AN ASSESSMENT REPORT ON A TIME DOMAIN INDUCED POLARIZATION SURVEY

for

FOX GEOLOGICAL CONSULTANTS LIMITED

by

LLOYD GEOPHYSICS LIMITED
VANCOUVER, BRITISH COLUMBIA

OCTOBER 1981

AN ASSESSMENT REPORT ON A TIME DOMAIN TIME INDUCED POLARIZATION SURVEY ON PART OF MAUD 1 TO 4 CLAIM GROUP, NEAR QUESNEL, BRITISH COLUMBIA, FOR FOX GEOLOGICAL CONSULTANTS LIMITED

by

John Lloyd M.Sc., P.Eng.

GEOPHYSICAL SURVEY DATA

Type of Survey :	Time Domain Induced Polarization (IP) Survey
Claims Surveyed :	Parts of Maud 1-4 claim group, lat.52° 44'N., long. 121° 55'W.
Surveyed by :	D. Hall B.Sc., and J. Warne B.A Sc., Lloyd Geophysics Limited
Supervision and Report by :	J. Lloyd M.Sc., P.Eng.
Claims Held by :	P.E. Fox PhD., P.Eng.
Claims Surveyed for :	Dome Exploration (Canada) Limited
Survey Dates :	June 13 to July 16, 1981

SUMMARY

During the period June 13 to July 16, 1981 Lloyd Geophysics Limited carried out an Induced Polarization (IP) survey for Fox Geological Consultants Ltd. on part of the Maud 1 to 4 mineral claim group near Quesnel, British Columbia.

The survey outlined a strong, complex, but well defined zone of increased chargeability.

Further exploration of the property is warranted, with drill target selection to be based on correlation and analysis of all available exploration data viz. geology, geochemistry and geophysics.

TABLE OF CONTENTS

	Page
1. INTRODUCTION	1
1.1 Property Location	1
1.2 Property Access	1
1.3 Purpose of Survey	1
2. INSTRUMENT SPECIFICATIONS	3
3. SURVEY SPECIFICATIONS	7
4. PRESENTATION OF DATA	8
5. DISCUSSION OF RESULTS	8
5.1 Geology	9
5.2 Induced Polarization Survey	10
6. CONCLUSIONS AND RECOMMENDATIONS	11
7. CERTIFICATION	12

ACCOMPANYING MAPS	In Map Pocket
Contours of Apparent Chargeability, First Separation, n=1 (1 to 5000)	L81226-1
Contours of Apparent Chargeability, Second Separation, n=2 (1 to 5000)	L81226-2
Contours of Apparent Resistivity, First Separation, n=1 (1 to 5000)	L81226-3
Contours of Apparent Resistivity, Second Separation, n=2 (1 to 5000)	L81226-4

1. INTRODUCTION

During the period June 13 to July 16, 1981, Lloyd Geophysics Limited carried out an Induced Polarization (IP) survey for Fox Geological Consultants Ltd. on part of the Maud 1 to 4 mineral claim group located around Maud Lake near Quesnel, British Columbia.

The Maud 1 to 4 claim group comprises seventy two (72) contiguous full sized units identified as follows:-

Claim Name	Record No.	Expiry Date
Maud 1	1785	August 1, 1991
Maud 2	1786	August 1, 1990
Maud 3	1787	August 1, 1990
Maud 4	1788	August 1, 1990

1.1 Property Location

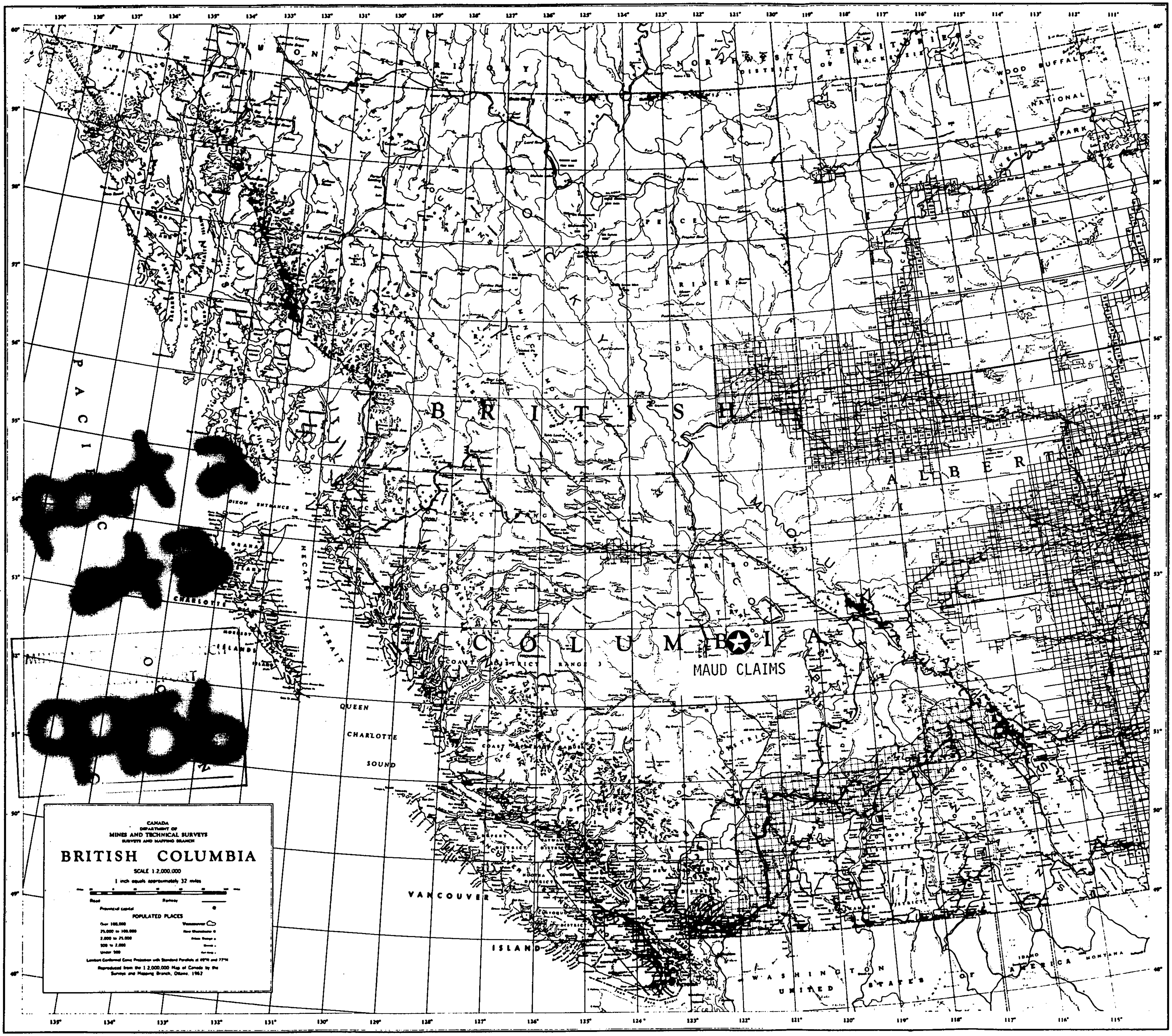
The Maud 1 to 4 claim group is located around Maud Lake, near Quesnel, British Columbia at latitude 52° 44' N., longitude 121° 55' W. The approximate location of the claim group is shown in Figure 1.

