Logistics Report on a UTEM Survey at Shun Lake, Ontario for Cominco Exploration Limited

July 1990

R.H. Sinclair

James C. Macnae*, Ph. D. (Geophysics)

This report

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†Graduate of the University of Western Ontario (B.Sc. Geophysics, 1987). Field geophysicist with Lamontagne Geophysics (1988-1990), Quantech Consulting (1988) and Terraquest Airborne Geophysics (1987).

INTRODUCTION

A UTEM 3 survey was carried out by Lamontagne Geophysics personnel on the Shun Property on behalf of Cominco Exploration during July of 1990. The Project is located approximately 80 kilometers east of Chapleau, Ontario in Cunningham Township (Figure 1). The grid is accessible by logging road from Sultan, Ontario. The purpose of the survey was to delineate any conductors underlying the grid.

GEOLOGY

The Shun claim group lies near the south-central part of the Swazye Greenstone Belt. Rocks in the region comprise mainly volcanic flows and synvolcanic sills. These are intercalated with intermediate to felsic pyroclastic rocks and with ferruginous and non-ferruginous chemical sediments. Differentiated gabbro and ultramafic sills and dykes, and felsic to intermediate plutons have intruded the supracrustal succession. Metamorphic grade is typically greenschist facies.

FIELD WORK

The crew mobilized from Toronto to Sultan on July 16. The crew consisted of Robert Sinclair (geophysicist-in-charge), Geoff Heminsley (geophysicist/operator) and Curtis Gavin (geophysical assistant). Patrick McGowan (Chief Geophysicist of Lamontagne Geophysics) visited the crew July 13 and 14. The crew was accommodated at Fern's Motel in Sultan, about 60 kilometers from the grid.

The equipment consisted of one UTEM receiver (#4) and transmitter (#4), including all accessories and support equipment. Data were reduced using a Lamontagne Macintosh II computer workstation and GEOMAC reduction routines. A Lamontagne four wheel drive vehicle was used to access the grid. A total of 29.9 kilometers of one component coverage (Hz) were surveyed from five loops, lying to the east, west, north and south of the survey lines. An additional 1.5 kilometers of two component coverage (Hz and Hx) were read from Loop 3. All loop lines were cut and marked prior to the arrival of the crew on the grid.

