680469

phelps dodge
Corporation of Canada, Limited

MEMORANDUM

Date: January 25, 1995

From: F.L. Jagodits

To: P.E. Fox
cc.: D.H. Waddington

Subject: Vendor Report: Induced Polarization/Resistivity Test Survey - Clisbako Area, Clisbako Project, Mt. Dent Area, BC.

Files: Clisbako - 236 and Geophysics

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1. Preamble

A test induced polarization/resistivity survey was conducted over the known mineralization at Clisbako to obtain IP and resistivity signatures. The survey took place during the early part of November and it was completed by Peter E. Walcott & Associates, geophysical survey contactor, of Coquitlam, BC.

The dipole-pole electrode array was used for the time domain IP/resistivity survey. The basic electrode separation ("a") was 50 m, but parts of three lines were also surveyed using an electrode separation of 25 m. Observations were made at dipole-pole separations ("n") of 1 to 6.

The following lines were surveyed:

"a" = 50 m

Line 412N: 288+00E - 299+75E
Line 413N: 285+00E - 299+75E
Line 414N: 282+00E - 299+75E
Line 415N: 282+25E - 299+75E
Line 416E: 282+25E - 299+75E

Total of 7925 m.

"a" = 25 m

Line 412N: 291+25E - 297+75 m
Line 414N: 287+62.5E - 295+37.5E
Line 416N: 291+25E - 297+87.5E

Total of 2100 m

Suite 912, 120 Adelaide Street West, Toronto, Ontario, Canada M5H 1T1
Telephone 416-594-0351 Telecopier 416-594-0355

2. Induced Polarization/Resistivity Survey

2.1 General

Depending on the amplitude of the induced polarization responses above background, the responses were classified as 1st, 2nd, 3rd and 4th order. Anomalies that are observed at larger pole-dipole separations are marked with the letter "D", indicating a deeper source. Sources that are believed to indicate lithological changes rather than individual sources are also identified; see the accompanying legend.

Eight ranges of apparent resistivity were established, that are

- VL < 100 ohm-m
- L 100 - 250 ohm-m
- LM 250 - 700 ohm-m
- M 700 - 1 000 ohm-m
- MH 1 000 - 2 500 ohm-m
- H 2 500 - 7 500 ohm-m
- HV 7 500 - 10 00 ohm-m
- VH > 10 000 ohm-m

2.2 The Results

2.2.1 General

The apparent resistivities generally range between 50 and 150 ohm-m, only occasionally reaching 200 ohm-m. The IP survey outlined a wide anomalous zone that covers nearly the entire length of each test line. The common IP signature of each line is the termination of the anomalous zone on the east, just past 296+00E. At the west end of the test lines, the anomalous IP zone just ends or it is open to the west. The anomalies of this zone vary from 1st order to 4th order. The width of this anomalous zone is at least 1400 m.

The apparent resistivities observed using the 25 m pole-dipole separation are similar to those obtained using the larger separation. As expected, the sources are better resolved by data collected with the 25 m separation survey.

2.1.2 West Pit

Lines 413E, 414E, 415E and 416E cross the West Pit Zone. The zone is identified by 1st order anomalies, that are

associated with apparent resistivities between 50 and 100 ohm-m, but mainly < 100 ohm-m. The source is shallow along Line 416N and the signature can indicate a dipping body. The source may be deeper and wider on Line 415E and the amplitude of the anomaly is somewhat deereased compared to the amplitude on Line 416N. The anomaly widens on Line 414N and it is observed at the larger pole-dipole separations. The amplitudes increase on Line 413N and the anomaly is open to the west.

The 25 m separation data along Line 416N clearly defines the West Pit anomaly. The indicated source is near surface.

2.2.3 West Lake

Line 414N crosses the West Lake "Zone". The narrow 1st order anomaly is within a much wider 2nd order anomaly and it is distinguished by apparent resistivities ranging from 148 - 174 ohm-m vs. 50 - 85 ohm-m resistivities to the east and to the west. On Line 413N, a narrow, increased apparent resistivity feature at 292+00E coupled with 1st order IP responses can be correlated with the West Lake Zone of Line 414N. Further to the east, the 1st order anomaly is associated with apparent resistivities < 100 ohm-m.

If the West Lake Zone continues towards the southeast, the narrow, increased resistivity zone is centred about 293+50E on Line 412N. The apparent resistivity signature is less defined and the IP signature is a part of a wide zone.

The advantage of the better resolution of the 25 m survey is well illustrated along Line 414N. The definition of the West Lake Zone by the 50 m separation survey is fairly diffused, but the zone clearly stands out from the 25 m separation data.

The possible southeastern continuation of the West Lake Zone is centred about 292+75E.

2.3 Conclusions

The result of the test closely correlate with the chargeability contours of an earlier gradient array IP survey, conducted by the previous operator. The possible exception is the Tuffa Zone (the east end of Line 416N) where only a 4th order anomaly was observed vs. a gradient array anomaly of >20 mV/V. The present IP survey indicates a wide anomalous zone, possibly a lithological source, within which individual sources can be distinguished.

Both the 50 m and 25 m separation surveys clearly demark the West Pit mineralization. The zone is narrower in the north and widens to the south. The apparent resistivity signature of West Lake Zone allows the separation of the IP anomaly from a wide anomalous zone that was observed with the 50 m separation. The 25 m separation data over the West Lake Zone along Line 414N is exemplary in outlining the mineralization.

Although the 50 m separation survey failed to uniquely define the West Lake Zone, there is sufficient evidence to separate the signature of the zone from the neighbouring data.

The advantages of both separations are well demonstrated. For future work at Clisbako, the use of both separations should be seriously considered. Alternate lines should be surveyed with 25 m and 50 m electrode separations, that would provide well resolved sources along one set of lines and deeper exploration along the other set of lines.

