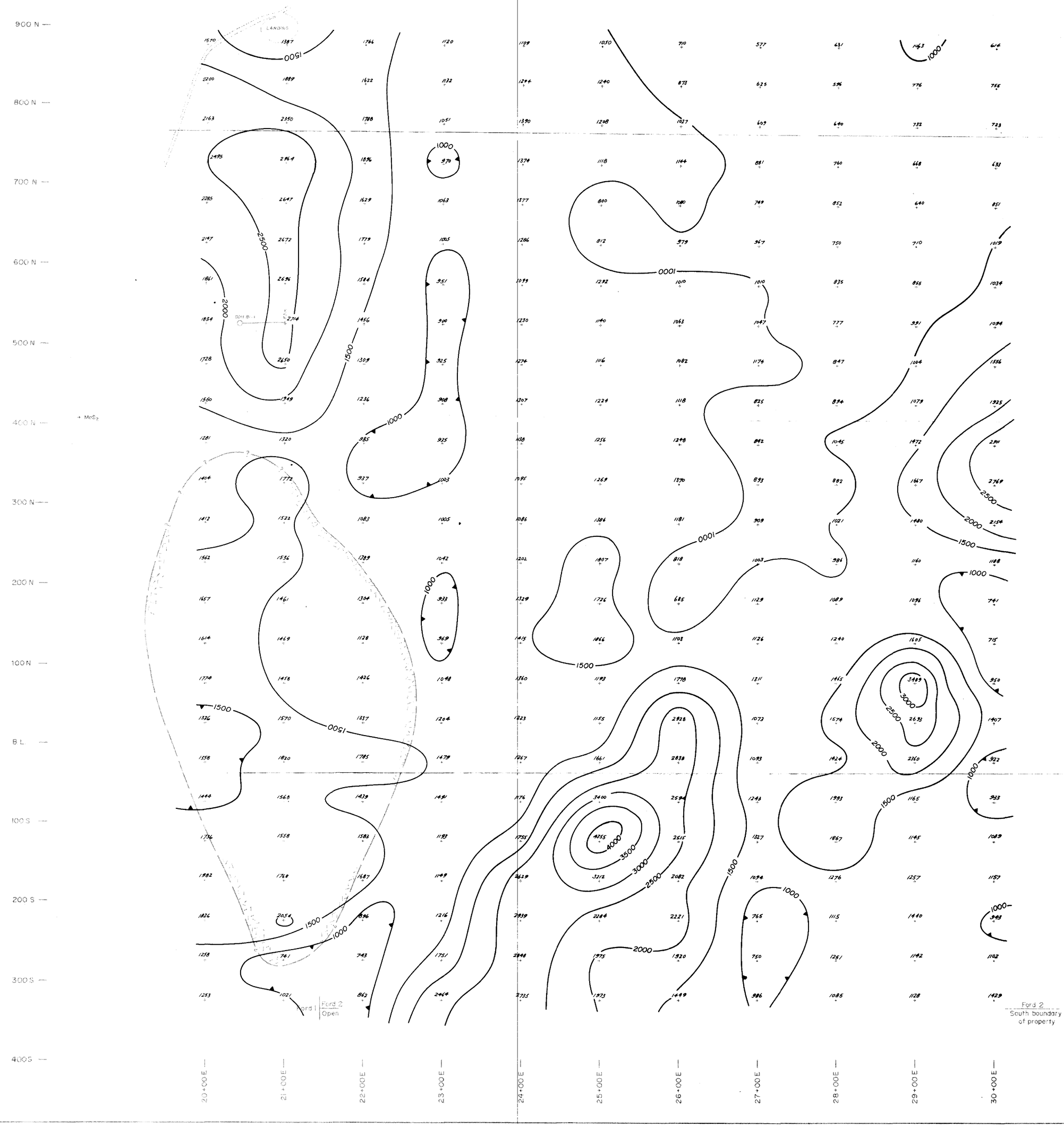
INDUCED POLARIZATION SURVEY

Metal Factor = $\frac{\text{Chargeability}}{\text{App. Resistivity}} \times 10^3$

