



**FALCONBRIDGE LIMITED**  
202 - 856 Homer Street  
Vancouver, B.C. V6B 2W2

UTEM SURVEY  
ON  
1989 BAY OPTION  
FOR  
FALCONBRIDGE LIMITED  
BY  
SJ GEOPHYSICS LTD. AND LAMONTAGME GEOPHYSICS LTD.  
OCTOBER 1989                      FIELD COPY

82M-4E

ENTERED

UTEM SURVEY

ON

1989 BAY OPTION

FOR

FALCONBRIDGE LIMITED

BY

SJ GEOPHYSICS LTD. AND LAMONTAGNE GEOPHYSICS LTD.

KAMLOOPS M.D.

N.T.S. 82M/4E

OCTOBER 1989

Report By  
Syd J. Visser  
SJ GEOPHYSICS LTD.

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## INTRODUCTION

A UTEM survey was performed on the 1989 Bay Option claims, located approximately 25 Km east of Barriere on the west side of Adams Lake, B.C., by SJ Geophysics Ltd. and Lamontagne Geophysics Ltd., at the request of Mr. Stan Clemmer, for Falconbridge Limited, during the period of October 1 to October 7, 1989.

The purpose of the UTEM survey was to search for massive sulfides at a depth deeper than attained by previous HLEM survey.

## DESCRIPTION OF UTEM SYSTEM

UTEM is an acronym for "University of Toronto ElectroMagnetometer". The system was developed by Dr. Y. Lamontagne (1975) while he was a graduate student of that University.

The field procedure consist of first laying out a large loop of single strand insulated wire and energizing it with current from a transmitter which is powered by a 2.2 kW motor generator. Survey lines are generally oriented perpendicular to one side of the loop and surveying can be performed both inside and outside the loop.

The transmitter loop is energized with a precise triangular current waveform at a carefully controlled frequency (54.409 Hz for this survey). The receiver system includes a sensor coil and backpack portable receiver module which has a digital recording facility on cassette magnetic tape. The time synchronization between transmitter and receiver is achieved through quartz crystal clocks in both units which must be accurate to about one second in 50 years.

The receiver sensor coil measures the vertical or horizontal magnetic component of the electromagnetic field and responds to its time derivative. Since the transmitter

current waveform is triangular, the receiver coil will sense a perfect square wave in the absence of geologic conductors. Deviations from a perfect square wave are caused by electrical conductors which may be geologic or cultural in origin. The receiver stacks any pre-set number of cycles in order to increase the signal to noise ratio.

The UTEM receiver gathers and records 10 channels of data at each station. The higher number channels (7-8-9-10) correspond to short time or high frequency while the lower number channels (1-2-3) correspond to long time or low frequency. Therefore, poor or weak conductors will respond on channels 10, 9, 8, 7 and 6. Progressively better conductors will give responses on progressively lower number channels as well. For example, massive, highly conducting sulfides or graphite will produce a response on all ten channels.

It was mentioned above that the UTEM receiver records data digitally on a cassette. This tape is played back into a computer at the base camp. The computer processes the data and controls the plotting on an 11" x 17" graphics printer. Data are portrayed on data sections as profiles of each of the first nine or ten channels, one section for each survey line.

#### FIELD WORK AND DISCUSSION OF FIELD PARAMETERS

Syd Visser, chief geophysicist with SJ Geophysics Ltd., and the equipment were mobilized from Vancouver. The two helpers required to aid in the survey, were supplied by Falconbridge Limited. The field crew commuted daily to the survey area from a house, rented by Falconbridge Limited, in Barriere. The field parameters and local geology were discussed in the field with Mr. Stan Clemmer, project geologist with Falconbridge Limited, before commencing the survey.

Approximately 11 Km, (for an average of about 2.5 Km per survey day), using a station spacing of 20M (40M on lines 4000W, 4300W and the north end of a few lines) were surveyed from 1 loop (Plate 1). The purpose of using a close station spacing in the search for deeper conductors is to better separate the short wavelength near surface conductors (known from a previous Max-Min survey) from the deeper long wavelength conductors.

The survey loop was placed to the south of the survey lines for the following reasons:

- 1) The coupling of the magnetic field lines with a conductor dipping shallow to the north are very good and field lines will also couple with any steeper dipping conductors.
- 2) Past experience with UTEM in the Adams Plateau area and throughout B.C., in general has shown that the background resistivity is low (500-1500 ohm-m) and the conductors are generally weak (1 to 50 mhos). It is therefore advantageous to take advantage of current channeling effects, generated by the above type of environment, in the initial part of the survey. This effect appears to be better outside the loop.
- 3) Initial interpretation, in the search for small deep conductive bodies in areas with multiple shallow conductors which were expected in the survey area, is better with data from outside the loop. Although it was not deemed necessary, a few lines could have been surveyed inside the loop to enhance interpretation.

Because of the relatively poor (< 50 mhos) conductors expected in the survey area a high base frequency of 54.409 Hz was used (normal base frequency used is 30.974 Hz but the UTEM can adjust frequencies by less than .1 Hz). This has the advantage of narrowing the UTEM time windows (therefore a weak conductor appears on more time channels) and speeding up the survey if there is no powerline interference.

Because the exact location of the station were not known the grid coordinates and a constant elevation was used



- N = PT for primary field normalized
- i is the data station for continuous normalized  
(each reading normalized by different primary  
field)
- i is the station below the arrow on the data  
sections for point normalized  
(each reading normalized by the same primary  
field)

Subtracting channel 1 from the remaining channels eliminates the topographic errors from all the data except ch.1.

If there is a response in channel 1 from a conductor then this value must be added to do a proper conductivity determination from the decay curves. Therefore channel 1 should not be subtracted indiscriminately.

The data from each line is plotted on at least 2 separate sections consisting of a continuous normalized section to which interpretation was added and a point normalized section. Additional point normalized data sections were produced where more than one conductor is present on the same line. Point normalization data is the absolute secondary field at a "gain setting" related to the normalization point. The data is usually point normalized over the central part of the crossover anomaly to aid in interpretation.

#### INTERPRETATION

The background resistivity which is between 700-1500 ohm-m, is very difficult to estimate because of the response of the conductive layers in the survey area.

There are three major conductive plate like features, striking across the majority of the grid area. The conductor axis outlined on Plate 1 as "A", "B" and "C" are the traces of the top edges of the conductive plates as best determined by the UTEM survey.



The conductive plates all appear to have a dip of between 30-40 degrees to the north. Because of some current channelling effects near the top edge of the plates especially on conductor "B", the exact dip is difficult to determine. These conductive plates are likely conductive beds or conductive thrust fault, which may have associated sulphide mineralization, graphitic material or water saturated clay minerals.

Conductive plate "A" which strikes across lines 3800W to 4600W at approximately 2900N appears to be a very weak conductor with a conductivity thickness product of  $< 0.5$  mhos. This conductor is very weak at the eastern end, where it appears more like a contact zone, and increases in conductivity to the west where it appears more like a shallow dipping conductive plate. The conductor axis does not appear on line 3700W but is seen again on 3600W where it is fairly strong (about 1 mhos) this conductor on line 3600W may possibly be due to the fault known to be located in the vicinity of this anomaly.

Conductor "B", which is striking across the grid at approximately 3180N, is the strongest conductor in the survey area and is estimated to have a conductivity between 5-10 mhos. The top edge of this conductor is very shallow between lines 4000W and 4400W and appears to deepen at the eastern and western end, with the deeper part on line 3700W where the depth to top is estimated to be approximately 50M deep. The increase in depth to the east may be due to a easterly dipping fault. The anomaly on line 3600W at 3150N is probably the same conductor offset to the south by the fault. The double anomaly noted on line 4500W is likely due to the sudden change in relief on this line. There does not appear to be any change in conductivity along the strike length of this conductive plate or any suggestion of a deeper more conductive part. A deeper conductive part would show migration of the conductor axis with time and there would also be a response later in time than shown in the

data. Although conductor "B" appears to correlate with a known thrust fault it is considered to be a fairly good conductor by the writer and should not be overlooked in the search for sulphides that may have associated gold values.

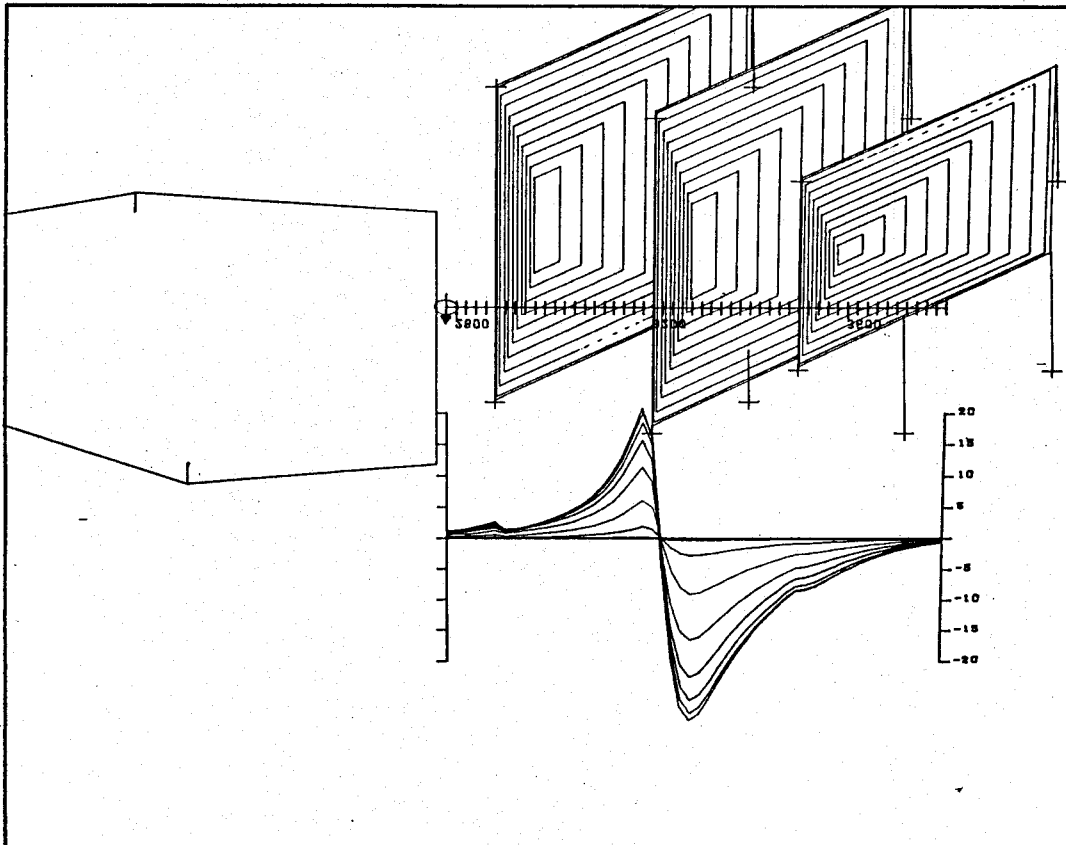
The conductive plate "C" striking from 3900W to 4500W at approximately 3475N is a weak ( $< 2$  mho) near surface conductive plate. There is no significant change in conductivity across the strike length of this conductor.

The depth extent of these conductors is estimated to be approximately 500M or greater.

Several models of different conductors using a number of different sizes, conductivities and dips of the conductive plates were modelled on a computer using the multiloop modelling program developed by Lamontagne Geophysics.

The response of a model that closely resembles the field data is shown on Fig 1 and 1A.

It is important to remember that this modeling program does not take into account the background  $1/2$  space response, current channeling, or thickness of the conductive zone which are all significant in the survey area.



FALCONBRIDGE LIMITED  
1989 BAY OPTION

PLATE 1	PLATE 2	PLATE 3
X LOC 2800.	X LOC 3200.0	X LOC 3500.0
DEPTH -5.00	DEPTH -20.00	DEPTH -10.00
DIP 30.00	DIP 30.00	DIP 30.00
DEPTH EXTENT 600.0	DEPTH EXTENT 600.0	DEPTH EXTENT 600.0

CONDUCTIVITY .50      CONDUCTIVITY 7.00      CONDUCTIVITY 1.00

POINT NORMALIZED AT 3200N

LINE 4100.0 M

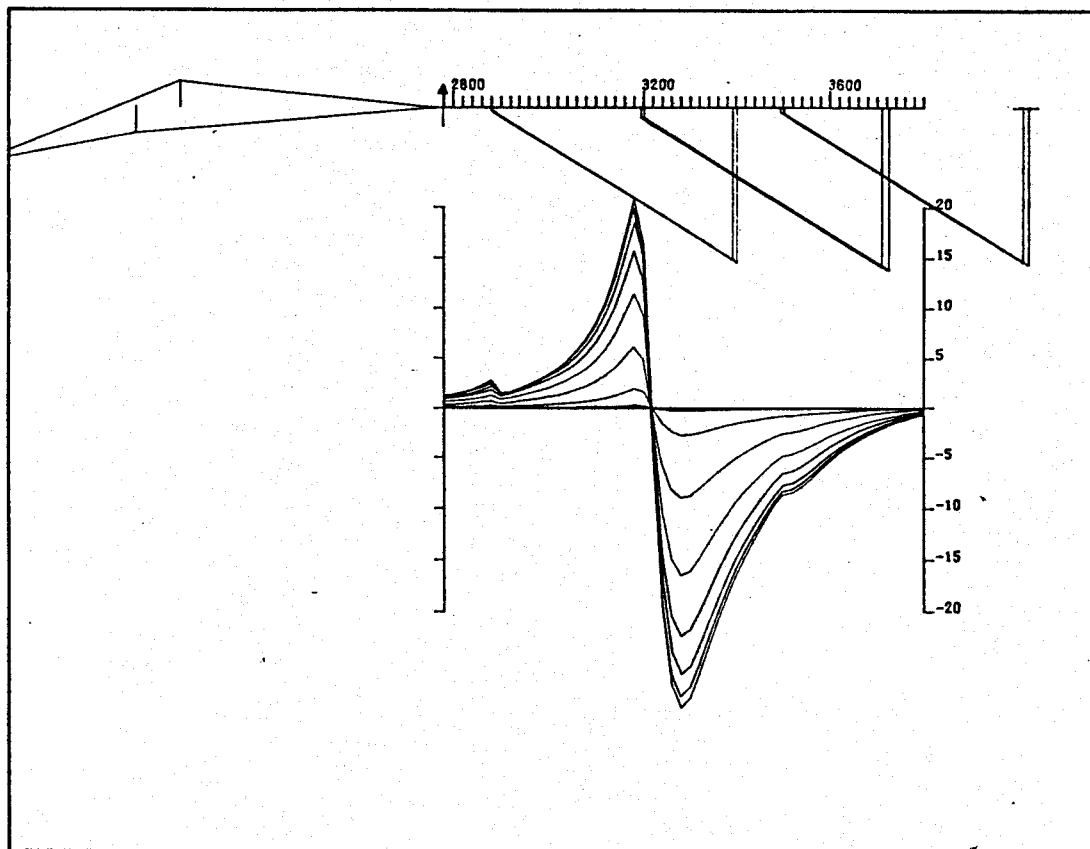
MODEL OF CONDUCTORS INTERPRETED FROM THE  
1989 UTEM SURVEY

MODEL BY: SYD VISSER SJV GEOPHYSICS LTD.      FIG 1

REGISTERED USER  
SJV C/.35,41.43

MultiLoop  
© LAPOINTE GEOPHYSICS LTD

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FALCONBRIDGE LIMITED  
1989 BAY OPTION

PLATE 1	PLATE 2	PLATE 3
X LOC 2880.	X LOC 3200.0	X LOC 3500.0
DEPTH -5.00	DEPTH -20.00	DEPTH -10.00
DIP 30.00	DIP 30.00	DIP 30.00
DEPTH EXTENT 600.0	DEPTH EXTENT 600.0	DEPTH EXTENT 600.0
CONDUCTIVITY .50	CONDUCTIVITY 7.00	CONDUCTIVITY 1.00

POINT NORMALIZED AT 3200N

LINE 4100.0 W

MODEL OF CONDUCTORS INTERPRETED FROM THE  
1989 UTEM SURVEY

MODEL BY: SYD VISSER SJ GEOPHYSICS LTD.

FIG 1A

REGISTERED USER  
SJV C/.35,41.43

MultiLoop  
© LARNTON GEOPHYSICS LTD

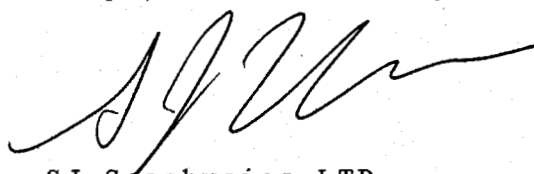
6

CONCLUSION

The background resistivity in the survey area is estimated to be between 700-1500 ohm-m.

The survey area is intersected by three northerly dipping conductive plate like features, at approximately 2900N, 3170N and 3500N, which may be conductive beds or conductive thrust faults. The conductor (5-10 mhos) striking across the grid at 3170N is the most significant and it should be determined if the conductor is due to a conductive thrust fault or possible sulphide mineralization. No strong (> 10 mhos) conductors were noted in the survey area.

Syd Visser F.G.A.C.  
Geophysicist



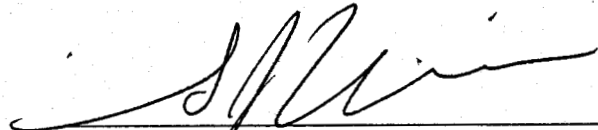
SJ Geophysics LTD.

APPENDIX I

STATEMENT OF QUALIFICATIONS

I, Syd J. Visser, of 8081 - 112th Street, Delta, British Columbia, hereby certify that,

- 1) I am a graduate from the University of British Columbia, 1981, where I obtained a B.Sc. (Hon.) Degree in Geology and Geophysics.
- 2) I am a graduate from Haileybury School of Mines, 1971.
- 3) I have been engaged in mining exploration since 1968.
- 4) I am a Fellow of the Geological Association of Canada.