Legend to Accompany Induced Polarization and Apparent Resistivity Pseudo-Sections and Maps

INDUCED POLARIZATION RESPONSES


1st order


2nd order


3rd order


4th order

? = questionable

D = Deeper (observed at larger dipole separations)

LD = limited depth extent

..... Lithological source

APPARENT RESISTIVITY RANGES (Ohm-m)

VL = <100

L = 100–250

LM = 250–700

M = 700–1000

MH = 1000–2500

H = 2500–7500

HV = 7500–10000

VH = >10000

CLISBAKO PROJECT

CLISBAKO PROPERTY

ORIENTATION
INDUCED POLARIZATION/RESISTIVITY SURVEY
INTERPRETATION MAP

1:5000

January, 1995

Francis L. Jagodits., P.Eng., Consulting Geophysicist

Camp

WEST PIT

WEST LAKE

289700E

296700E

L416N
L415N
L414N
L413N
L412N
L411N
L410N

TR-92-04
TR-92-03
TR-92-06
TR-91-07
TR-91-05
TR-92-05
TR-91-06
TR-91-04

JOE-A

North Zone

Chargeability Contours (mV)

pole-dipole array
a=25 m
a=50 m

250m

Legend to Accompany
Induced Polarization
and Apparent Resistivity
Pseudo-Sections
and Maps

INDUCED POLARIZATION RESPONSES

- 1st order
- 2nd order
- 3rd order
- 4th order
- ? = questionable
- D = Deeper (observed at larger dipole separations)
- LD = limited depth extent
- ..... Lithological source

APPARENT RESISTIVITY RANGES (Ohm-m)

- VL = <100
- L = 100-250
- LM = 250-700
- M = 700-1000
- MH = 1000-2500
- H = 2500-7500
- HV = 7500-10000
- VH = >10000

inches 0 1
centimetres 0 1 2

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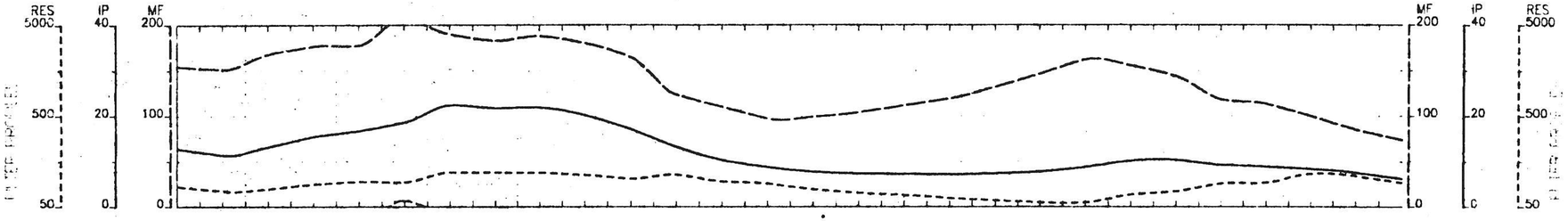
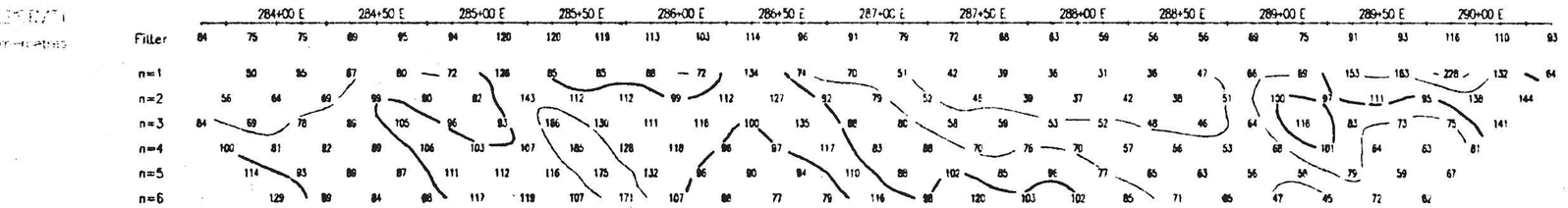
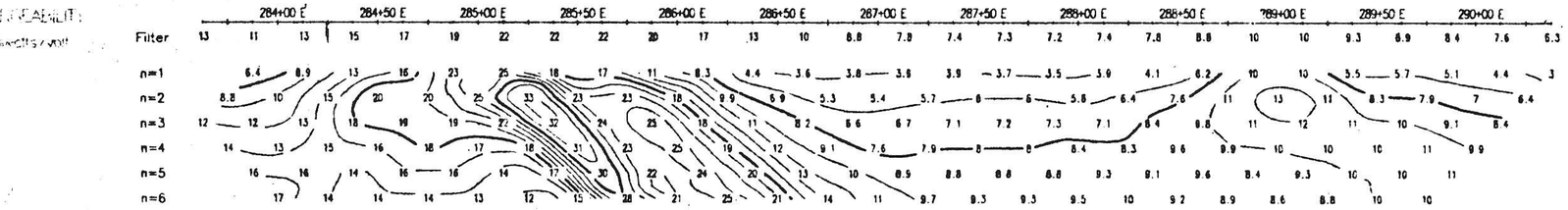
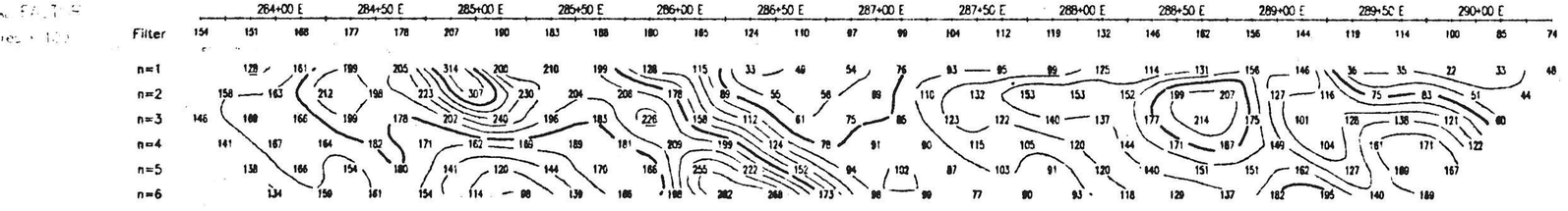
Line 41600 N

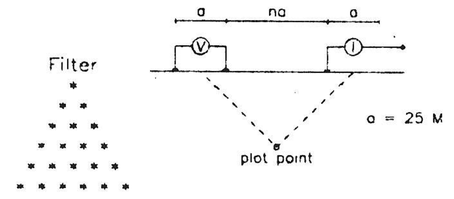








Dipole-Pole Array



instrument:
Huntec 2.5 kw. Tx., BRGM Elrec 6 Rx.
Frequency: 0.125 Hz.
Operators: G.M., D.H.