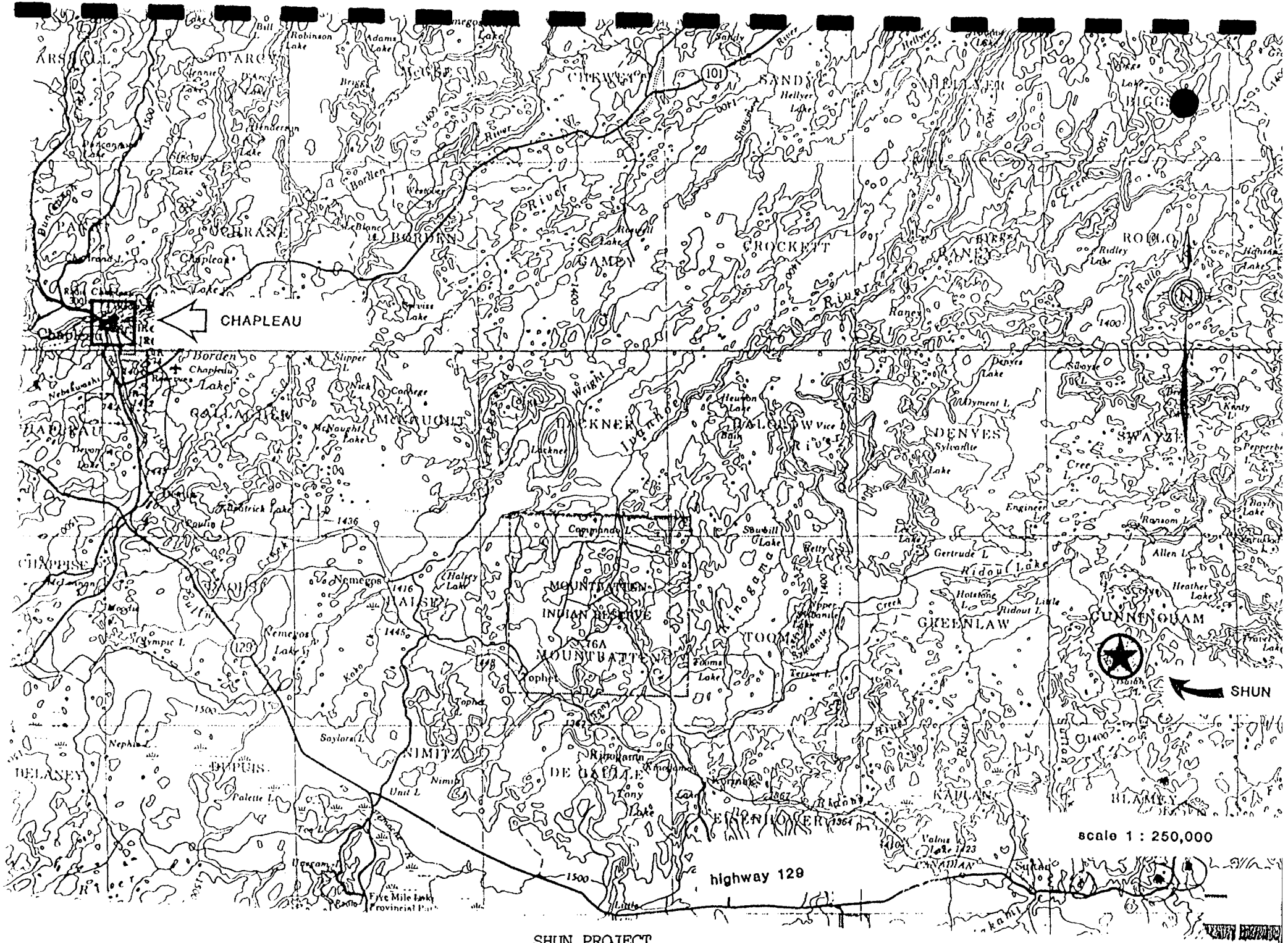
The first loop was laid out the morning after arrival and surveying commenced later that day. Surveying concluded on July 14 and the crew demobilized to Toronto the that night after picking up the loops.

TABLE I - PRODUCTION DIARY

date	kms.	rate	comments
July 5	-	-	Mobilized from Toronto to Sultan.
6	1.5	P	Laid loop 1 Read loop 1 lines: 2N 900W-100E and 0 900W-400W
7	4.5	P	Read loop 1 lines: 0 400W-100E, 2S 900W-100W 4S 900W-100W, 6S 900W-100W and 8S 900W-100W

Production Diary cont'd.....

8	-	S	Thunder storm. Picked up loop 1 Laid rest of loops
9	3.0	P	Read loop 2 lines: 3W 200N-800S 1W 200N-800S 1E 200N-800S Lost data from lines 5W 7W 9W.
10	4.0	P	Read loop 2 lines: 5W 200N-800S 9W 200N-800S loop 4 lines: 1W 200N-800S Loop 3 broken by construction of logging road
[illegible]	[illegible]	[illegible]	9W 200N-800S
11	6.8	P	Read loop 4 lines: 1E 200N-800S 3W 200N-800S 5W 200N-800S 7W 200N-800S 9W 200N-800S Read loop 5 lines: 8S 100W-800E 6S 100W-800E
12	5.4	P	Read loop 5 lines: 4S 100W-800E 2S 100W-800E 0 100W-800E 2N 100W-800E Read loop 3 lines: 8S 300E-700W 6S 100E-900W
13	4.7	P	Read loop 3 lines: 6S 1E-500E 4S 300E-900W 2S 700E-900W 0 100E-900W 2N 100E-400W Loop break in the morning and at the end of the day.
14	0.5	1/2P	Read loop 3 line: 2N 400W-900W Pick up loop 3 Leave for Toronto.



SHUN PROJECT
GRID LOCATION MAP
figure 1.

THE UTEM DESIGN PHILOSOPHY

UTEM uses a large, fixed, horizontal transmitter loop as its source. The loop may range in size from 300m x 300m up to as large as 4km x 4km. In general, smaller loops are used over conductive terrain whereas larger loops may only be used over resistive terrain. Depending on the noise levels, measurements may be made out to a distance of 1.5 to 2 times the loop dimensions. Lines may be surveyed out from the edge of the loop (used to detect dipping conductors) but may also be read across the loop wire through the centre of the loop (used to detect horizontal conductors).