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Syd J. Visser, B.Sc., F.G.A.C.  
Geophysicist

APPENDIX II



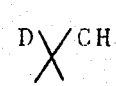
### LEGEND

Channel	Mean delay time Base Freq. 54.4 Hz	Plotting symbol
1	6.9 ms	1
2	3.45	/
3	1.725	\
4	0.863	□
5	0.432	≡
6	0.216	△
7	0.108	7
8	0.054	⊗
9	0.027	△
10	0.014	◇

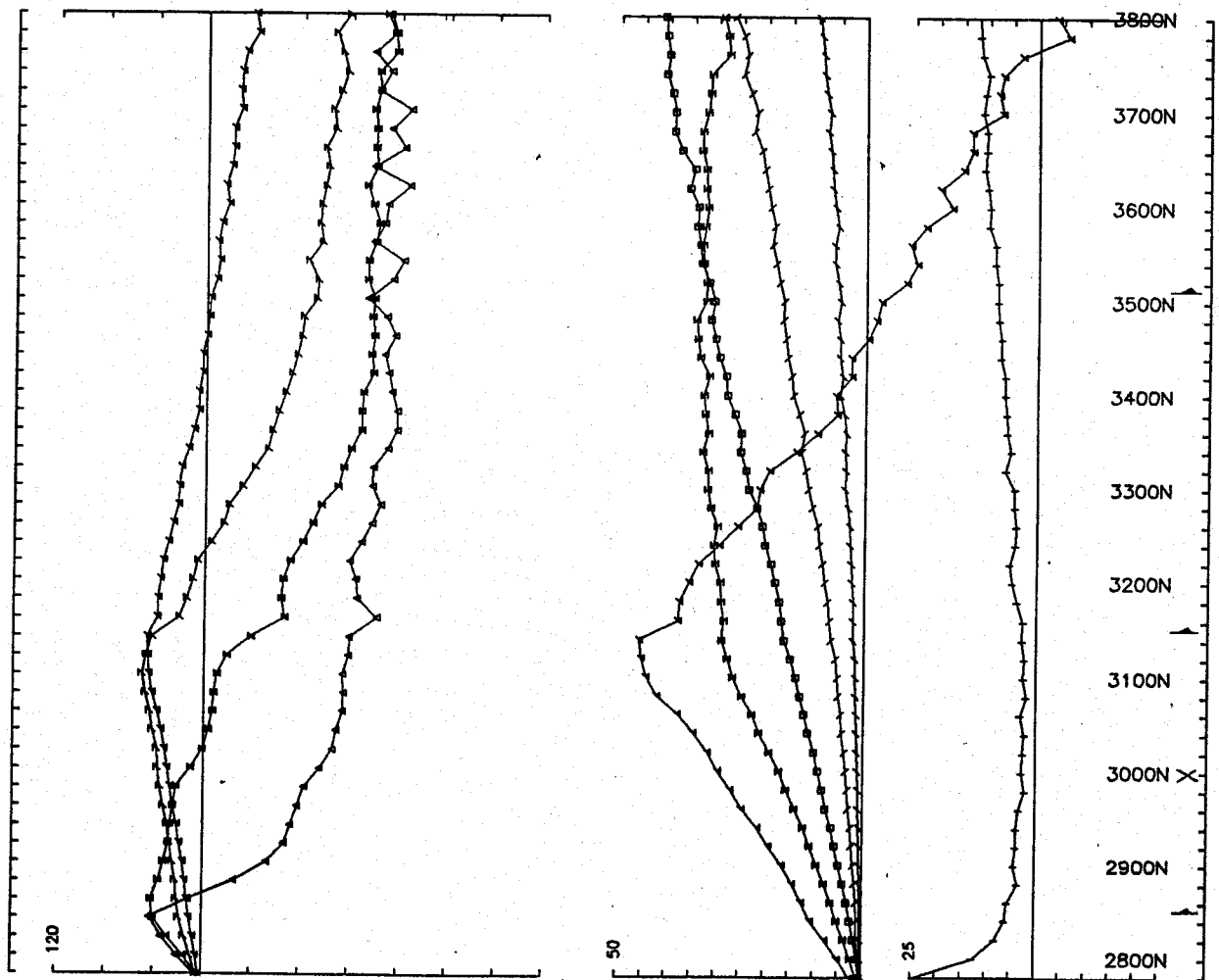
Change in conductivity:  
 Geological contact  
 Direction of increased conductivity  
 Top edge of shallow dipping plate



Crossover Axis:  
 D = depth:      S - Shallow depth  
                   M - Medium depth  
                   D - Deep depth  
 CH = Latest time channel

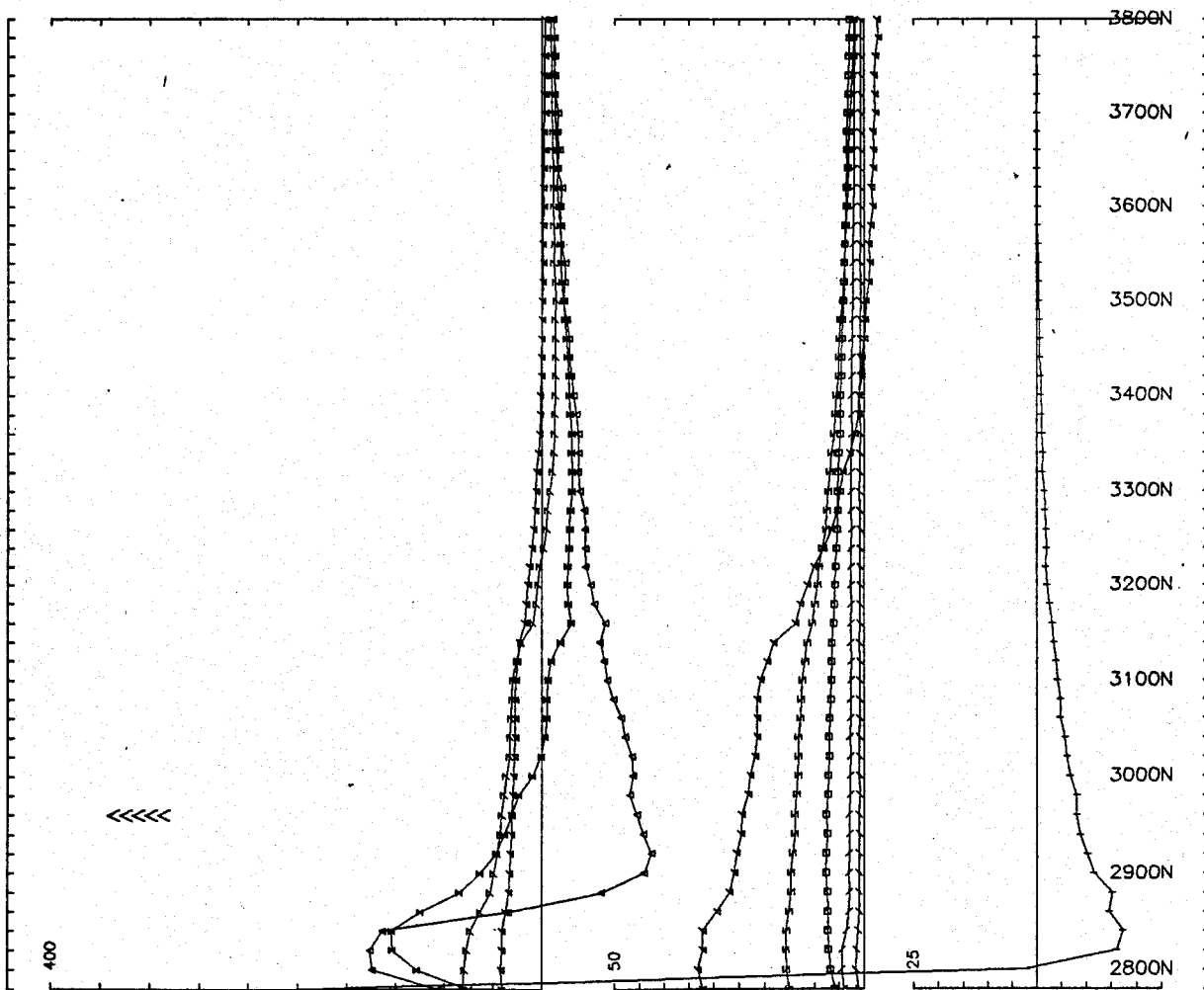


APPENDIX III



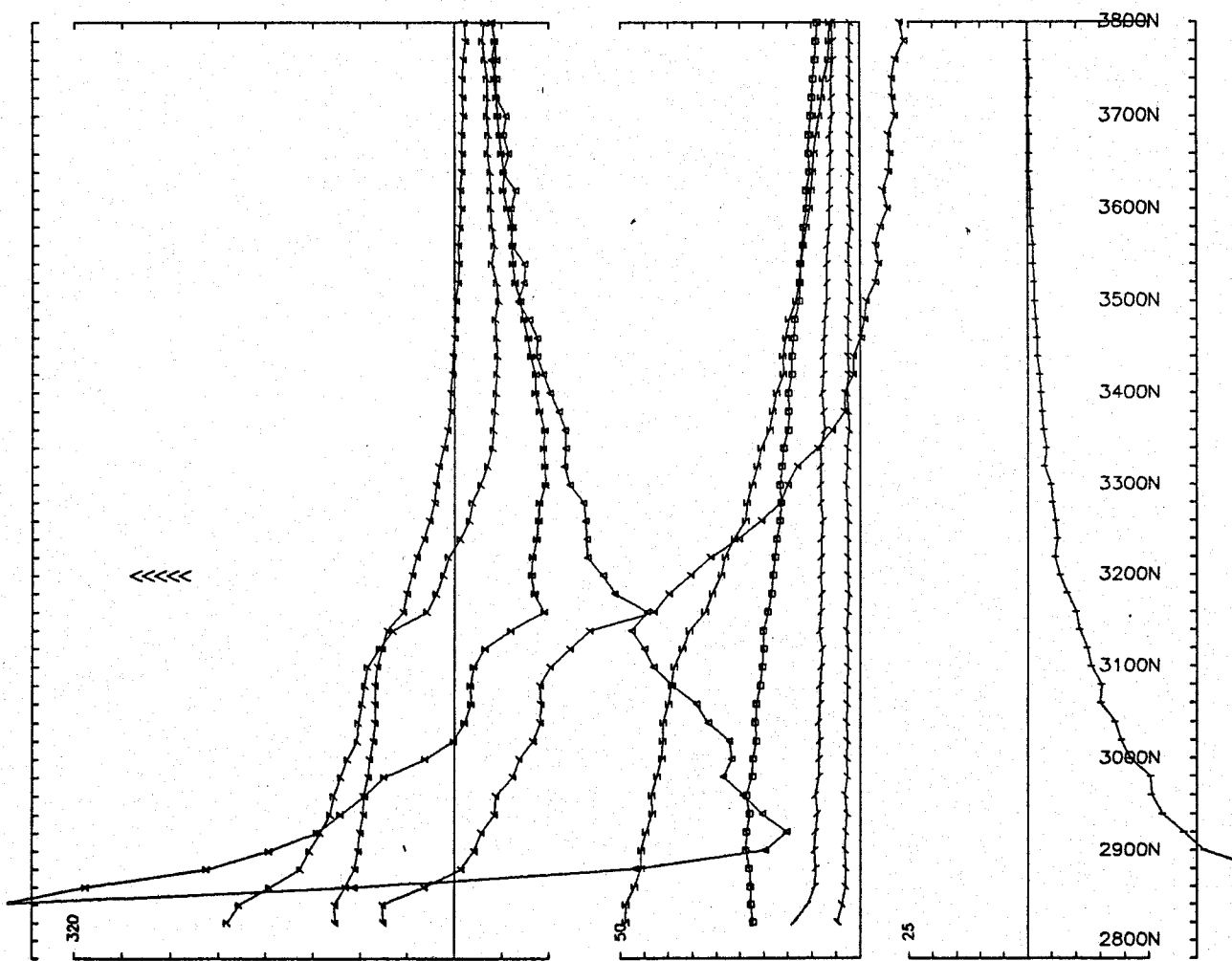
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Loopno 1 Line 3600W component Hz secondary Ch 1 normalized Ch 1 reduced contin. nom.



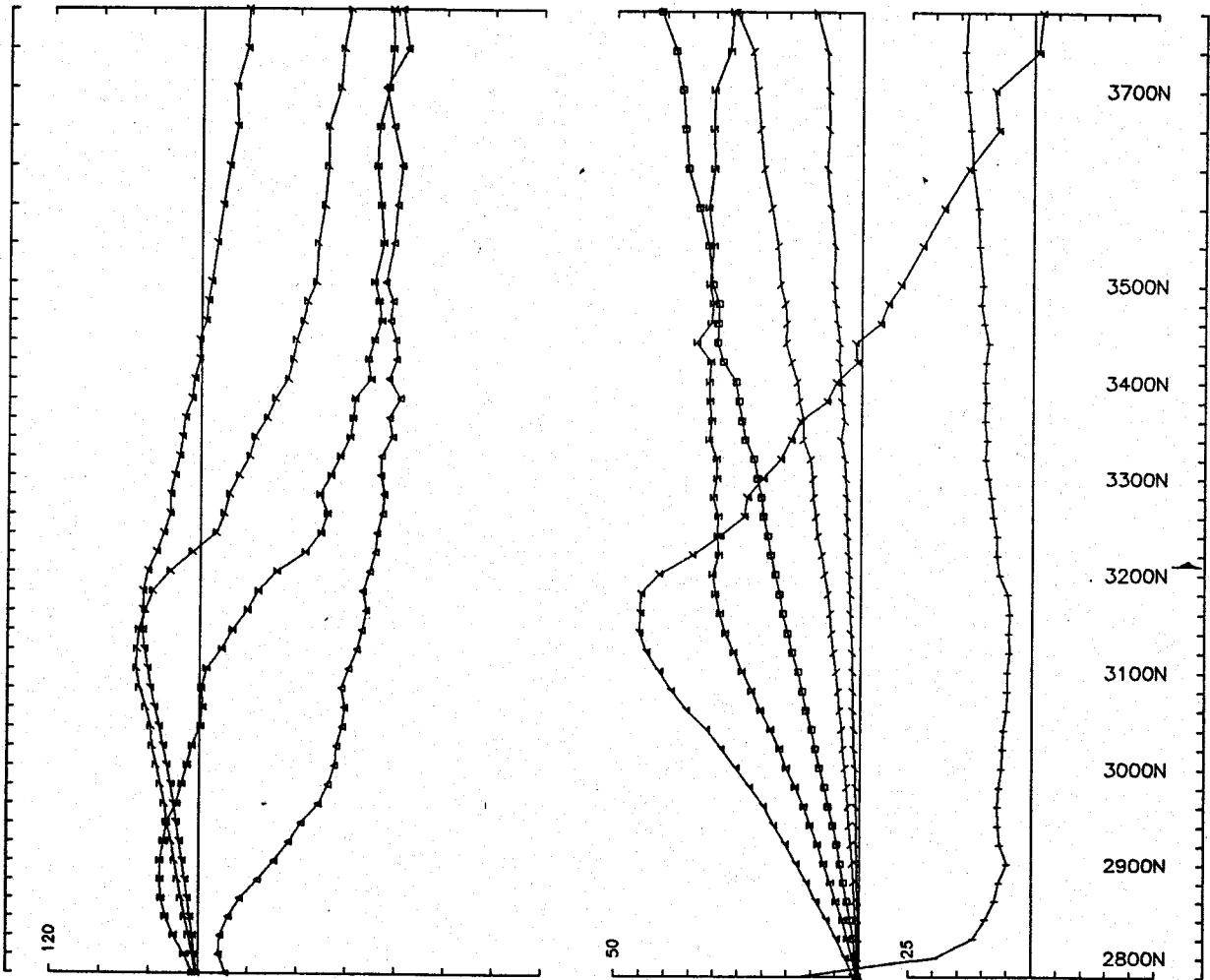
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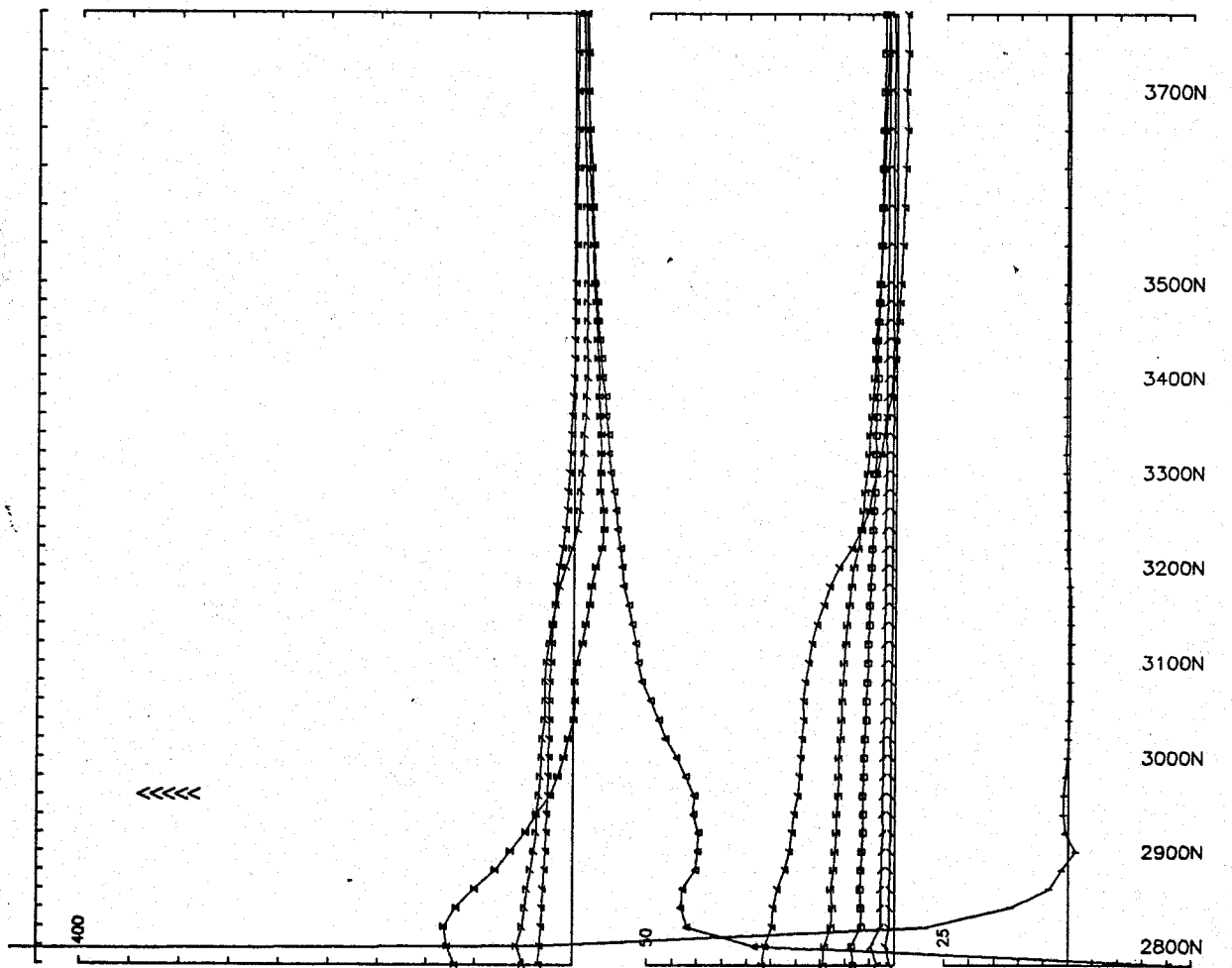
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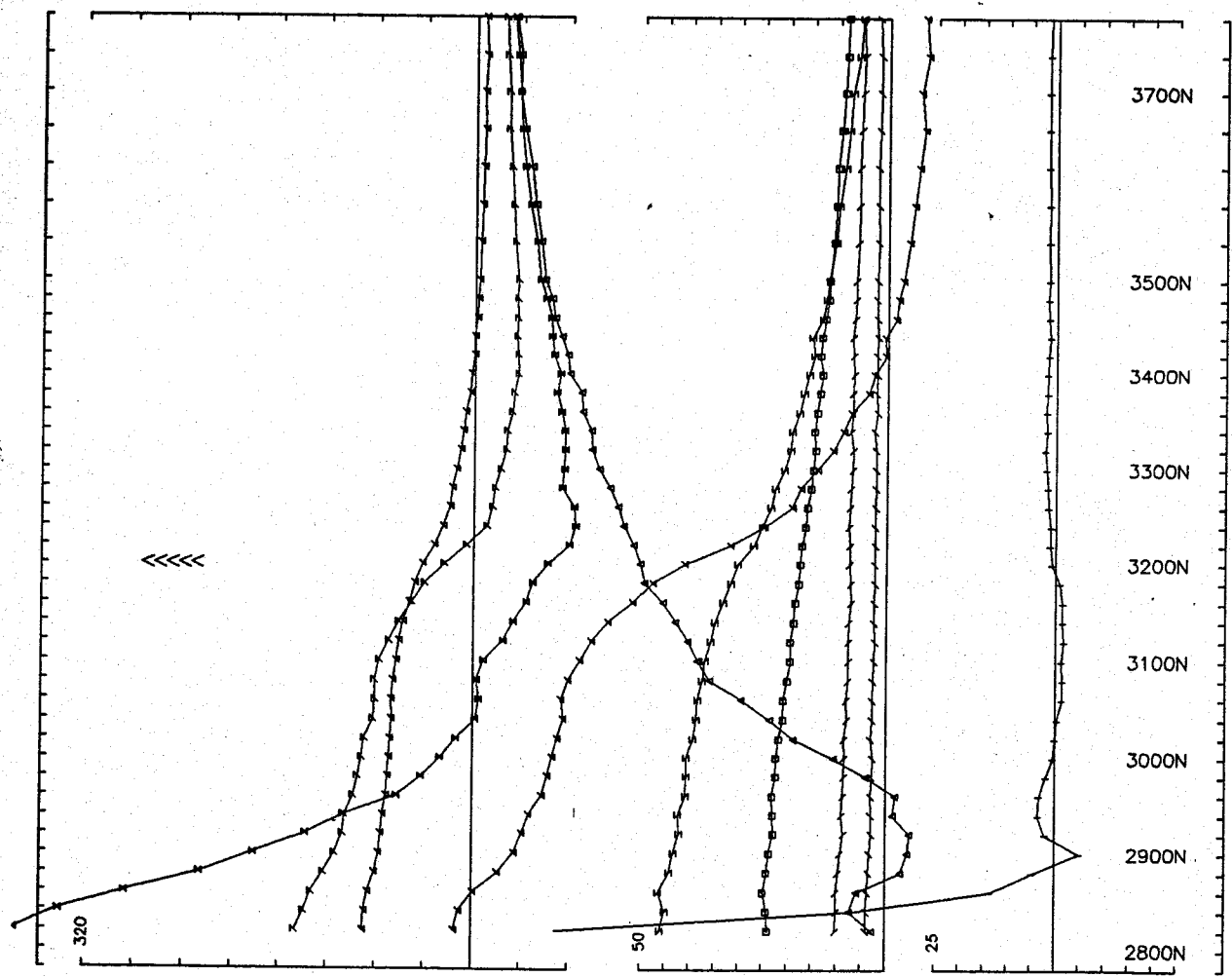
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Loopno 1 Line 3700W component HZ secondary Ch 1 normalized Ch 1 reduced contin. norm.



