MAR 19720001: FORT CHIPEWYAN

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REPORT ON

MAGNETOMETER AND SCINTILLOMETER SURVEYS

CONDUCTED ON

SELECTED AREAS OF PERMIT NO. 73

FORT CHIPEWYAN AREA, NORTHERN ALBERTA

Prepared For

Columbian Northland Exploration Ltd.

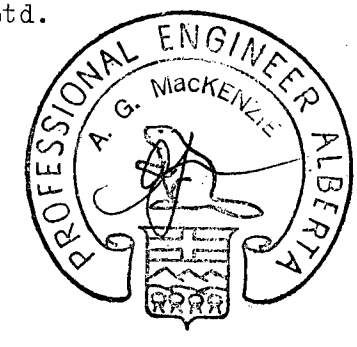
Calgary, Alberta

Prepared By

Angus G. MacKenzie Mining Consultants Ltd.

Calgary, Alberta

January, 1972



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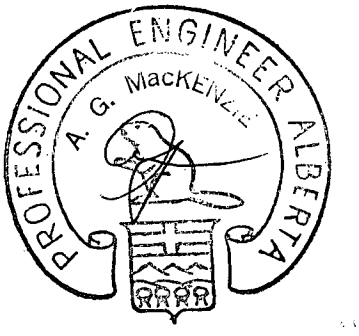

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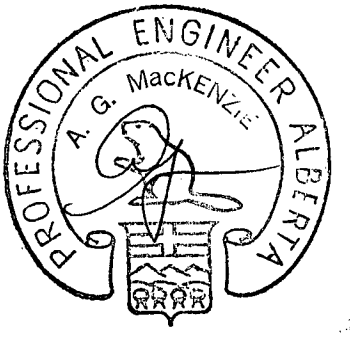


AUTHORITY

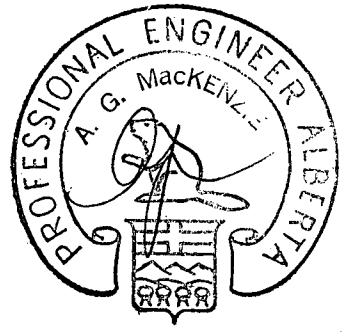
Authority to perform the work as outlined in our Proposal and Estimate to Columbian Northland Exploration Ltd. on Permit #73, Alberta was given to Angus G. MacKenzie Mining Consultants Ltd. by Mr. H. Cowan, Vice-President of Columbian Northland (the present operator of this exploration permit).

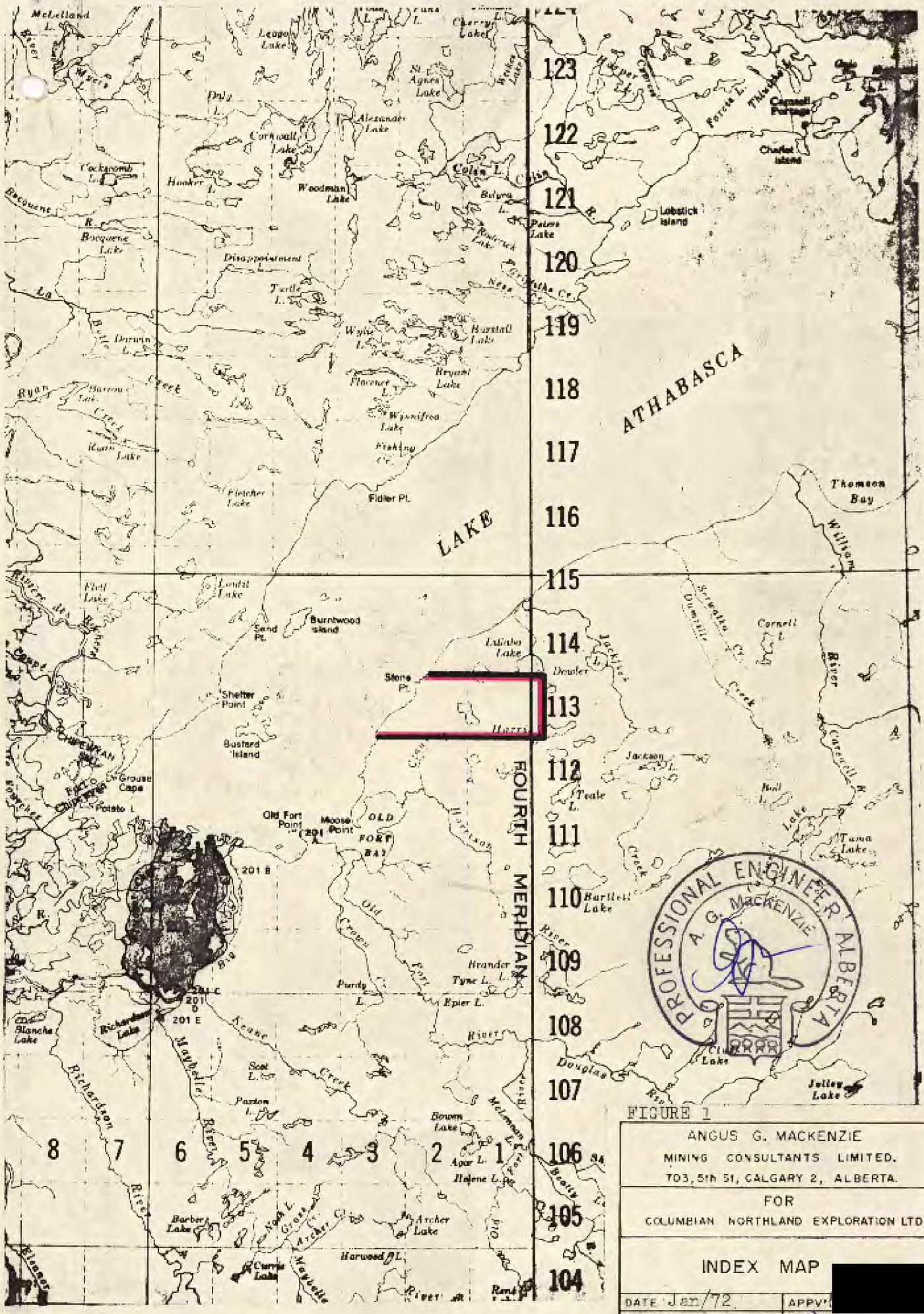
INTRODUCTION

Our crew, consisting of two field men and the requisite geophysical equipment, was in Uranium City on September 16th, and after making arrangements for supplies and helicopter support, left for Stone Point on September 17th. The magnetometer and scintillometer surveys were completed by September 24th.

The results of these surveys were plotted in plan (See Figures 2 and 3) and profile (See Appendix I, Radiometric Profiles and Appendix II, Magnetometer Profiles). An independent evaluation of these geophysical results, along with all previous geophysical work, was made by Dr. R. Agarwal, Ph.D., P. Eng., a specialist in these particular fields of geophysical interpretation.

The results of his study are the basis of this report and are included in toto as the major part of this report as follows: (pages 2 to 6 inclusive)





PROFESSIONAL ENGINEER ALBERTA A. G. MACKENZIE

FIGURE 1

ANGUS G. MACKENZIE
MINING CONSULTANTS LIMITED.
703, 5th St, CALGARY 2, ALBERTA.

FOR
COLUMBIAN NORTHLAND EXPLORATION LTD

INDEX MAP

DATE Jan/72. APPV'[redacted]
DWG NO. SCALE: 1" = 12 miles

19720001

REPORT

ON

THE GEOPHYSICAL SURVEYS

CONDUCTED ON

SELECTED AREAS OF PERMIT NO. 73

FORT CHIPEWYAN AREA, NORTHERN ALBERTA

Prepared By

R. G. Agarwal, Ph.D., P. Eng.

Consulting Geophysicist

Calgary, Alberta

INTRODUCTION

During the period from September 18th to September 22nd, 1971, a ground magnetometer survey and a radiometric survey were carried out by Angus G. MacKenzie Mining Consultants Ltd. on Permit 73, Fort Chipewyan area, Northern Alberta. The permit is located on the south side of Lake Athabasca in the province of Alberta (See Figure 1).

The purpose of the present report is to evaluate the magnetic and radiometric data as submitted by Angus G. MacKenzie Mining Consultants Ltd.

GENERAL GEOLOGY

South of Lake Athabasca the basement rocks are the Tazin Group and Martin Formation and these are covered by the Athabasca Sandstone Formation. This formation is highly fractured and jointed and is mostly covered. North of Lake Athabasca, especially in the Uranium City-Beaverlodge area, the Tazin Group and Martin Formation are supposed to be associated with uranium-bearing minerals. The Tazin Group consists of metamorphosed, sedimentary and volcanic rocks. These rocks are cut by granite and pegmatite dykes and sills and are faulted, fractured and folded. The overlying Martin Formation consists of basal conglomerate, arkose and basaltic and gabbroic rocks. These rocks are also fractured and faulted.

PREVIOUS WORK

The area was covered with aeromagnetic surveys in 1962 and subsequently a map was published by the Geological Survey of Canada (Map Sheet 74-L-16) in 1964. The aeromagnetic map does not reveal any anomalies in the permit area. Stone Point in the map area generally displays the magnetic low values, although some higher magnetic values lie in the southeast portion.

A reconnaissance, seismic survey in the area was undertaken during the years from 1962-63 and in 1968; the final results were published by the Geological Survey of Canada in 1969. The seismic results over the permit area indicate the thickness of the Athabasca Sandstone Formation overlying the basement rocks. The thickness of this formation varies from only a few hundred feet (approx. 200') near Stone Point to approximately 2,000 feet in the southeast corner of the permit.

In 1969, Angus G. MacKenzie Mining Consultants Ltd. carried out a reconnaissance, airborne, scintillometer survey over the permit area and ground-checked some of these anomalies. During the summer of 1970, ground checks of the airborne radiometric anomalies were continued and some of these anomalies were covered with ground radiometric survey.

No geological or structural information is available on the permit area as it is covered with Athabasca Sandstone Formation and a thin veneer of till.

MAGNETOMETER AND RADIOMETRIC SURVEYS

Equipment

The magnetometer used on this project was a McPhar, Model No. 700, Serial No. 6860. This instrument records the vertical component of the magnetic field to an accuracy of ±10 gammas. The final readings after diurnal correction are shown in Figure 2.

The radiometric survey was carried out with a McPhar Model TV-1 Scintillometer, Serial No. 170-28; it has been described in previous reports (1970) by A. G. MacKenzie. Total counts measured on this survey are shown in Figure 3.

Survey Specifications

Ground magnetometer and radiometric surveys were carried out along northwest-southeast lines (Figures 2 and 3) on Permit 73. Line spacing was 600 feet apart and the readings were taken at 300-foot station intervals.

The results of these surveys are presented on the attached maps at a scale of 1" = 1,200 feet. The resulting shear zones or faults and the anomalous radiometric zones are marked in alphabetical order.

Discussion of Survey Results

From the radiometric data (Figure 2) the average background readings are 700 to 800 counts per minute. Total counts of twice the background were encountered at only a few places as shown on the map (A, B, C and D). The

above background readings encountered may signify some seepage of radiation through the fractures or they may be caused by near-surface sources. The area is covered with several hundred feet of Athabasca Sandstone. The sandstone has fractures and block joints and at places is covered widely with swamps. It is possible that the measured radiation may be coming from surficial sources and derived from upward migration of radiation.

With the exception of the magnetic anomalies measured, the permit area is generally magnetically flat. Usually larger magnetic anomalies are caused by changes in composition of the basement rocks. Magnetic data is also useful in revealing geological features and structures such as strike, dip, faults, shear zones and fracture patterns.

The high magnetic anomalies in the permit area are associated with igneous bodies whereas magnetic low anomalies may correspond to meta-sediments and paragneisses. From magnetic data, it also appears that most of the faults or shear zones are in a northeast-southwest direction, although several of them also appear in a north-south or northwest-southeast direction.

In general, it appears that some of these faults or shear zones may be extensions of, or similar in nature to, those on the north of Lake Athabasca. It is well-known that the Black Bay fault system through Uranium City, Saskatchewan is associated with uranium-bearing minerals and lies in a northeast-southwest direction. Most of the faults or shear zones obtained from the magnetic data also fall in a northeast-southwest direction and are associated with radiometric anomalies. These combined anomalies require further testing by diamond drilling.

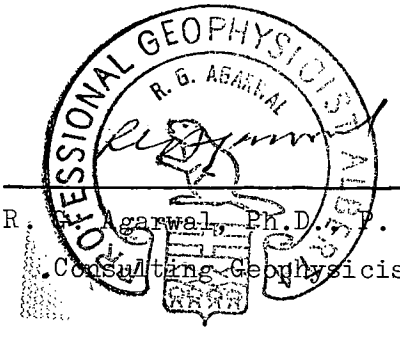
CONCLUSIONS AND RECOMMENDATIONS

From ground magnetic data it appears that there are several, shear, fracture or fault zones in this area. Several of these may be associated with major fault systems from a northeasterly direction such as the Black Bay fault system. The isolated magnetic highs may represent intrusive bodies whereas magnetic low anomalies may represent meta-sediments and paragneisses.

It is also noticed that several of the radioactive anomalies are associated with northeast-southwest fault or shear zones. The shear or fault systems as indicated by ground magnetic data on Permit 73 seem to align along the strike line of the Black Bay fault system which is well-known to be associated with radioactive occurrences.

In view of this, radioactive anomalies in the permit area become of importance and need to be investigated by drilling.

It is recommended that the radioactive anomalies, A, B, C and D should be tested by drilling. If the results are encouraging, then further exploration programs should be planned to outline other possible radioactive anomalies in this area. Depending upon the drilling results, further exploration programs could be reviewed accordingly.



R. G. Agarwal, Ph.D., P. Eng.
Consulting Geophysicist

INSTRUMENTATION

Radiometric

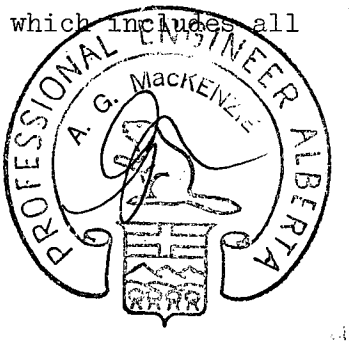
The instrument used in this survey was a McPhar Scintillometer, Model TV-1, Serial No. 170-28. The scintillometer measures the gamma rays emitted by radioactive minerals.

The gamma ray detecting principle lies in the sodium iodide crystal which, in this instrument, is $1\frac{1}{4}$ inches by 1 inch. The gamma ray entering the crystal interacts with the crystal atom, resulting in free electron and light emission. An optically coupled photo multiplier converts the light emission to electrical pulses. The magnitude of electrical pulses bears a relationship to the energy levels of the intercepted gamma ray.

The instrument is designed primarily for reconnaissance. A selective threshold switch is, however, provided for differentiating between radiation emitted by Uranium, Thorium and Potassium by providing quantitative information relating to each.

Various radioactive elements have characteristic gamma energy spectra. Thorium emits gamma rays with energy levels exceeding 2.5 Mev. The highest energy radiation from Potassium is about 1.6 Mev.

The threshold switch in the TV-1 model is marked T_1, T_2, and T_3. Threshold T_3 is at 2.5 Mev setting and measures only those electrical pulses corresponding to gamma rays emitted by Thorium. T_2 at 1.6 Mev measures electrical pulses above 1.6 Mev level which are emitted by both Uranium and Thorium. T_1 at .2 Mev measures all radiation above .2 Mev level which includes all gamma rays emitted by Potassium, Uranium and Thorium.



From readings at T_1, T_2, and T_3, individual values for each, Potassium, Uranium and Thorium can be computed. By comparing these values to empirical values of samples with known contents of Uranium and Thorium, a semi-quantitative estimate of the grade of a sample may be determined.

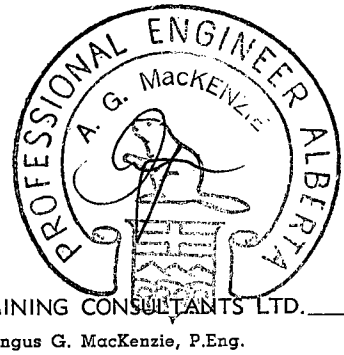
The meter that measures the electrical pulses derived from the interaction of the gamma ray and the sodium iodide atom is calibrated to display zero to 100 counts per minute. A four-position scale, multiplier switch provides four, full-scale ranges of 100, 1,000, 10,000 and 100,000 counts per minute. A fifth position is built in to test the charge on the batteries. This variable range switch enables the instrument to measure electrical impulses from zero counts per minute to 100,000 counts per minute.

Magnetometer

The M700 Magnetometer is a vertical field magnetometer employing the fluxgate principle. The instrument is self-levelling, and a self-cancelling circuit permits rapid, accurate measurement of the earth's magnetic field from a meter, without adjustments or calculations.

The self-levelling feature of this electronic magnetometer eliminates the need for bulky tripods and time consuming fine levelling procedures. Further, the instrument is practically insensitive to orientation. Errors are as low as 25 gammas for 180 degree rotation in a 15,000 gamma horizontal field.

Since the instrument can be adjusted electronically to measure vertical fields from plus 100,000 gammas to minus 100,000 gammas, there is no need for auxiliary magnets or complicated latitude adjustments.



The operation of the M700 is very simple. The reading on the meter is set to zero at a chosen base station by operating the latitude adjustment control. This can be done to an accuracy of 5 gammas. Next, as successive stations are occupied, the instrument is held roughly level, and the increase or decrease in the vertical component of the earth's magnetic field is read directly from the meter. Five scale ranges are available and on the most sensitive range the accuracy is 5 gammas.

The M700 Magnetometer is the result of extensive engineering based on rugged field requirements. It incorporates the latest advances in solid state components and has built in temperature stability. The instrument provides rapid, accurate, repeatable measurements.

Specifications

1. Maximum Sensitivity - 20 gammas per scale division on 1,000 gamma range. Readability is 1/4 scale division or 5 gammas.

2. Maximum Measurement - Zero to ±100,000 gammas in five ranges.

Range Switch Position	Full Scale In Gammas	Gammas Per Scale Division
1K	1,000	20 black scale
3K	3,000	50 red scale
10K	10,000	200 black scale
30K	30,000	500 red scale
100K	100,000	2,000 black scale

3. Measurement Polarity - The above ranges can be reversed in polarity as a simple function of the Polarity switch.

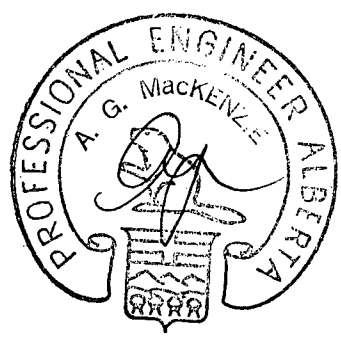
4. Latitude Adjustment - The latitude adjustment permits cancelling the earth's field up to a magnitude of ±100,000 gammas. The adjustment control is a ten revolution precision potentiometer located under the sliding side panel. A positive type locking lever on the control removes the hazard of accidentally dislodging the setting.

5. Self-Levelling Sensing Head - The unique self-levelling sensing head of this magnetometer is inserted as a plug-in unit. It is easily detached so that the same magnetometer can be used with other types of sensing heads such as the airborne gyro stabilized head, etc.

6. Orientation Error - The orientation error is set at the factory to 25 gammas or less in the presence of a 15,000 gamma horizontal field. It is possible to adjust the orientation error and the procedure is explained in the section 9-2 under Maintenance in the Instruction Manual comprised by McPhar for the M700 Magnetometer.

7. Temperature Stability - Over the temperature range of -35 to +55 degrees centigrade the temperature drift is limited to less than 50 gammas.

8. Battery Supply - The M700 Magnetometer is powered by two internally mounted 9-volt batteries. Any pair of the following batteries may be used: Eveready No. 276, Mallory No. M1603, Burgess No. D6, R.C.A. No. VS306. For sub-zero operation the batteries may be transferred to an external battery case and carried under clothing to keep them from freezing.



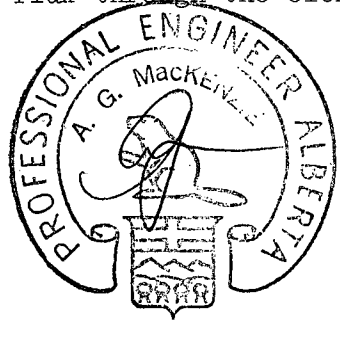
Two types of external battery cases are available. One type is for the above batteries. Another type of case will accommodate the equivalent in flashlight cells for use in countries where the normal batteries are difficult to obtain.

9. Accessory Receptacle - A Cannon receptacle is located on the side of the instrument under the sliding panel. This increases the versatility of the instrument so it can be used in a number of ways in addition to its normal vertical field ground magnetometer function.

10. Accessory & Latitude Switch - This is a double function switch. The first function is to permit operation north or south of the equator by simply changing one step on the switch. By switching an additional step, the accessory socket is brought into connection and accessories can be applied to the instrument.

The field sensitivity of the M700 magnetometer originates in a fluxgate element mounted so that its axis of maximum sensitivity is maintained in the vertical plane. The fluxgate element contains an excitation winding and a detector winding. In addition there are auxiliary windings around the element which carry D.C. currents. With the auxiliary windings, a D.C. flux is created to cancel the earth's field. Latitude adjust control and automatic cancelling.

The fluxgate element is continuously excited between saturation levels by an A.C. current. A detector winding consisting of differentially wound coils, picks up zero voltage when the resultant D.C. flux through the elements is zero.



When the external D.C. field changes in magnitude, a corresponding phase-reversible second harmonic output voltage is produced across the detector winding. The second harmonic output voltage is fed to a phase sensitive rectifier system and used to profice a cancelling D.C. current to oppose the external field attempting to unbalance the fluxgate element.

The system therefore is a self-cancelling one and at all times approximates a condition of zero flux about the fluxgate element.

The D.C. current fed back to maintain the zero flux condition is measured on the display meter and is directly proportional to the change in the earth's field. The meter, then, can be calibrated directly in gammas.

Five meter ranges are provided to permit the measurement of a change of field of up to 100,000 gammas. Because the field at any new measurement station may increase or decrease, a polarity reversal on the on-off switch is provided.

The main application of the instrument is for general ground surveying. Because of the lack of any set-up requirements and the rapid direct meter read out, it provides the fastest and most economical geophysical surveying available compared to any other type of instrument or techniques.

RADIOMETRIC SURVEY

This survey was run concurrently with the magnetometer survey; consequently the base camp was moved only once.

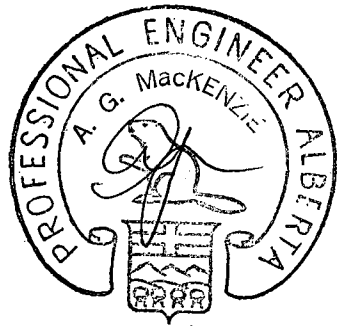


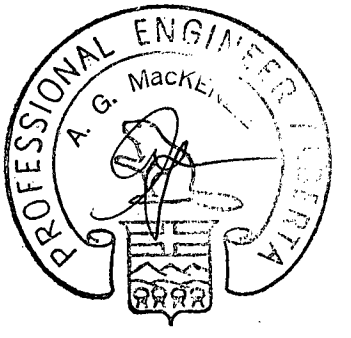
Figure 3 shows the results of our radiometric survey as well as the results of last year's survey. The major purpose of this season's work, as far as radiometrics were concerned, was to follow up some open ends that showed up on the 1970 survey and to try to close off some of these apparently significant anomalies. This was accomplished as the results shown on Figure 3 and the profiles indicate.

Our original recommendations for complete radiometric and magnetometer surveys over the entire area are justified by the 1971 survey results.

In our interpretation of the results, values below 499 counts per minute are considered below background; values between 500 and 999 counts per minute are considered to be background; and any values over 1,000 counts per minute are considered anomalous. Counts of 1,500 and over are considered to be very strongly anomalous.

Total count readings were taken for the entire survey as we felt that discrimination, at this stage of exploration, would not add anything to the picture we had already established last season.

Closure of several of last season's anomalies also indicated a surprising correspondence between the radiometric highs and the structural magnetic highs shown in Figure 2 from Dr. Agarwal's interpretation of the field results. This correspondence is also evident in the anomalous areas as indicated by the progressive profiles in Appendices I and II.



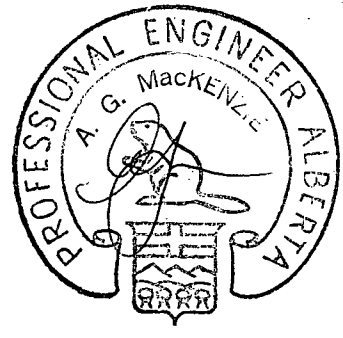
ECONOMIC GEOLOGY

The anomalies outlined in both the extended radiometric survey and the magnetometer survey, as well as the major structural trends indicated from the interpreted magnetometer results, support the possibility of the presence (in the basement complex) of a fracture and/or fault pattern aligned with the Black Bay and other, major, ore-bearing faults closely associated with the Black Bay structure.

As we pointed out in our last season's report, and indicated in our recommendations, it is essential to find out the source of this anomalous radioactivity. The correspondence of major fracture and/or fault trends (from the magnetometer survey) with measured and re-checked radiometric anomalies of significant stature, are reasons enough to recommend once again an exploratory drilling program.

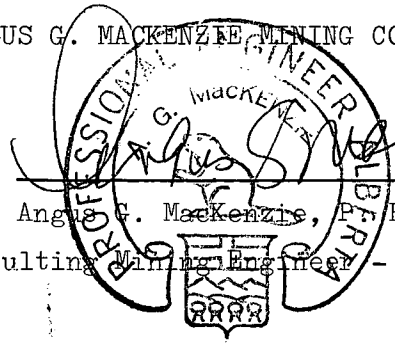
CONCLUSIONS AND RECOMMENDATIONS

We concur with the recommendations made by Dr. Agarwal and recommend that at least four diamond drill holes be put down at approximate locations as shown on Figure 4. These holes should be drilled vertically and should be programmed for a minimum of 400 feet each of A.Q. Wireline core. We would suggest a total core from one of the holes - No. 1 as shown. The other holes could be drilled with non-coring bits until the Athabasca Sandstone is penetrated and core taken in the basement complex. It is believed that the Athabasca Sandstone would not be much thicker than around 200 feet at the locations selected for drilling.



The results of this drilling program will definitely determine the prospects for this property.

ANGUS G. MACKENZIE MINING CONSULTANTS LTD.



Angus G. MacKenzie, P. Eng., MCIM
Consulting Mining Engineer - Mining Geologist

Calgary, Alberta.
January 11, 1972.

