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EXPLORATION

WESTERN DISTRICT

NTS: 82F/9

MINERAL RESOURCES BRANCH
ASSESSMENT REPORT
NO 10389

GEOPHYSICAL REPORT

FOR THE

UTEM ELECTROMAGNETIC SURVEY

ON THE

CLAIR 2, 4, 14 and 15 CLAIMS

FORT STEELE MINING DIVISION, B.C.

LATITUDE: 49°37'N; LONGITUDE: 116°15'W

WORK PERFORMED BY: J.J. LAJOIE, R.W. HOLROYD, E.T. EADIE,
AND S.J. VISSER

CLAIM OWNER AND OPERATOR: COMINCO LTD.

APRIL 1982

JULES J. LAJOIE

TABLE OF CONTENTS

	Page
INTRODUCTION	1
FIELD WORK	2
DESCRIPTION OF THE UTEM SYSTEM	2
DATA PRESENTATION	3
INTERPRETATION	6
CONCLUSIONS	18
REFERENCES	20
PLATE 224-81-1 LOCATION MAP	21
LEGEND FOR UTEM DATA SECTIONS	22
LEGEND FOR UTEM COMPILATION MAPS	23
DATA SECTIONS	24
STATEMENT	25
EXHIBIT "A" - STATEMENT OF EXPENDITURES	26
PERSONNEL	28
CERTIFICATION	29

PLATE 224-81-2	CLAIR UTEM COMPILATION	(in envelope)
PLATE 224-81-3	CLAIR DETAIL GRID - UTEM COMPILATION	(in envelope)
PLATE 224-81-4	CLAIR DETAIL GRID - MAGNETOMETER DATA	(in envelope)

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GEOPHYSICAL REPORT FOR THE UTEM ELECTROMAGNETIC SURVEY ON THE CLAIR 2, 4, 14 and 15 CLAIMS

INTRODUCTION

The CLAIR claims are located about 20 kilometers west of Marysville, B.C., as shown on the location map (Plate 224-81-1). The area of the geophysical survey described herein is located in the St. Mary River valley and is easily accessible by gravel road from Marysville, B.C.

CLAIR claims 2 and 4 were recorded on September 25, 1978, Claim 14 on July 16, 1980, and Claim 15 on April 29, 1981.

The geology is described in an assessment report by McCartney (1979). The claims are underlain by Middle and Lower Proterozoic sediments of the Aldridge Formation and Moyie gabbro intrusives. These sediments are known to host the Sullivan orebody near Kimberley, B.C.

This report describes a UTEM electromagnetic survey whose objective was to locate geologic conductors which may be caused by economic mineralization. The area covered is about 6.5 km by 1.5 km consisting of the St. Mary River valley directly west of St. Mary Lake. Line spacing was 300 meters and station spacing was 50 meters. Line spacing was reduced to 200 meters on a subsequent smaller detail grid. In all, 55.6 line kilometers of UTEM surveying were completed. 1,044 UTEM stations were established; nine channels of information were acquired and plotted for a total of 9,396 data entries. Also, about 550 magnetic readings were acquired on the detail grid.

FIELD WORK

The first stage of the field work was performed by J.J. Lajoie and R.W. Holroyd between April 5 and May 12, 1981. This work was done with the UTEM II apparatus built at the Univ. of Toronto (Lamontagne, 1975). The work was continually interrupted by elk breaking the transmitter loops and hence, slowing down the work considerably. The St. Mary River through the centre of the area caused many logistical problems, especially at the beginning of May when rising water levels flooded large areas.

The second stage of the field work was performed by E.T. Eadie and S.J. Visser on May 24 and 25, and from June 16 to 27 on a detailed grid covering an anomaly in the western part of the survey area. This work was done with the new UTEM III apparatus which had just been delivered to Cominco. The detail grid was also surveyed with a Geometrics G-836 proton magnetometer. The magnetic data were drift corrected in the normal manner.

A power line along the north side of the valley produced electrical noise which slowed the survey work considerably on those lines in the northern part of the survey area.

DESCRIPTION OF THE 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 unversity.

The field procedure consists 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 1.7 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 field procedure is similar to Turam, a better known electromagnetic surveying method.

The transmitter loop is energized with a precise triangular current waveform at a carefully controlled frequency (30.5 Hz for most of 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 magnetic component of the electromagnetic field and responseto 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 9 channels of data at each station. The later number channels (7-8-9) 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 9, 8, 7 and 6. Progressively better conductors will give responses on progressively lower number channels as well. For example, massive, highly conducting sulphides or graphite will produce a response on all nine 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 15" graphics plotter. Data are portrayed on data sections (D.S.) as profiles of each of the nine channels, one section for each survey line.

DATA PRESENTATION

The results of the survey are presented in one location map, three compilation maps and 68 data sections.

The maps are listed as follows:-

Plate 224-81-1 (in text)	Location Map Scale 1:250,000
Plate 224-81-2 (in envelope)	Clair UTEM Compilation Scale 1:20,000
Plate 224-81-3 (in envelope)	Clair UTEM Detail Grid Compilation Scale 1:20,000
Plate 224-81-4 (in envelope)	Clair Detail Grid Magnetometer Data Scale 1:5,000

Legends for both the UTEM compilation maps and the data sections are also attached.

The data sections are arranged in order of loop number (401 to 410), then in order of line number.

The magnetic field amplitudes from both the transmitter loop (primary field) and from the electric currents induced in the ground (secondary field) vary by a few orders of magnitude from the beginning of a line near the transmitter loop to the end of the survey line far from the transmitter loop. To present such data, a normalizing scheme must be used. In this survey, the primary field from the loop is used for normalizing and presenting the data according to the following schemes:-

1. Continuously normalized plots.
   This is the standard normalization scheme.

   a) For channel 1:

   $$\% \text{ Ch. 1 anomaly} = \frac{\text{Ch.1} - P}{P} \times 100\%$$

   where P is the primary field from the loop at the station and Ch.1 is the observed amplitude for channel 1.

b) For the remaining channels (n = 2 to 9)

$$\% \text{ Ch.n anomaly} = \frac{(\text{Ch.n} - \text{Ch.2})}{\text{Ch.1}} \times 100\%$$

where Ch.n is the observed amplitude of Channel n (n = 2 to 9)

2. Point normalized plots

These plots display an arrow at the top of the section indicating the station to which all data on the line are normalized. The purpose of point normalized plots is to display only the relative amplitude variation of the <u>secondary</u> field along the line, that is, only that magnetic field from the induced currents in the ground.

a) For Channel 1

$$\% \text{ Ch.2 anomaly} = \frac{\text{Ch.2} - P_A}{P_A} \times 100\%$$

where P_A is the primary field from the loop at station 'A' and Ch.1 is the observed amplitude for Channel 1.

b) For the remaining Channels (n = 2 to 9)

$$\% \text{ Ch.n anomaly} = \frac{\text{Ch.n} - \text{Ch.1}_A}{\text{Ch.1}_A} \times 100\%$$

where Ch.n is the observed amplitude of Channel.n and Ch.1_A is the above reduced Ch.1 anomaly at station 'A'.

Point normalized plots are usually produced on data sections with anomalies to help in interpretation.

The above normalization procedures result in chaining errors displayed in Channel 1 only.

INTERPRETATION

Plate 224-81-2 shows the UTEM geophysical grid in the St. Mary River valley with respect to the CLAIR claims 2, 4, 14 and 15. The loop corners are marked. Lines surveyed from each loop were on the west sides of the loops except for Loops 406 and 407 whose survey lines were on the east side. Loops 406 and 407 are physically the same as Loops 405 and 404 respectively (see Plate 224-81-2); different numbers are assigned when a new side of a loop is surveyed.

A computer generated model response is considered first to demonstrate typical background with the UTEM system. Figure 1 shows the UTEM response of a 1,000 meter x 1,000 meter loop over a halfspace with a conductivity of 0.01 mhos/m. Ten channels of data (see UTEM legend) are shown over a total line length of 1.4 km. Each channel has a characteristic response with increasing distance from the loop consisting firstly of a positive rise, secondly, a crossover from positive to negative, and finally, increasing negative amplitude coverging to -200%. The earliest time channels (10, 9, 8), corresponding to high frequencies, cross over closest to the loop edge, while, progressively, the later time channels (4, 3, 2, 1), corresponding to lower frequencies, cross over farther from the loop edge. For a LESS conductive halfspace, all channels would cross over FARTHER from the loop. For a MORE conductive halfspace, all channels would cross over CLOSER to the loop. This will be demonstrated later. Interpretation of halfspace conductivity is based mainly on the relative distances of the channel crossovers from the loop. The response of conductive layers such as overburden is qualitatively similar to that of the halfspace, differing only in quantitative aspects such as amplitude and relative distances between channel crossovers.

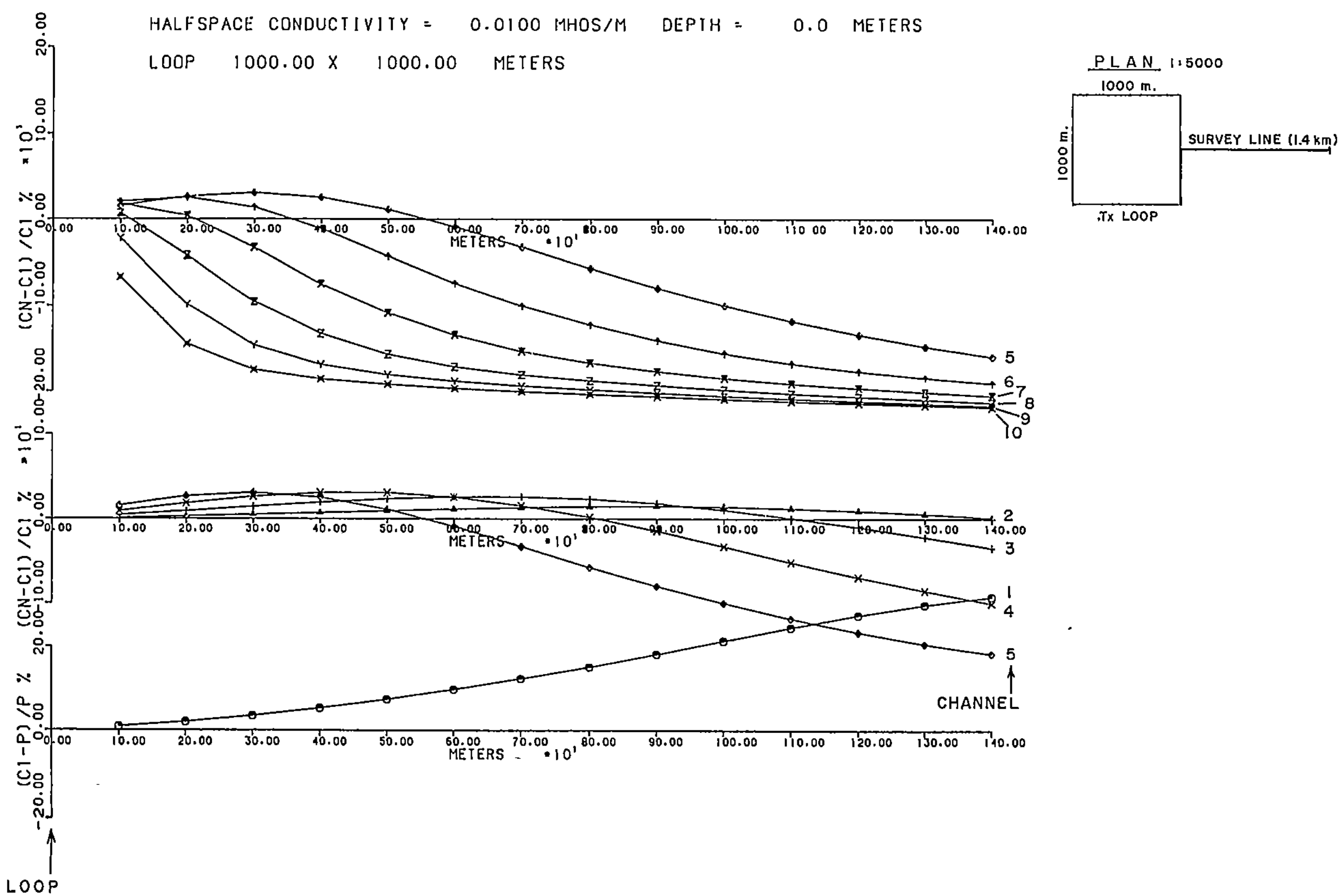

FIG. 1 Computer Generated Model Response of the UTEM System over a Halfspace with a Conductivity of 0.01 mhos/m, using a 1,000 x 1,000 meter loop and a Transmitter Frequency of 30 Hz. Continuous normalization is used.

Loops 402 - 407

Typical background responses are displayed in Loops 402 to 407 (Data Sections (D.S.) 8-38). The data from Loop 404 (D.S. 19-25) in the center of the grid are now considered. As was noted previously, the data normalization scheme results in chainage errors showing up only in Channel 1, accounting for the erratic behaviour of Channel 1 as for example, in the vicinity of Station 29W on Line 18N (D.S. 25). A normal Channel 1 response on a properly chained line is displayed on Line 6N (D.S. 21). Re-chaining of a poorly chained line would only be required for proper interpretation of highly conductive targets.

The response on Line 0 (D.S. 19) is typical of poorly conducting underlying material. Line 0 is south of the valley sediments. Channel 5 remains positive for the whole line, Channel 6 crosses over (from positive to negative) at the end of the line at Station 37.5W, Channel 7 at 32.25W, and Channel 8 at Station 29W.

Line 3N (D.S. 20) displays a similar pattern as Line 0 except for a small crossover anomaly at 35.25W which is superimposed on the background response. This anomaly corresponds to the edge of the valley sediments. On D.S. 20, the expected background response on Channels 5 and 7 are dashed in to display this small anomaly better.

On Line 6N (D.S. 21) the valley sediments appear to be only slightly thicker (and/or more conductive) than on Line 3N. Although Channel 5 remains positive for the wide line, Channel 6 now crosses over near the center of the line at Station 33W.

Line 9N (D.S. 22) displays considerably thicker (and/or more conductive) valley sediments. Channel 5 crosses over at Station 33W. On this line, there is an apparent anomaly corresponding to an offset in the line due to the river at 36W.

Under Line 12N (D.S. 23), the valley sediments are again thicker and/or more conductive with Channel 4 crossing over at about 35W.

Line 15N (D.S. 24) is very similar to Line 12N. The data is noisier because of the power line on the north side of St. Mary River valley.

Line 18N (D.S. 25) appears to show only slightly thinner and/or less conductive overburden with Channel 4 remaining high and positive for the whole line.

Line 12N from Loop 404 (D.S. 23) is now used to try to estimate a conductivity-thickness (σt) product for the valley-fill sediments. The time decay data interpolated for Station 30.60W, 360 meters from the loop edge, were superimposed on a nomogram for the tin layer response (Figure 2). The field data were shifted on the horizontal time axis until a reasonable fit was obtained with one of the model curves. Although the computational details are beyond the scope of this report, the best fitting thin layer model is calculated to be a 2.5 mho layer at a depth of 100 meters. Obviously, a thin layer at 100 meters is not a very good model for representing thick valley-fill sediments, but unfortunately, computer software is not available for modelling 'thick' layers. The significance of the interpretation is that the sediments in the deeper parts of the valley appear to have an "effective" conductivity-thickness product (σt) of about 2.5 mhos.

Searching through suites of thin layer model responses, Figure 3 shows the computer model response of a 3 mho infinite layer at a depth of 100 meters under a 1,000 m x 1,000 m loop. It is very similar to the field data of Loop 404, Line 12N (D.S. 23). In the model data (Figure 3), Channel 5 crosses from positive to negative about 500 meters from the loop while Channel 4 crosses at about 1,000 meters. In the field data (D.S. 23), the Channel 5 and 4 crossovers are about 450 and 800 meters respectively. On Line 15N from the same loop (D.S. 24), they are at 350 meters and 1,100 meters respectively. These are reasonable fits and support the previous interpretation of an effective σt of about 2.5 mhos for the deeper valley-fill sediments. To demonstrate the sensity of the models to varying σt,

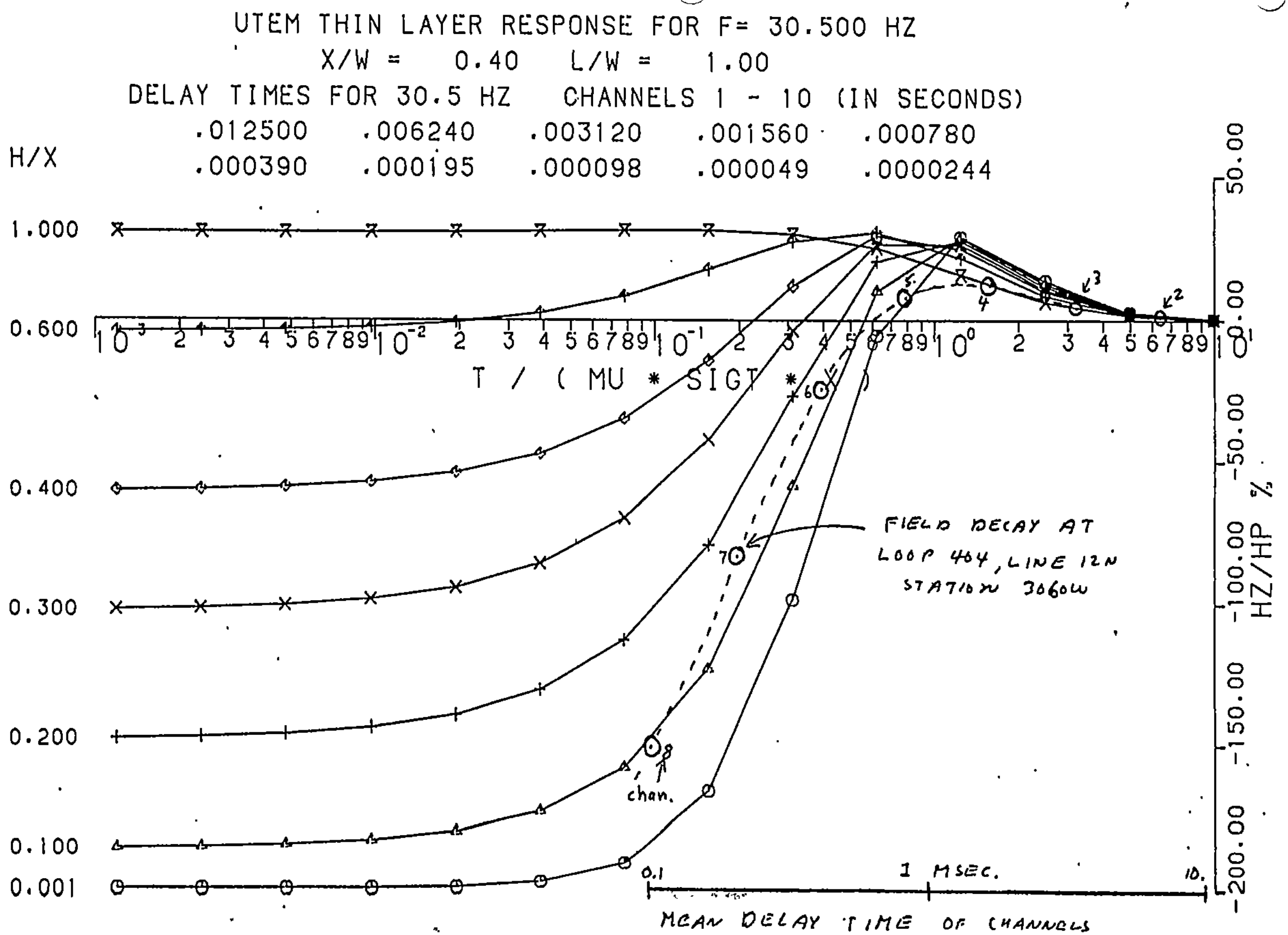

FIG. 2 Nomogram for Estimating Thin Layer Conductivity-Thickness (σt) and Depth. Circles display Field Data from Loop 404, Line 12N, Station 30.6W (Interpolated).

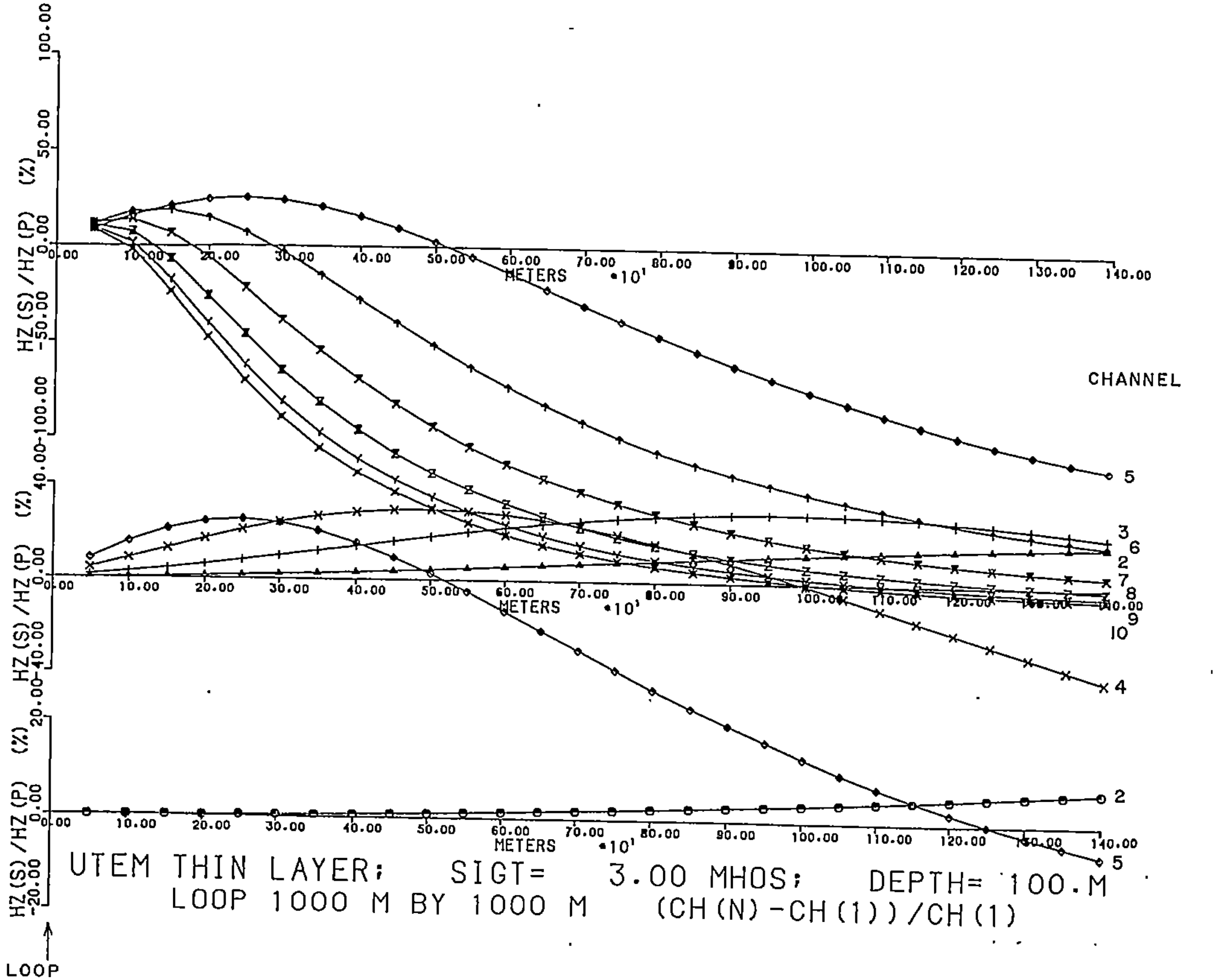

FIG. 3 UTEM Computer Model Response for a 3 mho Conductive Layer at a Depth of 100 Meters. Compare to Field Data: Loop 404, Line 12N (D.S. 23).

Figure 4 shows the model results for a 1 mho layer in which Channels 4 and 5 do not cross over within 1,400 meters of the loop, and Figure 5 shows the model results for a 10 mho layer where all the crossovers are much closer to the loop, with Channel 5 and 4 crossovers at 200 meters and 300 meters respectively.

The field data from Loops 402 to 407 are interpreted to be responding to the valley sediments. These appear to be thicker in the northern part of the valley with an "effective" σt of about 3 mhos.

Loop 401

An anomaly characterized by two or more channels crossing over at nearly the same location occurs on the data sections from Loop 401 (D.S. 1-7). The gaps in data sections 2 and 3 (Lines 15N and 18N) are because of difficult access due to the river. When it became evident that an anomaly occurred in these gaps, extra effort was spent in acquiring the missing information, as shown in data sections 2b and 3b. On Lines 15N and 18N there is a coincident crossover in Channels 5 to 3, marked by the 'X' in data sections 2b and 3b. Earlier time channels (6-9) cross over closer to the front of the loop, located at 54W, because of the response from the valley sediments. In the point normalized sections (D.S. 2c, 3c, 4a) showing only the variation in secondary field from the earth, positive amplitudes increase monotonically towards the loop, indicating the conductor dips under the transmitter loop. The interpreted location of the subcrop edge of the conductor is shown by the crosses in Plate 224-81-2. Dip is interpreted to be NE.

Loops 408 - 410

The above conductor strikes at an angle of about 45 degrees with respect to the geophysical grid, which is far from ideal for interpretation. It was decided to do detail work on a new grid with lines in a NE-SW direction, at a line separation of 200 meters. The new detail grid is shown in Plate 224-81-3. Three loops, 408 to 410 were used. Loop 410 was installed

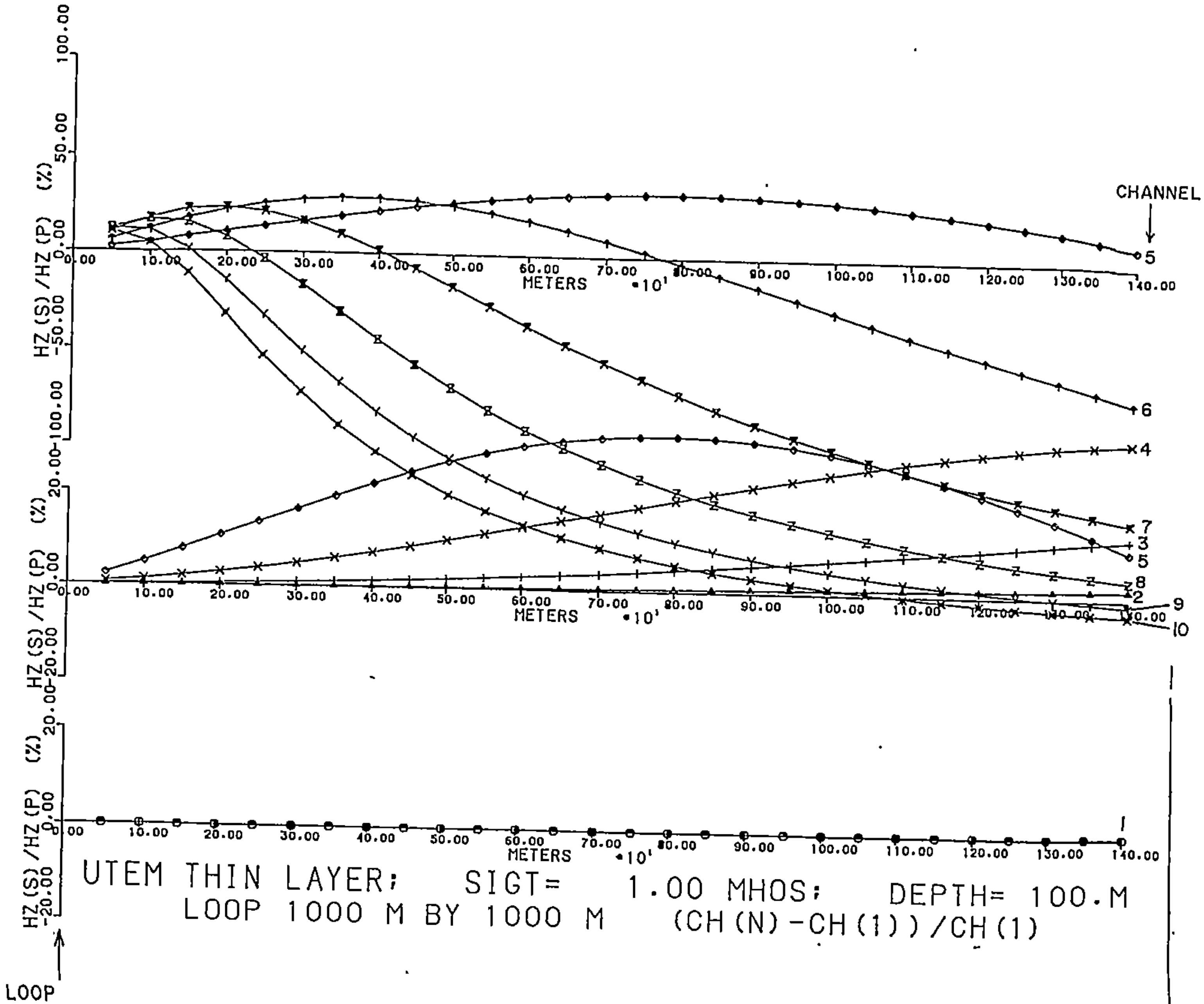

FIG. 4 UTEM Computer Model Response for a 1 mho Conductive Layer at a Depth of 100 Meters.

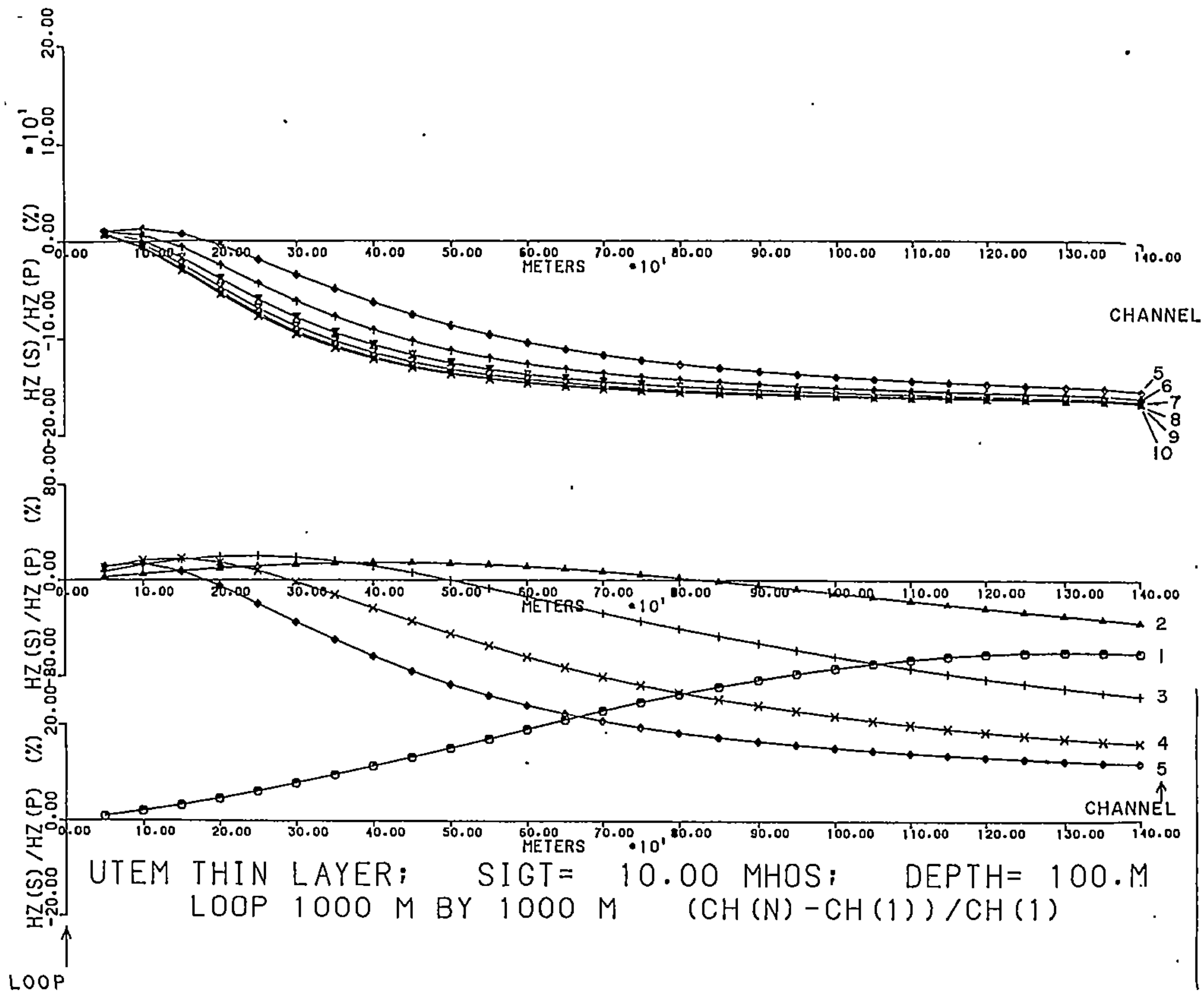

FIG. 5 UTEM Model Response for a 10 mho Conductive Layer of a Depth of 100 Meters.

by compass and topofil chain and so its location is only approximate. The frequency was lowered from about 30 Hz to about 17 Hz to help verify the possibility of a highly conducting target.

The crossover locations picked from the continuous normalization sections of Loops 408 and 409 (D.S. 39 to 49) are shown plotted on Plate 224-81-3. The point normalized plots (e.g., D.S. 41a, 42a, etc) show increasing secondary field amplitude towards the loop as was observed previously in Loop 401, again indicating that the conductor dips to the NE under Loops 408 and 409.

Four lines, 0NW to 6NW, were re-surveyed from Loop 410 installed to the SW of the conductor. On these lines, there are no crossovers coinciding with those observed from Loops 408 and 409.

Computer modelling was done to help explain the results. Figure 6 shows a computer model response of a flat 1,600 m x 1,600 m, 3mho plate conductor, at a depth of 150 meters. The edge of the conductor is 600 m from the loop and it extends under the loop. This model response provides a reasonable fit to most of the data sections from Loop 408 and some from Loop 409. Next, the plate conductor is moved so that although its edge is still 600 meters from the loop, it extends away from the loop. The results are shown in Figure 7 and simulate the field data from Loop 410, located on the SW side of the conductor. Note that the crossovers are displaced about 200 meters and that the late time (Channels 4 and 5) anomaly response is weaker, especially the positive shoulder which has nearly disappeared.

The modelling, therefore, suggests that the data from Loop 410 should show mainly a background type of response with little or no discernible anomaly superimposed, as is the case. This is as expected since, in the first case, where the conductor extends under the transmitter loop, there is much better coupling between the loop and the conductor, thereby producing a greater anomaly.

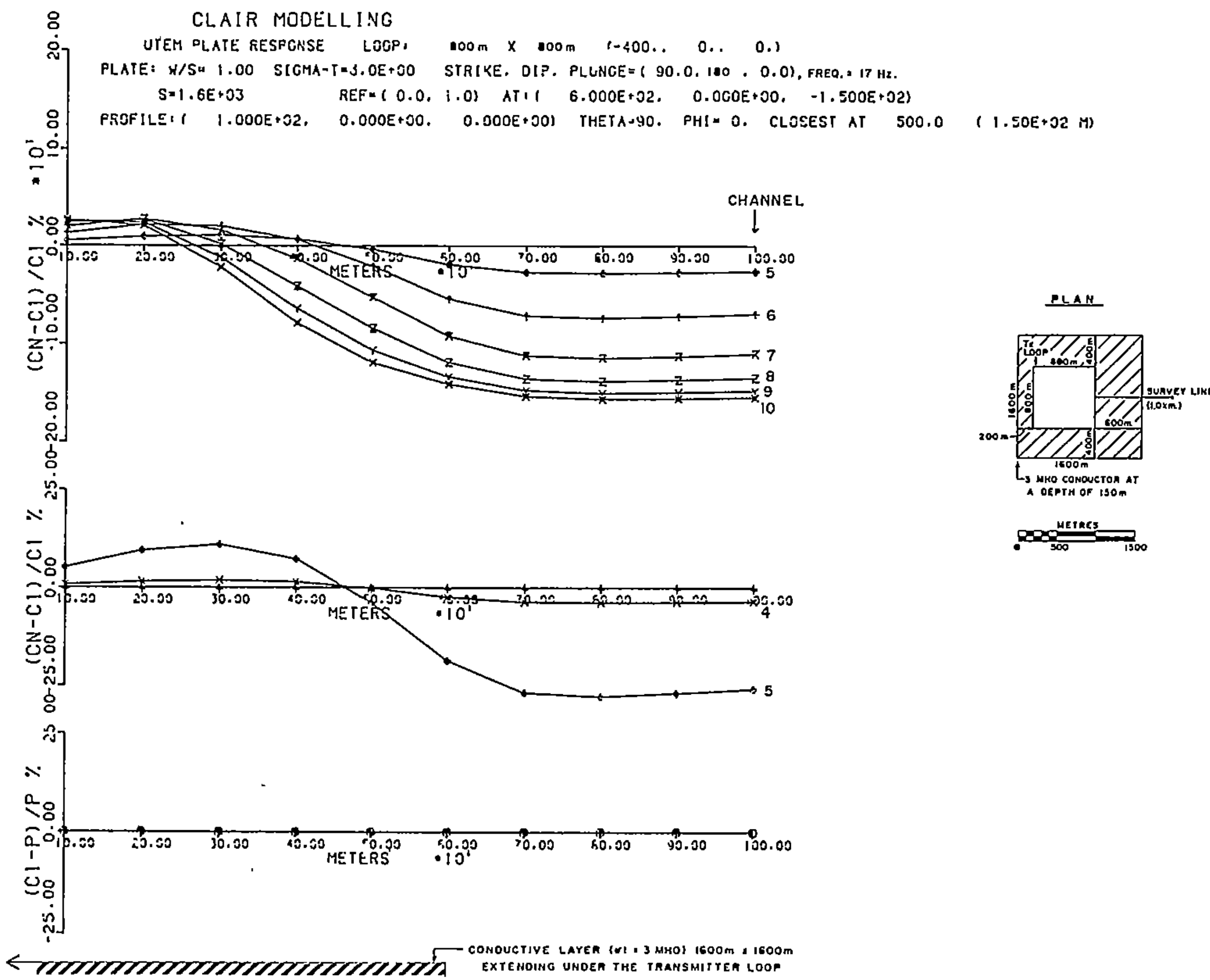

FIG. 6 Computer Model Response of a Conductive Plate Extending Under the Transmitter Loop.