Area BAY OPTION (NTS 82M/4E) client FALCONBRIDGE LIMITED operator SJ GEOPHYSICS LTD. freq(hz) 54.409

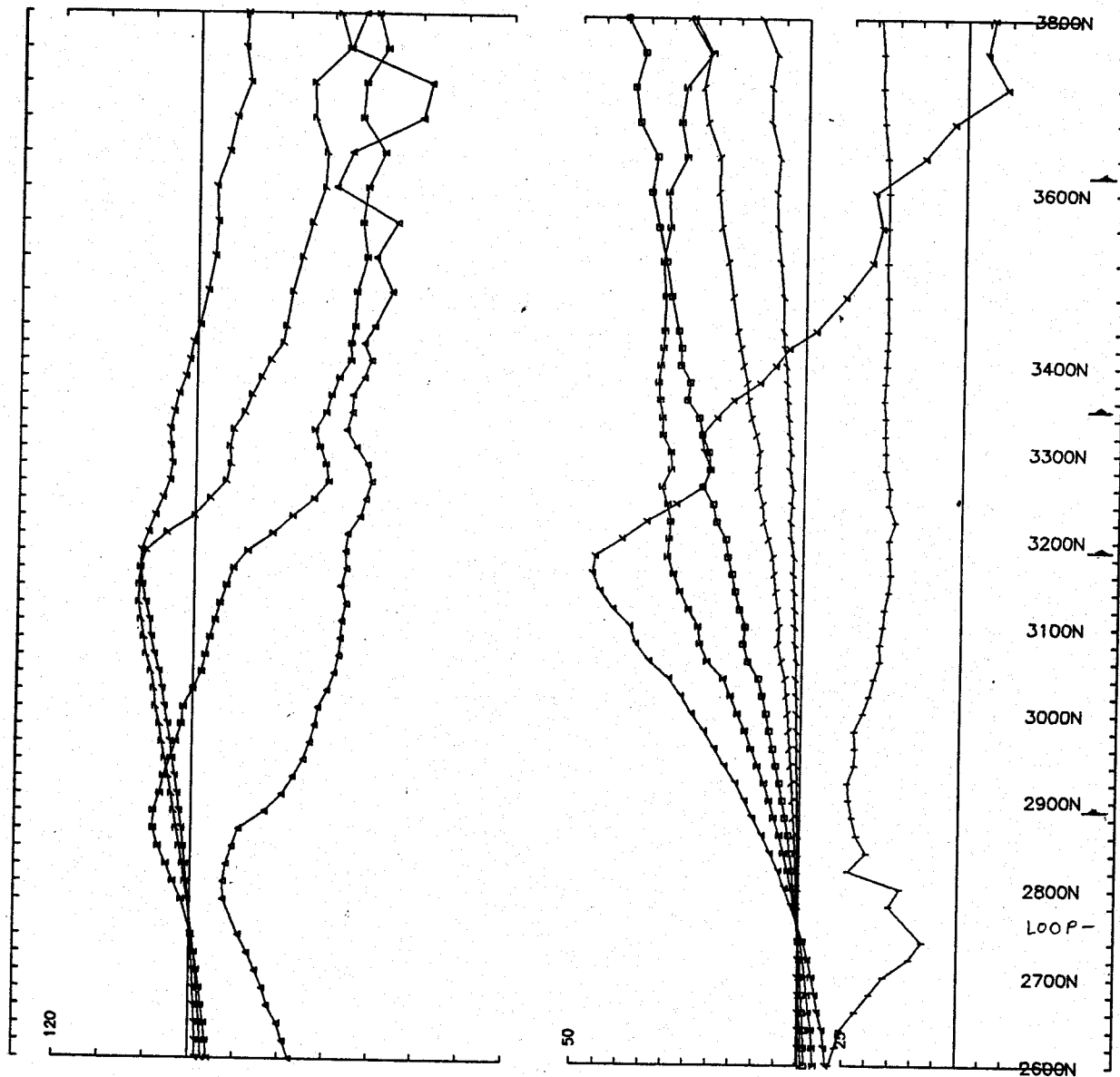
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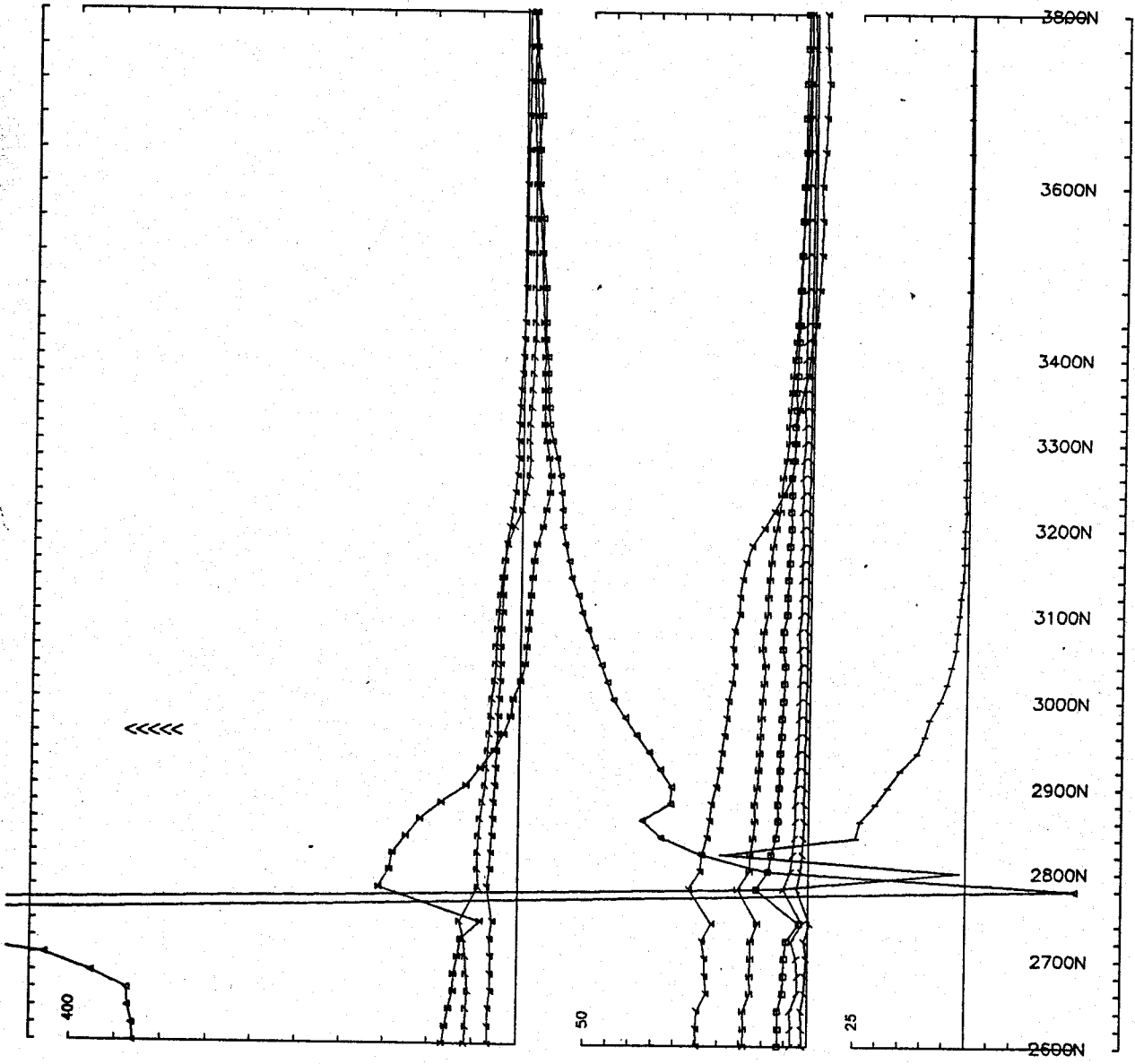
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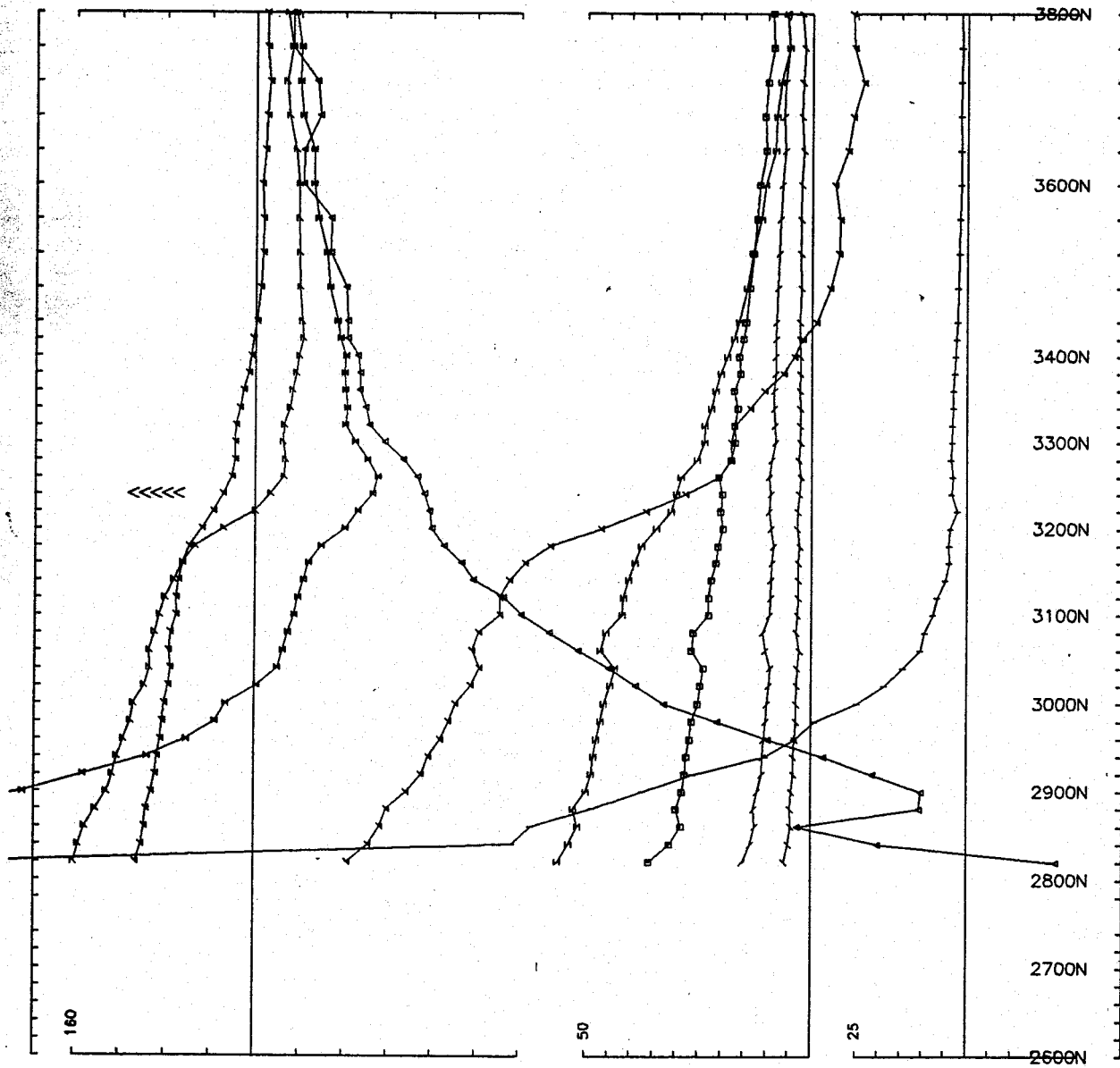
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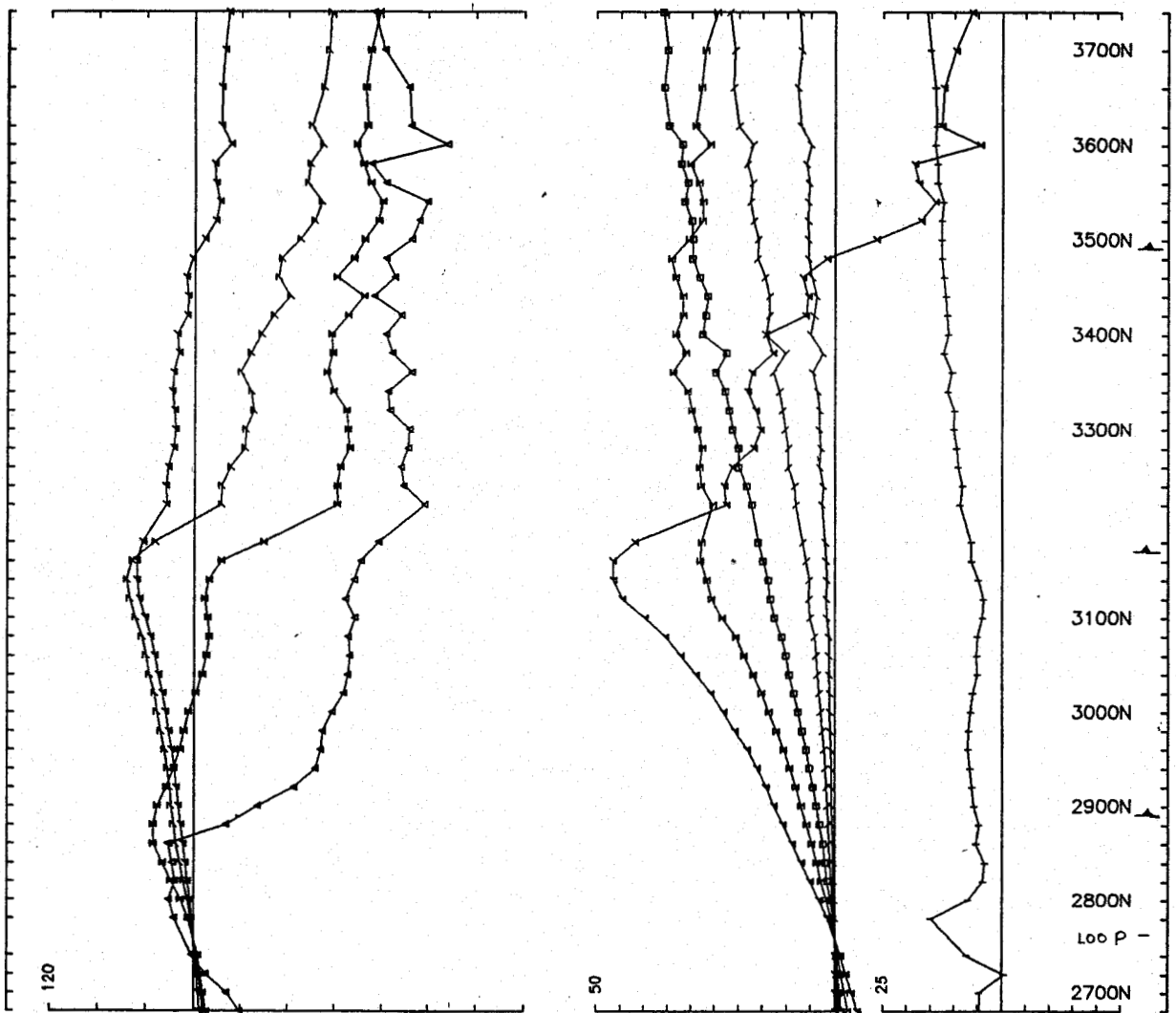
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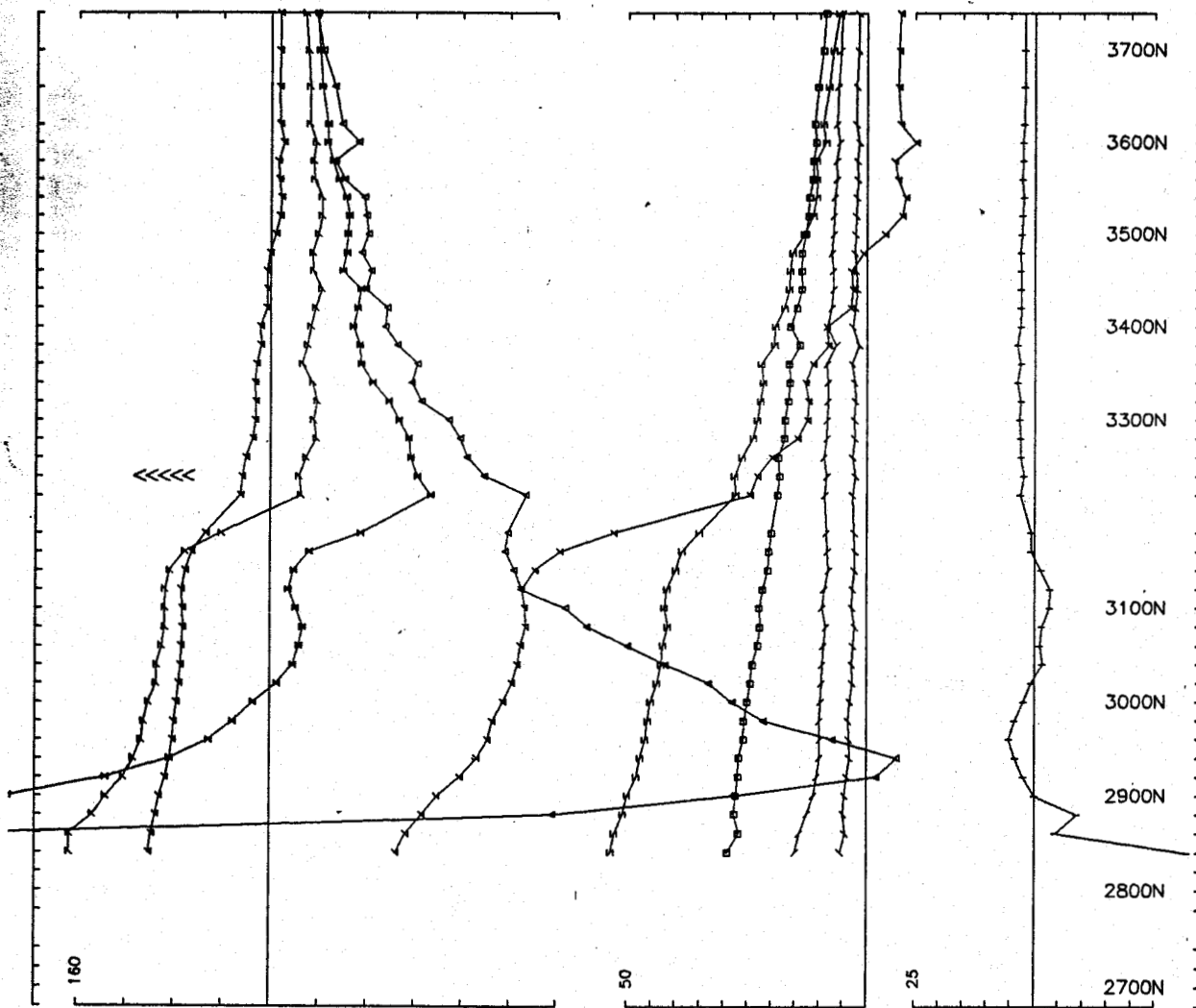