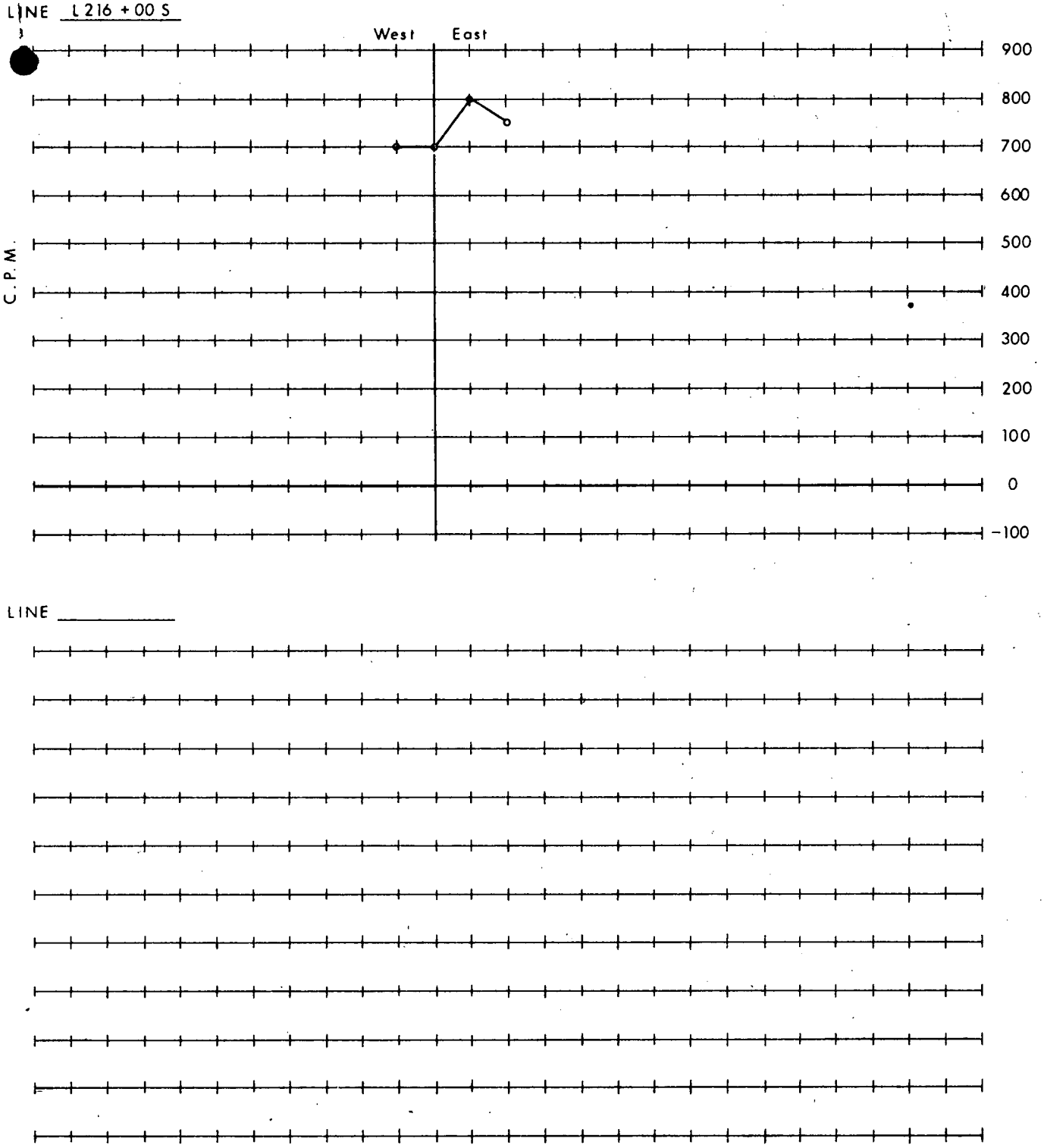


FIG. 5 19720001

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A. G. MacKENZIE

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MINING CONSULTANTS LIMITED
703 5th ST., CALGARY 2, ALBERTA

FOR
COLUMBIAN NORTHLAND EXPLORATION LTD.

RADIOMETRIC PROFILES
FORT CHIPEWYAN AREA
LAKE ATHABASCA, NORTHERN ALBERTA

DATE : SEPT., 1971	APPV'D [redacted]
DWG. NO. :	SCALE : 1" = 1200'

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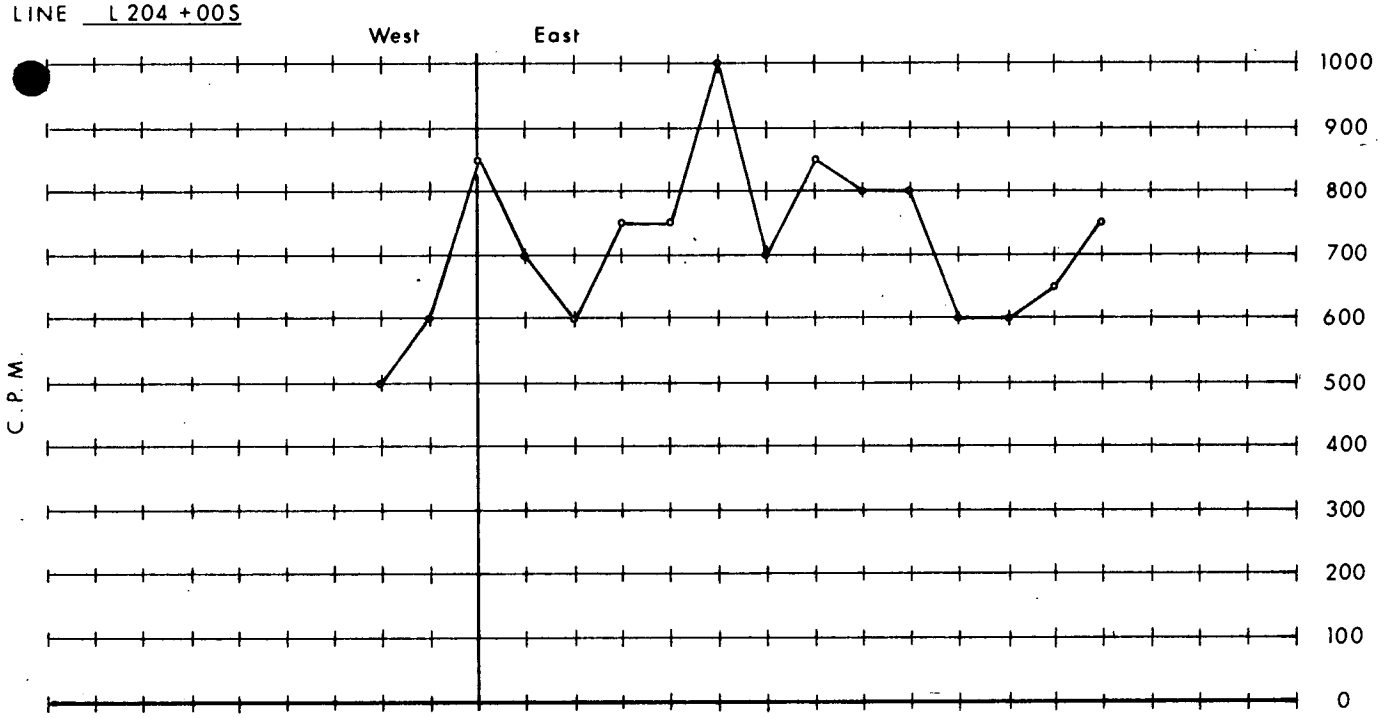

LINE L 210 +00S

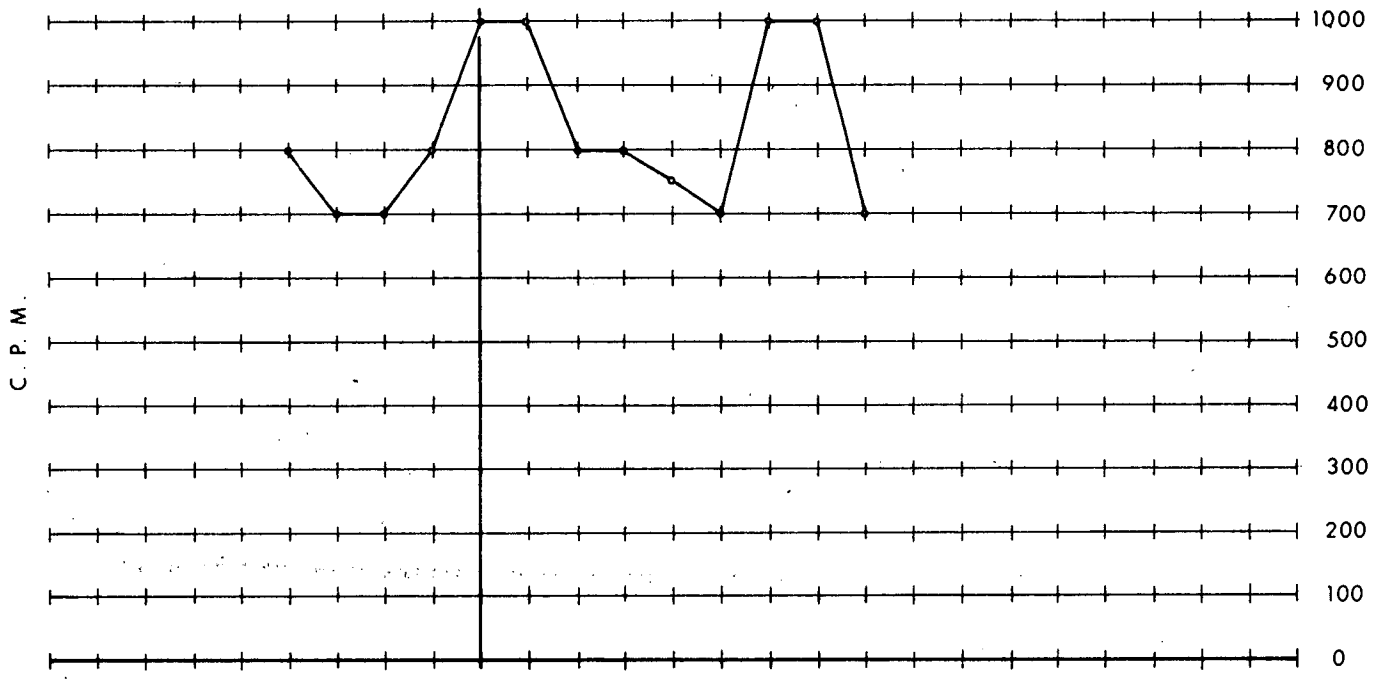

FIG. 6 19720001

ANGUS G. MACKENZIE
MINING CONSULTANTS LIMITED
703 5th ST., CALGARY 2, ALBERTA

FOR
COLUMBIAN NORTHLAND EXPLORATION LTD.

RADIOMETRIC PROFILES
FORT CHIPEWYAN AREA
LAKE ATHABASCA, NORTHERN ALBERTA

DATE : SEPT., 1971	APPV'D: [redacted]
DWG. NO. :	SCALE : 1" = 1200'

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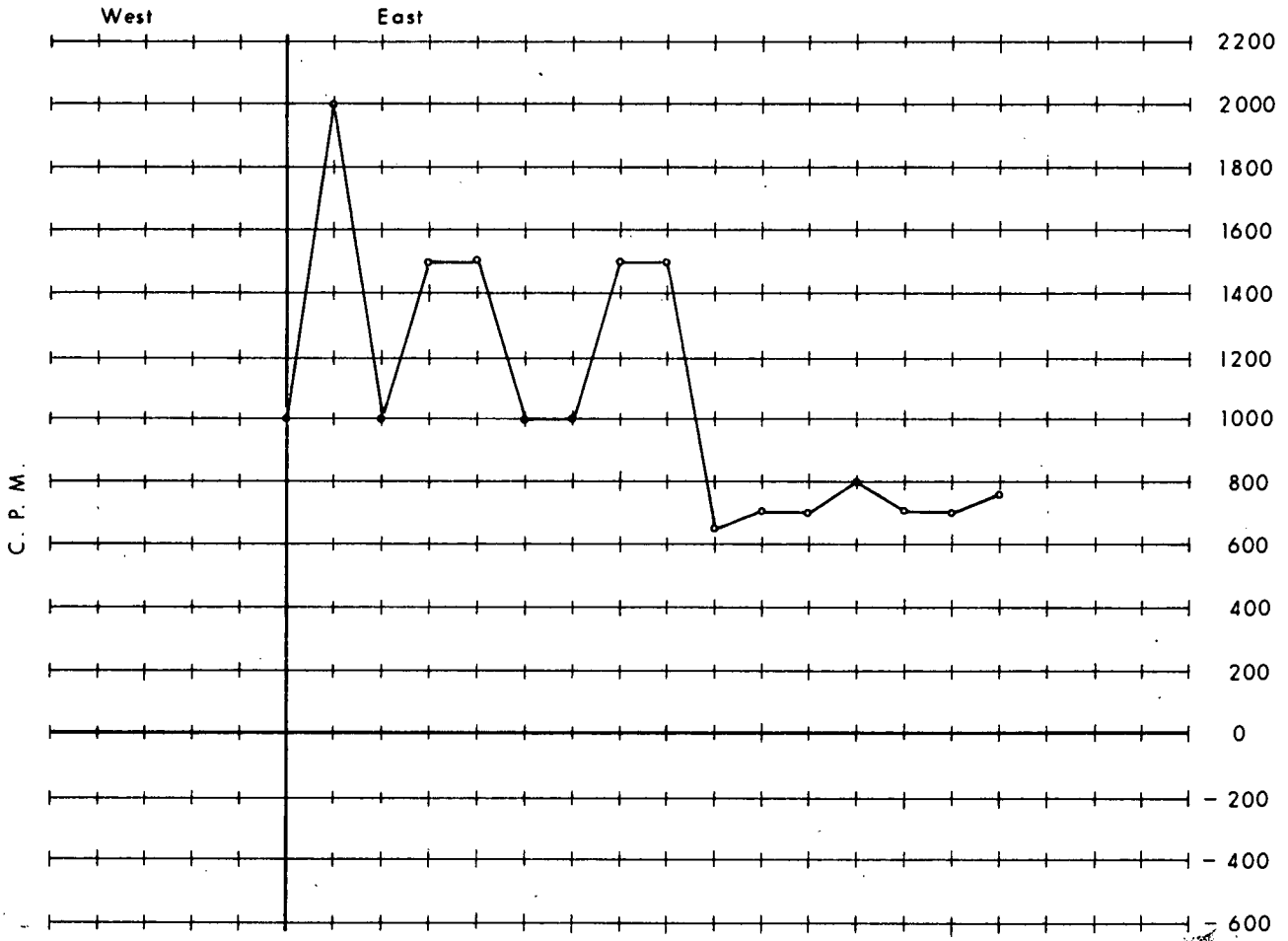

PROFESSIONAL ENGINEER ALBERTA
A. G. MacKENZIE

FIG. 7 19720001

ANGUS G. MACKENZIE MINING CONSULTANTS LIMITED 703 5th ST., CALGARY 2, ALBERTA	
FOR COLUMBIAN NORTHLAND EXPLORATION LTD.	
RADIOMETRIC PROFILE FORT CHIPEWYAN AREA LAKE ATHABASCA, NORTHERN ALBERTA	
DATE: SEPT., 1971	APPV'D [redacted]
DWG. NO.:	SCALE: 1" = 1200'

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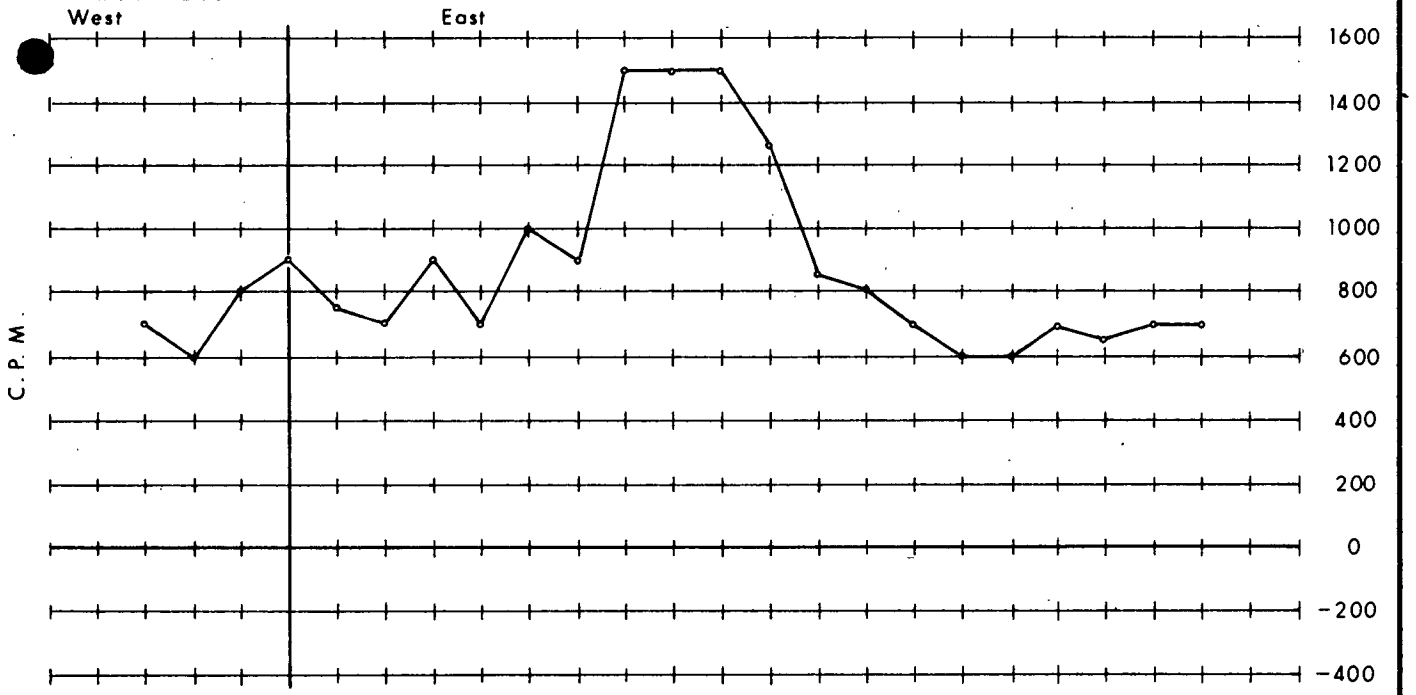

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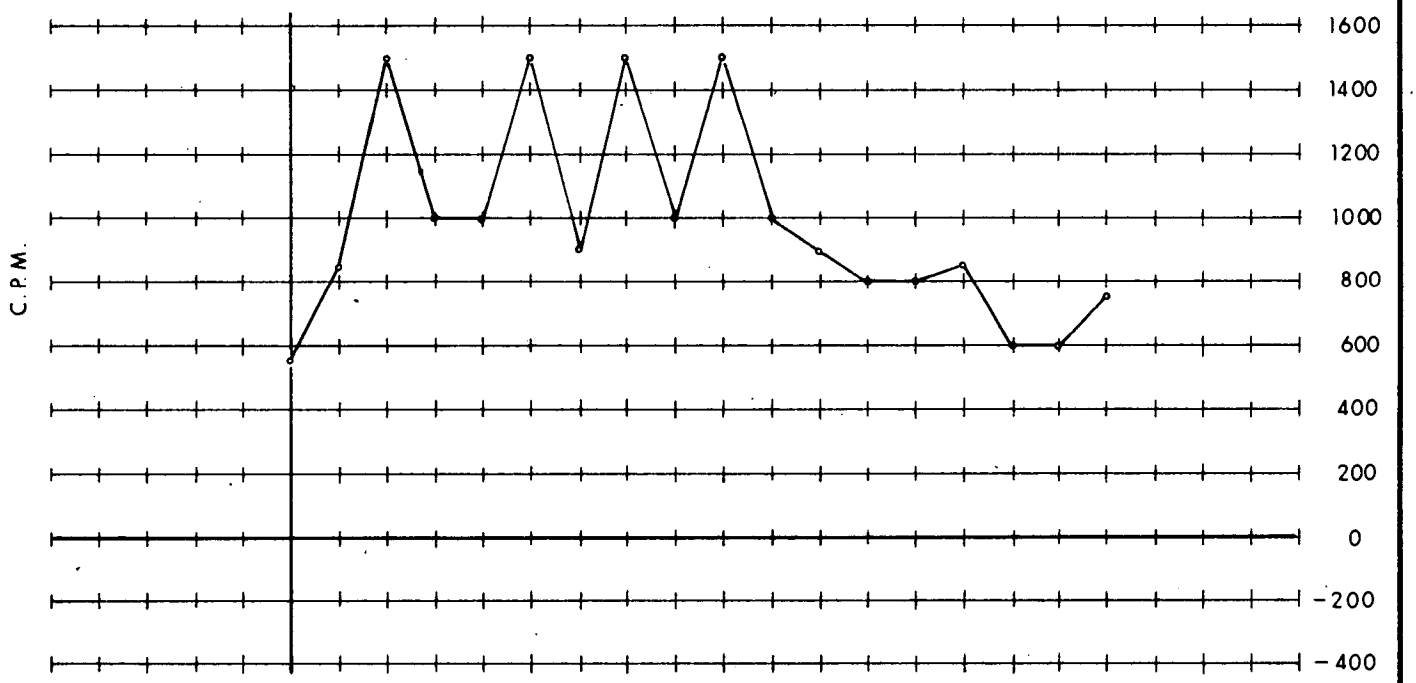

PROFESSIONAL ENGINEER ALBERTA
A. G. MacKENZIE

FIG. 8 19720001

ANGUS G. MACKENZIE
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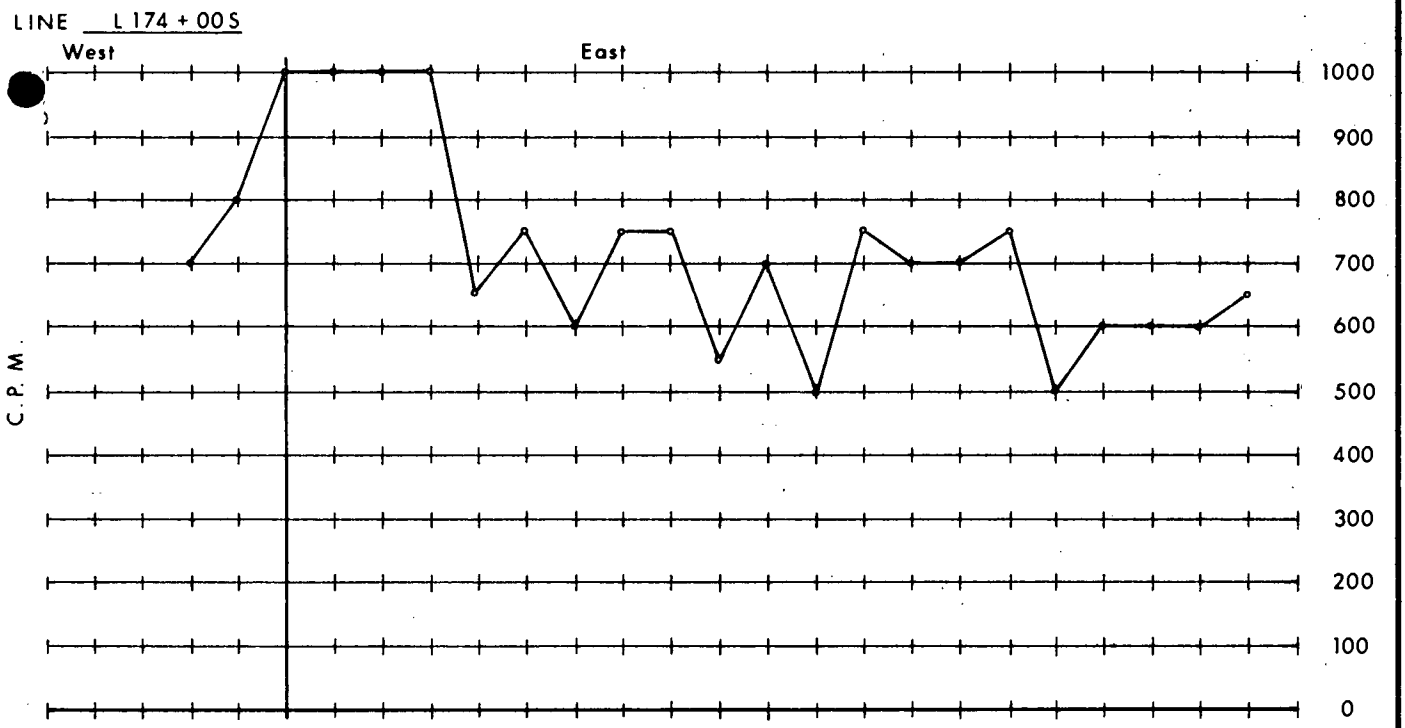
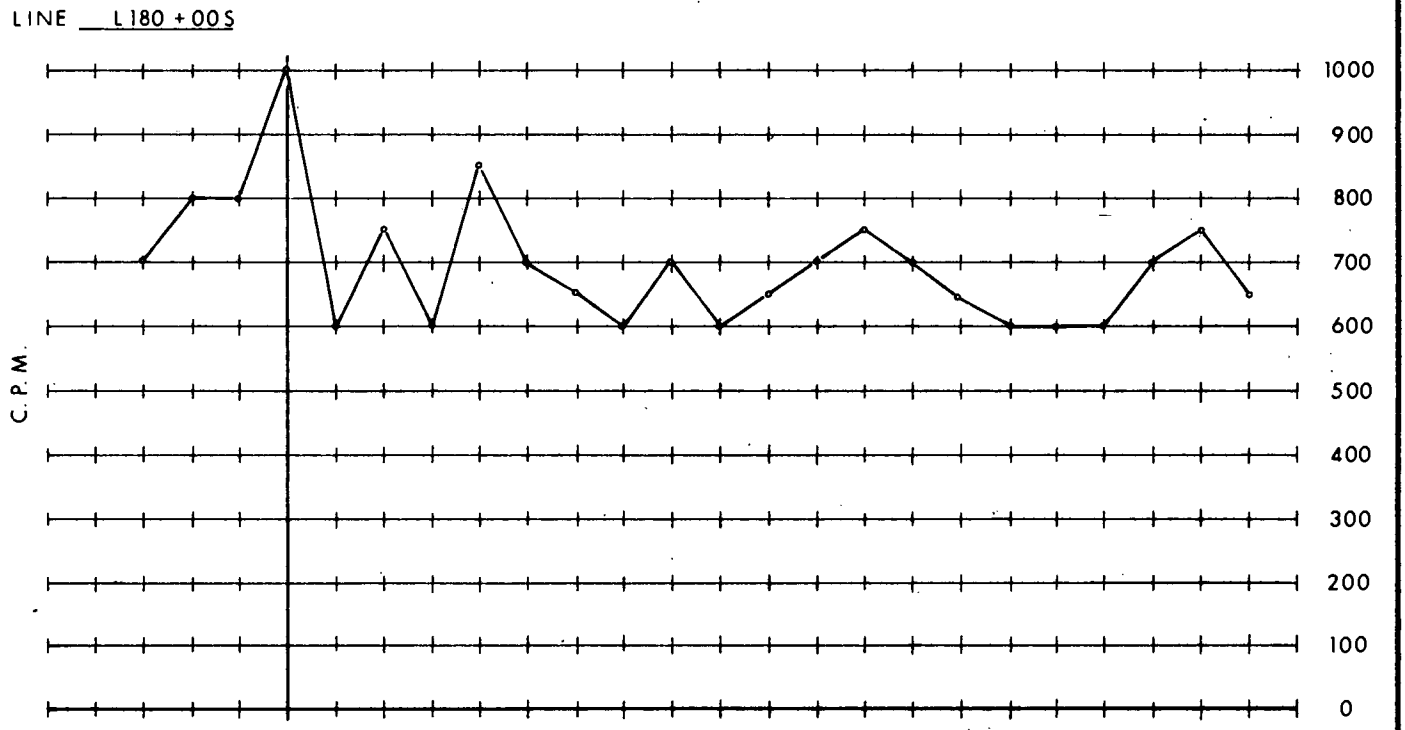
FOR
COLUMBIAN NORTHLAND EXPLORATION LTD.