1.2 Property Access

Access to the property is by four wheel drive truck along a 40 km forestry road which leads off Highway 26 approximately 19 km east of Quesnel to Nyland Lake. The Nyland Lake road leads south-easterly into the property.

1.3 Purpose of the Survey

The purpose of the IP survey was to search for and outline concentrations of disseminated mineralization (mainly pyrite and magnetite) which is known to occur in the volcanic strata which have been intruded by a small dioritic stock.



BRITISH COLUMBIA
ALBERTA
MAUD CLAIMS
PACIFIC OCEAN
QUEEN CHARLOTTE SOUND
HECATE STRAIT
VANCOUVER ISLAND
WASHINGTON
UNITED STATES OF AMERICA
MONTANA
IDAHO
CANADA
DEPARTMENT OF
MINES AND TECHNICAL SURVEYS
SURVEYS AND MAPPING BRANCH
BRITISH COLUMBIA
SCALE 1:2,000,000
1 inch equals approximately 32 miles
POPULATED PLACES

FIGURE 1

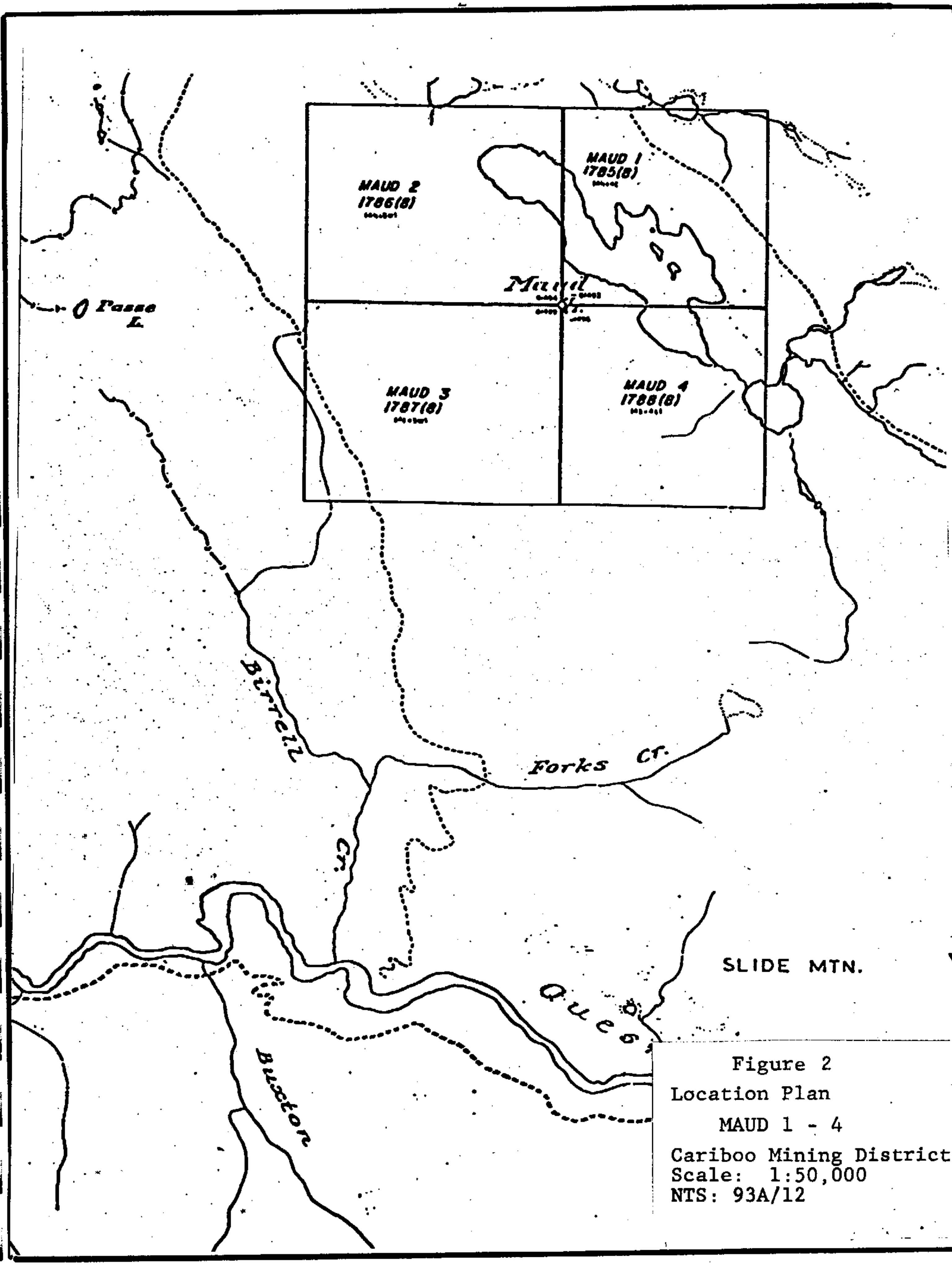


Figure 2
Location Plan
MAUD 1 - 4
Cariboo Mining District
Scale: 1:50,000
NTS: 93A/12

2. INSTRUMENT SPECIFICATIONS

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

The system used for this work consisted of a transmitter, a motor generator and a Mark III receiving unit incorporating a digital display readout for chargeability measurements.

The transmitter, which provides a maximum of 10 kw D.C. to the ground, obtains its power from a 10 kw, 400 cycle, 3 phase Leland alternator driven by an Onan gasoline engine. The total cycle time for the transmitter was 8 seconds and the duty ratio (R) was 1 to 1. This means the cycling rate of the transmitter was 2 seconds current "ON" and 2 seconds current "OFF" with the pulses reversing continuously in polarity.

The Mark III receiver presents digitally four individual (M) values of the decay curve at each station. The (M) value reading is the ratio of (V_s) divided by (V_p) expressed as a percentage. The quantity (V_p) is displayed separately.

The parameters measured by this unit are shown in Figure 2. The delay time (t_d) and the integration interval (t_p) of the receiver define completely the measurements (M_1), (M_2), (M_3) and (M_4).

The delay time (t_d) may be set to 15, 30, 60, 120 or 240 milliseconds; similarly the integration interval (t_p) may be set to 20, 30, 40, 50 or 60 milliseconds. This provides twenty-five different sets of values for each of the four sample points (t_1), (t_2), (t_3) and (t_4) of Figure 2. These quantities have been calculated and are shown in Table 1,

$$M_1 = \frac{e(t_1)}{V_p} = \sum_{1}^{n} \int_{(td)}^{(td+tp)} V_s \cdot dt \Big/ V_p \cdot t_p$$

$$M_2 = \frac{e(t_2)}{V_p} = \frac{1}{2} \sum_{1}^{n} \int_{(td+tp)}^{(td+3tp)} V_s \cdot dt \Big/ V_p \cdot t_p$$

$$M_3 = \frac{e(t_3)}{V_p} = \frac{1}{4} \sum_{1}^{n} \int_{(td+3tp)}^{(td+7tp)} V_s \cdot dt \Big/ V_p \cdot t_p$$

$$M_4 = \frac{e(t_4)}{V_p} = \frac{1}{8} \sum_{1}^{n} \int_{(td+7tp)}^{(td+15tp)} V_s \cdot dt \Big/ V_p \cdot t_p$$

$$M_a = t_p \times 10^{-2} \sum (M_1 + 2M_2 + 4M_3 + 8M_4) \quad \text{(Milliseconds)}$$