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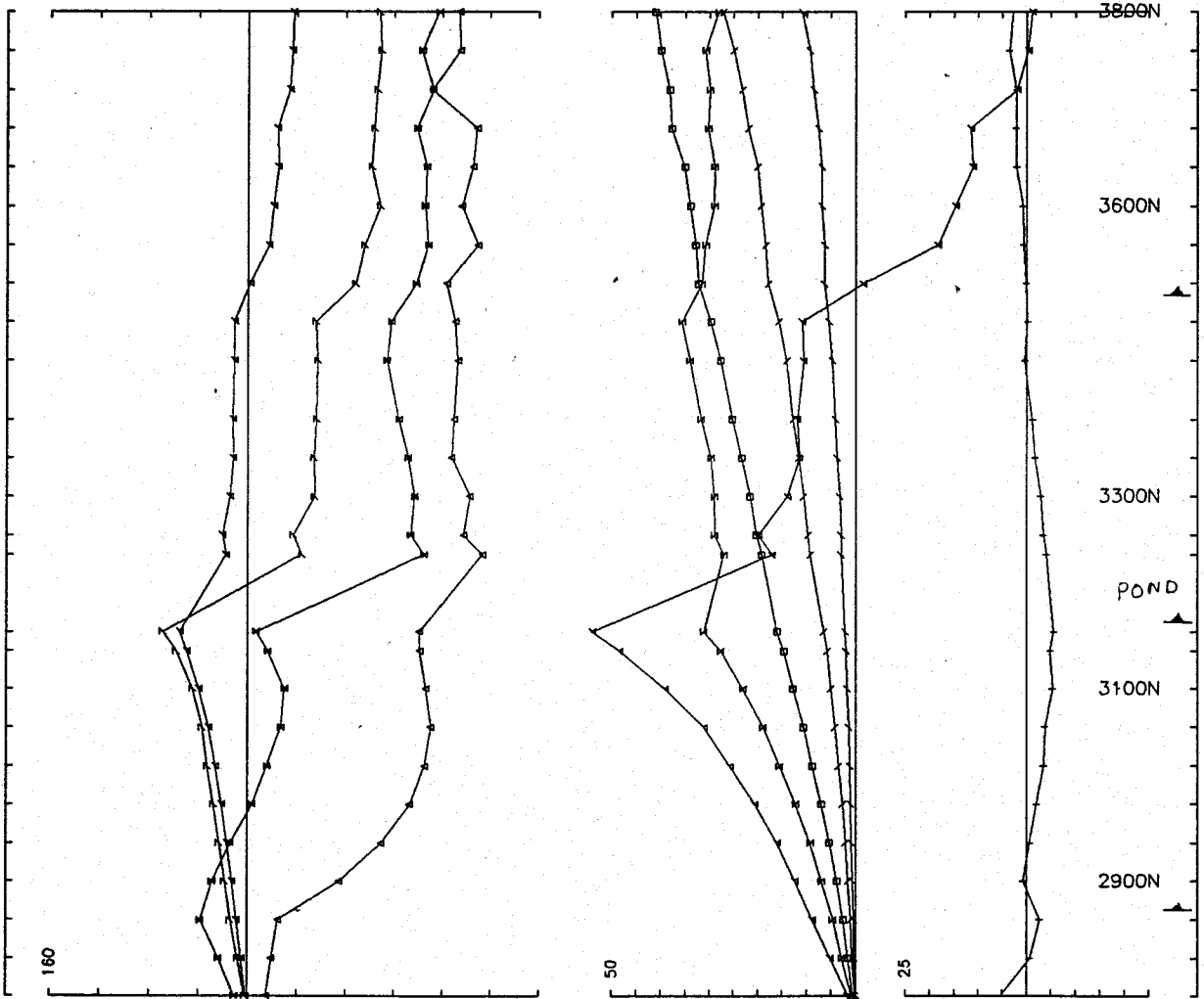
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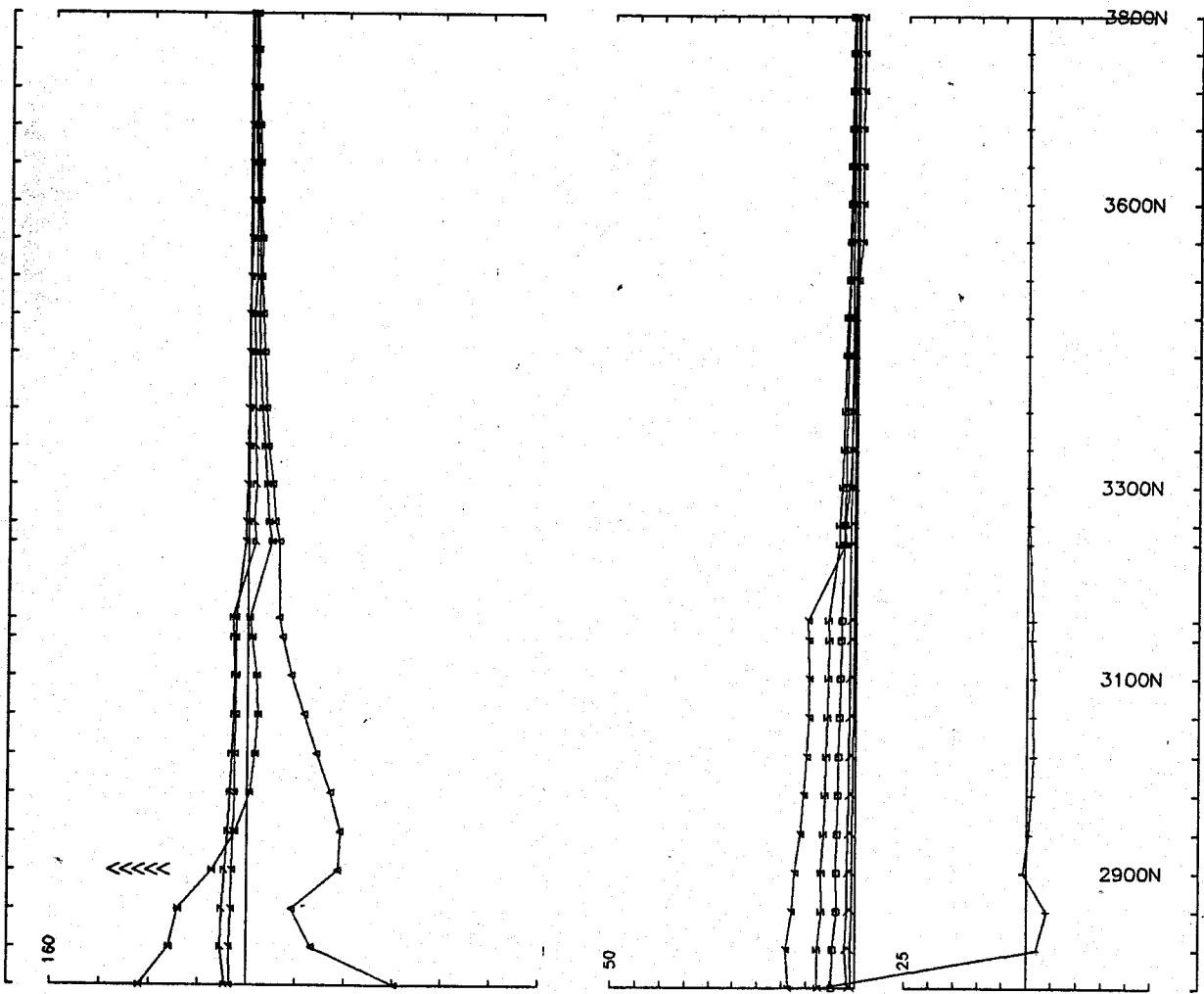
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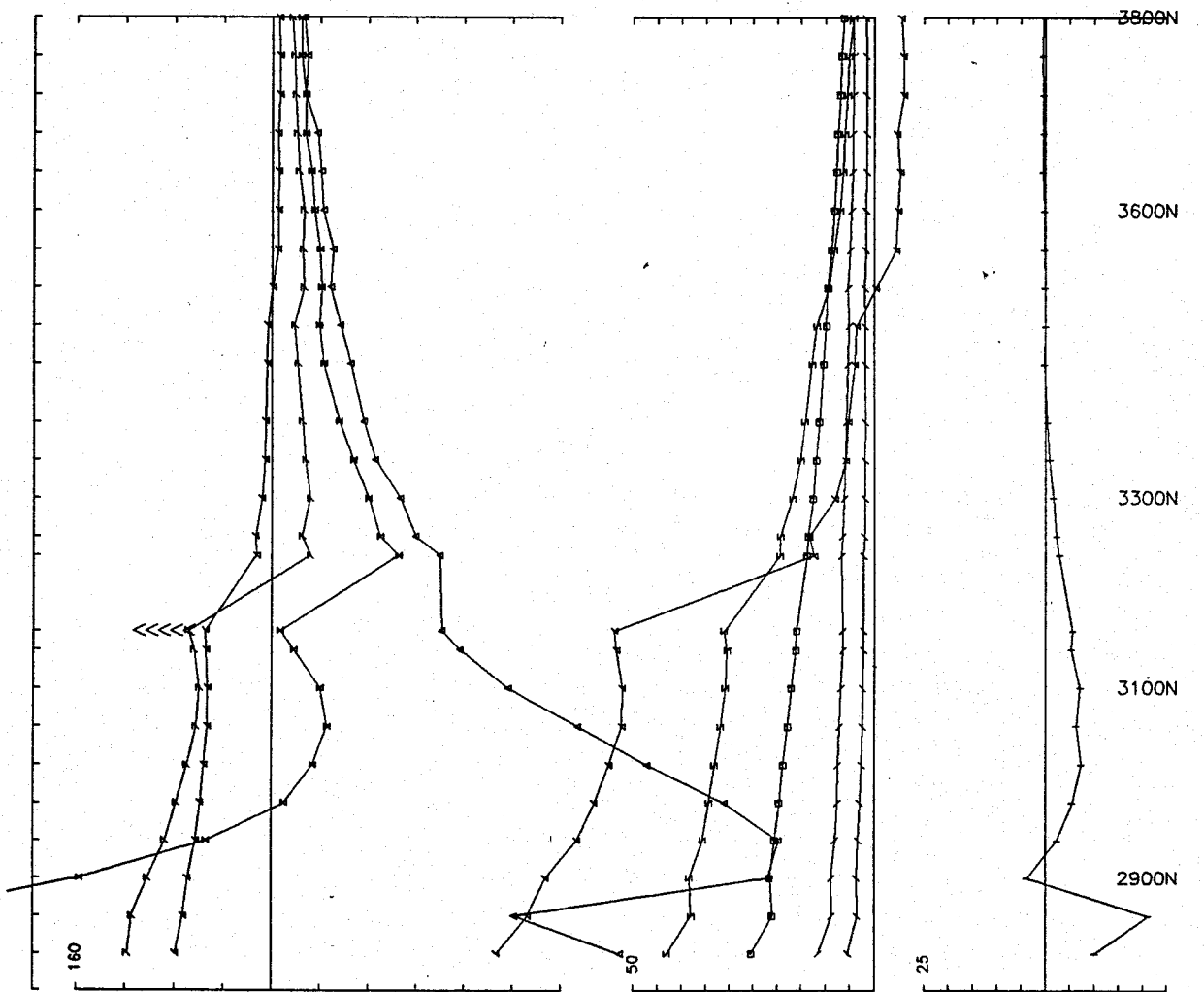
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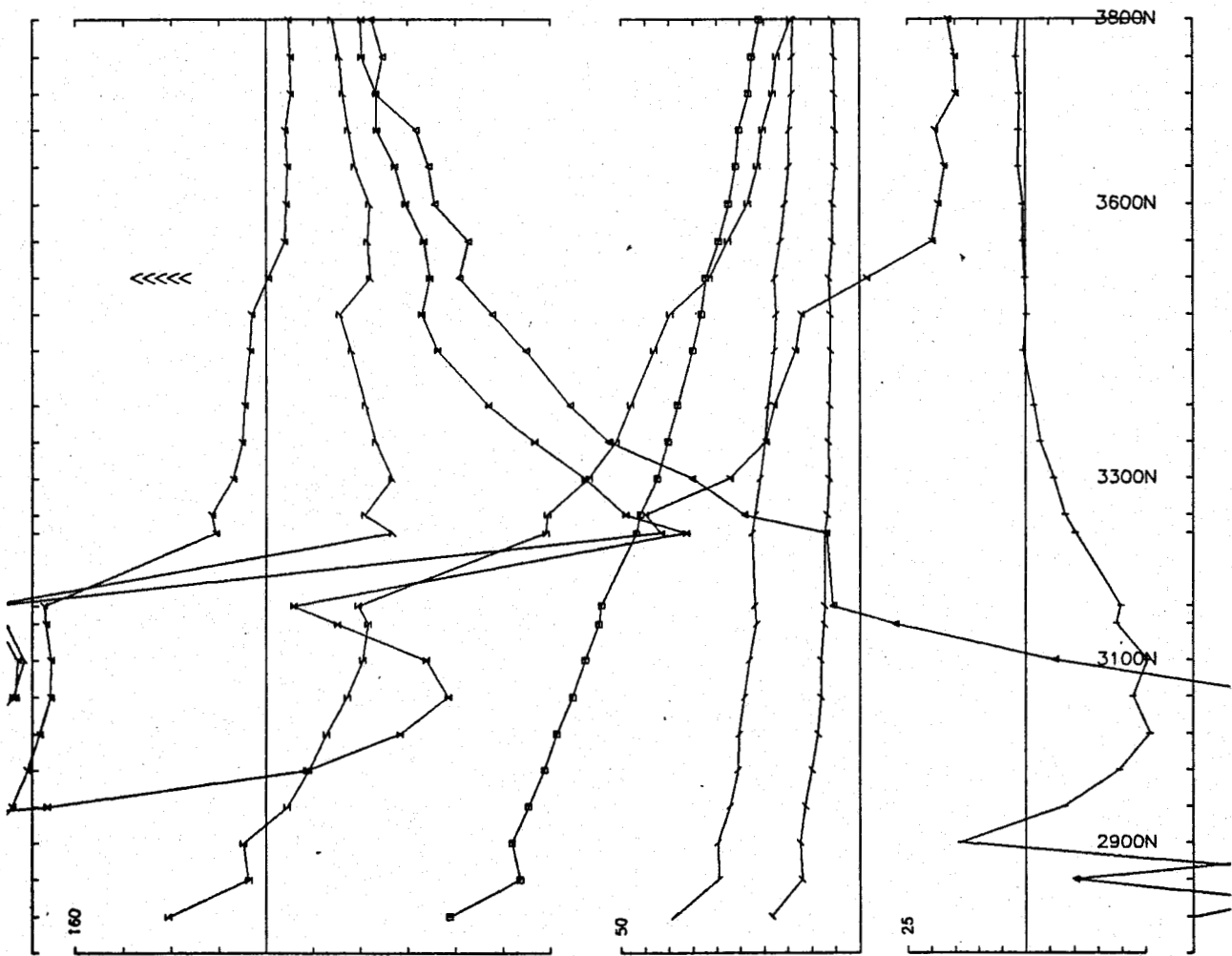
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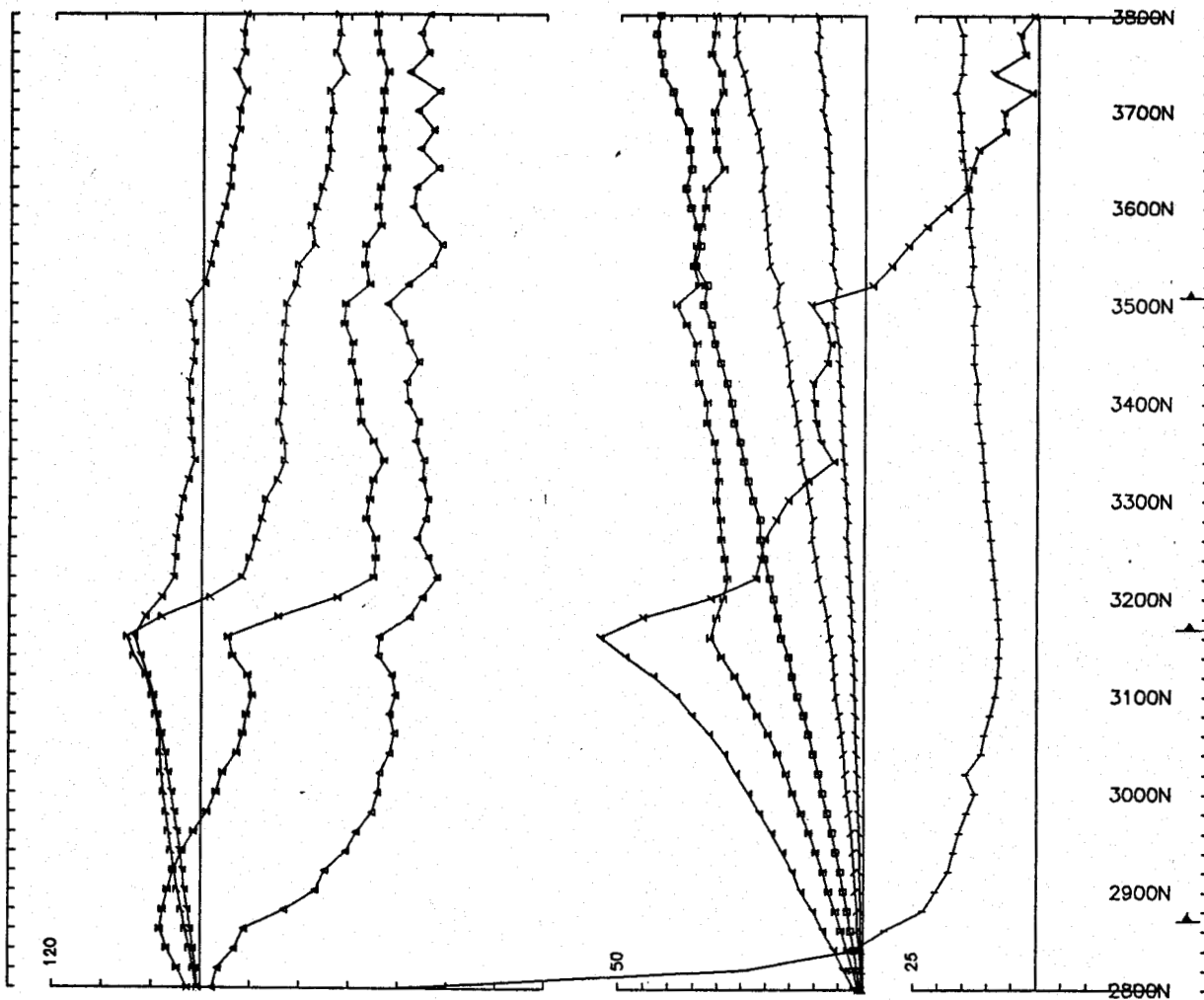