RADIOMETRIC PROFILES
FORT CHIPEWYAN AREA
LAKE ATHABASCA, NORTHERN ALBERTA

DATE : SEPT., 1971	APPV'D: [redacted]
DWG. NO. :	SCALE : 1" = 1200'





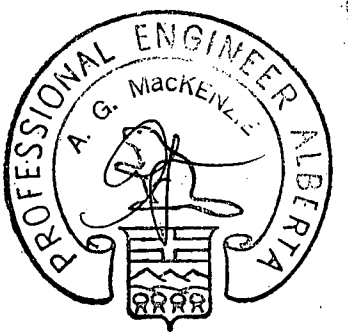


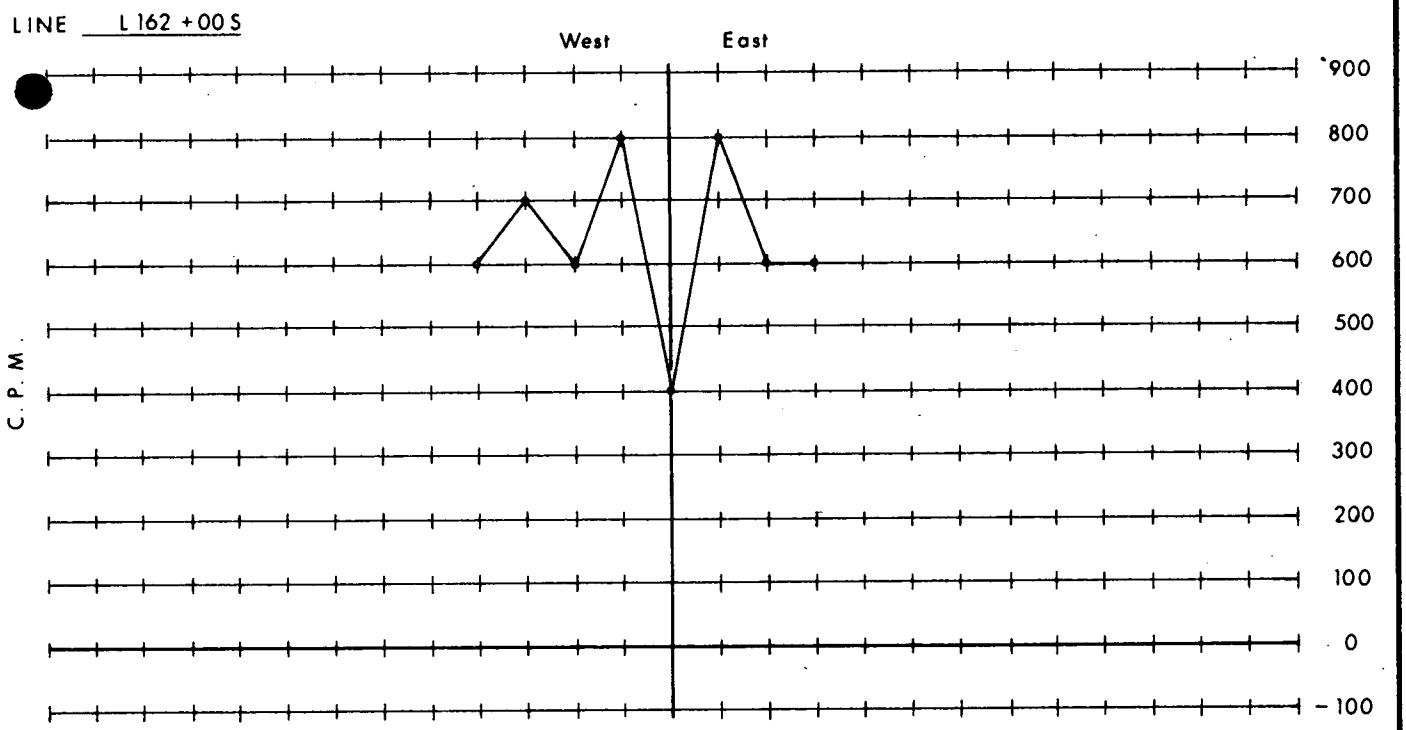
FIG. 9 19720001

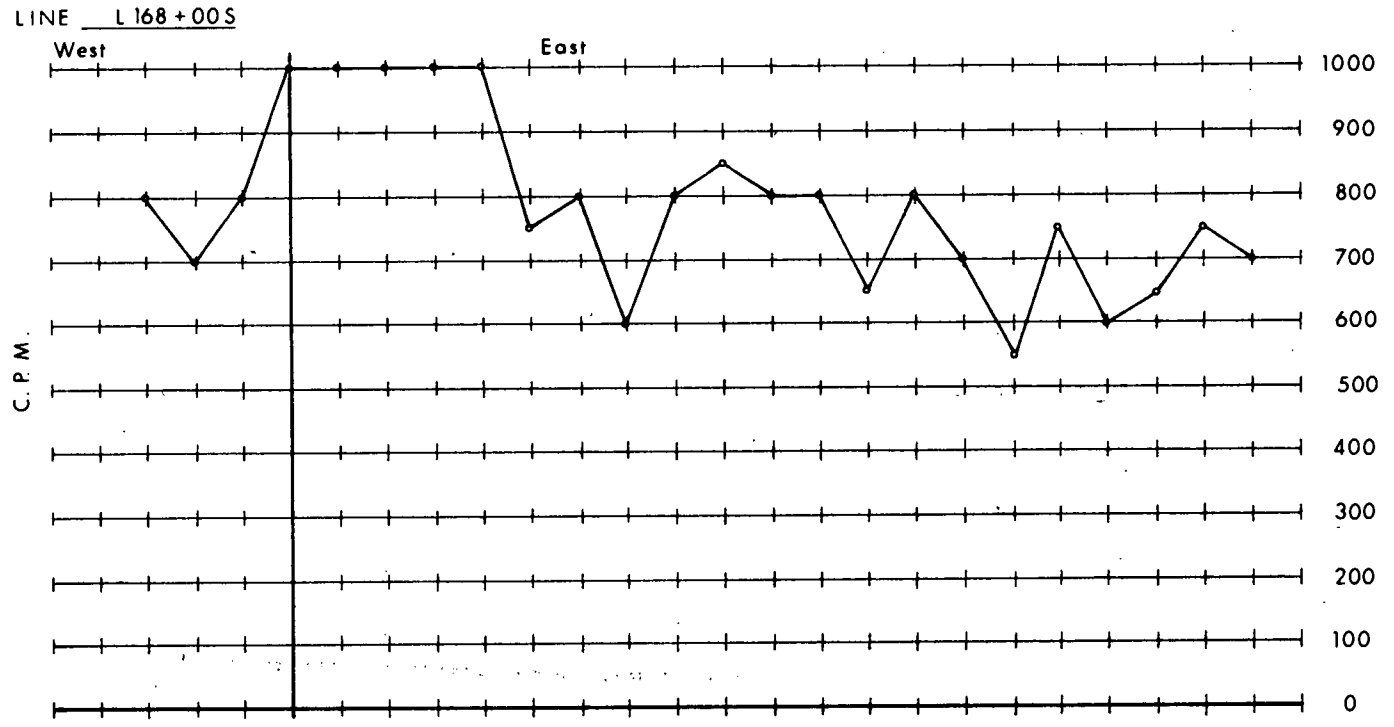
ANGUS G. MACKENZIE
MINING CONSULTANTS LIMITED
703 5th ST., CALGARY 2, ALBERTA

FOR
COLUMBIAN NORTHLAND EXPLORATION LTD.

RADIOMETRIC PROFILES
FORT CHIPEWYAN AREA
LAKE ATHABASCA, NORTHERN ALBERTA

DATE : SEPT.; 1971	APPV'D: [redacted]
DWG. NO. :	SCALE : 1" = 1200'





PROFESSIONAL ENGINEER ALBERTA
A. G. MacKENZIE

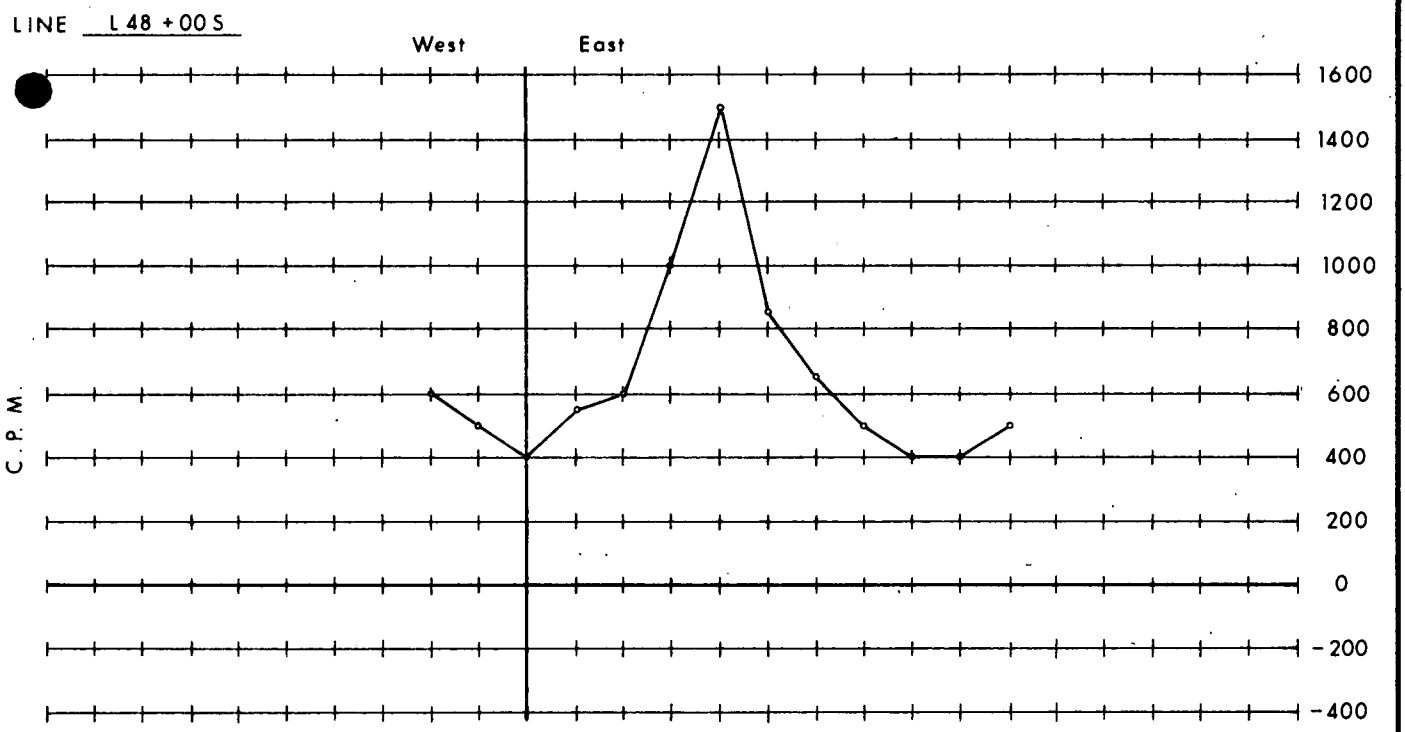
FIG. 9 19720001

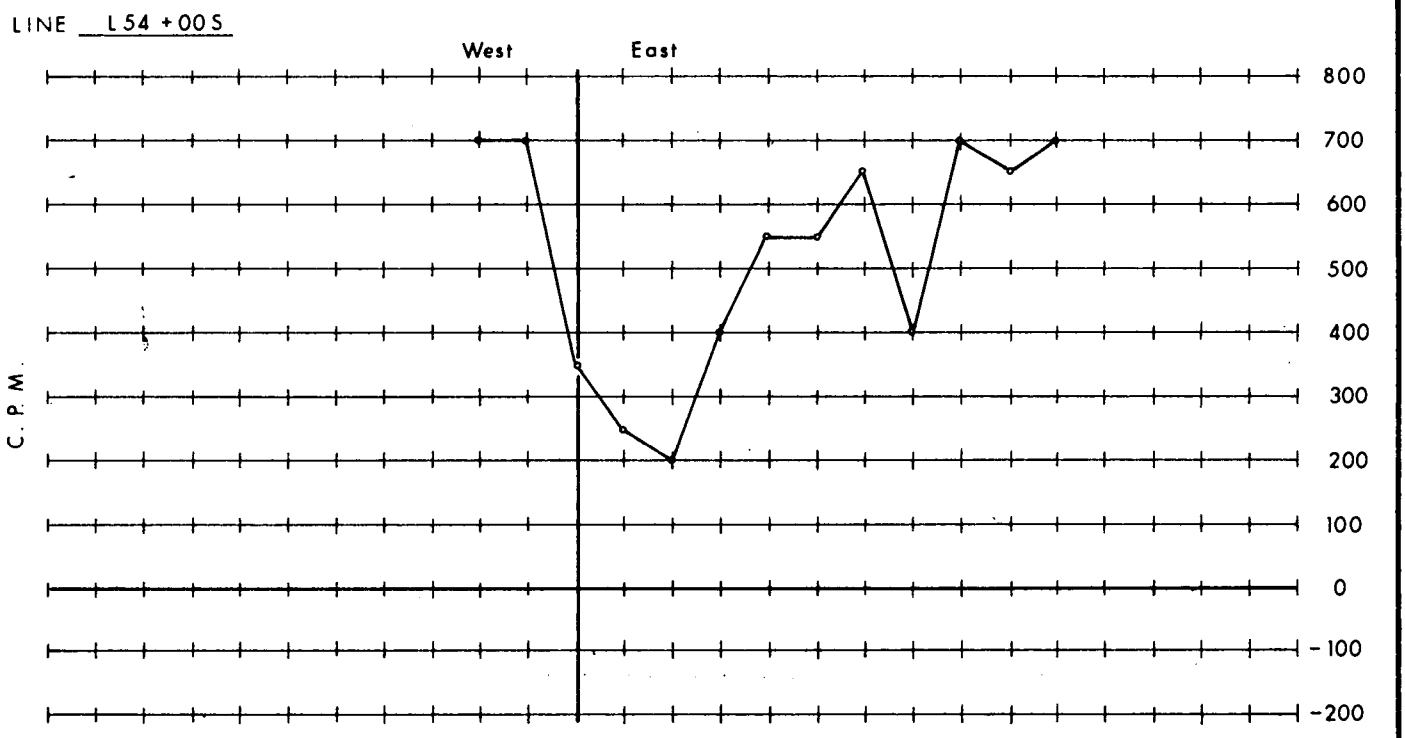
ANGUS G. MACKENZIE
MINING CONSULTANTS LIMITED
703 5th ST., CALGARY 2, ALBERTA

FOR
COLUMBIAN NORTHLAND EXPLORATION LTD.

RADIOMETRIC PROFILES
FORT CHIPEWYAN AREA
LAKE ATHABASCA, NORTHERN ALBERTA

DATE : SEPT., 1971	APPV'D: [redacted]
DWG. NO. :	SCALE : 1" = 1200'





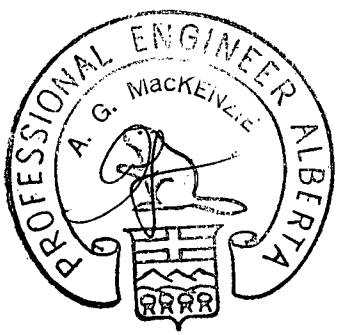


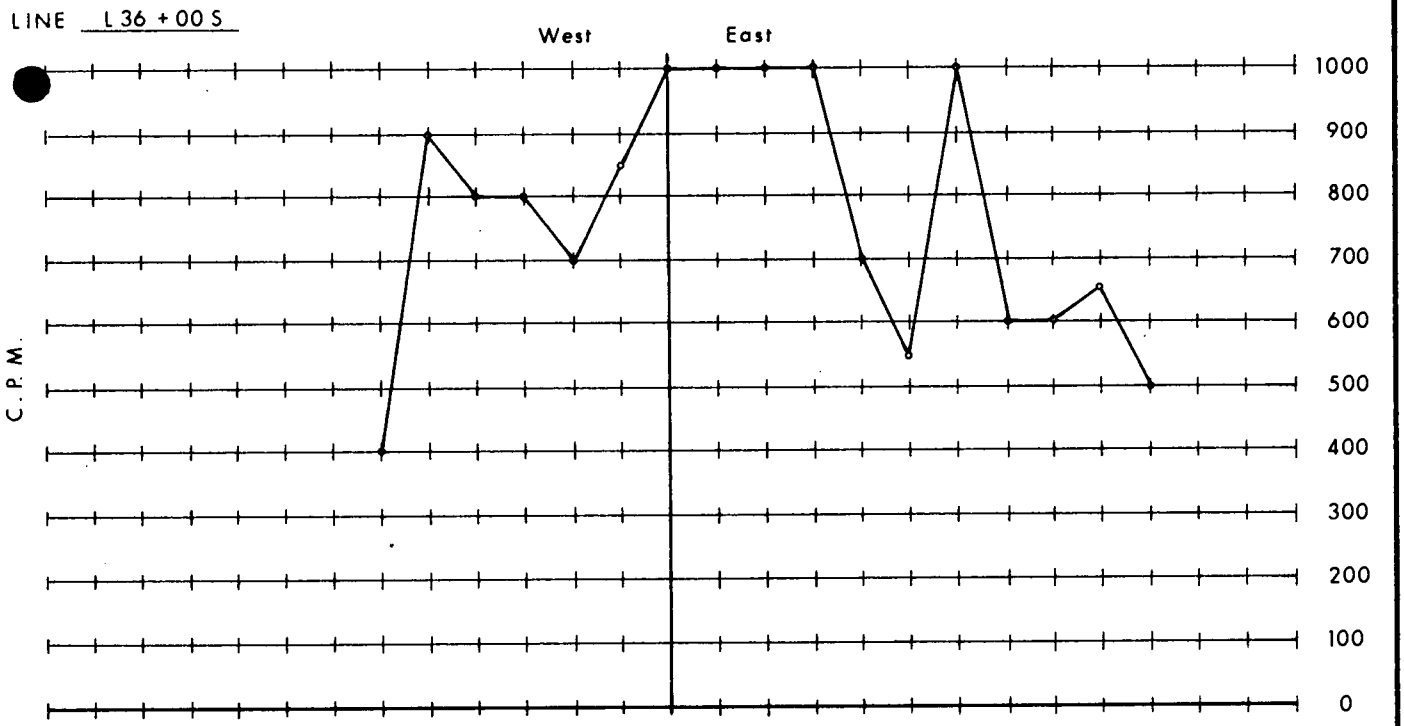
FIG. 10 19726001

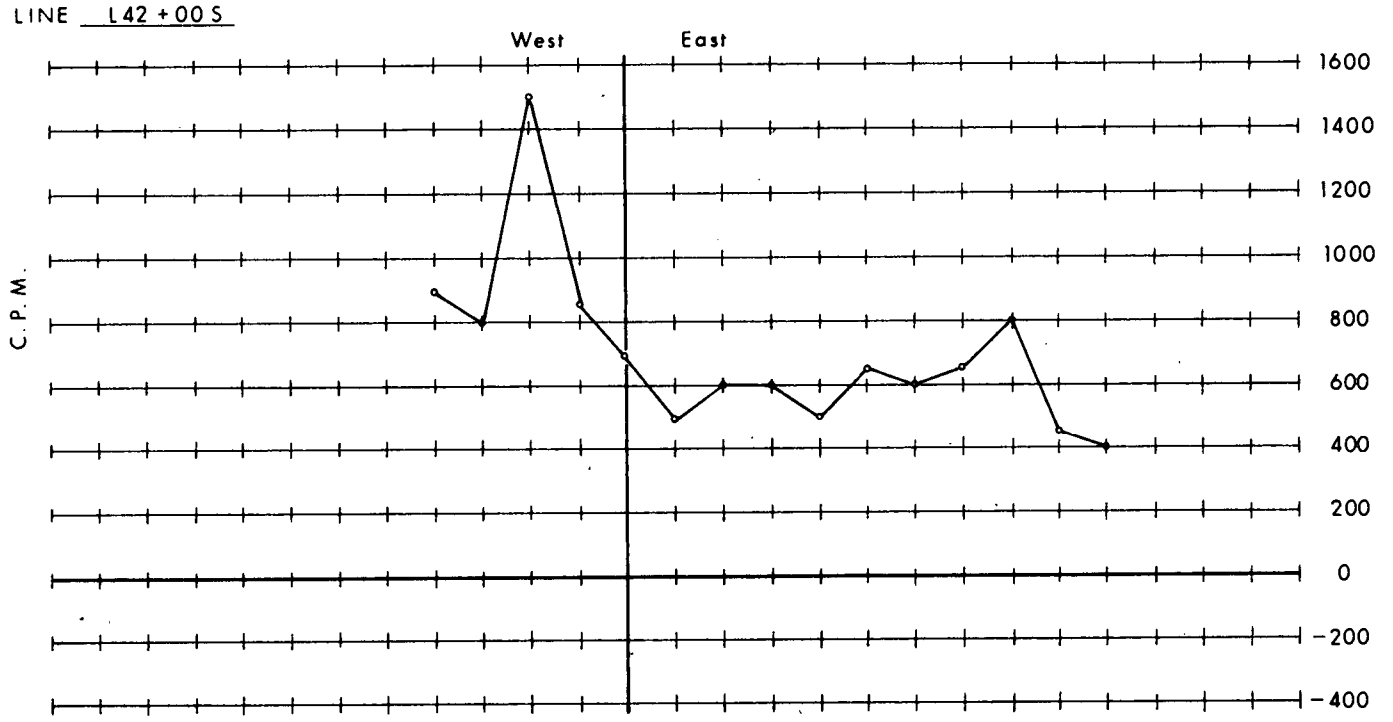
ANGUS G. MACKENZIE
MINING CONSULTANTS LIMITED
703 5th ST., CALGARY 2, ALBERTA

FOR
COLUMBIAN NORTHLAND EXPLORATION LTD.

RADIOMETRIC PROFILES
FORT CHIPEWYAN AREA
LAKE ATHABASCA, NORTHERN ALBERTA

DATE : SEPT., 1971	APPV'D: [redacted]
DWG. NO. :	SCALE : 1" = 1200'





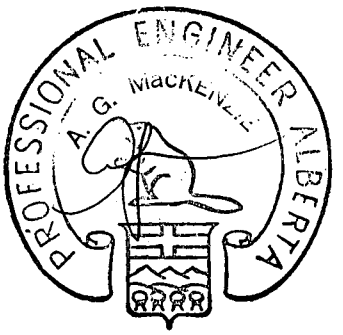


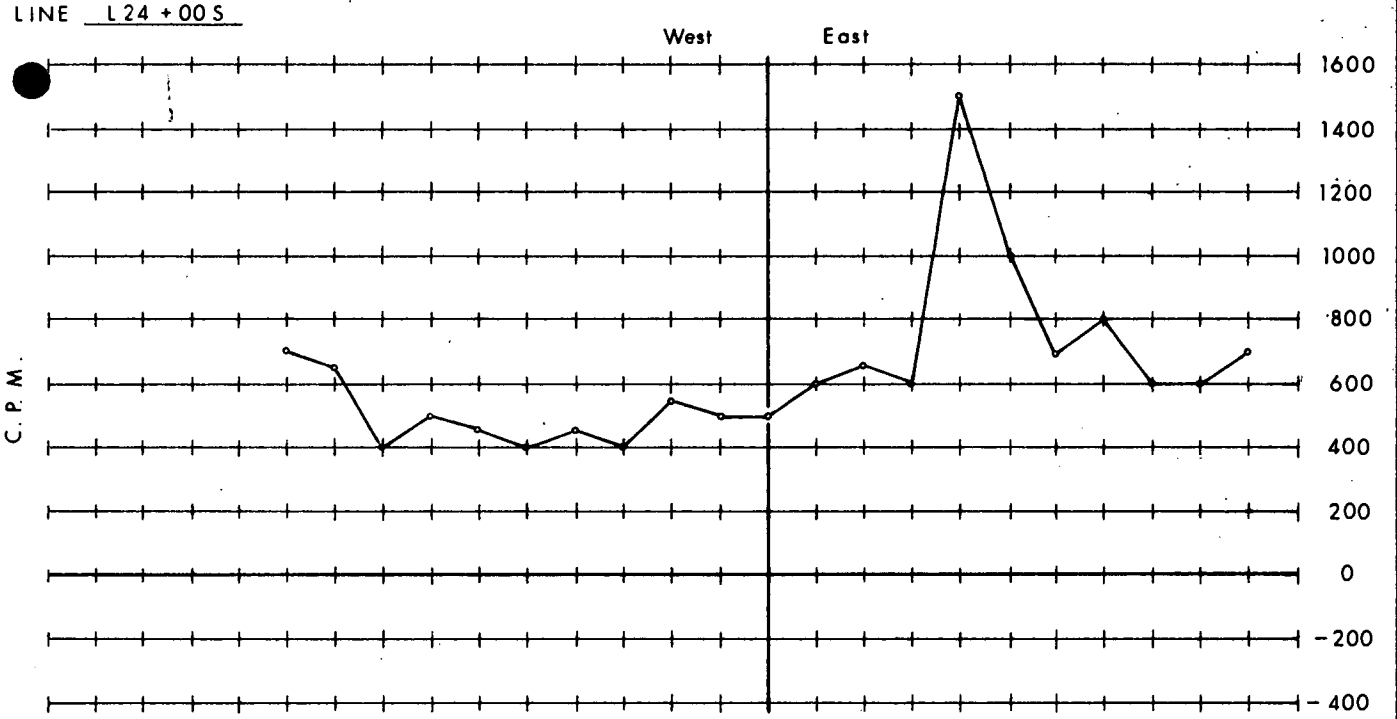
FIG. 11 19720001

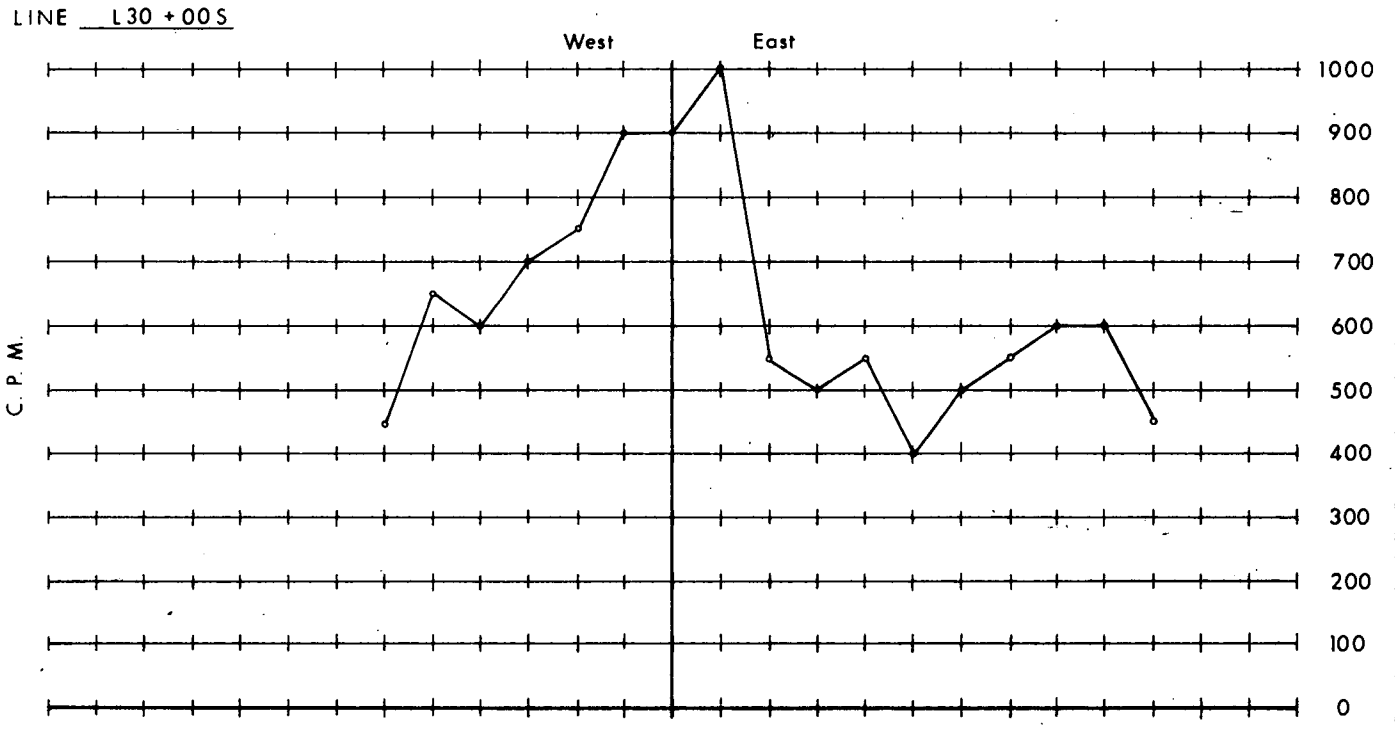
ANGUS G. MACKENZIE
MINING CONSULTANTS LIMITED
703 5th ST., CALGARY 2, ALBERTA

FOR
COLUMBIAN NORTHLAND EXPLORATION LTD.