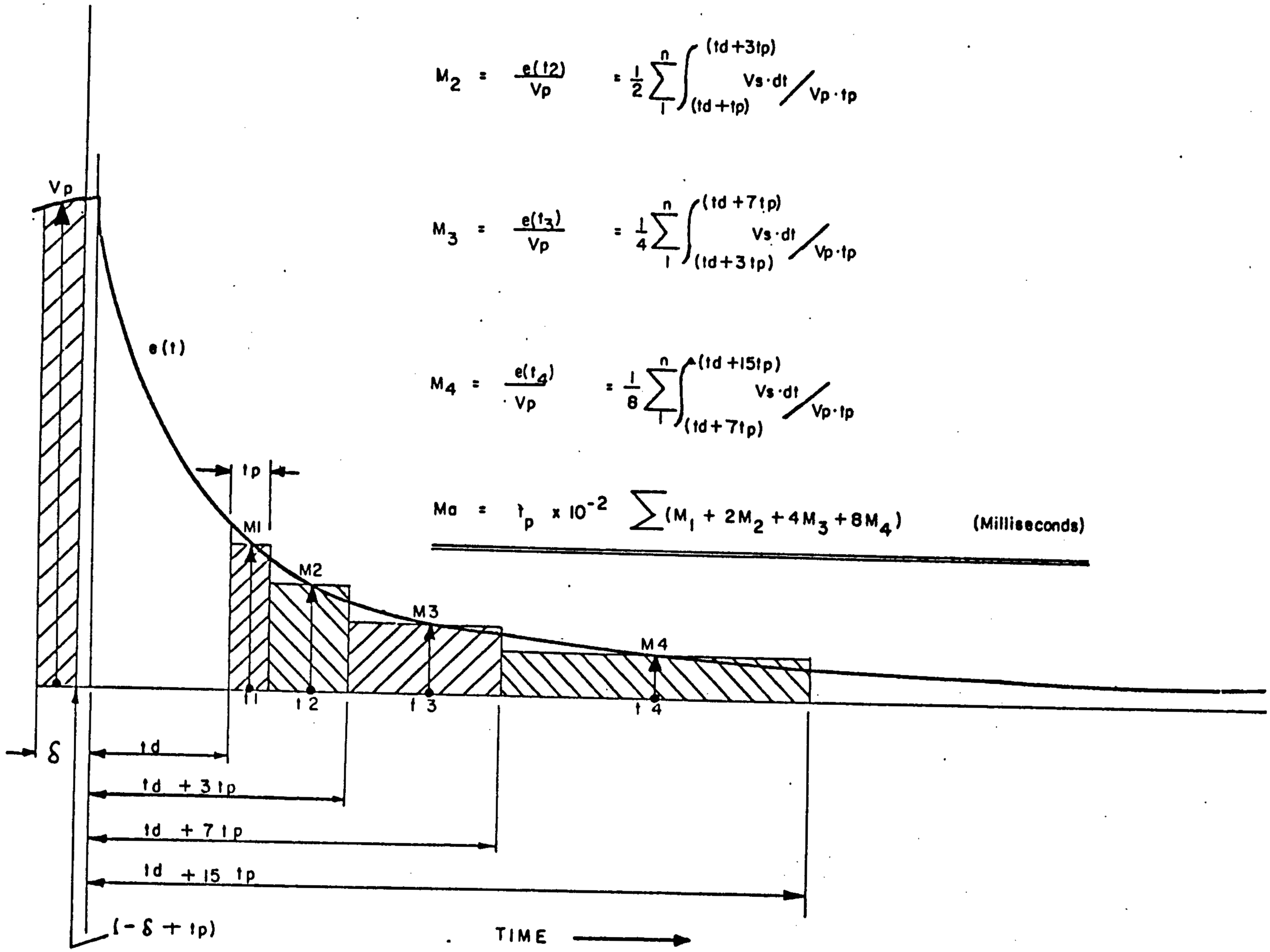


FIGURE 2

PERIOD t_p IN MILLISECONDS		DELAY TIME t_d IN MILLISECONDS 15			30			60			120			240			
		S	M	E	S	M	E	S	M	E	S	M	E	S	M	E	
	20	15	25	35	30	40	50	60	70	80	120	130	140	240	250	260	M_1
		35	55	75	50	70	90	80	100	120	140	160	180	260	280	300	M_2
		75	115	155	90	130	170	120	160	200	180	220	260	300	340	380	M_3
		155	235	315	170	250	330	200	280	360	260	340	420	380	460	540	M_4
	30	15	30	45	30	45	60	60	75	90	120	135	150	240	255	270	M_1
		45	75	105	60	90	120	90	120	150	150	180	210	270	300	330	M_2
		105	165	225	120	180	240	150	210	270	210	270	330	330	390	450	M_3
		225	345	465	240	360	480	270	390	510	330	450	570	450	570	690	M_4
	40	15	35	75	30	50	70	60	80	100	120	140	160	240	260	280	M_1
		75	95	135	70	110	150	100	140	180	160	200	240	280	320	360	M_2
		135	215	295	150	230	310	180	260	340	240	320	400	360	440	520	M_3
		295	455	615	310	470	630	340	500	660	400	560	720	520	680	840	M_4
	50	15	40	65	30	55	80	60	85	110	120	145	170	240	265	290	M_1
		65	115	165	80	130	180	110	160	210	170	220	270	290	340	390	M_2
		165	265	365	180	280	380	210	310	410	270	370	470	390	490	590	M_3
		365	565	765	380	580	780	410	610	810	470	670	870	590	790	990	M_4
	60	15	45	75	30	60	90	60	90	120	120	150	180	240	270	300	M_1
		75	135	195	90	150	210	120	180	240	180	240	300	300	360	420	M_2
		195	315	435	210	330	450	240	360	480	300	420	540	420	540	660	M_3
		435	675	915	450	690	930	480	720	960	540	780	1020	660	900	1140	M_4

Table 1

S - time in milliseconds from turn off at which integration commences.

E - time in milliseconds from turn off at which integration ceases.

M - the mid point between S and E.

- Instrument Parameters selected for this survey.

together with the limits of integration corresponding to each of the intervals (M_1), (M_2), (M_3) and (M_4).

For this survey the delay time (t_d) was fixed at 120 milliseconds and the integrating interval (t_p) of 60 milliseconds; this gave a total integrating time (T_p) of 900 milliseconds.