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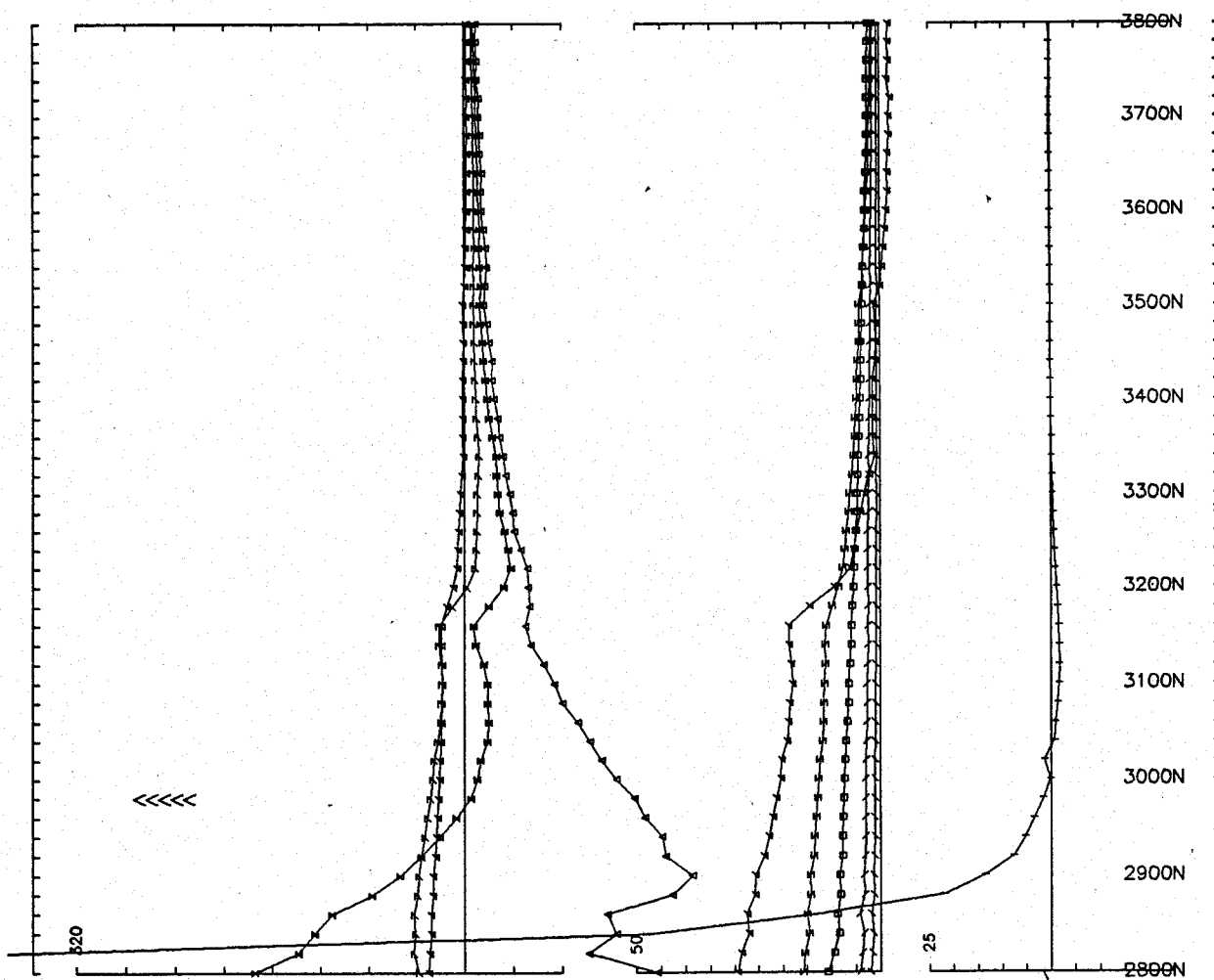
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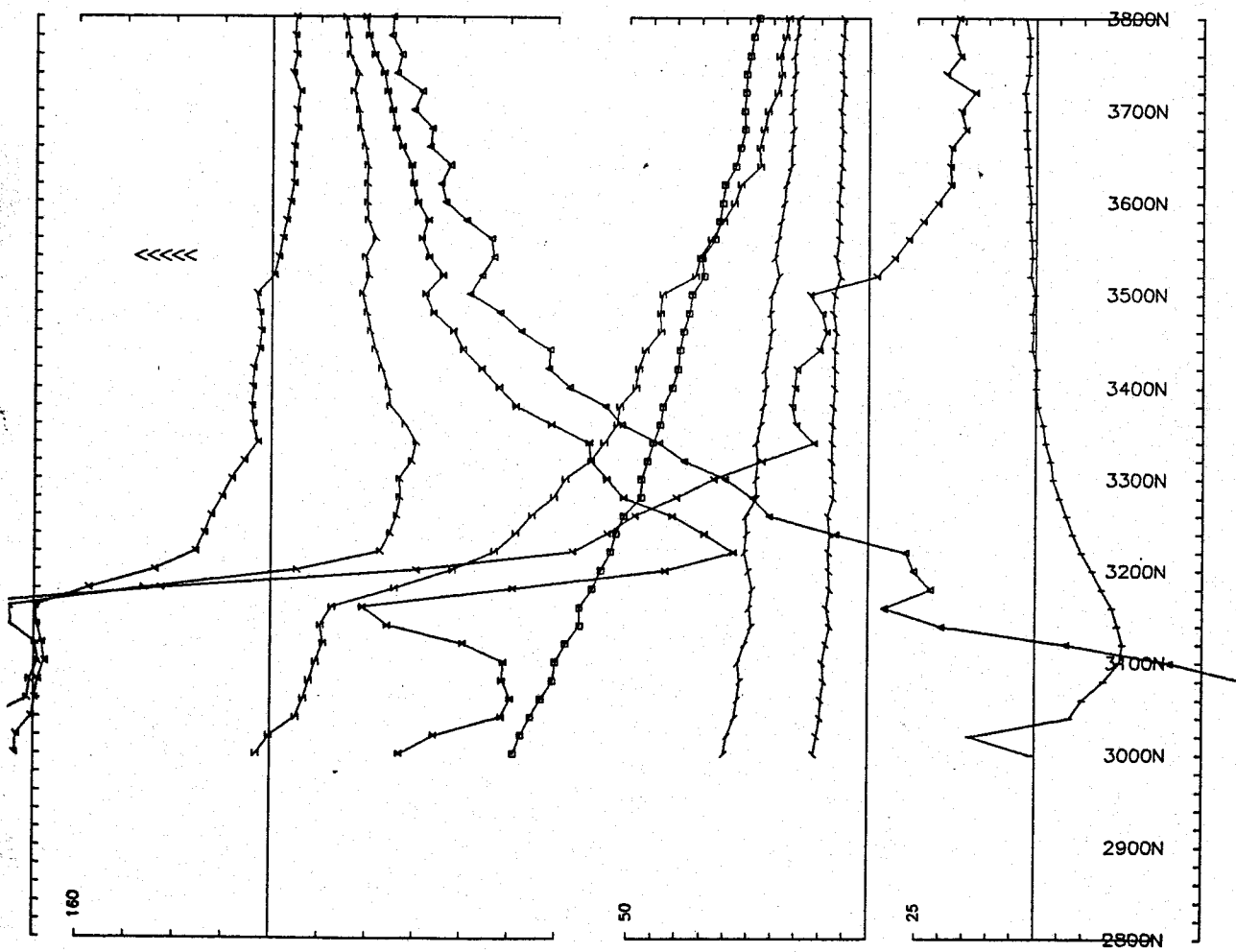
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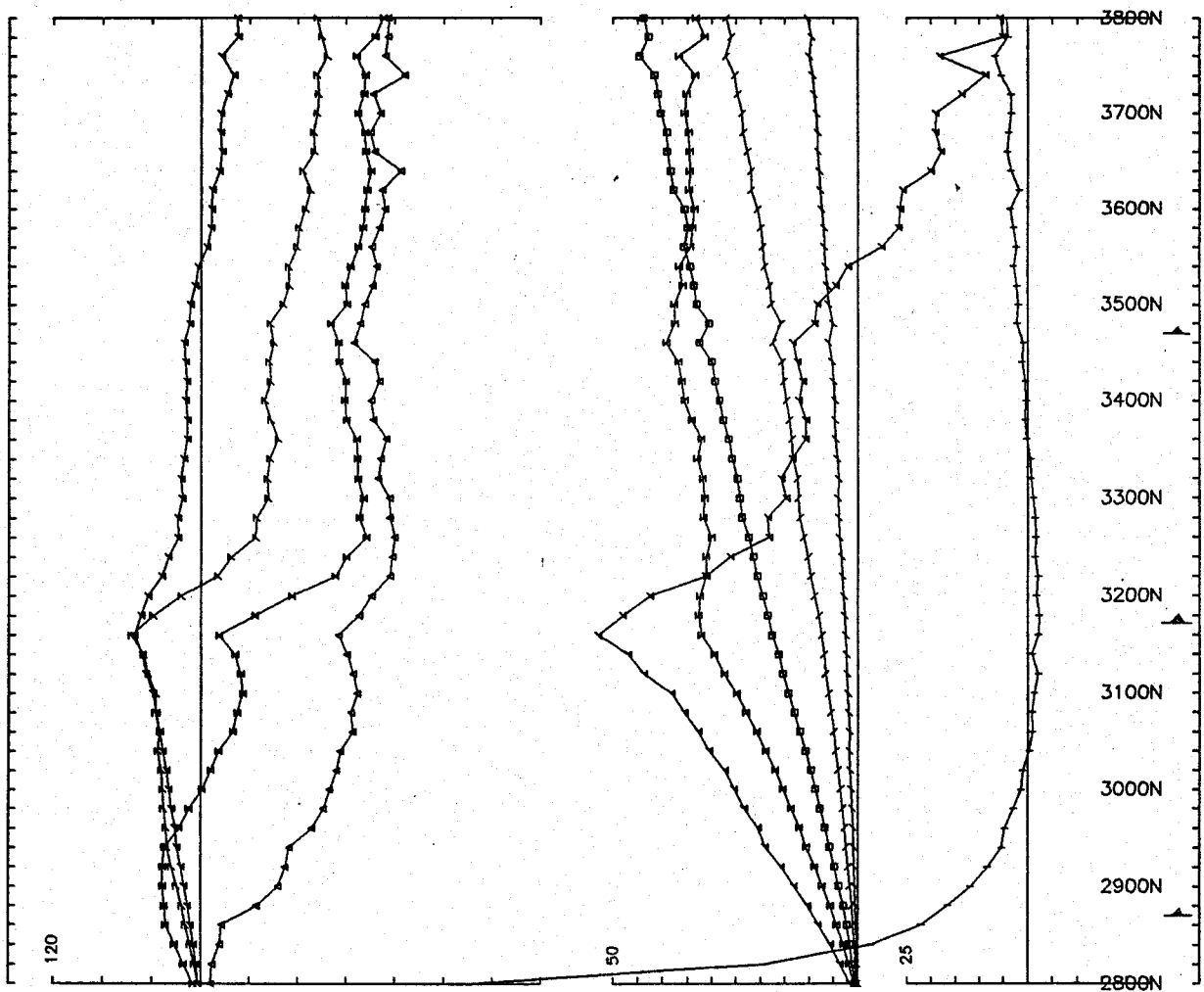
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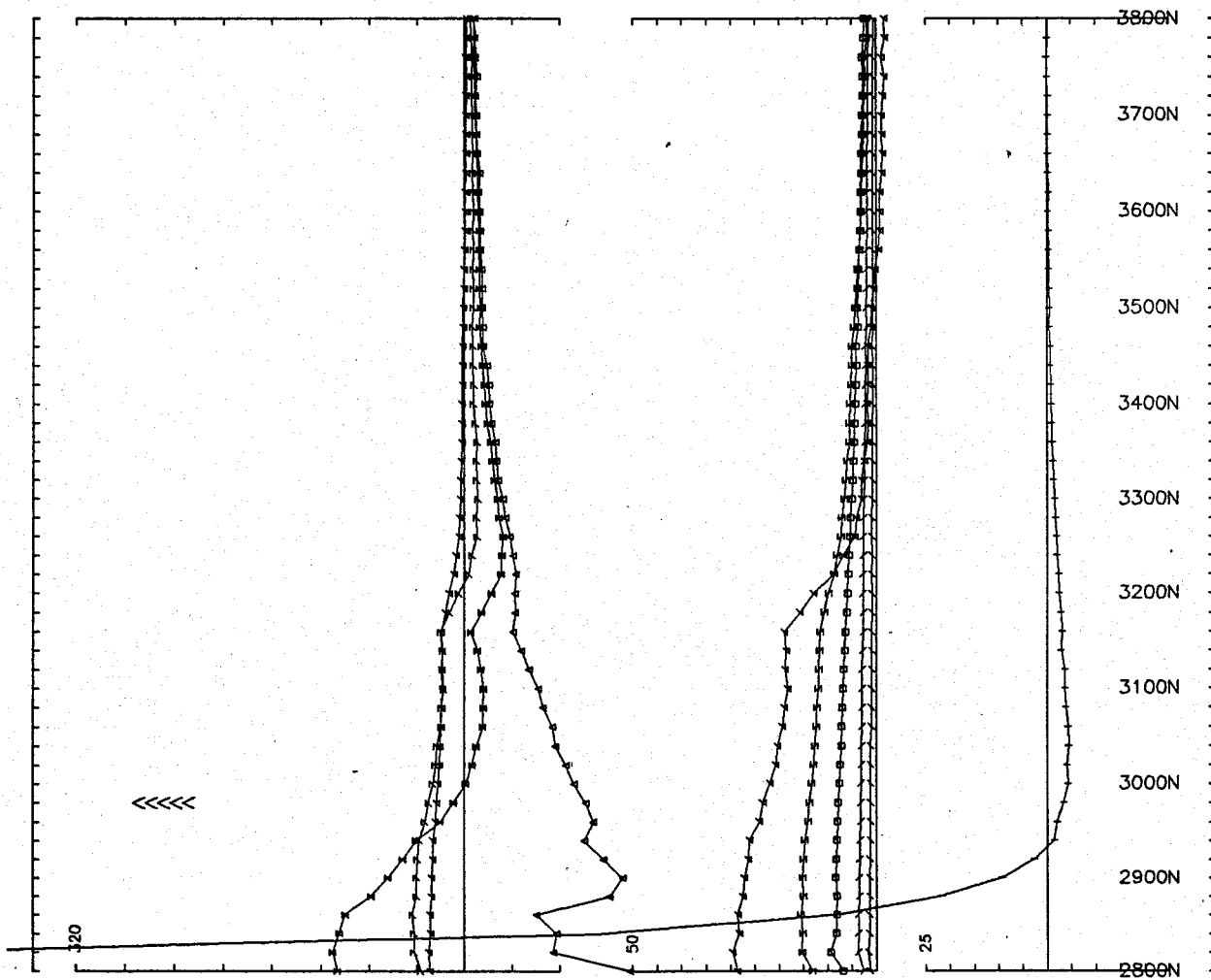
Area BAY OPTION (NTS 82M/4E) client FALCONBRIDGE LIMITED operator SJ GEOPHYSICS LTD. freq(hz) 54.409