Logarithmic Contours 1, 1.5, 2, 3, 5, 7.5, 10,..

INTERPRETATION

Well defined, strong increase in polarization with or without marked decrease in resistivity.

Fairly well defined moderate increase in polarization.

Poorly defined polarization increase.

Resistivity feature.

Scale 1:2500

25 0 25 50 75 100 125 150
(meters)

PRELIMINARY
CONFIDENTIAL

inches
0 1
0 1 2
centimetres

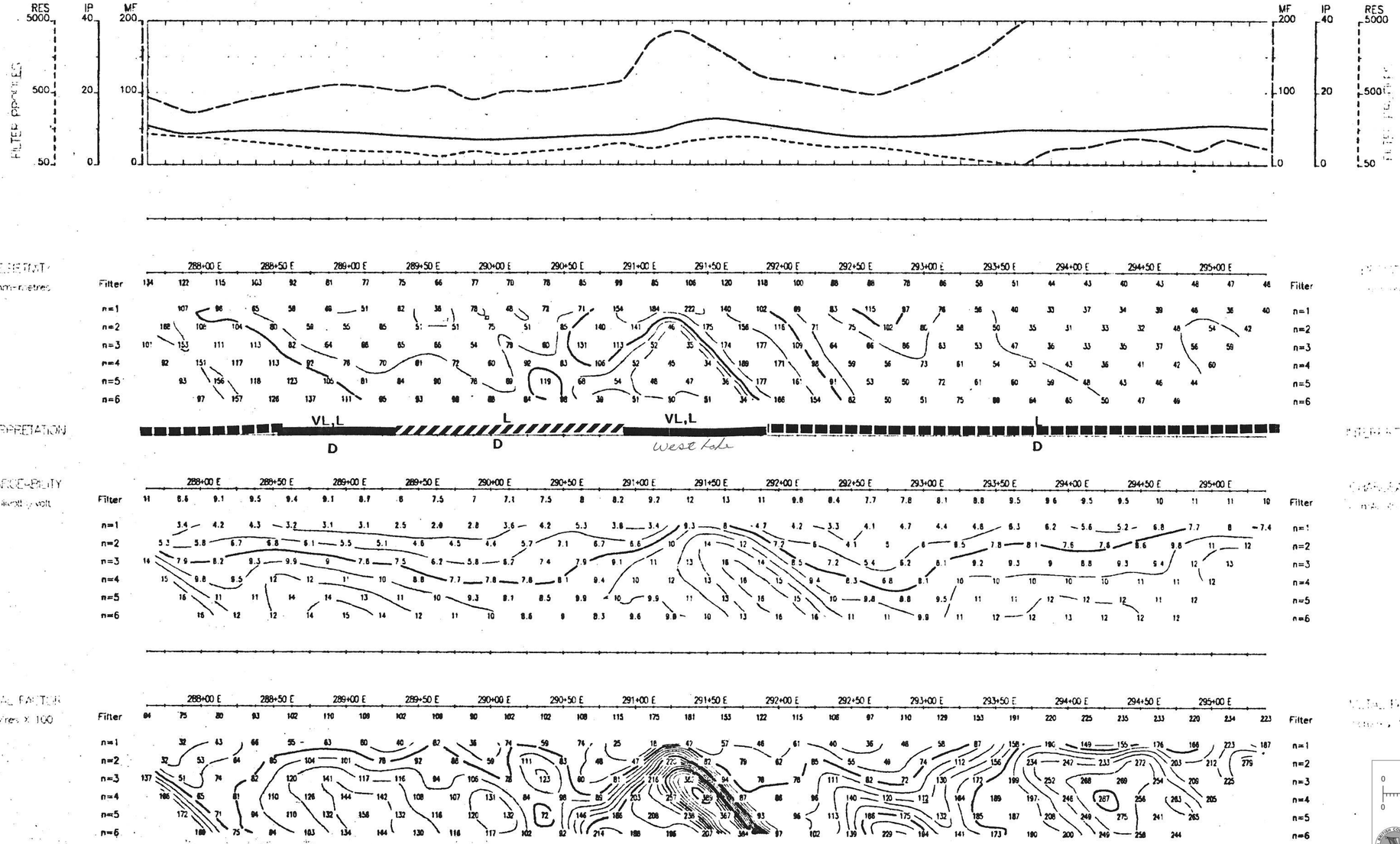
This reference scale bar has been added to the original image. It will scale at the same rate as the image, therefore it can be used as a reference for the original size.

PHELPS DODGE CORPORATION CANADA LIMITED

INDUCED POLARIZATION SURVEY
CUSBAKO PROPERTY
MT. DENT AREA, BRITISH COLUMBIA

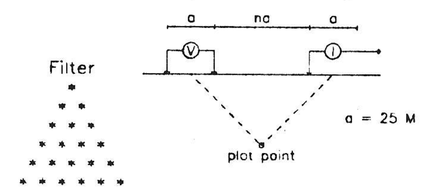
Date: NOVEMBER 1994 N.T.S. 93 C/16
Interpretation:

PETER E. WALCOTT & ASSOC. LTD.