The apparent chargeability (M_a) in milliseconds is obtained by summing the (M) factors, weighted for their individual integrating times as follows:

$$M_a = t_p \times 10^{-2} \sum (M_1 + 2M_2 + 4M_3 + 8M_4) \text{ milliseconds} \quad \text{-- (1)}$$

The apparent resistivity (ρ_a) in ohm-metres is obtained by dividing (V_p) by the measured current (I_g) and multiplying by a factor (K) which is dependent on the geometry of the array used. The absolute value of (V_p) is obtained by multiplying the digital voltmeter reading by the scale factor of the input attenuator.

The chargeabilities and resistivities obtained are called apparent as they are values which that portion of the earth sampled would have if it were homogeneous. As the earth sampled is usually inhomogeneous, the calculated apparent chargeabilities and resistivities are functions of the actual chargeabilities and resistivities of the rocks.

The majority of geophysicists, using time domain equipment, quote their apparent chargeability measurements in units of milliseconds. This is an unfortunate choice of units since these units are really millivolt seconds per volt. Therefore data obtained by different transmitters and receivers using different timing and sampling sequences will yield different "millisecond" values over the same orebody or mineralized zone. The interpreter must therefore pay special attention to the transmitter timing cycle, the receiver delay time, the integrating interval, and total integrating time, before making comparisons between data obtained with different systems.

3. SURVEY SPECIFICATIONS

The pole-dipole array was used for this survey. With this array the 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 a least ten 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 or some multiple of the distance between P_1 and P_2. For a sulphide body of some particular size, shape, depth and true chargeability, the dipole length (x) determines mainly the sensitivity of the array, whereas the electrode separation (nx) determines mainly the depth of penetration of the array.