Loopno 1 Line 4100W component Hz secondary Ch 1 normalized Ch 1 reduced point norm.



Area BAY OPTION (NTS 82M/4E) client FALCONBRIDGE LIMITED operator SJ GEOPHYSICS LTD. freq(hz) 54.409

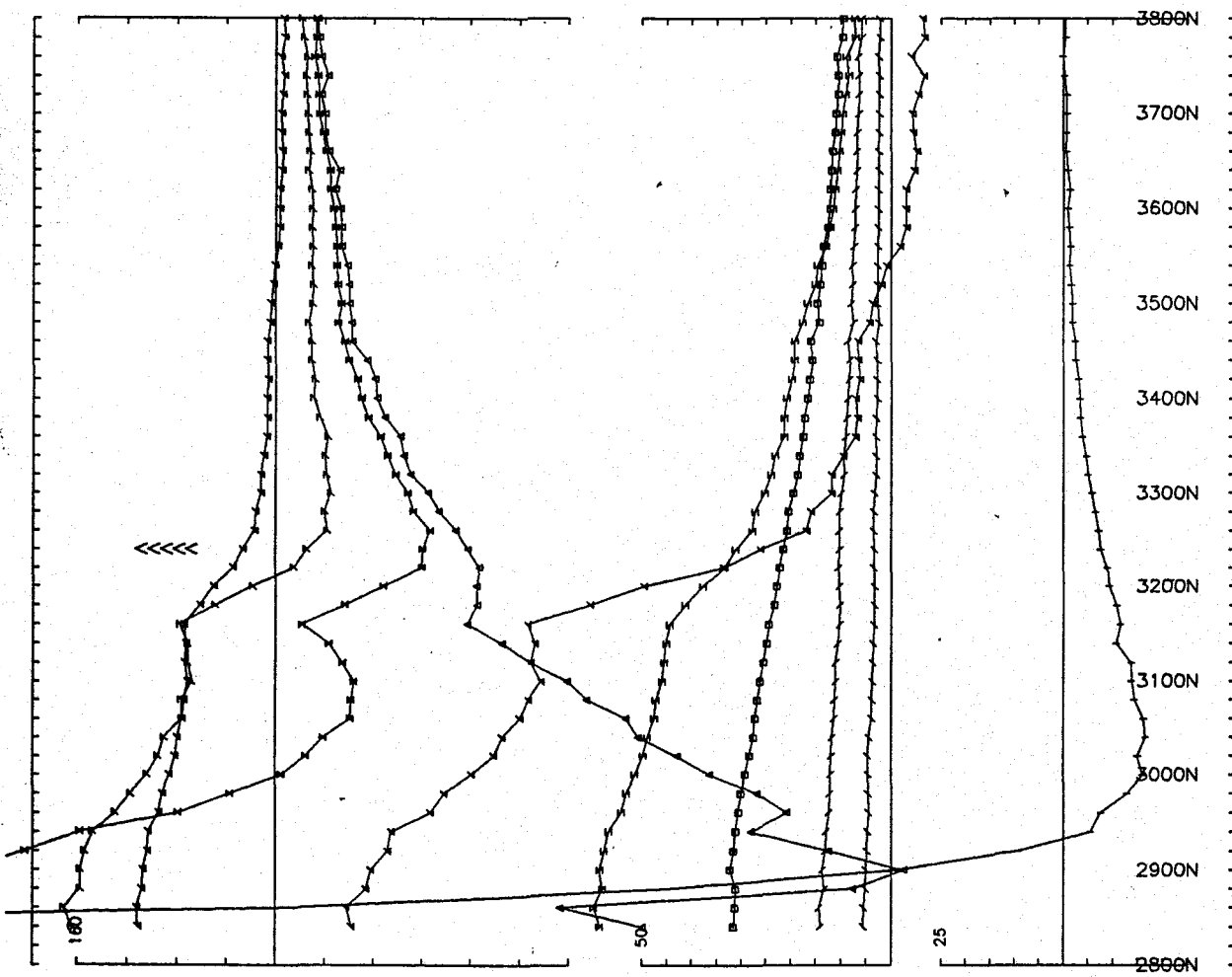
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Area BAY OPTION (NTS 82M/4E) client FALCONBRIDGE LIMITED operator SJ GEOPHYSICS LTD. freq(hz) 54.409

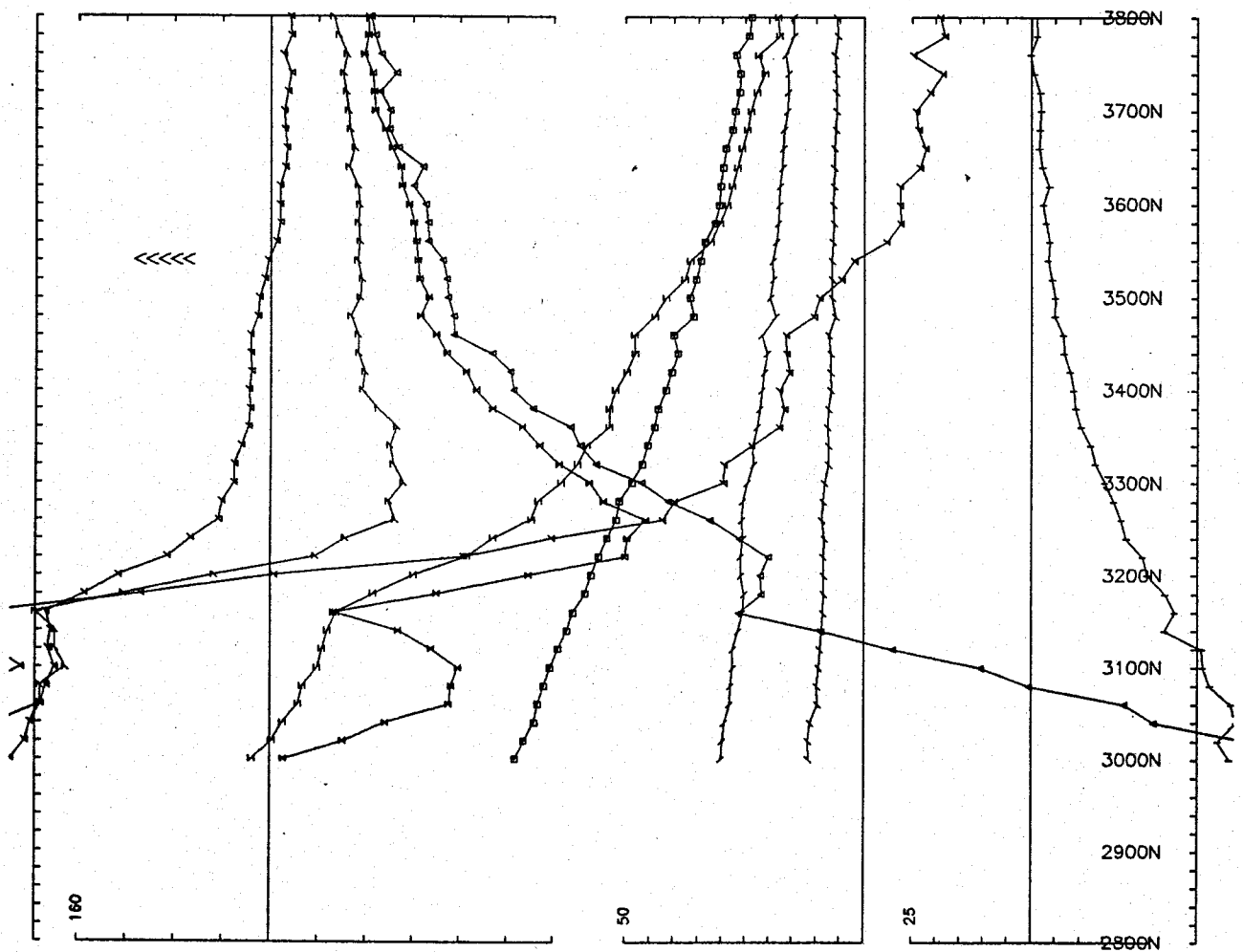
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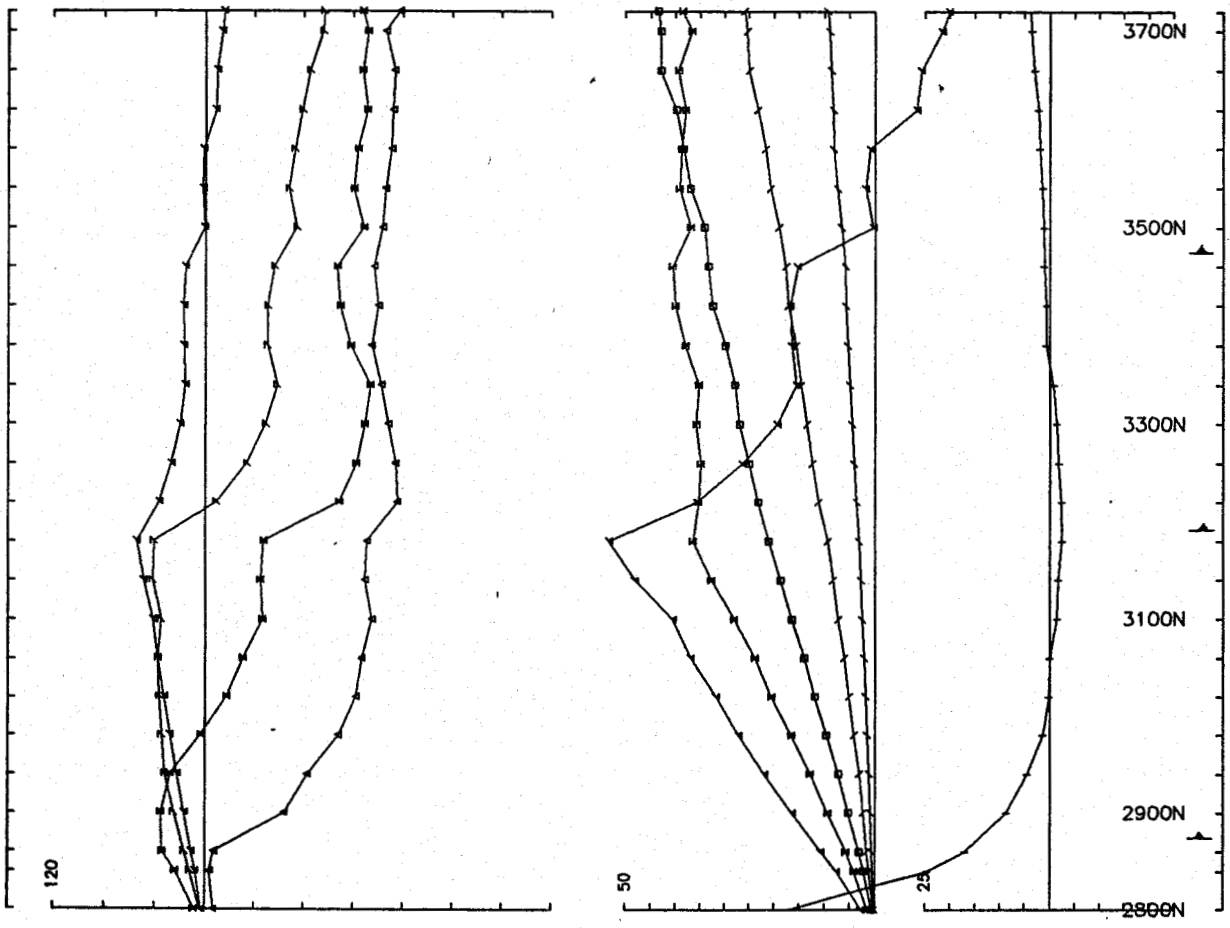
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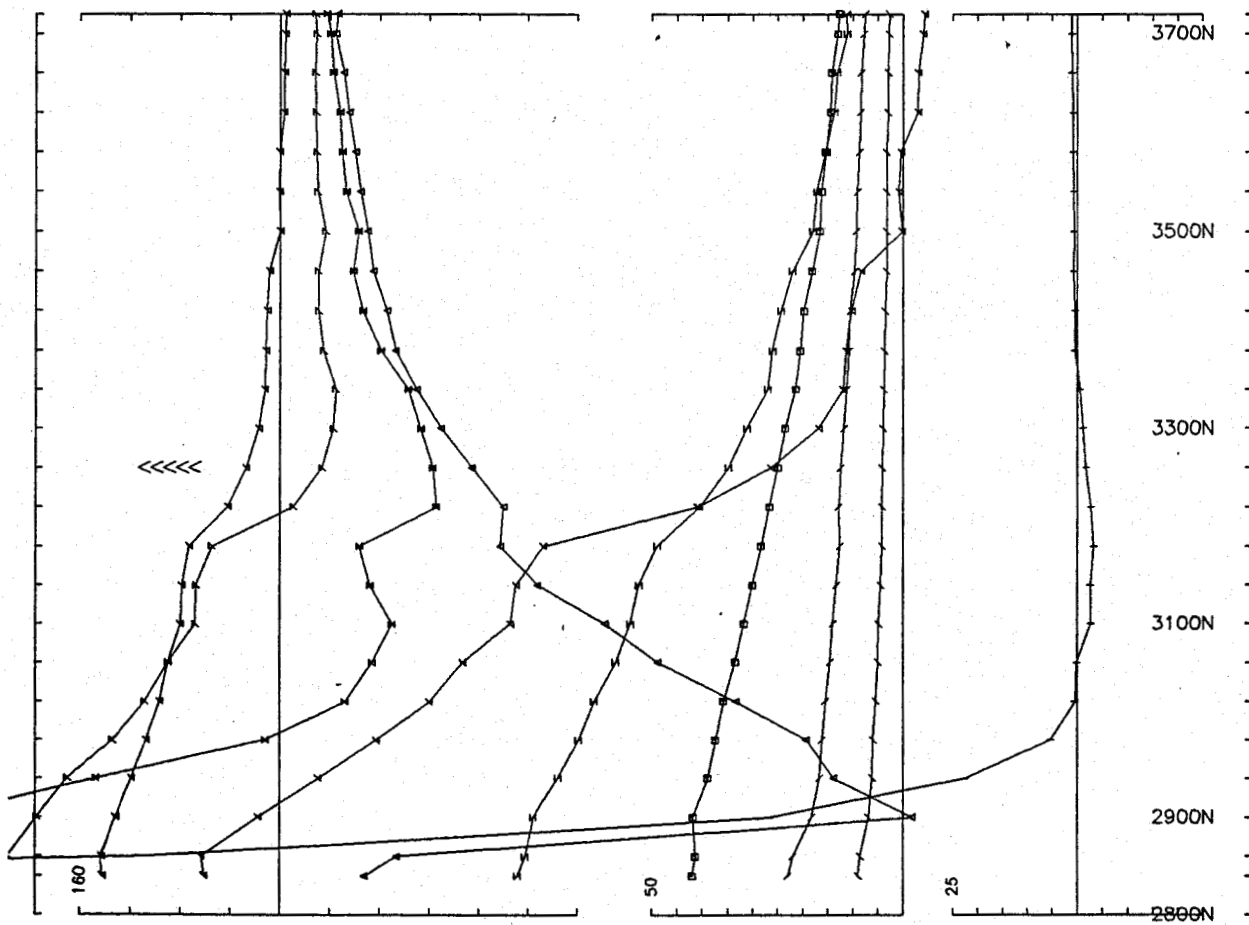
Area BAY OPTION (NTS 82M/4E) client FALCONBRIDGE LIMITED operator SJ GEOPHYSICS LTD. freq(hz) 54.409

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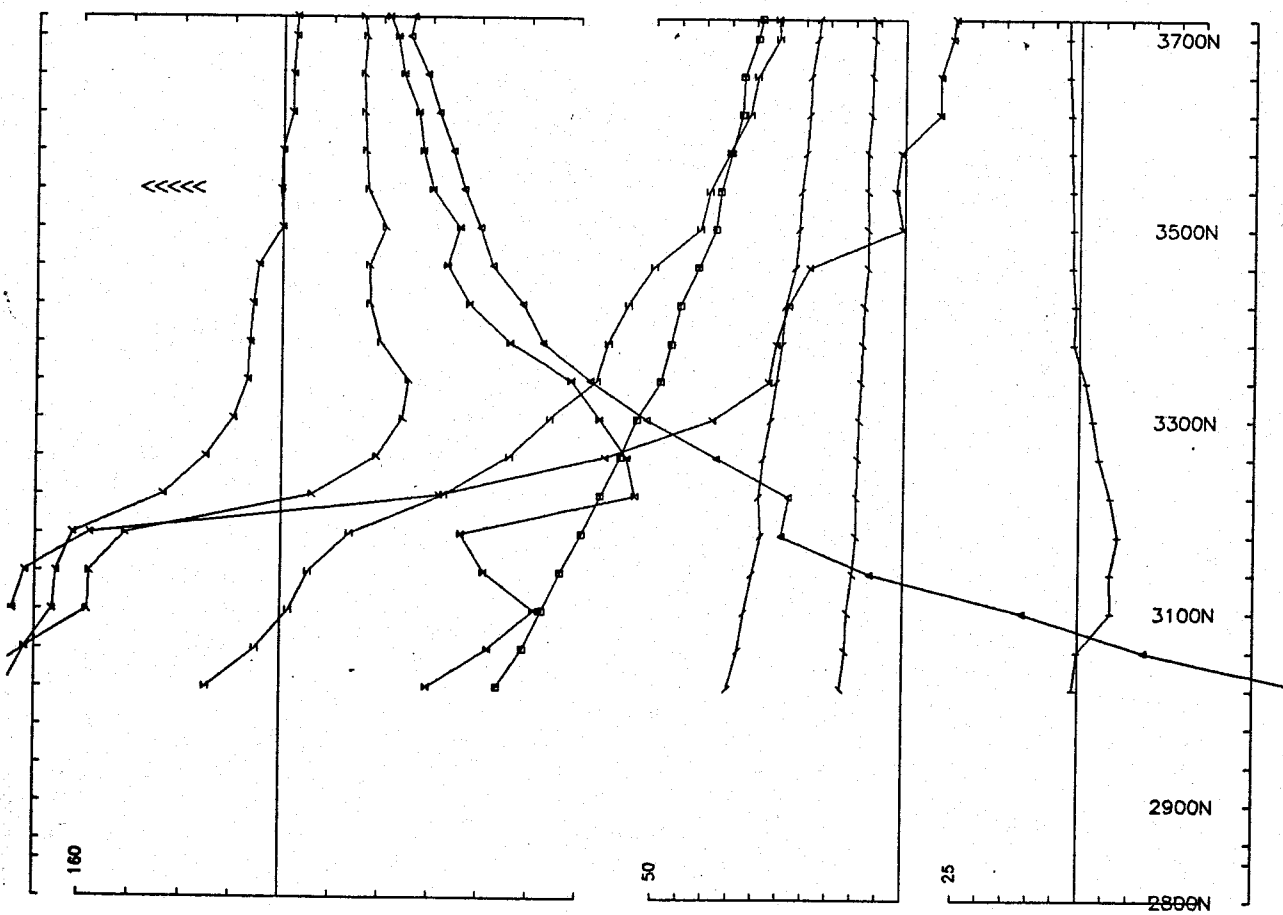
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Loopno 1 Line 4300W component Hz secondary Ch 1 normalized Ch 1 reduced contin. norm.