Line 41400 N

Dipole-Pole Array



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Frequency: 0.125 Hz.
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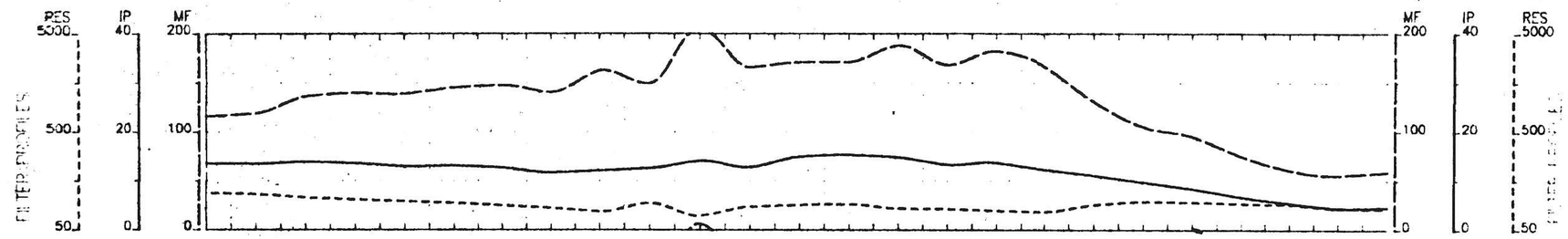
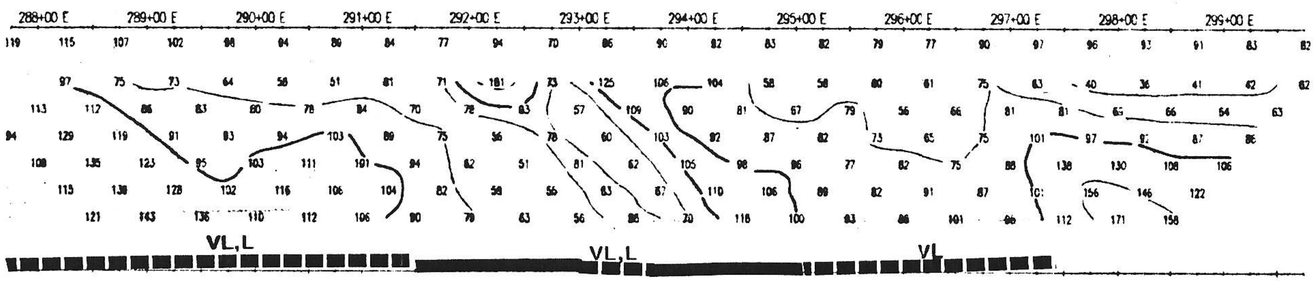
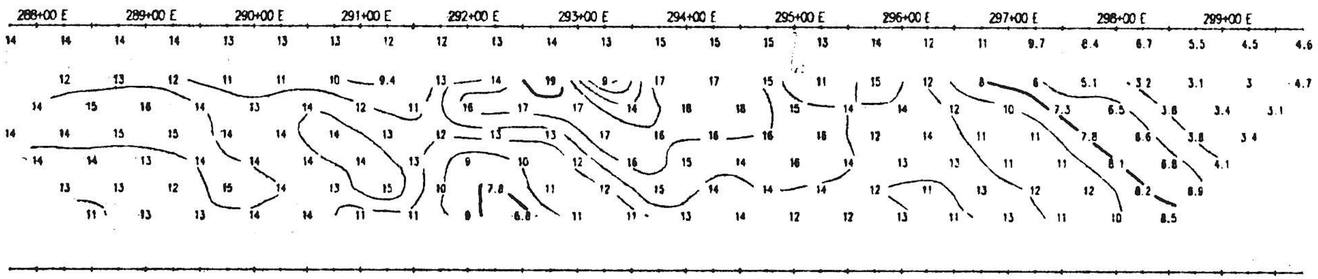
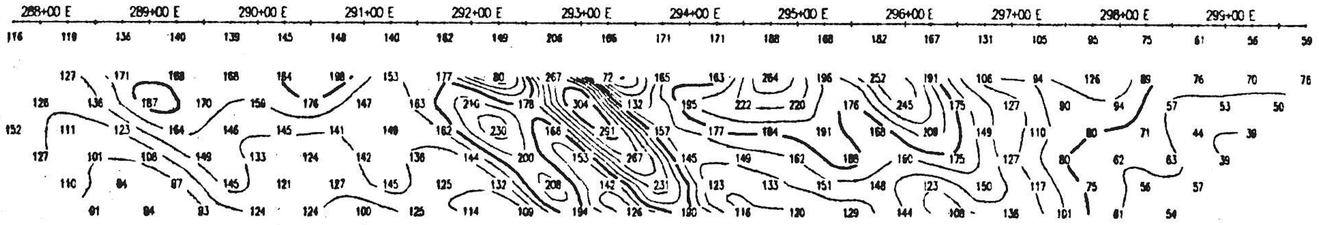


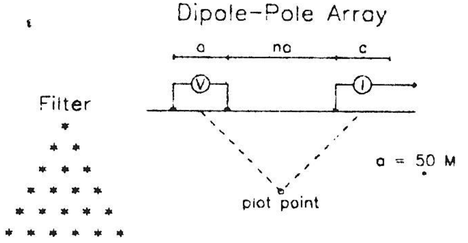






Line 41200 N

Dipole-Pole Array



Instrument:
Huntec 2.5 kw. Tx., BRGM Elrec 6 Rx.
Frequency: 0.125 Hz.
Operators: G.M., D.H.

Logarithmic Contours 1, 1.5, 2, 3, 5, 7.5, 10,..

INTERPRETATION

Well defined, strong increase in polarization with or without marked decrease in resistivity.

Fairly well defined moderate increase in polarization.

Poorly defined polarization increase.

Resistivity feature.

Scale 1:5000

50 0 50 100 150 200 250 300
(meters)