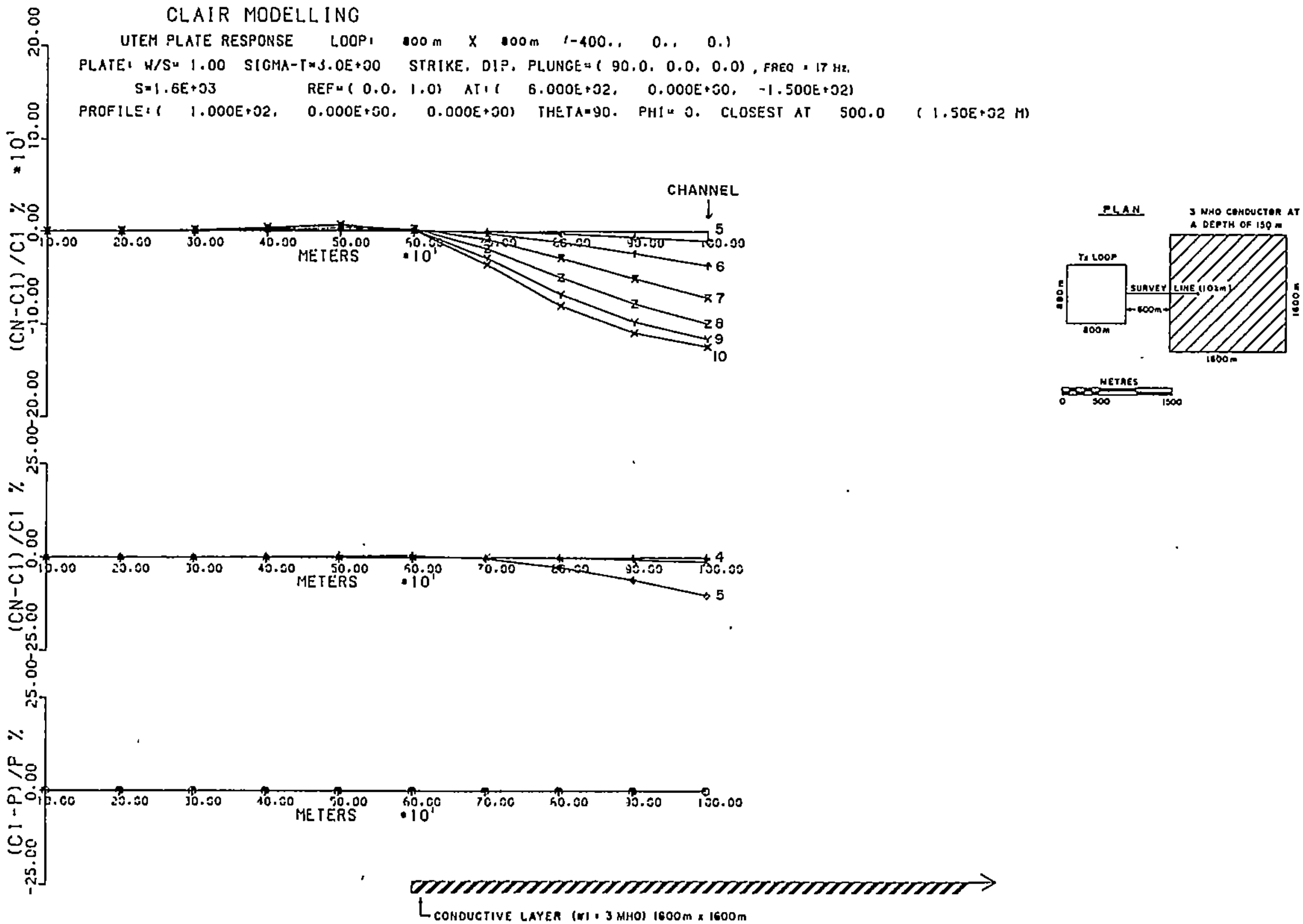

FIG. 7 Computer Model Response of a Conductive Plate Extending Away From the Loop.

The main significance of this modelling is that the conductivity-thickness product of the conductor is estimated at about 3 mhos, about two orders of magnitude less than expected for an economic massive sulphide deposit of the Sullivan type. Furthermore, the conductor's σt of about 3 mhos is the same as was interpreted for the effective σt of the deeper valley sediments further east. The anomaly is, therefore, interpreted to be due to a sudden increase in thickness in the valley sediments north of the crossovers plotted in Plate 224-81-3. It is possible that the increase in thickness continues furthereast, following the river valley, where it would not produce a distinct anomaly because it parallels the survey lines. However, it was noted previously in the discussion of the results from Loop 404 that Line 9N showed significantly thicker and/or more conductive valley sediments than Line 6N. This could well be the extension of the feature which produced the anomaly in the western part of the grid, where it crossed survey lines.

The magnetic data shown in Plate 224-81-4 display anomalous responses only south of the valley sediments where the overburden should be much thinner. A 2000 gamma anomaly occurs at about 850S on Lines 2NW and 4NW, within a broad weaker magnetic zone extending from 2NW to 14NW. There is no EM response coincident with this anomaly and therefore, it is unlikely to be of economic interest. The remainder of the detail grid is featureless, within the 10 gamma sensitivity of the G-836 magnetometer and therefore, sheds no light on the above UTEM interpretation.

CONCLUSIONS

A 55.6 line kilometer UTEM survey was performed to explore for Sullivan type mineralization under the sediments of the St. Mary River valley. An anomaly was discovered and detailed with a second grid. The anomaly was found to have a conductivity-thickness product of less than about 5 mhos, about 2 orders of magnitude below that required for Sullivan type mineralization and is interpreted to be due to a sudden increase in thickness of the valley sediments. The conductor is not of economic interest.

Report by: Jules J. Lajoie, Ph.D., P.Eng.
Geophysicist
Technical Support, Exploration
Cominco Ltd.

Approved for Release by: John M. Hamilton, P.Eng.
Chief Geologist, Kimberley
~~Sullivan Mine~~
Cominco Ltd.

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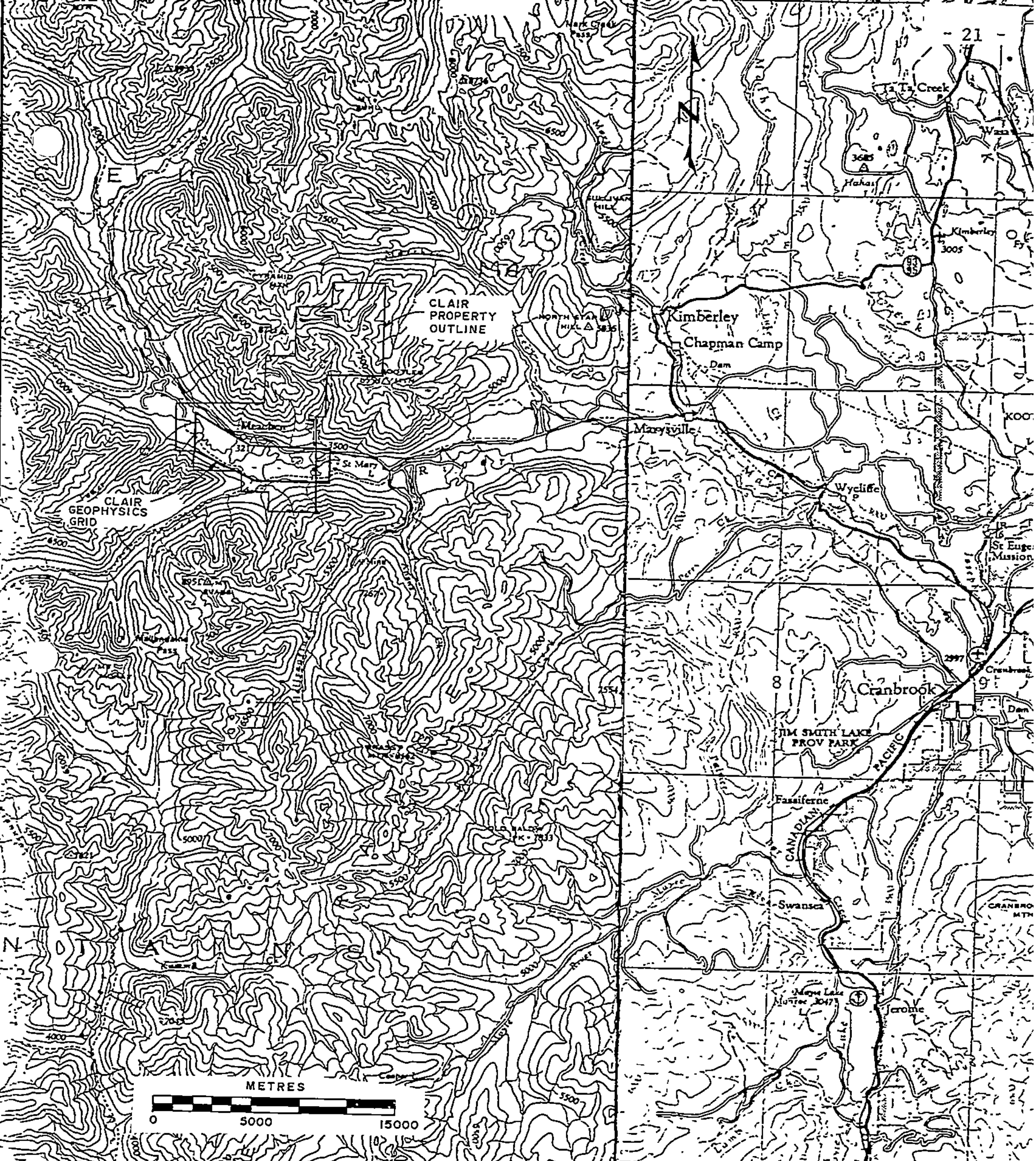
Lamontagne, Y., 1975	Applications of Wideband, Time-Domain EM Measurements in Mineral Exploration: Doctoral Thesis, University of Toronto
McCartney, I., 1979	Geological Report, CLAIR 3, 4, 5, Fort Steele Mining Division, submitted to Mining Recorder, October 1979.



Drawn by:		Traced by:	
Revised by	Date	Revised by	Date

CLAIR PROPERTY

LOCATION MAP

Scale: 1:250,000

Date: APRIL 1982

Plate: 224-81-1

L E G E N D

UTEM DATA SECTIONS

ORDINATE	:	Amplitude scale in %
ABSCISSA	:	Station or Picket Numbers in hundreds of meters
LEGEND	:	The legend to the first data section (D.S. 2) is explained as follows:-

CLAIR 81	Survey Area and Year
30.50 Hz	Base Frequency of the Transmitter
C - P)/P	Channel 1 Reduction as Explained in the section on "Data Presentation"
C - C1/C1	Reduction for Channels 2 to 9 as Explained in the section on "Data Presentation"
H_z	Denotes the Vertical (z) Component of the Magnetic (M) Field
12N	The Line Number, 12N
401	The Loop Area Number

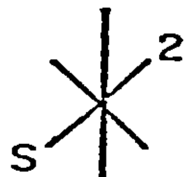
Further symbols found on other data sections:

I_1, I_2, etc	Denotes Changes in Transmitter Current, I
X^n	Crossover anomaly with 'n' Denoting the Latest Anomalous Channel

LEGEND

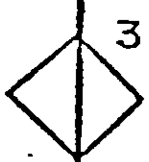
UTEM COMPILATION MAPS

SYMBOL	CHANNEL	MEAN DELAY TIME	
		15 Hz	30 Hz
ı	1	25.6 ms	12.8 ms
/	2	12.8	6.4
\	3	6.4	3.2
□	4	3.2	1.6
Σ	5	1.6	0.8
Δ	6	0.8	0.4
7	7	0.4	0.2
X	8	0.2	0.1
Δ	9	0.1	0.05
◊	10	0.05	

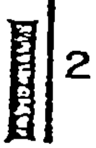


Axis of a cross-over anomaly. The number indicates the latest anomalous channel.

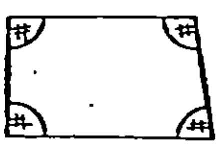
Depth indicated by: S - Shallow (< 30m)
M - Moderate (30-75m)
D - Deep (> 75m)



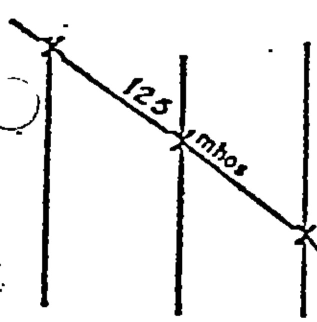
Axis of reversed cross-over anomaly produced when a small conductor dips at less than 70° towards the transmitter. In normal cross-over the positive response is towards the transmitter; reversed one, it is away from the transmitter.



Indicates a negative anomaly of width shown by the dash. The latest anomalous channel is shown. Can sometimes be confused with the negative part of a cross-over anomaly.



Outline of a transmitter loop.

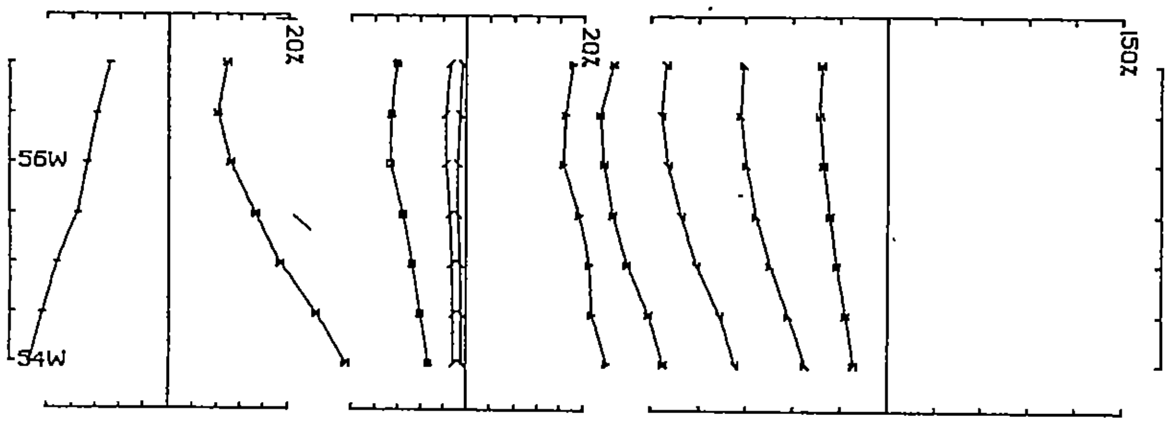


Conductor axis located by cross-over anomalies with a conductance determination. The conductance is the interpreted conductivity x thickness of the conductor in mhos (same as Siemens).

Only the principal cross-overs are indicated

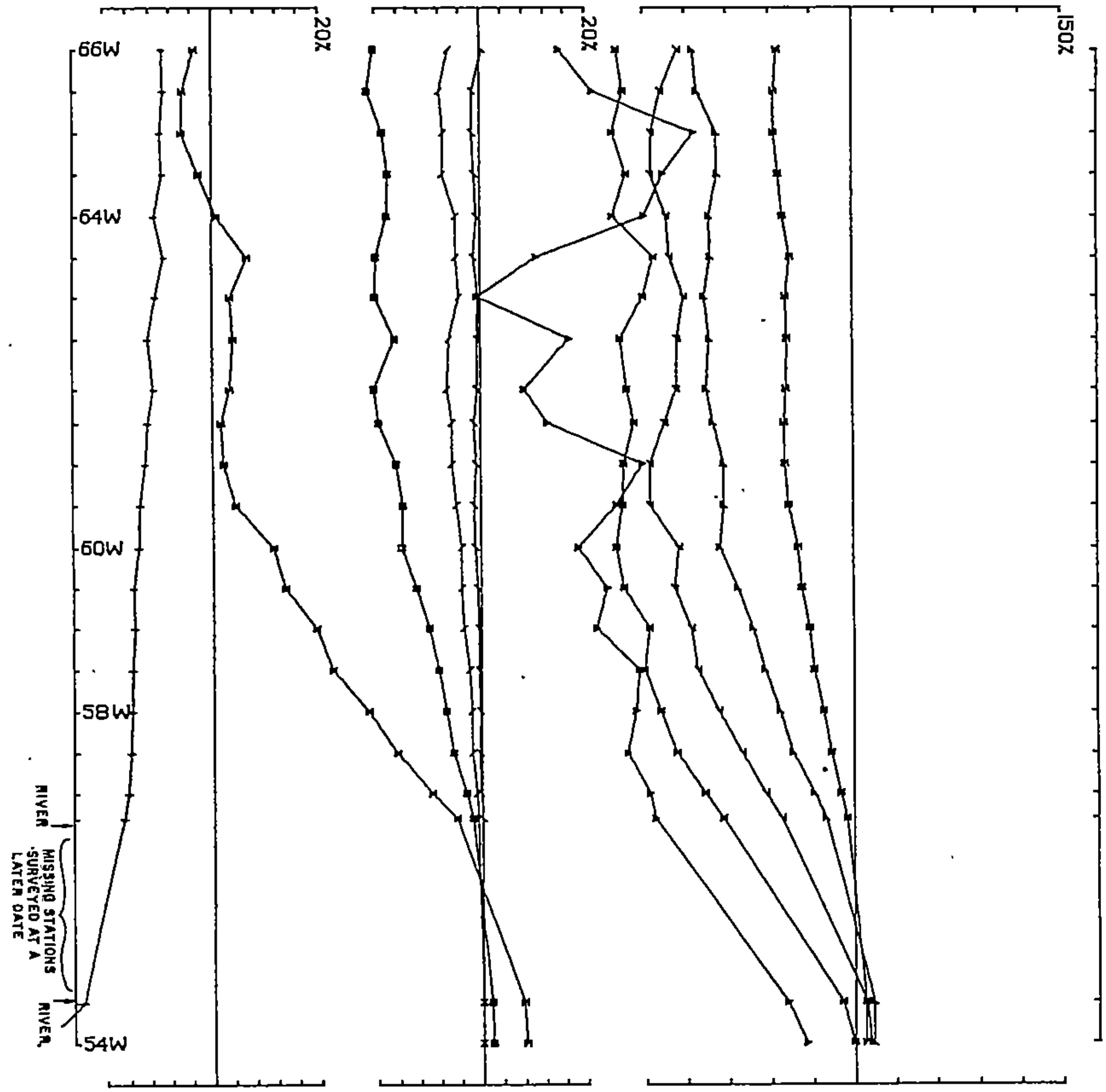
D A T A   S E C T I O N S

(D.S. 1 - 53)



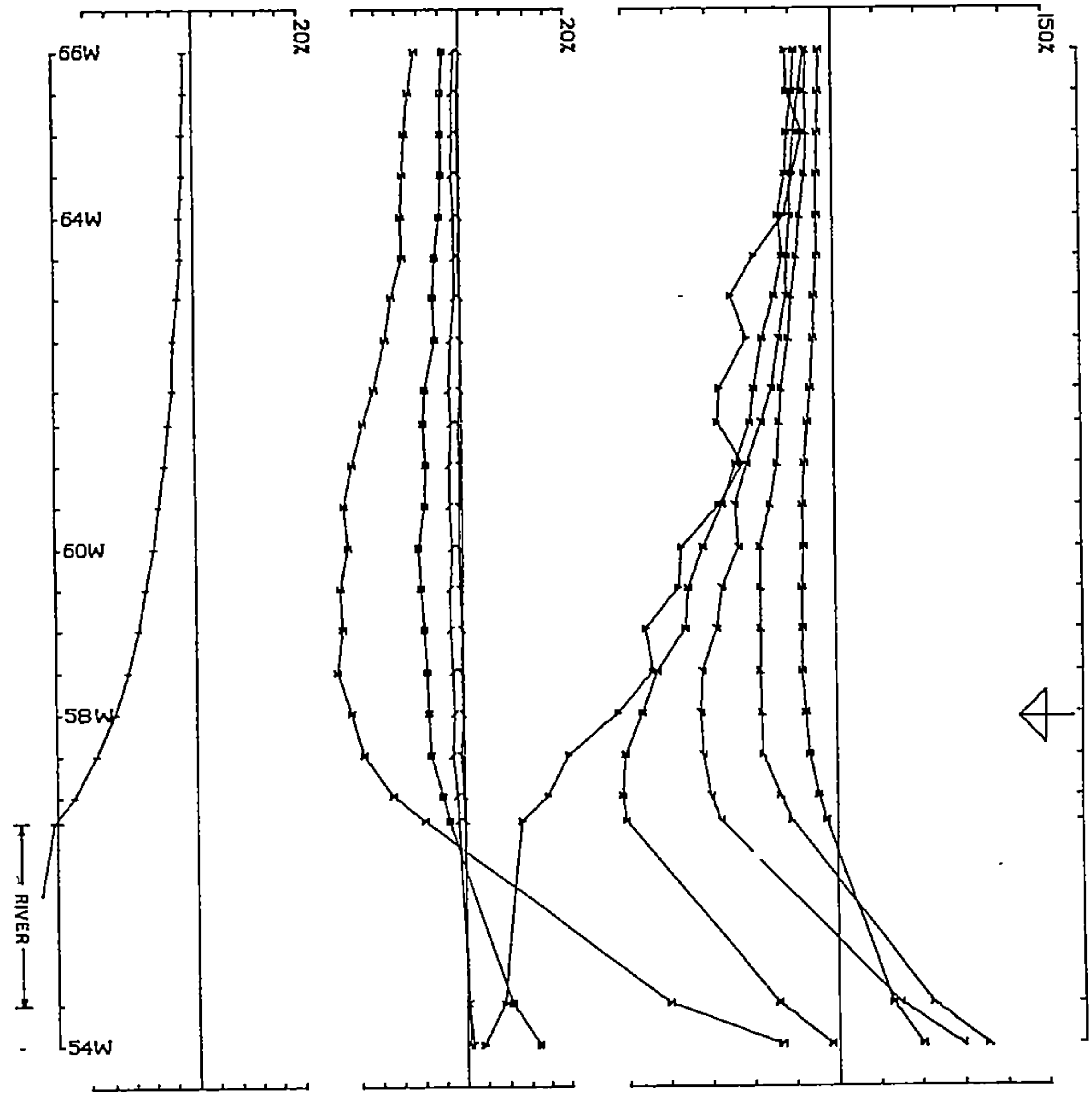
DS 1

CLAIR 81 30.50 HZ C-P)/P C-CI)/CI Hz 12N 40I

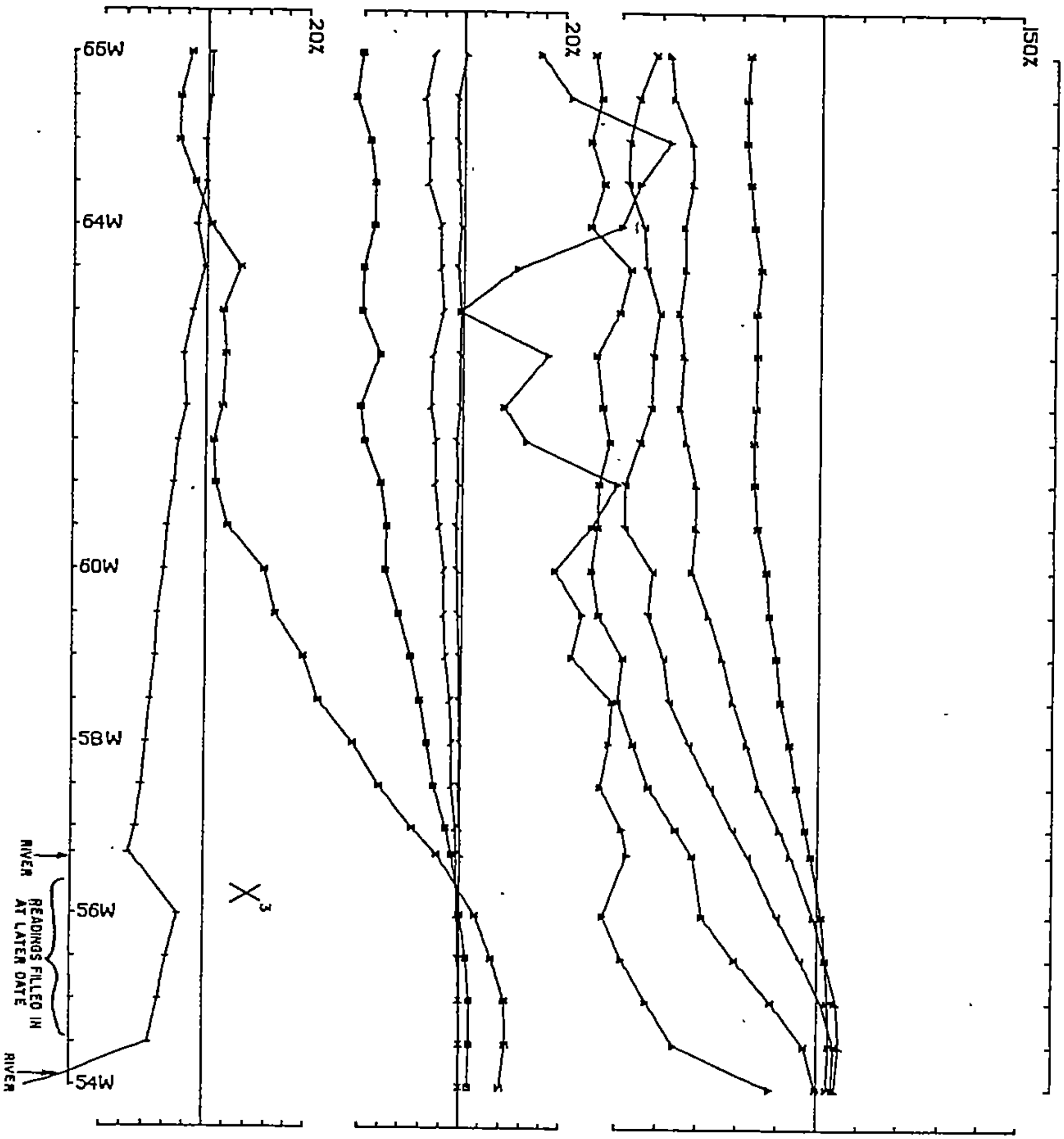


CLAIR 81 30,50 HZ C-P)/P C-Cl)/Cl Hz 15N 401

DS 2

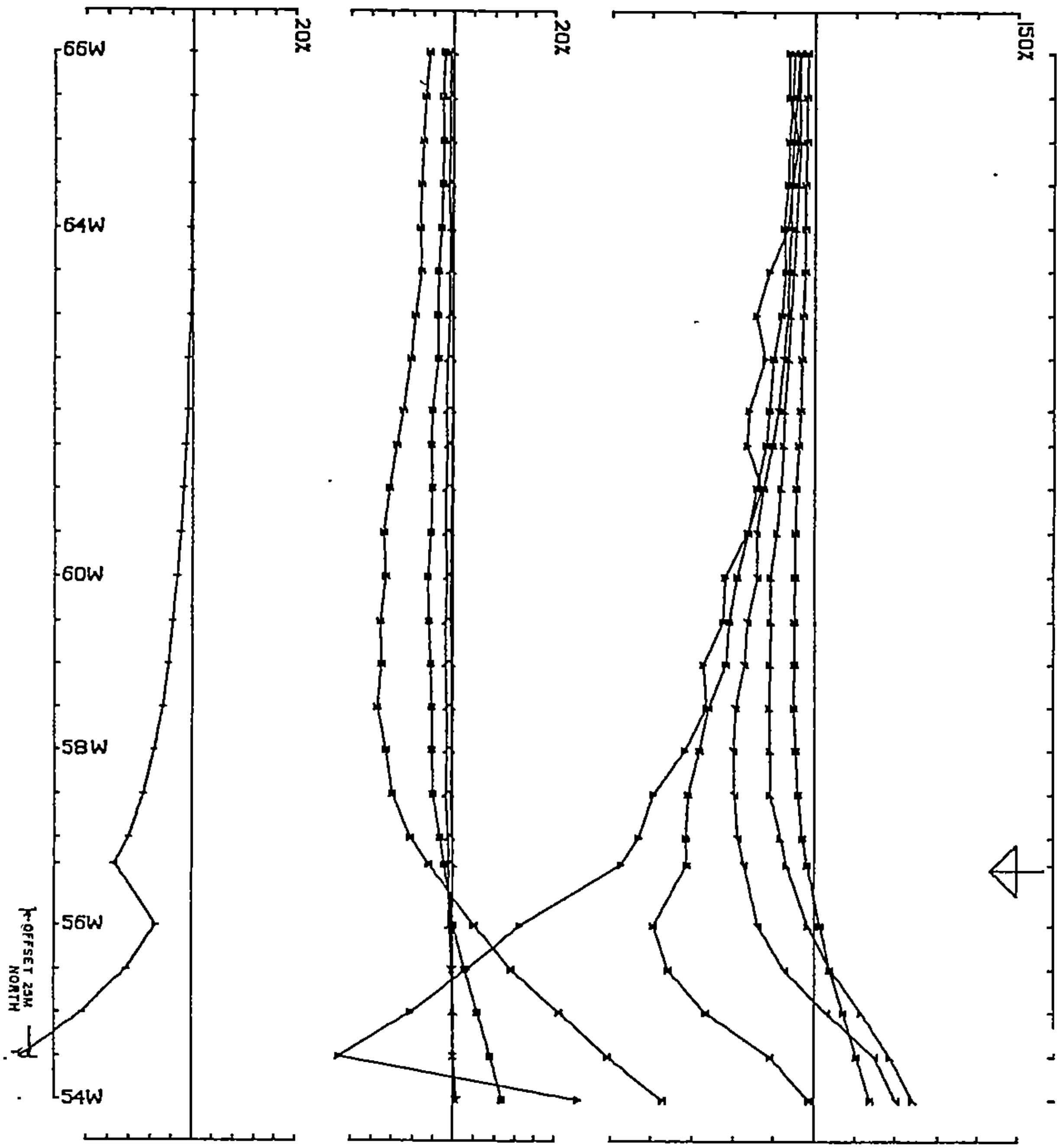


DS 2a CLAIR 81 30.50 HZ C-P)/P C-CI)/CI Hz 15N 40I



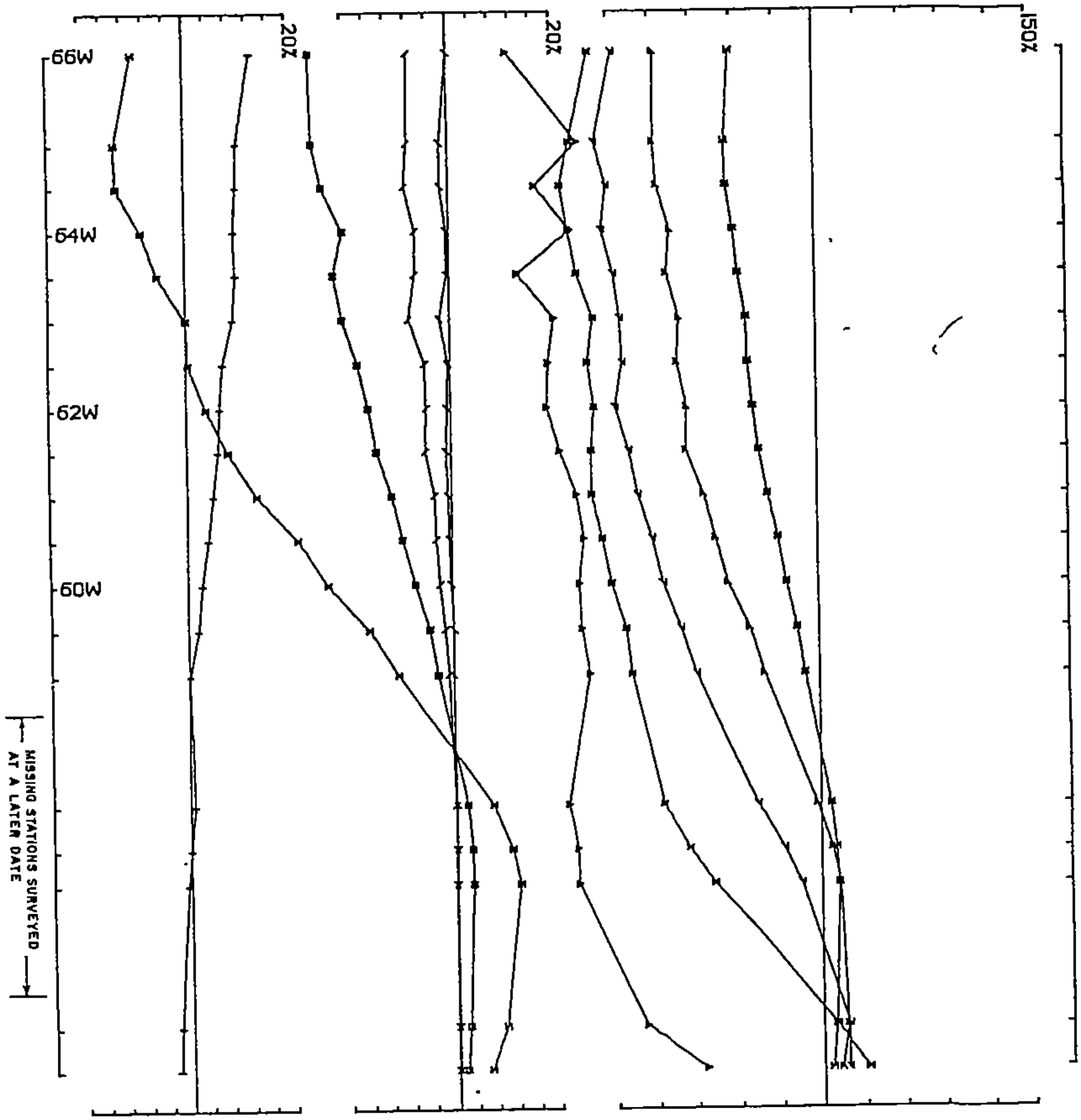
DS 2b

CLAIR 81 30.50 HZ C-PVP Hz 15N 401



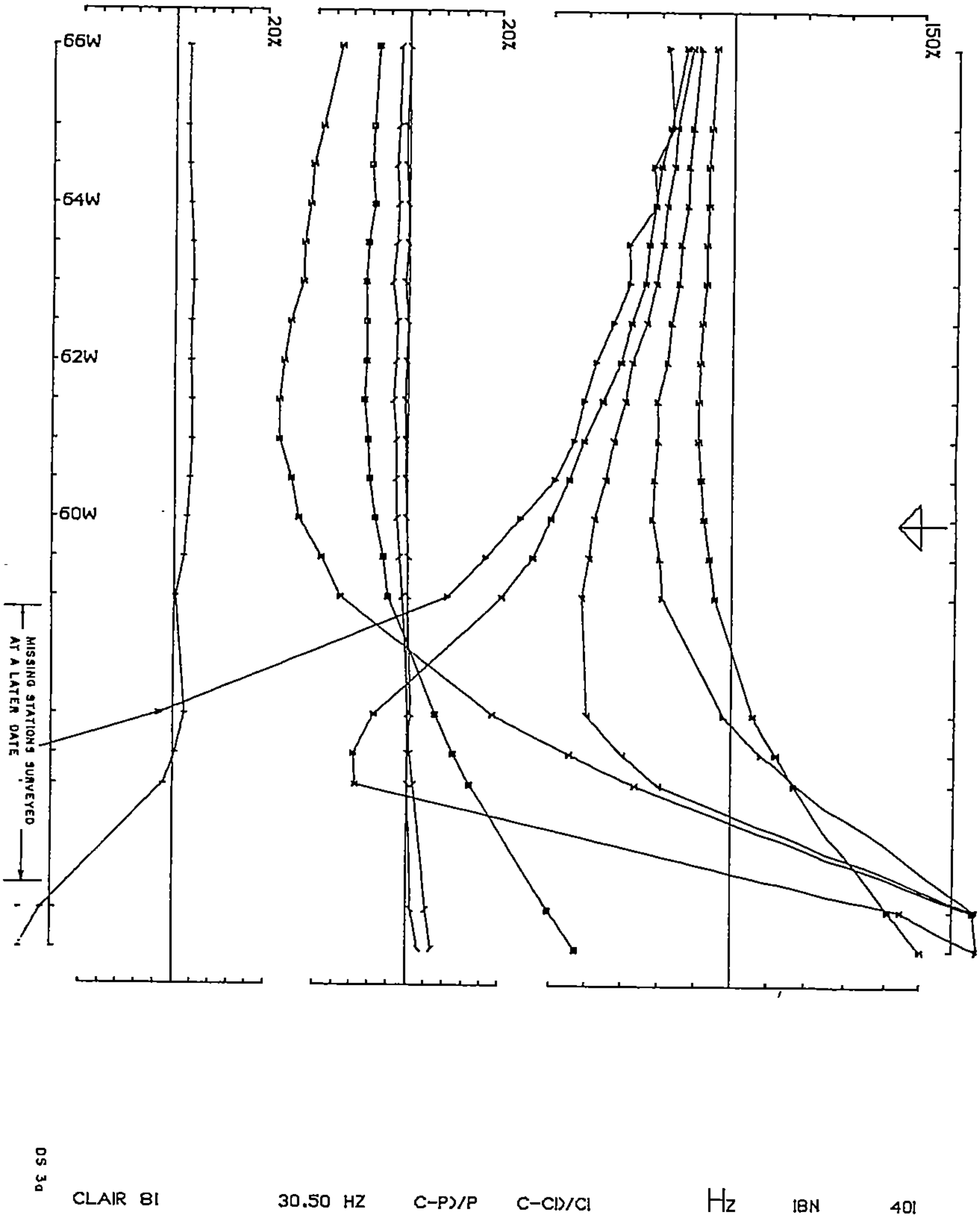
DS 2c

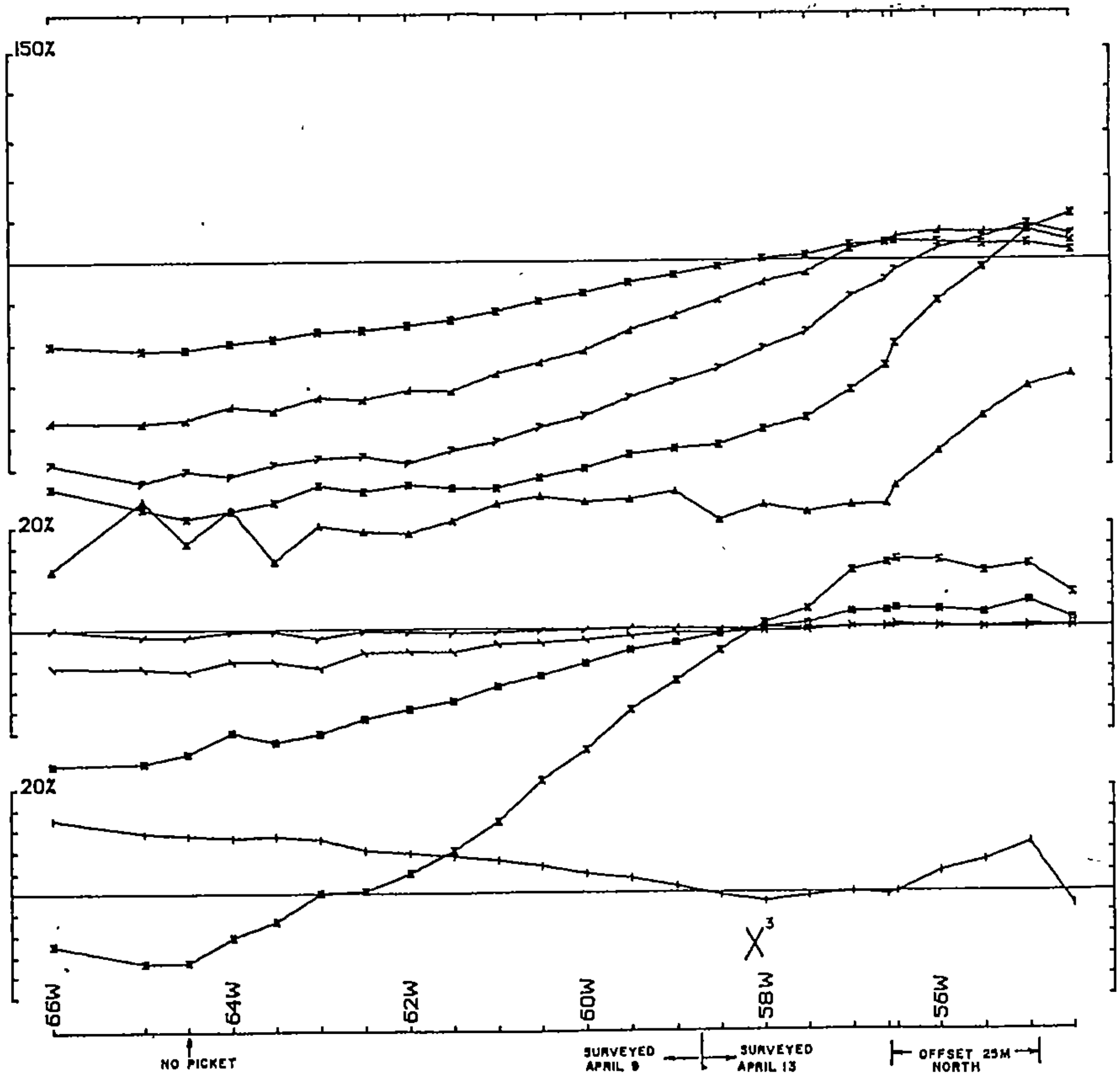
CLAIR 81 30.50 HZ C-P)/P C-CI)/CI Hz 15N 401