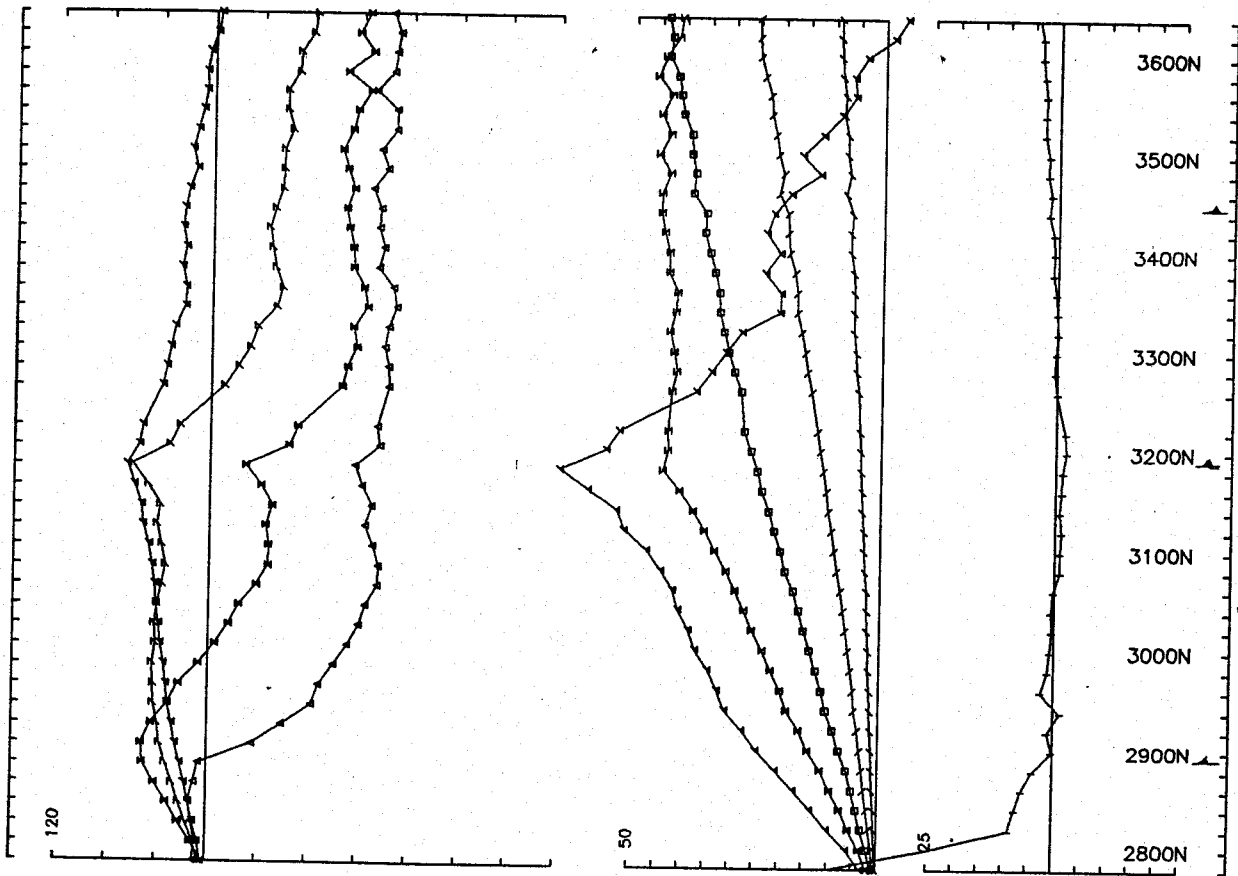
Area BAY OPTION (NTS 82M/4E) client FALCONBRIDGE LIMITED operator SJ GEOPHYSICS LTD. freq(hz) 54.409

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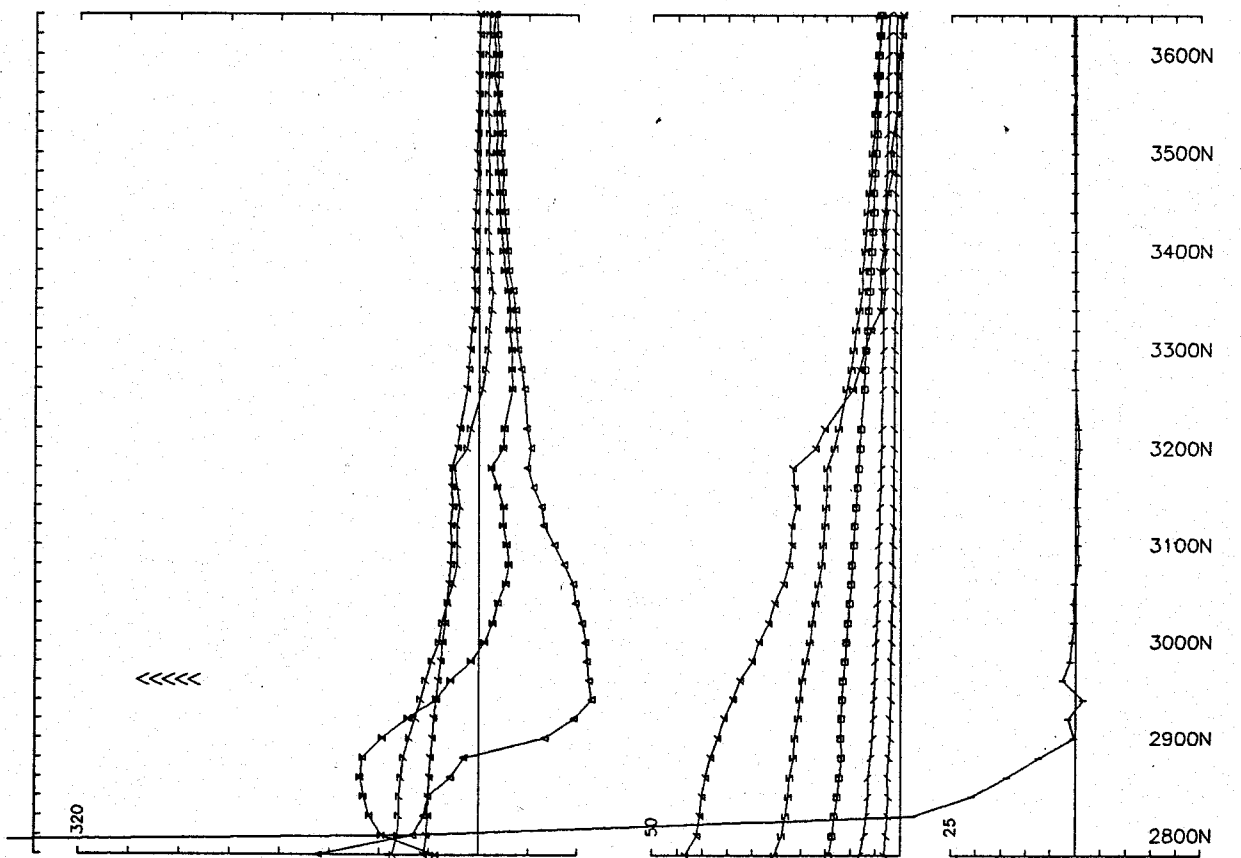
Area BAY OPTION (NTS 82M/4E) client FALCONBRIDGE LIMITED operator SJ GEOPHYSICS LTD. freq(hz) 54.409

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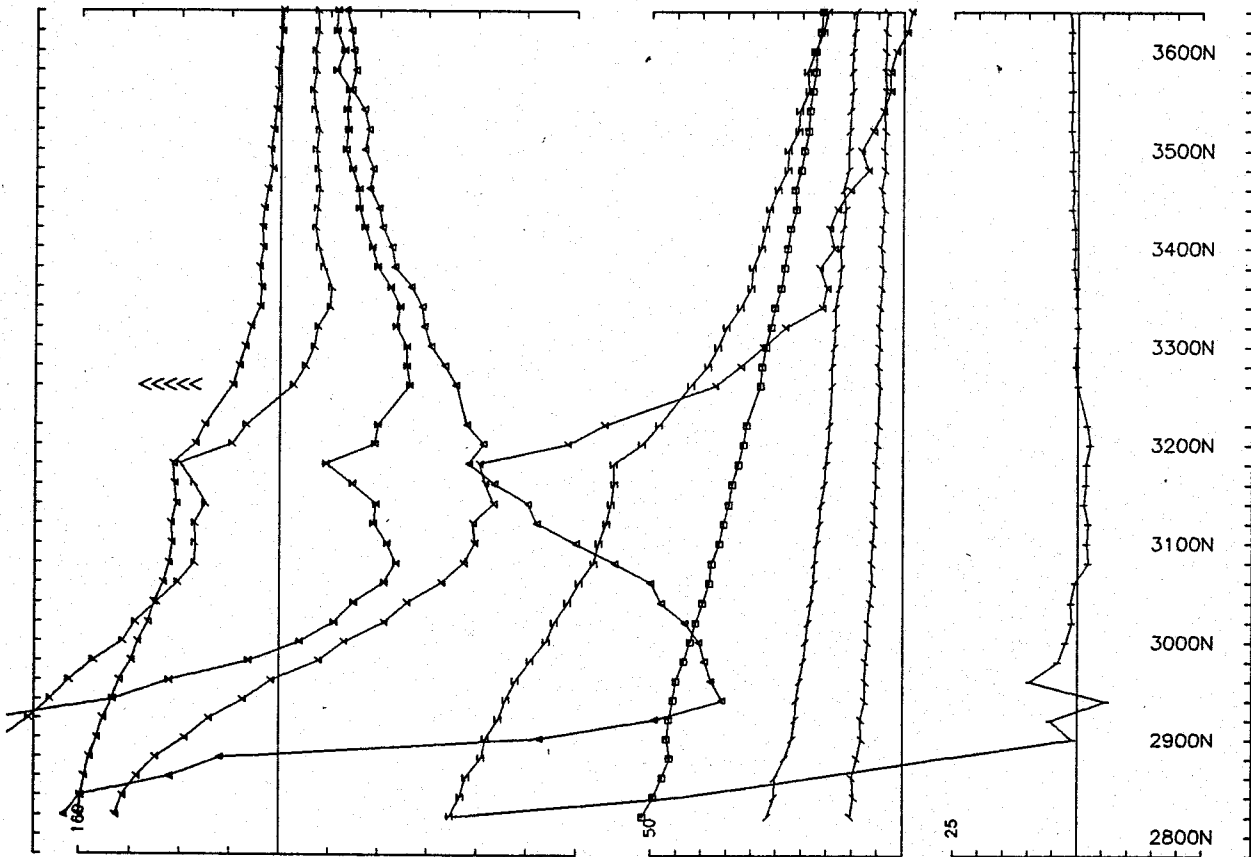
Area BAY OPTION (NTS 82M/4E) client FALCONBRIDGE LIMITED operator SJ GEOPHYSICS LTD. freq(hz) 54.409

Loopno 1 Line 4400W component HZ secondary Ch 1 normalized Ch 1 reduced contin. norm.



Area BAY OPTION (NTS 82M/4E) client FALCONBRIDGE LIMITED operator SJ GEOPHYSICS LTD. freq(hz) 54.409

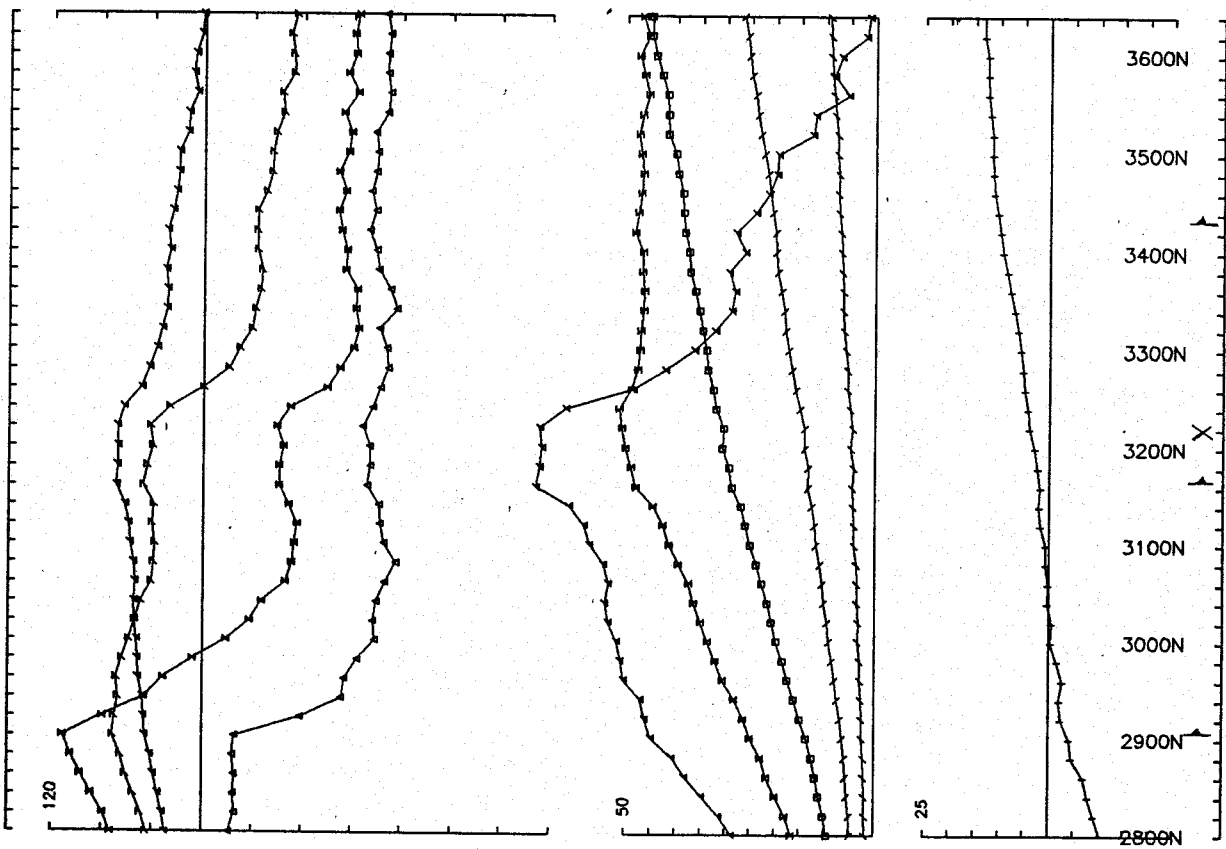
Loopno 1. Line 4400W component HZ secondary Ch 1 normalized Ch 1 reduced point norm.



Area BAY OPTION (NTS 82M/4E) client FALCONBRIDGE LIMITED operator SJ GEOPHYSICS LTD. freq(hz) 54.409

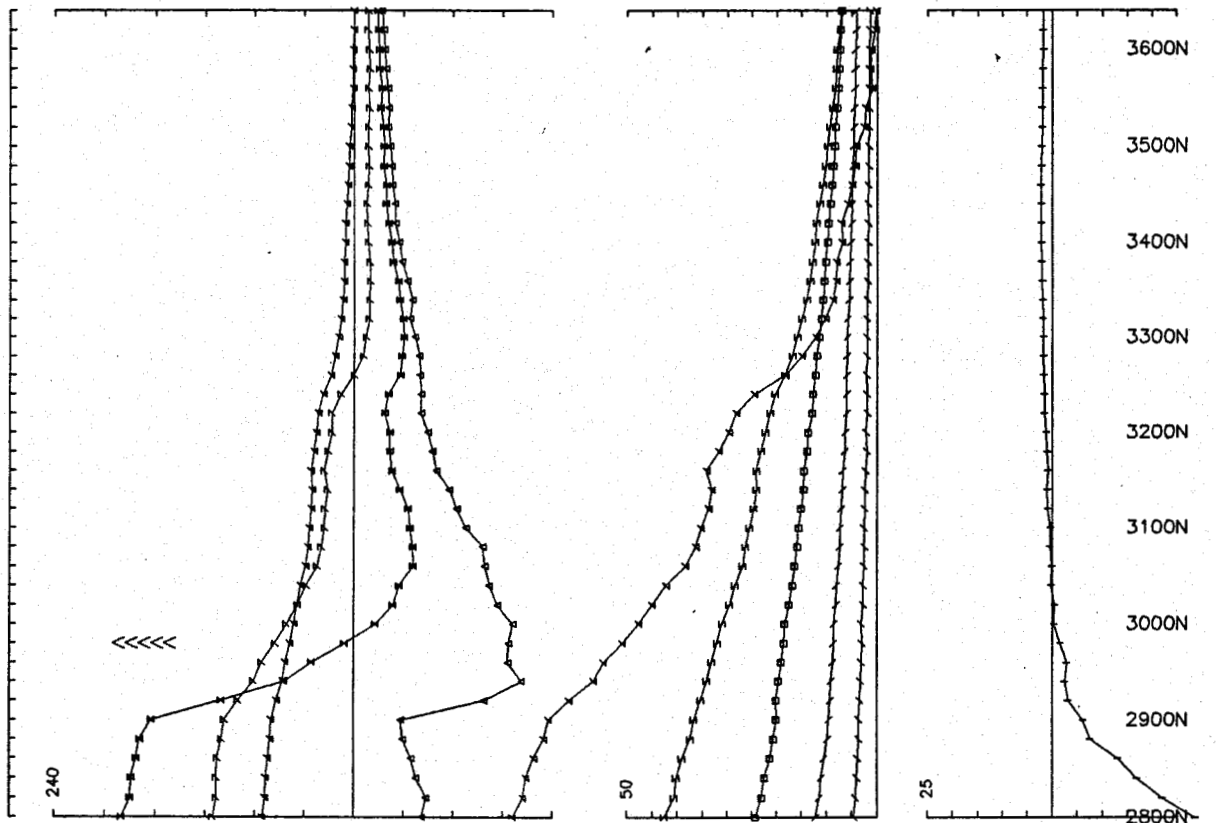
Loopno 1 Line 4400W component Hz secondary Ch 1 normalized Ch 1 reduced point norm.