PRELIMINARY

inches
0 1
0 1 2
centimetres

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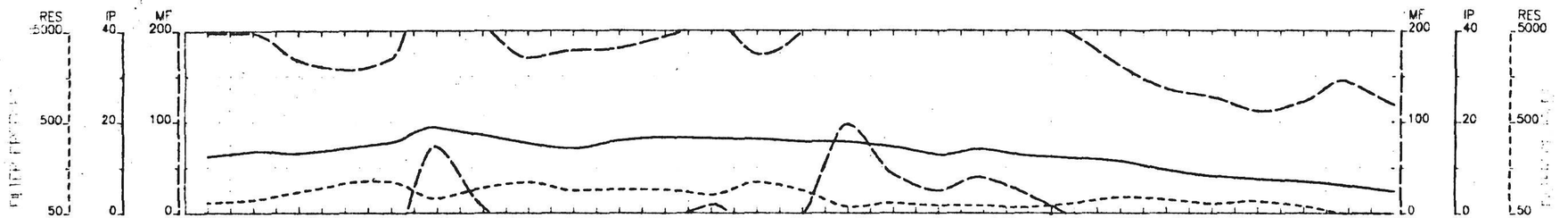
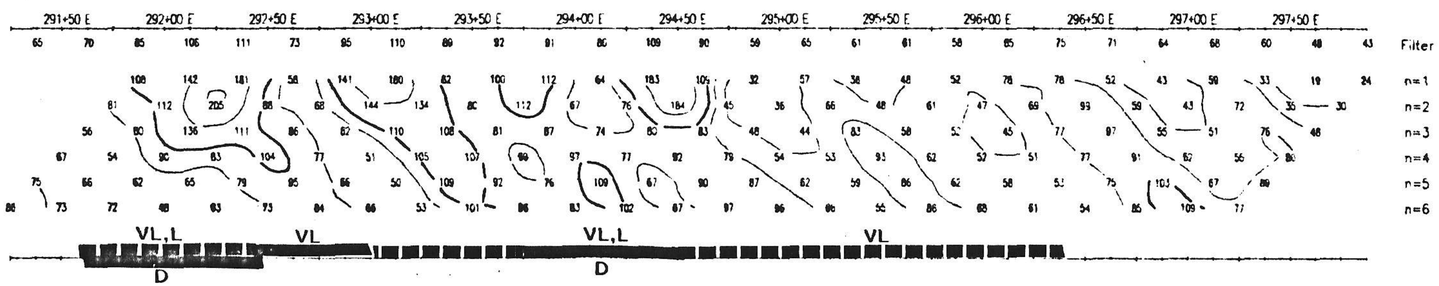
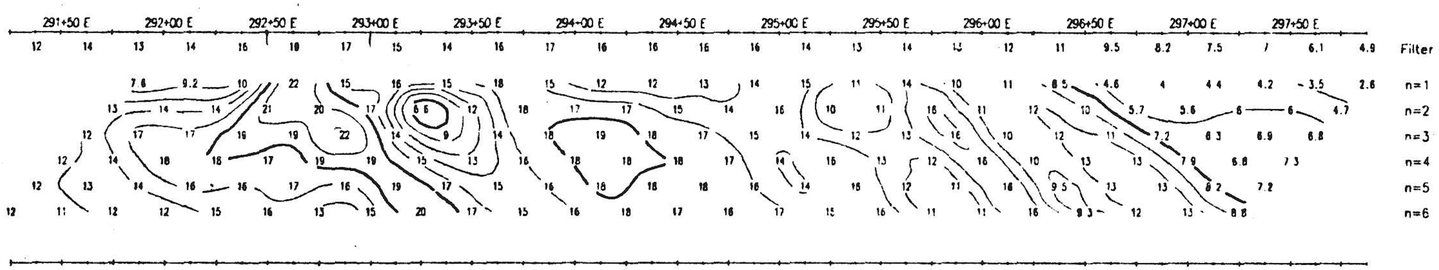
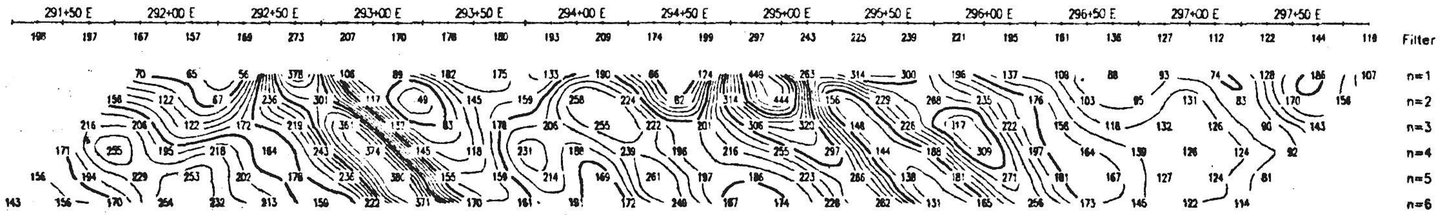


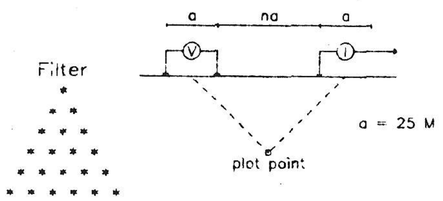






Line 41200 N

Dipole-Pole Array



Instrument:
Huntec 2.5 kw. Tx., BRGM Elrec 6 Rx.
Frequency: 0.125 Hz.
Operators: G.M., D.H.

Logarithmic Contours 1, 1.5, 2, 3, 5, 7.5, 10,..

INTERPRETATION

Well defined, strong increase in polarization with or without marked decrease in resistivity.

Fairly well defined moderate increase in polarization.

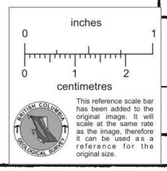
Poorly defined polarization increase.

Resistivity feature.

Scale 1:2500

25 0 25 50 75 100 125 150
(meters)