DS 3

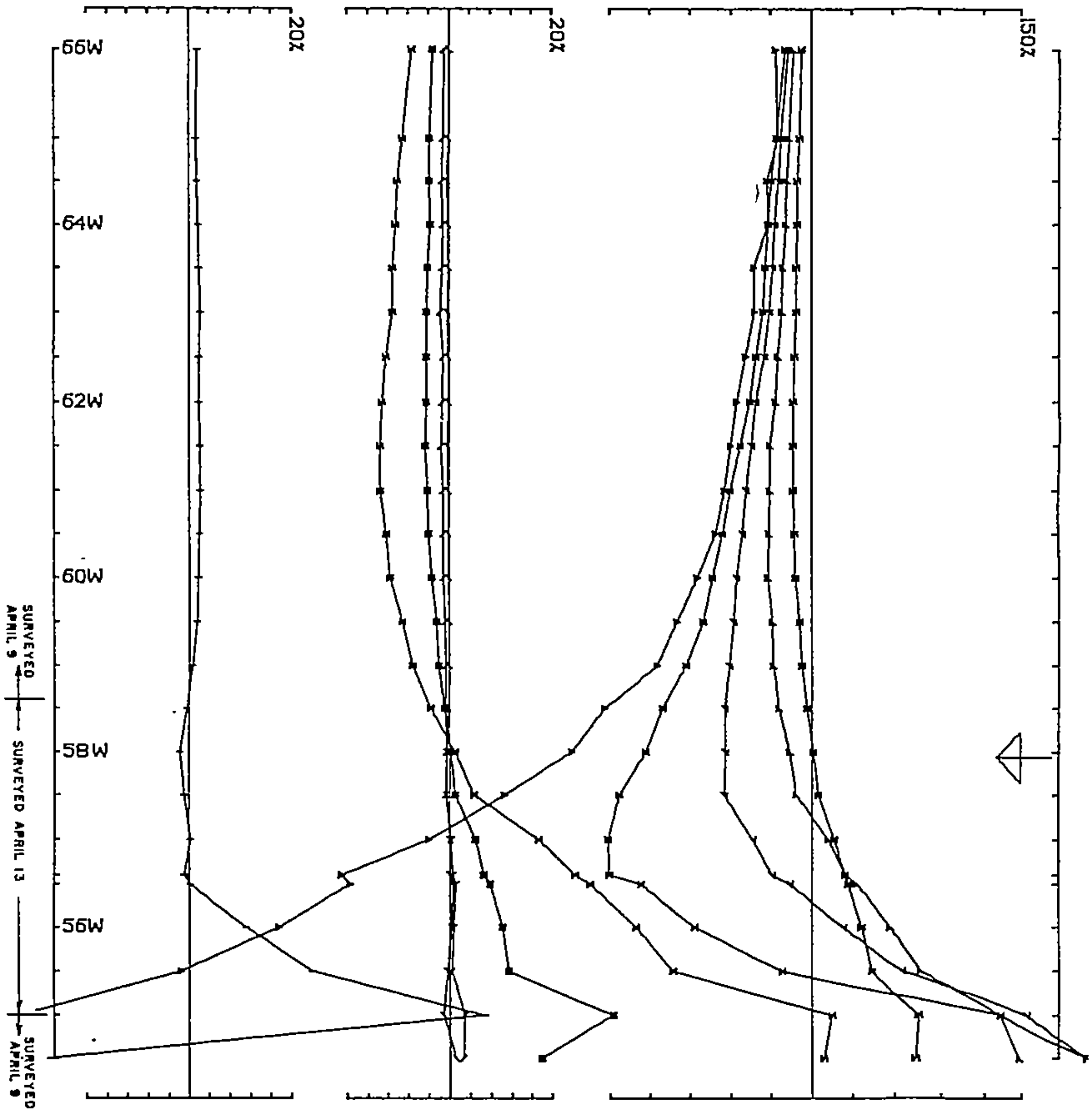
CLAIR 81 30.50 HZ C-P)/P C-CI)/CI Hz IBN 401


150%
20%
20%
66W
64W
62W
60W
MISSING STATIONS SURVEYED AT A LATER DATE
CLAIR 8I
30.50 HZ
C-P)/P
C-CI)/CI
Hz
IBN
40I
DS 3a



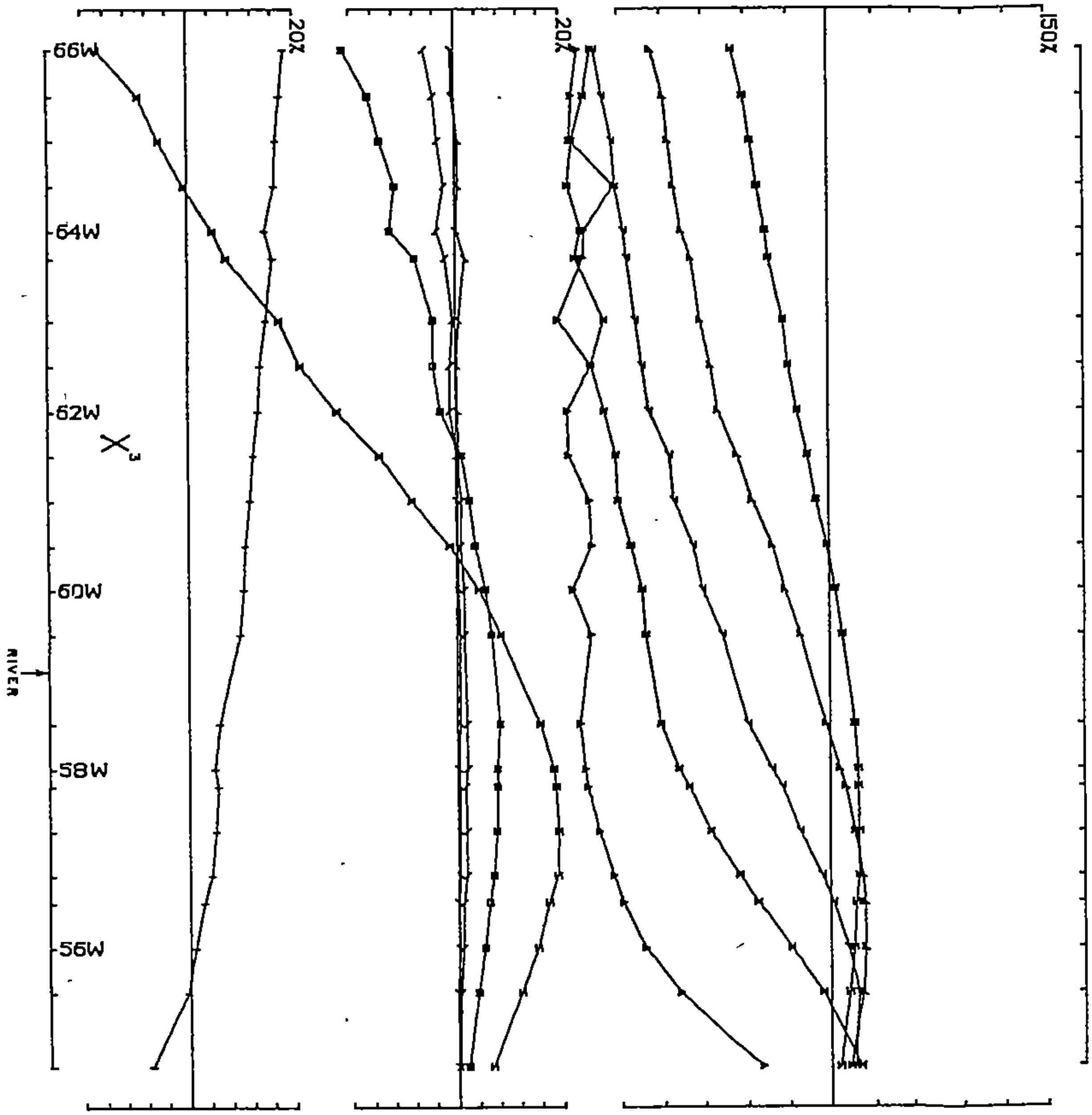
CLAIR 81 30.50 HZ C-P)/P C-Cl)/Cl . Hz 18N 401

DS 3b



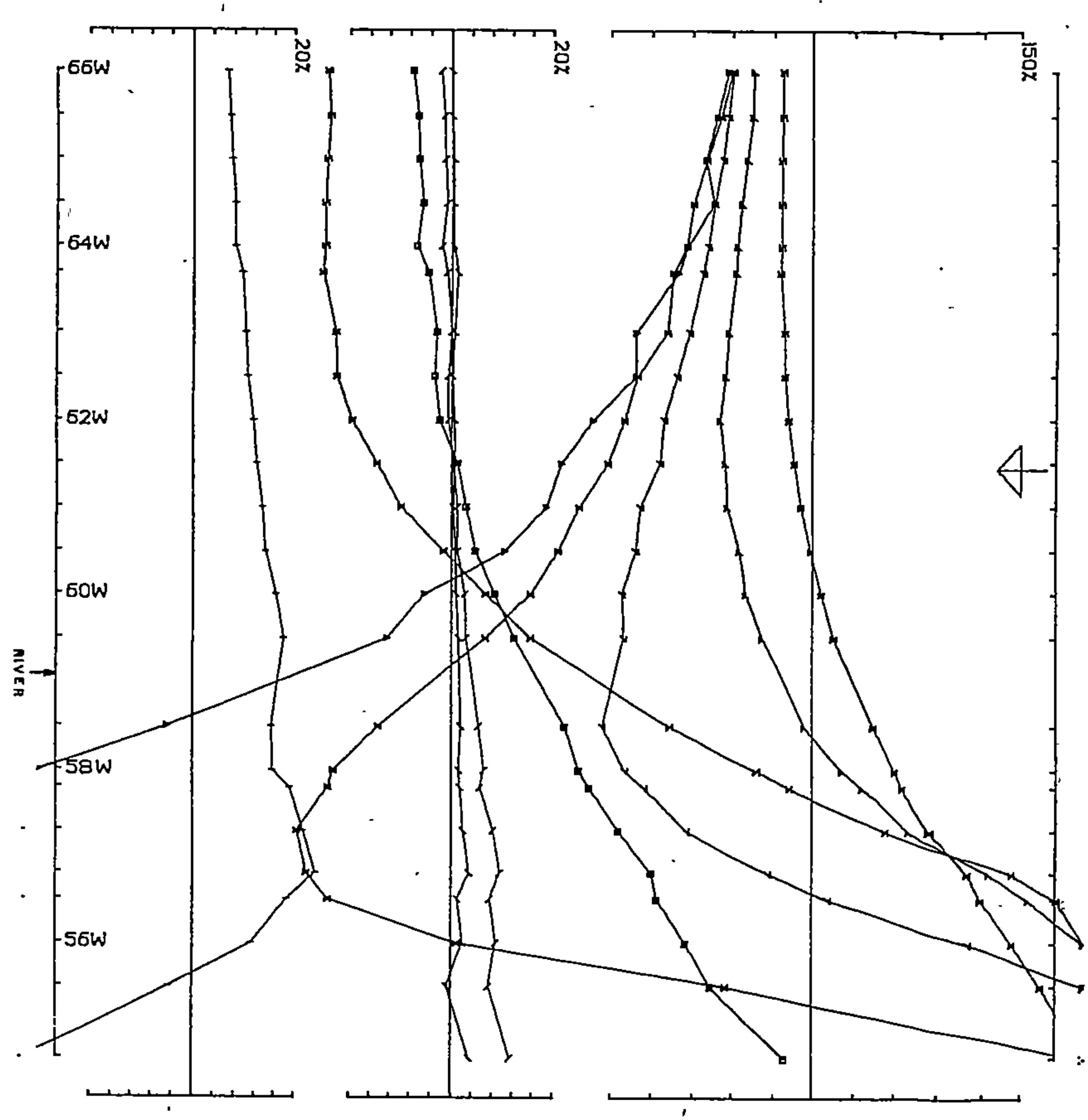
DS 3c

CLAIR 81   30.50 HZ   C-P)/P   C-CI)/CI   Hz   18N   401



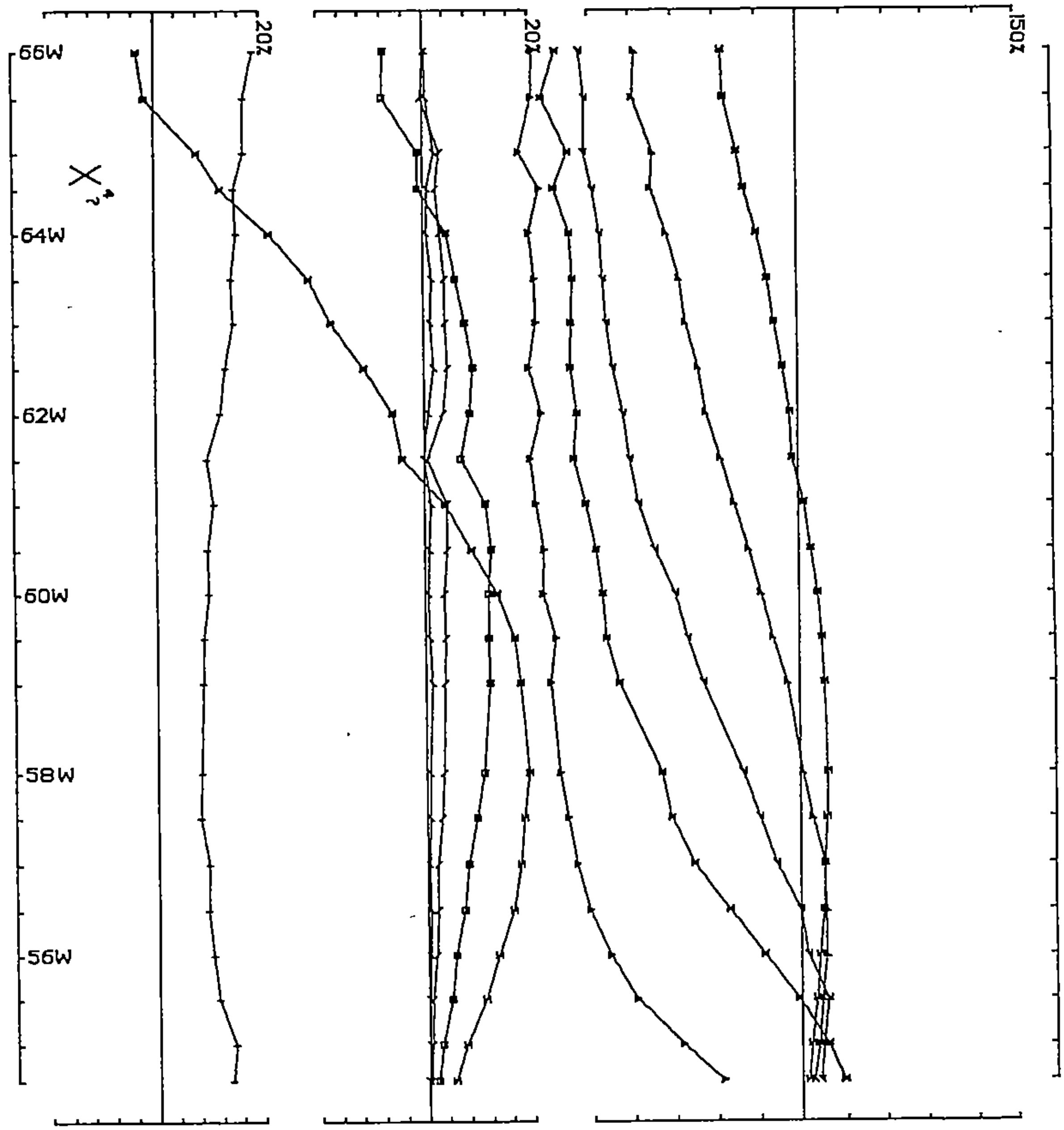
CLAIR 81 30.50 HZ C-P)/P C-CI)/CI , Hz 2IN 401

DS 4



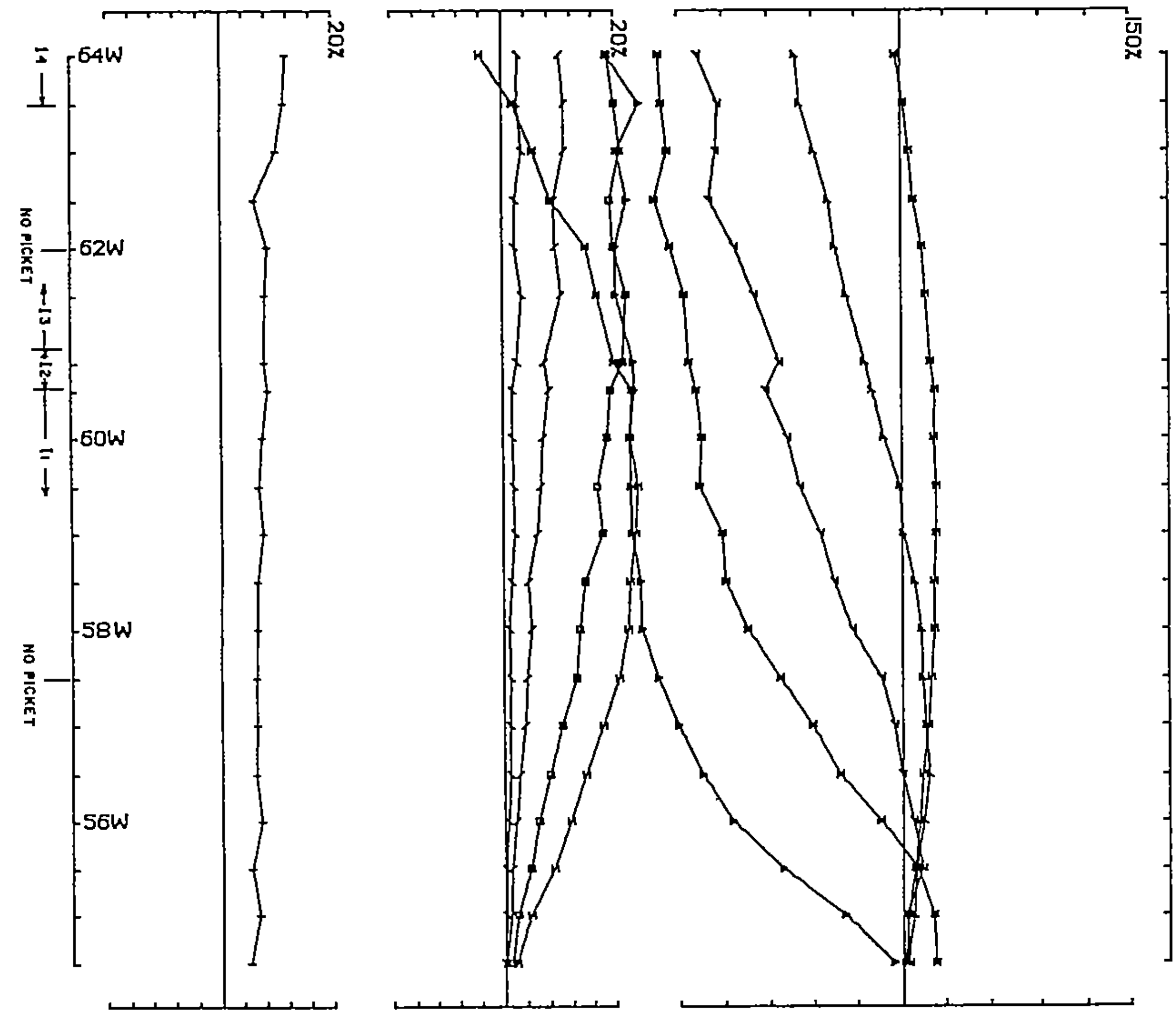
DS 4a

CLAIR 81 30.50 HZ C-P)/P C-CI)/CI Hz 2IN 40I



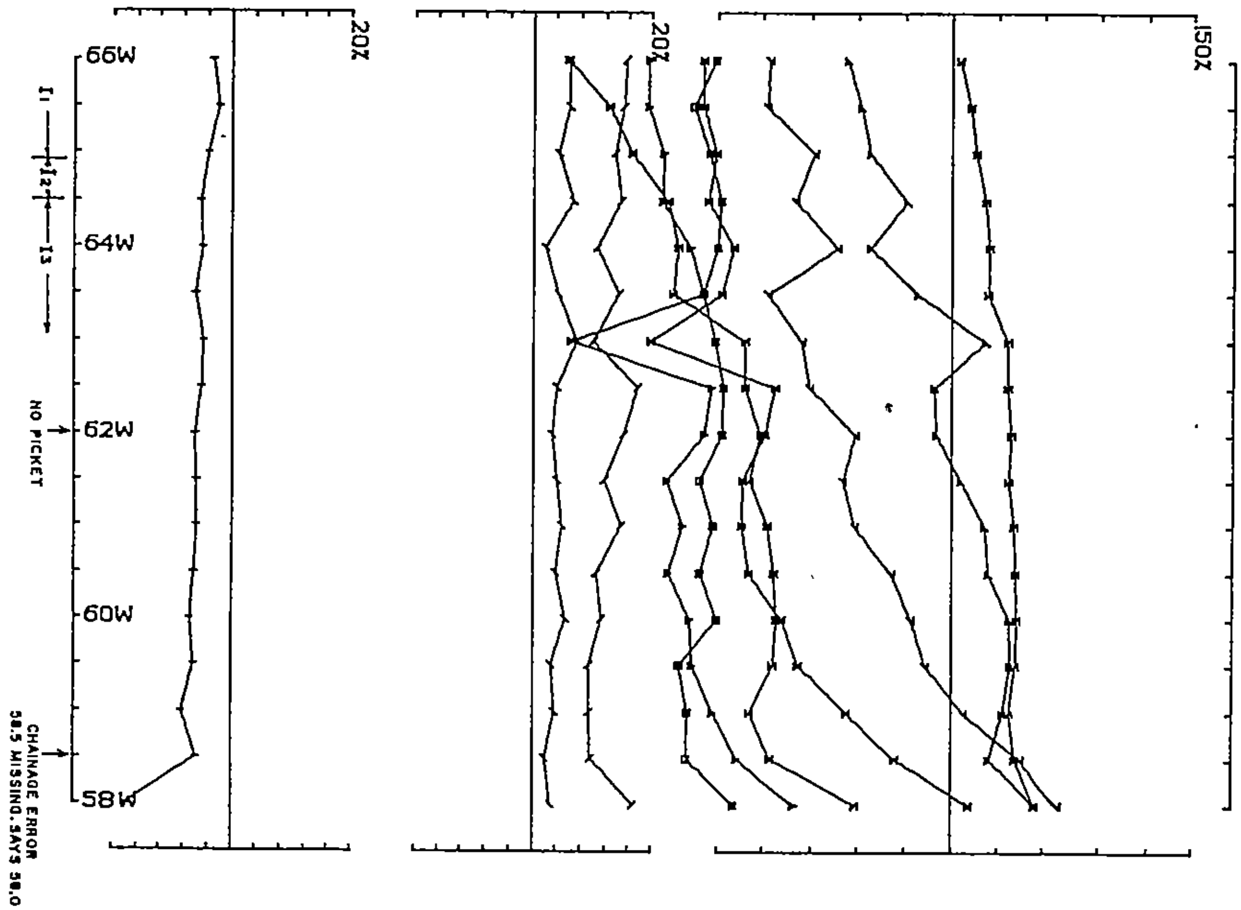
DS 5

CLAIR 81 30.50 HZ C-P)/P C-Cl)/Cl Hz 24N 40I



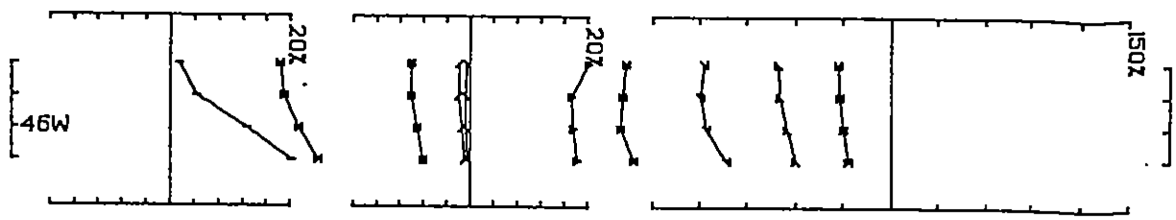
DS 6

CLAIR 81 30.50 HZ C-P)/P C-CI)/CI . Hz 27N 401



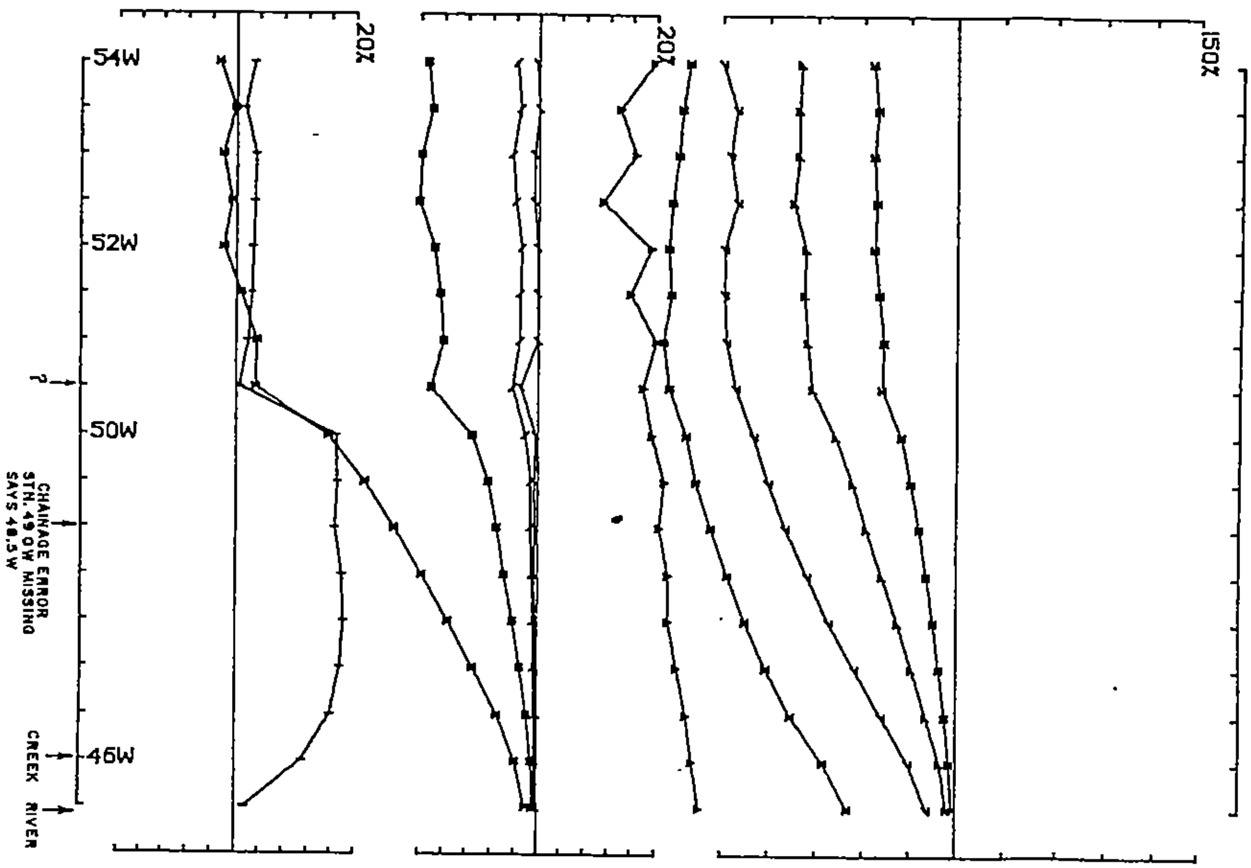
DS 7

CLAIR 81 30.50 HZ C-P)/P C-CI)/CI Hz 30N 401



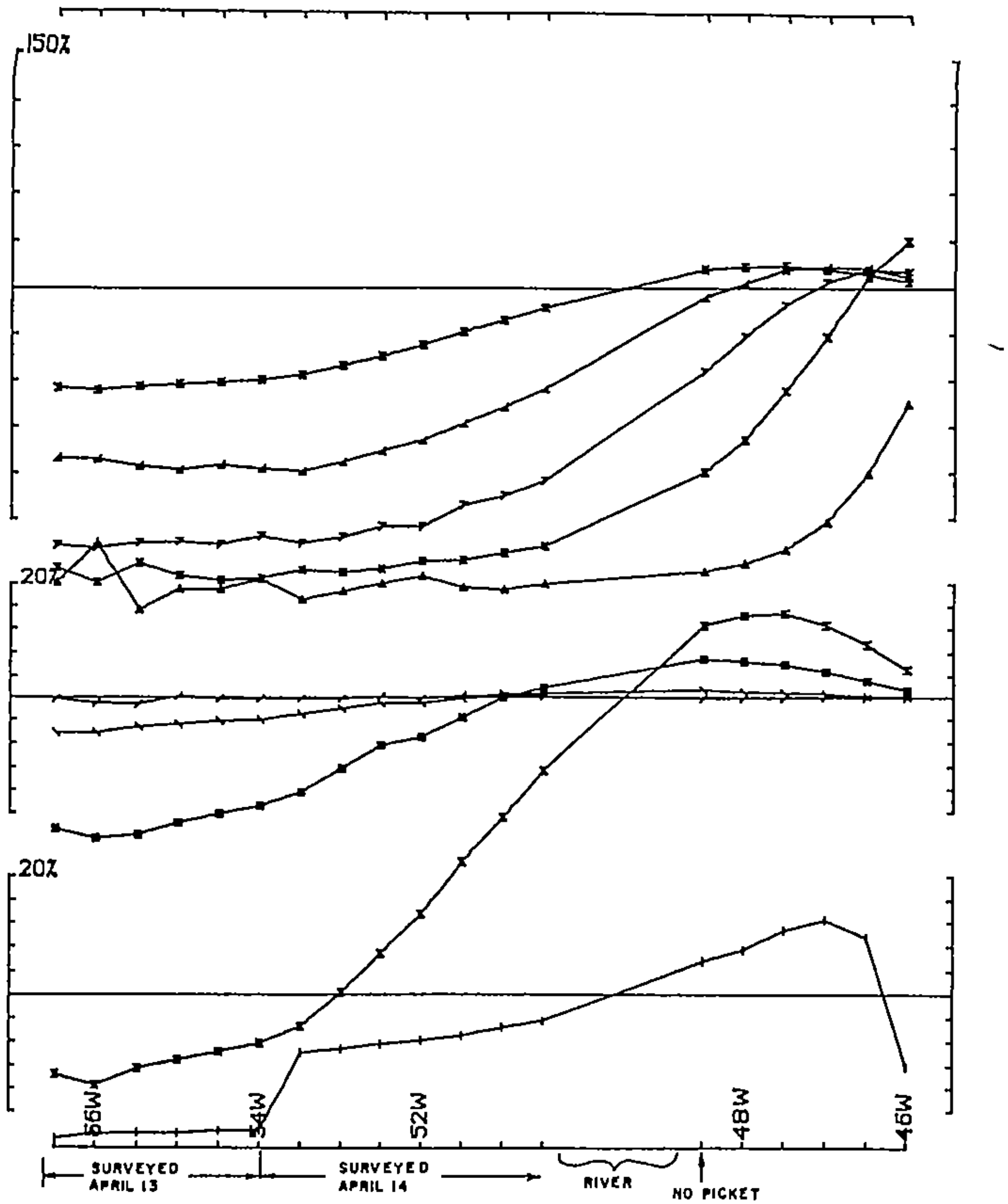
DS 8

CLAIR 81 30.50 HZ C-P)/P C-CI)/CI Hz 6N 402



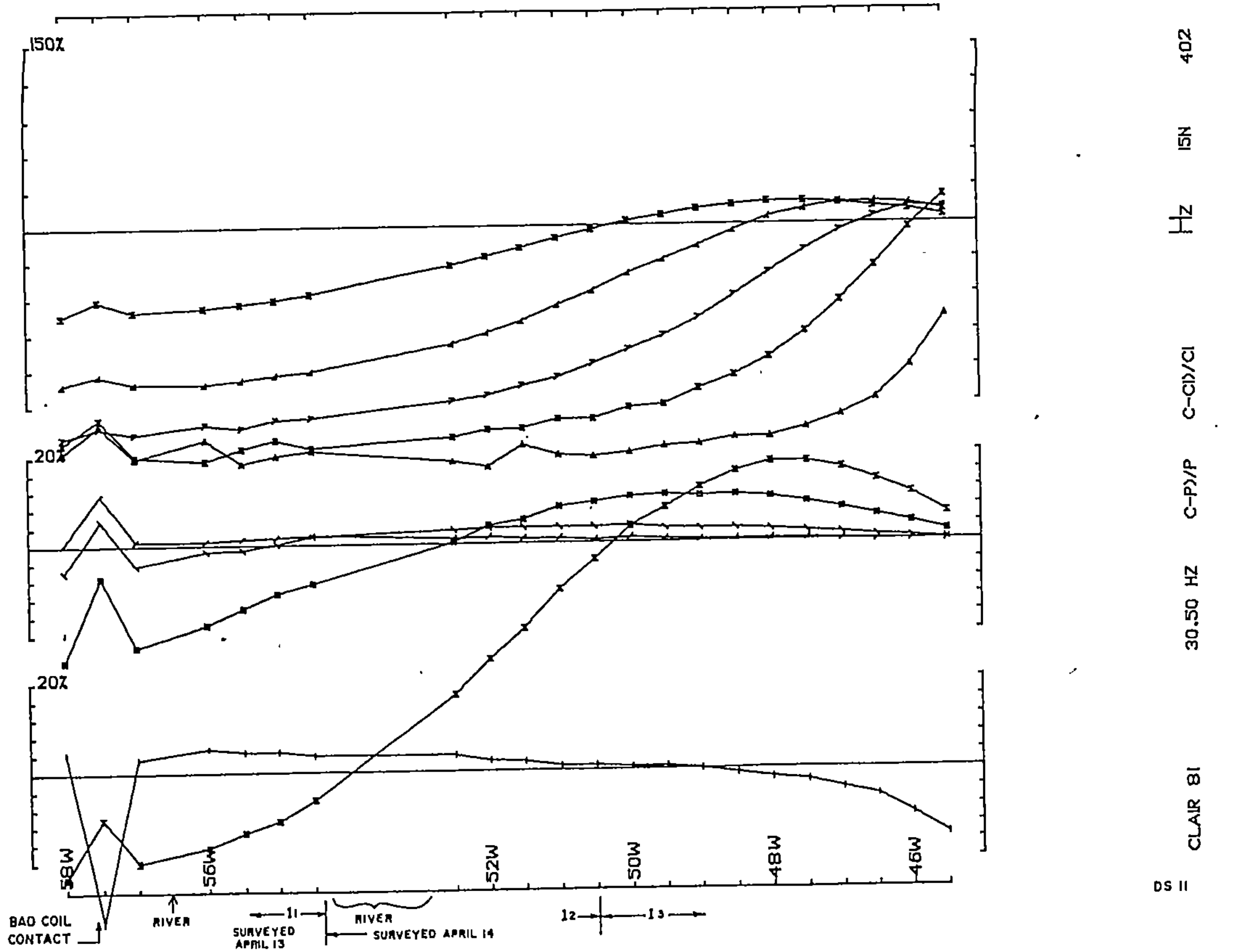
DS 9

CLAIR 81 30.50 HZ C-P)/P C-CI)/CI Hz 9N 402

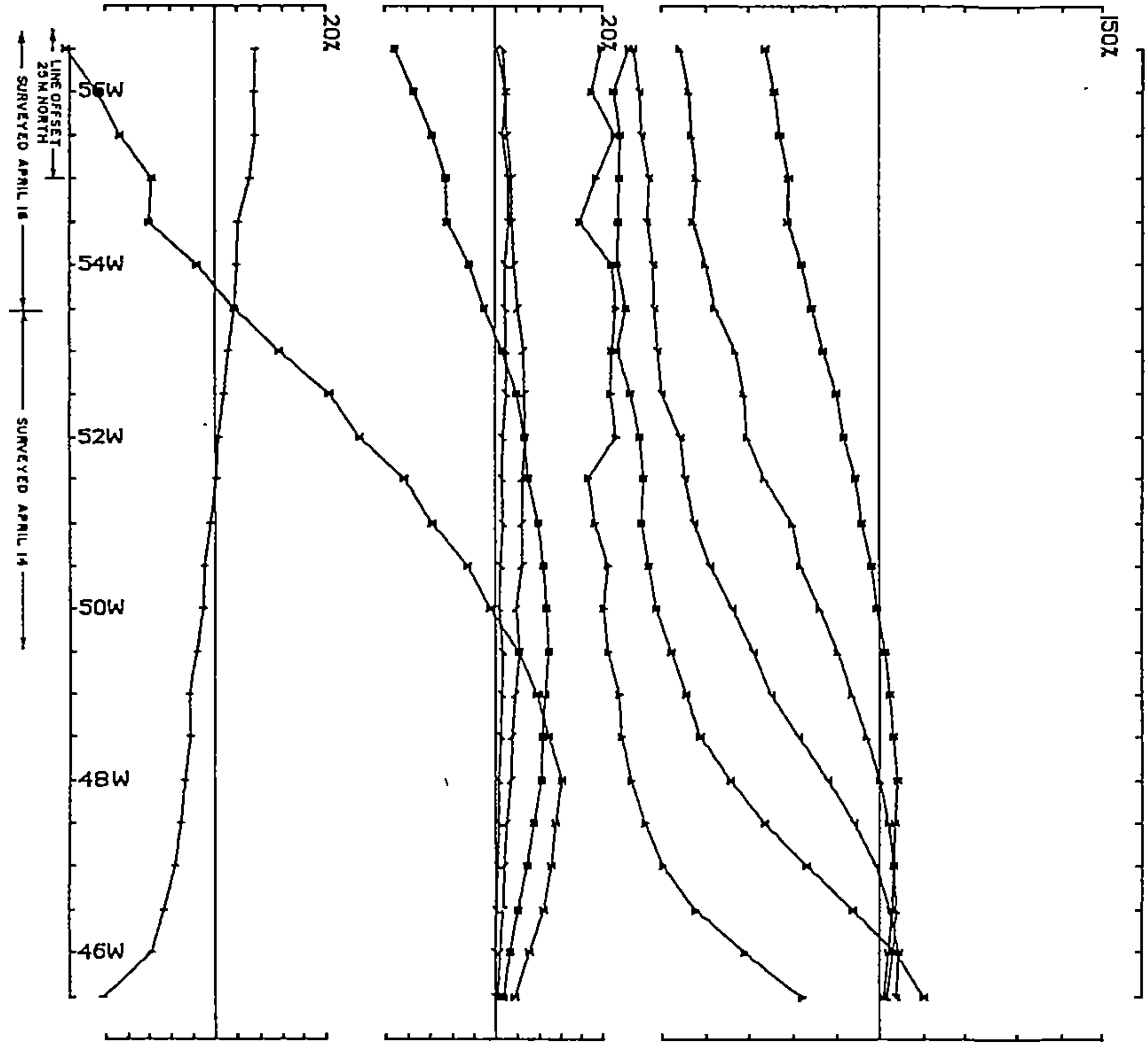


CLAIR BI 30.50 HZ C-P)/P C-CI)/CI Hz 12N 402

DS 10

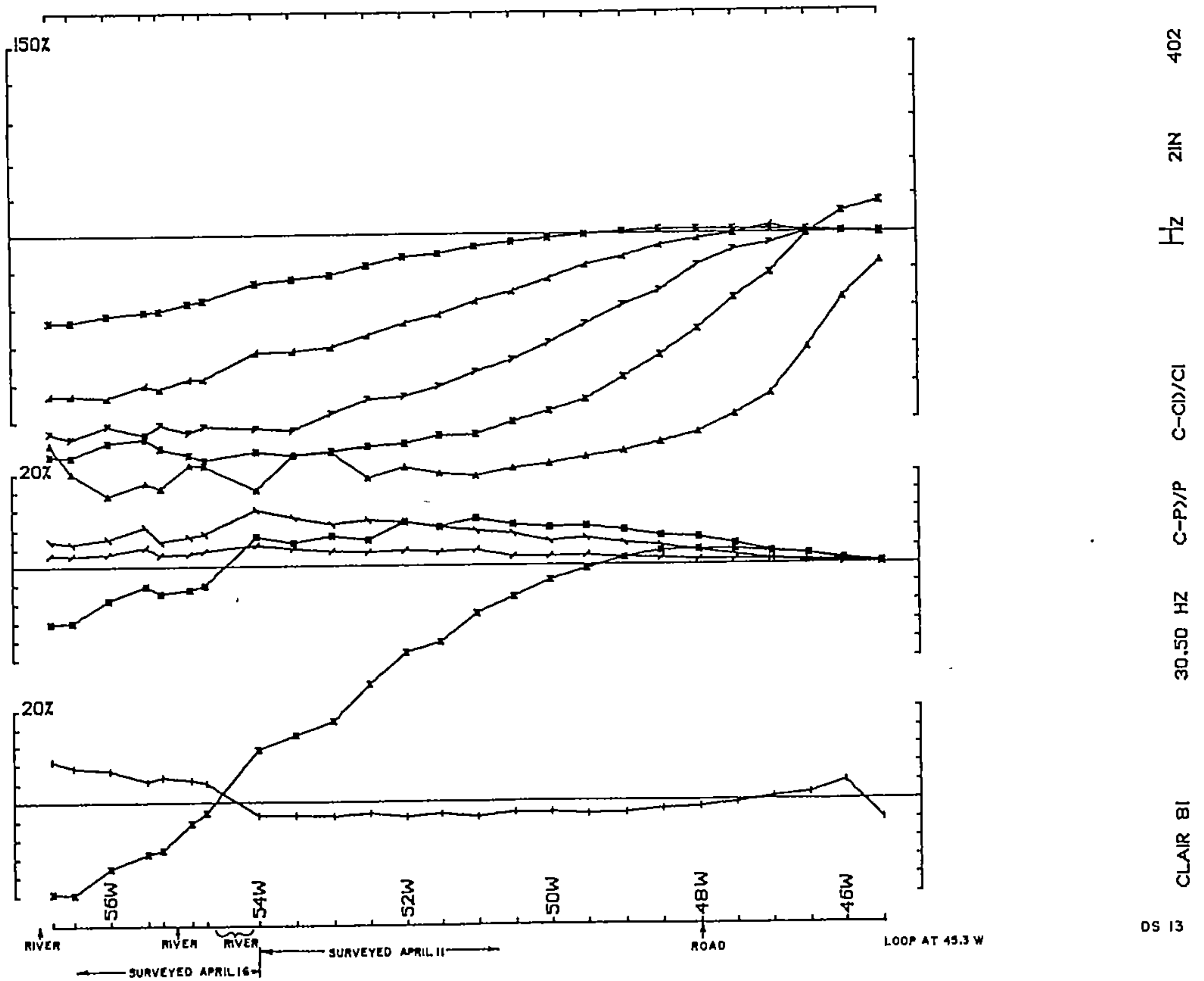


150%
20%
20%
58W
56W
52W
50W
48W
46W
BAD COIL CONTACT
RIVER
1 1
SURVEYED APRIL 13
RIVER
SURVEYED APRIL 14
1 2
1 3
402
15N
Hz
C-CI)/CI
C-P)/P
30.50 HZ
CLAIR 81
DS II