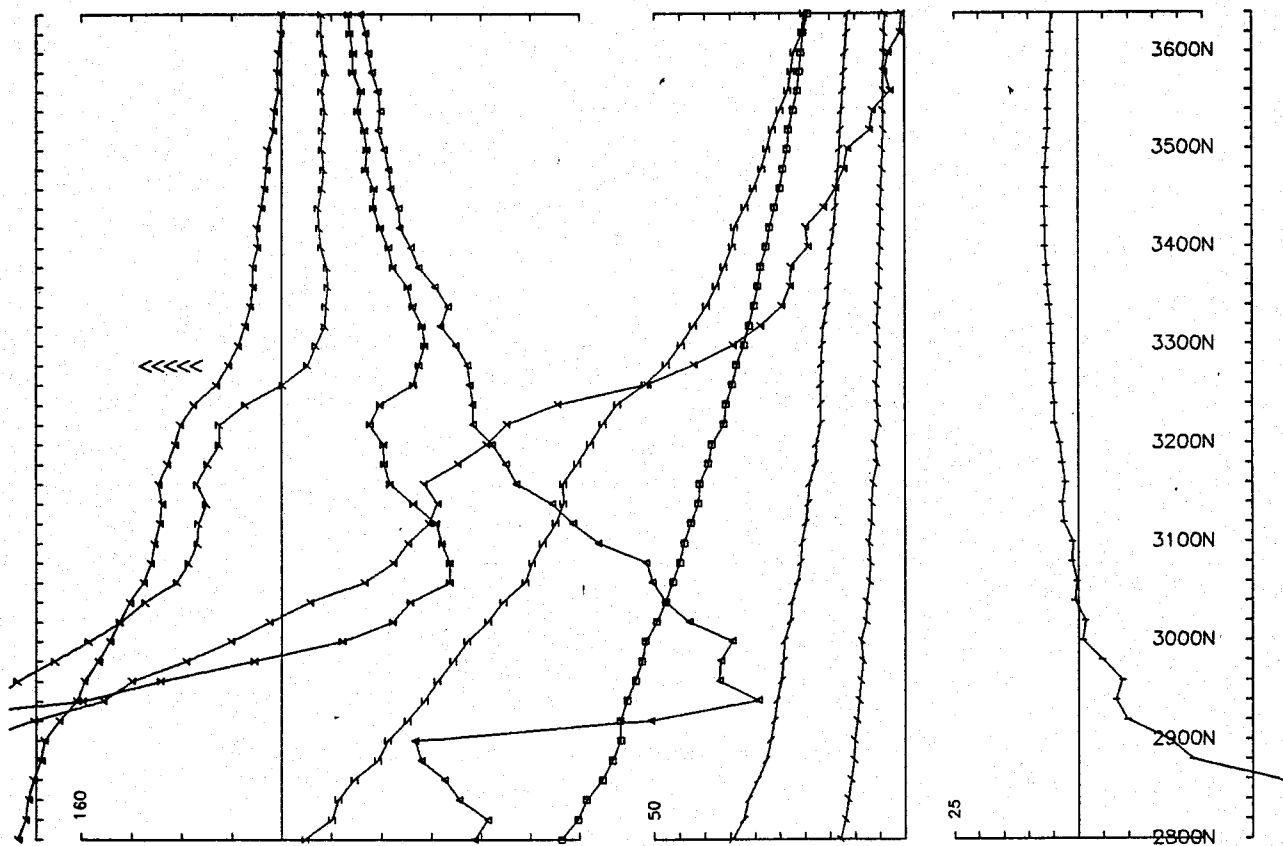
Area BAY OPTION (NTS 82M/4E) client FALCONBRIDGE LIMITED operator SJ GEOPHYSICS LTD. freq(hz) 54.409

Loopno 1 Line 4500W component Hz secondary Ch 1 normalized Ch 1 reduced contin. norm.



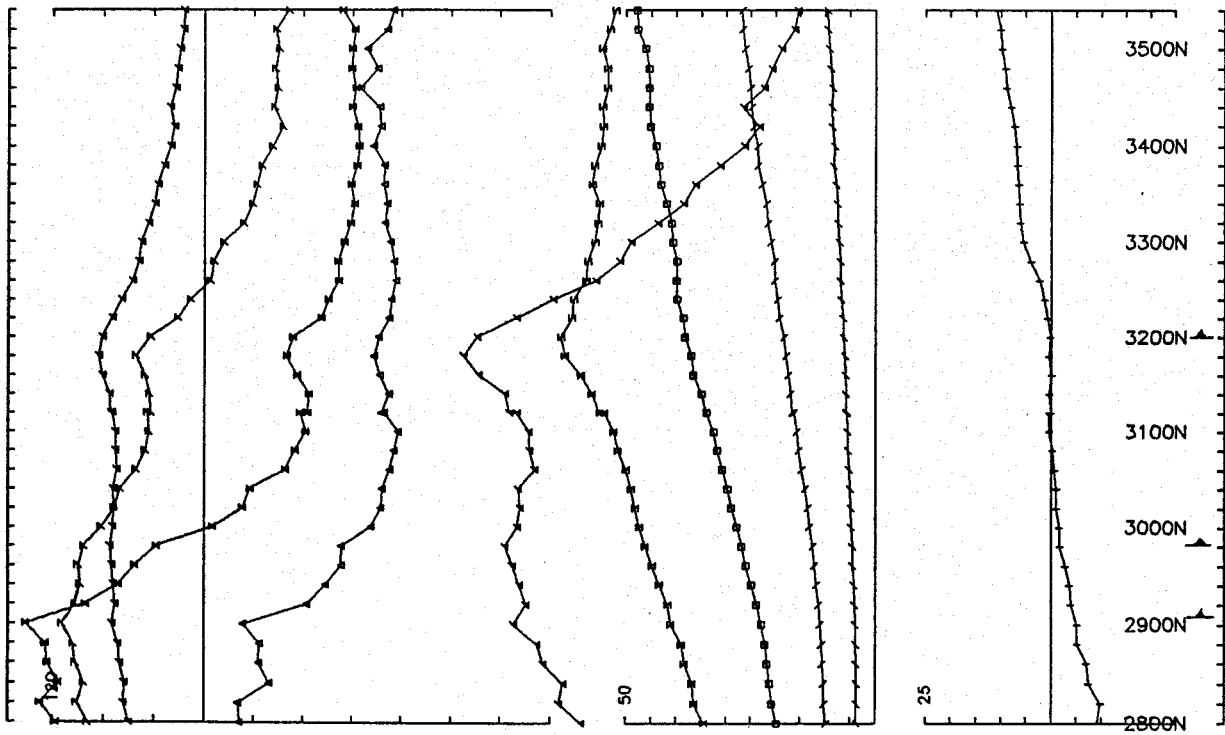
Area BAY OPTION (NTS 82M/4E) client FALCONBRIDGE LIMITED operator SJ GEOPHYSICS LTD. freq(hz) 54.409

Loopno 1 Line 4500W component Hz secondary Ch 1 normalized Ch 1 reduced point norm.



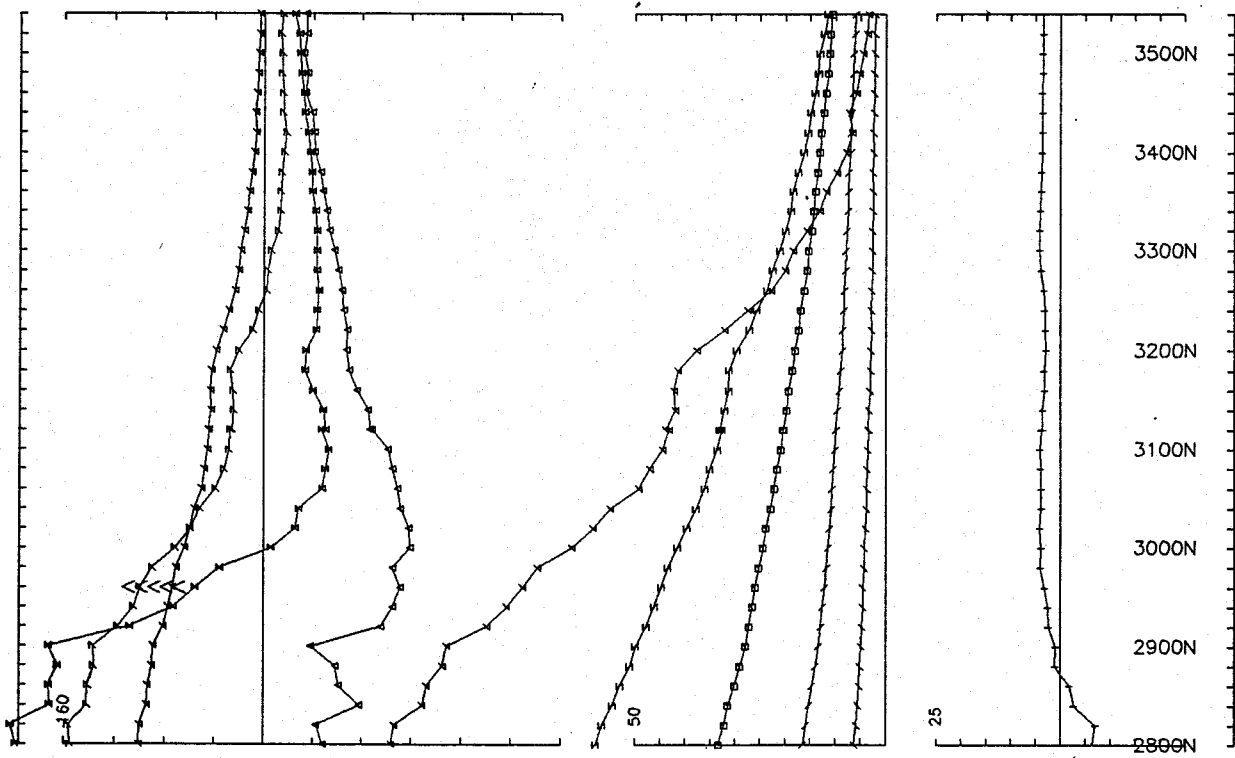
Area BAY OPTION (NTS 82M/4E) client FALCONBRIDGE LIMITED operator SJ GEOPHYSICS LTD. freq(hz) 54.409

Loopno 1 Line 4500W component Hz secondary Ch 1 normalized Ch 1 reduced point norm.



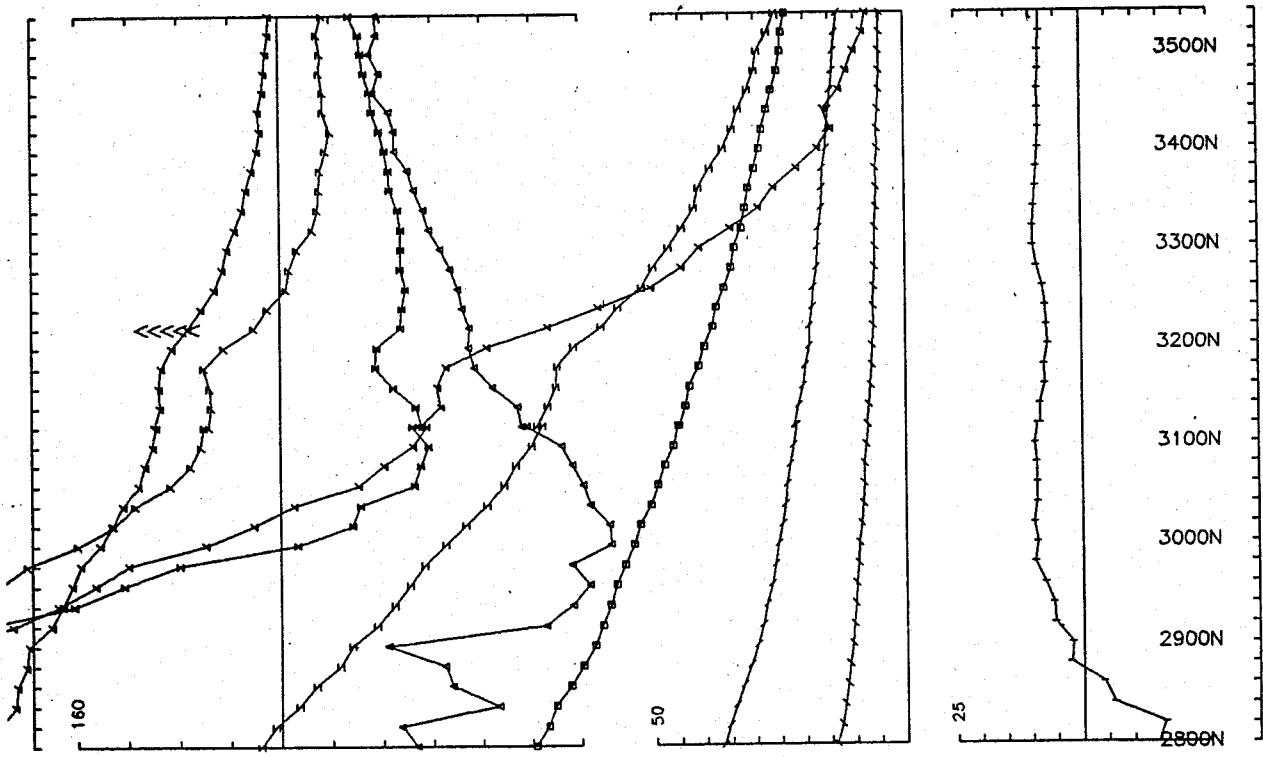
Area BAY OPTION (NTS 82M/4E) client FALCONBRIDGE LIMITED operator SJ GEOPHYSICS LTD. freq(hz) 54.409

Loopno 1 Line 4600W component Hz secondary Ch 1 normalized Ch 1 reduced contin. norm.



Area BAY OPTION (NTS 82M/4E) client FALCONBRIDGE LIMITED operator SJ GEOPHYSICS LTD. freq(hz) 54.409

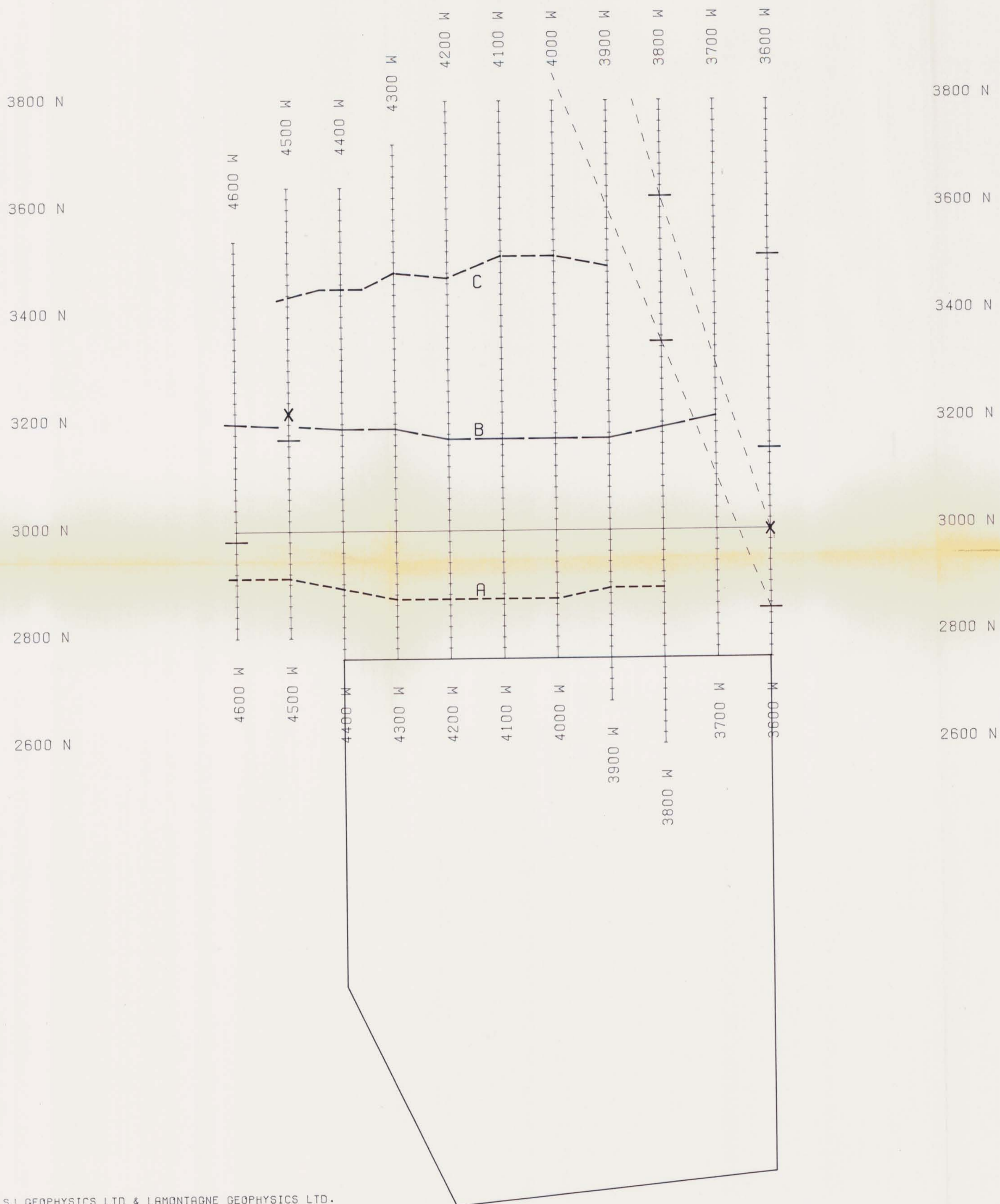
Loopno 1 Line 4600W component Hz secondary Ch 1 normalized Ch 1 reduced point norm.



Area BAY OPTION (NTS 82M/4E) client FALCONBRIDGE LIMITED operator SJ GEOPHYSICS LTD. freq(hz) 54.409

Loopno 1 Line 4600W component Hz secondary Ch 1 normalized Ch 1 reduced point norm.





LEGEND

- UTEM TRANSMITTER LOOP
- - - - POSSIBLE CROSS STRUCTURES
- X WEAK CROSSOVER ANOMALIES
- TOP EDGE OF CONDUCTOR AXIS
- A - - - - LESS THAN 0.5 MHOS
- B - - - - 5 TO 10 MHOS
- C - - - - LESS THAN 2 MHO

FALCONBRIDGE LIMITED  
 1989 BAY OPTION  
 UTEM COMPILATION MAP

NTS 82M/4E PROJECT NO. 144

1:5000



OCT. 1989

PLATE: 1