PRELIMINARY
CONFIDENTIAL



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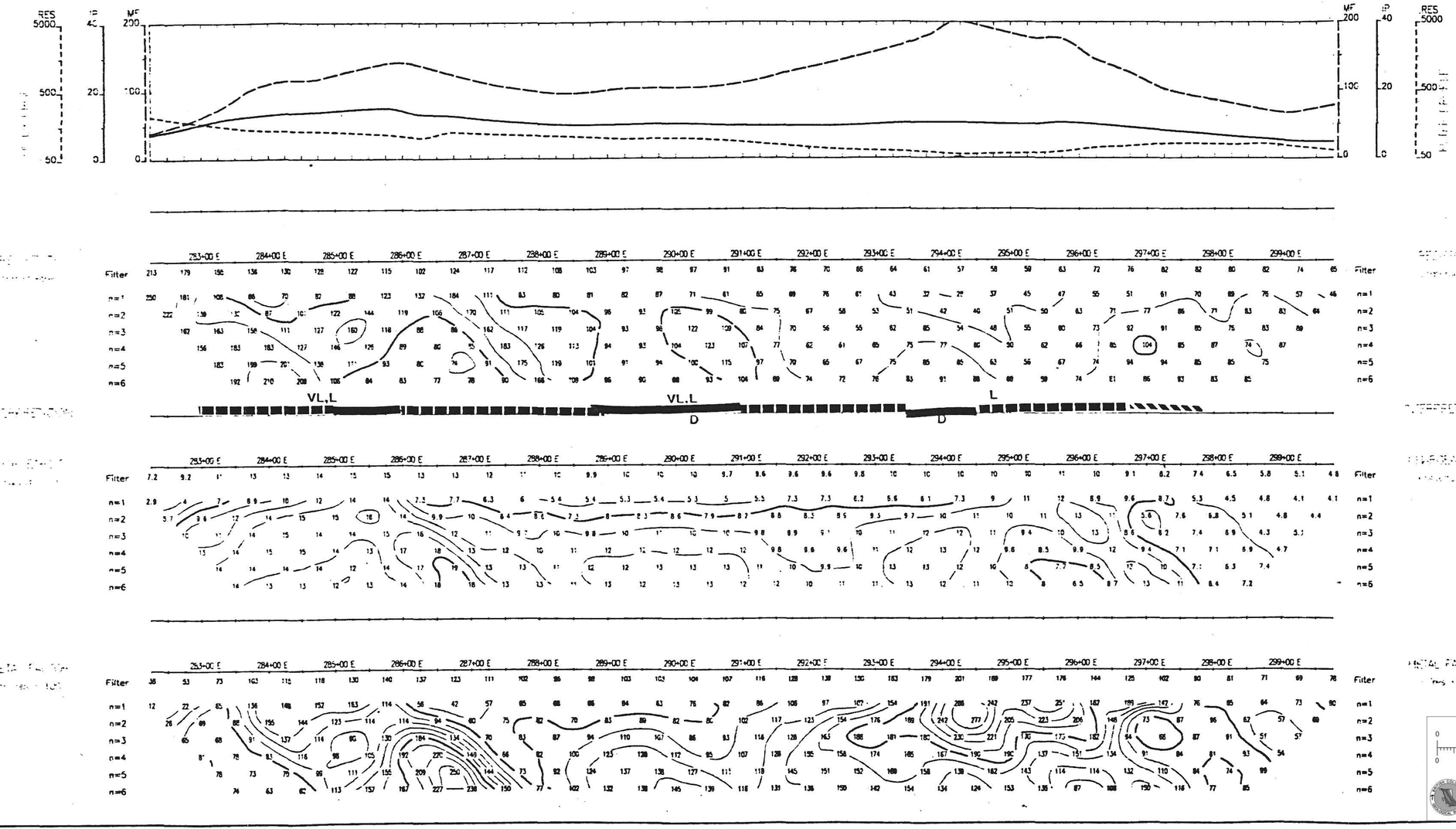
INDUCED POLARIZATION SURVEY
CUSBAKO PROPERTY
MT. DENT AREA, BRITISH COLUMBIA

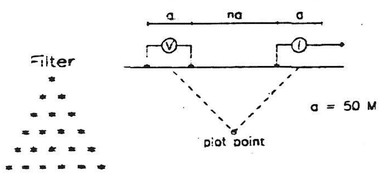
Date: NOVEMBER 1994 N.T.S. 93 C/16
Interpretation:

PETER E. WALCOTT & ASSOC. LTD.



Line 41500 N

Dipole-Pole Array



Instrument:
Huntec 2.5 kw. Tx., BRGM Elrec 6 Rx.
Frequency: 0.125 Hz.
Operators: G.M., D.H.

Logarithmic Contours 1, 1.5, 2, 3, 5, 7.5, 10,..

INTERPRETATION

Well defined, strong increase in polarization with or without marked decrease in resistivity.

Fairly well defined moderate increase in polarization.

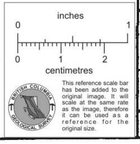
Poorly defined polarization increase.

Resistivity feature.

Scale 1:5000

50 0 50 100 150 200 250 300
(meters)

PRELIMINARY



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CLISBAKO PROPERTY
MT. DENT AREA, BRITISH COLUMBIA

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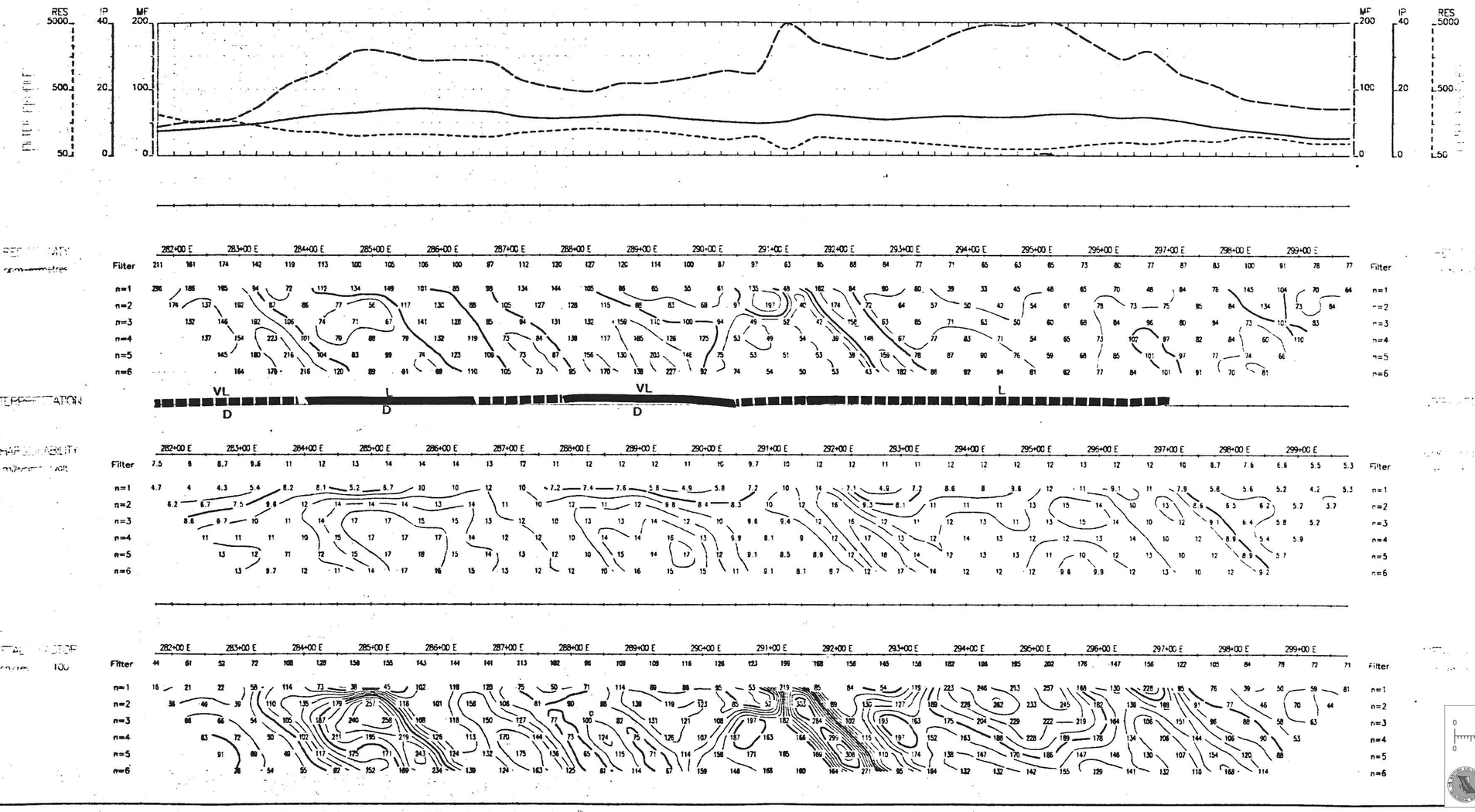
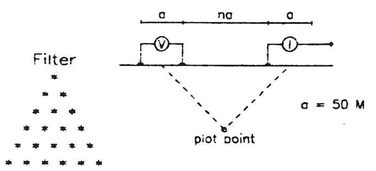