All lines were surveyed using a dipole length (x) of 60 metres. Chargeability and resistivity measurements were made for two electrode separations that is for n = 1 and 2.

All lines were surveyed with the measuring dipole P_1P_2 to the east of the leading current electrode C_1.

4. PRESENTATION OF DATA

The data obtained from the survey described in this report are presented on four maps, folded into the map pocket at the end of the report.

Map numbers L81226-1 and L81226-2 are contour maps of apparent chargeability for the first, n=1, and second, n=2, separation measurements respectively.

Map numbers L81226-3 and L81226-4 are contour maps of apparent resistivity for the first, n=1, and second, n=2, separation measurements respectively.

The scale of all four maps is 1 to 5000.

5. 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.

The sulphide content of the underlying rocks or, since rocks containing magetite, graphite or clay minerals, frequently give rise to an IP response, an equivalent sulphide content is one of the critical factors that we would like to determine from field measurements. However experience has shown that this is both difficult and unreliable, mainly because of the large number of factors, described above, which contribute to an IP response. These factors vary considerably from one geological environment to another. Despite this, some interpreters have developed empirical rules for making rough estimates of the percent sulphides by volume contained within rocks giving anomalous IP responses.

5.1 GEOLOGY

The Maud property covers a dioritic stock and enclosing mineralized volcanic strata exposed on the west side of the Maud Lake. The property is situated 10 kilometres north of the Quesnel River gold prospect currently being explored by Dome Mines Limited. The Maud prospect is associated with a small alkalic intrusion consisting of diorite, monzodiorite and monzonite that intrudes a thick succession of augite basalt, trachybasalt, felsic breccia, and volcanic wackes and sediments. Bedrock exposures on the property are confined to rocky summits and steep slopes.
The remainder of the area consists of gentle slopes where bedrock is covered by several feet or more of glacial till.

Dark grey basaltic flows, layers of unstratified autobreccia and thick accumulations of felsic breccia form rocky summits and ridges in the central part of the property. Poorly bedded volcanic wackes and sedimentary grits outcrop at lower elevations to the west. The sediments strike northwesterly, dip 50° west, and overlie the volcanic strata to the east.

5.2 Induced Polarization Survey

The IP survey has outlined a well defined zone of increased chargeability. This zone is shown on the second separation chargeability map (L81226-2).

The zone strikes north-westerly and varies in width from a few hundred metres to over one thousand metres. Outside of the zone, chargeability background varies from 5 to 10 milliseconds. Within the zone the chargeability is usually greater than 15 milliseconds, however strong isolated chargeability highs often reach over 40 milliseconds and in one particular case over 70 milliseconds.

A number of faults and/or fault contacts have been interpreted from a study of the resistivity data and from disruptions and deflections in the strong linear chargeability trends.

A magnetometer survey, not reported on here, has recently been completed over the IP survey grid lines. Where good correlation exists between a strong magnetic response and a chargeability high the source of the chargeability high is generally expected to be caused mainly by magnetite. Where little or no correlation exists between a strong magnetic response and a chargeability high the source of the chargeability high is most probably caused by sulphides, probably pyrite.

Further exploration of the property by drilling is warranted. Selection of drill targets should be based on geology, coincident geochemical and chargeability highs with poor magnetic response.

6. CONCLUSIONS AND RECOMMENDATIONS

From a study of the IP data obtained from the survey described in this report it has been concluded that:

A. The strong IP response is most probably caused by sulphides, mainly pyrite, with lesser amounts of magnetite.

B. In view of the large areal extent of the IP response, the selection of drill targets will require the use of additional exploration data, such as geochemical sampling data and magnetic survey data.

In view of the favourable exploration data obtained on the property to date, it is recommended that the property be drilled, with drill target selection based on a careful analysis of the geological, geochemical and geophysical data obtained to date.

Respectfully submitted

LLOYD GEOPHYSICS LIMITED

John Lloyd P.Eng.
Geophysicist

Vancouver, B.C.
October 1981

7. CERTIFICATION

I, John Lloyd, of 410 - 675 West Hastings 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.