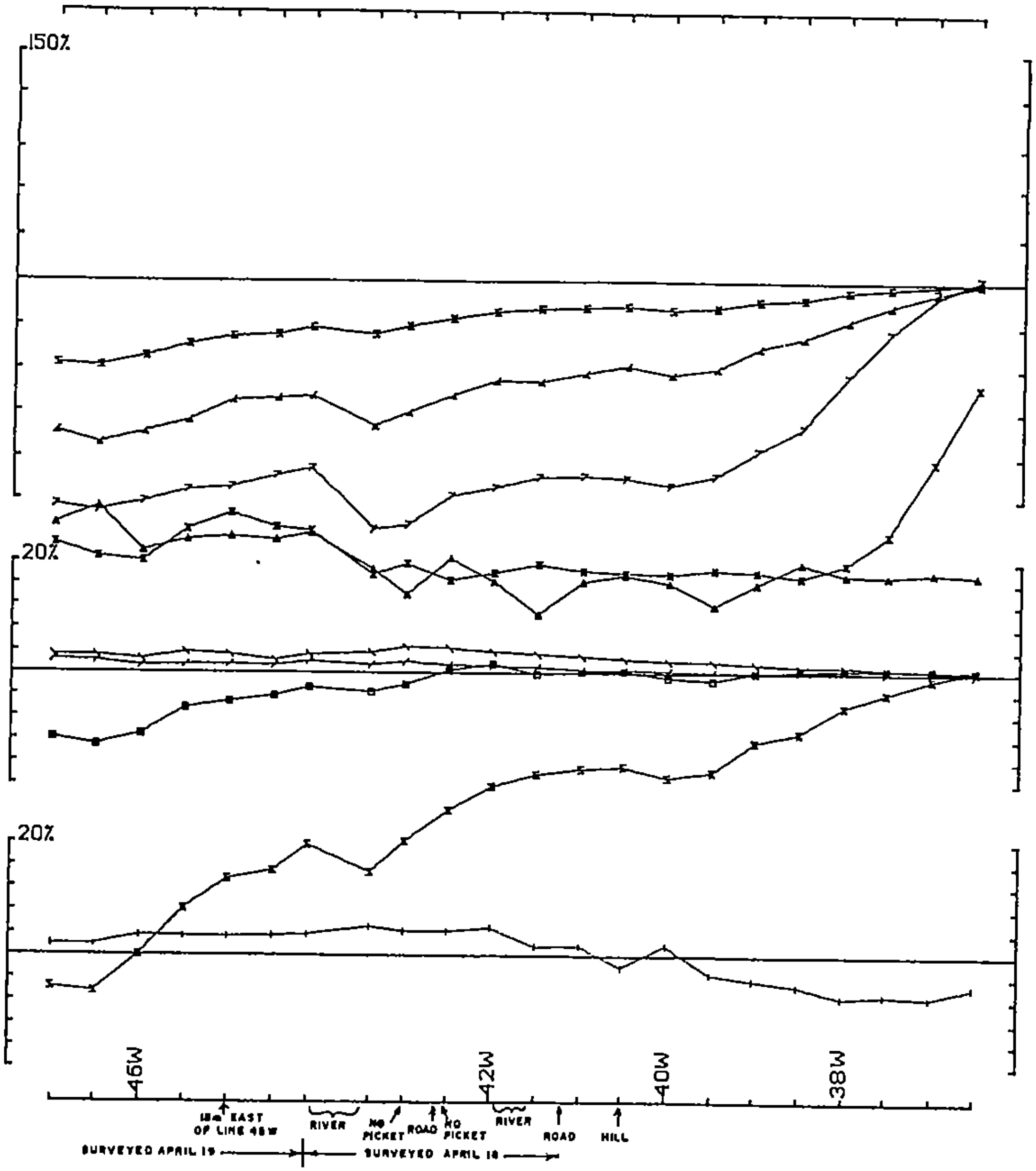


CLAIR 81   30.50 HZ   C-P)/P   C-CI)/CI   Hz   18N   402

DS 12

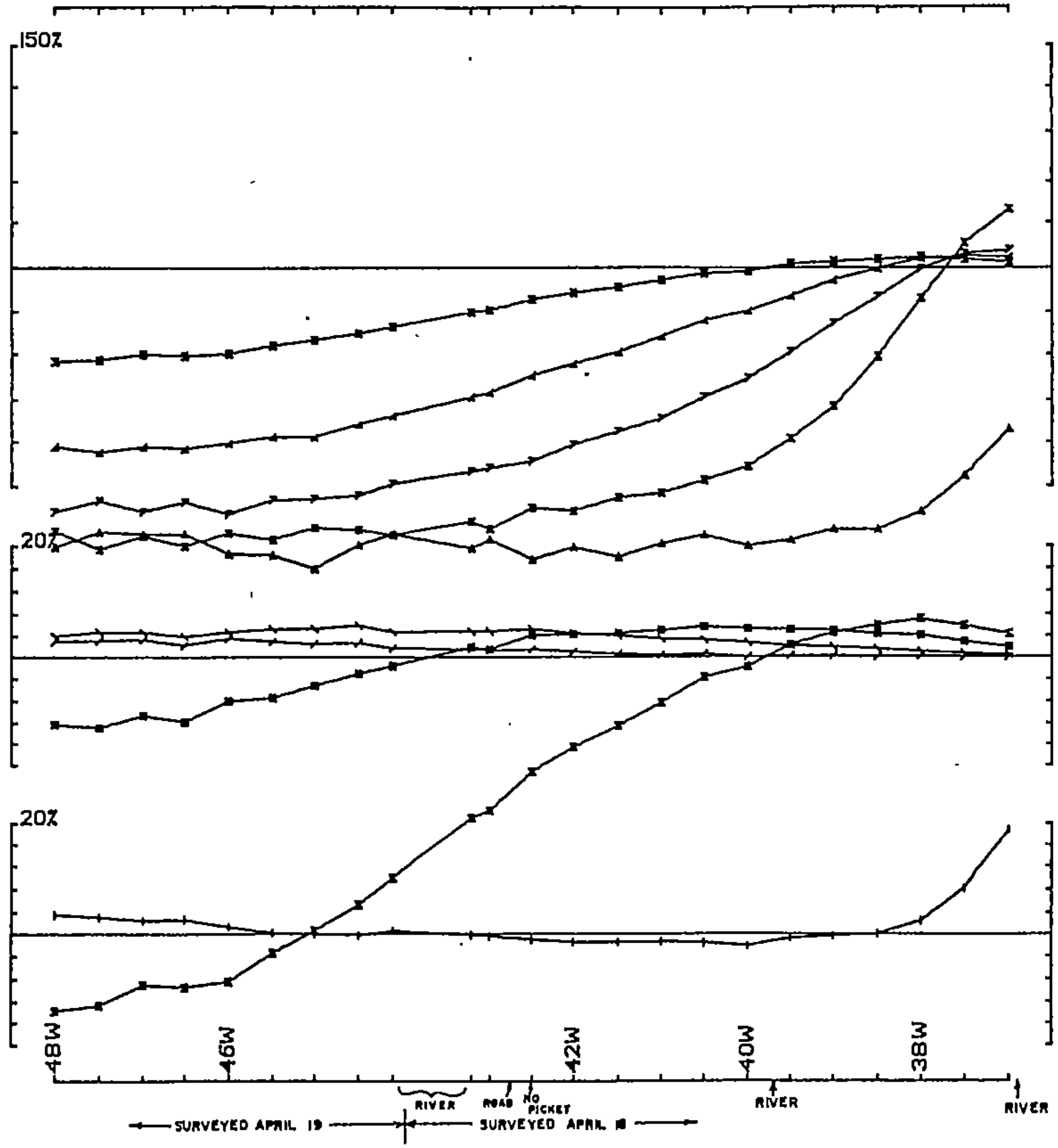


150%
20%
20%
56W
54W
52W
50W
48W
46W
RIVER
RIVER
RIVER
ROAD
LOOP AT 45.3 W
SURVEYED APRIL 11
SURVEYED APRIL 16
402
2IN
Hz
C-CI)/CI
C-P)/P
30.50 HZ
CLAIR BI
DS 13



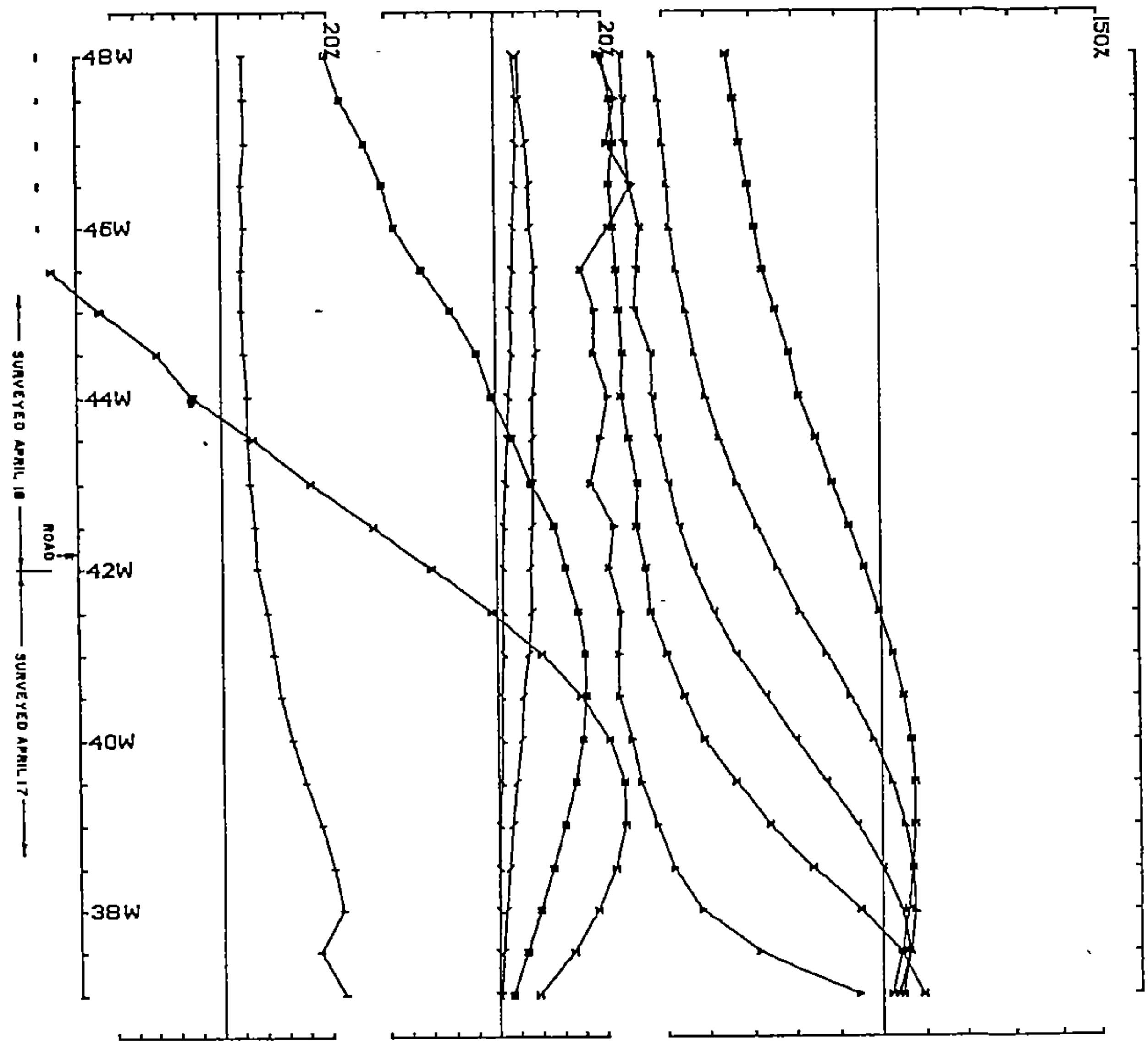
CLAIR 81 30.50 HZ C-P)/P C-Cl)/Cl Hz 6N . 403

DS 14



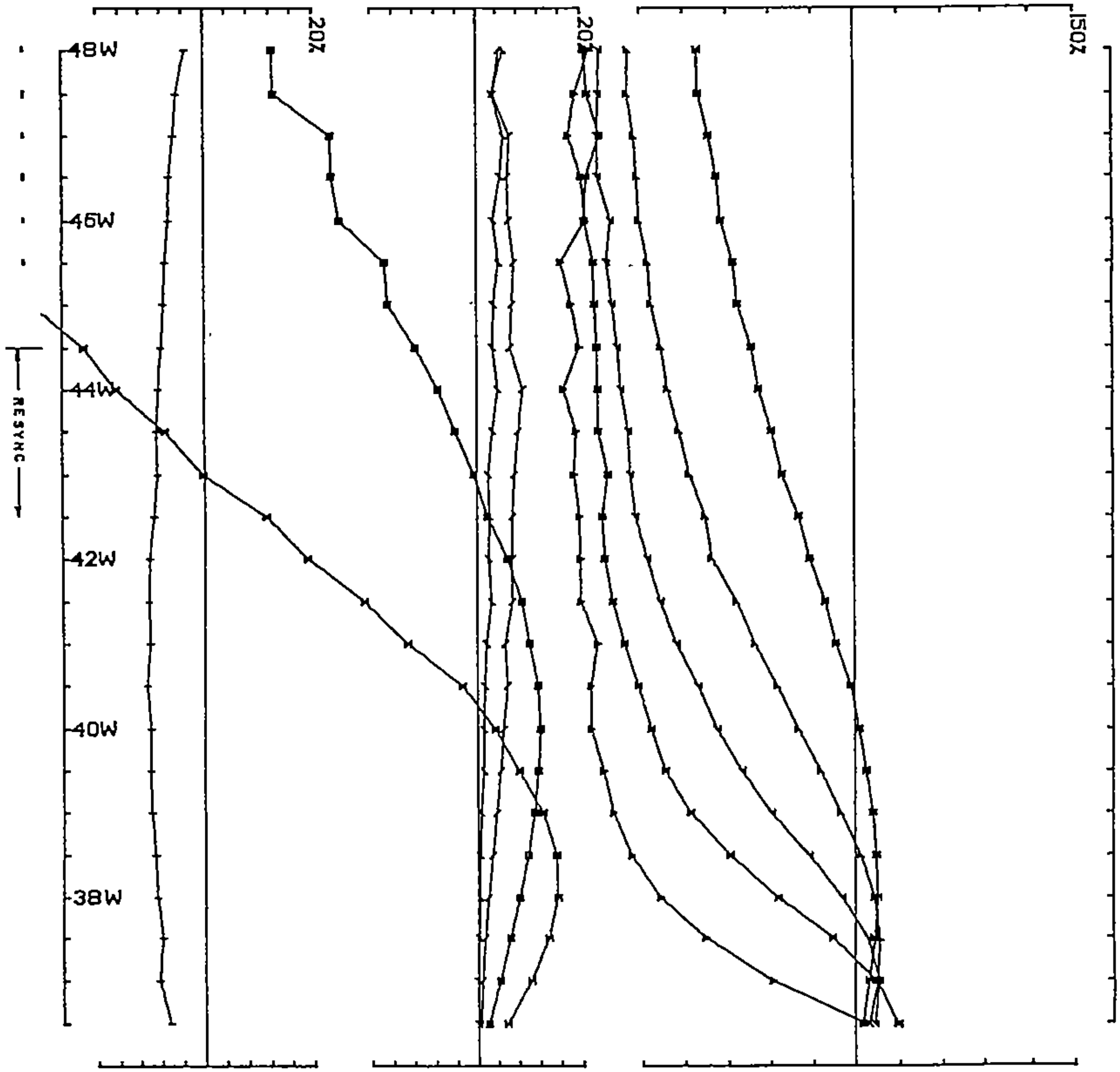
CLAIR 81 30.50 HZ C-P)/P C-Cl)/Cl Hz 9N 403