Line 41400 N

Dipole-Pole Array



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Frequency: 0.125 Hz.
Operators: G.M., D.H.

Logarithmic Contours 1, 1.5, 2, 3, 5, 7.5, 10,..

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Resistivity feature.

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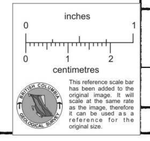
50 0 50 100 150 200 250 300
(meters)

PRELIMINARY



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CUSSBAKO PROPERTY
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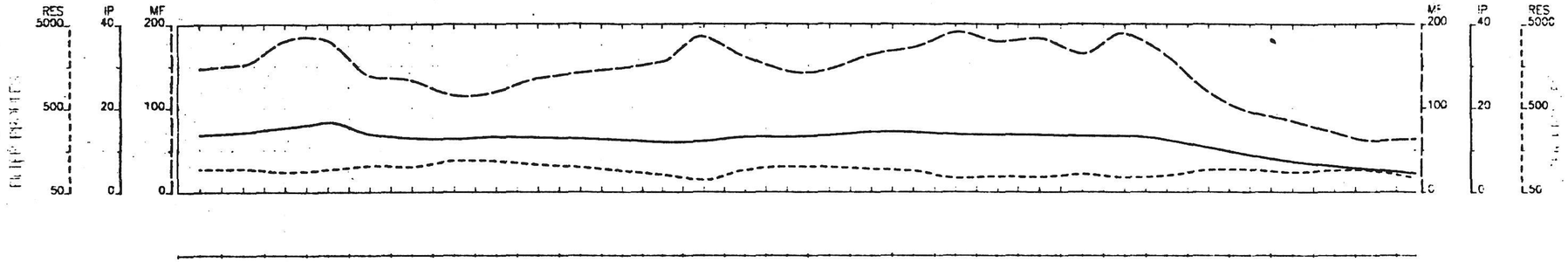
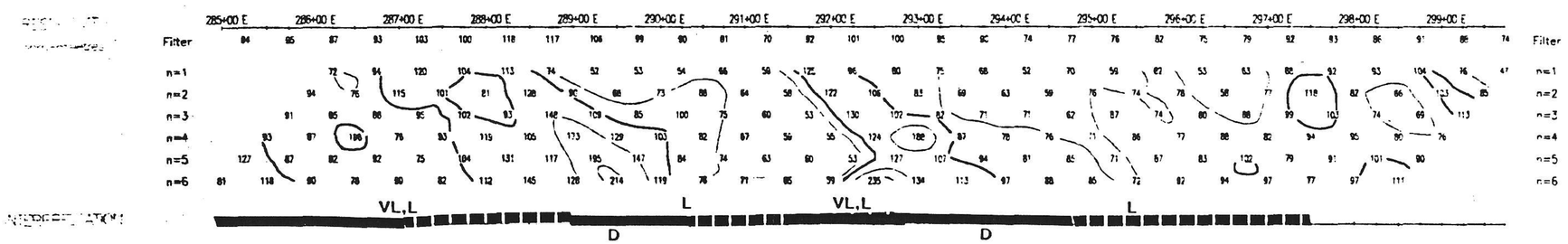
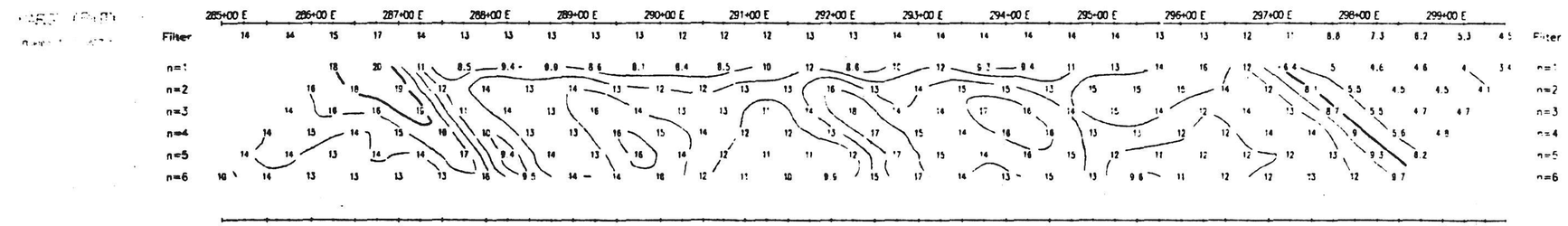
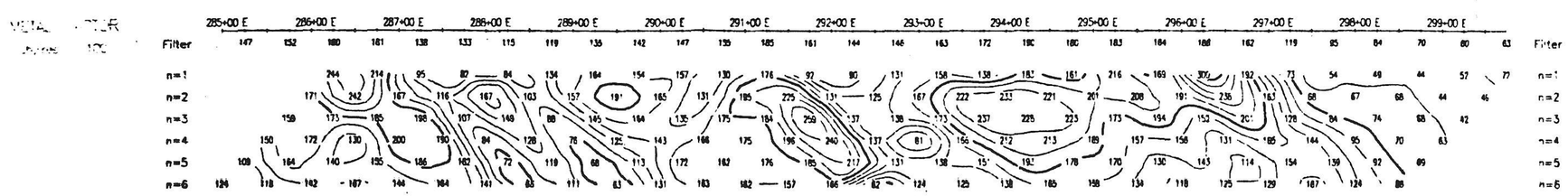


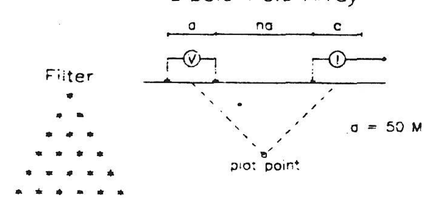






Line 41300 N

Dipole-Pole Array



Instrument:
Huntec 2.5 kw. Tx., BRGM Elrec 6 Rx.
Frequency: 0.125 Hz.
Operators: G.M., D.H.