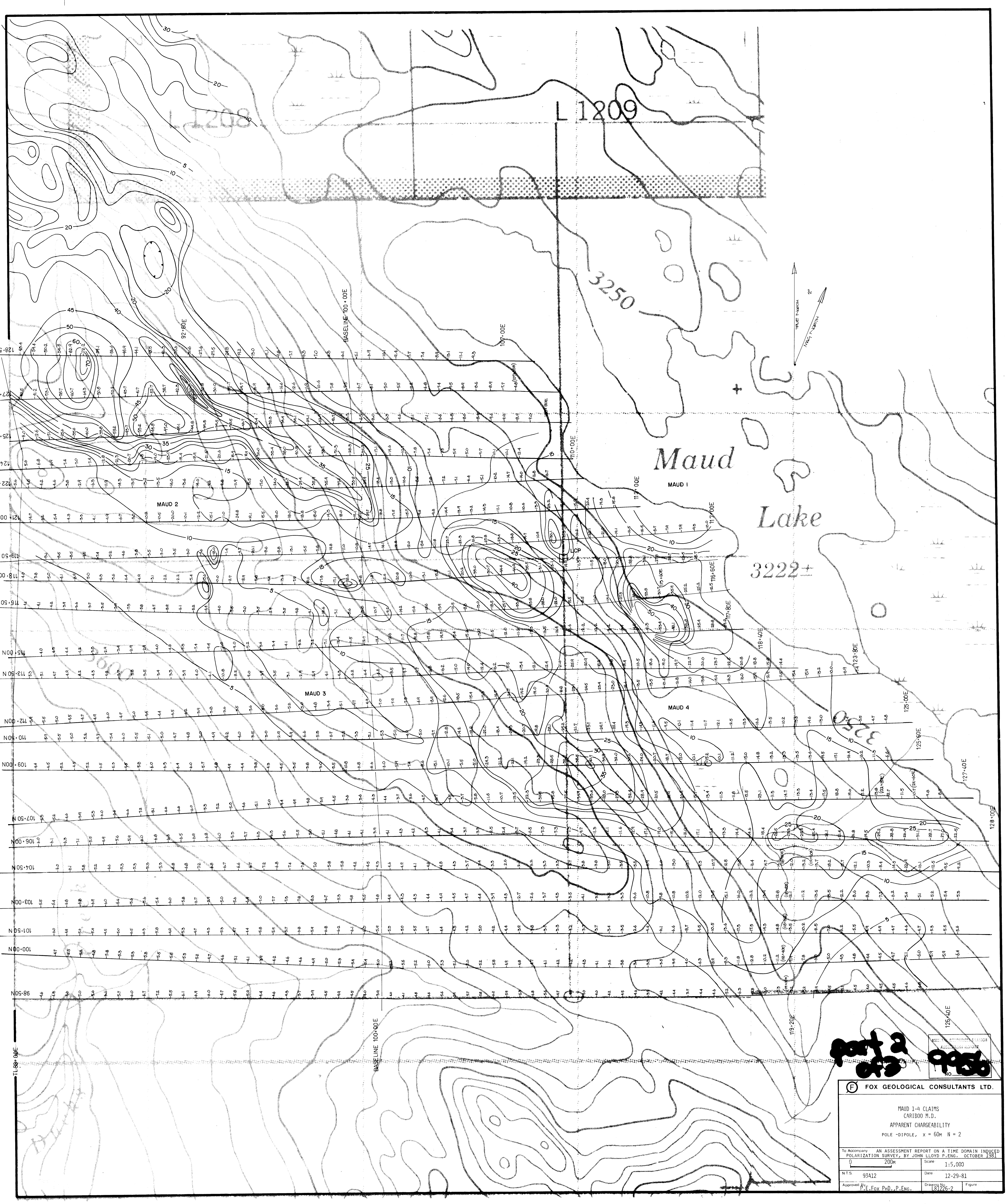
4. I am a member in good standing of the Association of Professional Engineers in the Province of British Columbia, the Society of Exploration Geophysicists of America, the European Association of Exploration Geophysicists and the Canadian Institute of Mining and Metallurgy.

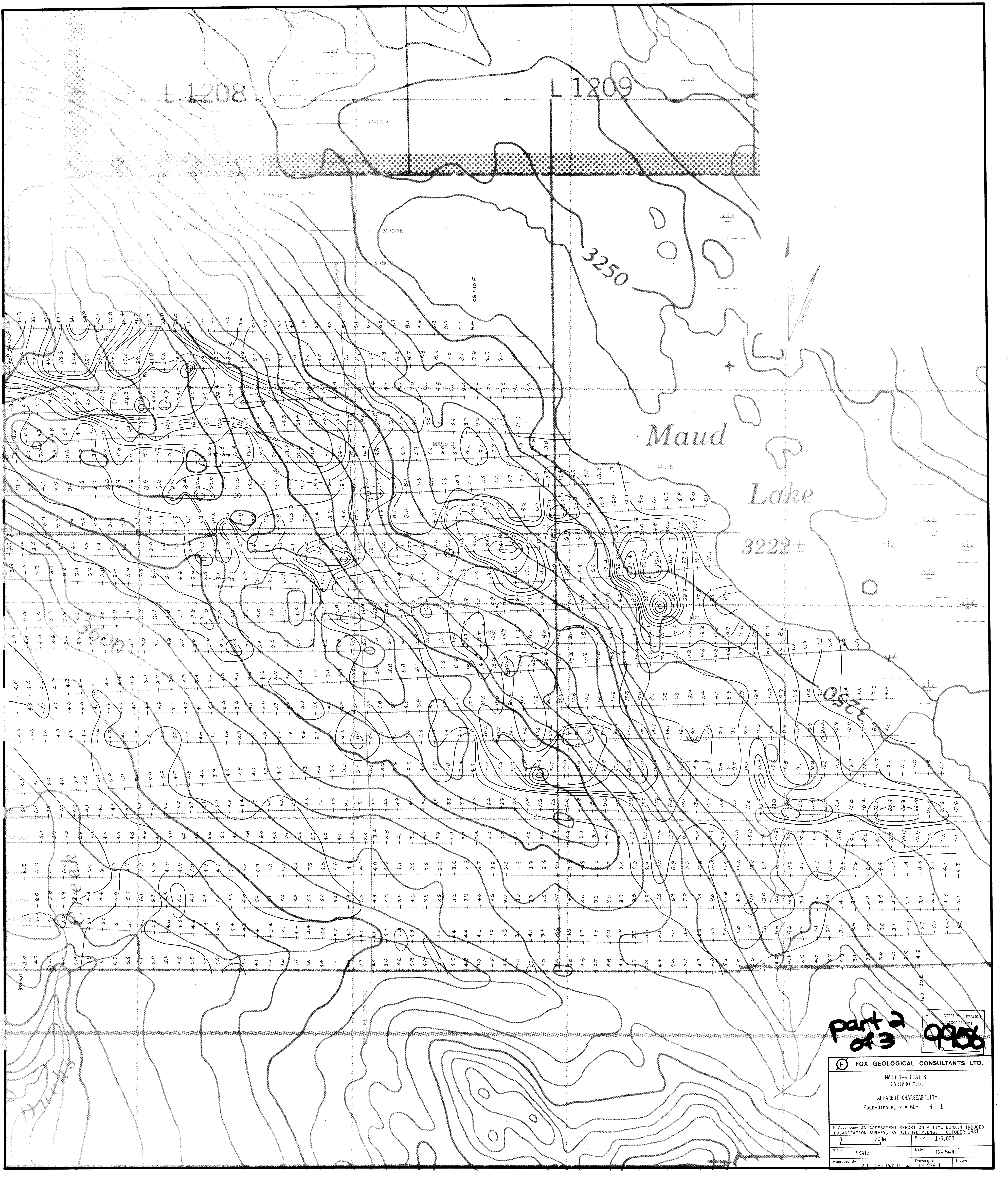
5. I have been practising my profession for the last nineteen years.