RADIOMETRIC PROFILES
FORT CHIPEWYAN AREA
LAKE ATHABASCA, NORTHERN ALBERTA

DATE : SEPT., 1971	APPV'D [redacted]
DWG. NO. :	SCALE : 1" = 1200'





PROFESSIONAL ENGINEER ALBERTA
A.G. MacKenzie

FIG. 12 19720001

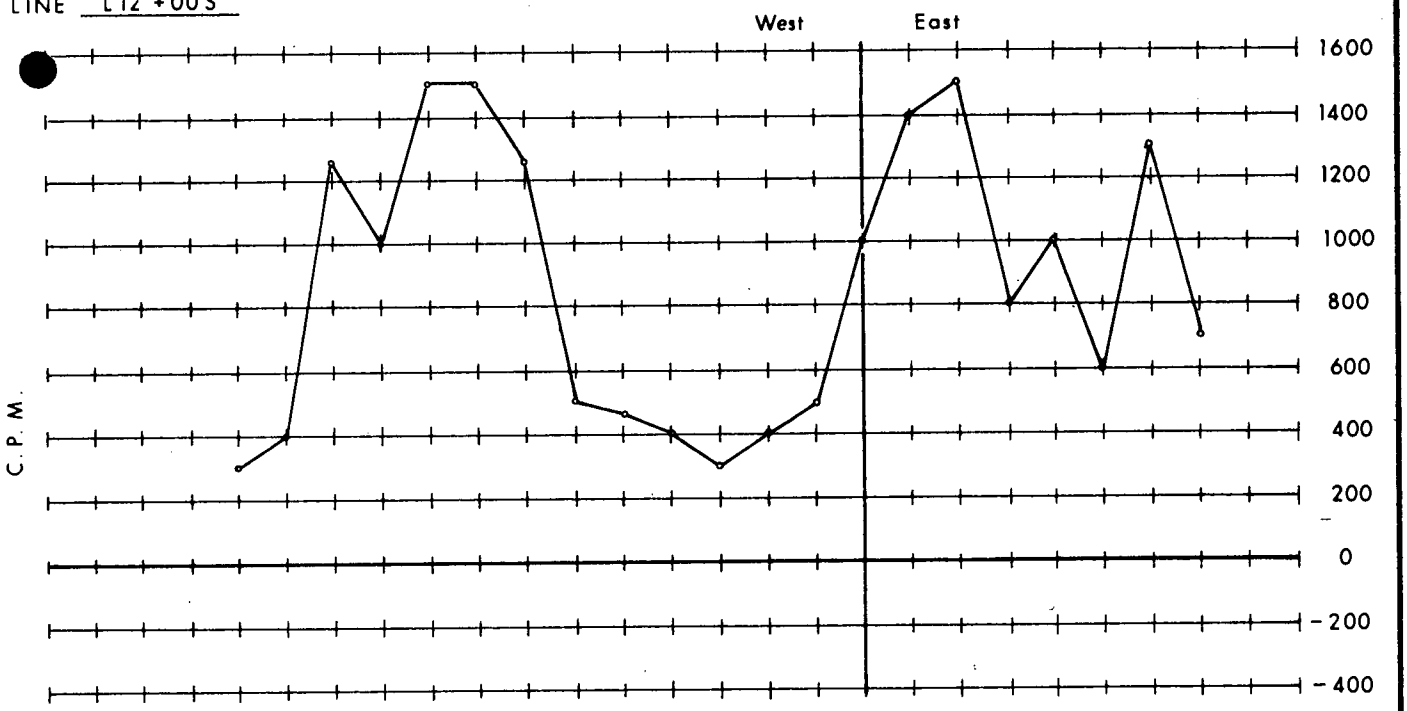
ANGUS G. MACKENZIE
MINING CONSULTANTS LIMITED
703 5th ST., CALGARY 2, ALBERTA

FOR
COLUMBIAN NORTHLAND EXPLORATION LTD.

RADIOMETRIC PROFILES
FORT CHIPEWYAN AREA
LAKE ATHABASCA, NORTHERN ALBERTA

DATE : SEPT., 1971	APPV'D: [redacted]
DWG. NO. :	SCALE : 1" = 1200'

LINE L12 +00S



LINE L18 +00S

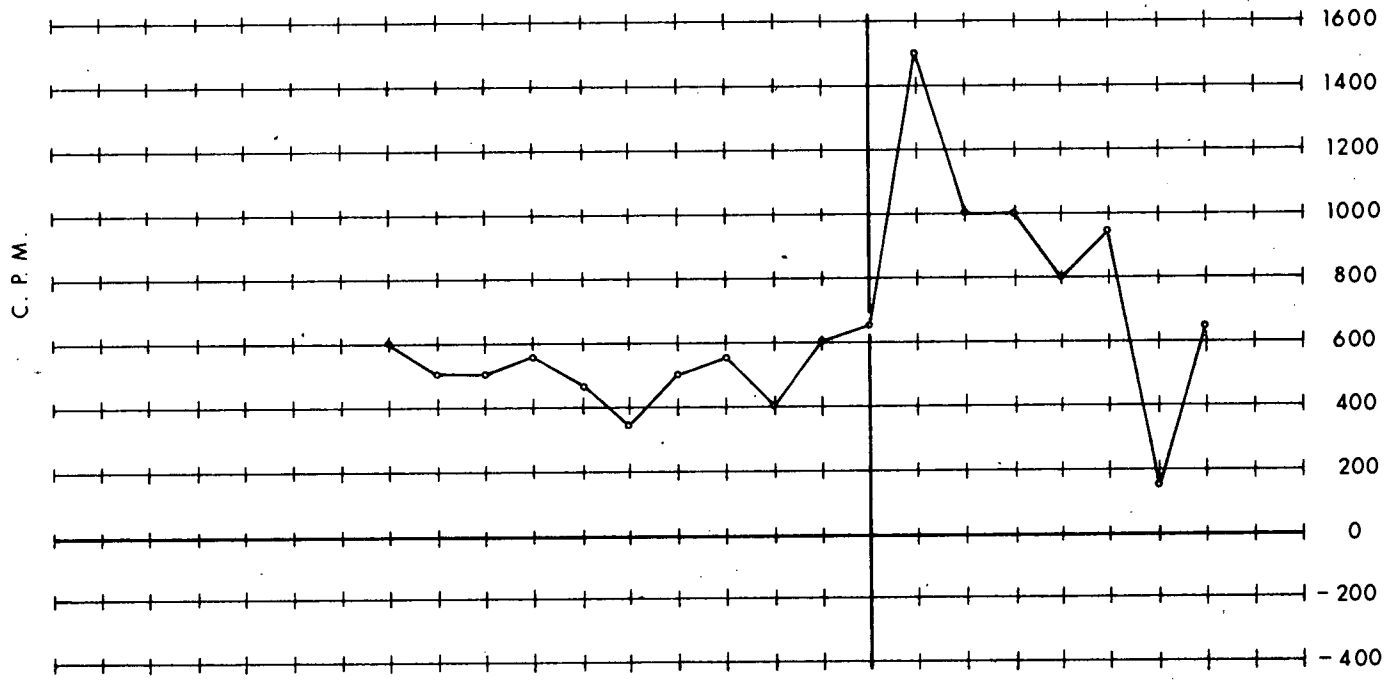


FIG. 19 19720001

PROFESSIONAL ENGINEER ALBERTA
A.G. MacKENZIE

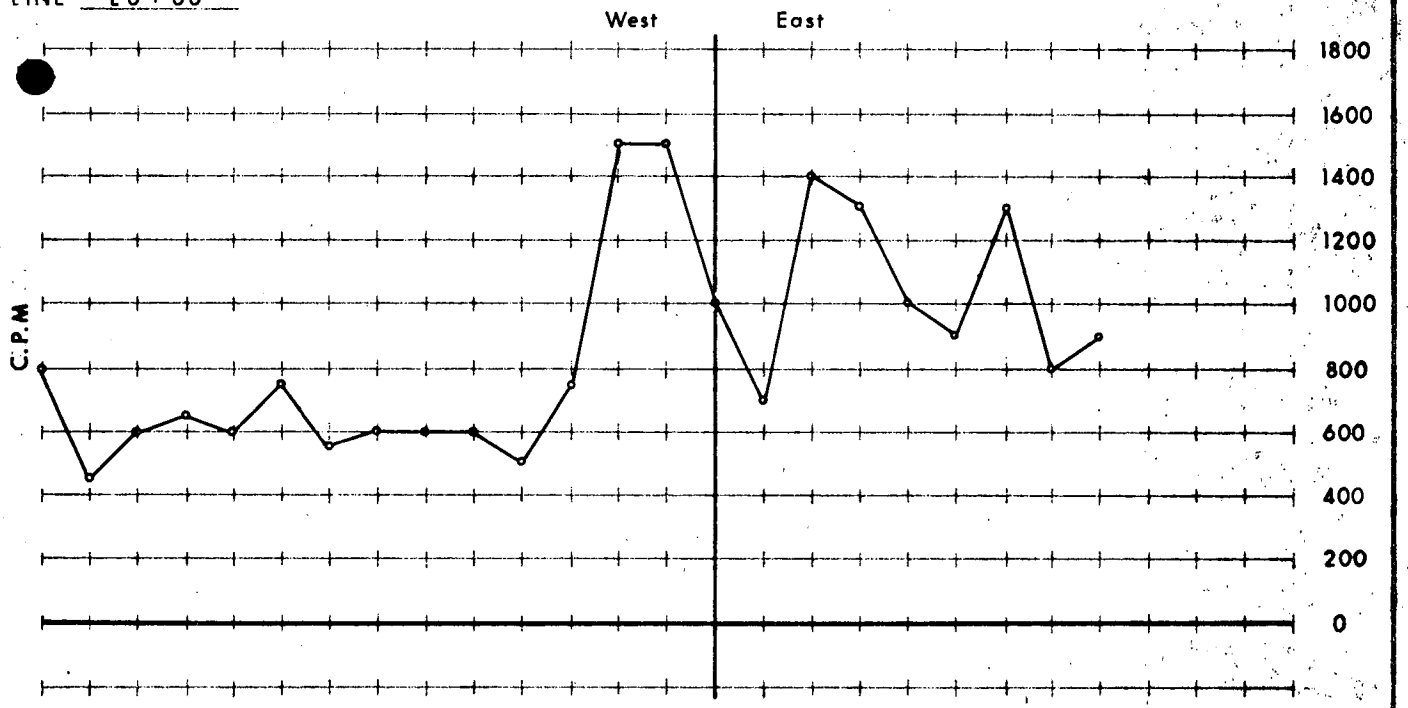
ANGUS G. MACKENZIE
MINING CONSULTANTS LIMITED
703 5th ST., CALGARY 2, ALBERTA

FOR
COLUMBIAN NORTHLAND EXPLORATION LTD.

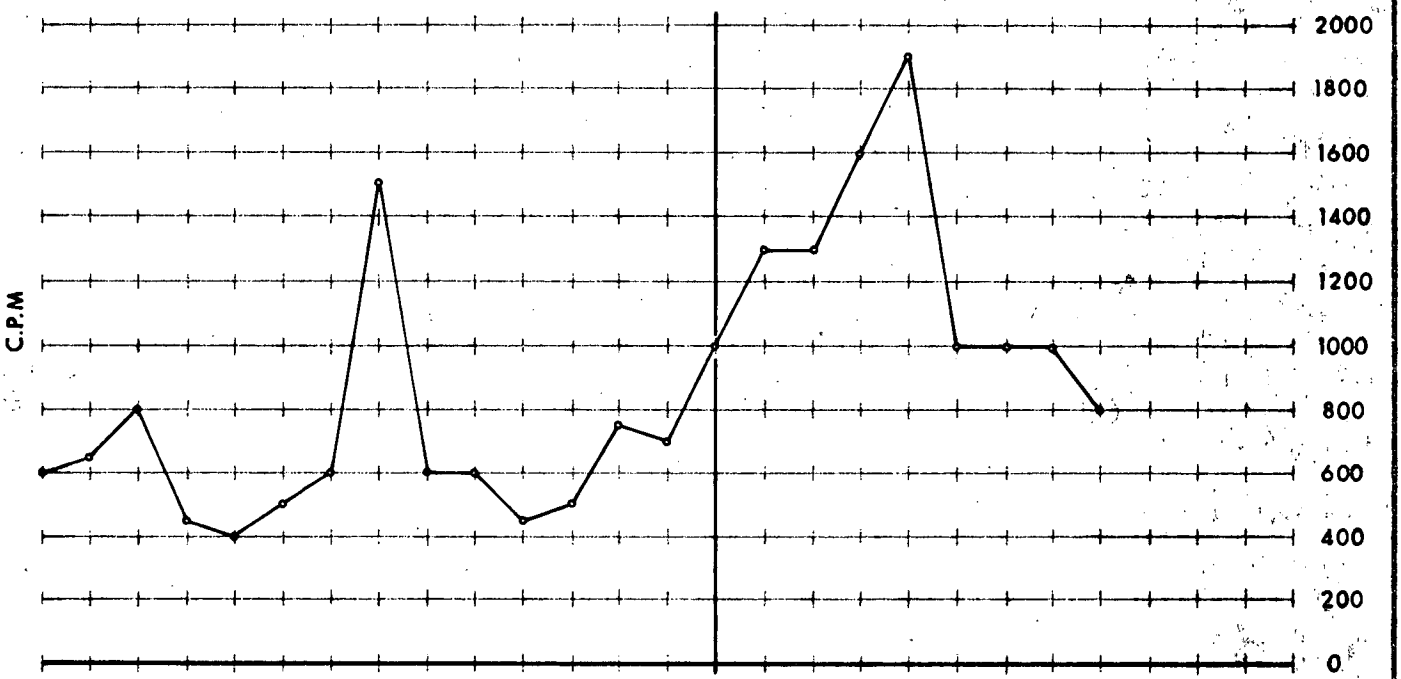
RADIOMETRIC PROFILES.
FORT CHIPEWYAN AREA
LAKE ATHABASCA, NORTHERN ALBERTA

DATE : SEPT., 1971	APPV'D: [redacted]
DWG. NO. :	SCALE : 1" = 1200'

LINE L0 + 00



LINE L6 + 00 S



PROFESSIONAL ENGINEER ALBERTA
A. G. MacKENZIE

FIG. 14 19720001

ANGUS G. MACKENZIE
MINING CONSULTANTS LIMITED
703 5th ST., CALGARY 2, ALBERTA

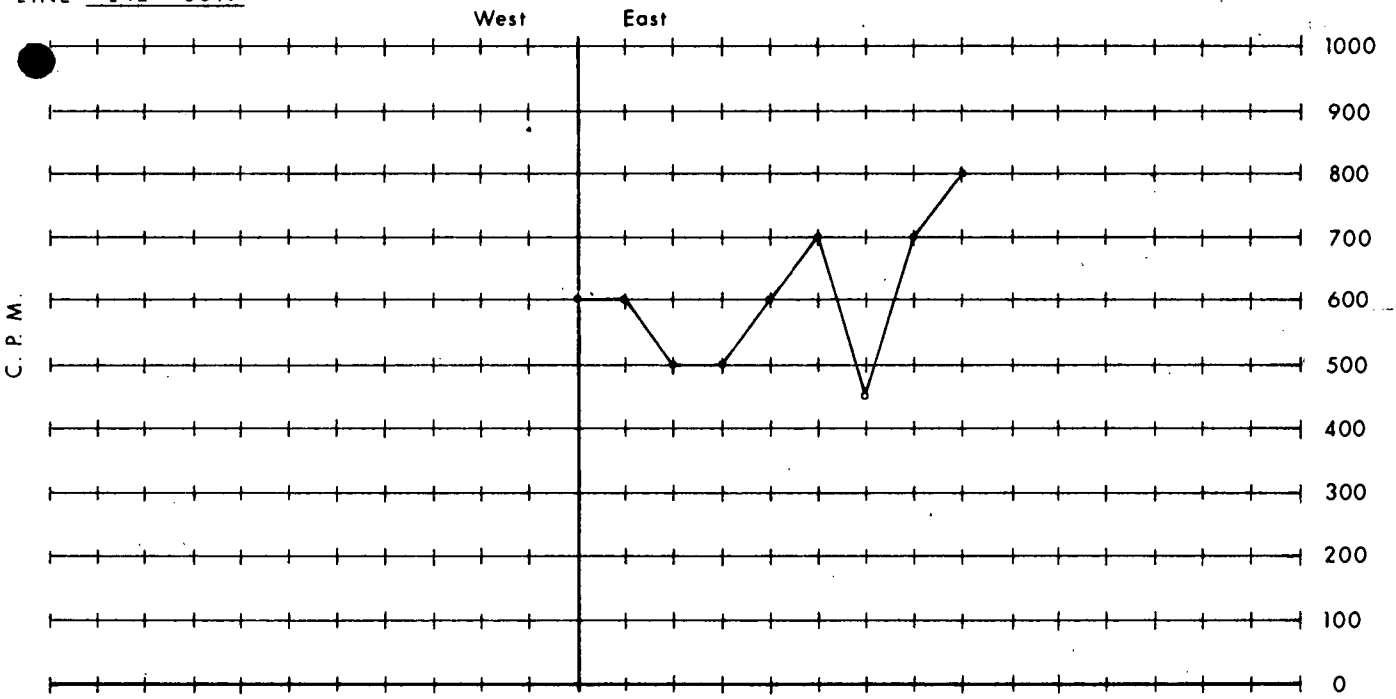
FOR
COLUMBIAN NORTHLAND EXPLORATION LTD.

RADIOMETRIC PROFILES

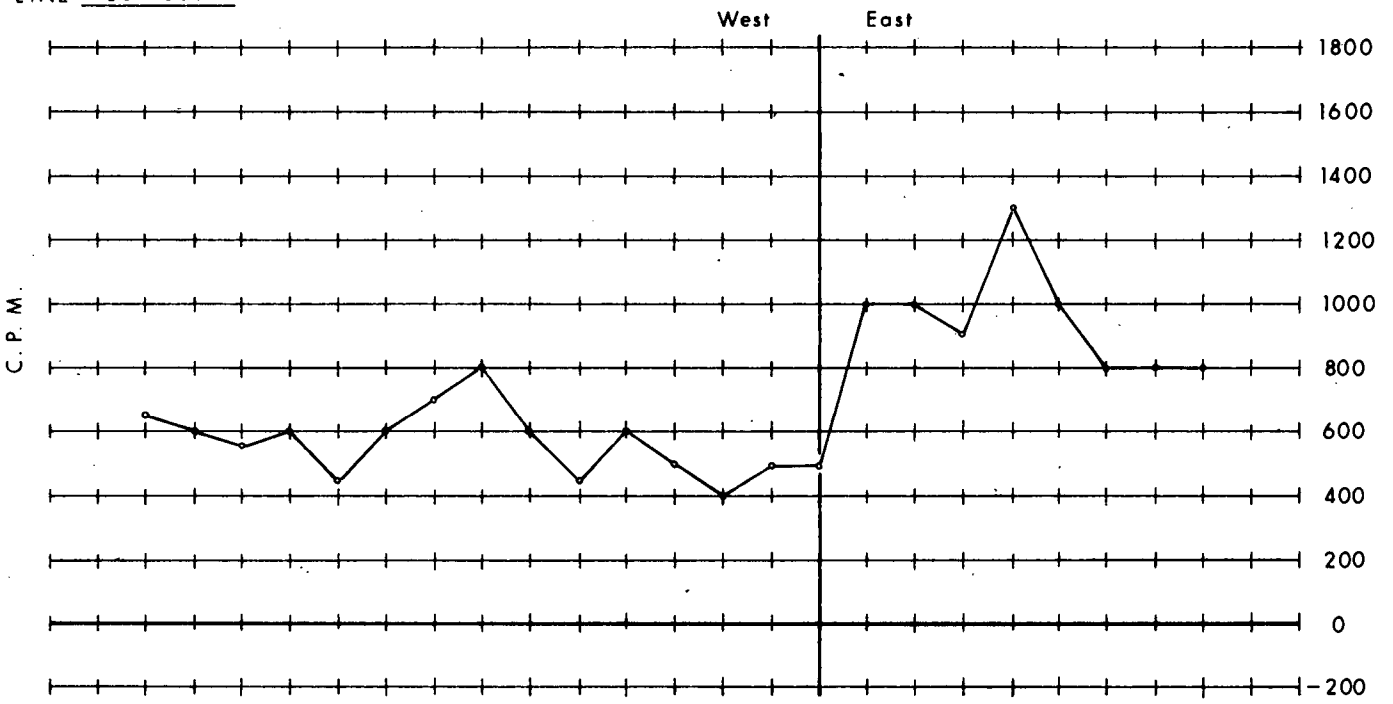
LAKE ATHABASCA, NORTHERN ALBERTA

DATE : SEPT., 1971	APPV'D: [redacted]
DWG. NO. :	SCALE : 1" = 1200'

LINE L12 +00N



LINE L6 +00N



PROFESSIONAL ENGINEER ALBERTA
A. G. MacKENZIE

FIG. 15 19720001

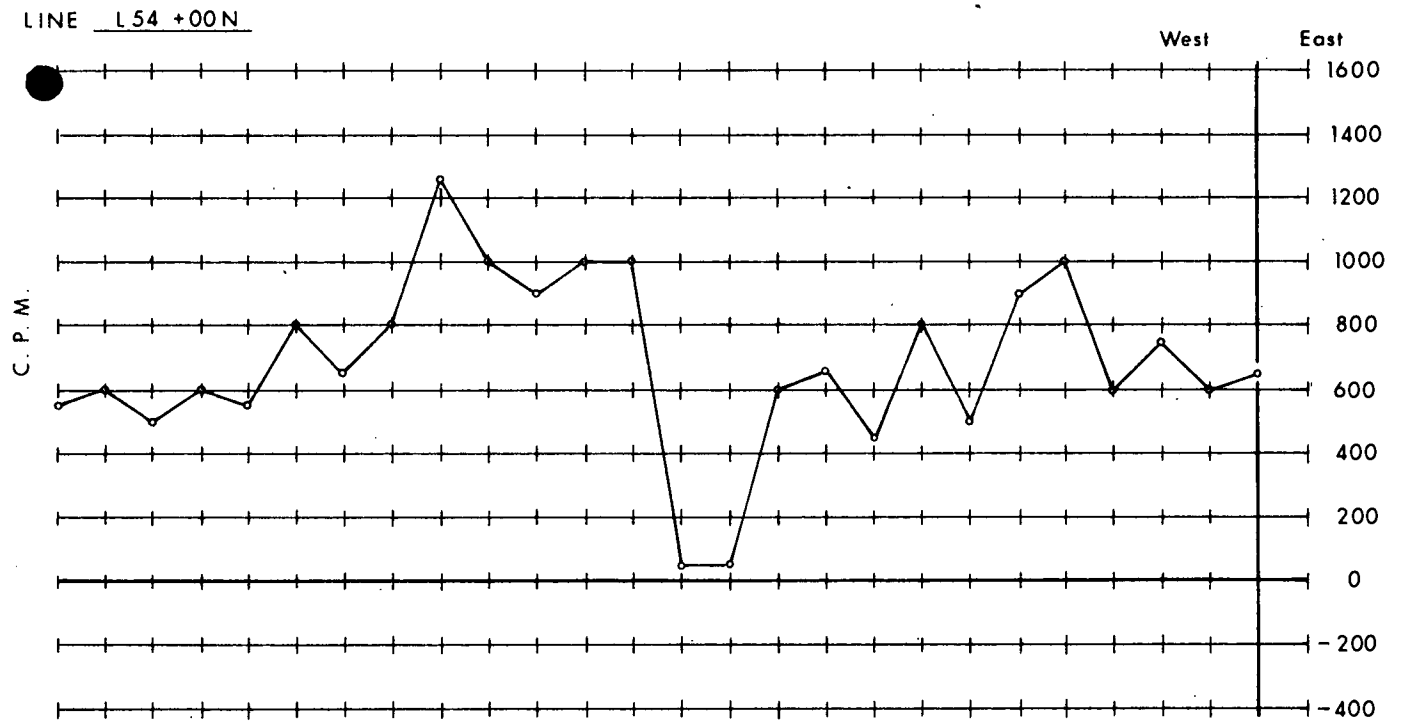
ANGUS G. MACKENZIE
MINING CONSULTANTS LIMITED
703 5th ST., CALGARY 2, ALBERTA

FOR
COLUMBIAN NORTHLAND EXPLORATION LTD.

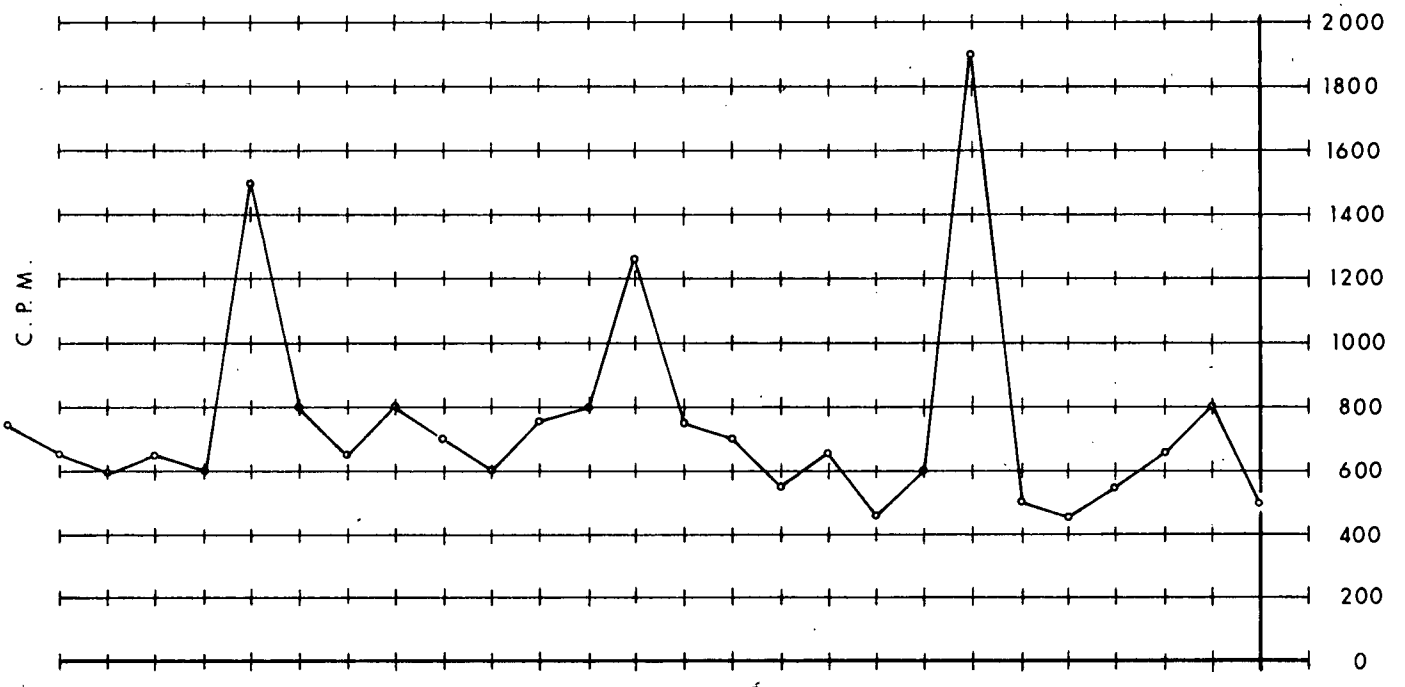
RADIOMETRIC PROFILES
FORT CHIPEWYAN AREA
LAKE ATHABASCA, NORTHERN ALBERTA

DATE : SEPT., 1971	APPV'D [redacted]
DWG. NO. :	SCALE : 1" = 1200'

LINE L54 +00N



LINE L48 +00N



PROFESSIONAL ENGINEER ALBERTA
A. G. MacKENZIE

FIG. 16 19720001

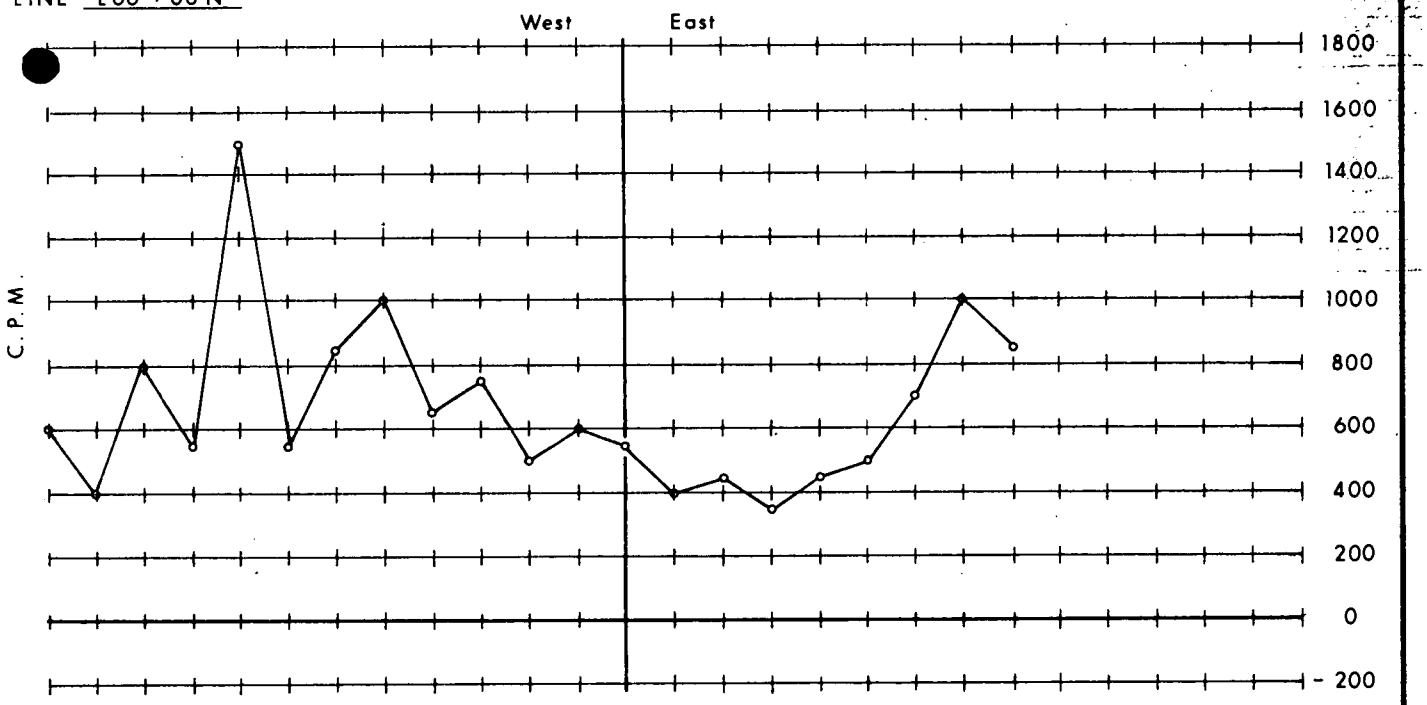
ANGUS G. MACKENZIE
MINING CONSULTANTS LIMITED
703 5th ST., CALGARY 2, ALBERTA

FOR
COLUMBIAN NORTHLAND EXPLORATION LTD.

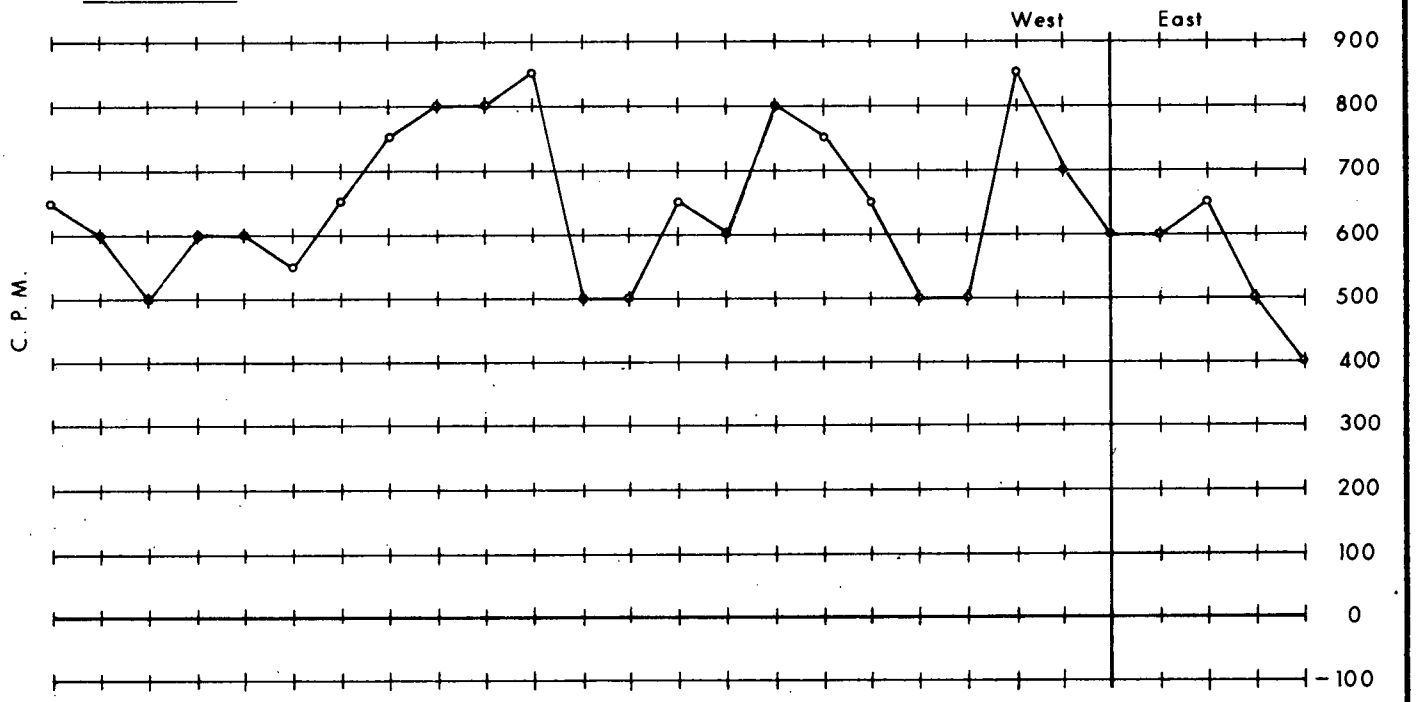
RADIOMETRIC PROFILES
FORT CHIPEWYAN AREA
LAKE ATHABASCA, NORTHERN ALBERTA

DATE : SEPT., 1971	APPV'D [redacted]
DWG. NO. :	SCALE : 1" = 1200'

LINE L66 + 00 N



LINE L60 + 00 N



PROFESSIONAL ENGINEER ALBERTA
A. G. MacKenzie

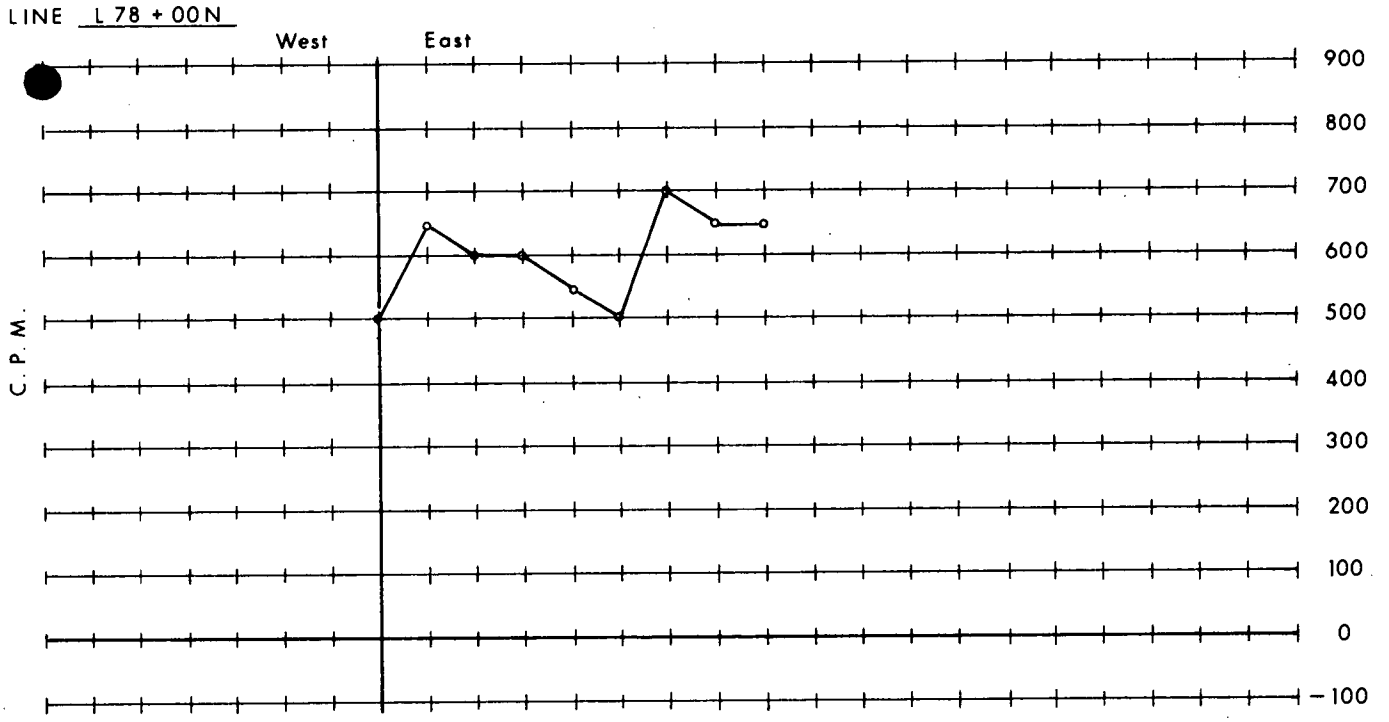
FIG. 17 19720001

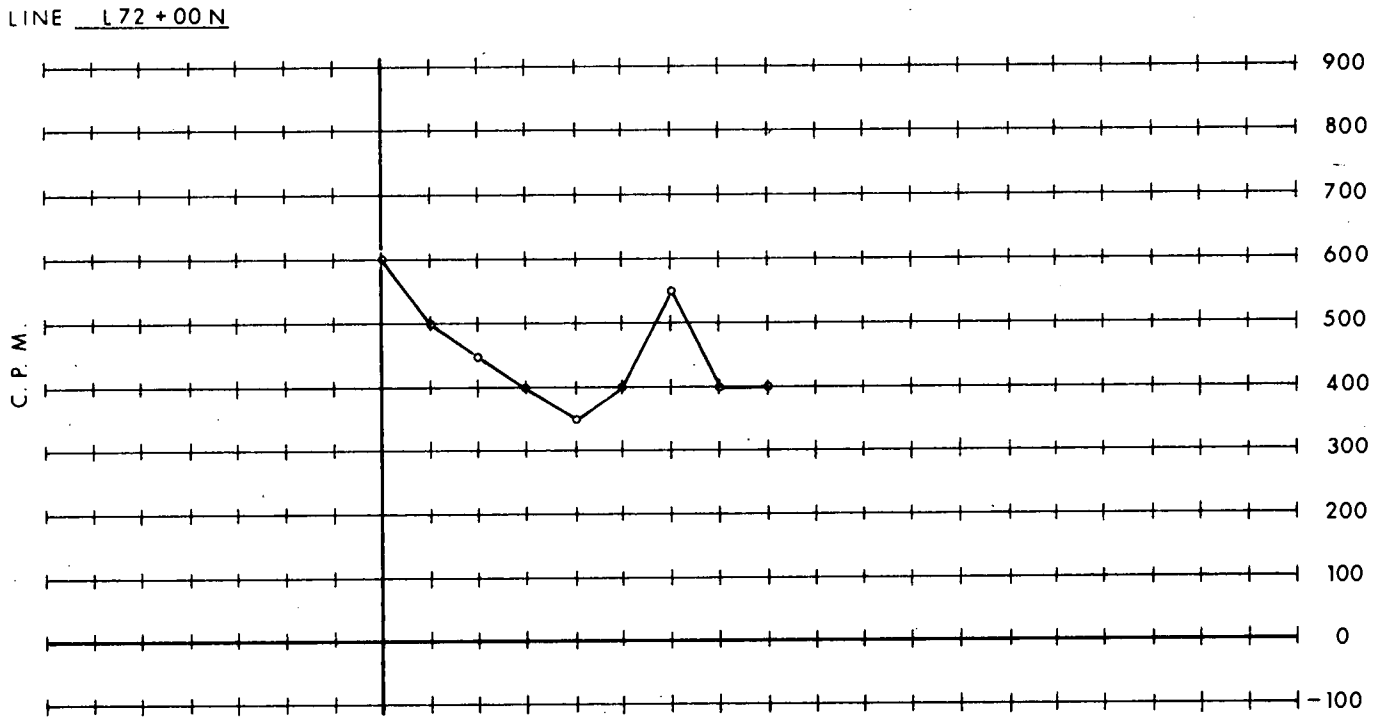
ANGUS G. MACKENZIE
MINING CONSULTANTS LIMITED
703 5th ST., CALGARY 2, ALBERTA

FOR
COLUMBIAN NORTHLAND EXPLORATION LTD.

RADIOMETRIC PROFILES
FORT CHIPEWYAN AREA
LAKE ATHABASCA, NORTHERN ALBERTA

DATE : SEPT., 1971	APPV'D: [redacted]
DWG. NO. :	SCALE : 1" = 1200'





PROFESSIONAL ENGINEER ALBERTA
A. G. MacKENZIE

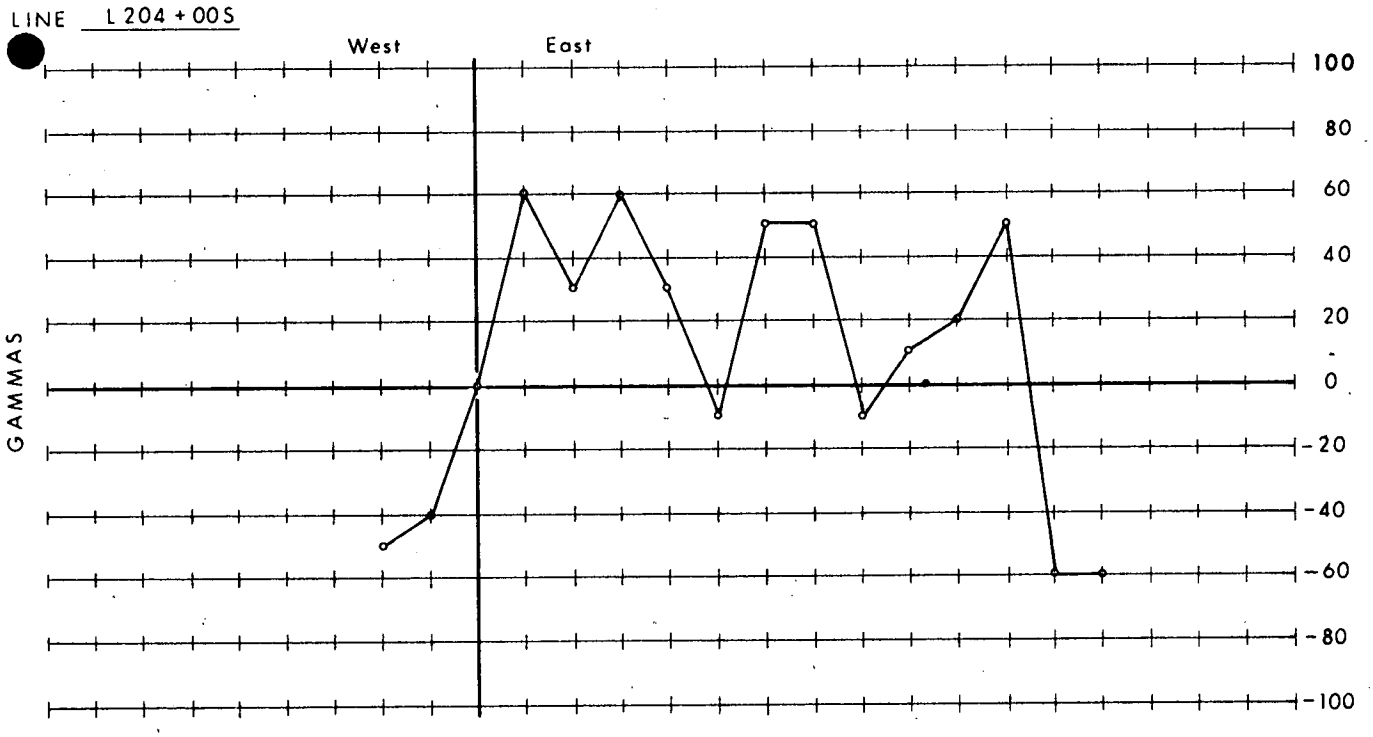
FIG. 18 19720001

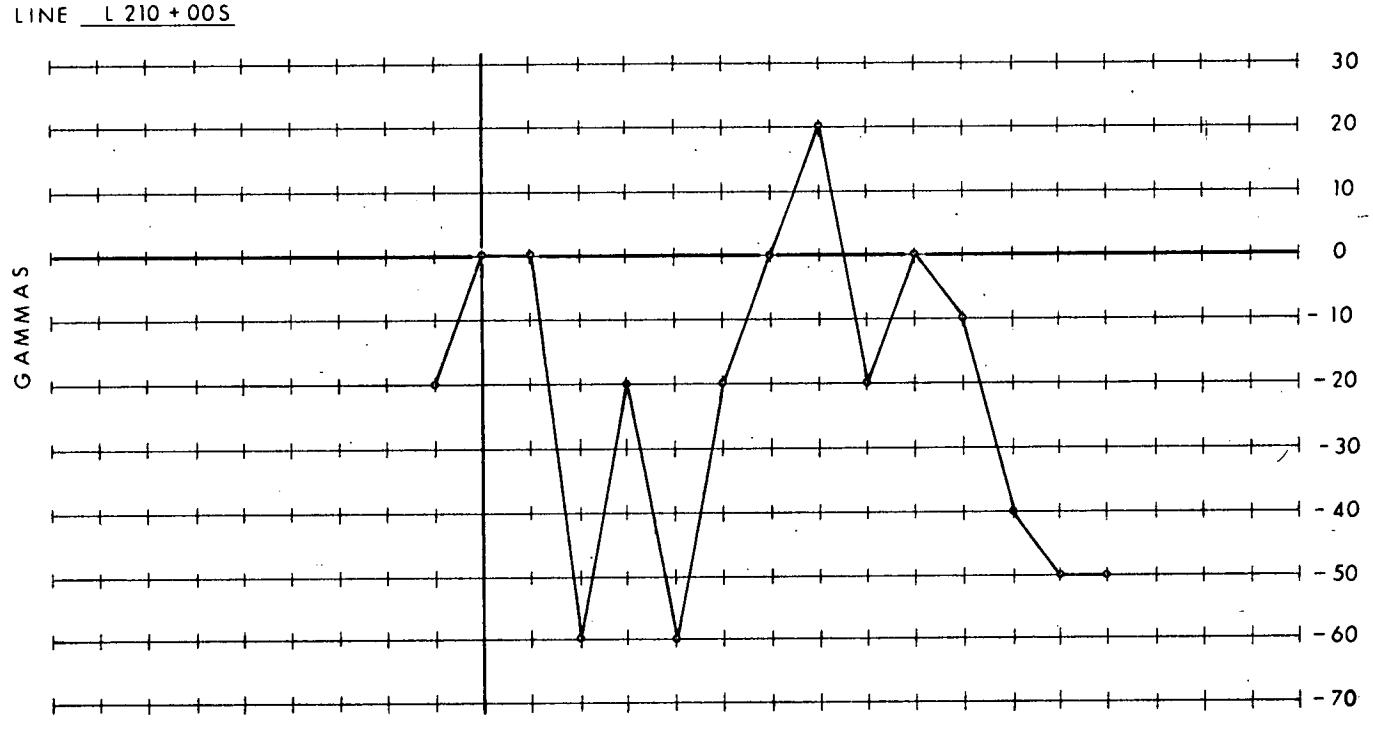
ANGUS G. MACKENZIE
MINING CONSULTANTS LIMITED
703 5th ST., CALGARY 2, ALBERTA

FOR
COLUMBIAN NORTHLAND EXPLORATION LTD.

RADIOMETRIC PROFILES
FORT CHIPEWYAN AREA
LAKE ATHABASCA, NORTHERN ALBERTA

DATE : SEPT., 1971	APPV'D: [redacted]
DWG. NO. :	SCALE : 1" = 1200'





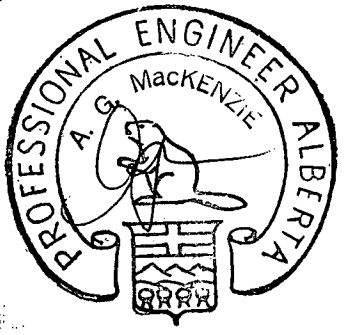


FIG. 19 19720001

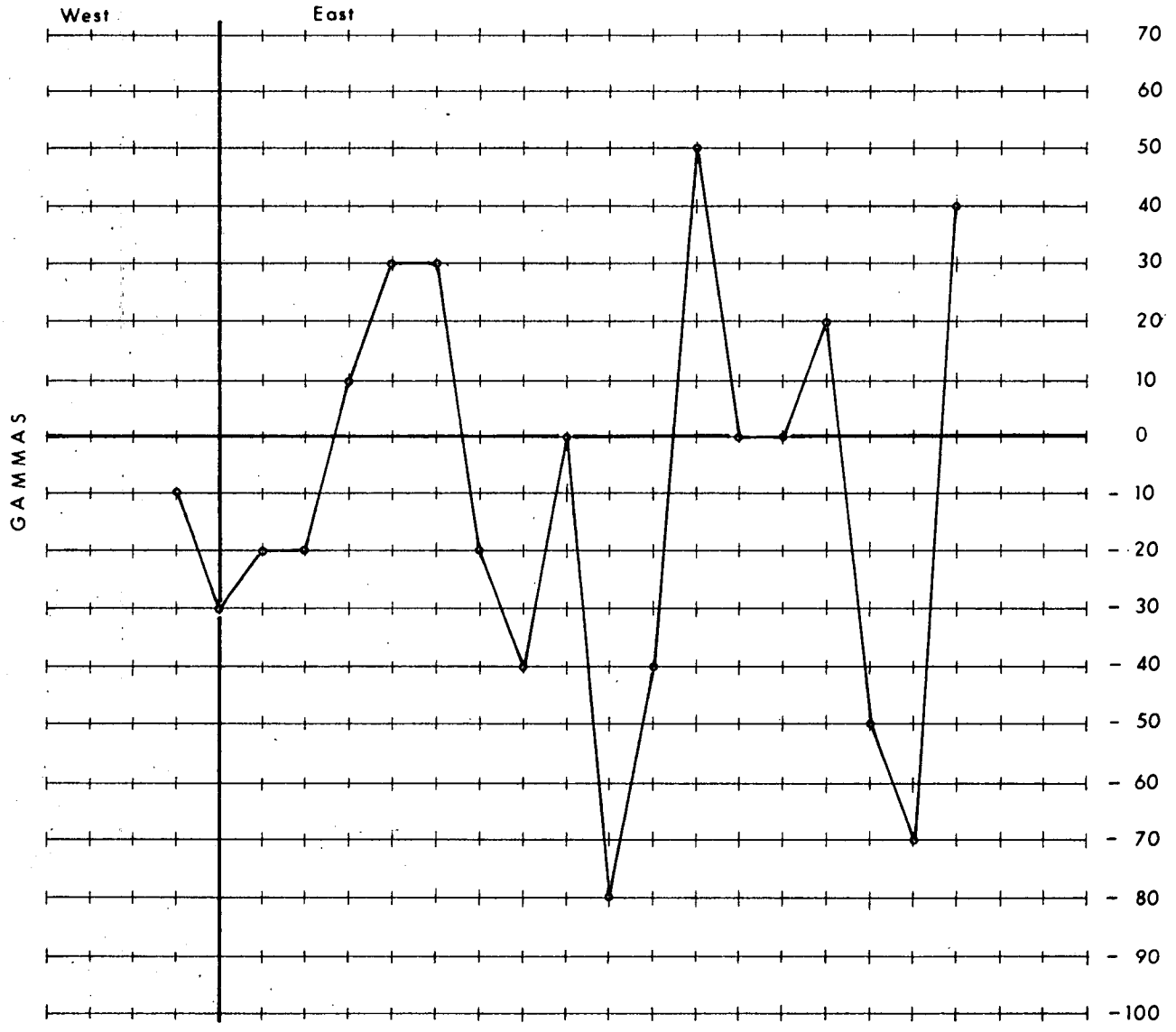
ANGUS G. MACKENZIE
MINING CONSULTANTS LIMITED
703 5th ST., CALGARY 2, ALBERTA

FOR
COLUMBIAN NORTHLAND EXPLORATION LTD.

MAGNETOMETER PROFILES
FORT CHIPEWYAN AREA
LAKE ATHABASCA, NORTHERN ALBERTA

DATE : SEPT., 1971	APPV'D [redacted]
DWG. NO. :	SCALE : 1" = 1200'

LINE L 198 + 00S



PROFESSIONAL ENGINEER ALBERTA
A. G. MacKenzie

FIG. 20 19720001

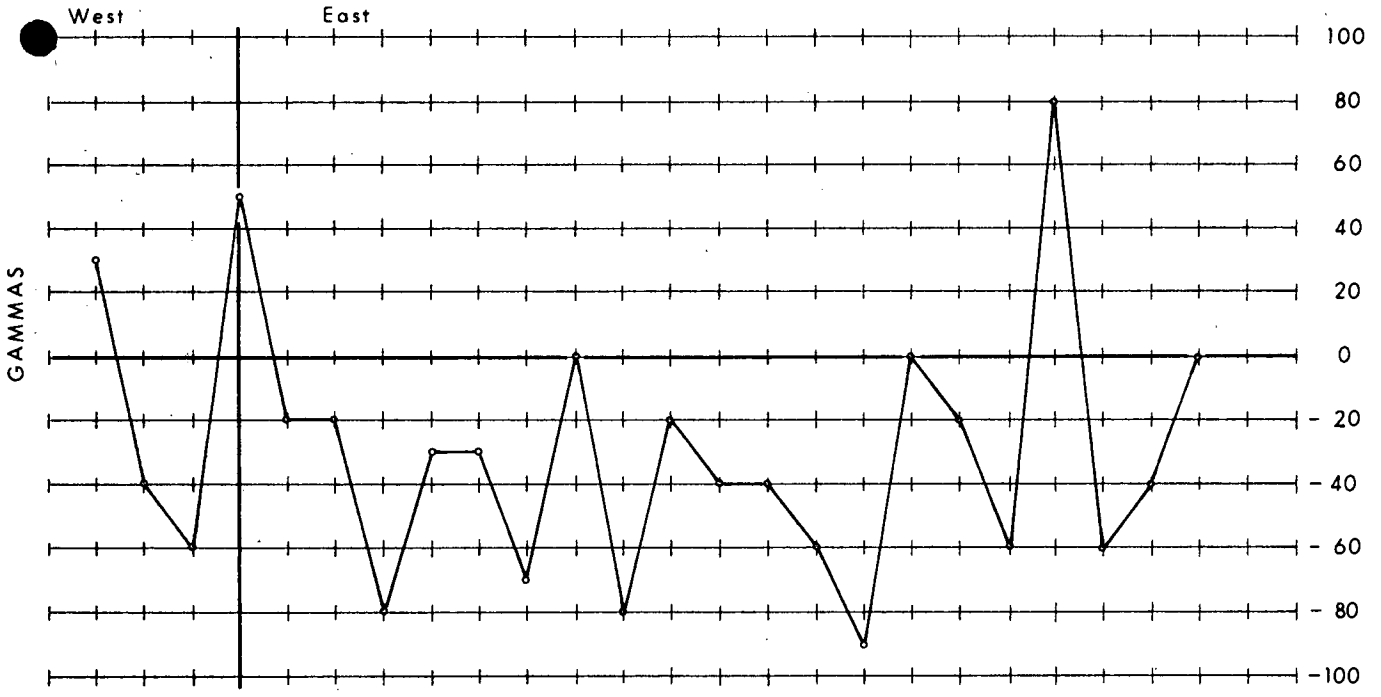
ANGUS G. MACKENZIE
MINING CONSULTANTS LIMITED
703 5th ST., CALGARY 2, ALBERTA

FOR
COLUMBIAN NORTHLAND EXPLORATION LTD.

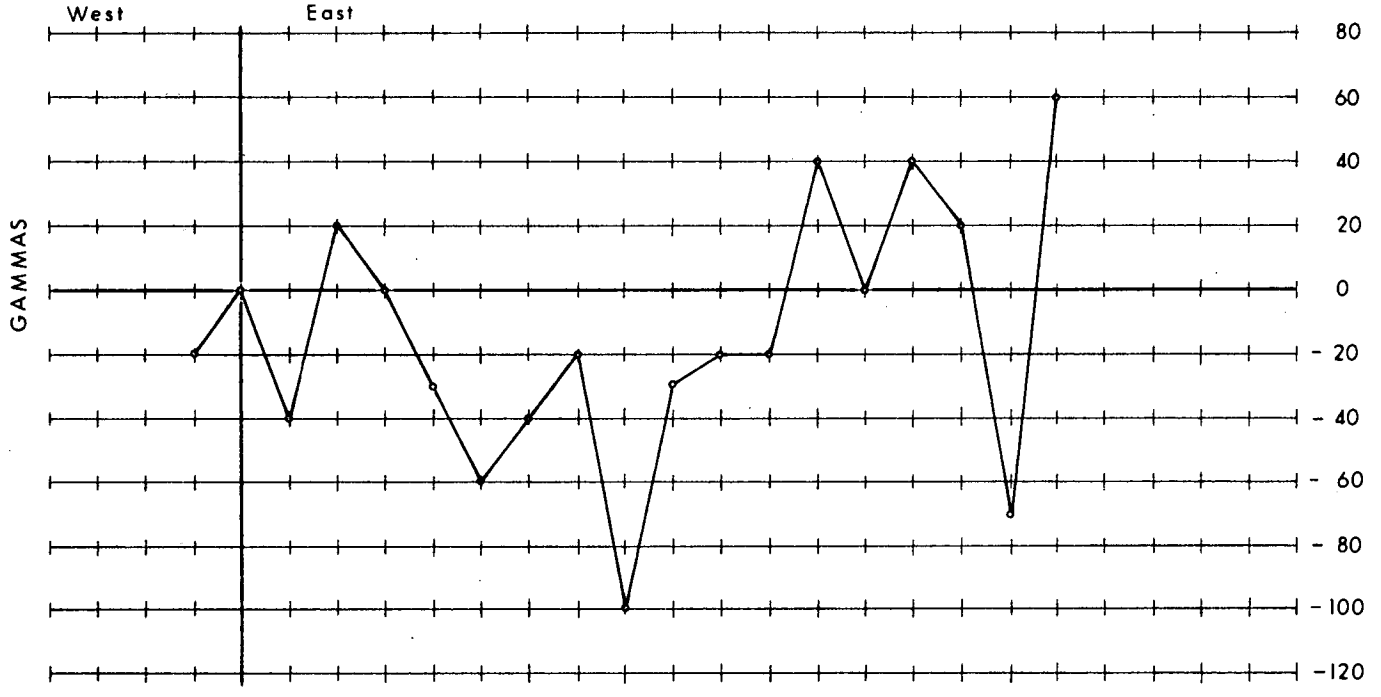
MAGNETOMETER PROFILE
FORT CHIPEWYAN AREA
LAKE ATHABASCA, NORTHERN ALBERTA

DATE: SEPT., 1971	APPV'D: [redacted]
DWG. NO.:	SCALE: 1" = 1200'

LINE L 186 + 00S



LINE L 192 + 00S



PROFESSIONAL ENGINEER ALBERTA
A. G. MacKENZIE

FIG. 21 19720001

ANGUS G. MACKENZIE
MINING CONSULTANTS LIMITED
703 5th ST., CALGARY 2, ALBERTA

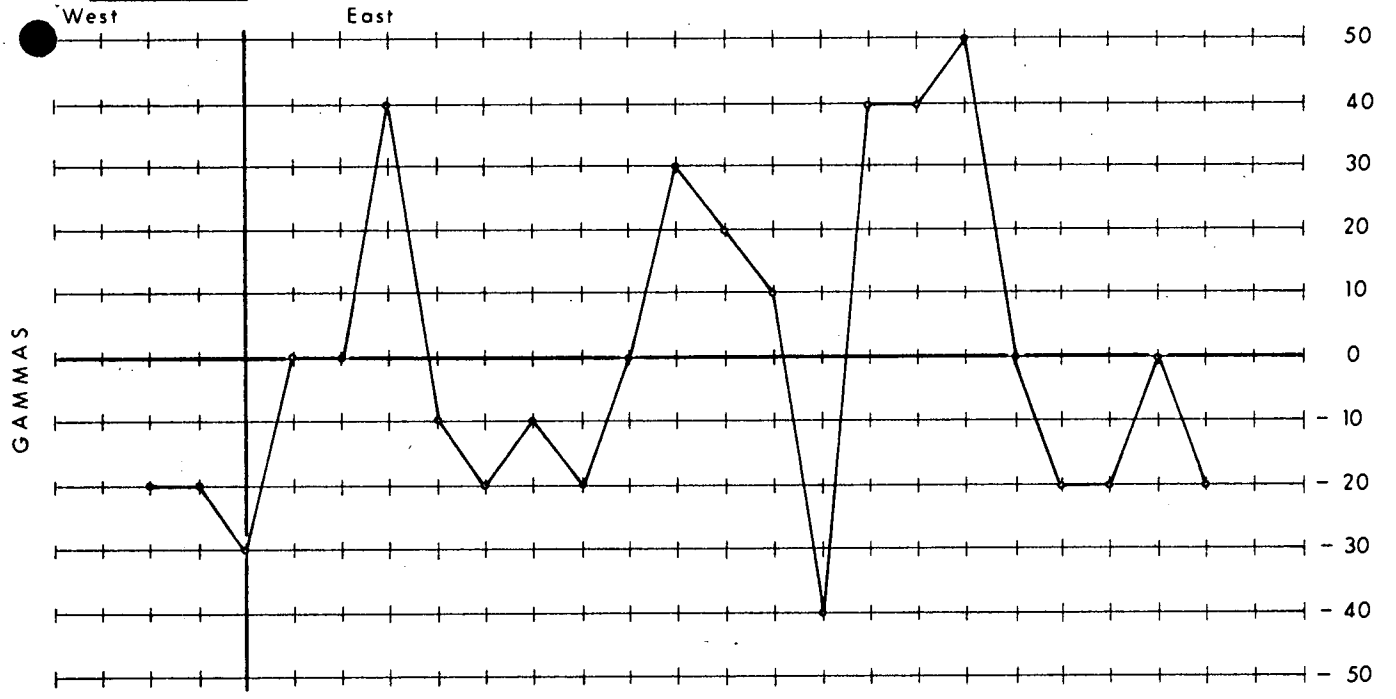
FOR
COLUMBIAN NORTHLAND EXPLORATION LTD.

MAGNETOMETER PROFILES
FORT CHIPEWYAN AREA
LAKE ATHABASCA, NORTHERN ALBERTA

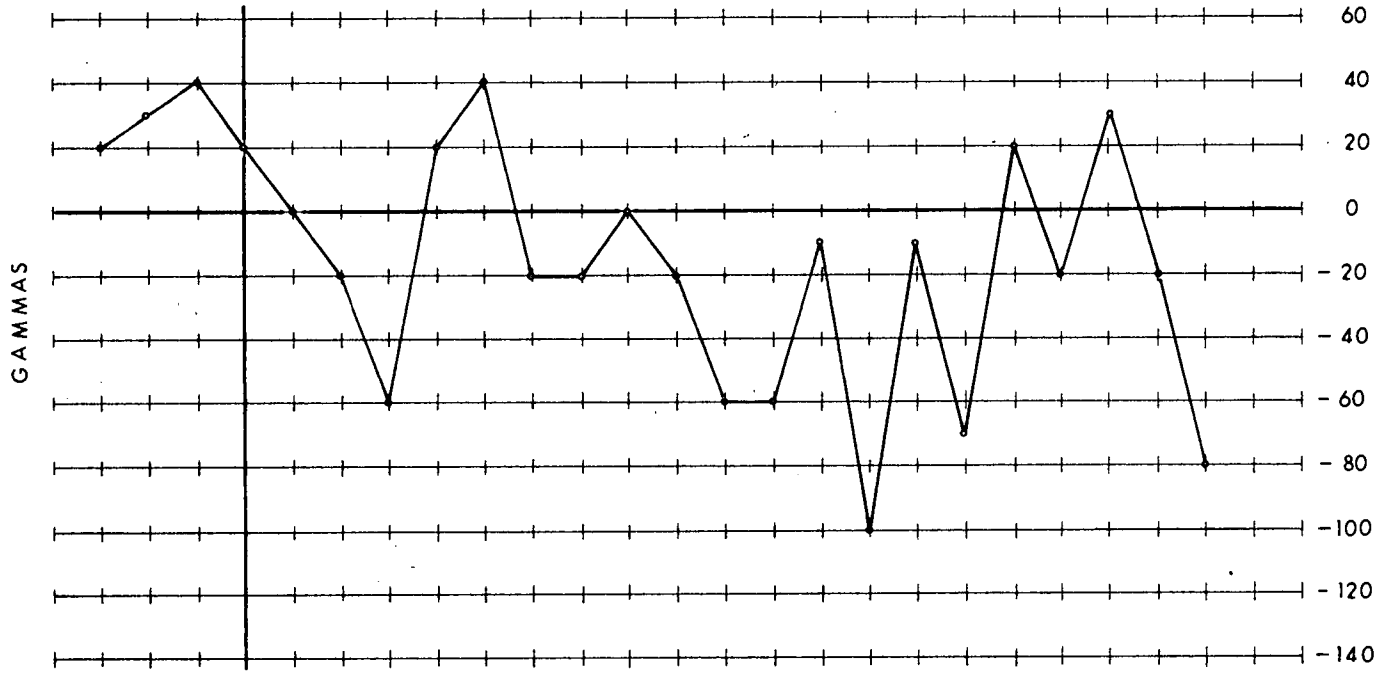
DATE : SEPT., 1971	APPV'D: [redacted]
DWG. NO. :	SCALE : 1" = 1200'

LINE L 174 + 00S

West East



LINE L 180 + 00S



PROFESSIONAL ENGINEER ALBERTA
A. G. MacKENZIE

FIG. 22 19720001

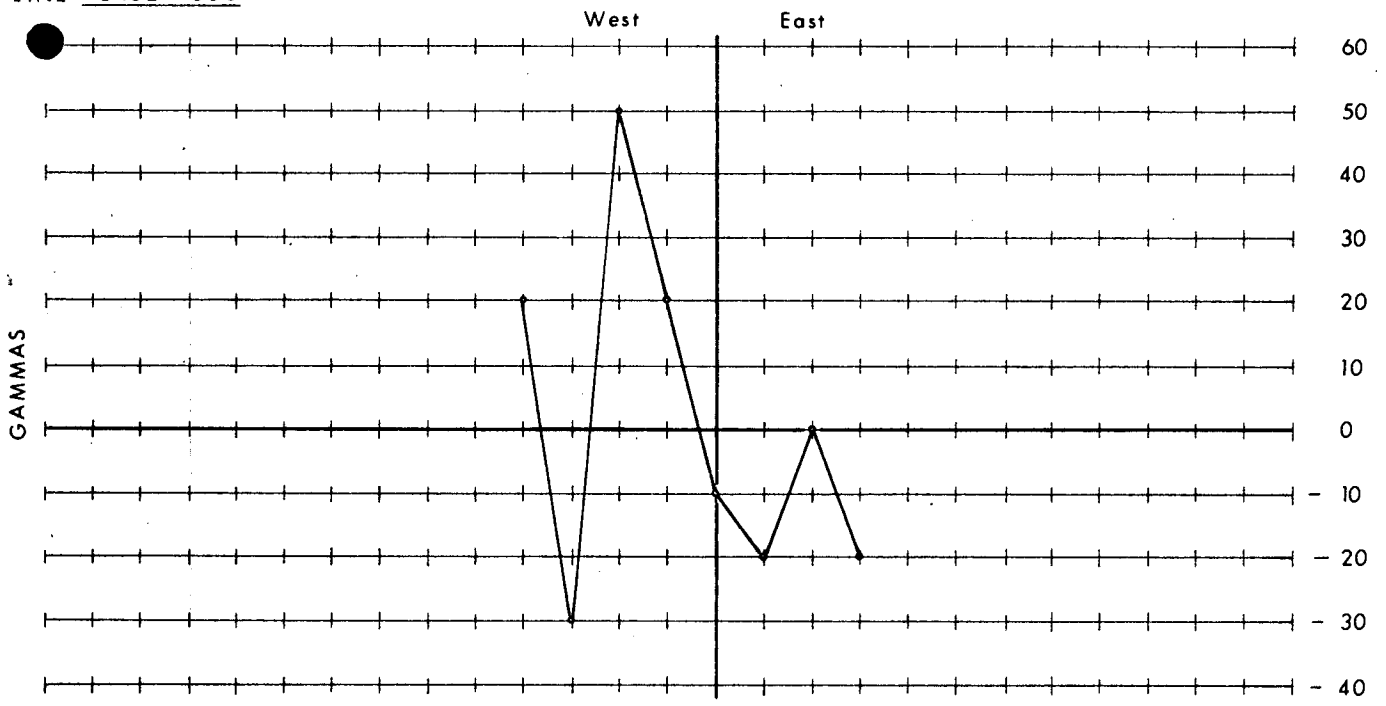
ANGUS G. MACKENZIE
MINING CONSULTANTS LIMITED
703 5th ST., CALGARY 2, ALBERTA

FOR
COLUMBIAN NORTHLAND EXPLORATION LTD.

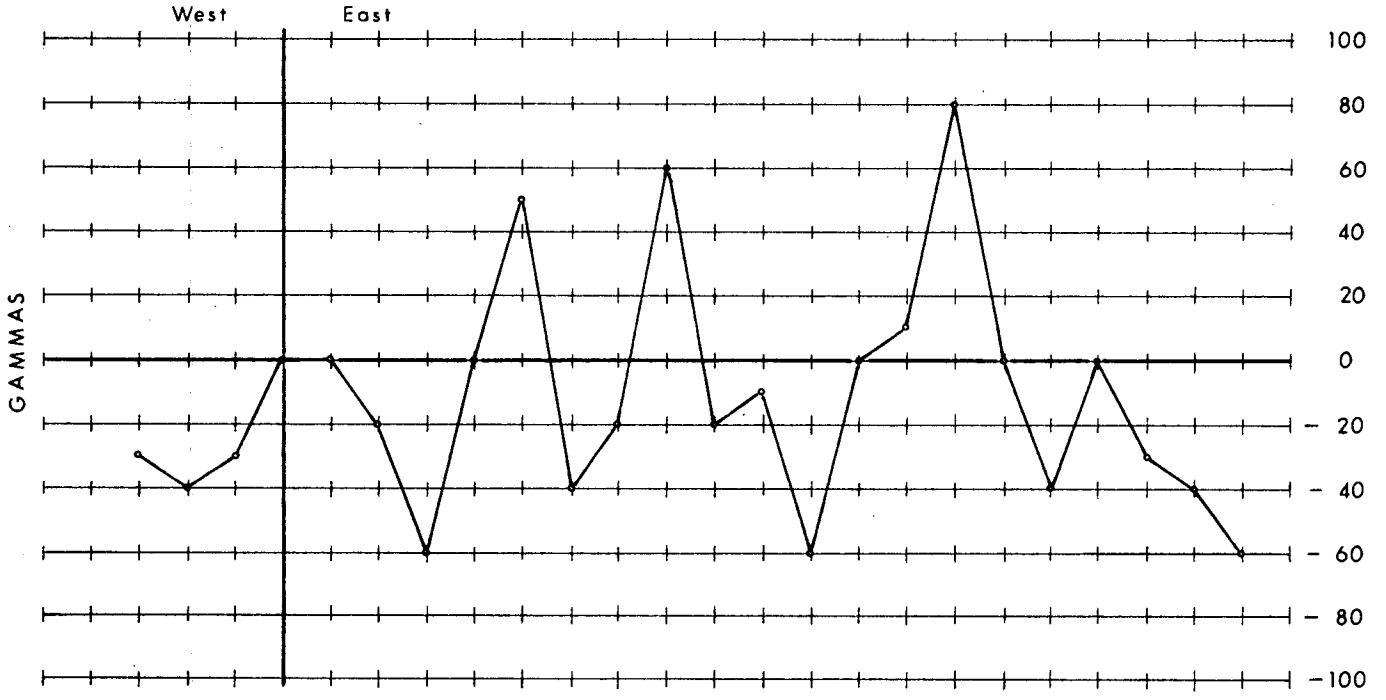
MAGNETOMETER PROFILES
FORT CHIPEWYAN AREA
LAKE ATHABASCA, NORTHERN ALBERTA

DATE : SEPT., 1971	APPV'D [redacted]
DWG. NO. :	SCALE 1" = 1200'

LINE L 162 + 00S



LINE L168 +00S



PROFESSIONAL ENGINEER ALBERTA
A. G. MacKENZIE

FIG. 23 19720001

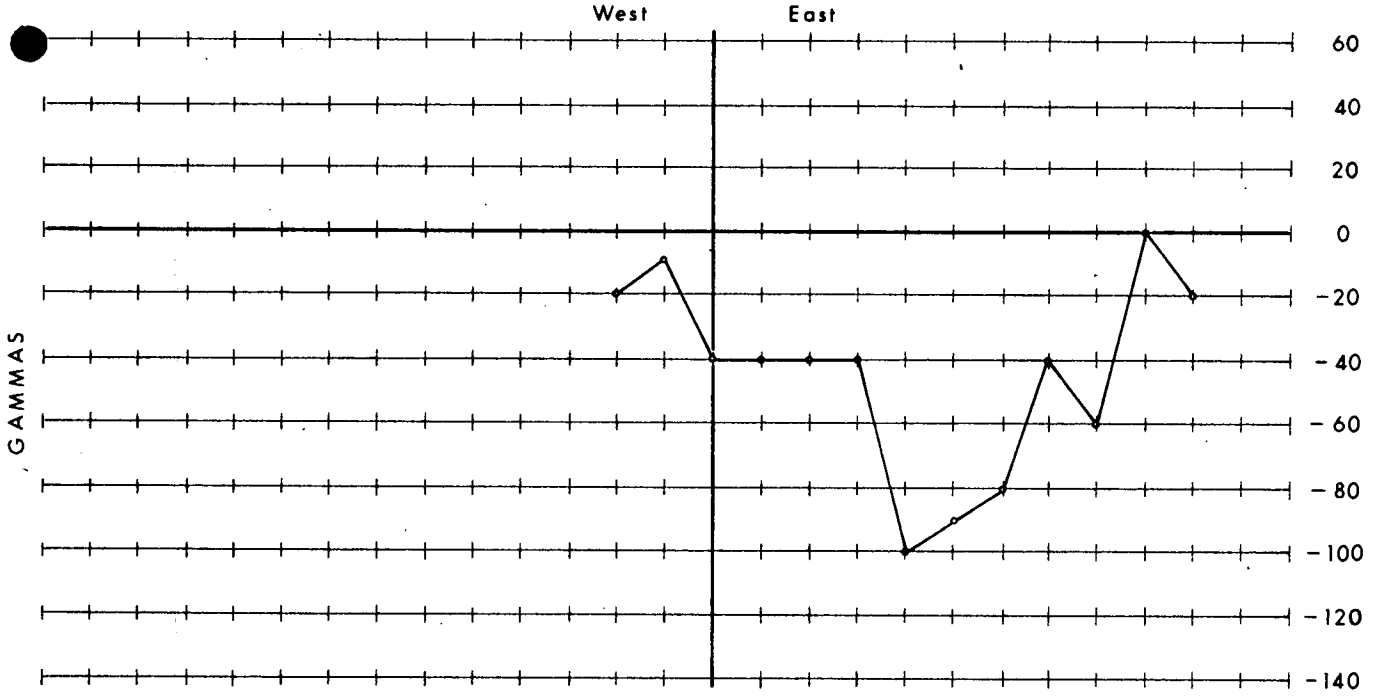
ANGUS G. MACKENZIE
MINING CONSULTANTS LIMITED
703 5th ST., CALGARY 2, ALBERTA

FOR
COLUMBIAN NORTHLAND EXPLORATION LTD.

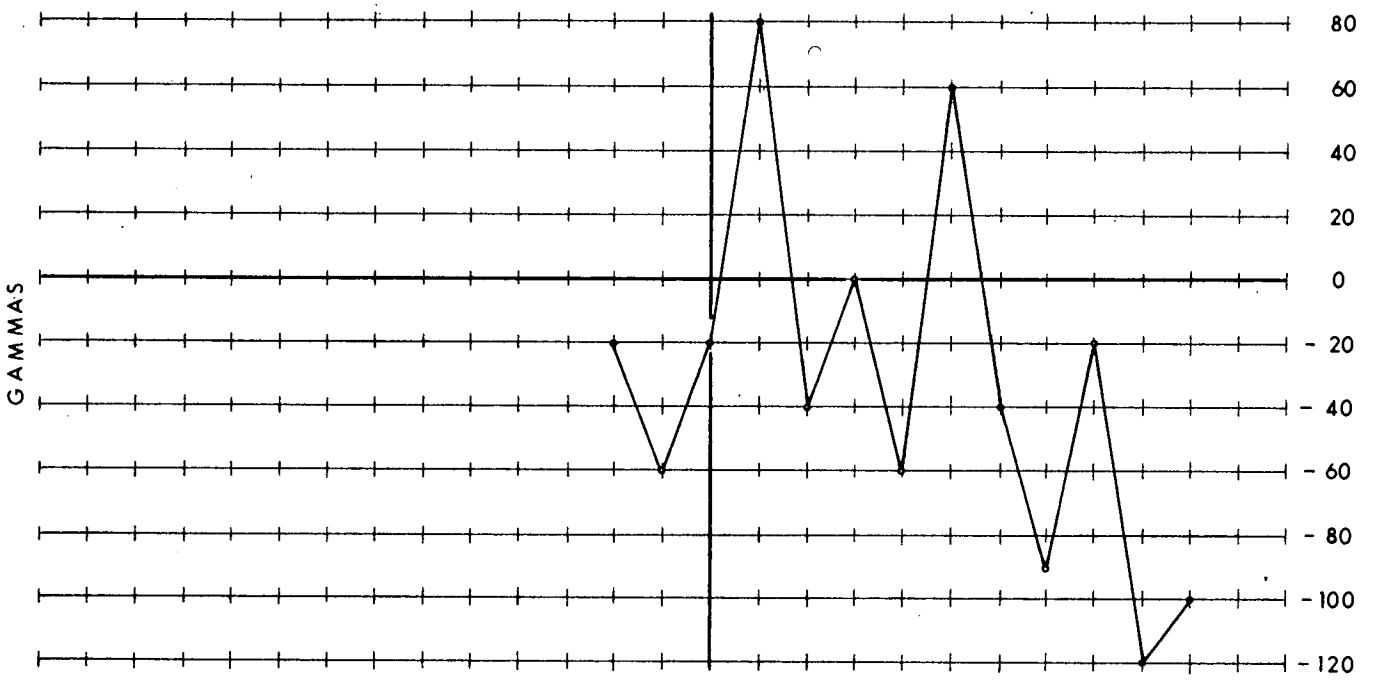
MAGNETOMETER PROFILES
FORT CHIPEWYAN AREA
LAKE ATHABASCA, NORTHERN ALBERTA

DATE : SEPT., 1971 | APPV'D [redacted]
DWG. NO. : | SCALE : 1" = 1200'

LINE L48 + 00 S



LINE L 54. + 00 S



PROFESSIONAL ENGINEER ALBERTA
A. G. MacKENZIE

FIG. 24 19720001

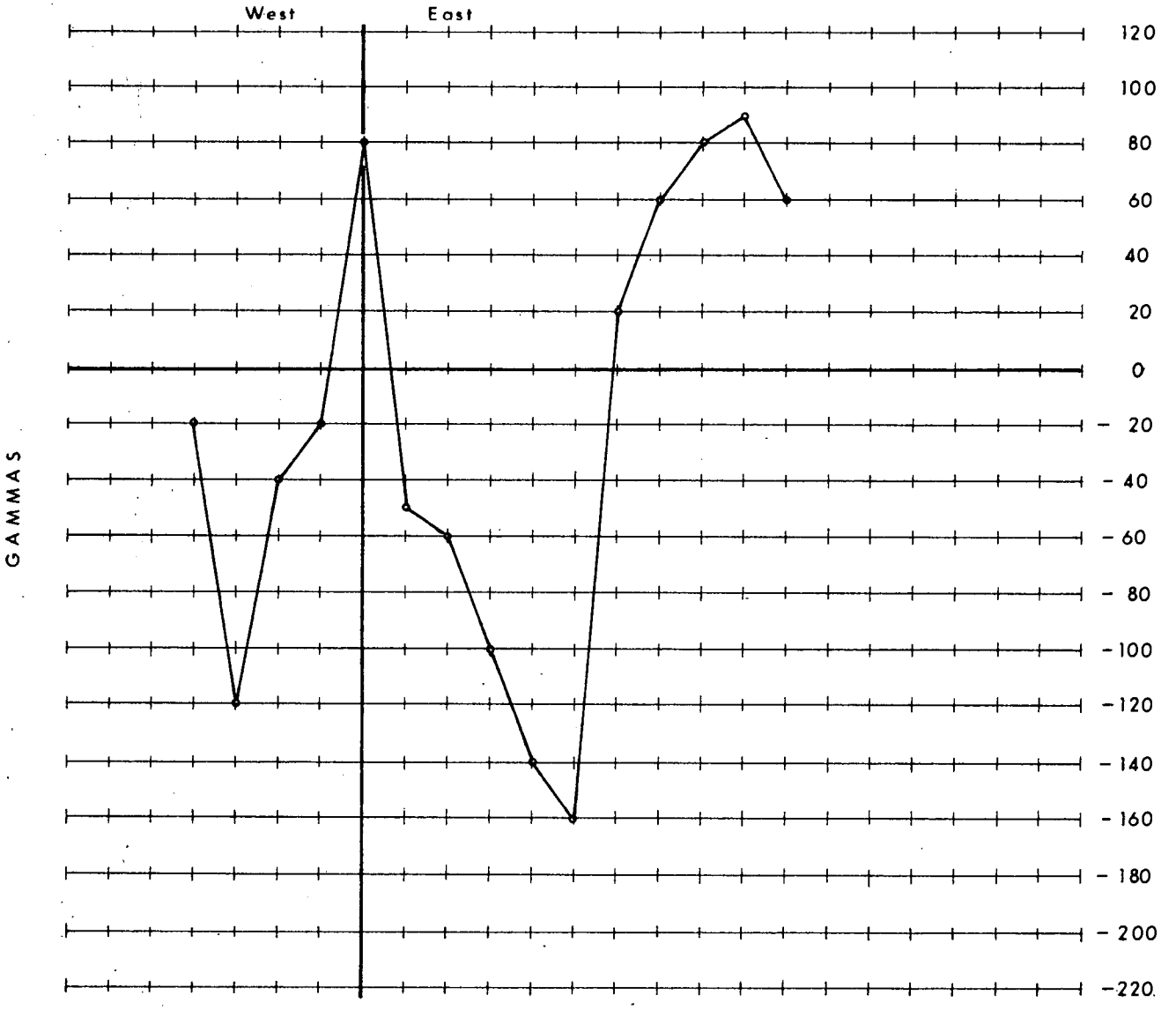
ANGUS G. MACKENZIE
MINING CONSULTANTS LIMITED
703 5th ST., CALGARY 2, ALBERTA

FOR
COLUMBIAN NORTHLAND EXPLORATION LTD.

MAGNETOMETER PROFILES
FORT CHIPEWYAN AREA
LAKE ATHABASCA, NORTHERN ALBERTA

DATE : SEPT., 1971	APPV'D [redacted]
DWG. NO. :	SCALE : 1" = 1200'

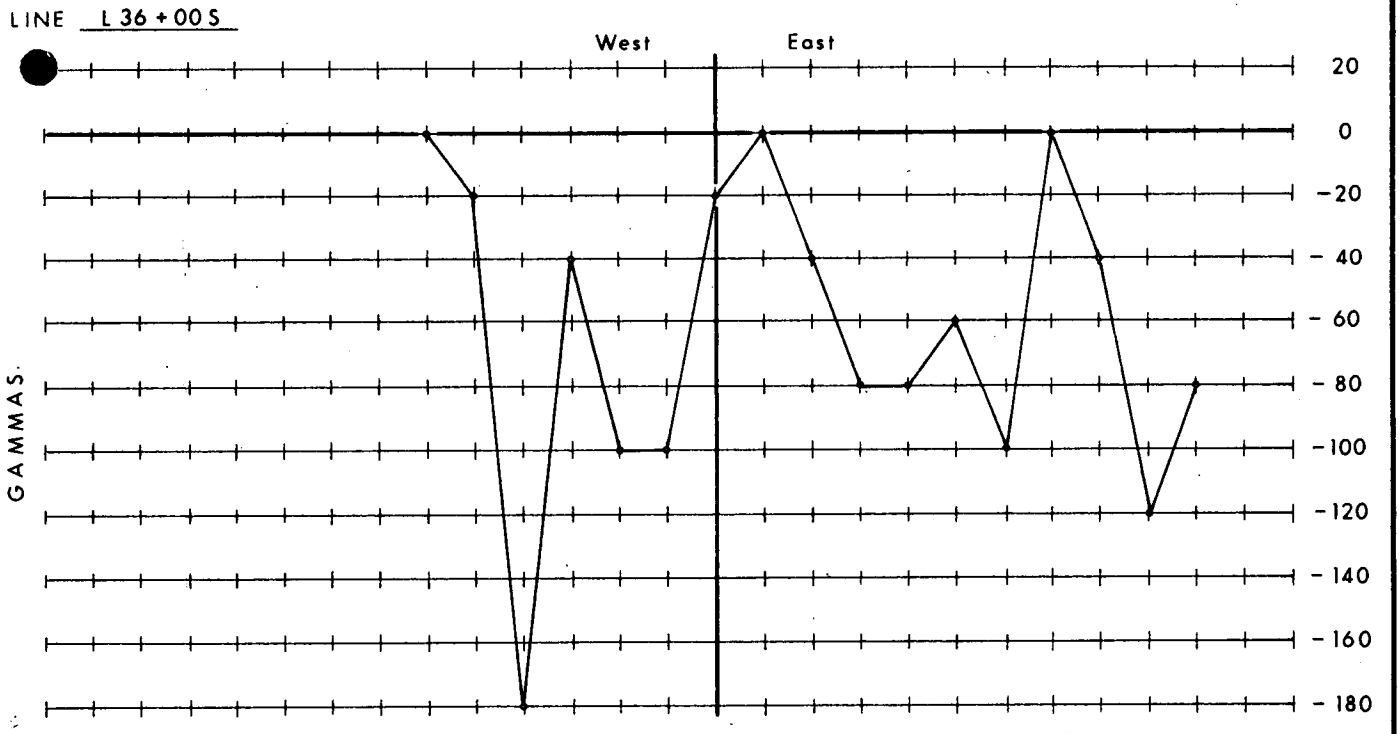
LINE L42 + 00S



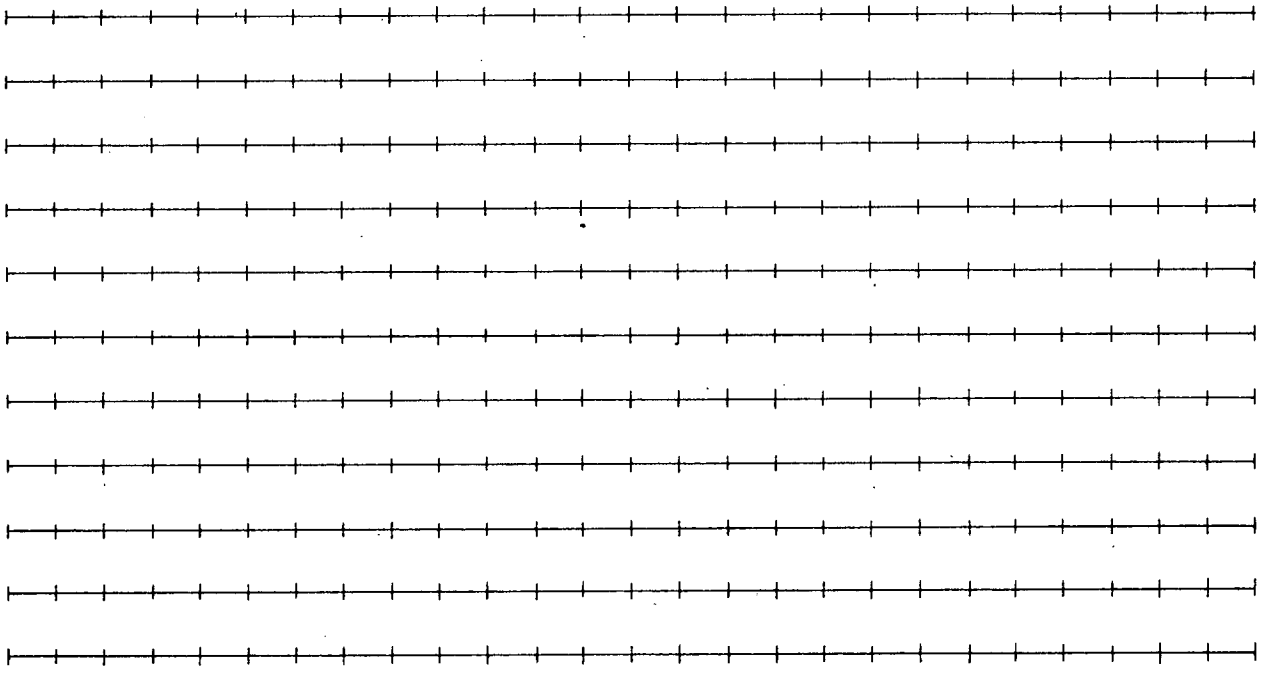
PROFESSIONAL ENGINEER ALBERTA
A. G. MacKENZIE

FIG. 25 19720001

ANGUS G. MACKENZIE MINING CONSULTANTS LIMITED 703 5th ST., CALGARY 2, ALBERTA
FOR COLUMBIAN NORTHLAND EXPLORATION LTD.
MAGNETOMETER PROFILE FORT CHIPEWYAN AREA LAKE ATHABASCA, NORTHERN ALBERTA
DATE: SEPT., 1971 — APPV'D [redacted]
DWG. NO.: — SCALE 1" = 1200'



LINE _____



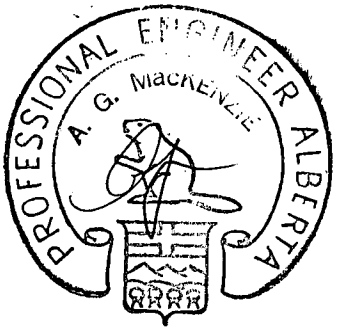


FIG. 26 19720001

ANGUS G. MACKENZIE
MINING CONSULTANTS LIMITED
703 5th ST., CALGARY 2, ALBERTA

FOR
COLUMBIAN NORTHLAND EXPLORATION LTD.

MAGNETOMETER PROFILES
FORT CHIPEWYAN AREA
LAKE ATHABASCA, NORTHERN ALBERTA

DATE : SEPT., 1971	APPV'D [redacted]
DWG. NO. :	SCALE : 1" = 1200'

LINE L 30 + 00S

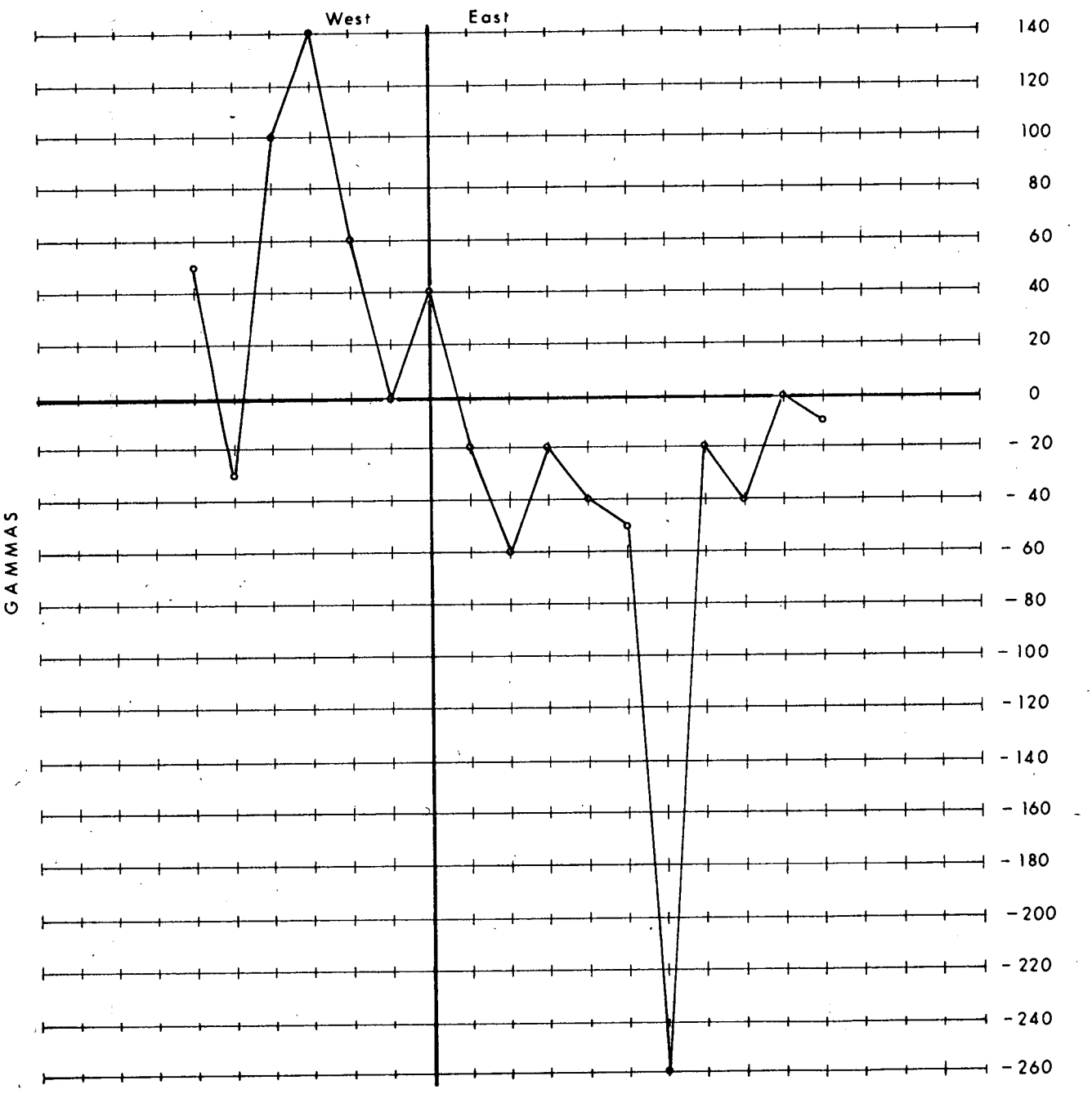


FIG. 27 19720001

PROFESSIONAL ENGINEER ALBERTA
A. G. MacKENZIE

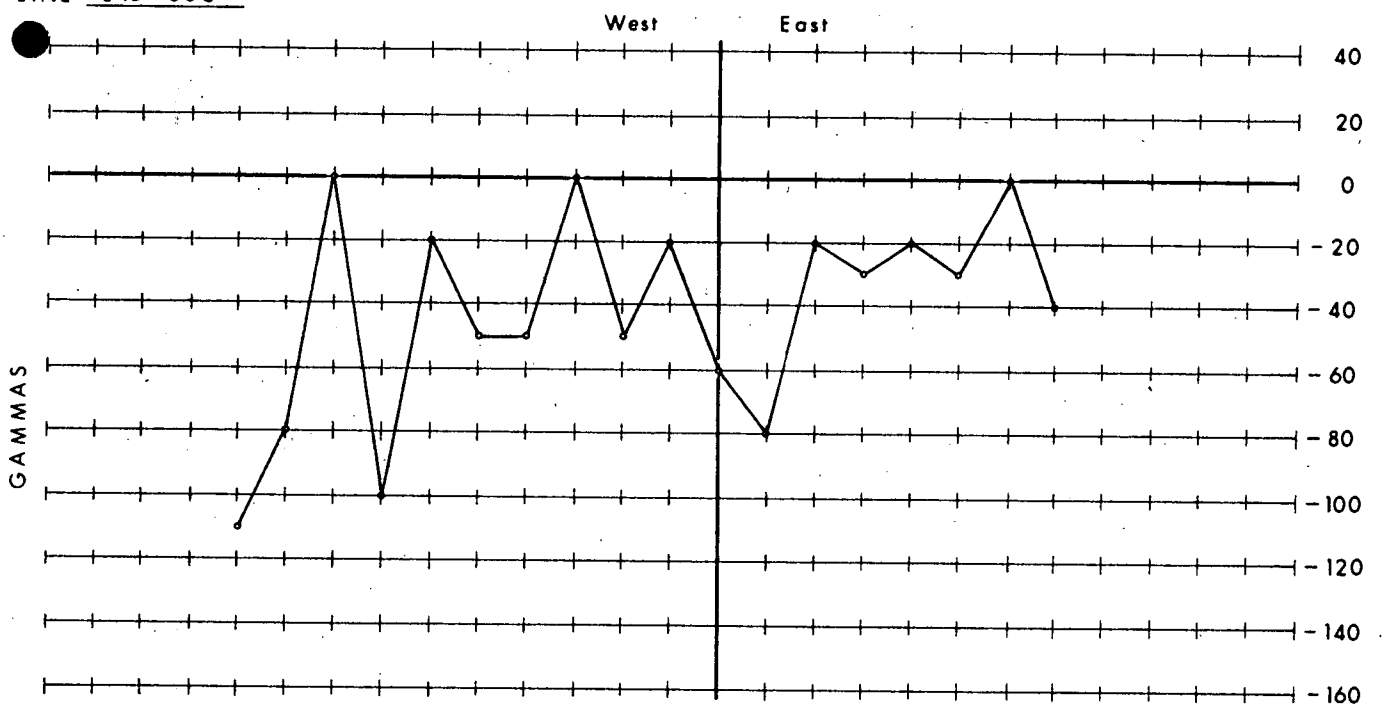
ANGUS G. MACKENZIE
MINING CONSULTANTS LIMITED
703 5th ST., CALGARY 2, ALBERTA

FOR
COLUMBIAN NORTHLAND EXPLORATION LTD.

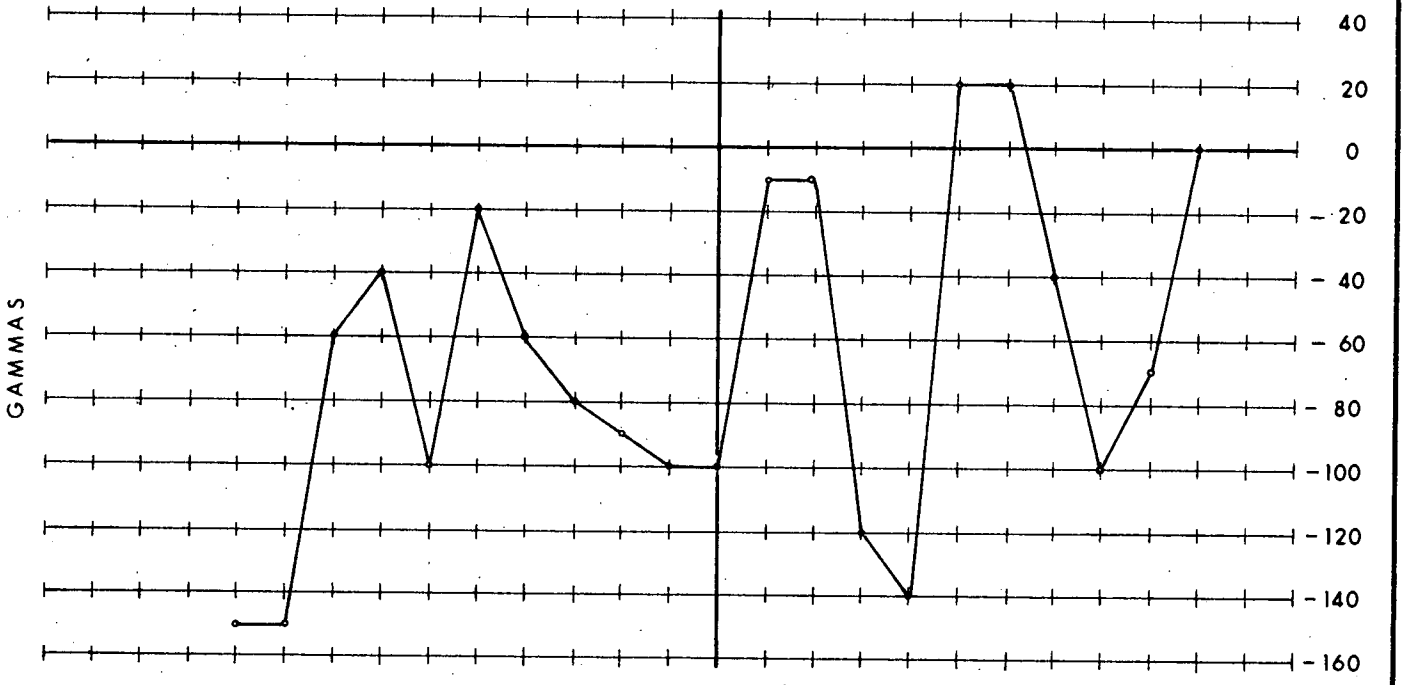
MAGNETOMETER PROFILE
FORT CHIPEWYAN AREA
LAKE ATHABASCA, NORTHERN ALBERTA

DATE: SEPT., 1971	APPV'D [redacted]
DWG. NO.:	SCALE: 1/1" = 1200'

LINE L 18 + 00 S



LINE L 24 + 00 S



PROFESSIONAL ENGINEER ALBERTA
A.G. MacKenzie

FIG. 28 19720001

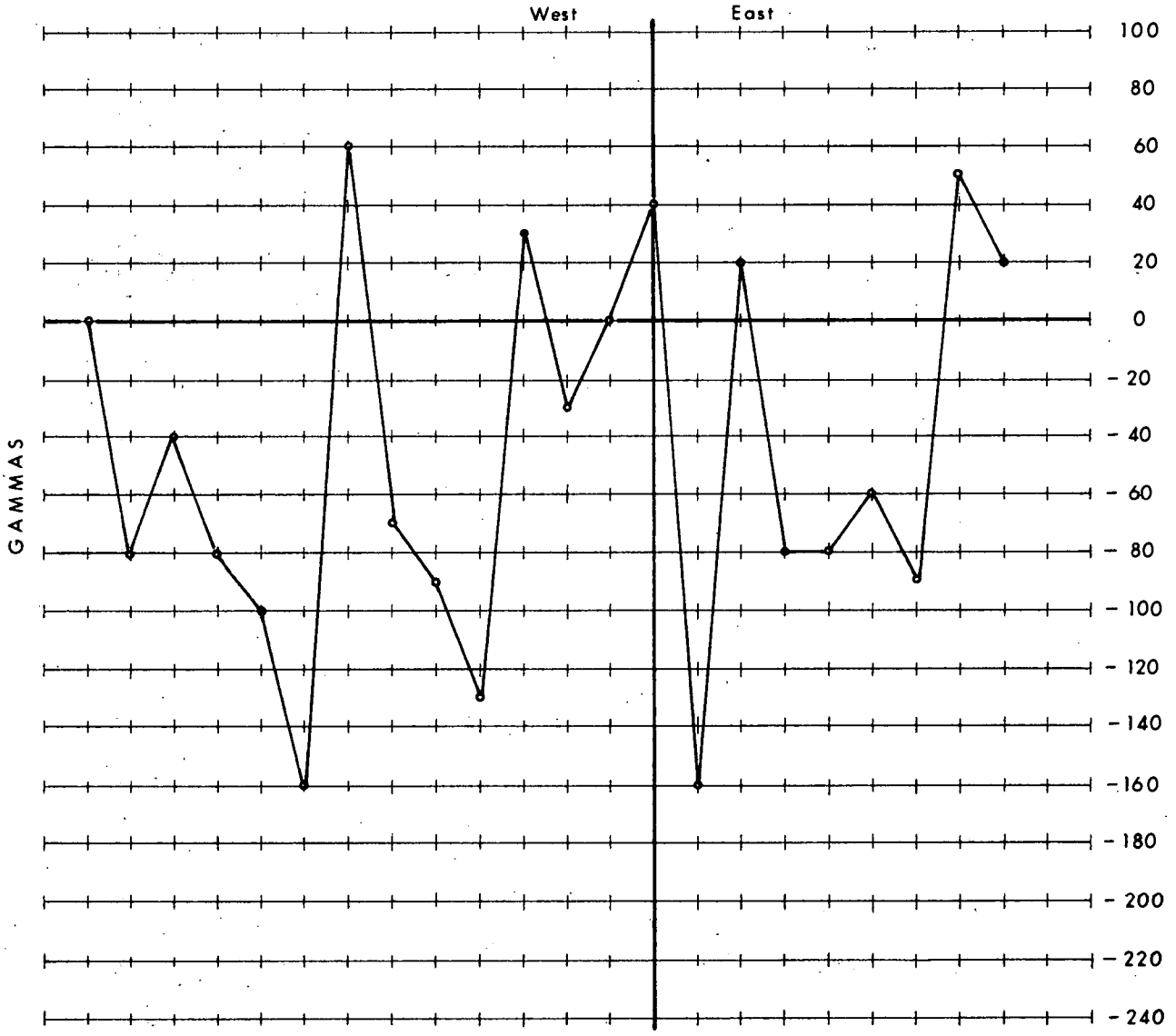
ANGUS G. MACKENZIE
MINING CONSULTANTS LIMITED
703 5th ST., CALGARY 2, ALBERTA

FOR
COLUMBIAN NORTHLAND EXPLORATION LTD.

MAGNETOMETER PROFILES
FORT CHIPEWYAN AREA
LAKE ATHABASCA, NORTHERN ALBERTA

DATE : SEPT., 1971	APPV'D: [redacted]
DWG. NO. :	SCALE : " = 1200 '

LINE L 12 + 00S



PROFESSIONAL ENGINEER ALBERTA
A. G. MacKENZIE

FIG. 29 19720001

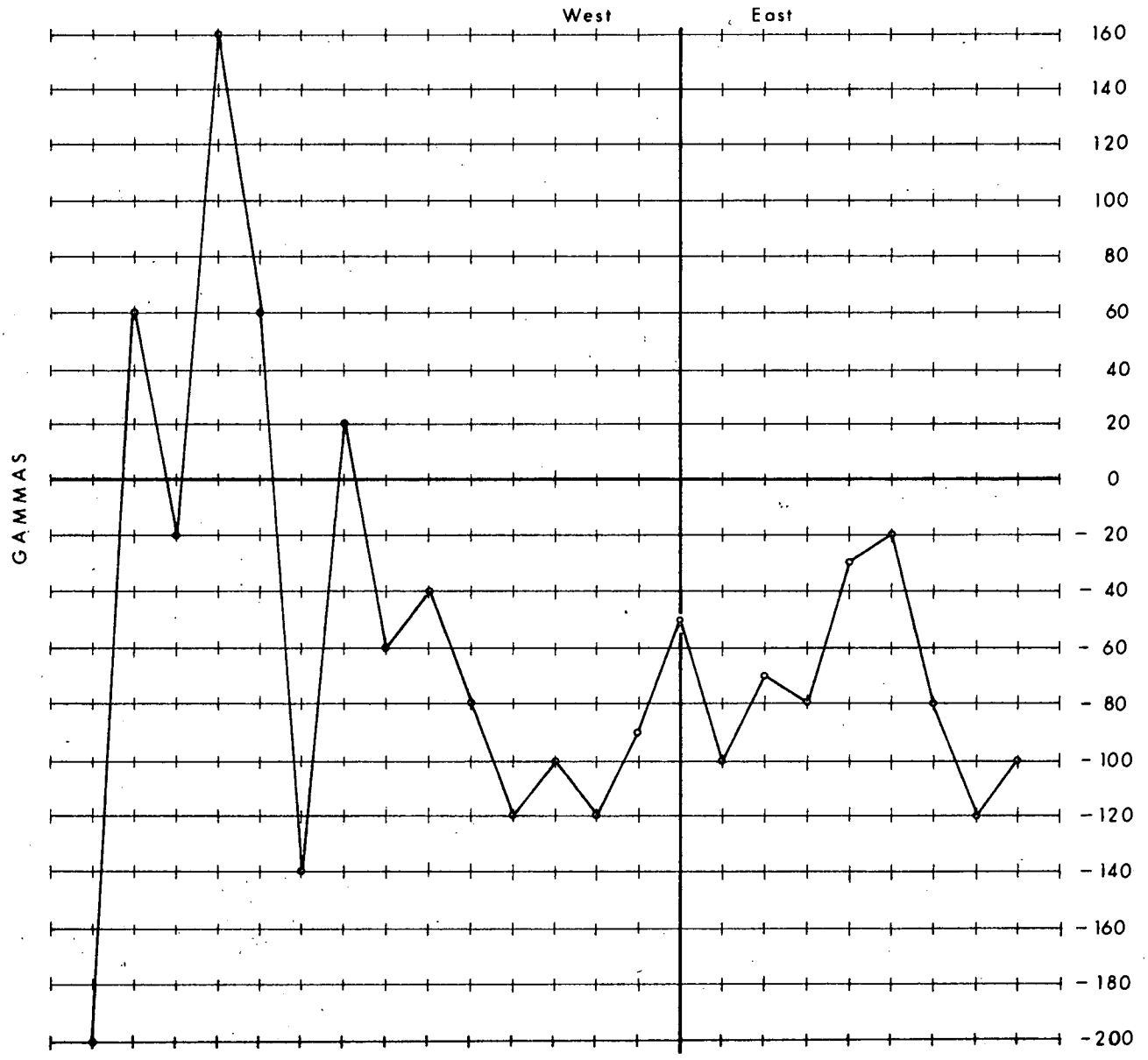
ANGUS G. MACKENZIE
MINING CONSULTANTS LIMITED
703 5th ST., CALGARY 2, ALBERTA

FOR
COLUMBIAN NORTHLAND EXPLORATION LTD.

MAGNETOMETER PROFILE
FORT CHIPEWYAN AREA
LAKE ATHABASCA, NORTHERN ALBERTA

DATE: SEPT., 1971	APPV'D: [redacted]
DWG. NO.:	SCALE: 1" = 1200'

LINE L6 + 00S



PROFESSIONAL ENGINEER ALBERTA
A. G. MacKenzie
RRRR

FIG. 30 19720501

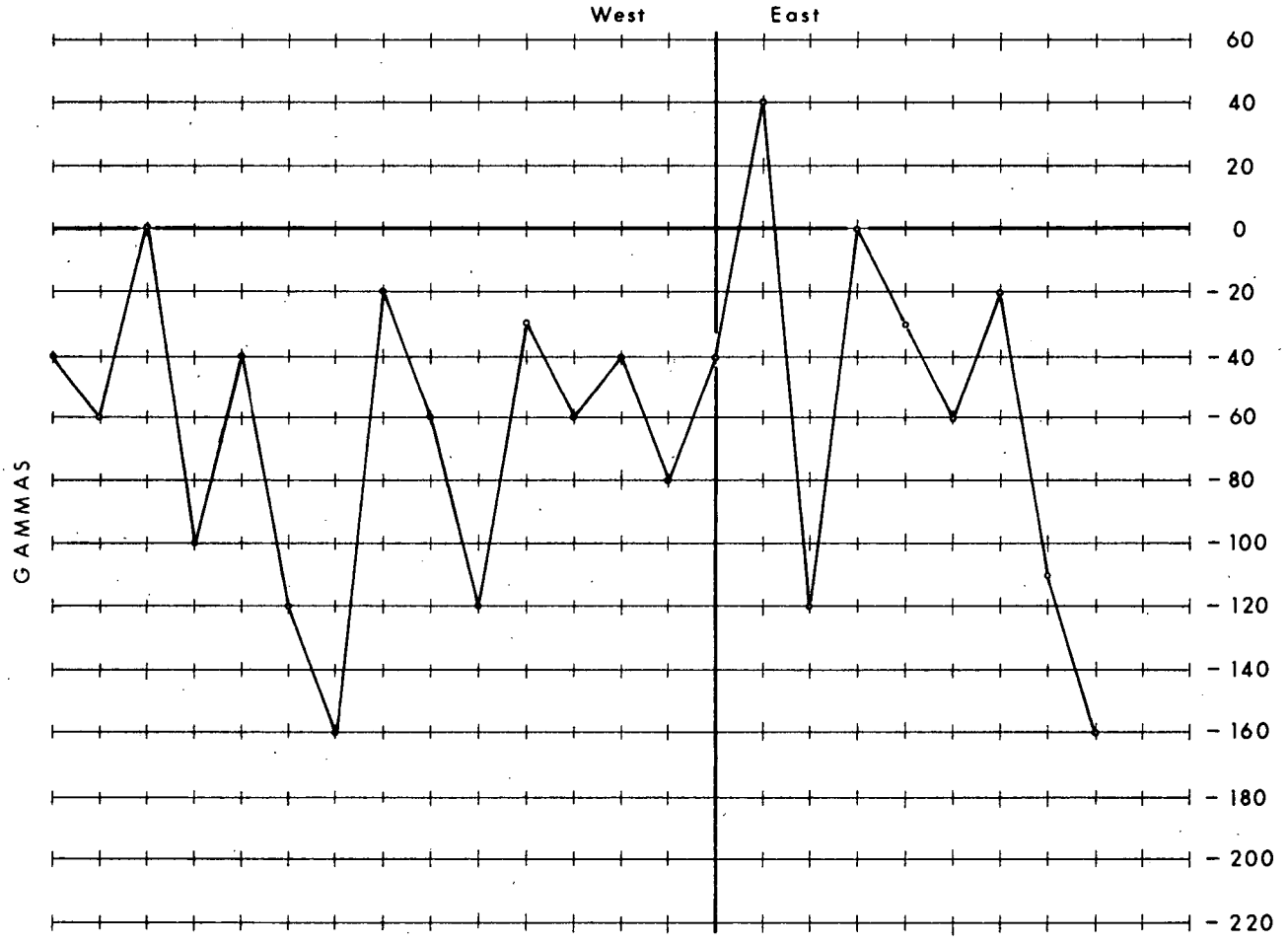
ANGUS G. MACKENZIE
MINING CONSULTANTS LIMITED
703 5th ST., CALGARY 2, ALBERTA

FOR
COLUMBIAN NORTHLAND EXPLORATION LTD.

MAGNETOMETER PROFILE
FORT CHIPEWYAN AREA
LAKE ATHABASCA, NORTHERN ALBERTA

DATE: SEPT., 1971	APPV'D [redacted]
DWG. NO.:	SCALE: 1" = 1200'

LINE L 0 + 00



PROFESSIONAL ENGINEER ALBERTA
A. G. MacKENZIE

FIG. 31 19720001

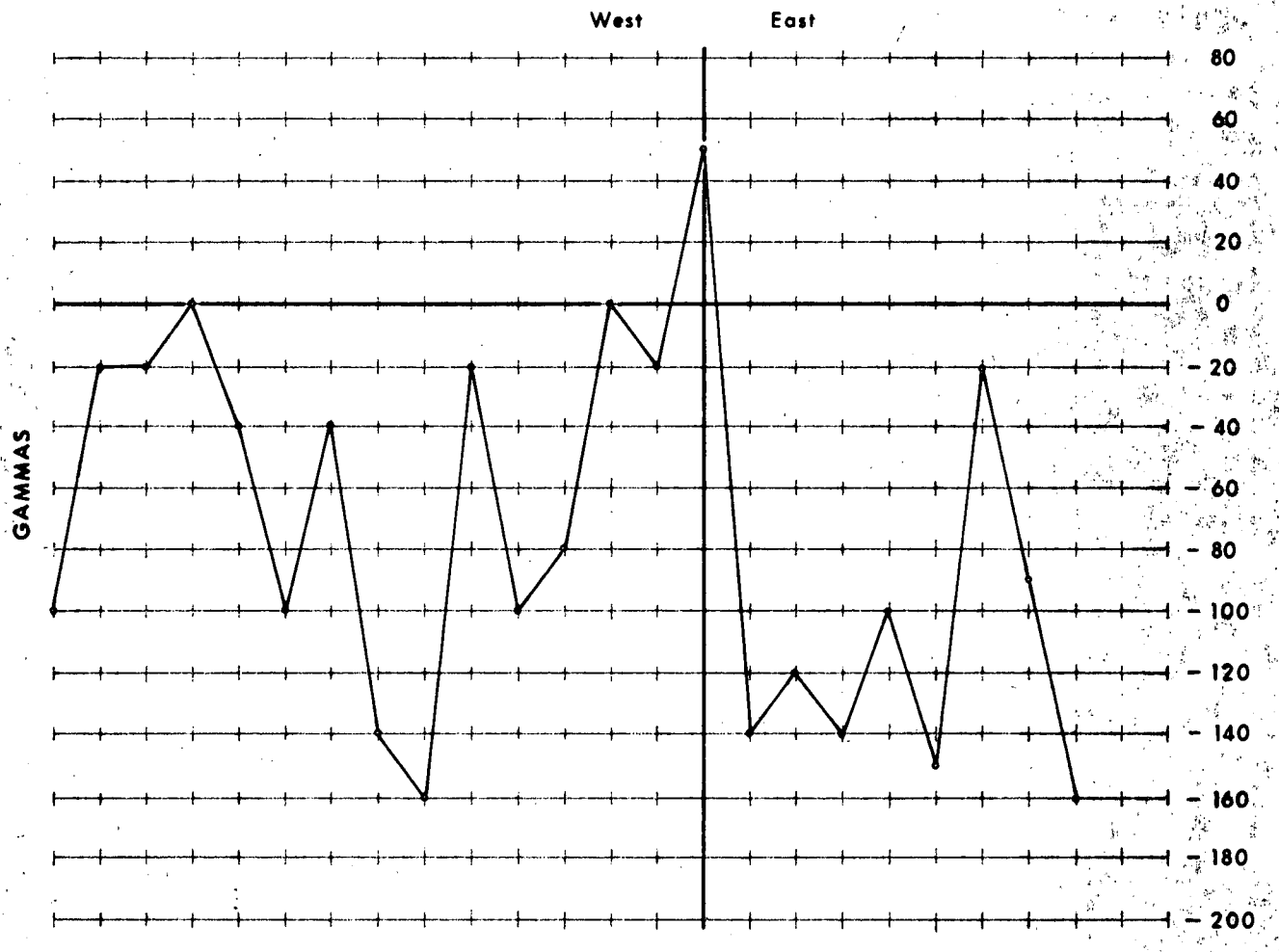
ANGUS G. MACKENZIE
MINING CONSULTANTS LIMITED
703 5th ST., CALGARY 2, ALBERTA

FOR
COLUMBIAN NORTHLAND EXPLORATION LTD.

MAGNETOMETER PROFILE
FORT CHIPEWYAN AREA
LAKE ATHABASCA, NORTHERN ALBERTA

DATE: SEPT., 1971	APPV'D: [redacted]
DWG. NO.:	SCALE: 1" = 1200'

LINE L6 +00N



PROFESSIONAL ENGINEER ALBERTA
A. G. MacKENZIE

FIG. 32 (1972000)

ANGUS G. MACKENZIE
MINING CONSULTANTS LIMITED
703 5th ST., CALGARY 2, ALBERTA

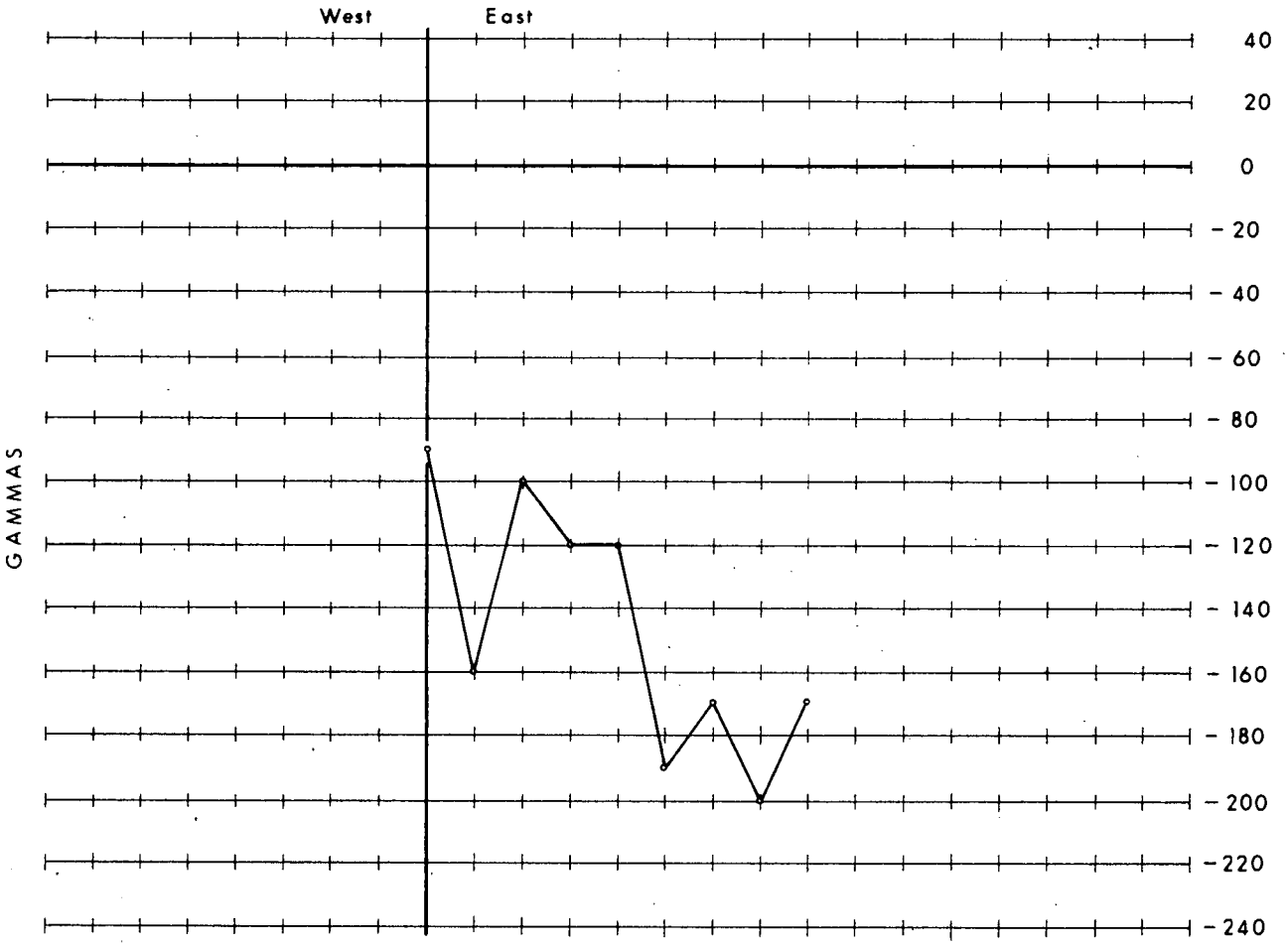
FOR
COLUMBIAN NORTHLAND EXPLORATION LTD.

MAGNETOMETER PROFILE

LAKE ATHABASCA, NORTHERN ALBERTA

DATE: SEPT., 1971	APPV'D: [redacted]
DWG. NO.:	SCALE: 1" = 1200'

LINE L12+00N



PROFESSIONAL ENGINEER ALBERTA
A. G. MacKENZIE

FIG. 33 . L972c0001

ANGUS G. MACKENZIE MINING CONSULTANTS LIMITED 703 5th ST., CALGARY 2, ALBERTA	
FOR COLUMBIAN NORTHLAND EXPLORATION LTD.	
MAGNETOMETER PROFILE FORT CHIPEWYAN AREA LAKE ATHABASCA, NORTHERN ALBERTA	
DATE: SEPT., 1971	APPV'D [redacted]
DWG. NO.:	SCALE: 1" = 1200'

LIST OF REFERENCES

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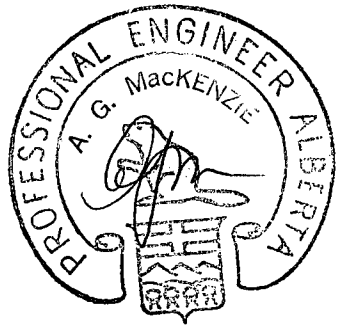
Geological Map 434A, Foster Lake Sheet (West Half), Northern Saskatchewan; Department of Mines and Resources, Ottawa.



DECLARATION OF QUALIFICATIONS

OF

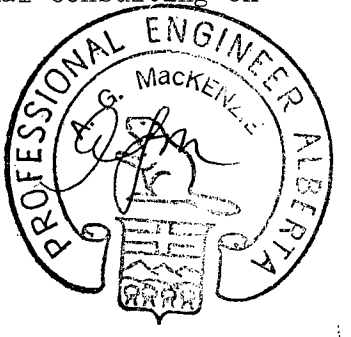
ANGUS G. MACKENZIE, P. ENG., MCIM

1. I, Angus G. MacKenzie, hereby certify that I am a Consulting Mining Engineer - Mining Geologist. I am a graduate (B. E.) in Mining and Metallurgy of Nova Scotia Technical College, Halifax, N. S. and I have taken post-graduate economic geology at Dalhousie University.

2. I have spent the past thirty years in the Mineral Industries as a Mining Engineer and/or Mining Geologist and have maintained responsible positions in these fields at mining properties in Newfoundland, Nova Scotia, Quebec, Ontario, Manitoba, Saskatchewan, Alberta, British Columbia, the Yukon and Northwest Territories. I have also had considerable experience in the U.S.A. and Mexico.

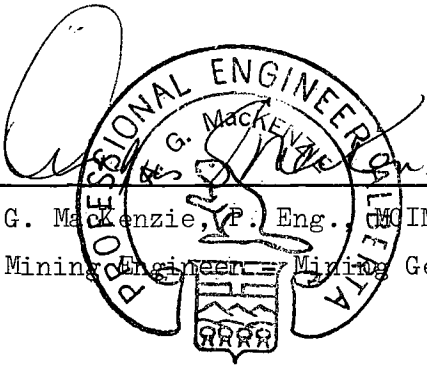
3. I am a Registered Professional Engineer in the Provinces of Alberta and Manitoba and the Yukon Territory and am licensed to practise in Saskatchewan and British Columbia. I have been registered in Nova Scotia, Quebec and in the State of Colorado, U.S.A.

4. I have no personal, financial interest directly or indirectly in the property herein reported on, nor in the securities of Columbian Northland Exploration Ltd. or any of its associated companies, nor do I expect to receive any such interest, other than normal consulting engineering fees.



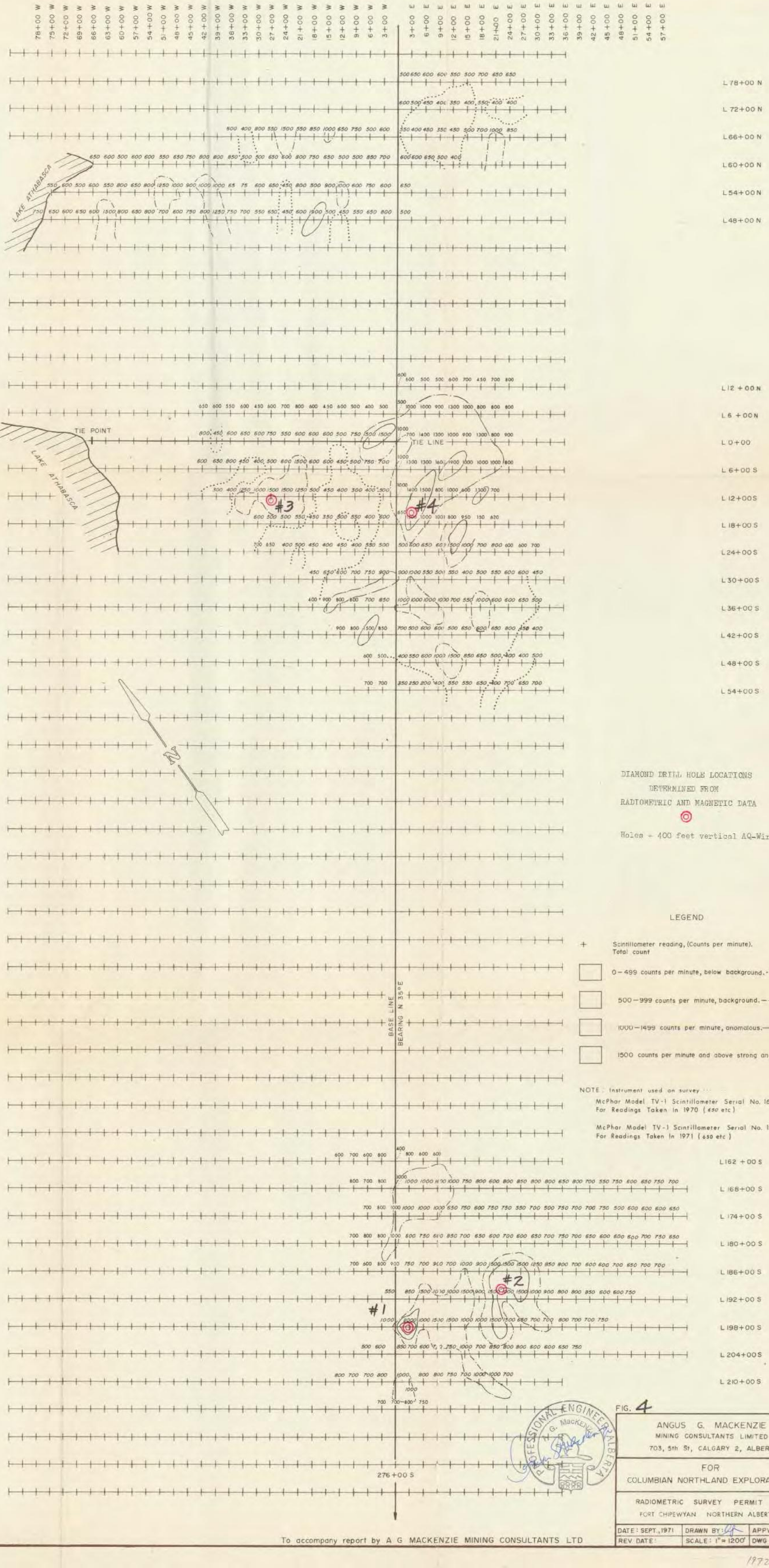
5. This report is the direct result of an examination by Angus G. MacKenzie Mining Consultants Ltd. over a period of approximately one week on Permit 73 of Columbian Northland Exploration Ltd., and a review of all pertinent literature for the area.

6. I have made this report at the request of Mr. H. Cowan, Vice-President of Columbian Northland Exploration Ltd., 1570 Elveden House, Calgary 2, Alberta.



Angus G. MacKenzie, P. Eng., MCIM
Consulting Mining Engineer - Mining Geologist

Calgary, Alberta.
January 11, 1972.



DIAMOND DRILL HOLE LOCATIONS
DETERMINED FROM
RADIOMETRIC AND MAGNETIC DATA

◎ Holes - 400 feet vertical AQ-Wireline

LEGEND

\+ Scintillometer reading, (Counts per minute).
Total count

0 – 499 counts per minute, below background. ····· 499

500 – 999 counts per minute, background. – – – 999

1000 – 1499 counts per minute, anomalous. ——— 1499

1500 counts per minute and above strong anomaly.

NOTE: Instrument used on survey ···

McPhar Model TV-1 Scintillometer Serial No. 169-32,
For Readings Taken In 1970 (650 etc)

McPhar Model TV-1 Scintillometer Serial No. 170-28,
For Readings Taken In 1971 (650 etc)

PROFESSIONAL ENGINEER ALBERTA
A. G. MacKenzie

FIG. 4

ANGUS G. MACKENZIE
MINING CONSULTANTS LIMITED
703, 5th St, CALGARY 2, ALBERTA.

FOR
COLUMBIAN NORTHLAND EXPLORATION LTD

RADIOMETRIC SURVEY PERMIT 73
FORT CHIPEWYAN NORTHERN ALBERTA

DATE: SEPT., 1971	DRAWN BY:	APPV'D:
REV. DATE:	SCALE: 1" = 1200'	DWG NO:

To accompany report by A G MACKENZIE MINING CONSULTANTS LTD

1972000/


LAKE ATHABASCA
TIE POINT
TIE LINE
BASE LINE
BEARING N 35° E
L 78+00 N
L 72+00 N
L66+00 N
L60+00 N
L54+00 N
L48+00 N
L12 +00 N
L6 +00 N
L 0+00
L 6+00 S
L 12+00 S
L 18+00 S
L 24+00 S
L 30+00 S
L 36+00 S
L 42+00 S
L 48+00 S
L 54+00 S
L162 +00 S
L 168+00 S
L 174+00 S
L 180+00 S
L 186+00 S
L 192+00 S
L 198+00 S
L 204+00 S
L 210+00 S
276+00 S
N
LEGEND
Scintillometer reading, (Counts per minute). Total count
0–499 counts per minute, below background. 499
500–999 counts per minute, background. 999
1000–1499 counts per minute, anomalous. 1499
1500 counts per minute and above strong anomaly.
NOTE: Instrument used on survey
McPhar Model TV-1 Scintillometer Serial No. 169-32, For Readings Taken In 1970 (650 etc)
McPhar Model TV-1 Scintillometer Serial No. 170-28, For Readings Taken In 1971 (650 etc)
FIG. 3
ANGUS G. MACKENZIE
MINING CONSULTANTS LIMITED
703, 5th St, CALGARY 2, ALBERTA.
FOR
COLUMBIAN NORTHLAND EXPLORATION LTD
RADIOMETRIC SURVEY PERMIT 73
FORT CHIPEWYAN NORTHERN ALBERTA
DATE: SEPT., 1971
DRAWN BY:
APPV'D:
REV DATE:
SCALE: 1" = 1200'
DWG NO:
PROFESSIONAL ENGINEER
ALBERTA
To accompany report by A G MACKENZIE MINING CONSULTANTS LTD

1972 0001

78+00 W 75+00 W 72+00 W 69+00 W 66+00 W 63+00 W 60+00 W 57+00 W 54+00 W 51+00 W 48+00 W 45+00 W 42+00 W 39+00 W 36+00 W 33+00 W 30+00 W 27+00 W 24+00 W 21+00 W 18+00 W 15+00 W 12+00 W 9+00 W 6+00 W 3+00 W

3+00 E 6+00 E 9+00 E 12+00 E 15+00 E 18+00 E 21+00 E 24+00 E 27+00 E 30+00 E 33+00 E 36+00 E 39+00 E 42+00 E 45+00 E 48+00 E 51+00 E 54+00 E 57+00 E

L 78+00 N
L 72+00 N
L 66+00 N
L 60+00 N
L 54+00 N
L 48+00 N
L 12+00 N
L 6+00 N
L 0+00
L 6+00 S
L 12+00 S
L 18+00 S
L 24+00 S
L 30+00 S
L 36+00 S
L 42+00 S
L 48+00 S
L 54+00 S

LAKE ATHABASCA

TIE POINT

LAKE ATHABASCA

N

BASE LINE
BEARING N 35°E

L 162+00 S
L 168+00 S
L 174+00 S
L 180+00 S
L 186+00 S
L 192+00 S
L 198+00 S
L 204+00 S
L 210+00 S

276+00 S

BASE STATION CALIBRATION

0+00 - 18/9/71 8am —— 0
" 4pm —— -40
- 19/9/71 7:30 am —— -40
" 4:30 pm —— -20
- 20/9/71 7:30 am —— -30
0+00 - 20/9/71 11 am —— -10

L 157+00 S - 21/9/71 8 am —— -40
" 5:30 pm —— -20
- 22/9/71 8 am —— -0
L 157+00 S - 22/9/71 12:15 pm —— +50

LEGEND

FAULT, FRACTURE, OR SHEAR ZONE INTERPRETED FROM MAGNETIC DATA

NOTE: Instrument used on survey ····· McPhar Magnetometer Model 700 Serial No. 6860

NOTE Contour Interval 10 Gammas

FIG. 2

PROFESSIONAL ENGINEER ALBERTA A. G. MacKenzie

ANGUS G. MACKENZIE
MINING CONSULTANTS LIMITED
703, 5th St, CALGARY 2, ALBERTA.

FOR
COLUMBIAN NORTHLAND EXPLORATION LTD

MAGNETOMETER SURVEY PERMIT 73 -
FORT CHIPEWYAN NORTHERN ALBERTA

DATE: SEPT., 1971	DRAWN BY:	APPV'D:
REV DATE:	SCALE: 1"=1200'	DWG NO:

To accompany report by A G MACKENZIE MINING CONSULTANTS LTD

19720001