DS 15



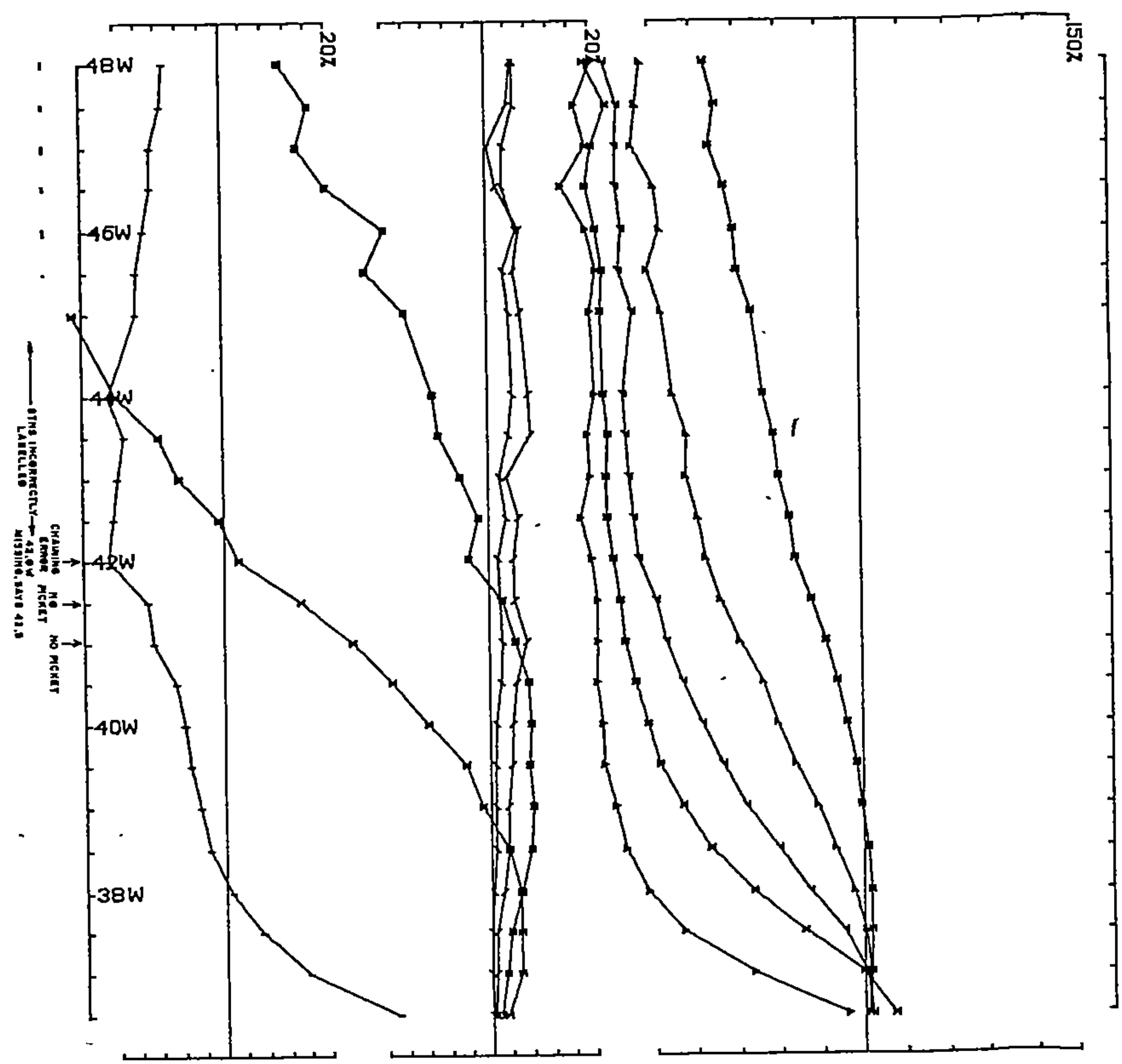
DS 16

CLAIR 81 30.50 HZ C-P)/P C-CI)/CI Hz 12N 403



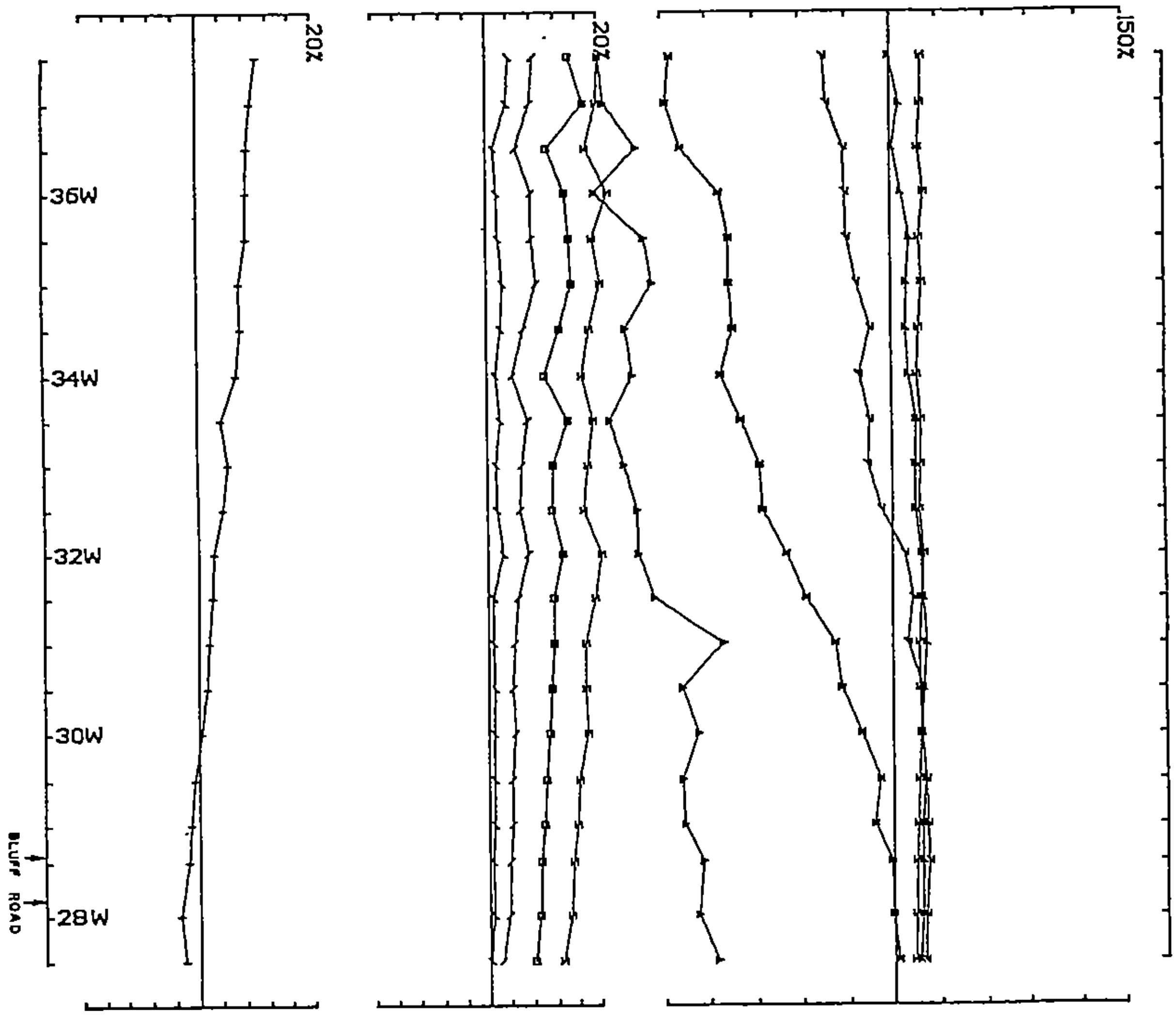
DS 17

CLAIR 81 30.50 HZ C-P)/P C-CI)/CI Hz 15N 403



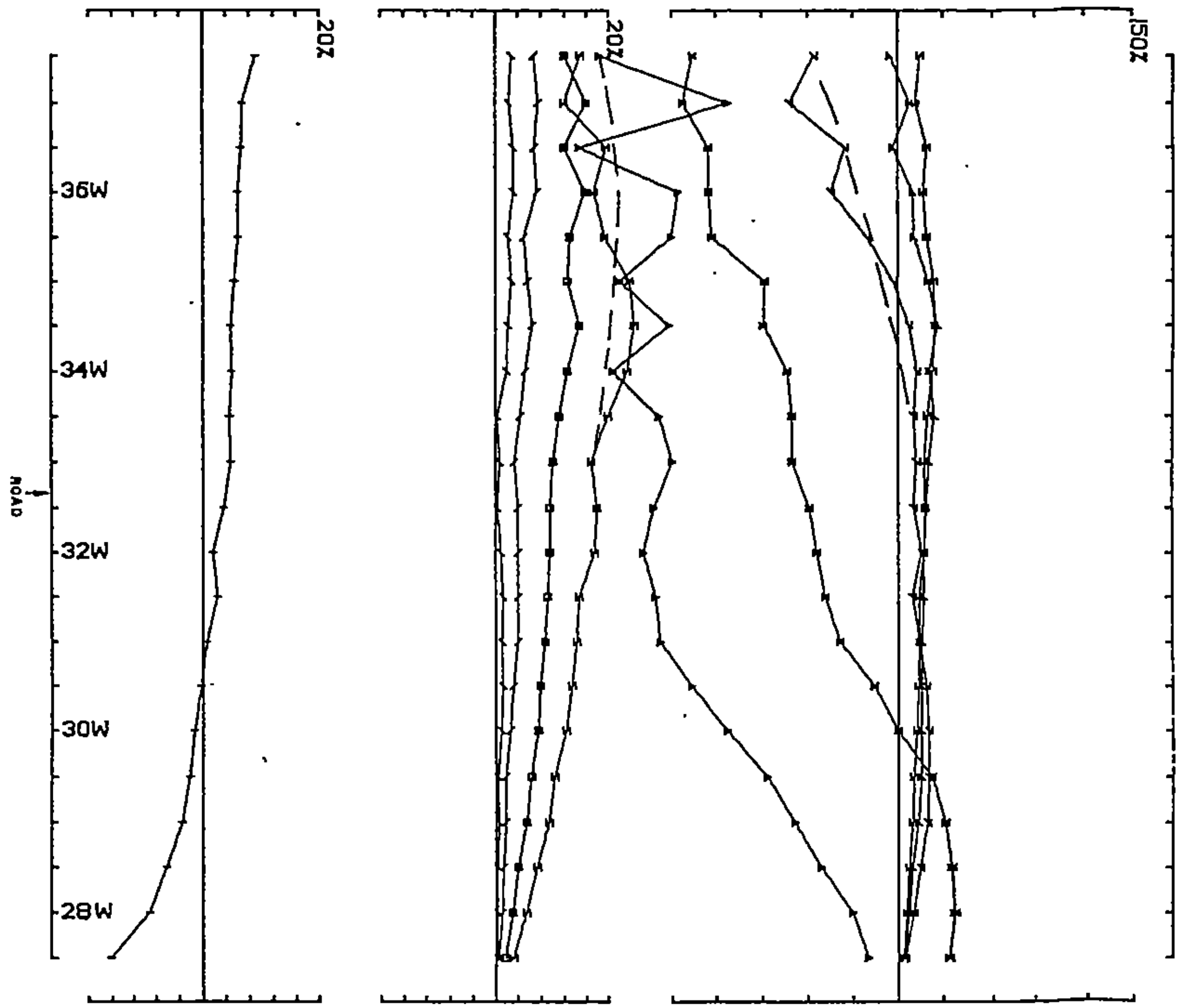
DS 18

CLAIR 81 30.50 HZ C-P)/P C-CI)/CI Hz 18N 403



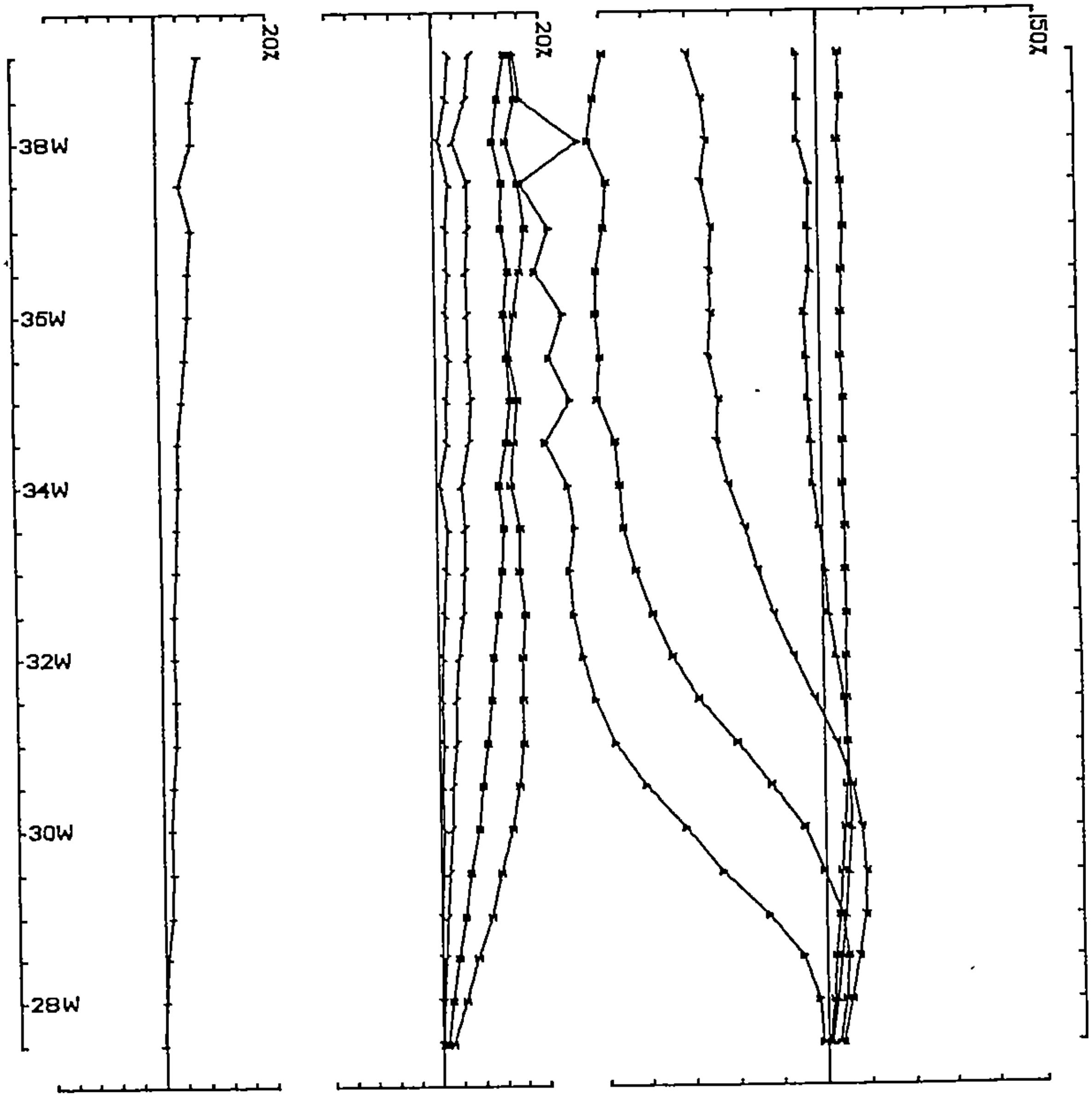
DS 19

CLAIR 81 30.50 HZ C-P)/P C-Cl)/Cl Hz 0 404



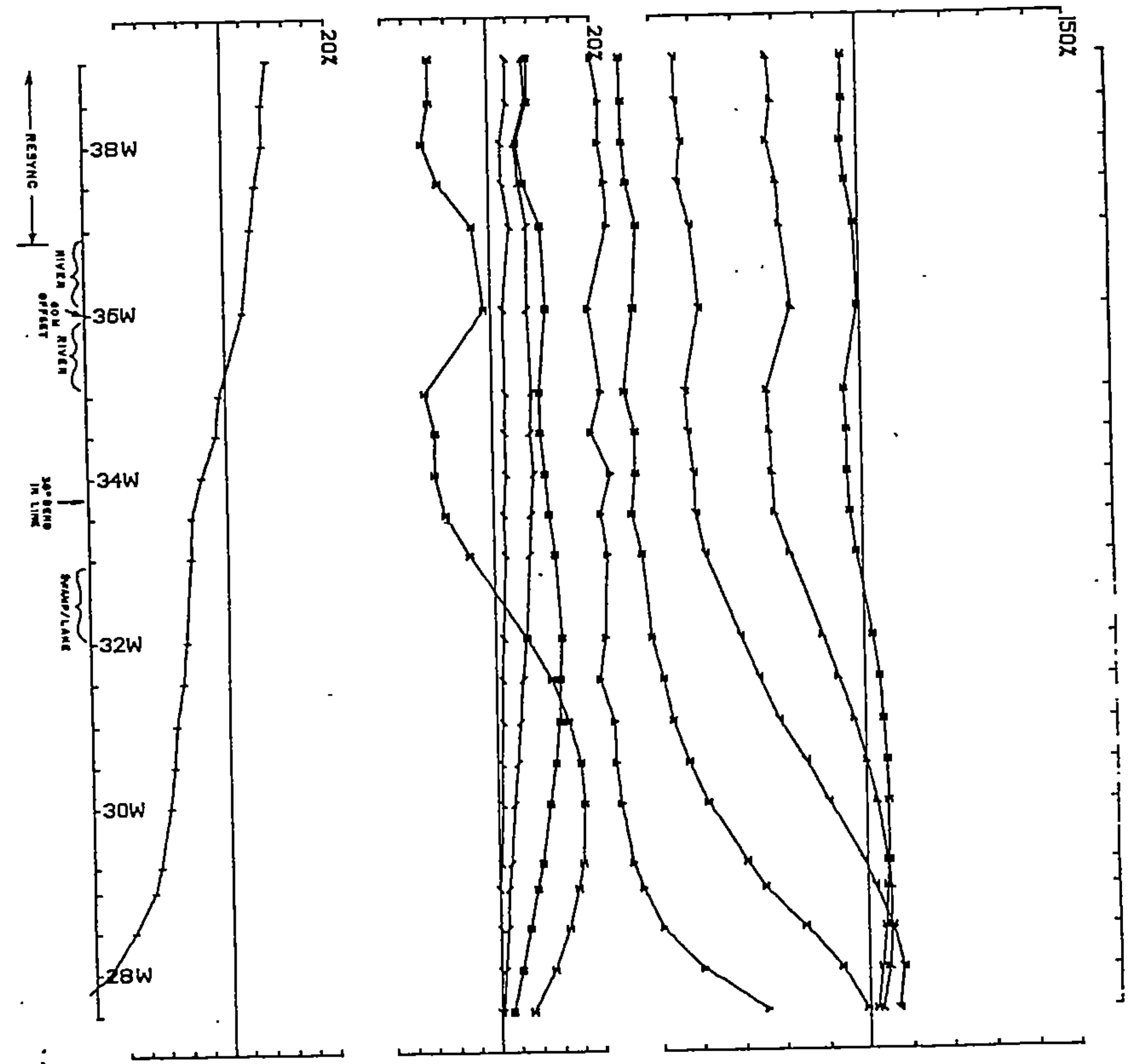
DS 20

CLAIR 81 30.50 HZ C-P)/P C-CI)/CI Hz 3N 404



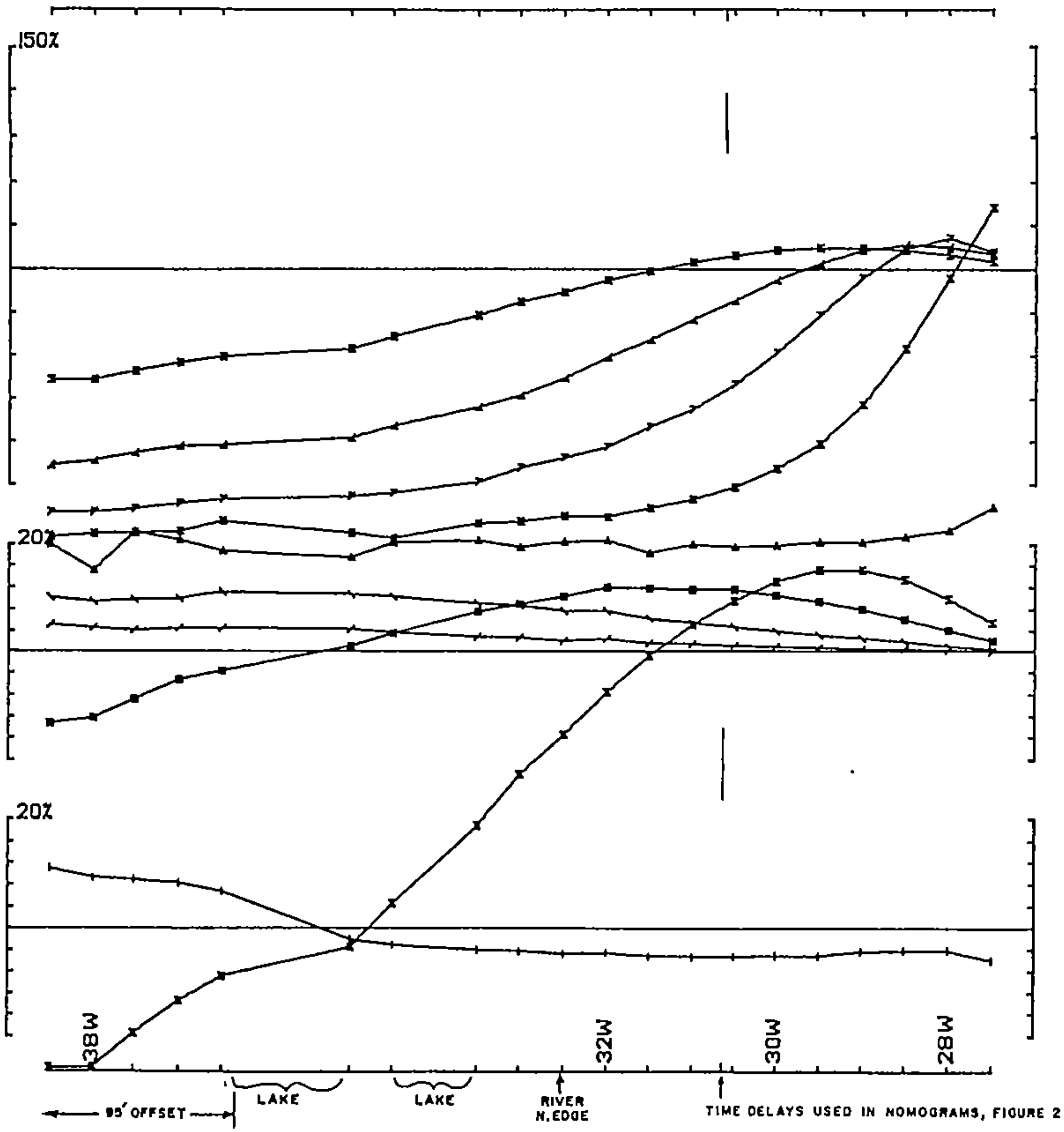
DS 21

CLAIR 81 30.50 HZ C-P)/P C-Cl)/Cl Hz 6N 404



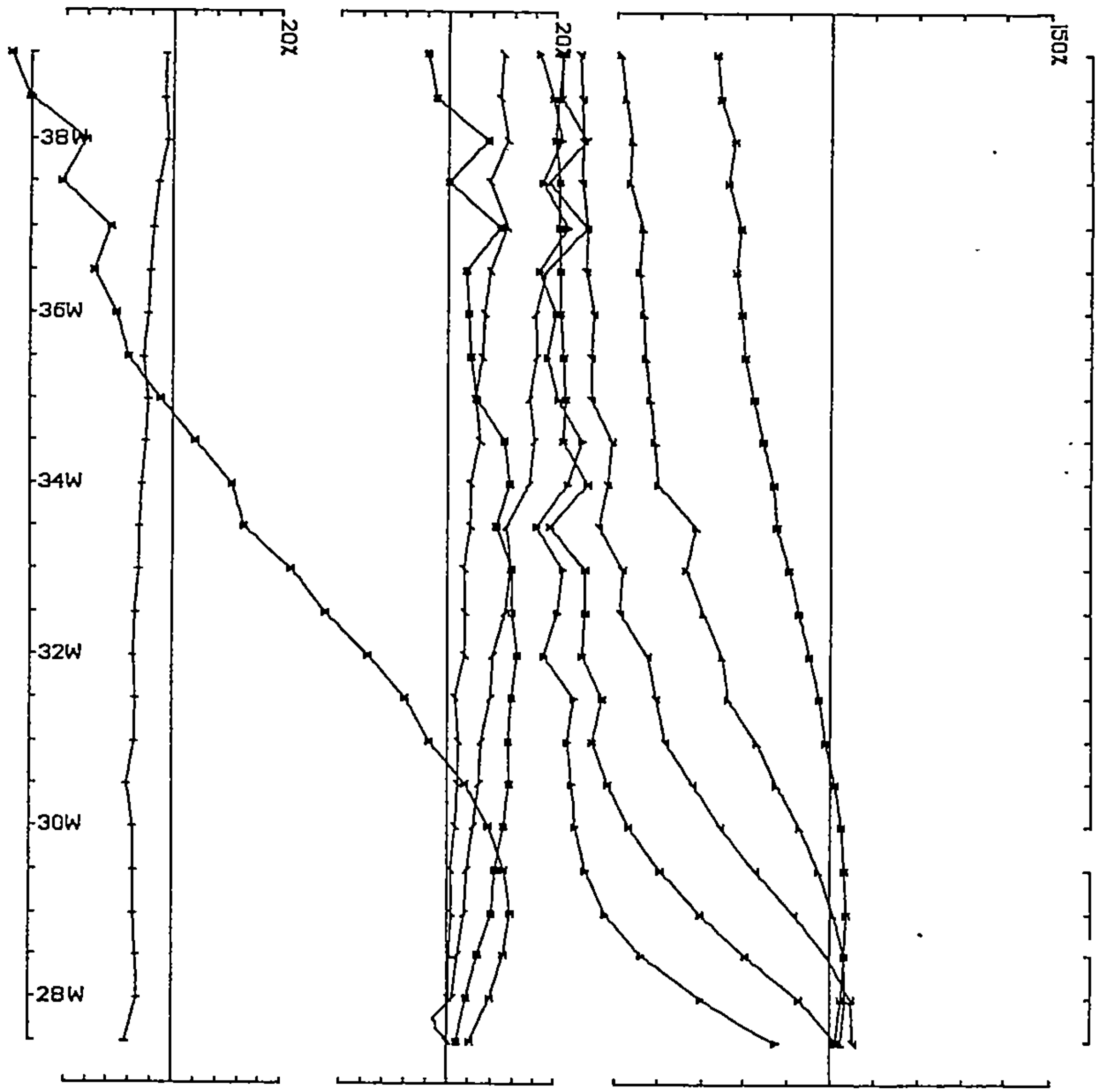
DS 22

CLAIR 81 30.50 HZ C-P)/P C-CI)/CI Hz 9N 404



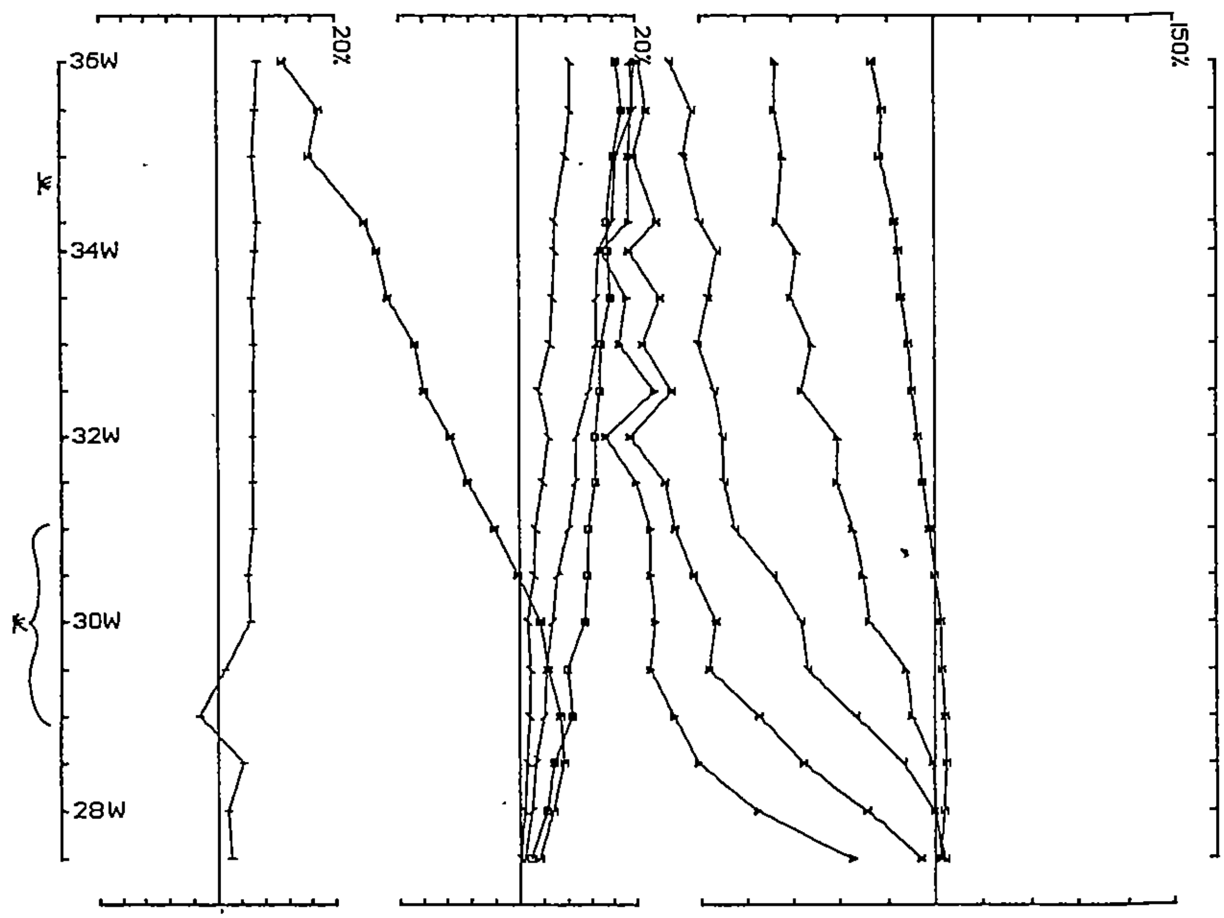
CLAIR 81 30.50 HZ C-P)/P C-CI)/CI Hz 12N 404

DS 23



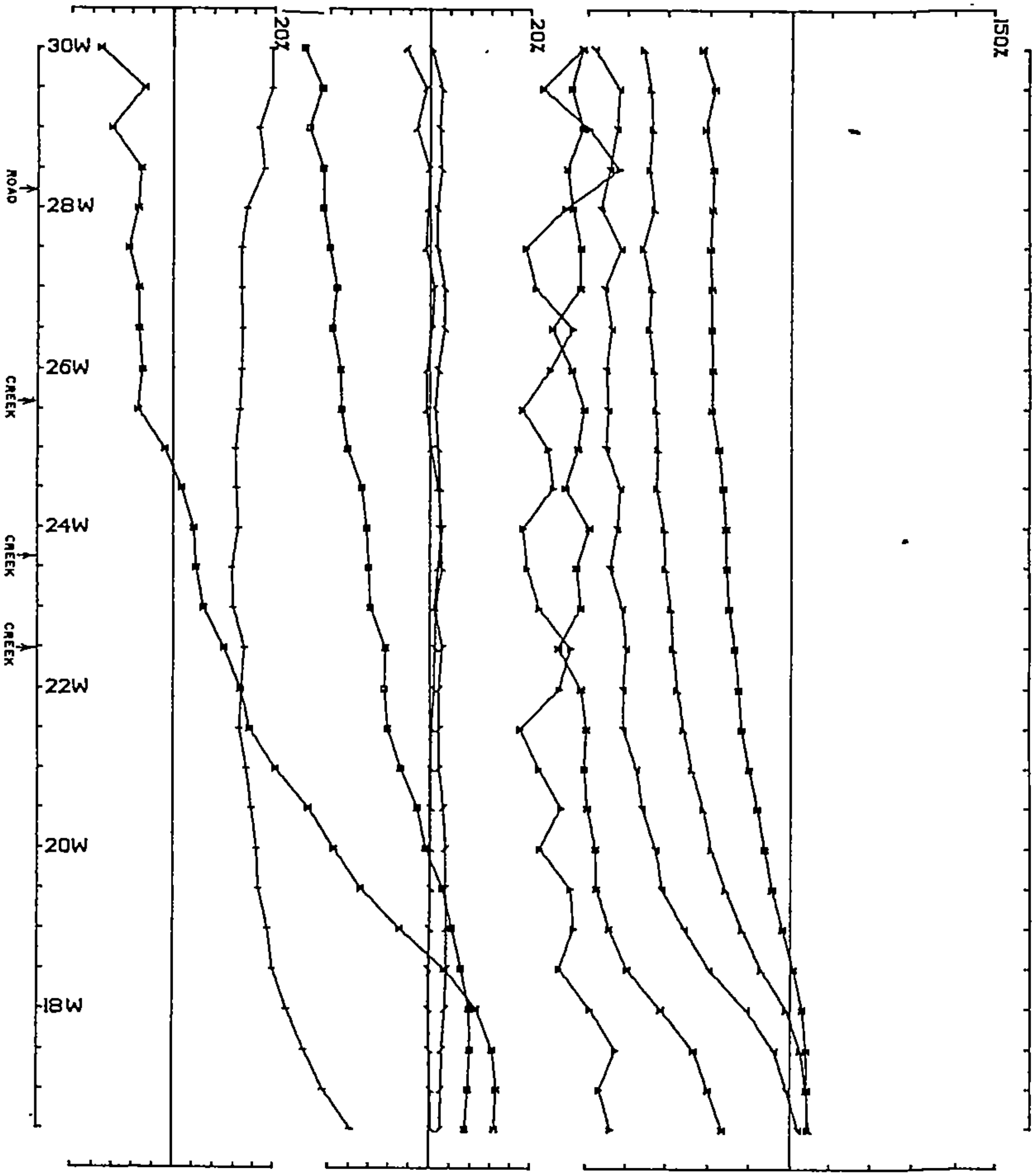
OS 24

CLAIR 81 30.50 HZ C-P)/P G-CI)/CI Hz 15N 404



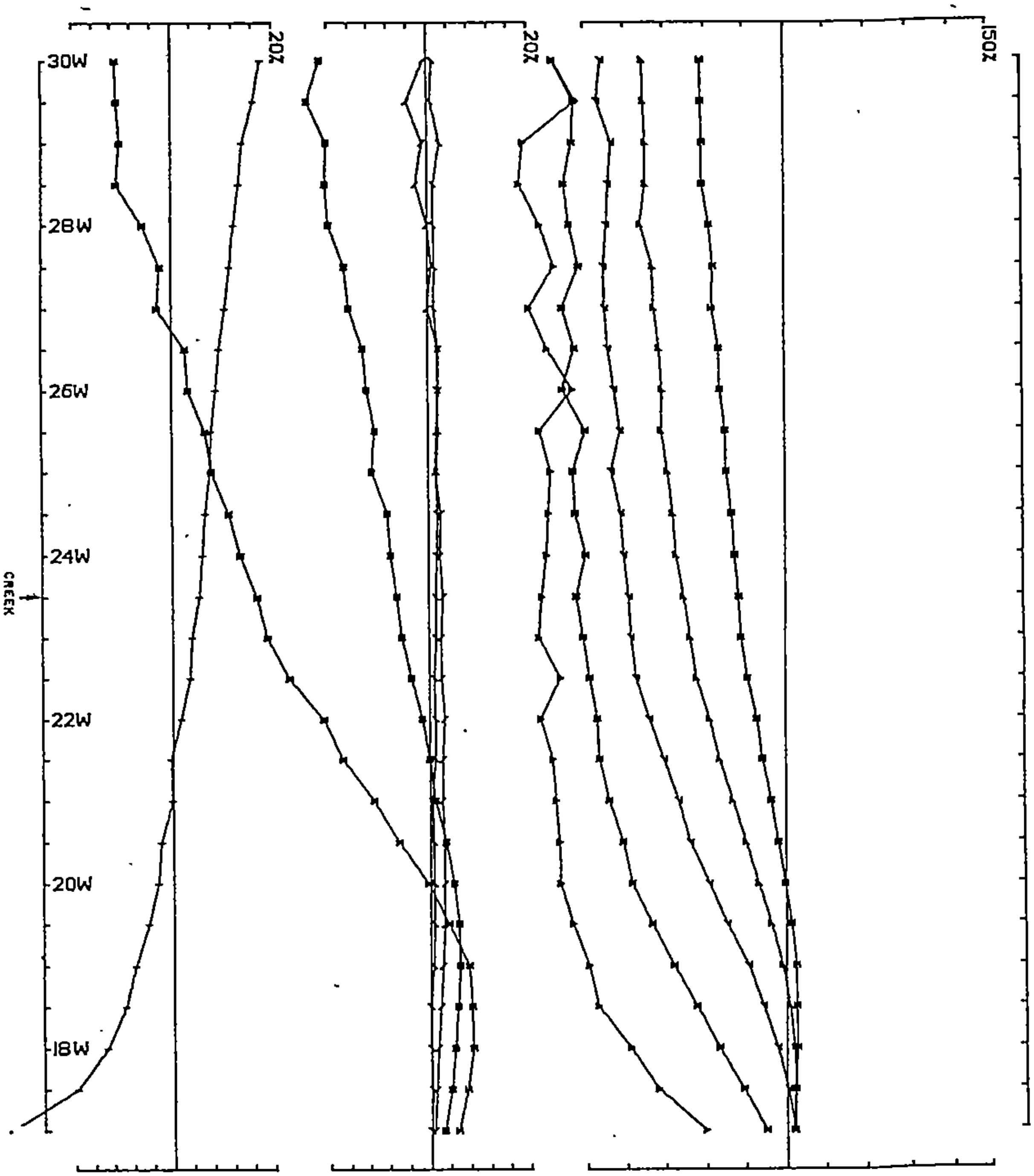
OS 25

CLAIR 81 30.50 HZ C-P)/P C-CI)/CI Hz 18N 404



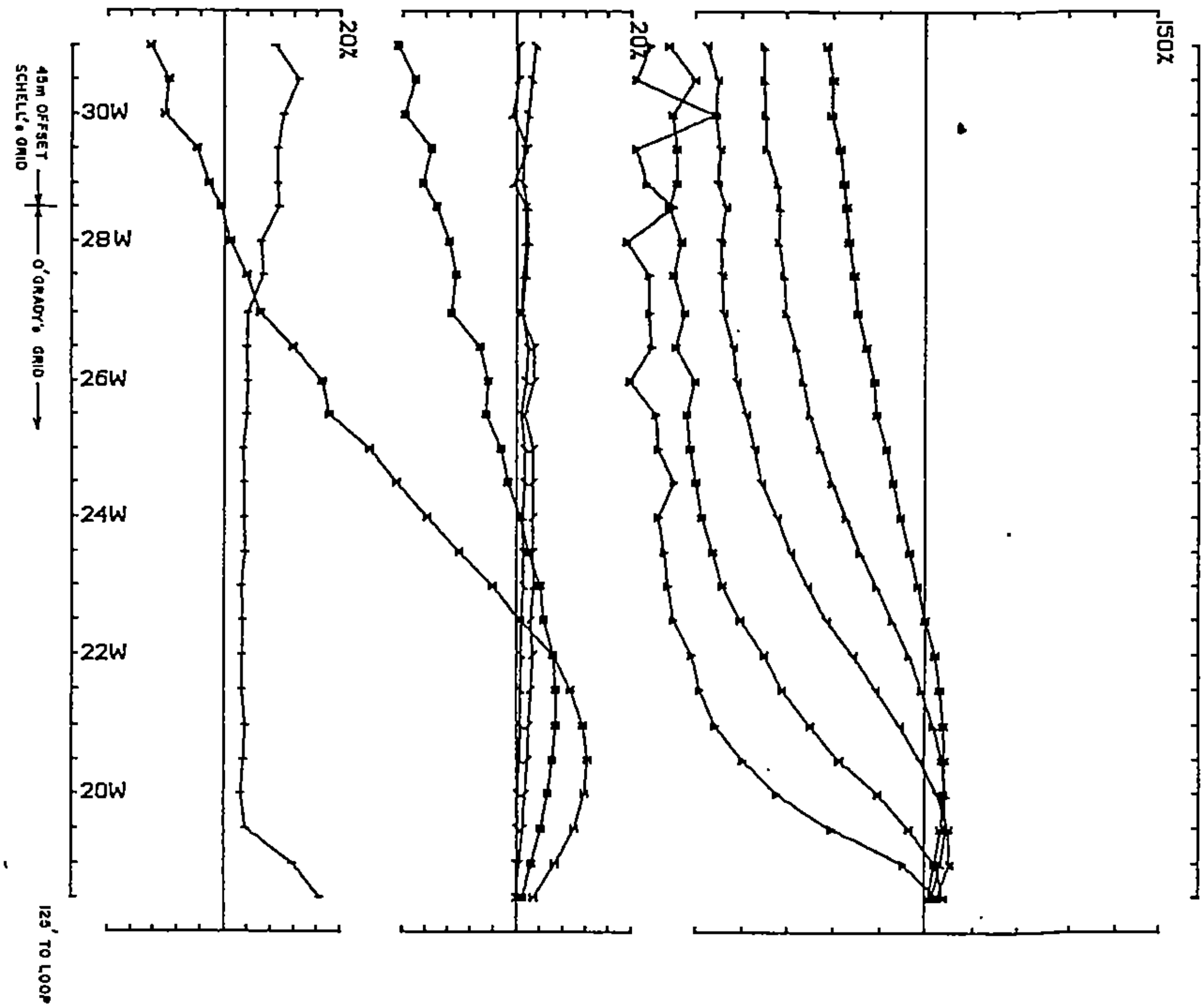
OS 26

CLAIR 81 30.50 HZ C-P)/P C-CI)/CI Hz 0 405



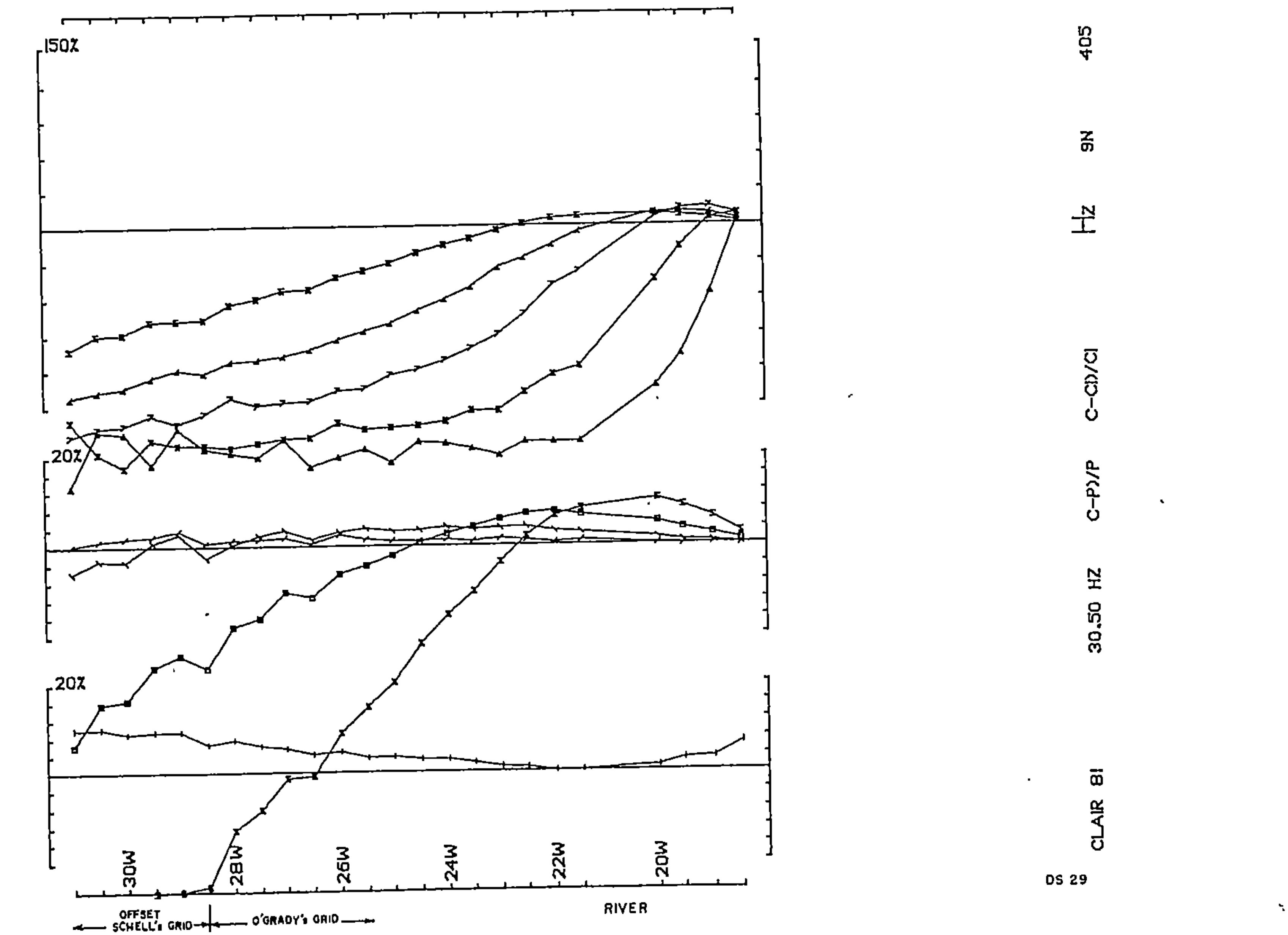
DS 27

CLAIR BI 30.50 HZ C-P)/P C-CD/CI Hz 3N 405

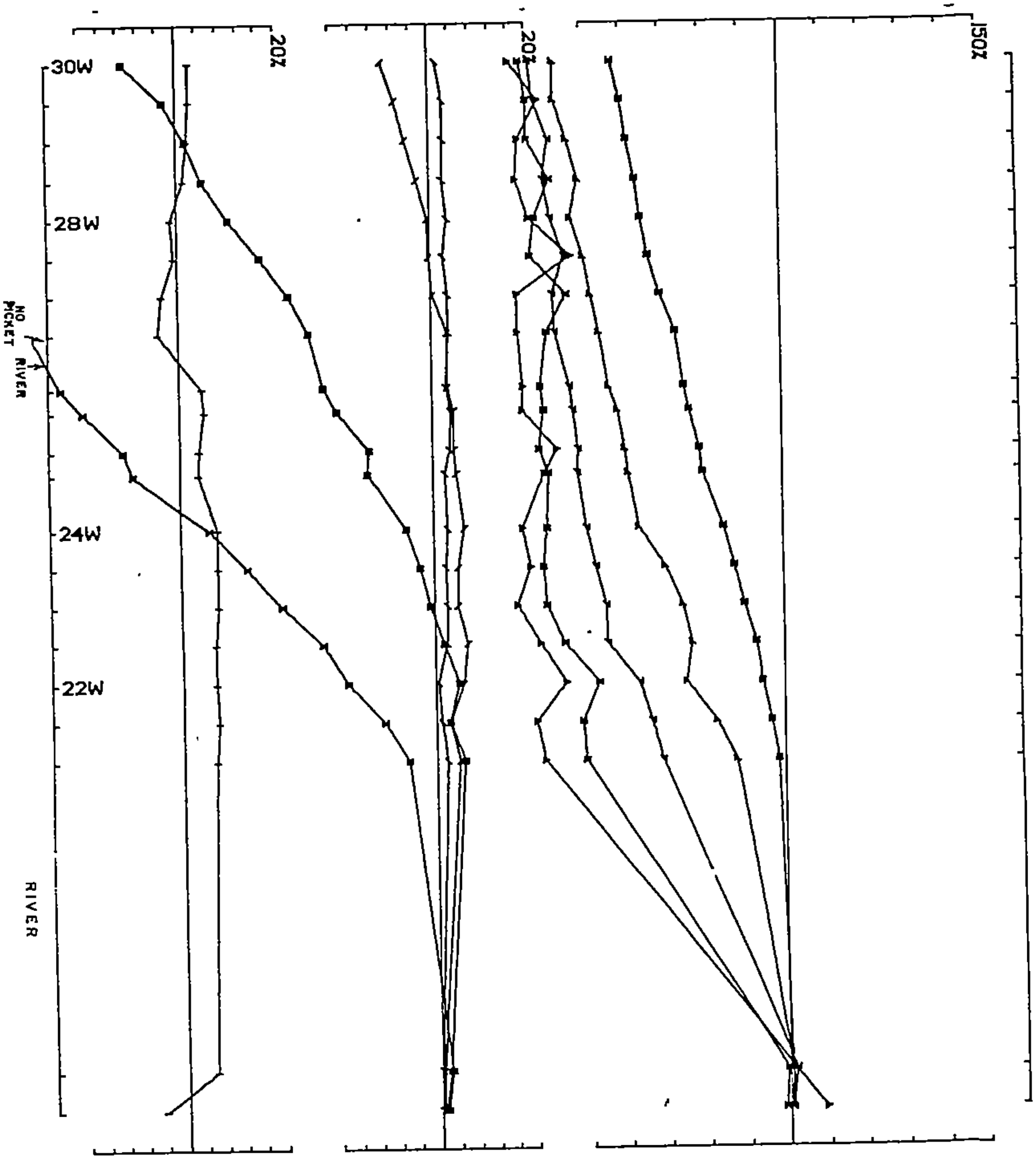


DS 28

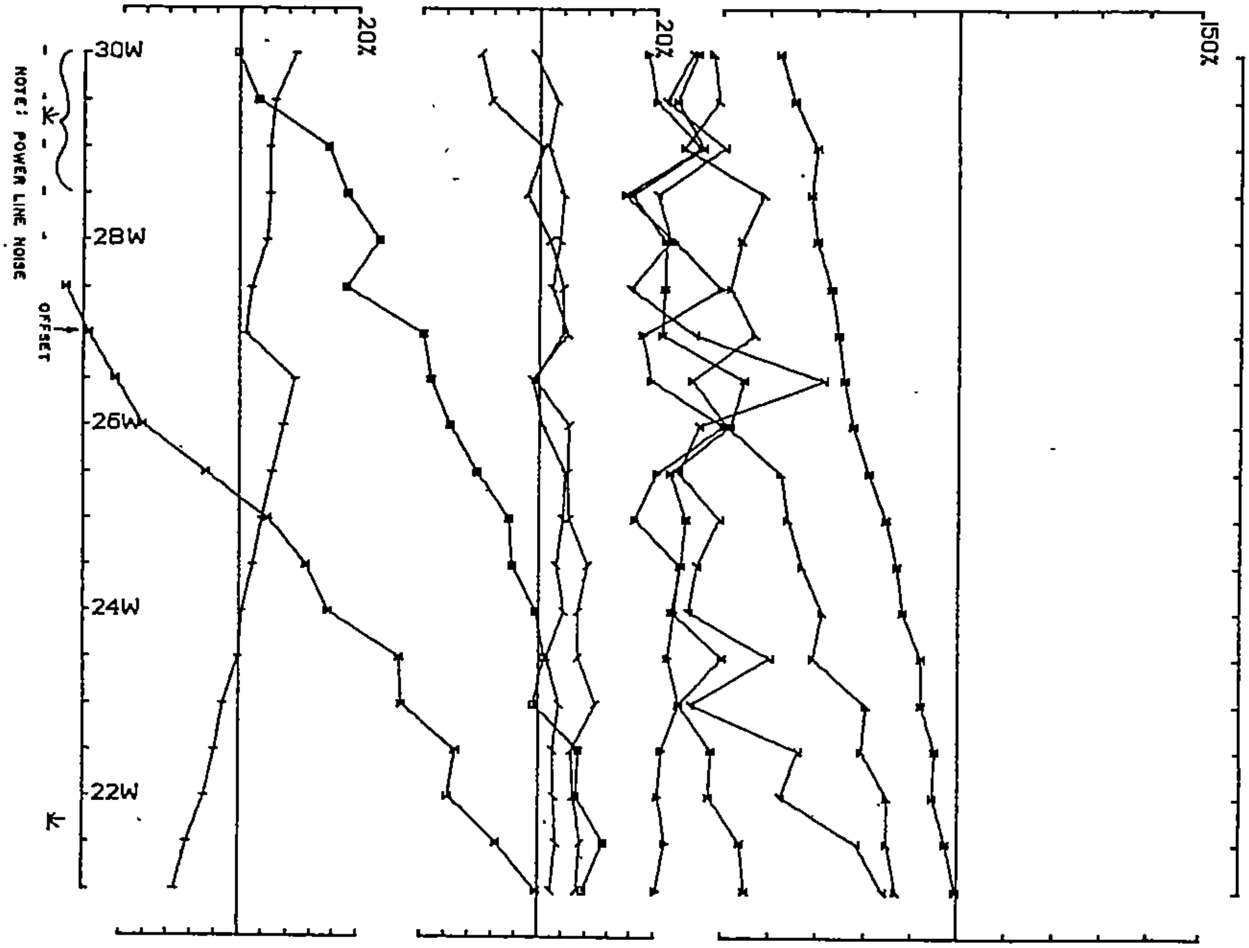
CLAIR 81 30.50 HZ C-P)/P C-Cl)/Cl Hz 6N 40S



150%
20%
20%
30W
28W
26W
24W
22W
20W
OFFSET
SCHELL's GRID
O'GRADY's GRID
RIVER
405
9N
Hz
C-C)/C
C-P)/P
30.50 HZ
CLAIR B1
DS 29