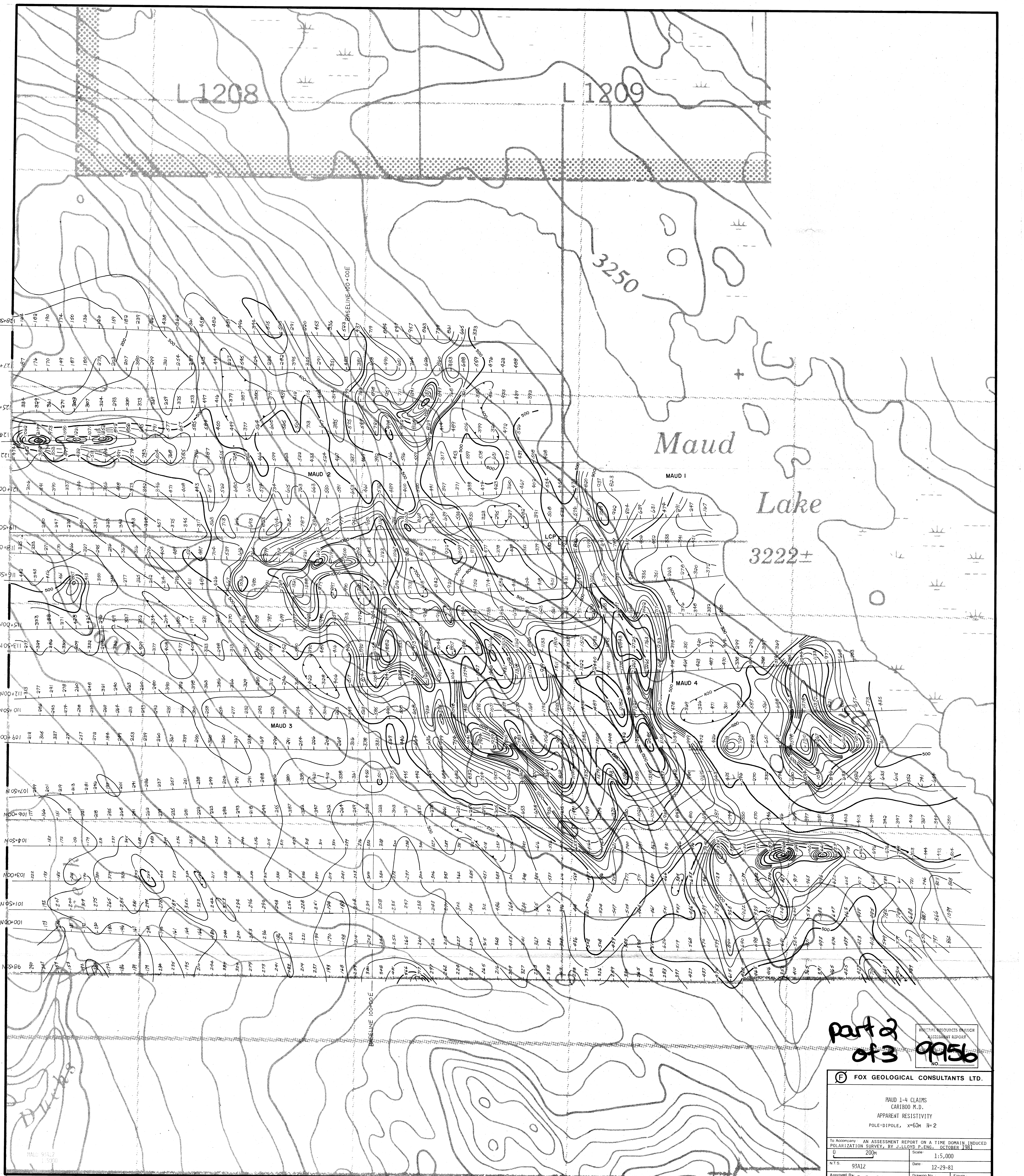
John Lloyd, P.Eng.

Vancouver, B.C.
October 1981

John Lloyd


L 1208
L 1209
3250
Maud
Lake
3222±
MAUD 1
MAUD 2
MAUD 3
MAUD 4
LCP
BASELINE 100+00E
TRUE NORTH
MAG NORTH
part 2 of 3
MINERAL RESOURCES BRANCH
ASSESSMENT REPORT
NO. 9956
FOX GEOLOGICAL CONSULTANTS LTD.
MAUD 1-4 CLAIMS
CARIBOO M.D.
APPARENT CHARGEABILITY
POLE -DIPOLE, X = 60M N = 2
To Accompany: AN ASSESSMENT REPORT ON A TIME DOMAIN INDUCED POLARIZATION SURVEY, BY JOHN LLOYD P.ENG. OCTOBER 1981
0 200M
Scale 1:5,000
N.T.S. 93A12
Date 12-29-81
Approved By P.E.Fox PhD.,P.Eng.
Drawing No. L81226-2
Figure