TEN POINT MOVING AVERAGE

SCALE	DATE	BY	NTS	DWG. Nº
1:2500	May 1987	dlp / JL	82F/10W	87263-14

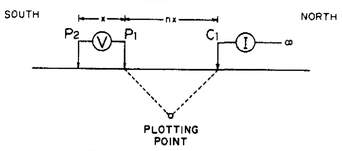
LLOYD GEOPHYSICS LIMITED



GEOLOGICAL BRANCH
ASSESSMENT REPORT

16,150

POLE-DIPOLE ARRAY



x = 50m Ten point moving average

CURRENT ELECTRODE C_1 NORTH OF POTENTIAL DIPOLE P_1P_2

SCALE
50 0 50 100 150 200 METRES

Contour interval: 500 ohm-metres

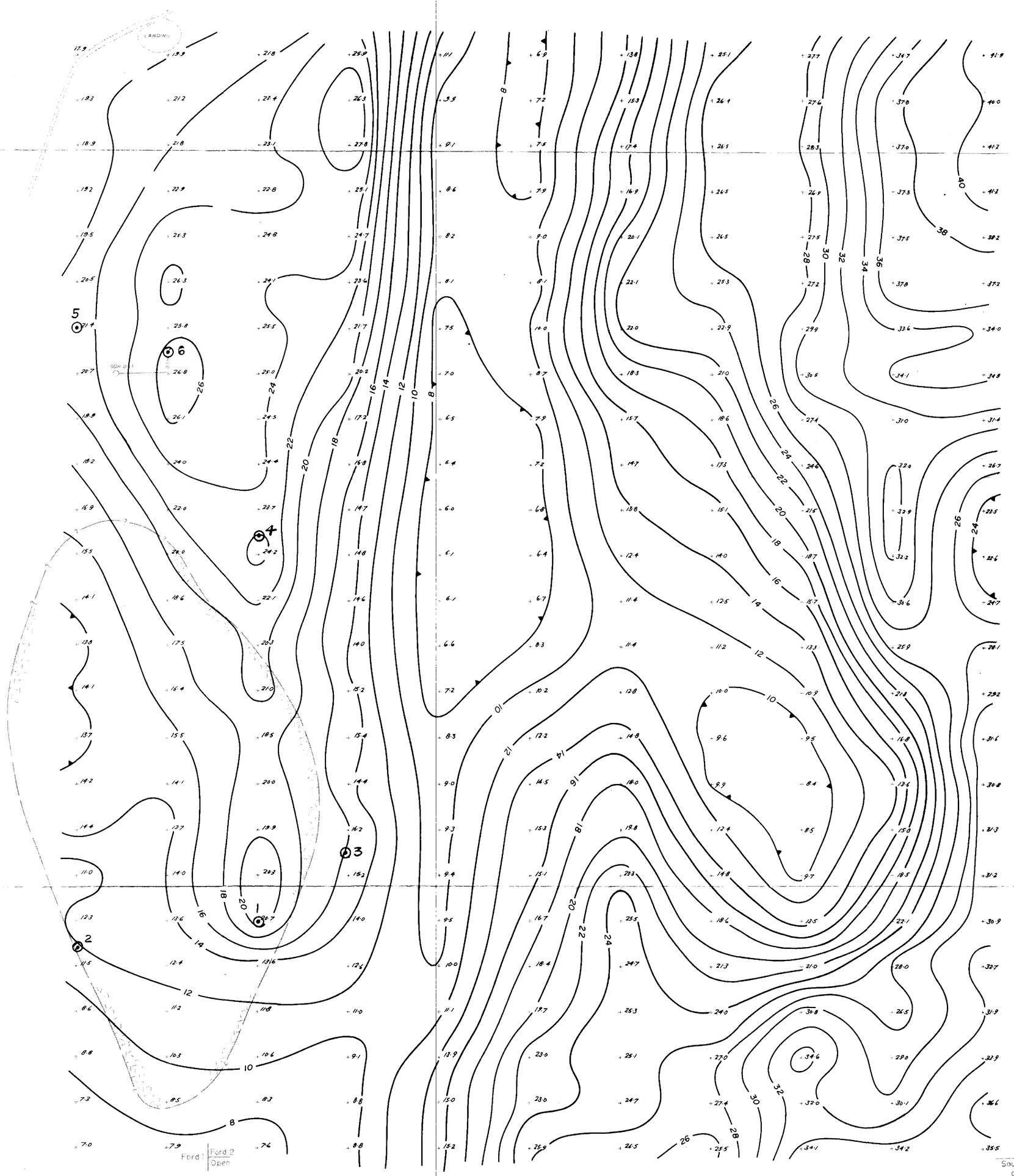
Intrusive contact: approximate / assumed

Road

To accompany report dated May 1987 by J. Lloyd M.Sc., P.Eng.

AMARADO RESOURCES LIMITED				
FORD PROPERTY			NELSON M.D., B.C.	
INDUCED POLARIZATION SURVEY Apparent Resistivity: ohm-m. TEN POINT MOVING AVERAGE				
SCALE	DATE	BY	NTS	DWG. Nº
1:2500	May 1987	dlp / JL	82F/10W	87263-13

LLOYD GEOPHYSICS LIMITED



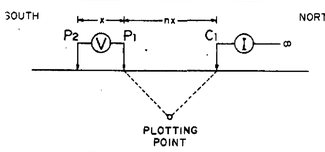
GEOLOGICAL BRANCH
ASSESSMENT REPORT

16,150

N

SCALE
50 0 50 100 150 200 METRES

POLE-DIPOLE ARRAY



x = 50m Ten point moving average

CURRENT ELECTRODE C_1 NORTH OF POTENTIAL DIPOLE P_1P_2

Contour interval: 2 milliseconds

Intrusive contact: approximate / assumed

Road

⊙ PROPOSED DRILL HOLE

To accompany report dated May 1987 by J. Lloyd M.Sc., P.Eng.

AMARADO RESOURCES LIMITED

FORD PROPERTY — NELSON M.D., B.C.

INDUCED POLARIZATION SURVEY

Apparent Chargeability: milli-secs.

TEN POINT MOVING AVERAGE

SCALE	DATE	BY	NTS	DWG. Nº
1:2500	May 1987	dlp / JL	82F/10W	87263-12

LLOYD GEOPHYSICS LIMITED