Logarithmic Contours , 1.5, 2, 3, 5, 7.5, 10,..

INTERPRETATION

Well defined, strong increase in polarization with or without marked decrease in resistivity.

Fairly well defined moderate increase in polarization.

Poorly defined polarization increase.

Resistivity feature

Scale 1:5000

50 0 50 100 150 200 250 300
(meters)

PRELIMINARY
CONFIDENTIAL

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INDUCED POLARIZATION SURVEY
OLSBAKO PROPERTY
MT. DENT AREA, BRITISH COLUMBIA

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inches
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centimetres

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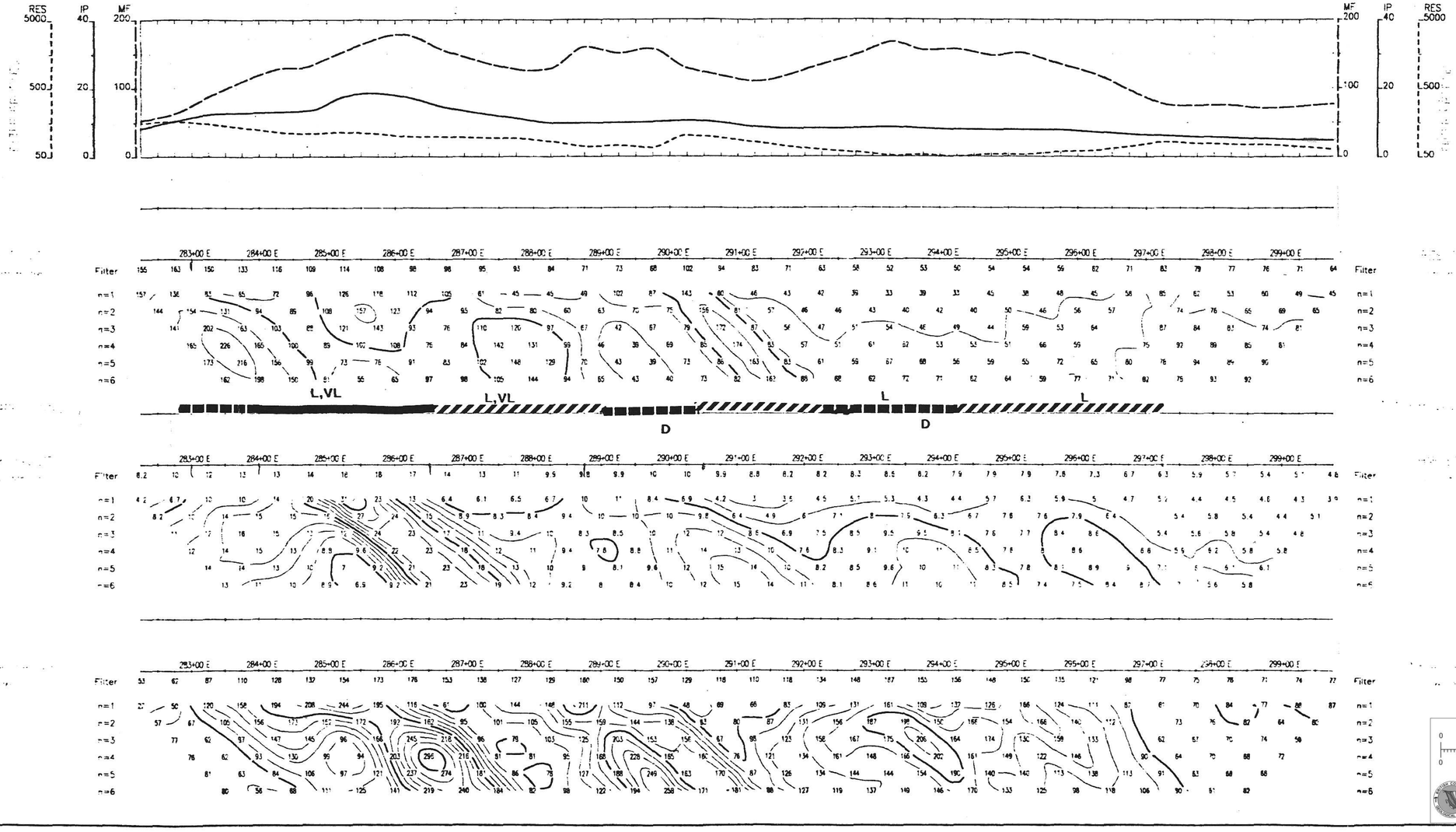
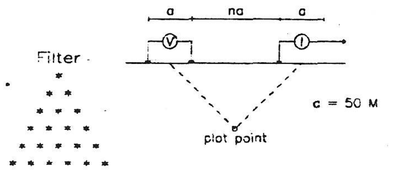


Line 41600 N

Dipole-Pole Array



Instrument:
Huntec 2.5 kw. Tx., BRGM Elrec 6 Rx.
Frequency: 0.125 Hz.
Operators: G.M., D.H.

Logarithmic Contours 1, 1.5, 2, 3, 5, 7.5, 10,..

INTERPRETATION

Well defined, strong increase in polarization with or without marked decrease in resistivity.

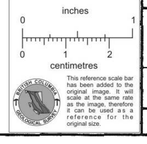
Fairly well defined moderate increase in polarization.

Poorly defined polarization increase.

Resistivity fecture.

Scale 1:5000

50 0 50 100 150 200 250 300
(meters)



PHELPS DODGE CORPORATION CANADA LIMITED

INDUCED POLARIZATION SURVEY
CUSBAKO PROPERTY
MT. DENT AREA, BRITISH COLUMBIA

Date: NOVEMBER 1994 N.T.S. 93 C/16
Interpretation:

PETER E. WALCOTT & ASSOC. LTD.