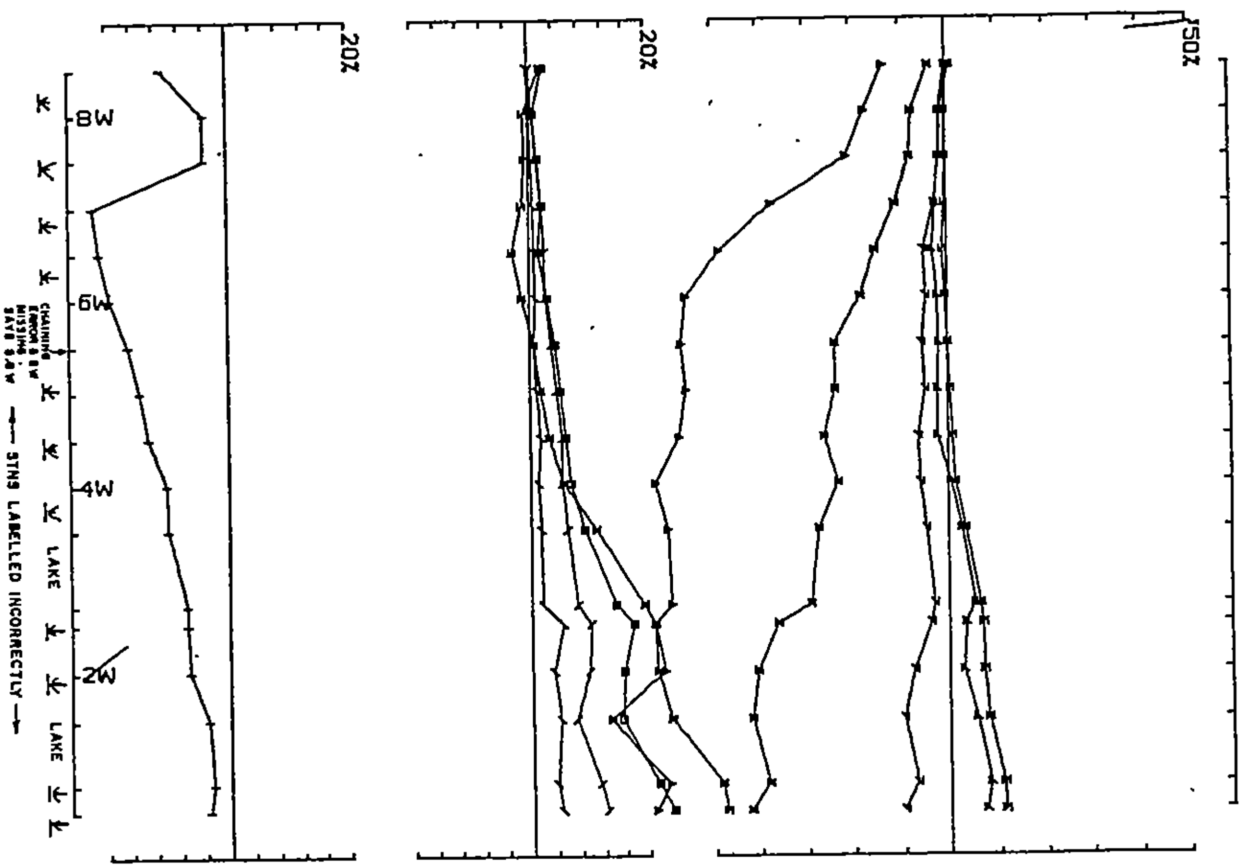


DS 30 CLAIR 81 30.50 HZ C-P)/P C-Cl)/Cl Hz 12N 405



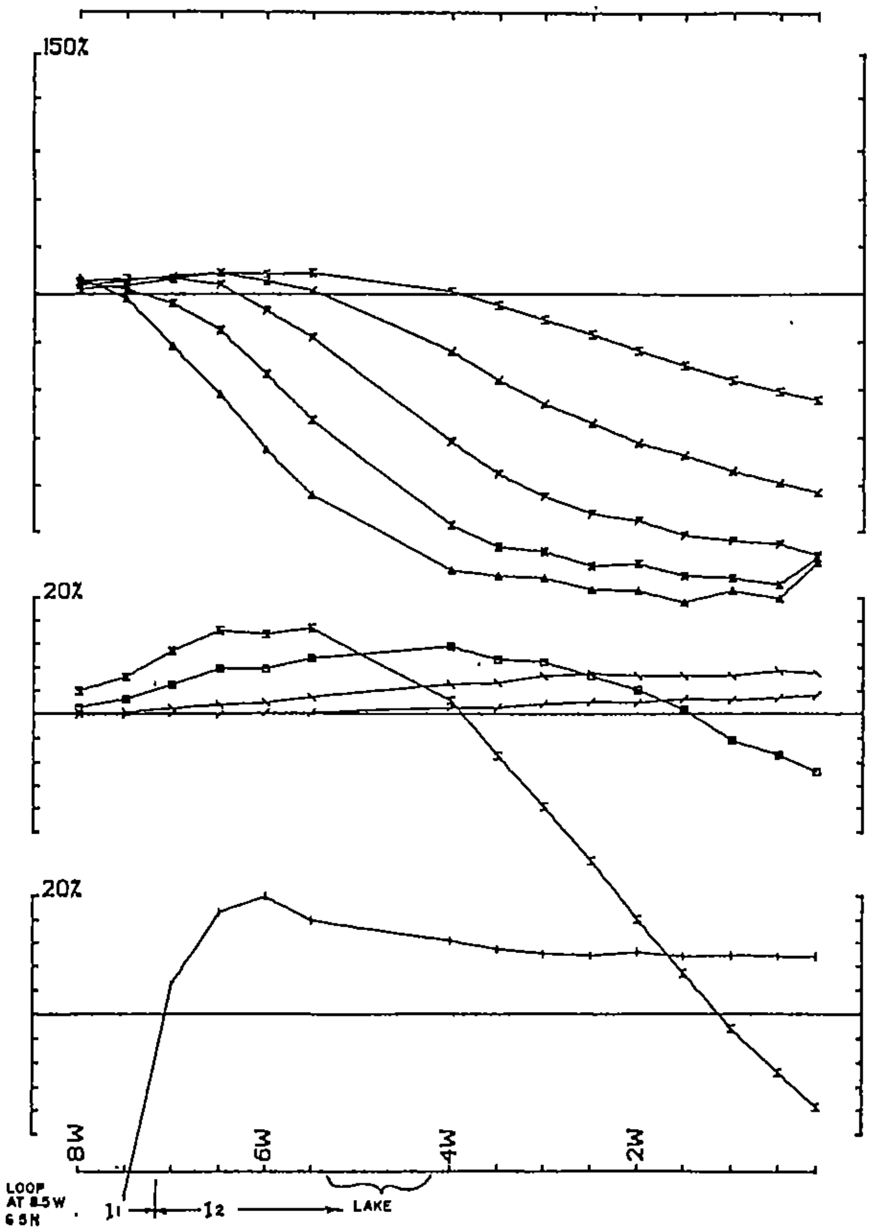
DS 31

CLAIR 81 30.50 HZ C-P)/P C-CI)/CI Hz 15N 405



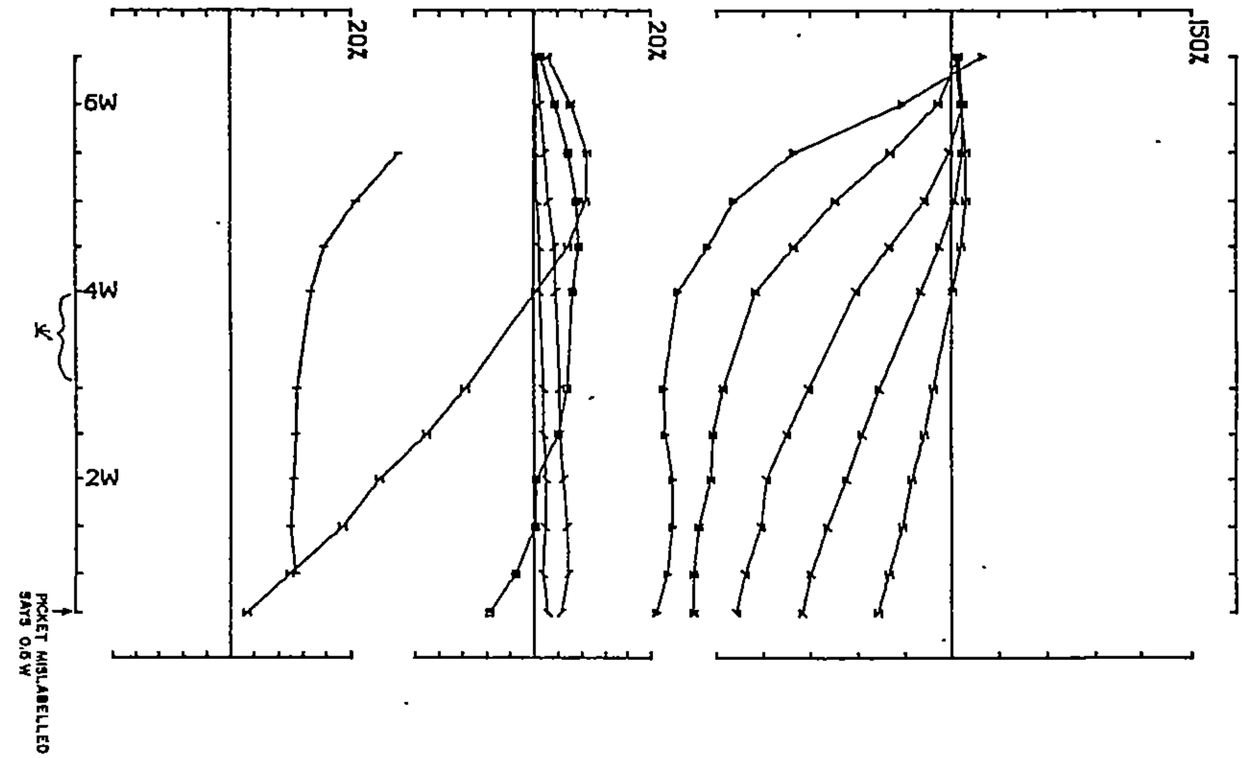
DS 32

CLAIR 81 30.50 HZ C-P)/P C-CI)/CI Hz 0 406



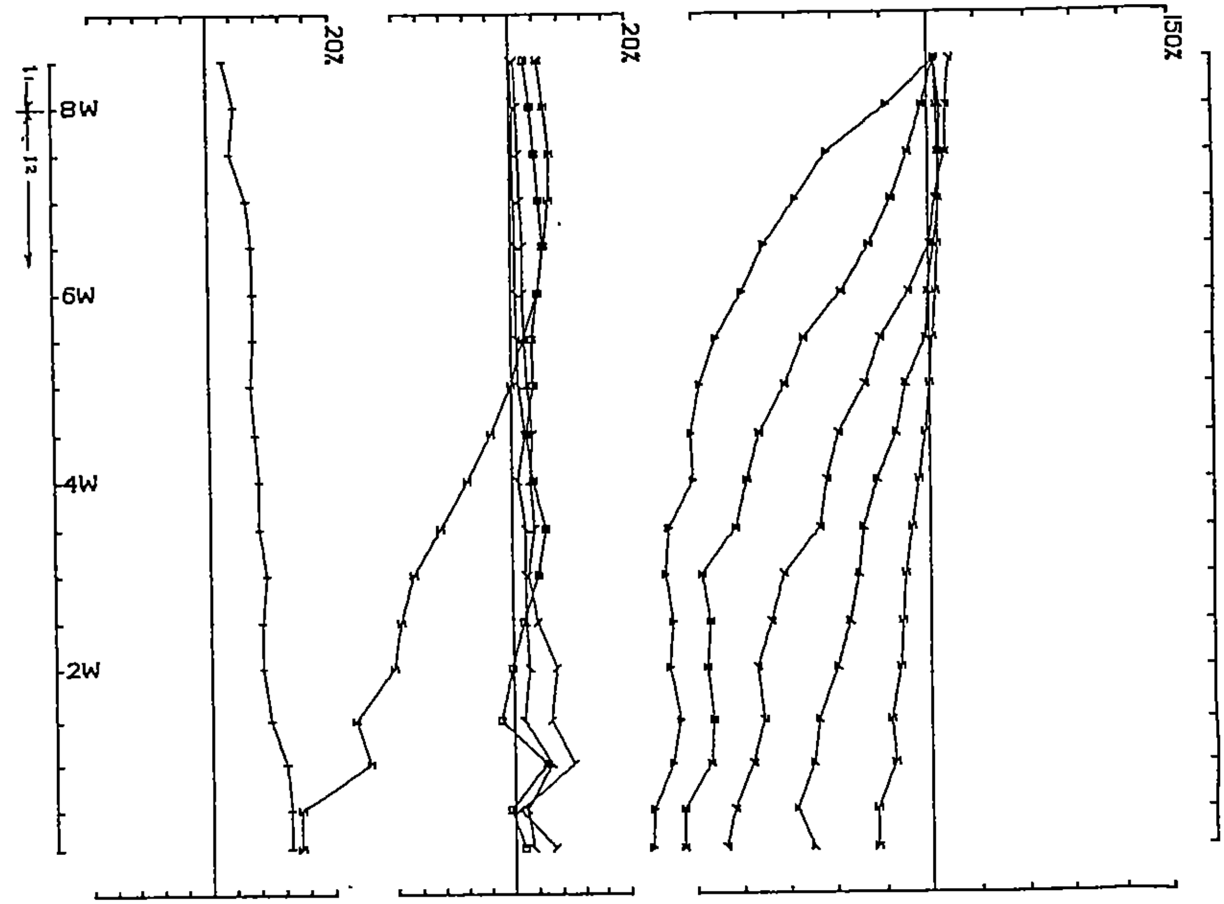
CLAIR 81 30.50 HZ C-P)/P C-CI)/CI . Hz 6N 406

DS 33



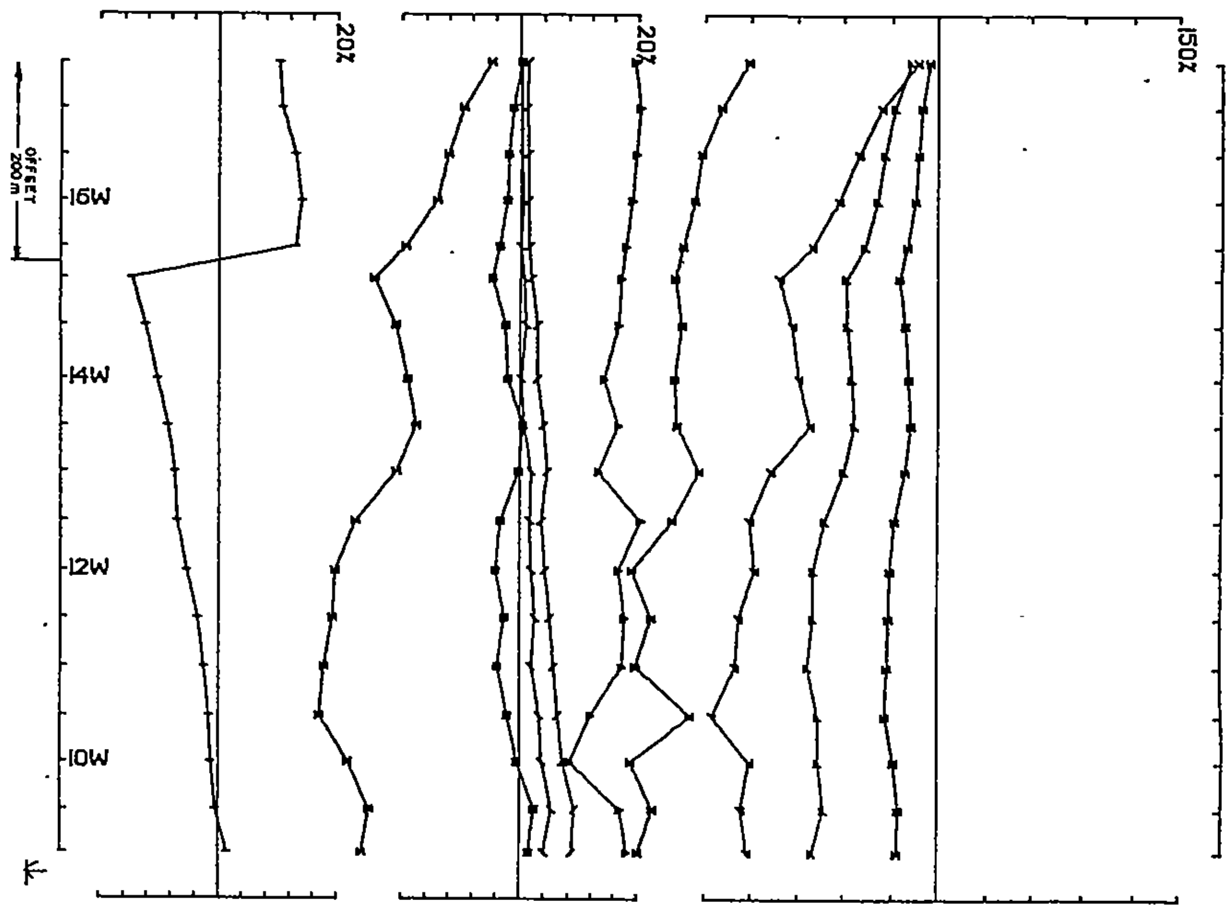
DS 34

CLAIR 81 30.50 HZ C-P)/P C-CI)/CI . Hz 9N 406



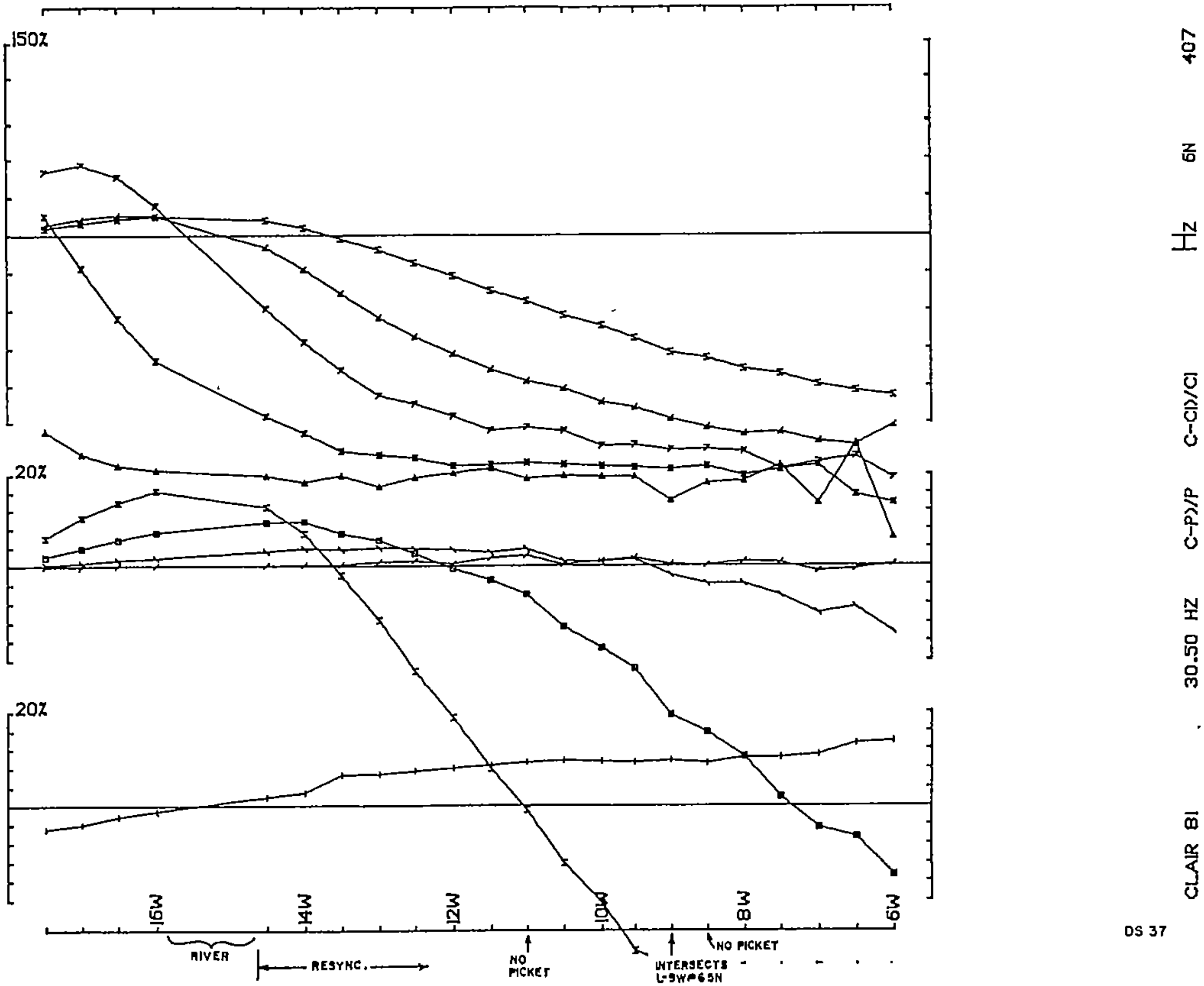
DS 35

CLAIR 81 30.50 HZ C-P)/P C-CI)/CI Hz 12N 405



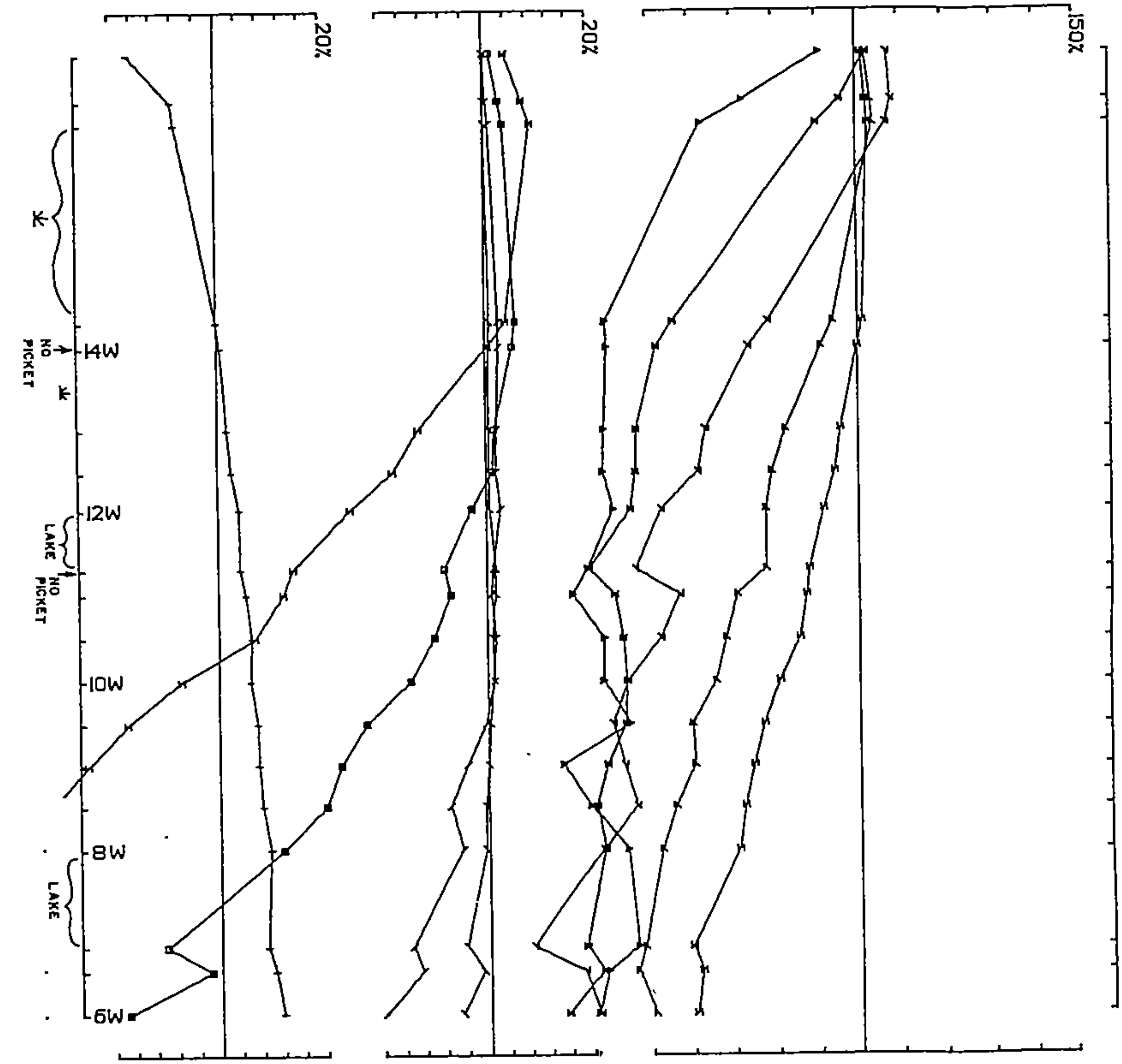
DS 36

CLAIR 81 30.50 HZ C-P)/P C-Cl)/Cl Hz 0 407



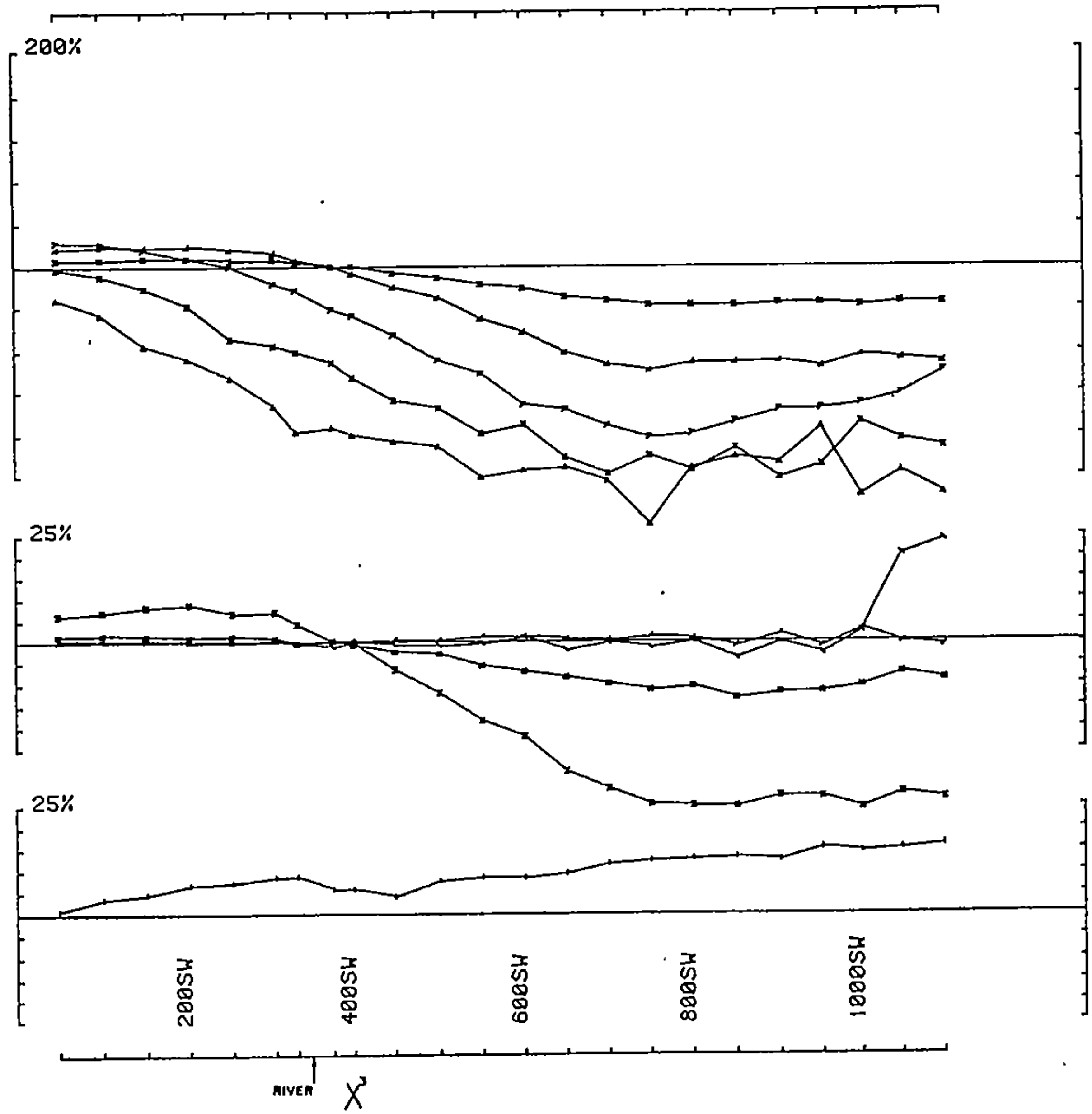
150%
20%
20%
16W
14W
12W
10W
8W
6W
RIVER
RESYNC.
NO PICKET
INTERSECTS L-9W@65N
NO PICKET
CLAIR 81
30.50 HZ
C-P)/P
C-CI)/CI
Hz
6N
407

DS 37



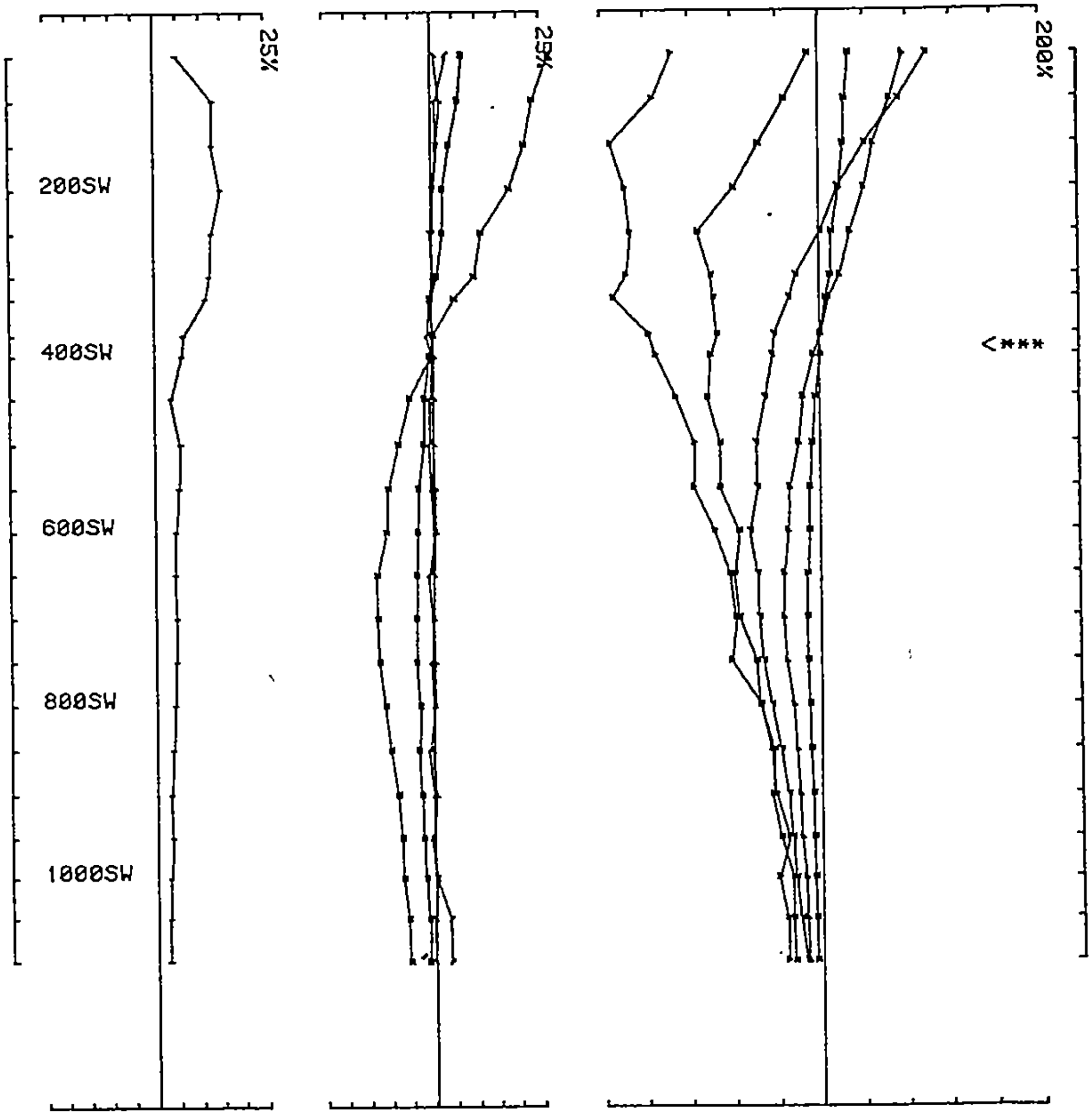
DS 38

CLAIR 81 30.50 HZ C-P)/P C-CI)/CI Hz 9N 407



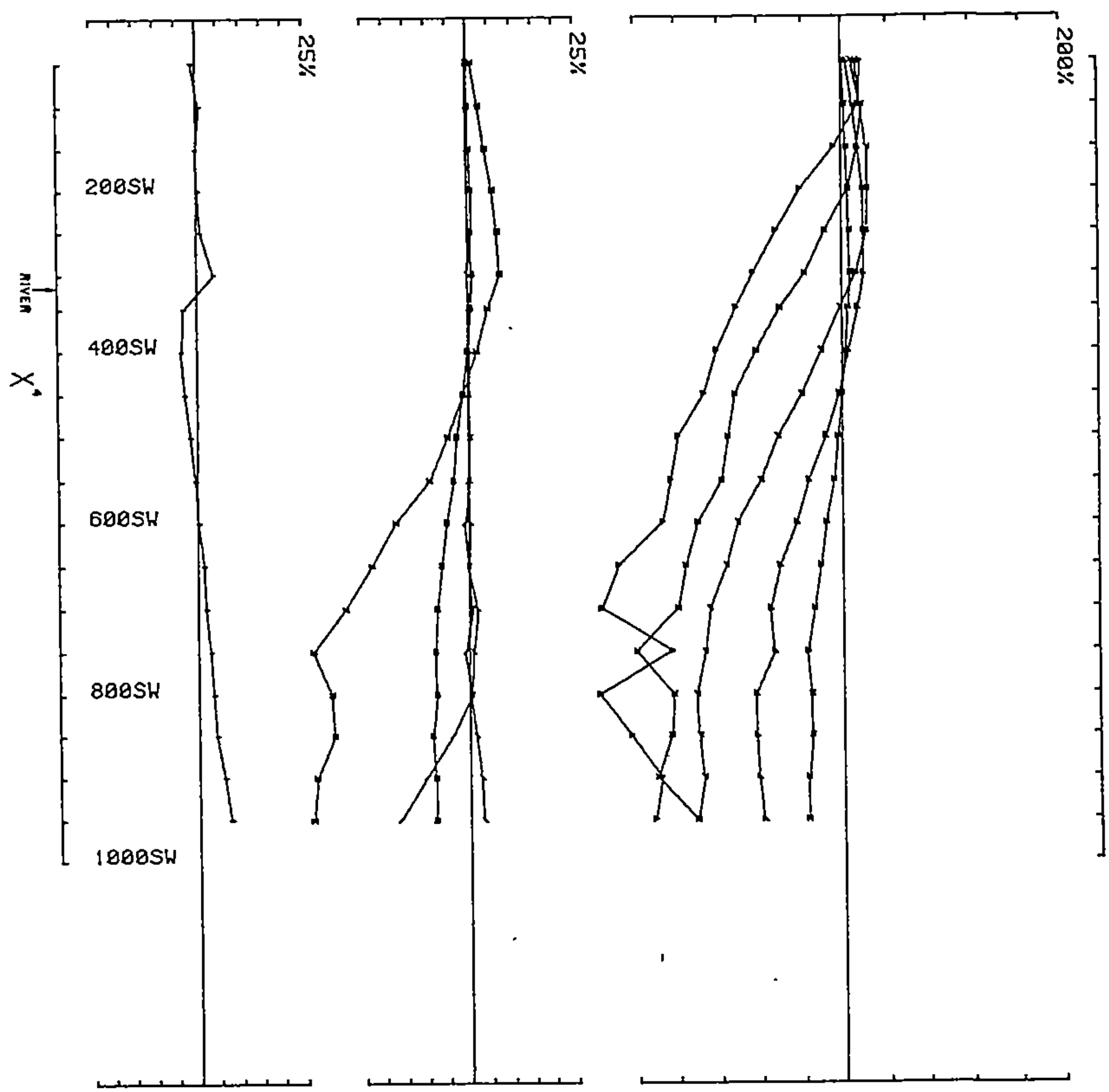
Area Clair Detail   ComInco   Job 408   freq(hz) 16.751
Loopno 0408 Line 200SE component Hz secondary   Ch 1 normalized

DS 39



Area Clair Detail   Cominco   Job 408   freq(hz) 16.751
Loopno 0408   Line 200SE component   Hz   secondary   Ch I normalized .

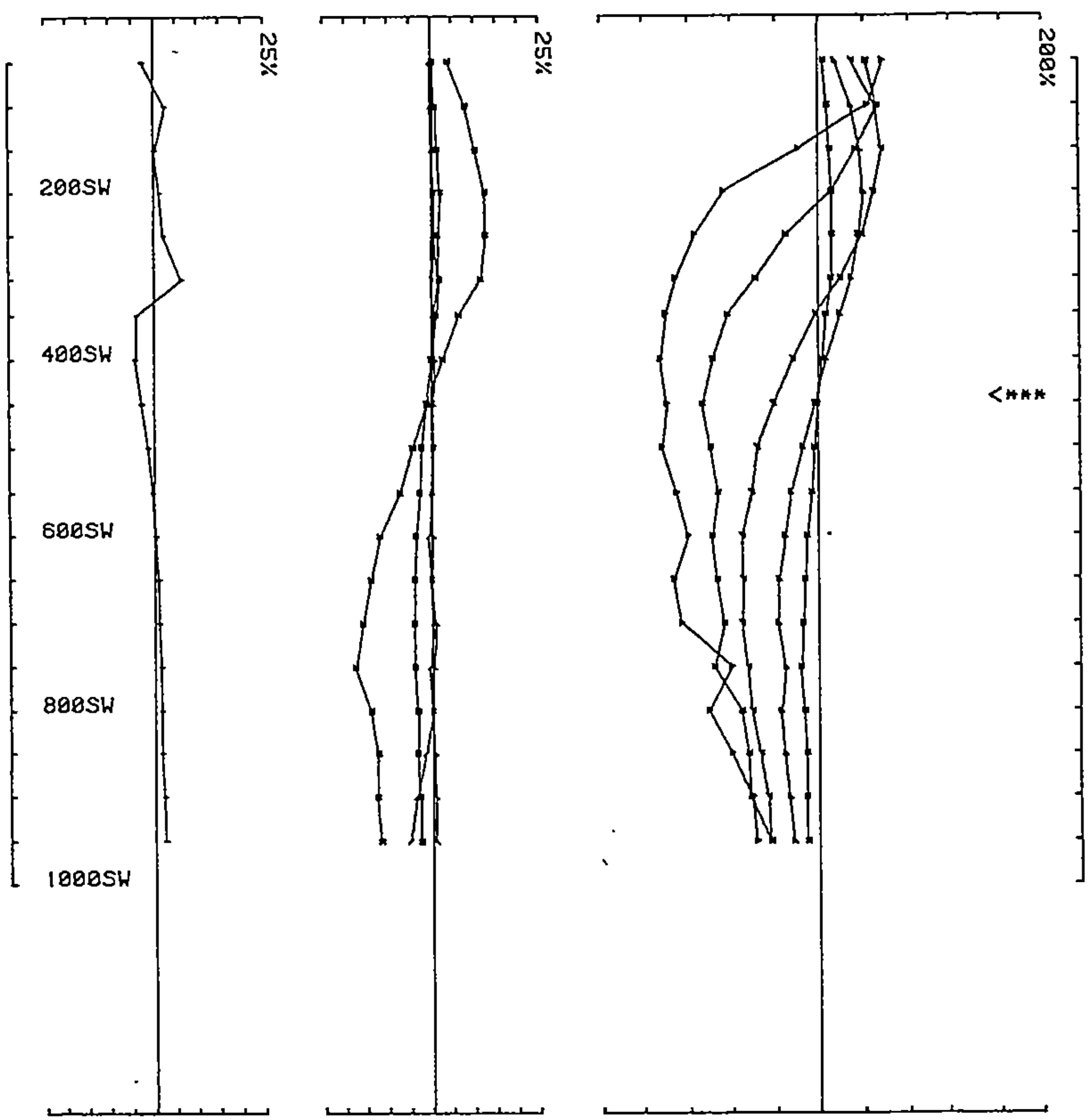
DS 39a



Area Clair Detail Cominco Job 408 freq(hz) 16.751

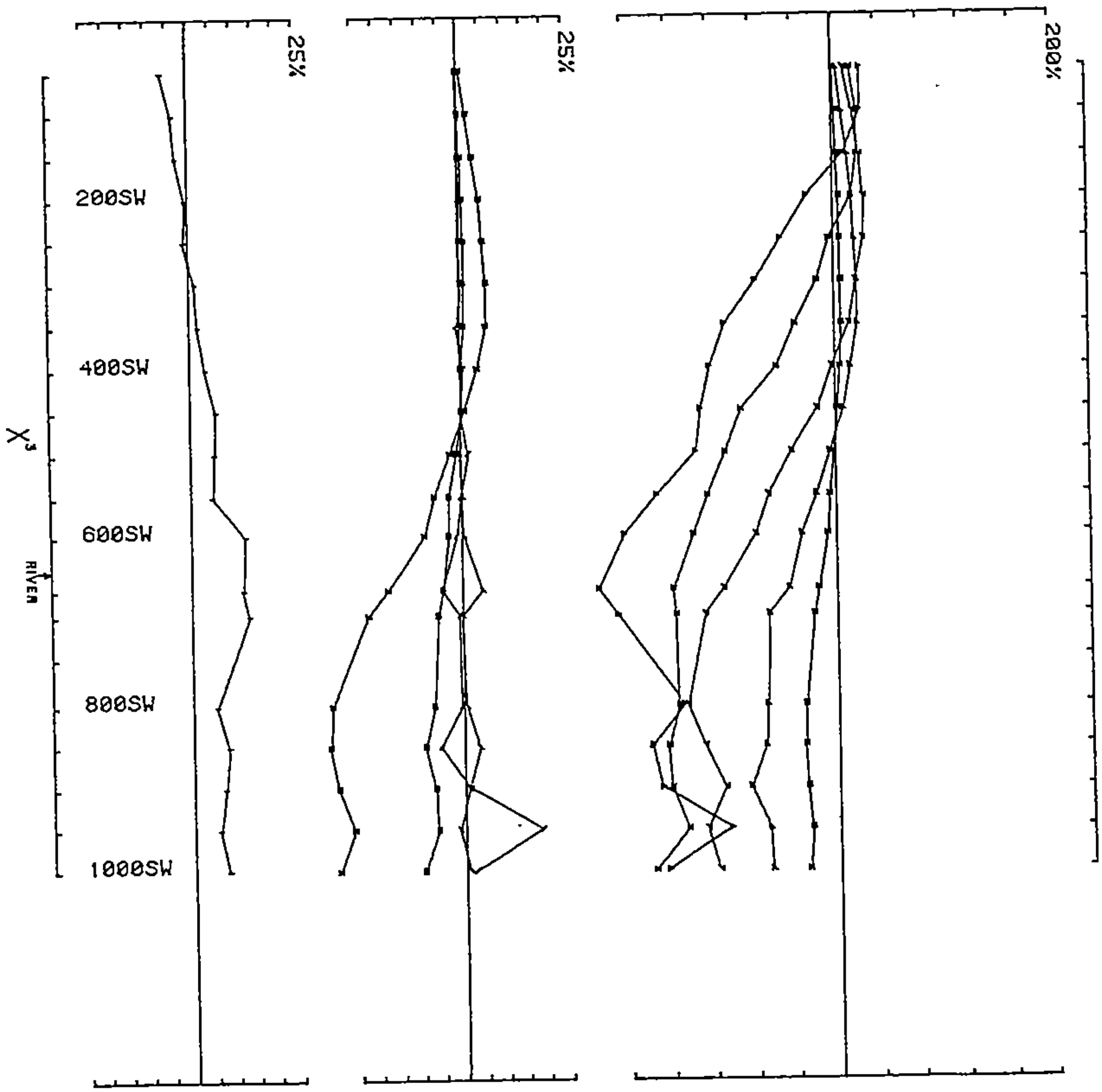
Loopno 0408 Line 0NW component Hz secondary Ch 1 normalized

DS 40



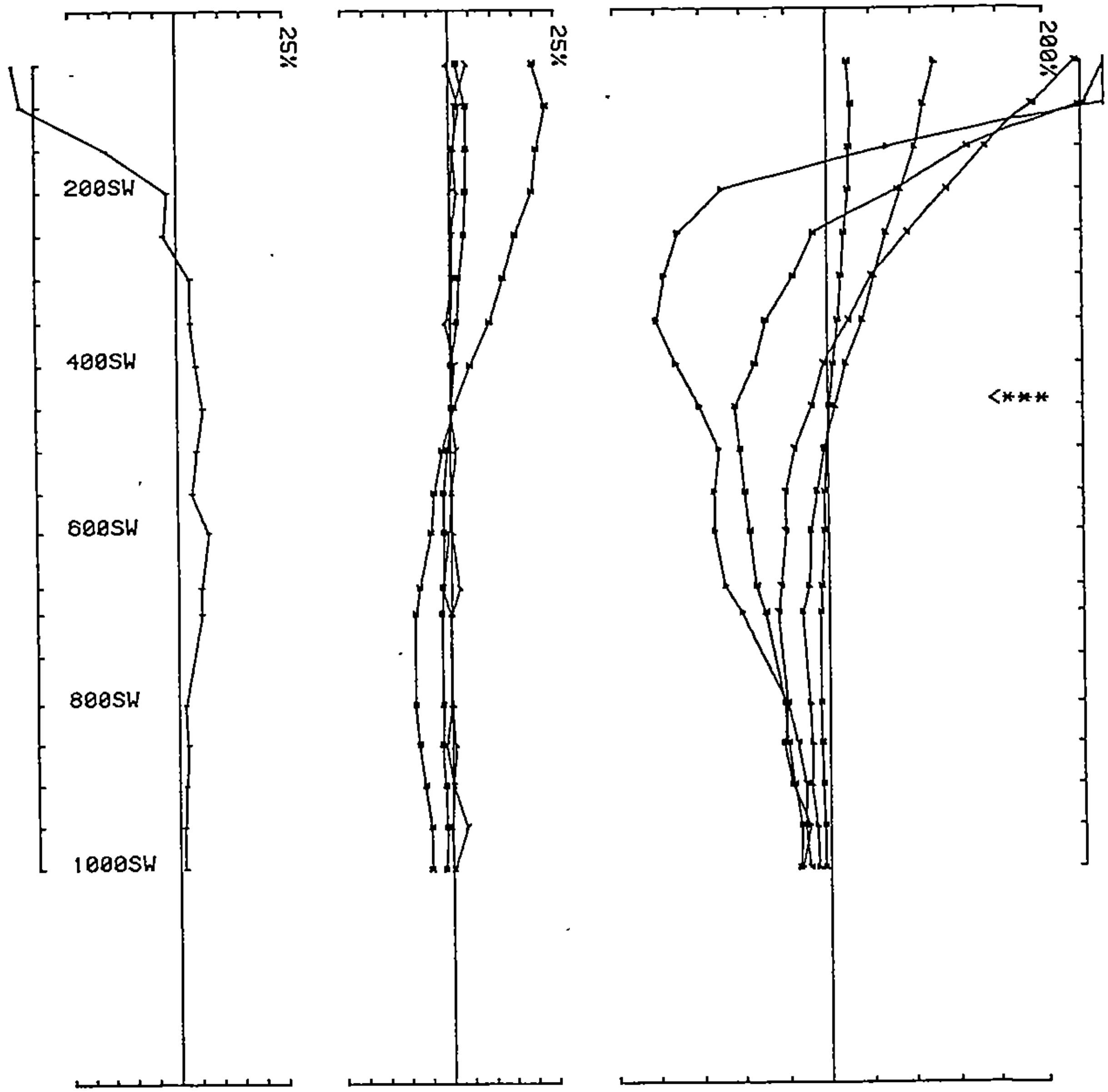
Area Clair Detail Cominco Job 408 freq(hz) 16.751
Loopno 0408 Line 0NW component Hz secondary Ch 1 normalized