L 1208
L 1209
3250
Maud
MAUD 1
Lake
3222±
MAUD 2
3250
part 2 of 3
9956
FOX GEOLOGICAL CONSULTANTS LTD.
MAUD 1-4 CLAIMS
CARIBOO M.D.
APPARENT CHARGEABILITY
POLE-DIPOLE, X = 60M N = 1
To Accompany AN ASSESSMENT REPORT ON A TIME DOMAIN INDUCED POLARIZATION SURVEY, BY J.LLOYD P.ENG. OCTOBER 1981
0 200M
Scale: 1:5,000
N.T.S. 93A12
Date: 12-29-81
Approved By: P.E. FOX PHD P.ENG
Drawing No. 181226-1
Figure



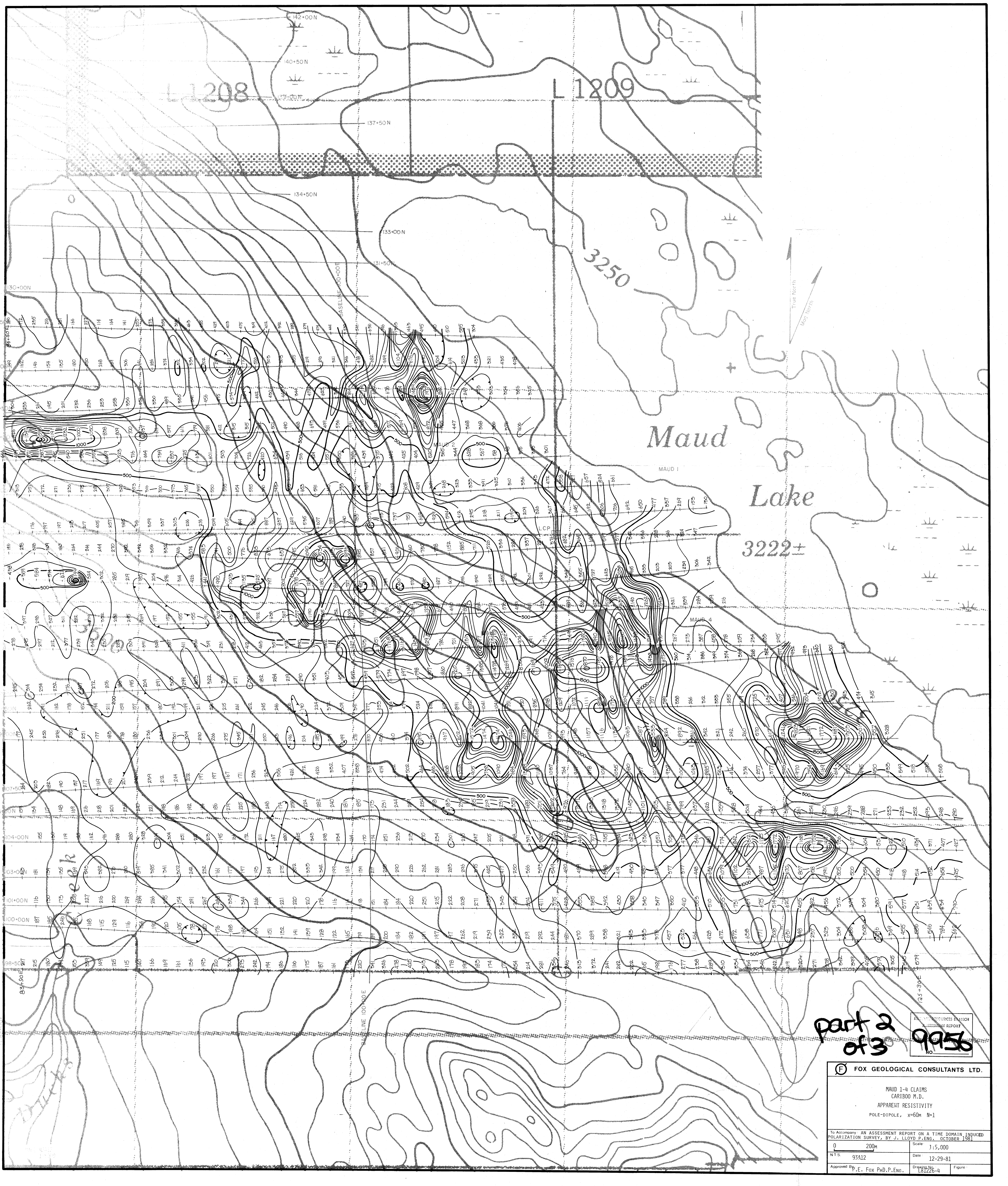
part 2 of 3

FOX GEOLOGICAL CONSULTANTS LTD.

MAUD 1-4 CLAIMS
CARIBOO M.D.
APPARENT RESISTIVITY
POLE-DIPOLE, x=60M N=2

To Accompany: AN ASSESSMENT REPORT ON A TIME DOMAIN INDUCED POLARIZATION SURVEY, BY J.LLOYD P.ENG. OCTOBER 1981

0 200M	Scale: 1:5,000
N.T.S. 93A12	Date: 12-29-81
Approved By: P.E. Fox PhD.P.Eng.	Drawing No.: L81226-3 Figure:



FOX GEOLOGICAL CONSULTANTS LTD.

MAUD 1-4 CLAIMS
CARIBOO M.D.

APPARENT RESISTIVITY

POLE-DIPOLE, x=60M N=1

To Accompany: AN ASSESSMENT REPORT ON A TIME DOMAIN INDUCED POLARIZATION SURVEY, BY J. LLOYD P.ENG. OCTOBER 1981

0 200M	Scale: 1:5,000
N.T.S. 93A12	Date: 12-29-81
Approved By: P.E. Fox PhD.P.Eng.	Drawing No.: L81226-4 / Figure: