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REPORT ON THE INDUCED POLARIZATION AND RESISTIVITY SURVEY ON THE NADINA CLAIM GROUP, OWEN LAKE AREA, B.C. FOR KENNCO EXPLORATIONS (WESTERN) LTD.

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ROBERT A. BELL, Ph. D.

and

D. B. SUTHERLAND, M.A.

NAME AND LOCATION OF PROPERTY:

NADINA CLAIM GROUP, OWEN LAKE AREA, 54°N 126°W; SW

DATE STARTED - AUGUST 7, 1967

DATE COMPLETED - AUGUST 14, 1967

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# MCPHAR GEOPHYSICS LIMITED

#### REPORT ON THE

INDUCED POLARIZATION

AND RESISTIVITY SURVEY

ON THE

NADINA CLAIM GROUP,

OWEN LAKE AREA, B. C.

#### FOR

#### KENNCO EXPLORATIONS (WESTERN) LTD.

#### 1. INTRODUCTION

At the request of Mr. H. W. Fleming, geophysicist for the Company, an induced polarization and resistivity survey has been carried out on the Nadina Claim Group in the Owen Lake Area of British Columbia, on behalf of Kennco Explorations (Western) Limited. The property is in the Omineca Mining Division, in the southwest quadrant of the one degree quadrilateral whose southeast corner is at 54°N-126°W.

The area of interest is reportedly underlain by an acid intrusive complex near the contact with Hazelton Group volcanic and sedimentary rocks. Disseminated pyrite with minor chalcopyrite is commonly present in the intrusive and there are also narrow veins containing galena and sphalerite.

The geophysical survey was performed during the summer

of 1967 using a McPhar frequency type IP system. Lines were run northeast-southwest at 600 foot intervals, with electrode spacings of 200 feet. The purpose of the survey was to outline the areas of metallic mineralization.

#### 2. PRESENTATION OF RESULTS

The Induced Polarization and Resistivity results are shown on the following data plots in the manner described in the notes preceding this report.

Line	spreads	Dwg. No.
170+00W	200'	IP 2739-1
176+00W	2001	IP 2739-2
182+00W	2001	IP 2739-3
188+00W	200'	IP 2739-4
194+00W	400'	IP 2739-5
194+00W	200'	IP 2739-6
200+00W	200'	IP 2739-7
206+00W	200'	IP 2739-8
212+00W	200'	IP 2739-9
220+00W	200'	IP 2739-10
176+00N	200'	IP 2739-11

Enclosed with this report is Dwg. Misc. 4332, a plan map of the grid at a scale of 1" = 400'. The definite and possible induced polarization anomalies are indicated by solid and broken bars respectively on this plan map as well as the data plots. These bars represent the surface projection of the anomalous zones as interpreted from the location of the transmitter and receiver electrodes when the anomalous values were measured.

Since the induced polarization measurement is essentially an averaging process, as are all potential methods, it is frequently difficult to exactly pinpoint the source of an anomaly. Certainly, no anomaly can be located with more accuracy than the spread length; i. e. when using 200' spreads the position of a narrow sulphide body can only be determined to lie between two stations 200' apart. In order to locate sources at some depth, larger spreads must be used, with a corresponding increase in the uncertainties of location. Therefore, while the center of the indicated anomaly probably corresponds fairly well with source, the length of the indicated anomaly along the line should not be taken to represent the exact edges of the anomalous material.

#### 3. DISCUSSION OF RESULTS

The geophysical results on the Nadina Grid are characterized by uniformly low resistivities and moderately high background IP effects, suggesting minor disseminated sulphides throughout most of the area. On several lines there are definite increases in the magnitude of the IP effects indicating increased amounts of metallic mineralization.

#### Line 170+00W

Anomalous effects were measured from about station 226+00N to 238+00N with a stronger section at moderate depth from 229+00N to 233+00N. There is also a probable deep, narrow source at 242+00N to

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#### 244+00N.

#### Line 176+00W

On this line the IP effects are somewhat weaker and the source appears to be deeper, particularly at the south end of the traverse.

#### Lines 182+00W and 188+00W

The anomalies are weaker again on these lines.

#### Line 194+00W

This line was surveyed with both 400 foot as well as 200 foot electrode intervals. With 400 foot intervals the entire line is anomalous, with the strongest sections at 218+00N to 220+00N and 226+00N to 234+00N. Similar results were obtained with 200 foot intervals, except that the stronger section from 226+00N to 232+00N now appears to be at considerable depth.

The section from 240+00N to 250+00N may also be anomalous as the traverse does not extend far enough to establish the background level.

#### Line 200+00W

Here there is a definite anomaly at 214+00N although the pattern is not complete. A shallow, moderate magnitude anomaly occurs at 225+00N to 229+00N with weaker extensions to 216+00N and 233+00N. There is a marked increase in the M. F. values on the wide separations from about 238+00N to 244+00N.

#### Line 206+00W

The IP effects are generally weaker on this traverse, except at 234+00N, although it did not extend far enough south to check the stronger features on the preceding line.

#### Line 212+00W

Anomalous values were measured throughout most of this traverse, with a fairly strong section at moderate depth from 244+00N to 248+00N.

#### Line 220+00W

The Metal Factor values are appreciably lower than on the preceding line but there is still an anomalous zone from 260+00N to at least 236+00N.

#### Line 176+00N

Anomalous effects were measured from 242+00W to 272+00W, including the largest values encountered during the survey at 264+00W to 266+00W. Sections of the line also show quite low background IP effects e.g. 230+00W to 236+00W.

#### 4. SUMMARY AND RECOMMENDATIONS

Throughout the Nadina Grid the resistivity level is uniformly low (less than 100) and the background IP effects are moderately high. The results are suggestive of very extensive areas of minor metallic mineral content. Locally there are stronger anomalies but these

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sections cannot be readily correlated into throughgoing zones. If surface mapping indicates a positive correlation between copper content and total sulphide content, then a few test holes should be drilled on the stronger IP anomalies, as listed below:

1)	Line 176+00N	-	264+00W - 266+00W
2)	Line 170+00W	***	232+00N

- 3) Line 200+00W 214+00N
- 4) Line 212+00W 246+00N

#### McPHAR GEOPHYSICS LIMITED

lert a Bill Robert A. Bell, Sund.L. Geologist.

D. B. Sutherland, Geophysicist.

Dated: September 26, 1967

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#### ASSESSMENT DETAILS

PROPERTY: Nadina Claim Group	þ	MINING DIVISION:		
SPONSOR: Kennco Explorations (Western) Ltd.		<b>PROVINCE:</b> Britis	<b>h Columbia</b>	:
LOCATION: Owen Lake Area				
TYPE OF SURVEY: Induced Pola zation	ıri-			
OPERATING MAN DAYS:	<b>32.</b> 5	DATE STARTED: A	ugust 7, 1967	
EQUIVALENT 8HR. MAN DAYS:	<b>48.5</b> <u>71</u>	DATE FINISHED: A	ugust 14, 1967	
CONSULTING MAN DAYS:	2	NUMBER OF STAT	IONS: 210	
DRAUGHTING MAN DAYS:	4	NUMBER OF REAL	DINGS: 1304	
TOTAL MAN DAYS:	54.5	MILES OF LINE SU	JRVEYED: 8.4	

#### CONSULTANTS:

R.A. Bell, 50 Hemford Crescent, Don Mills, Ontario. D.B. Sutherland, Apt. 2518, 47 Thorncliffe Park Drive, Toronto 17, Ontario.

#### FIELD TECHNICIANS:

G. Trefananko, 651 Sheppard Avenue West, Toronto, Ontario.
T. Yeo, Box 355, Fort Saskatchewan, Alberta.
3 Helpers - supplied by client.

#### DRAUGHTSMEN:

D. Jenkins, 2911, Bayview Avenue, Suite 117D, Willowdale, Ontario. V. Young, 320 Tweedsmuir Avenue, Apt. 507, Toronto 10, Ontario.

#### MCPHAR GEOPHYSICS LIMITED

Robert a. Bell

Robert A. Bell, Lar. U.L. Geologist.

Dated: September 26, 1967

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# SUMMARY OF COST

Nadina Claim Group

#### Crew

6 1/2 days Operating	@ \$215.00/day	\$1, 397. 50
1 1/2 days Travel	@ \$ 75.00/day	112.50

#### Expenses

\$22.	00
9.	87
15.	01
	43
	15.

47.31

#### \$1,557.31

### MCPHAR GEOPHYSICS LIMITED

Robert A. Bell, Geologist. Rev. N.L.

## Dated: September 26, 1967

City / Declared before me at the Auncanan, in the bf Province of Eridish Columbia, this 'day of December 1967, A.D. her for taking Affidavits within British Columbia or A Commis A Notacy ublic in and for the Province of British Columbia, SUB - MINING RECORDER

### MCPHAR GEOPHYSICS LIMITED

# NOTES ON THE THEORY OF INDUCED POLARIZATION

AND THE METHOD OF FIELD OPERATION

Induced Polarization as a geophysical measurement refers to the blocking action or polarization of metallic or electronic conductors in a medium of ionic solution conduction.

This electro-chemical phenomenon occurs wherever electrical current is passed through an area which contains metallic minerals such as base metal sulphides. Normally, when current is passed through the ground, as in resistivity measurements, all of the conduction takes place through ions present in the water content of the rock, or soil, i. e. by ionic conduction. This is because almost all minerals have a much higher specific resistivity than ground water. The group of minerals commonly described as "metallic", however, have specific resistivities much lower than ground waters. The induced polarization effect takes place at those interfaces where the mode of conduction changes from ionic in the solutions filling the interstices of the rock to electronic in the metallic minerals present in the rock.

The blocking action or induced polarization mentioned above, which depends upon the chemical energies necessary to allow the ions to give up or receive electrons from the metallic surface, increases with the time that a d.c. current is allowed to flow through the rock; i. e. as ions pile up against the metallic interface the resistance to current flow increases. Eventually, there is enough polarization in the form of excess ions at the interfaces to effectively stop all current flow through the metallic particle. This polarization takes place at each of the infinite number of solution-metal interfaces in a mineralized rock.

When the d.c. voltage used to create this d.c. current flow is cut off, the Coulomb forces between the charged ions forming the polarization cause them to return to their normal position. This movement of charge creates a small current flow which can be measured on the surface of the ground as a decaying potential difference.

From an alternate viewpoint it can be seen that if the direction of the current through the system is reversed repeatedly before the polarization occurs, the effective resistivity of the system as a whole will change as the frequency of the switching is changed. This is a consequence of the fact that the amount of current flowing through each metallic interface depends upon the length of time that current has been passing through it in one direction.

The values of the "metal factor" or "M.F." are a measure of the amount of polarization present in the rock mass being surveyed. This parameter has been found to be very successful in mapping areas of sulphide mineralization, even those in which all other geophysical methods have been unsuccessful. The induced polarization measurement is more sensitive to sulphide content than other electrical measurements

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because it is much more dependent upon the sulphide content. As the sulphide content of a rock is increased, the "metal factor" of the rock increases much more rapidly than the resistivity decreases.

Because of this increased sensitivity, it is possible to locate and outline zones of less than 10% sulphides that can't be located by E. M. Methods. The method has been successful in locating the disseminated "porphyry copper" type mineralization in the Southwestern United States.

Measurements and experiments also indicate that it should be possible to locate most massive sulphide bodies at a greater depth with induced polarization than with E. M.

Since there is no I. P. effect from any conductor unless it is metallic, the method is useful in checking E. M. anomalies that are suspected of being due to water filled shear zones or other ionic conductors. There is also no effect from conductive overburden, which frequently confuses E. M. results. It would appear from scale model experiments and calculations that the apparent metal factors measured over a mineralized zone are larger if the material overlying the zone is of low resistivity.

Apropos of this, it should be stated that the induced polarization measurements indicate the total amount of metallic constituents in the rock. Thus all of the metallic minerals in the rock, such as pyrite, as well as the ore minerals chalcopyrite, chalcocite, galena, etc. are responsible for the induced polarization effect. Some

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oxides such as magnetite, pyrolusite, chromite, and some forms of hematite also conduct by electrons and are metallic. All of the metallic minerals in the rock will contribute to the induced polarization effect measured on the surface.

In the field procedure, measurements on the surface are made in a way that allows the effects of lateral changes in the properties of the ground to be separated from the effects of vertical changes in the properties. Current is applied to the ground at two points a distance (X) apart. The potentials are measured at two other points (X) feet apart, in line with the current electrodes. The distance between the nearest current and potential electrodes is an integer number (N) times the basic distance (X).

The measurements are made along a surveyed line, with a constant distance (NX) between the nearest current and potential electrodes. In most surveys, several traverses are made with various values of (N); i. e. (N) = 1, 2, 3, 4, etc. The kind of survey required (detailed or reconnaissance) decides the number of values of (N) used.

In plotting the results, the values of the apparent resistivity and the apparent metal factor measured for each set of electrode positions are plotted at the intersection of grid lines, one from the center point of the current electrodes and the other from the center point of the potential electrodes. The resistivity values are plotted above the line and the metal factor values below. The lateral displacement of a given value is determined by the location along the survey

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line of the center point between the current and potential electrodes. The distance of the value from the line is determined by the distance (NX) between the current and potential electrodes when the measurement was made.

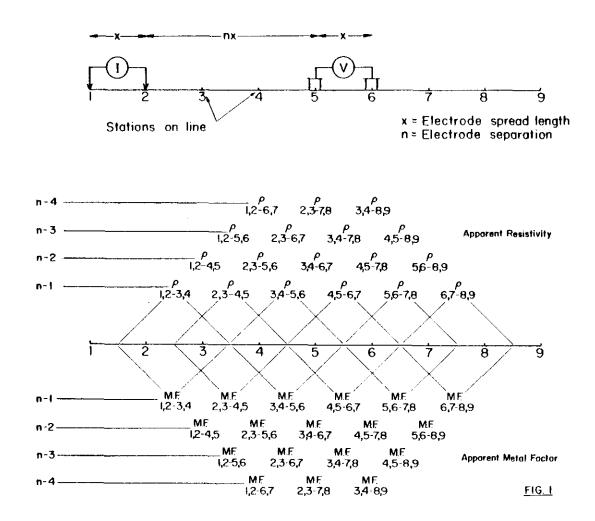
The separation between sender and receiver electrodes is only one factor which determines the depth to which the ground is being sampled in any particular measurement. These plots then, when contoured, are not section maps of the electrical properties of the ground under the survey line. The interpretation of the results from any given survey must be carried out using the combined experience gained from field, model and theoretical investigations. The position of the electrodes when anomalous values are measured must be used in the interpretation.

In the field procedure, the interval over which the potential differences are measured is the same as the interval over which the electrodes are moved after a series of potential readings has been made. One of the advantages of the induced polarization method is that the same equipment can be used for both detailed and reconnaissance surveys merely by changing the distance (X) over which the electrodes are moved each time. In the past, intervals have been used ranging from 100 feet to 1000 feet for (X). In each case, the decision as to the distance (X) and the values of (N) is largely determined by the expected size of the mineral deposit being sought, the size of the expected anomaly and the speed with which it is desired to progress.

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The diagram in Figure 1 below demonstrates the method used in plotting the results. Each value of the apparent resistivity and the apparent "Metal factor" is plotted and identified by the position of the four electrodes when the measurement was made. It can be seen that the values measured for the larger values of (n) are plotted farther from the line indicating that the thickness of the layer of the earth that is being tested is greater than for the smaller values of (n); i. e. the depth of the measurement is increased.

> METHOD USED IN PLOTTING DIPOLE-DIPOLE INDUCED POLARIZATION AND RESISTIVITY RESULTS



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#### CERTIFICATE

I, Robert Alan Bell, of the City of Toronto, Province of Ontario, do hereby certify that:

1. I am a geologist residing at 50 Hemford Crescent, Don Mills, (Toronto) Ontario.

2. I am a graduate of the University of Toronto in Physics and Geology with the degree of Bachelor of Arts (1949); and a graduate of the University of Wisconsin in Economic Geology with the degree of Ph. D. (1953).

3. I am a member of the Society of Economic Geologists and a fellow of the Geological Association of Canada.

4. I have been practising my profession for over fifteen years.

5. I have no direct or indirect interest, nor do I expect to receive any interest directly or indirectly, in the property or securities of Kennco Explorations (Western) Ltd. or any affiliate.

6. The statements made in this report are based on a study of published geological literature and unpublished private reports.

7. Permission is granted to use in whole or in part for assessment and qualification requirements but not for advertising purposes.

#### Dated at Toronto

This 26th day of September 1967.

Robert A. Bell, Ph. D.

#### CERTIFICATE

I, Don Benjamin Sutherland of the City of Toronto, Province of Ontario, do hereby certify that:

1. I am a geophysicist residing at 47 Thorncliffe Park Drive, Apartment 2518, Toronto 17, Ontario.

2. I am a graduate of the University of Toronto in Physics and Geology with the degree of Bachelor of Arts (1954); and a graduate of the University of Toronto in Physics with the degree of Master of Arts (1955).

3. I am a member of the Society of Exploration Geophysicists and a member of the European Association of Exploration Geophysicists.

4. I have been practising my profession for over eleven years.

5. I have no direct or indirect interest, nor do I expect to receive any interest directly or indirectly, in the property or securities of Kennco Explorations (Western) Ltd. or any affiliate.

6. The statements made in this report are based on a study of published geological literature and unpublished private reports.

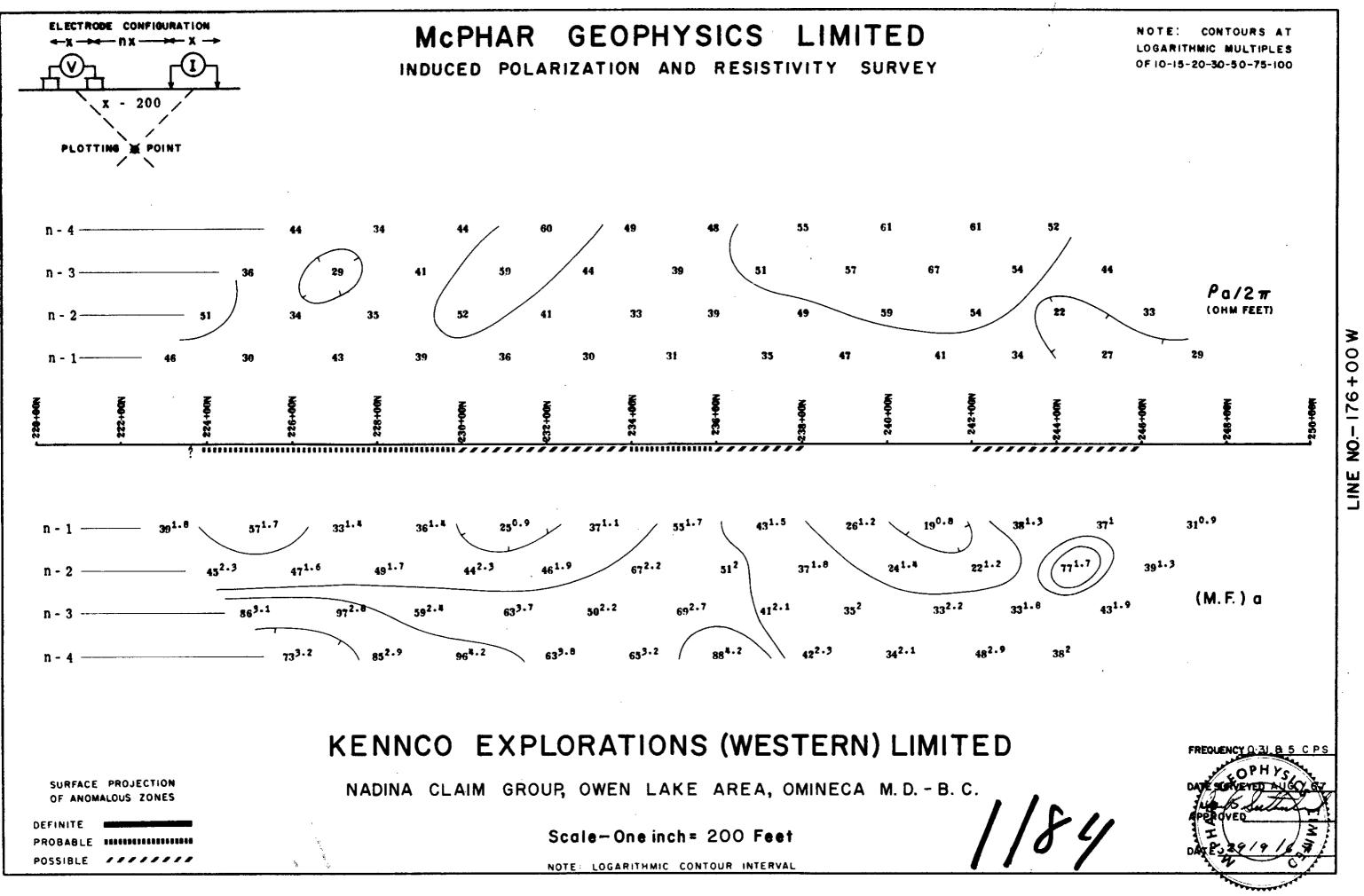
7. Permission is granted to use in whole or in part for assessment and qualification requirements but not for advertising purposes.

Dated at Toronto

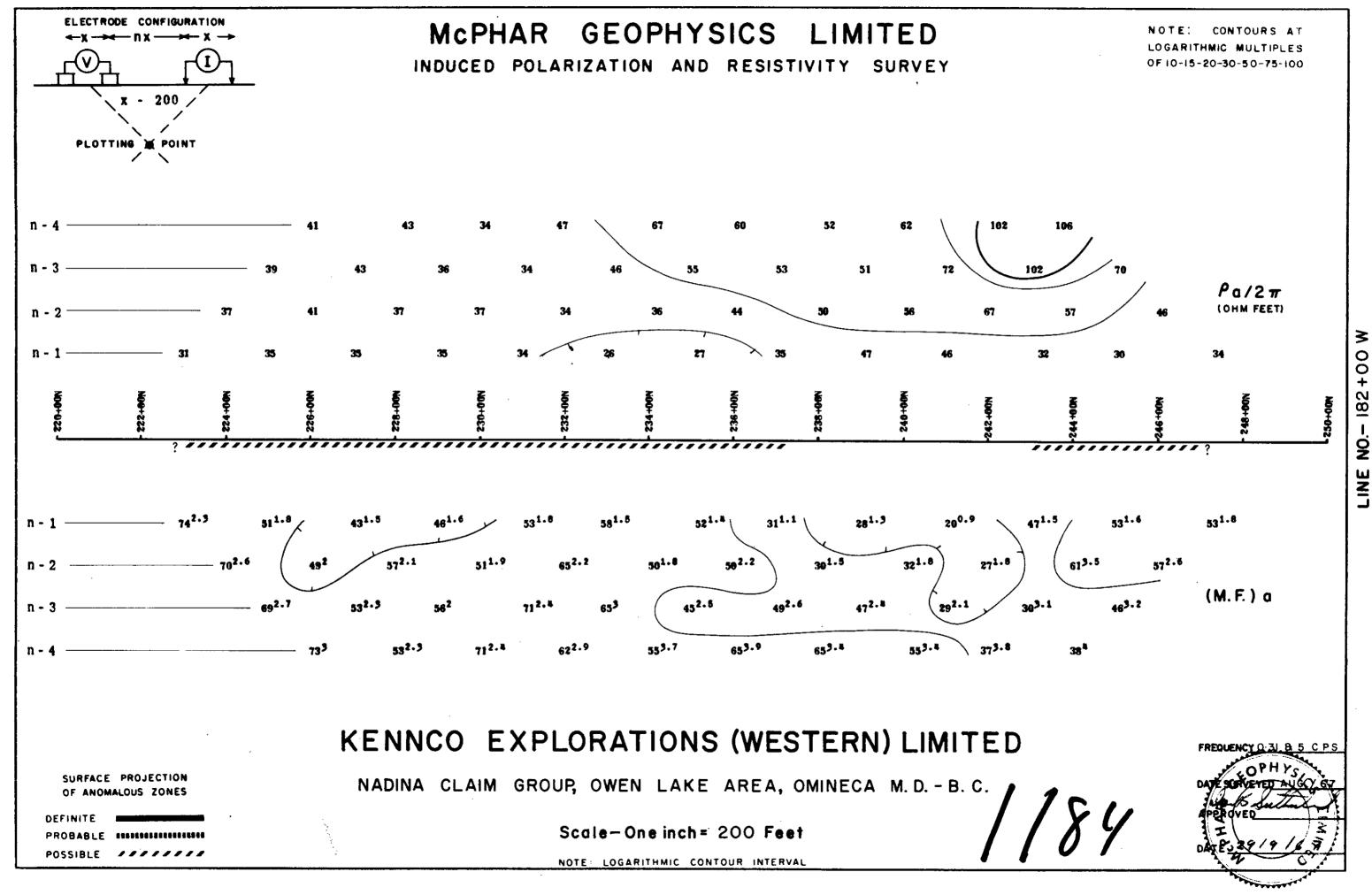
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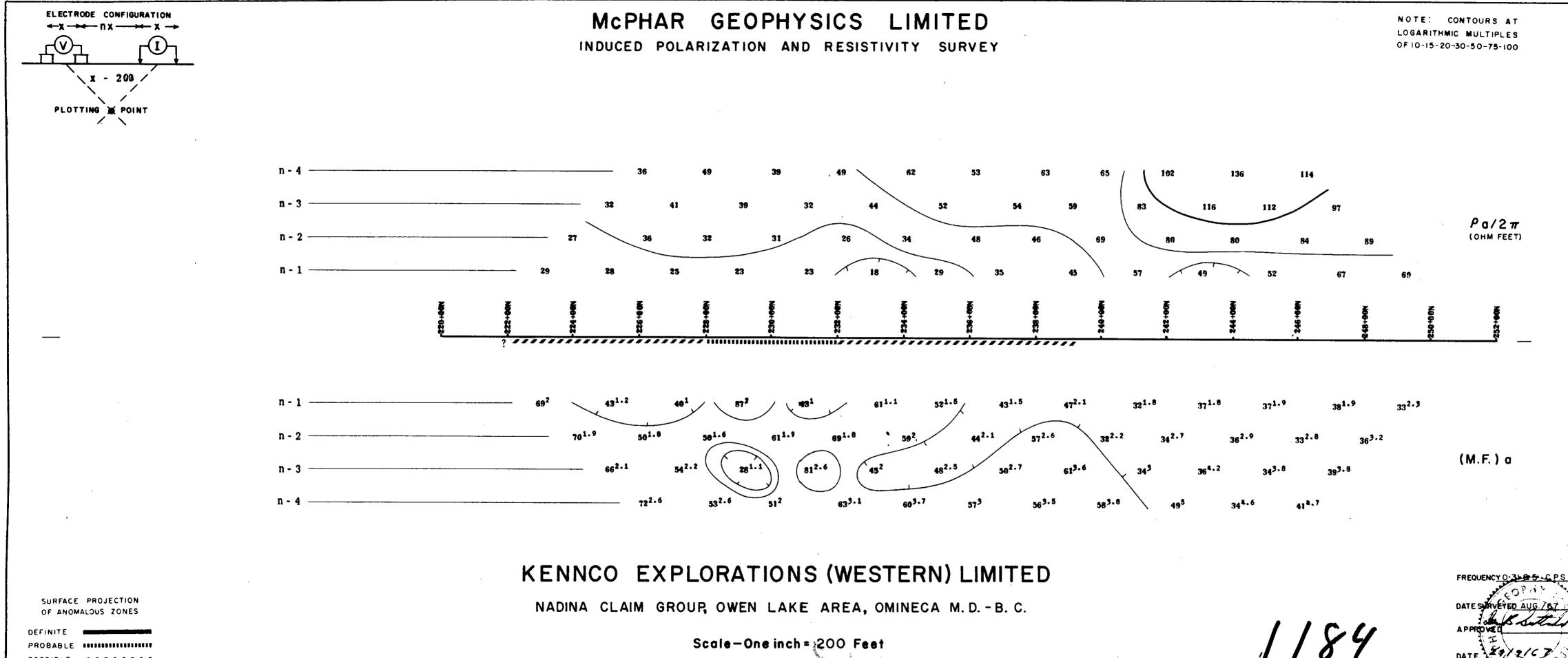
This 26th day of September 1967.

Don B. Sutherland, M.A.









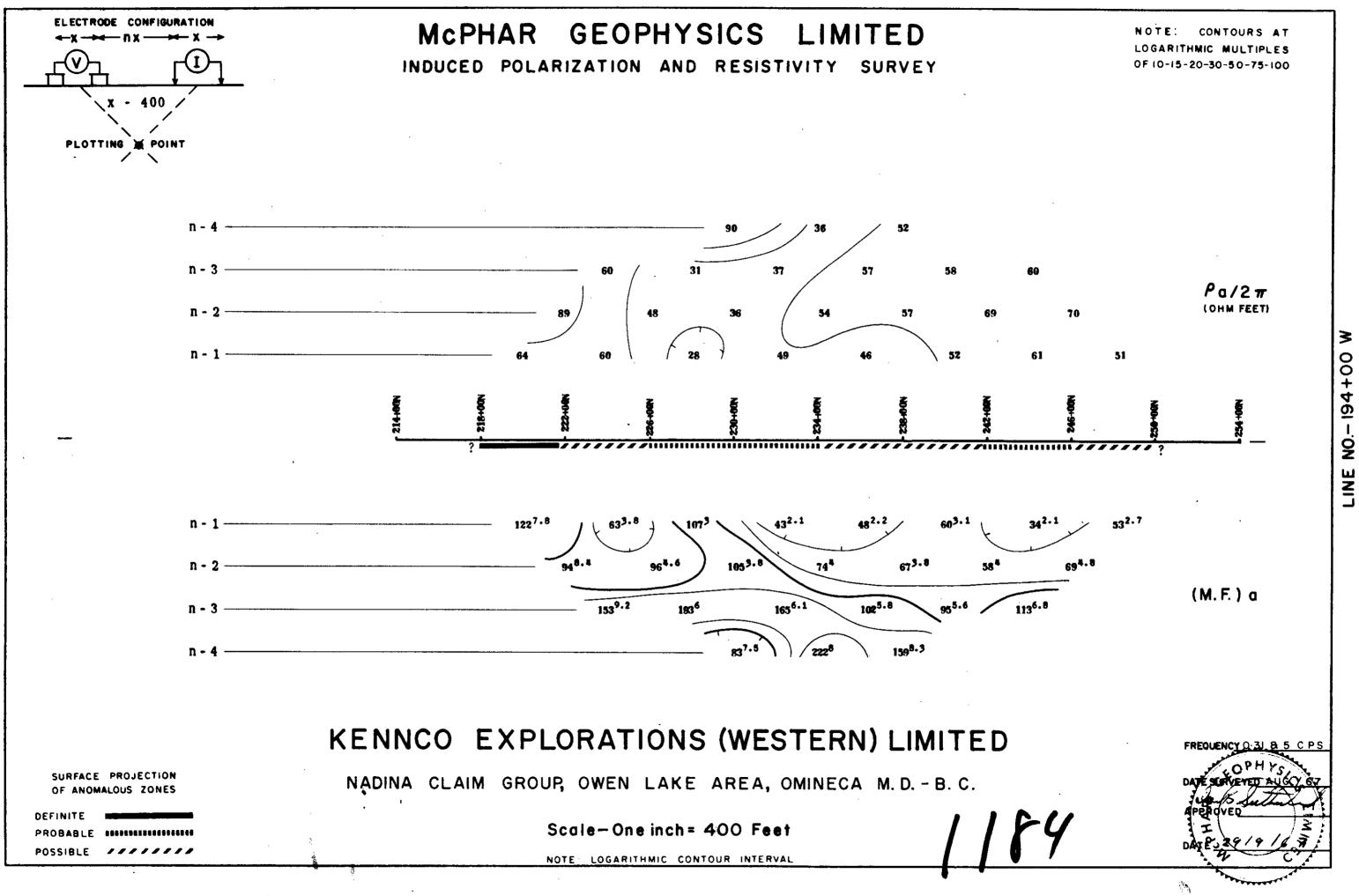
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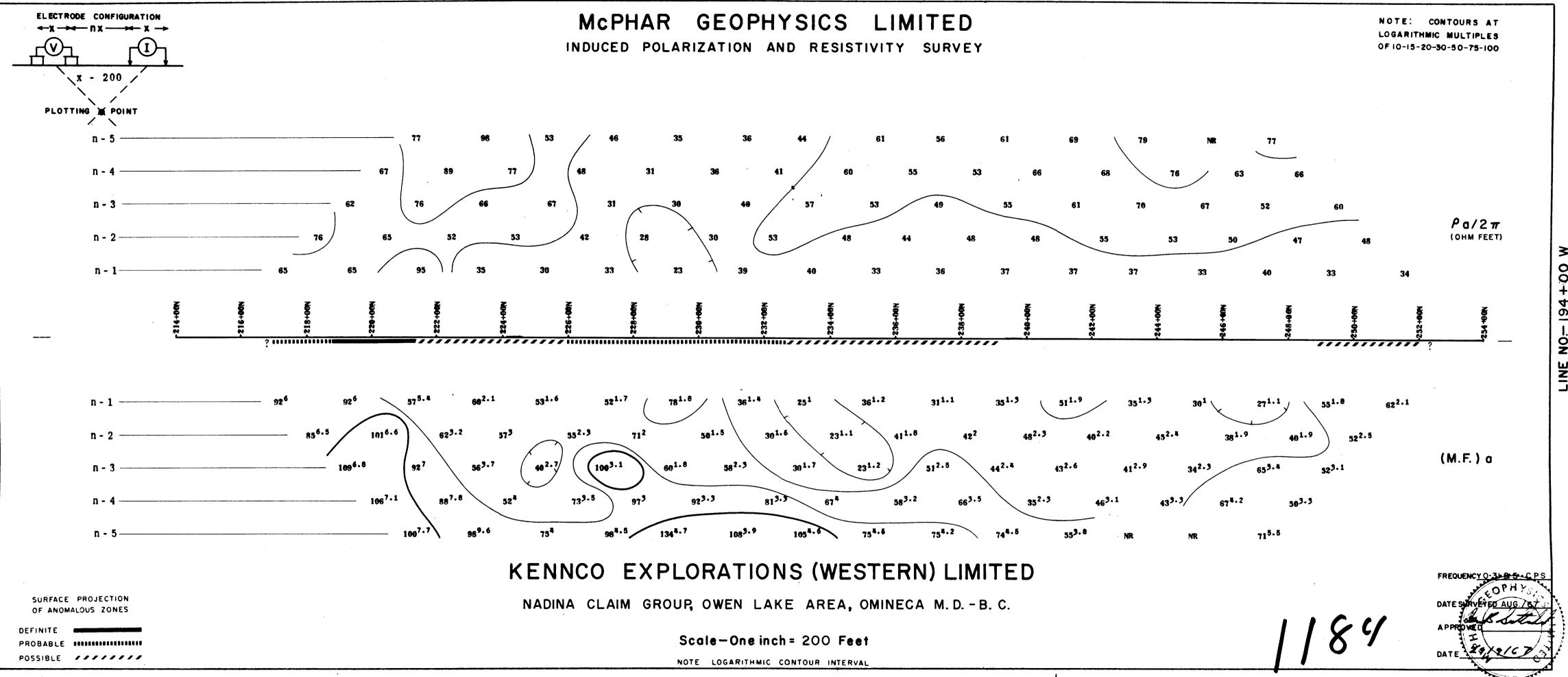
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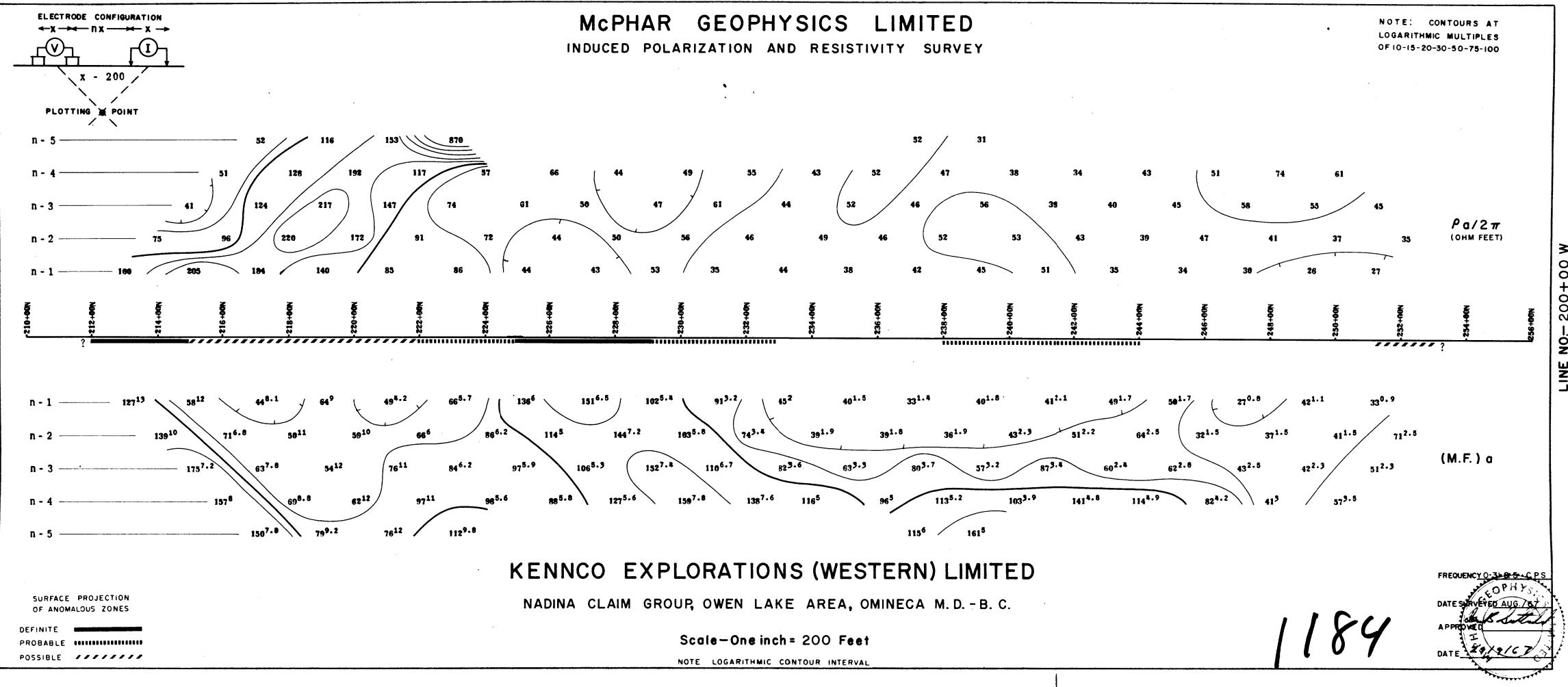
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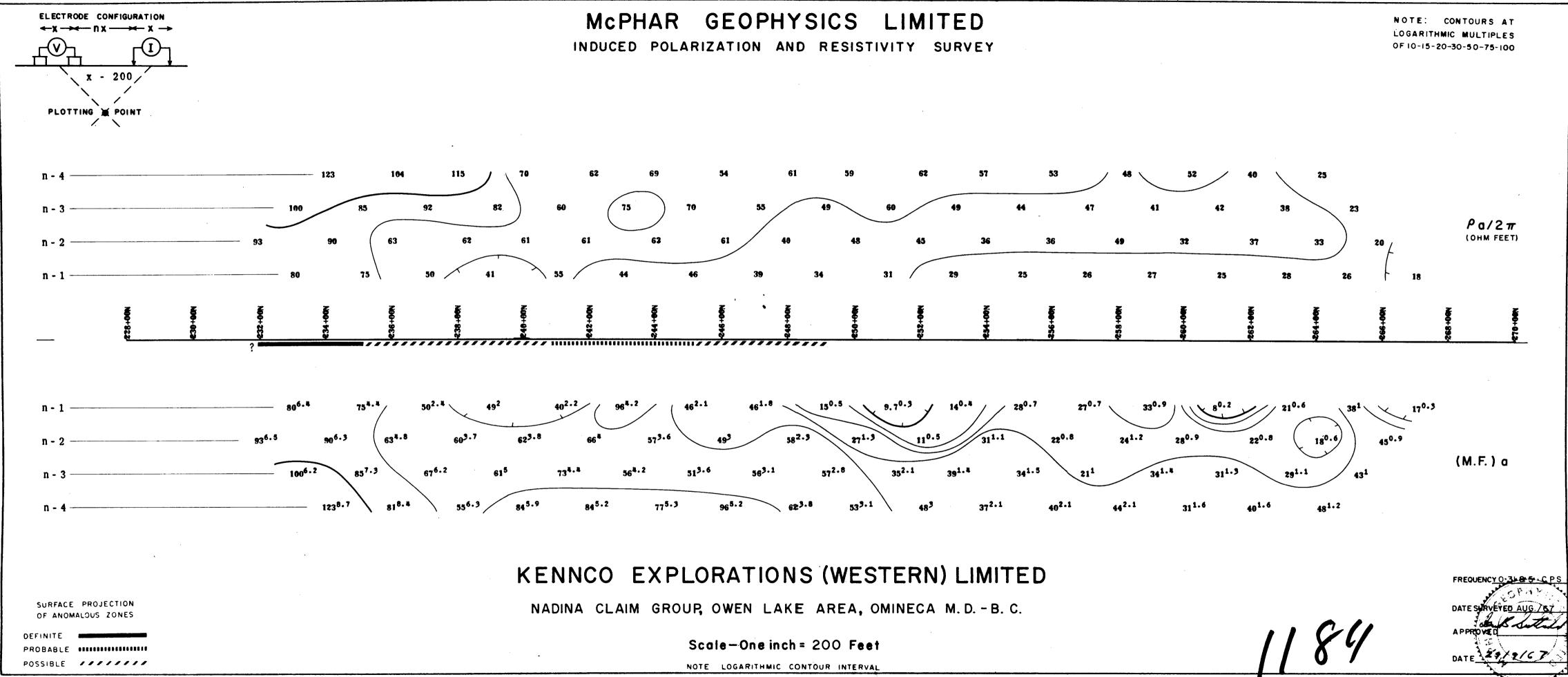
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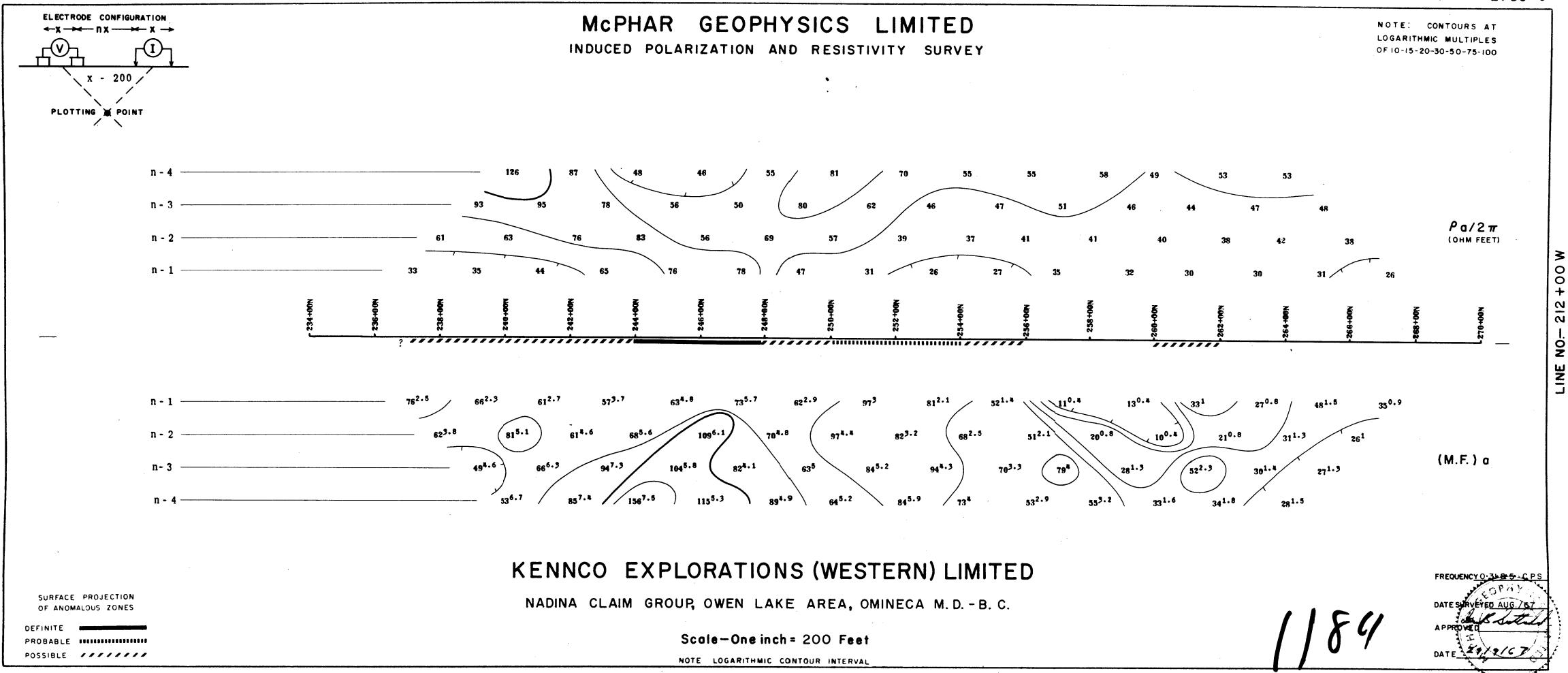
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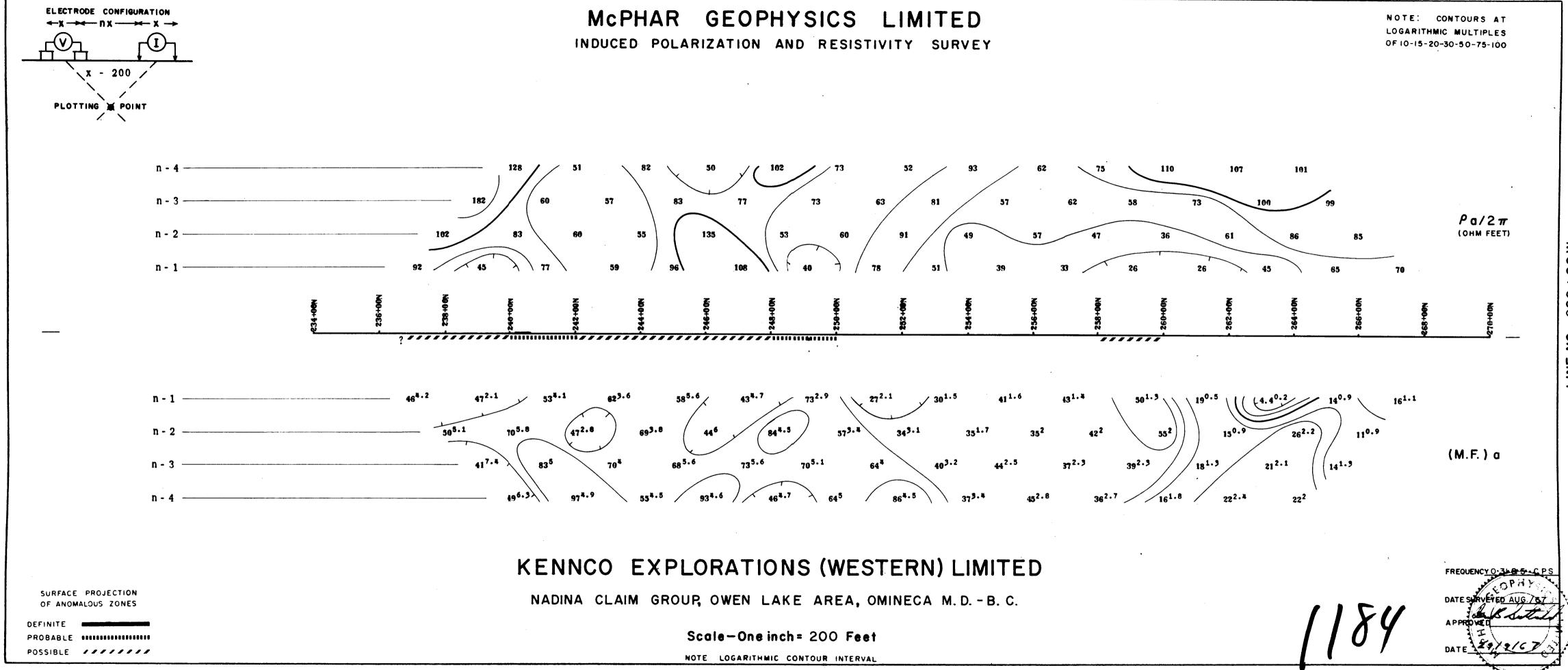
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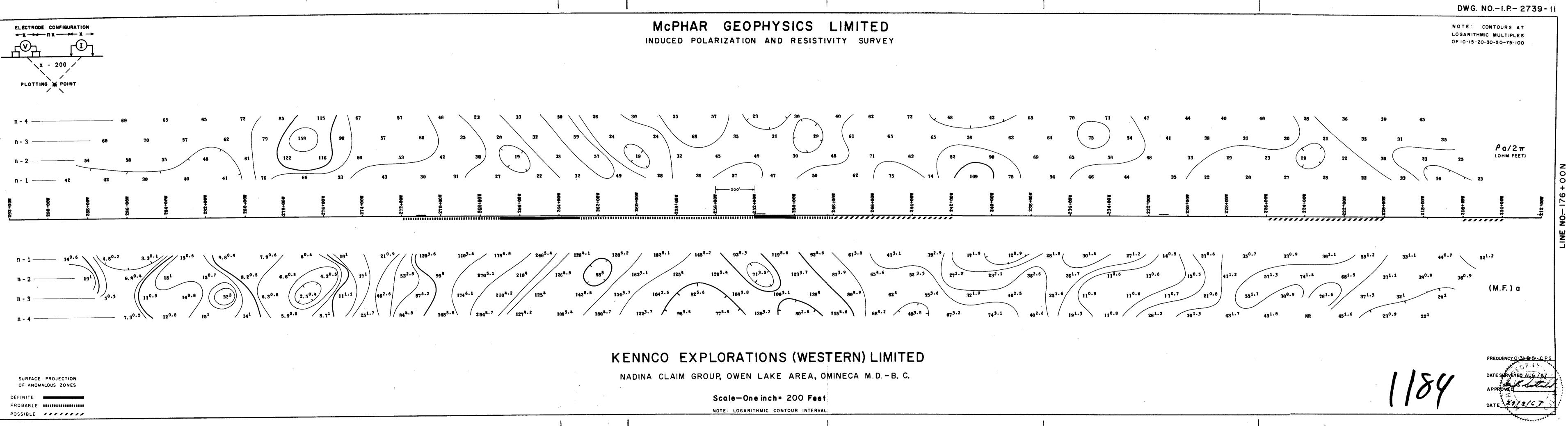
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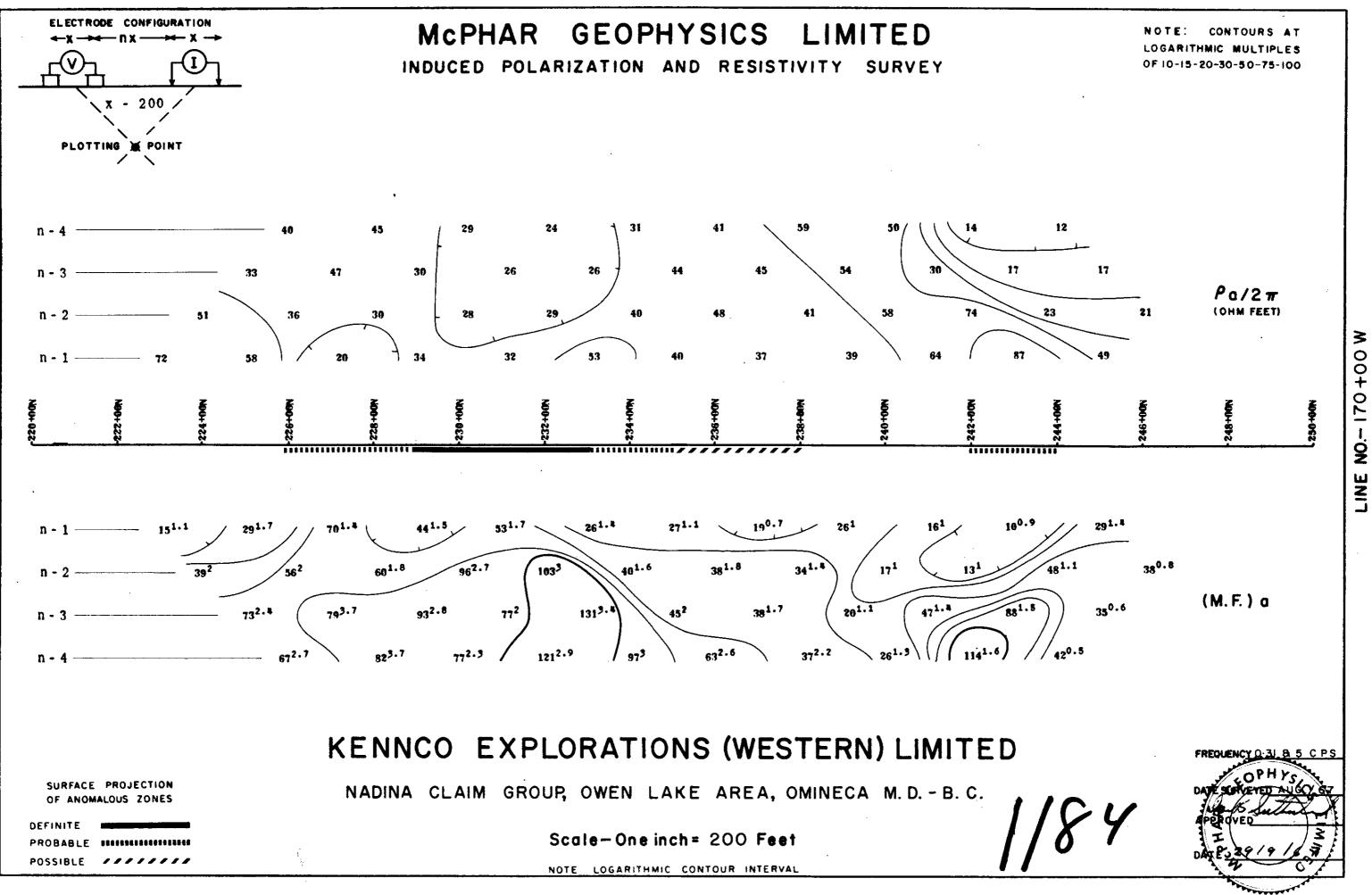


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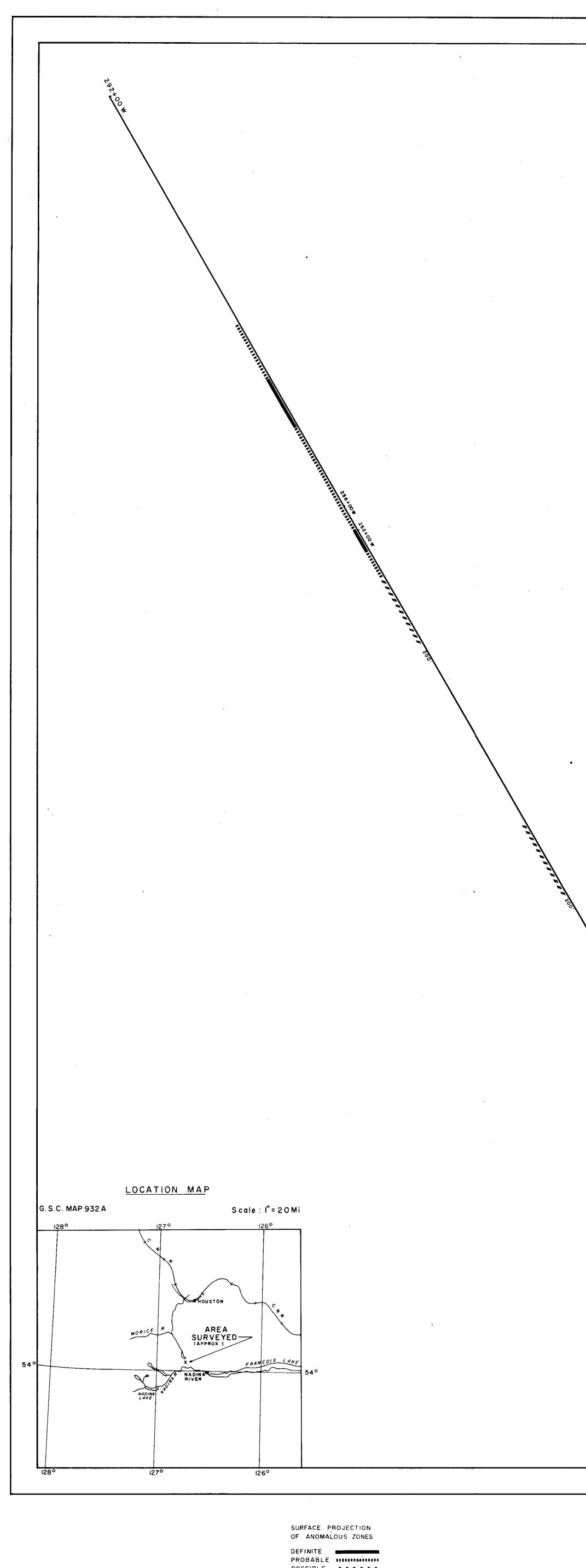
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