DS 40a



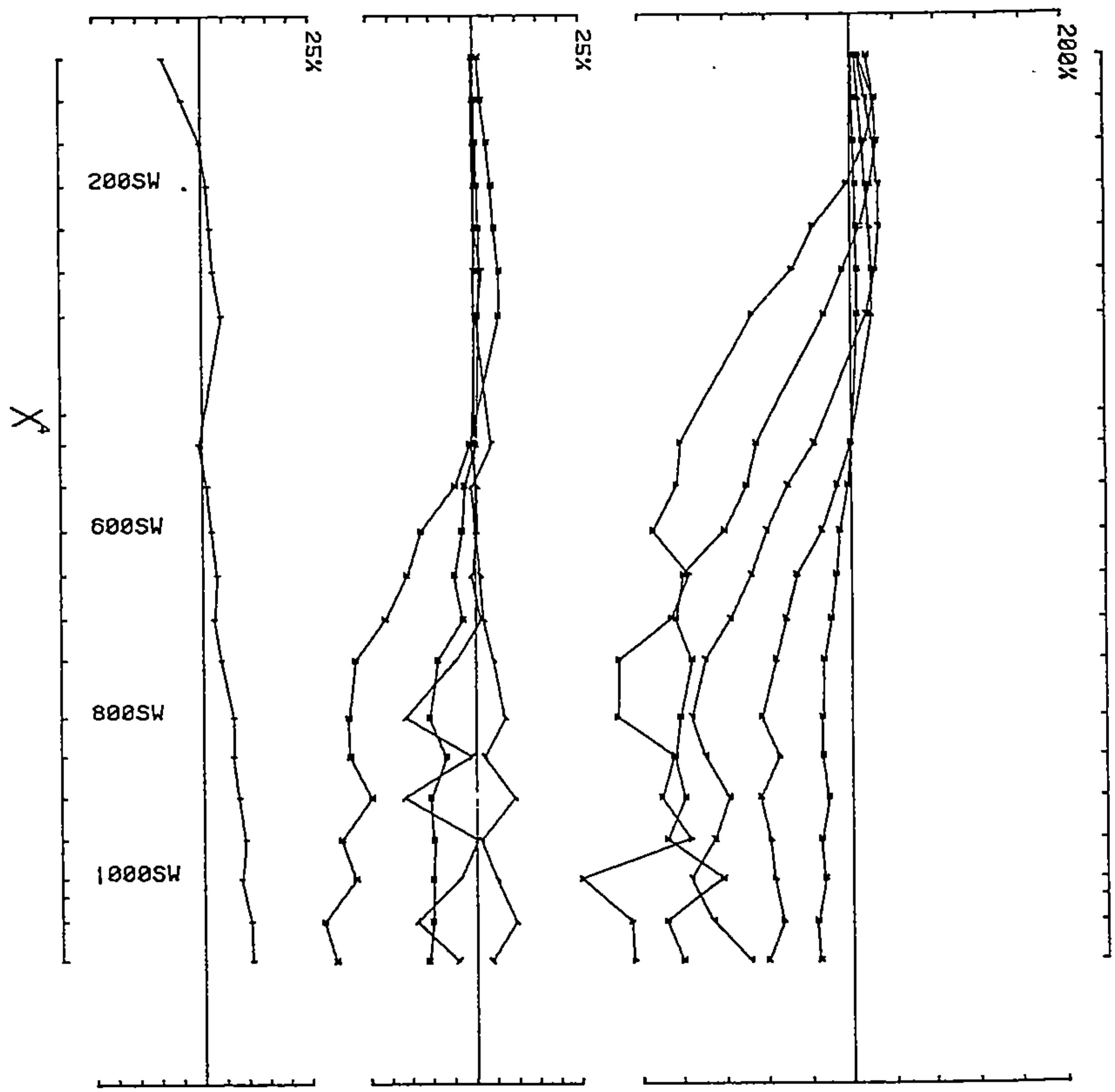
Area Clair Detail Cominco Job 408 freq(hz) 16.751
Loopno 0408 Line 200NW component Hz secondary Ch I normalized

DS 41



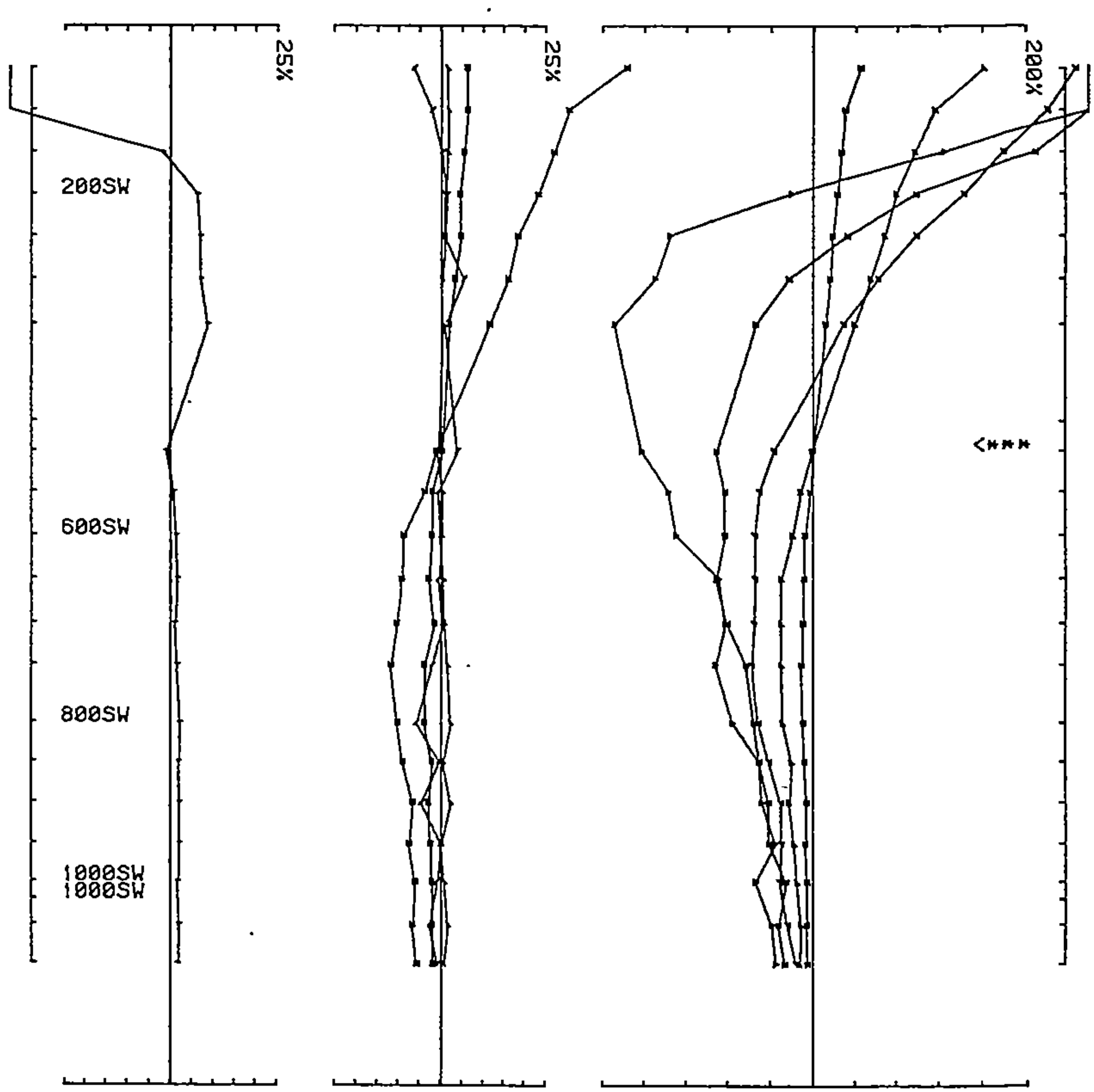
Area Clair Detail   Cominco   Job 408   freq(hz) 16.751
Loopno 0408   Line 200NW component Hz secondary   Ch 1

DS 41a



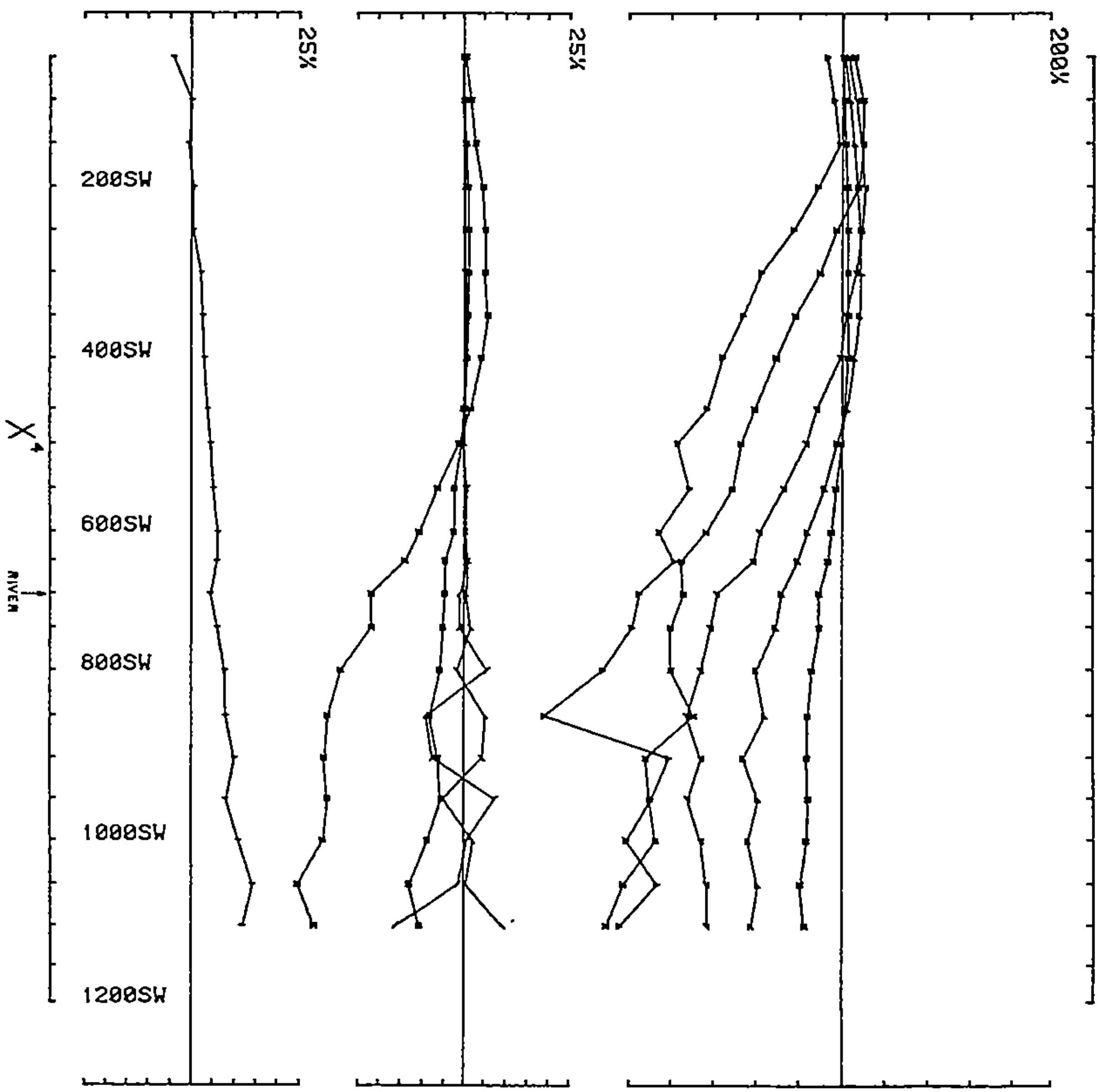
Area Clair Detail Cominco Job 408 freq(hz) 16.751
Loopno 0408 Line 400NW component Hz secondary Ch 1 normalized .

DS 42



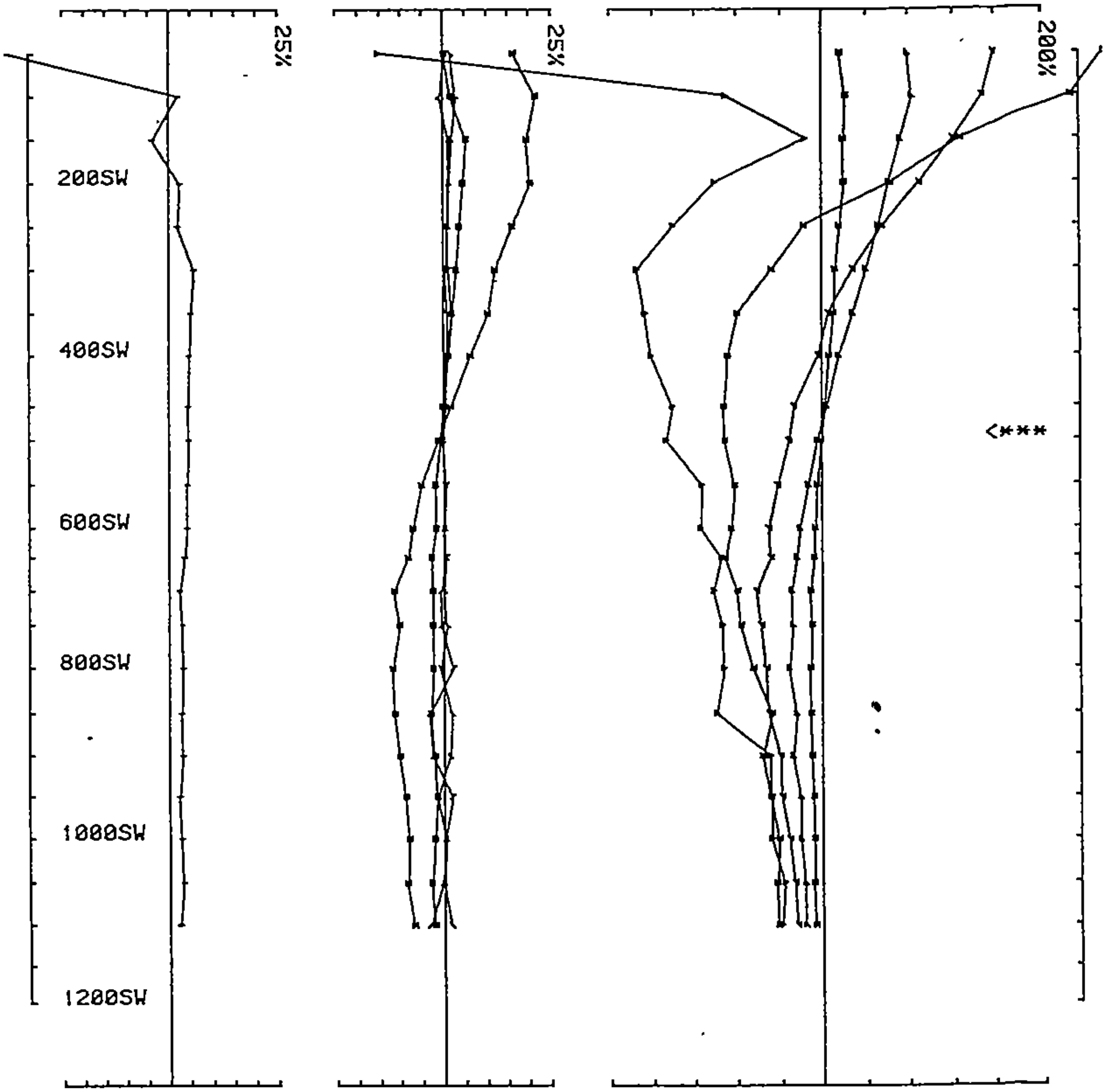
DS 42a

Area Clair Detail   Cominco   Job 408   freq(hz) 16.751
Loopno 0408   Line 400NW component   Hz   secondary   Ch 1 normalized



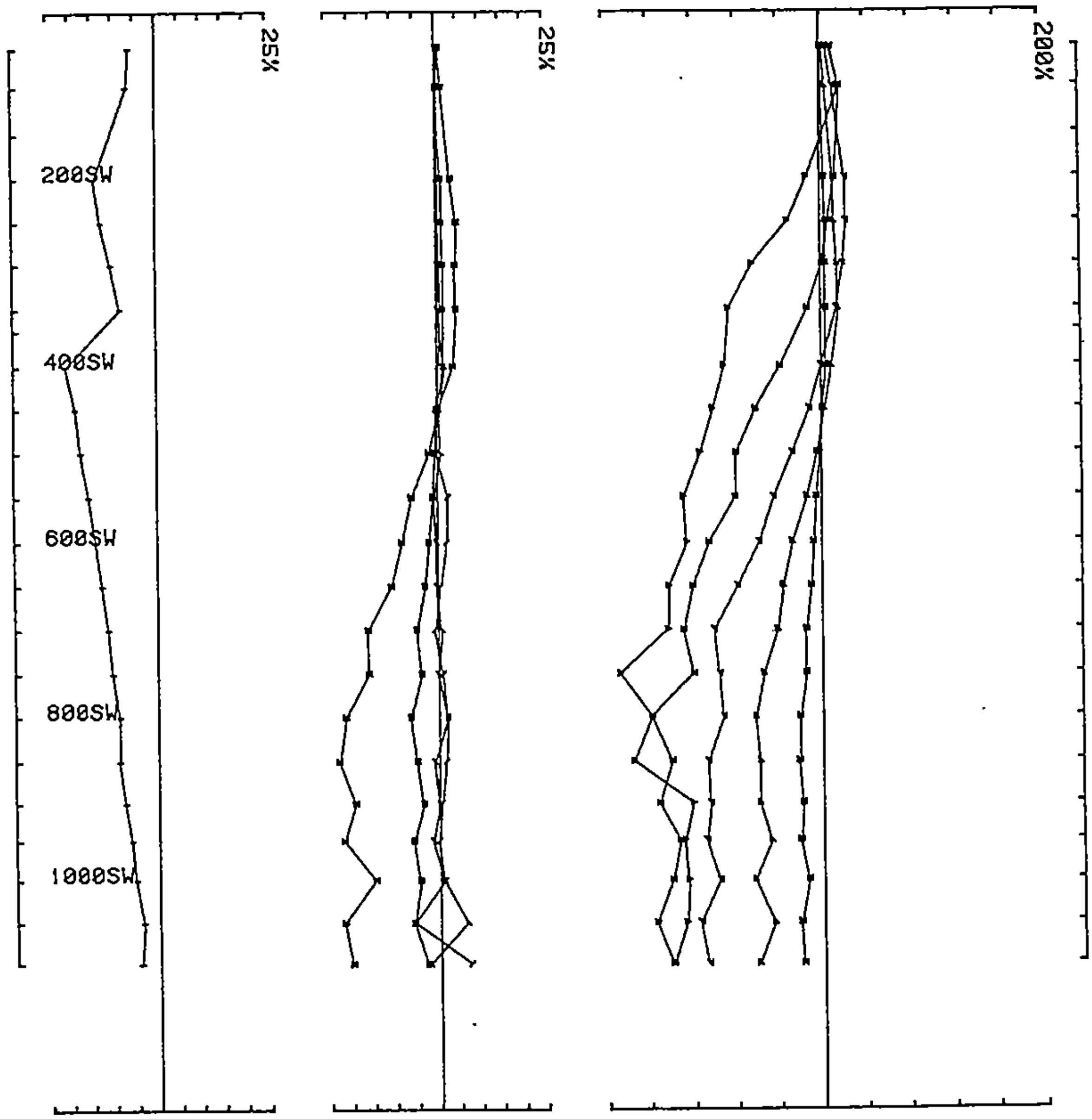
Area Clair Detail   Cominco   Job 408   freq(hz) 18.751
Loopno 0408   Line 600NW component   Hz

DS 43



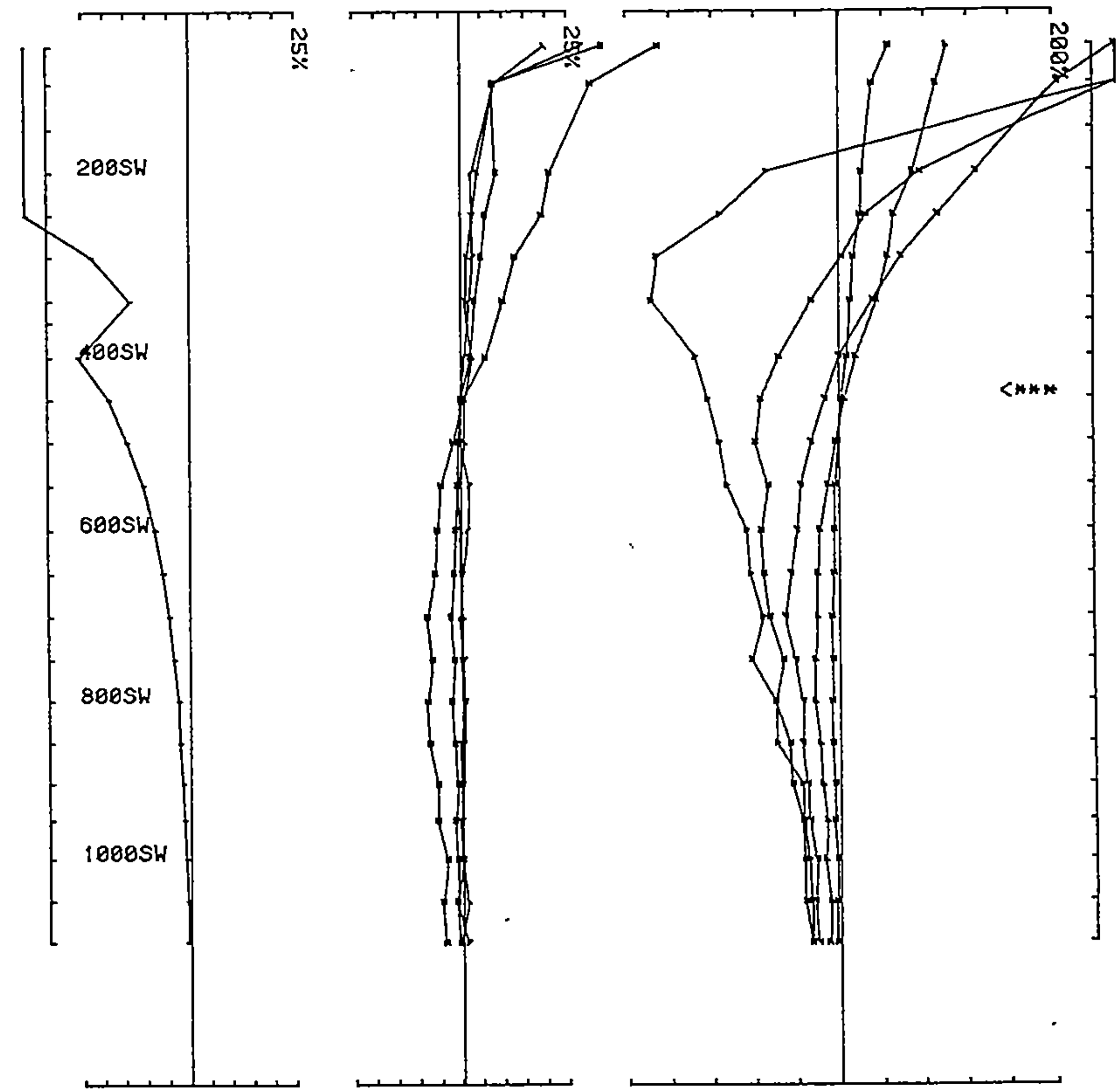
Area Clair Detail   Cominco   Job 408   freq(hz) 16.751
Loopno 0408 Line 600NW component Hz secondary   Ch 1

DS 43a



Area Clair Detail Cominco Job 409 freq(hz) 16.751
Loopno 0409 Line 800NW component Hz secondary Ch I normalized

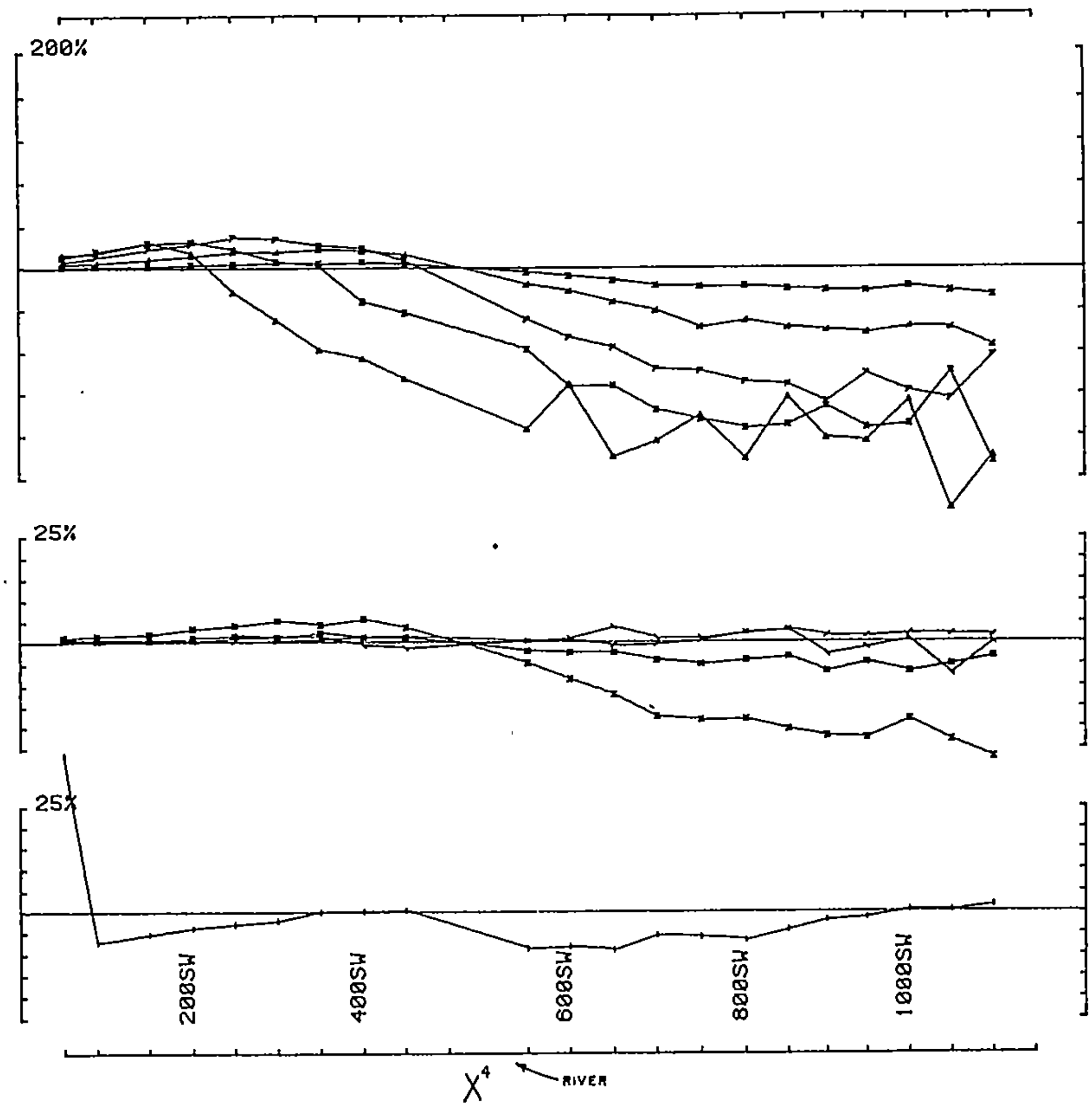
DS 44



DS 44a

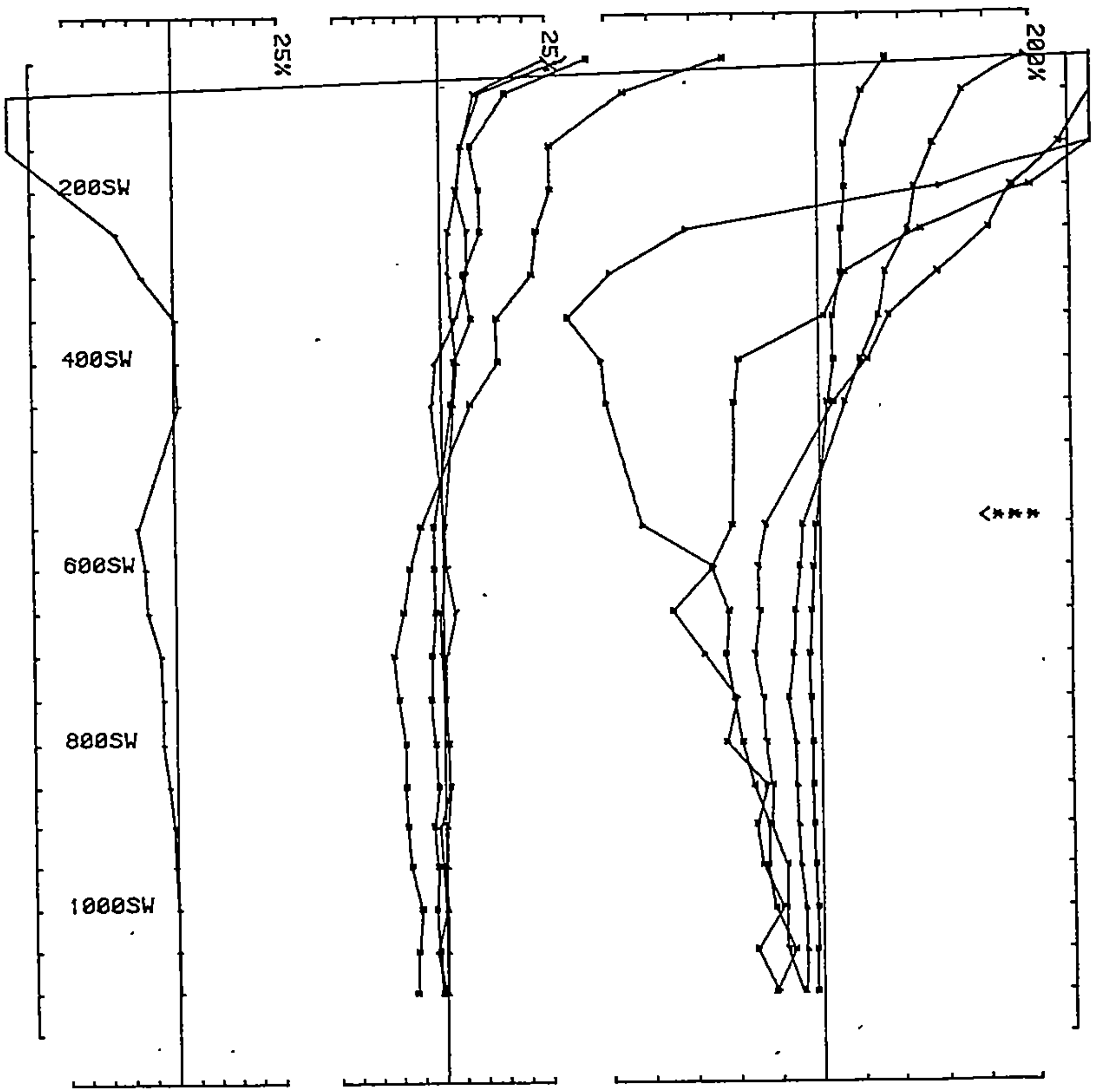
Area Clair Detail   Cominco   Job 409 freq(hz) 16.751

Loopne 0409 Line 800NW component Hz secondary   Ch 1 normalized



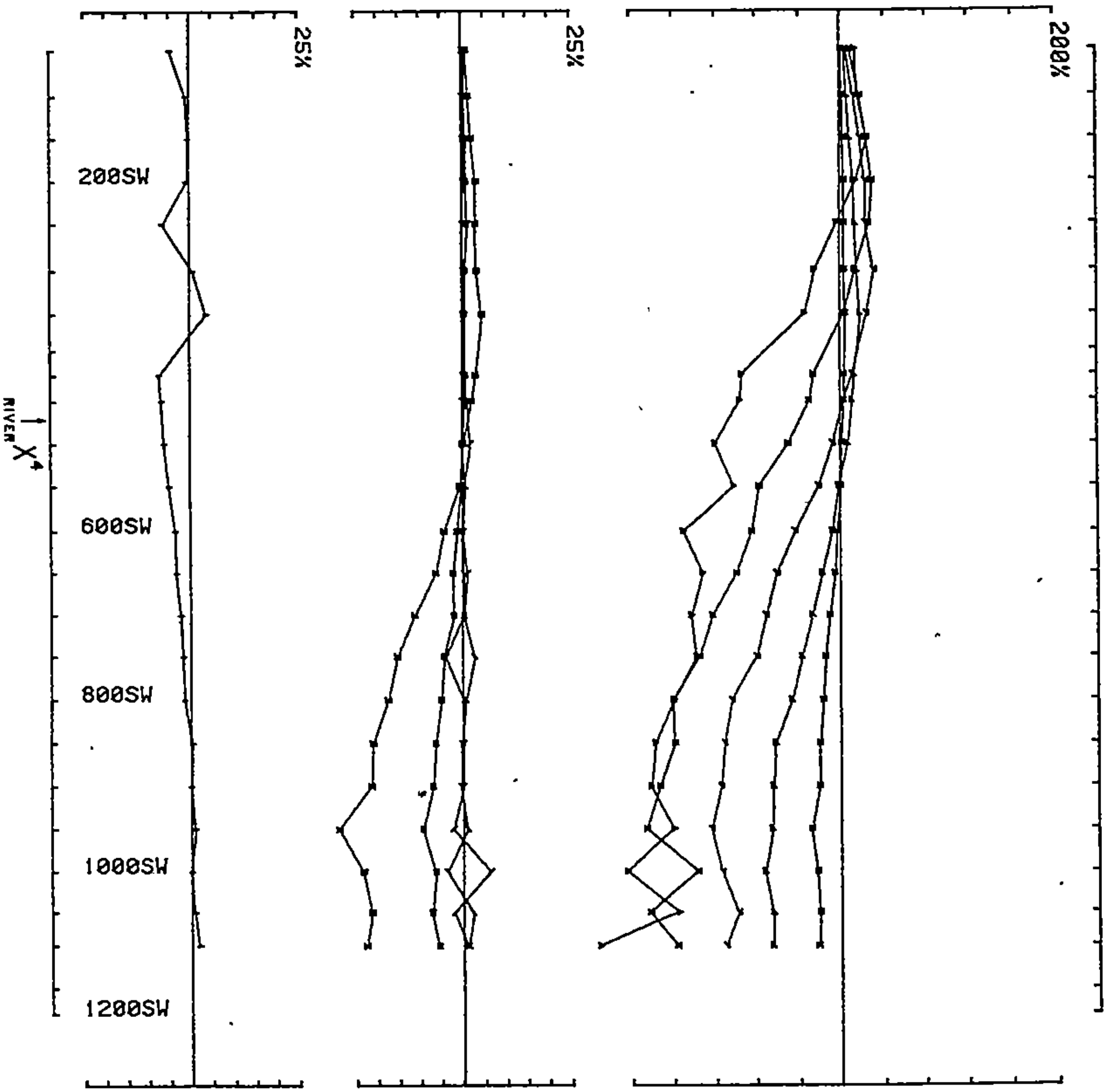
Area Clair Detail Cominco Job 409 freq(hz) 16.751
Loopno 0409 Line 1000NW component Hz secondary Ch 1 normalized

DS 45



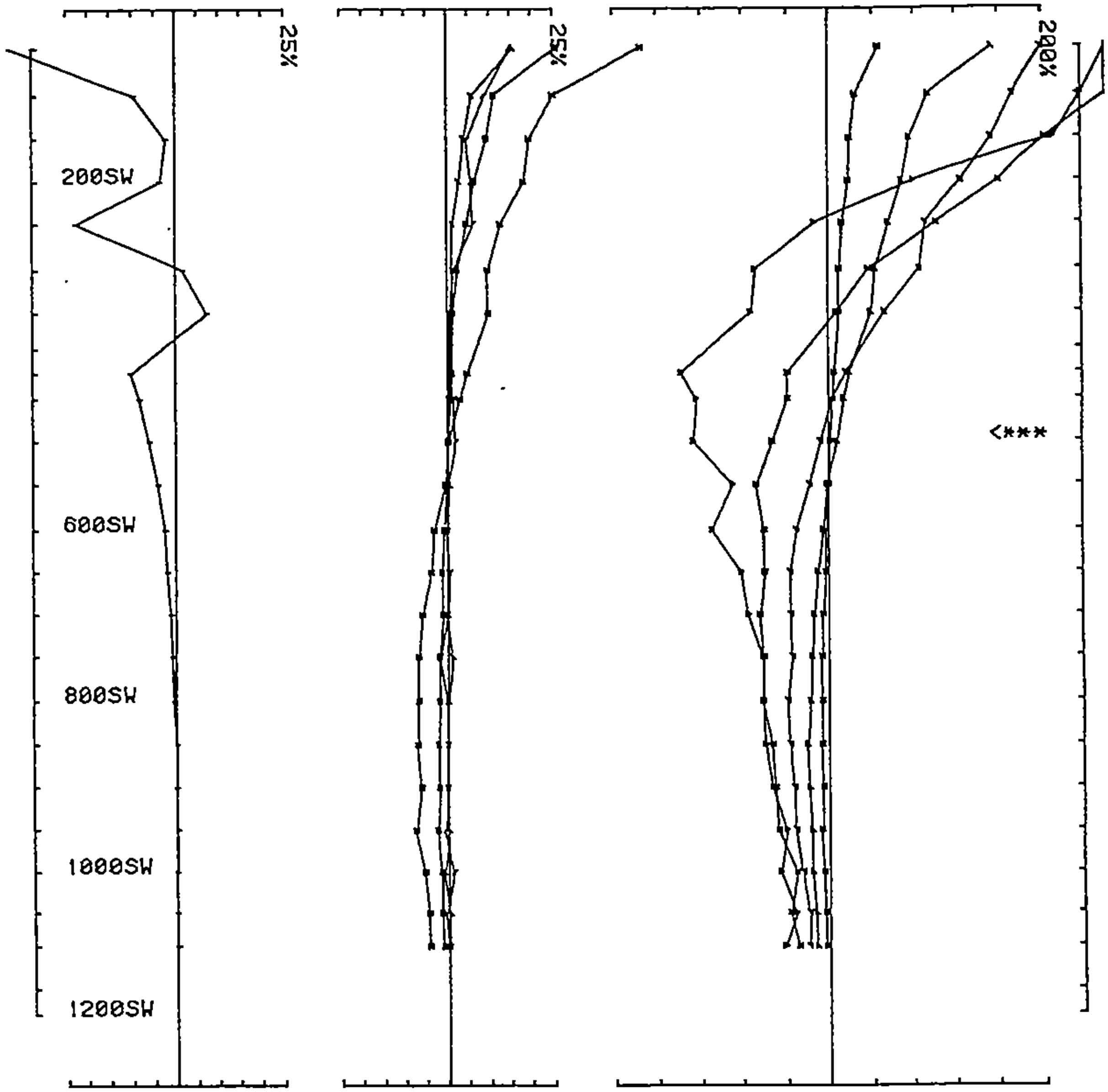
Area Clair Detail Cominco Job 409 freq(hz) 16.751
Loopno 0409 Line 1000NW component Hz secondary Ch 1 normalized

DS 45a



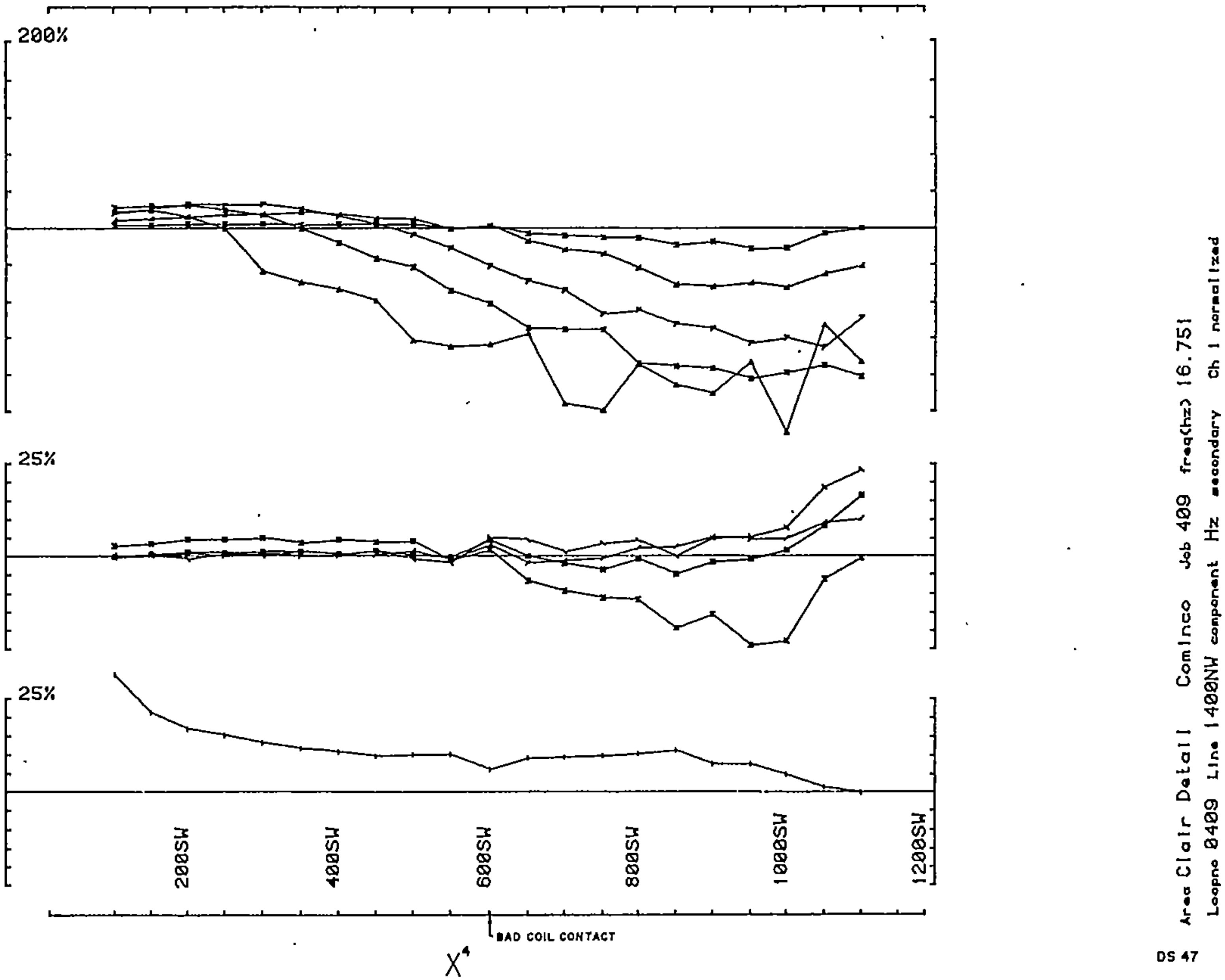
Area Clair Detail Cominco Job 409 freq(hz) 16.751
Loopno 0409 Line 1200NW component Hz secondary Ch 1 normalized

DS 46

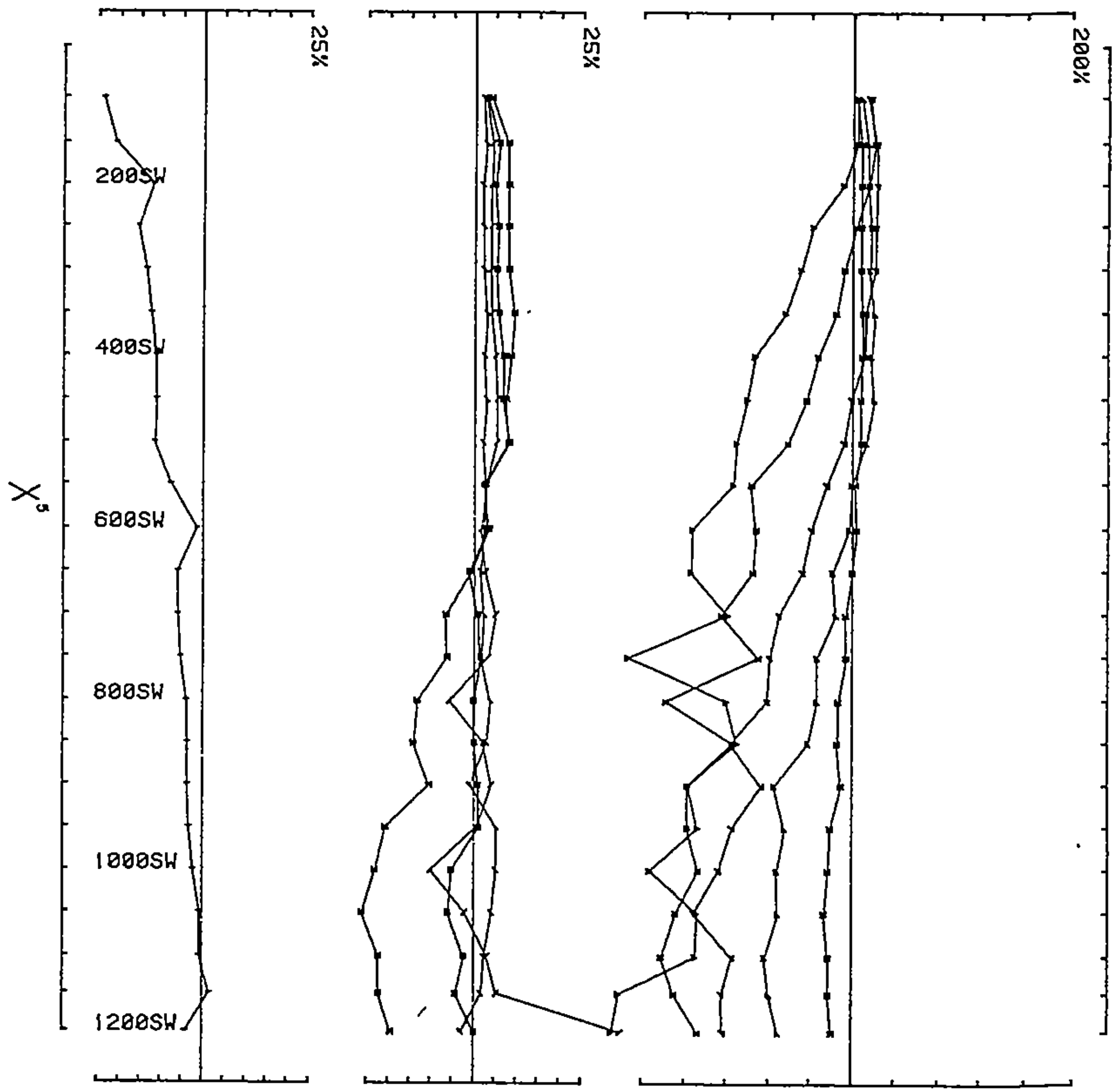


Area Clair Detail Cominco Job 409 freq(hz) 16.751
Loopno 0409 Line 1200NW component Hz secondary Ch 1 normalized

DS 46a

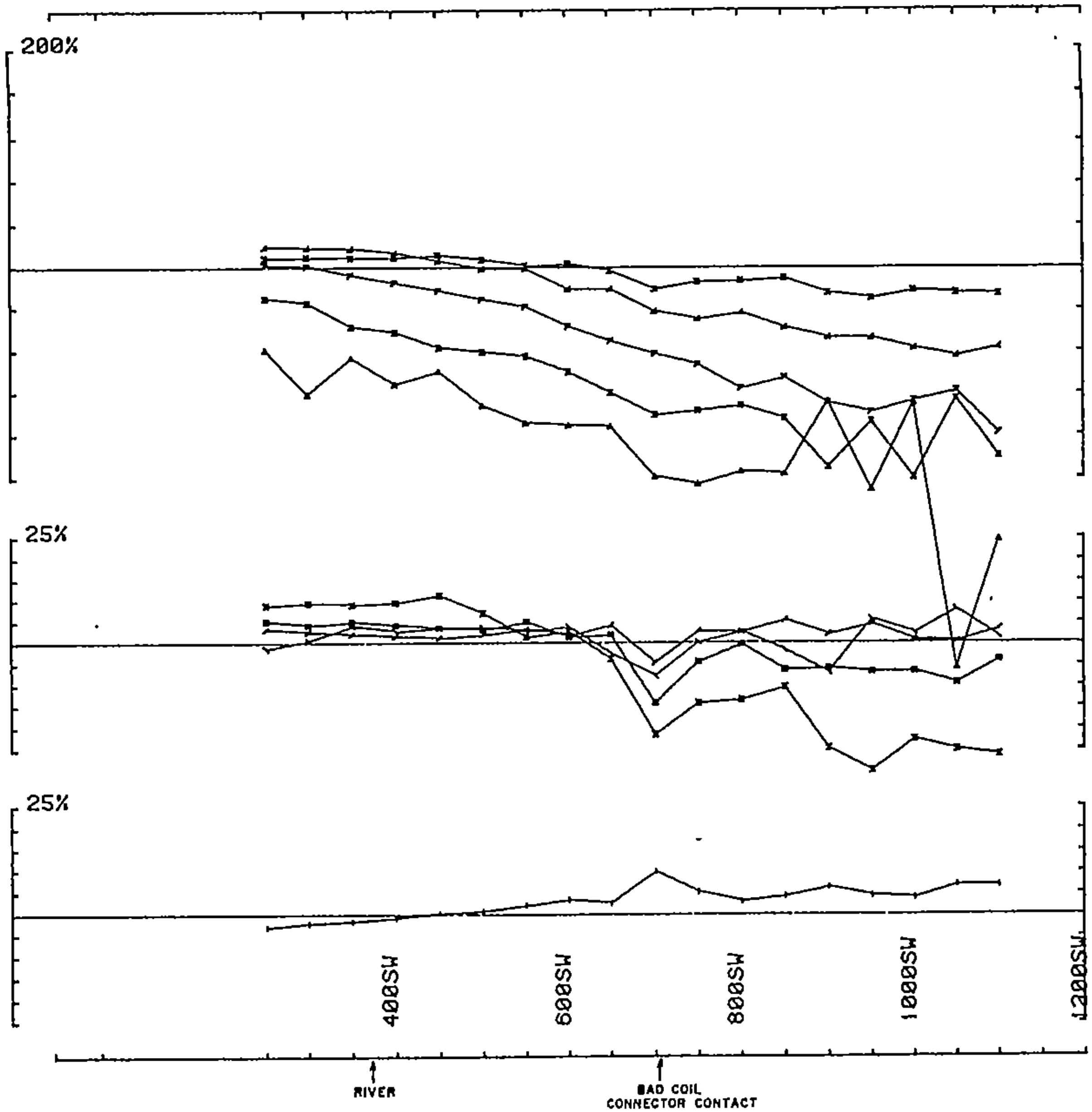

200%
25%
25%
200SW
400SW
600SW
800SW
1000SW
1200SW
BAD COIL CONTACT
X4
Area Clair Detail Cominco Job 409 freq(hz) 16.751
Loopno 0409 Line 1400NW component Hz secondary Ch 1 normalized

DS 47



OS 48

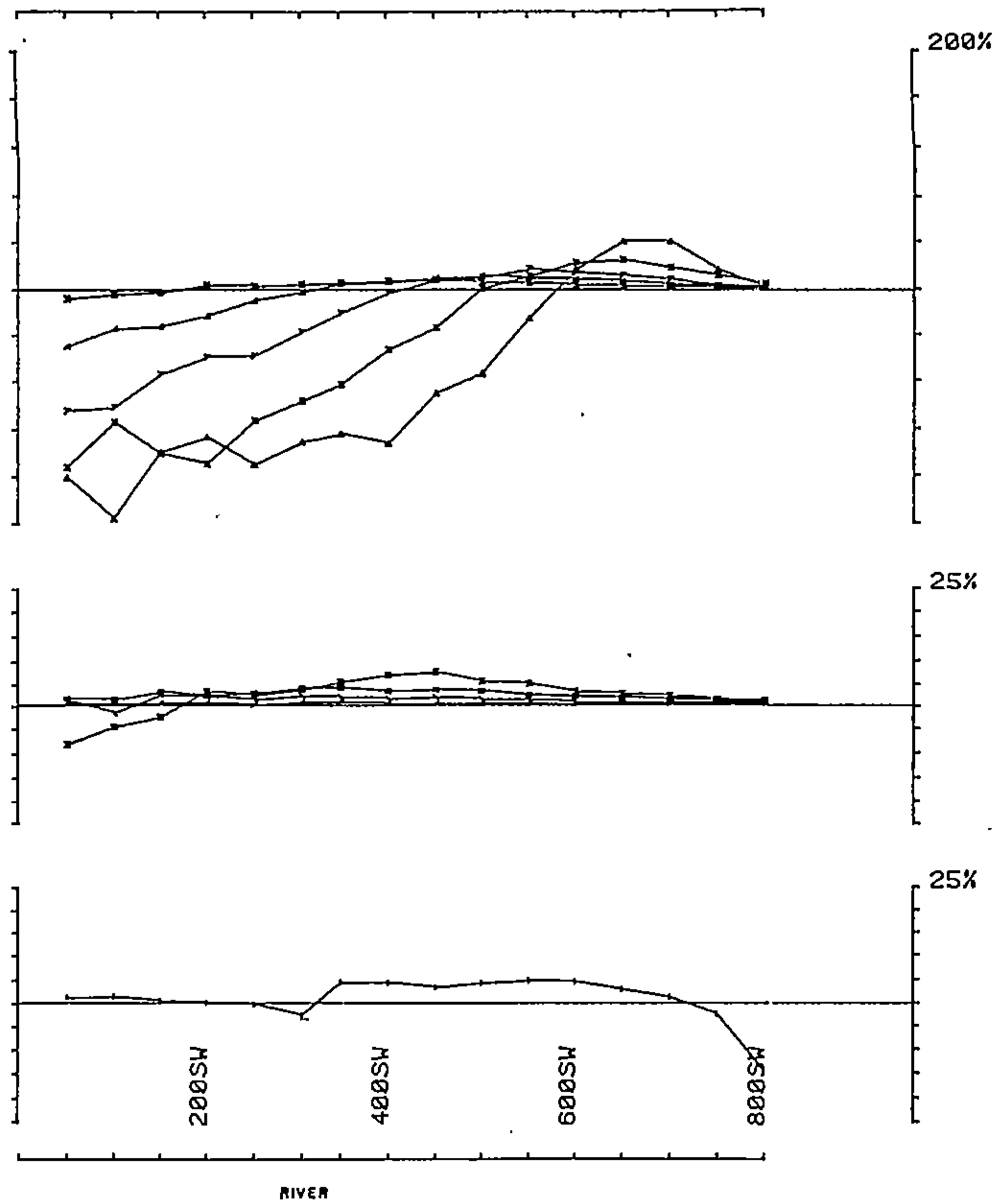
Area Clair Detail Cominco Job 409 freq(hz) 16.751
Loopno 0409 Line 1600NW component Hz secondary Ch 1 normalized



Area Clair Detail   Cominco   Job 409   freq(hz) 16.751

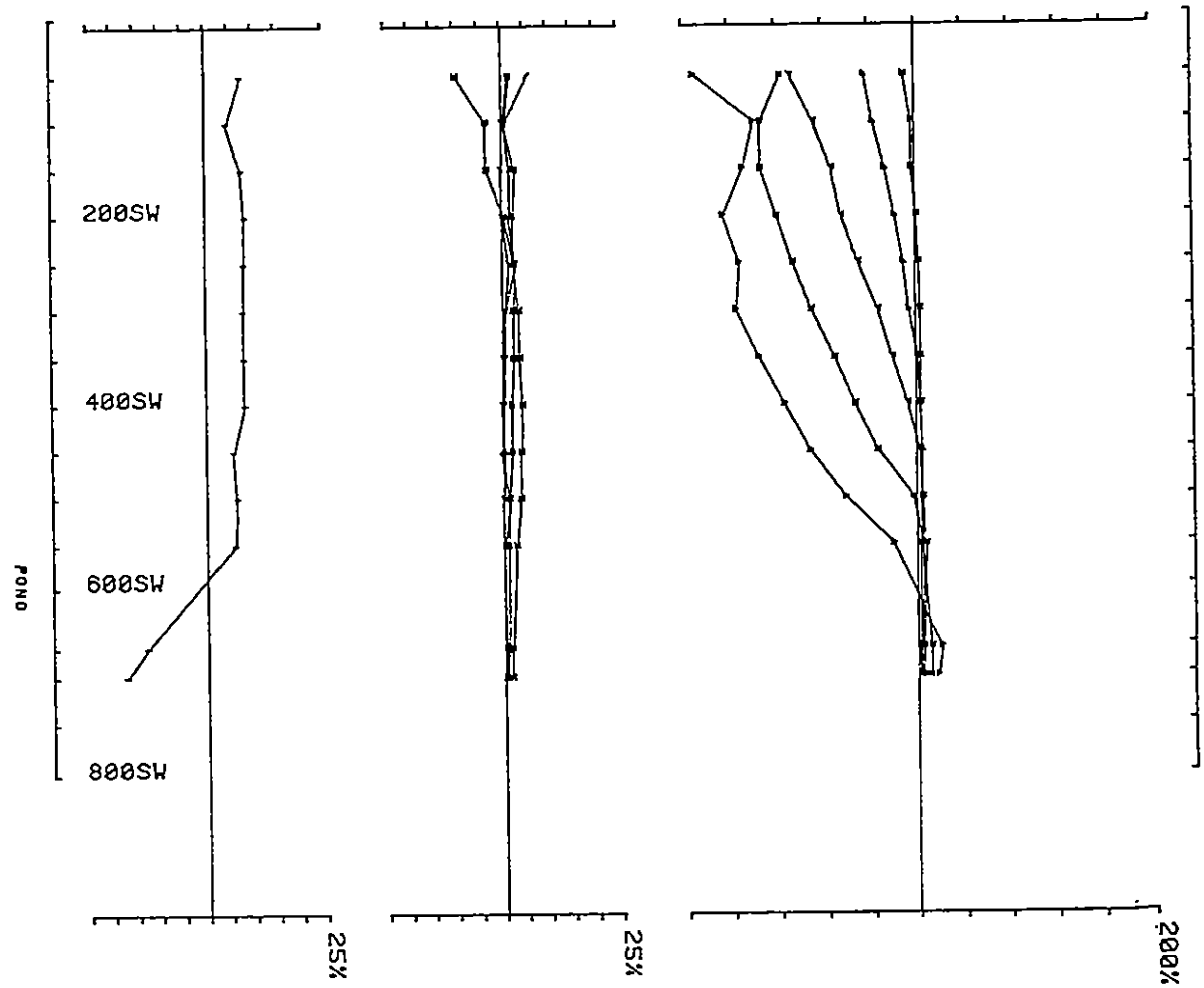
Loopno 0409 Line 1800NW component Hz secondary Ch 1 normalized

DS 49



Area Clair Cominco Job 410 freq(hz) 18.583
Leapno 0410 Line 0SE component Hz secondary Ch 1 normalized

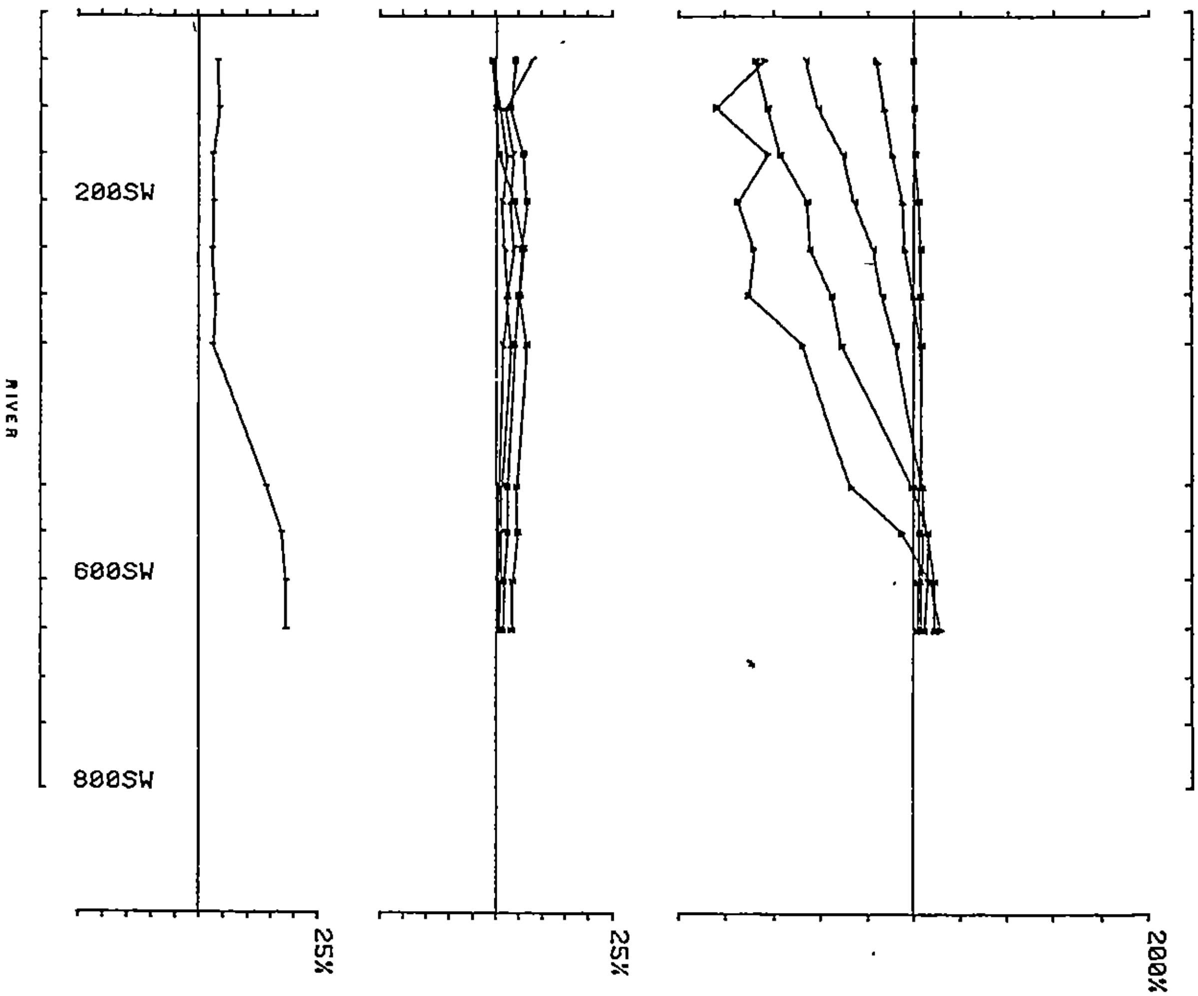
DS 50



Area Clair Cominco Job 410 freq(hz) 18.583

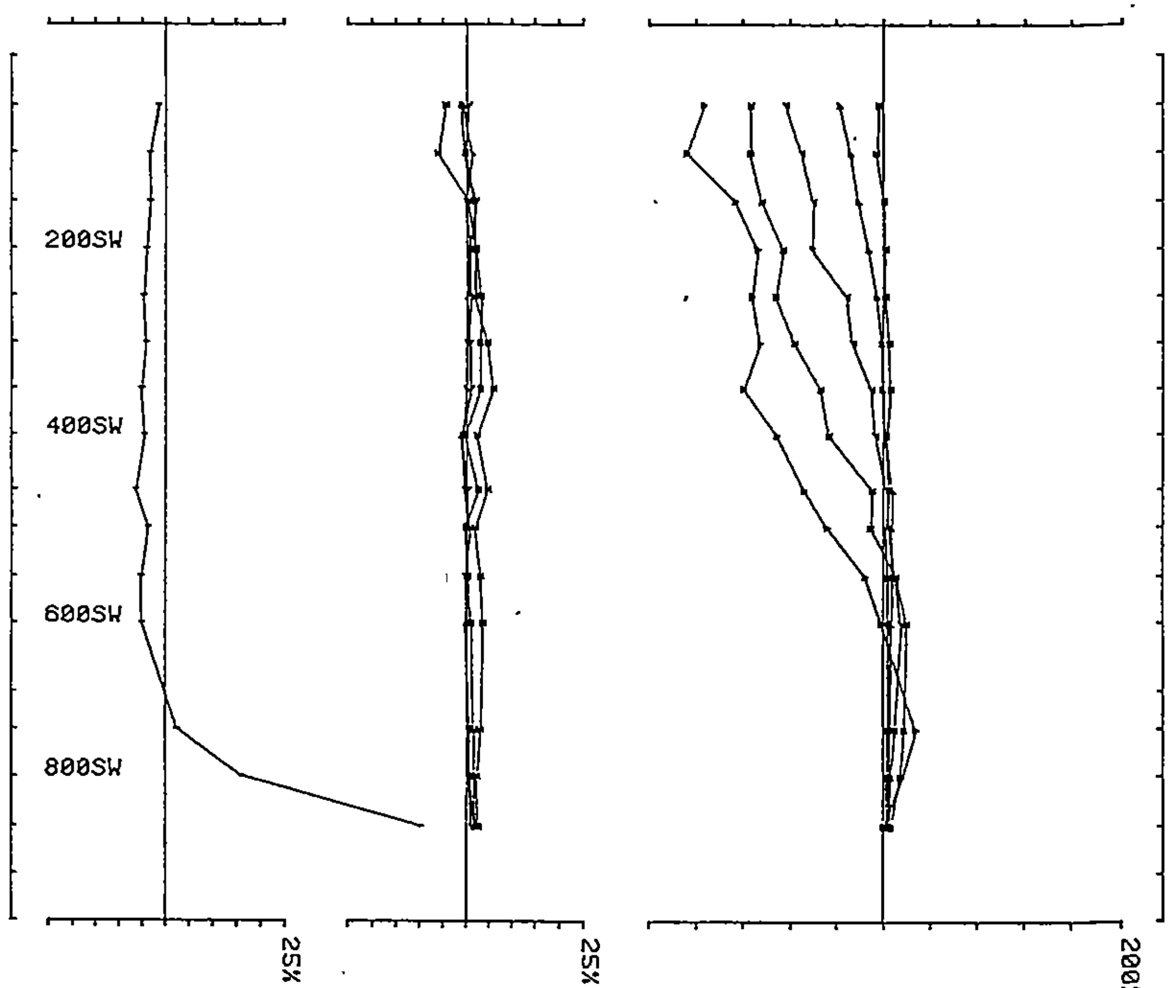
Loopno 0410 Line 200NW component Hz secondary Ch I normalized

DS 51



Area Clair Cominco Job 410 freq(hz) 18.583
Loopno 0410 Line 400NW component Hz secondary Ch 1 normalized 1

DS 52



DS 53 Area Clair Cominco Job 410 freq(hz) 18.583
Loopno 8410 Line 600NW component Hz secondary Ch 1 normalized

IN THE MATTER OF THE B.C. MINERAL ACT

AND IN THE MATTER OF A GEOPHYSICAL PROGRAMME

CARRIED OUT ON THE CLAIR CLAIMS 2, 4, 14 AND 15

LOCATED 20 KM W. OF MARYSVILLE, B.C.

IN THE FORT STEELE MINING DIVISION OF THE

PROVINCE OF BRITISH COLUMBIA, MORE PARTICULARLY

N.T.S. 82 F/9

STATEMENT

I, Jules J. Lajoie of the City of West Vancouver in the Province of British Columbia, make oath and say:

1. That I am employed as a geophysicist by Cominco Ltd. and, as such have a personal knowledge of the facts to which I hereinafter depose;

2. That annexed hereto and marked as "Exhibit A", to this statement is a true copy of expenditures incurred on geophysical survey on the CLAIR mineral claims;

3. That the said expenditures were incurred between April 5th and June 27th, 1981, for the purpose of mineral exploration of the above-noted claims.

Jules J. Lajoie, Ph.D., P.Eng.
Geophysicist, Cominco Ltd.

	Balance Carried Forward		$ 42,245.74
5.	Miscellaneous		
	Wire Usage	$ 500.00	
	Freight	440.00	
	Honda Motor Generator	300.00	
	Portable Radio Rental	150.00	1,390.00
	TOTAL		$ 43,635.74

I certify this to be a true statement of expenditures for the UTEM geophysical survey on the CLAIR 2, 4, 14 and 15 claims in 1981.

Jules J. Lajoie, Ph.D., P.Eng.
Geophysicist, Cominco Ltd.

(1) Operating Day Charge: for those days on which useful data is acquired to cover costs of drafting, computer modelling, interpretation, and report writing.

PERSONNEL

JJL	Jules J. Lajoie	Cominco Ltd. 853 - 409 Granville St., Vancouver, B.C. V6C 1T2
ETE	E. Tom Eadie	Cominco Ltd. 853 - 409 Granville St., Vancouver, B.C. V6C 1T2
RWH	Robert W. Holroyd	Cominco Ltd. 1700 - 120 Adelaide St., West Toronto, Ontario M5H 1T1
SJV	Sidney J. Visser	Cominco Ltd. 853 - 409 Granville St., Vancouver, B.C. V6C 1T2
RSY	Robin S. Young	Cominco Ltd. 853 - 409 Granville St., Vancouver, B.C. V6C 1T2
RF	Ray Fregin	Kootenay Exploration #1051 Industrial Road No. 2 Cranbrook, B.C. V1L 4X7
NW	Nancy Wilson	Kootenay Exploration #1051 Industrial Road No. 2 Cranbrook, B.C. V1L 4X7

C E R T I F I C A T I O N

I, Jules J. Lajoie, of 5655 Keith Road, in the City of West Vancouver, in the Province of British Columbia, do hereby certify that:-

1. I graduated from the University of Ottawa in 1968 with an Honours B.Sc. in Physics, from the University of British Columbia in 1970 with a M.Sc. in Geophysics, and from the University of Toronto in 1973 with a Ph.D. in Geophysics.

2. I am a registered member of the Association of Professional Engineers of the Province of British Columbia, the Society of Exploration Geophysicists, and the British Columbia Geophysical Society.

3. I have been practicing my profession for the past eight years.

Jules Lajoie

Jules J. Lajoie, Ph.D., P.Eng.
Geophysicist, Cominco Ltd.

LEGEND

10,389

OUTLINE OF LOOP CORNERS;
PREFIX 40 OMITTED FOR CLARITY

X^n UTEM CROSSOVER ANOMALY
n - LATEST ANOMALOUS CHANNEL

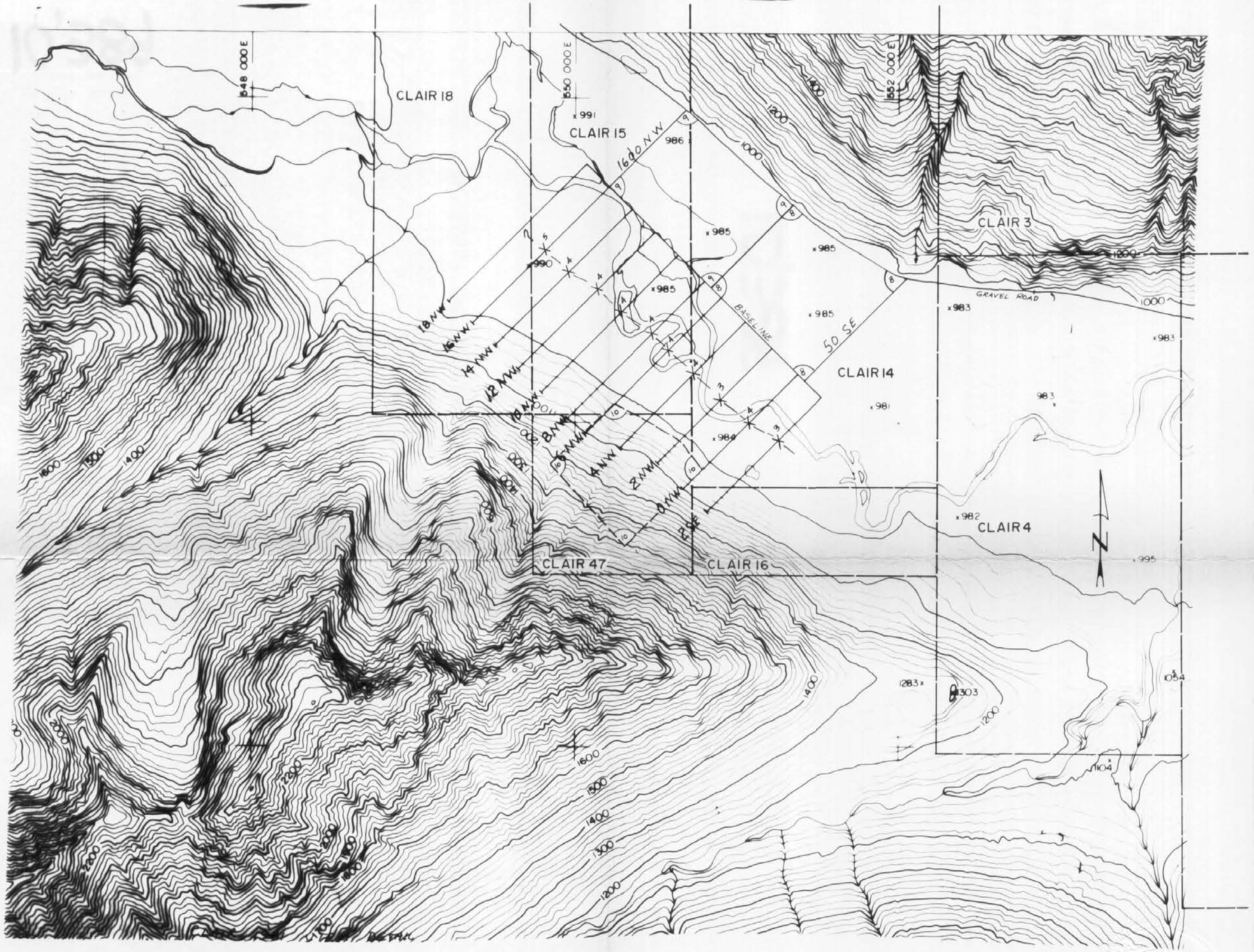
METRES
0 400 800 1600

TO ACCOMPANY A REPORT BY J.J. LaJOIE Ph.D., P.Eng. Jules LaJoie

CLAIR PROPERTY

CLAIR
UTEM COMPILATION

1:20,000 | MARCH 1982 | 224-81-2



LEGEND

OUTLINE OF LOOP CORNERS ;
PREFIX 40 OMITTED FOR CLARITY

X^n UTEM CROSSOVER ANOMALY
n- LATEST ANOMALOUS CHANNEL

TO ACCOMPANY A REPORT BY J.J. LaJOIE Ph.D., P.Eng.

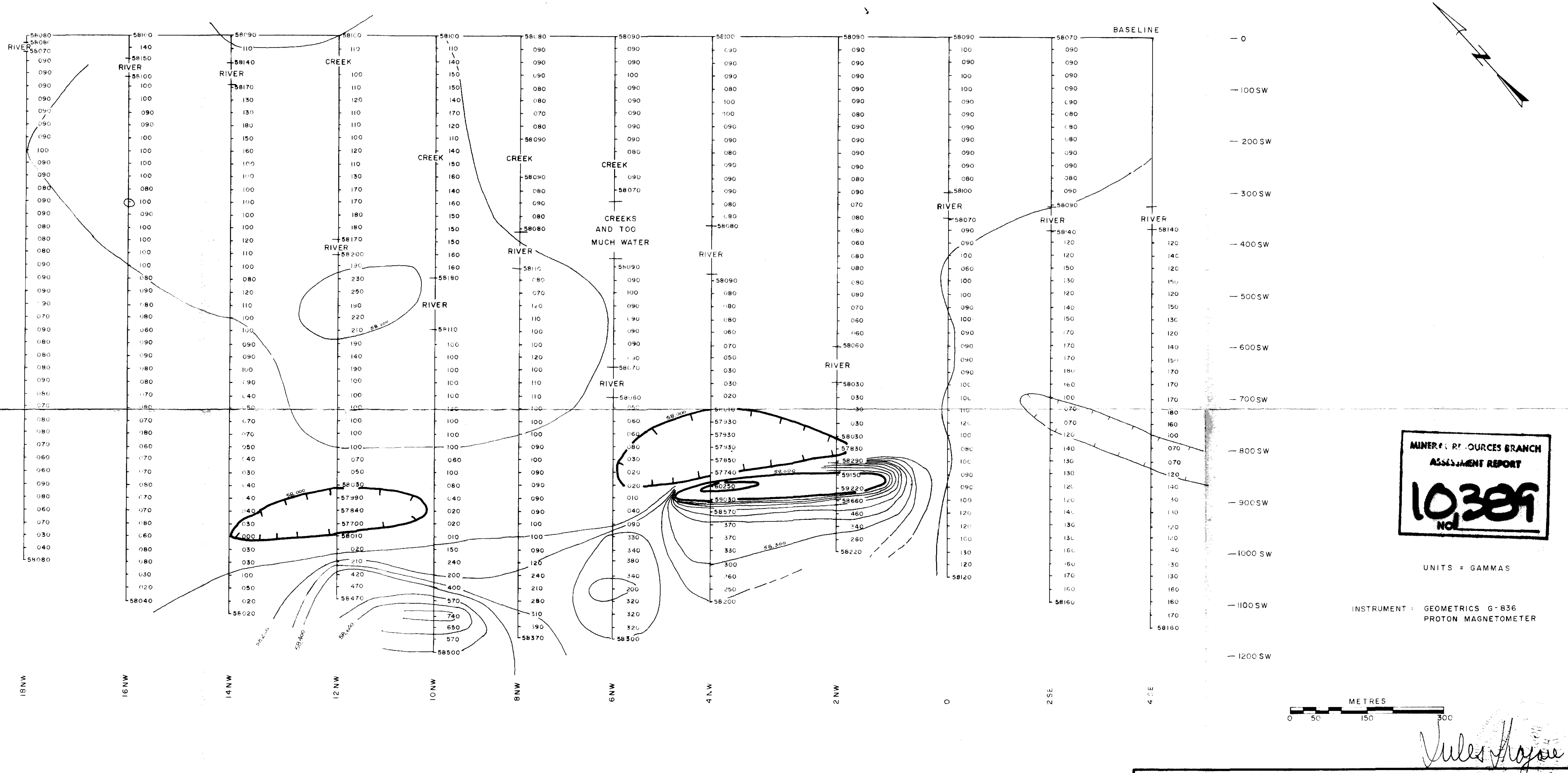
0.0 400.0 800.0 1600.0 METRES

CLAIR PROPERTY

DRAWN BY: TRACED BY:
REVISED BY: G.E.L. DATE: APRIL 82

CLAIR
UTEM
DETAIL GRID COMPILATION

SCALE: 1:20,000 DATE: MARCH 1982 PLATE: 224-81-3



CLAIR PROPERTY

Drawn by:	Traced by:	CLAIR DETAIL GRID MAGNETOMETER DATA
Revised by / Date	Revised by / Date	

Scale: 1 : 5000 | Date: APRIL 1982 | Plate: 224-81-4