The vertical component of the magnetic field (Hz) of the loop is always measured. However, horizontal in-line (Hx) and cross-line (Hy) components may also be measured if more detailed information is required. A receiver coil mounted on a portable tripod is used to measure the magnetic field. The UTEM system is also capable of measuring the two horizontal components of the electric field (Ex, and Ey), but this is used only for very specific geological problems. A dipole sensor comprised of two electrodes is used to measure the electric field components.

The UTEM transmitter passes a low-frequency (4 Hz to 90 Hz) current of precise triangular waveform through the transmitter loop. The frequency may be set to any value within the operating range of the transmitter, but is usually set at 31 Hz so as to minimize powerline effects (60 Hz noise). Since the receiver coil responds to the time derivative of the magnetic field, the system really "sees" the step response of the ground. UTEM is the only time domain system which measures the step response of the ground. All other systems to date transmit a modified step current so that they "see" the (im)pulse response of the ground at the receiver.

The transmitted ("primary") field induces current flow in the ground below and around the transmitter loop (i.e. in the "half-space") which itself produces a measurable EM field called the secondary field. This current flow has an inherent "momentum" which resists the change in primary field direction (at each step) much like the flow in a bucket of water resists being forced in the other direction after it has been stirred. It takes a certain amount of time for the current to be redirected by the new primary field direction; this time is called the time (decay) constant. The time constant of a good conductor is greater than that of a poor conductor.

The large scale current which is induced in the half-space by the primary field produces the half-space response as seen in typical UTEM profiles. Other currents may be induced in locally more conductive zones (conductors). In general, these have greater time constants than the half-space response. Such responses are superimposed upon (and distorted by) the half-space response. Using a scale modeling tank, the UTEM response of many different conductive bodies has been measured (in free space). These responses take the form of one or several crossovers with a variety of amplitudes and shapes. They have been assembled into type curve suites which are available from Lamontagne Geophysics.

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SURVEY DESIGN

The Shun grid is interpreted to be underlain by a fold nose. As a consequence the survey had to be designed to provide good coupling with a number of possible dips. For this reason lines were surveyed east-west as well as north-south using transmitter loops lying to the north, south, east and west of the grid (Figure 2). A fifth loop lying in the middle of the grid was used to read lines at the extreme eastern edge of the grid. The relative positions of the lines compared to the transmitter loops is shown in the foldout location map included with this report.

DATA PRESENTATION

The data are plotted in "channel 1 normalized" form whereby a different reduction formula is used for channel 1 and the rest of the channels.

The channel 1 data are reduced before plotting according to the formula:

$$R1_c = (Ch1_c - H^p_c) / (H^p) \times 100\%$$

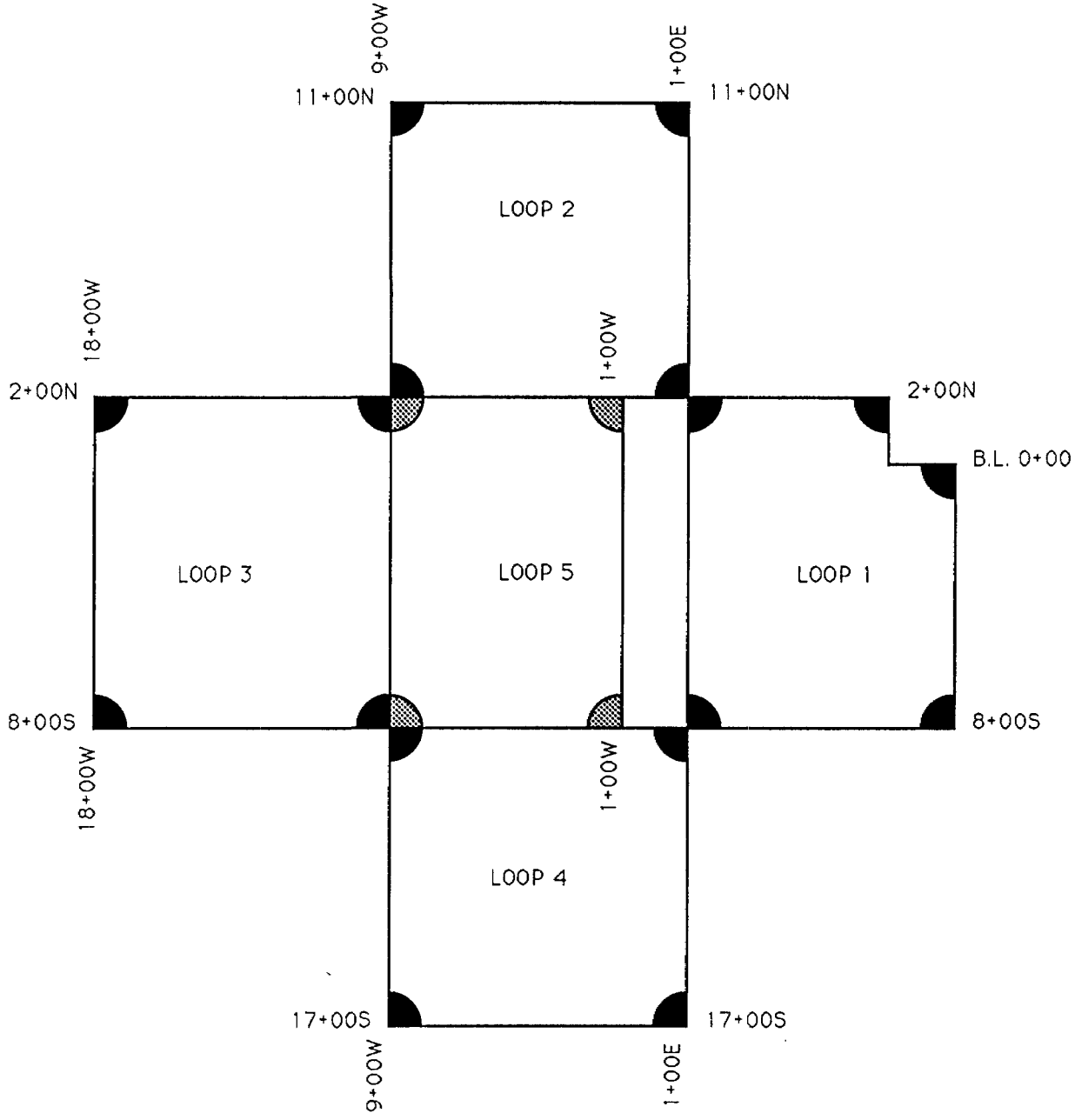
The other channels or reduced using a slightly different formula:

$$\text{Hz:} \quad Rn_c = (Chn_c - Ch1_c) / (Ch1_c) \times 100\%$$

$$\text{Hx:} \quad Rn_c = (Chn_c - Ch1_c) / (H^p) \times 100\%$$

The data may be plotted in either *point normalized* or *continuously normalized* form. In point normalized form the normalizing factor in the denominator of the above expressions (Hp for Hx and Ch1c for Hz) is the observed channel 1 amplitude or computed primary field at a single chosen station on the survey line. Thus at every station the field is expressed as a percentage of the normalizing field at the point of normalization. This point is denoted by "***>" on the plot. In continuously normalized form the normalizing factor in the denominator is the local ch1 value or computed primary field. In this form the response is thus continuously amplified as a function of offset from the loop as the primary exciting field diminishes. Although this type of normalization considerably distorts the response shape, it permits anomalies to be easily identified at a wide range of distances from the loop. Interpretation of the shape of the anomaly is usually done on the point normalized profiles.

The data are plotted on three axes. On the bottom axis channel 1 (latest time) is plotted alone, normalized to the calculated primary field. The intermediate to late time channels (ch5 - ch2) are plotted on the center axis. The early time channels (Ch10 - ch6) along with a repeat of channel 5 for comparison are plotted at the top on a reduced scale. The symbols used to identify the channels on the plots as well as the mean delay time for each channel is shown in the table below. The Y axis on each plot represents the difference from 100% of channel 1 (or calculated primary field in the case of channel 1).

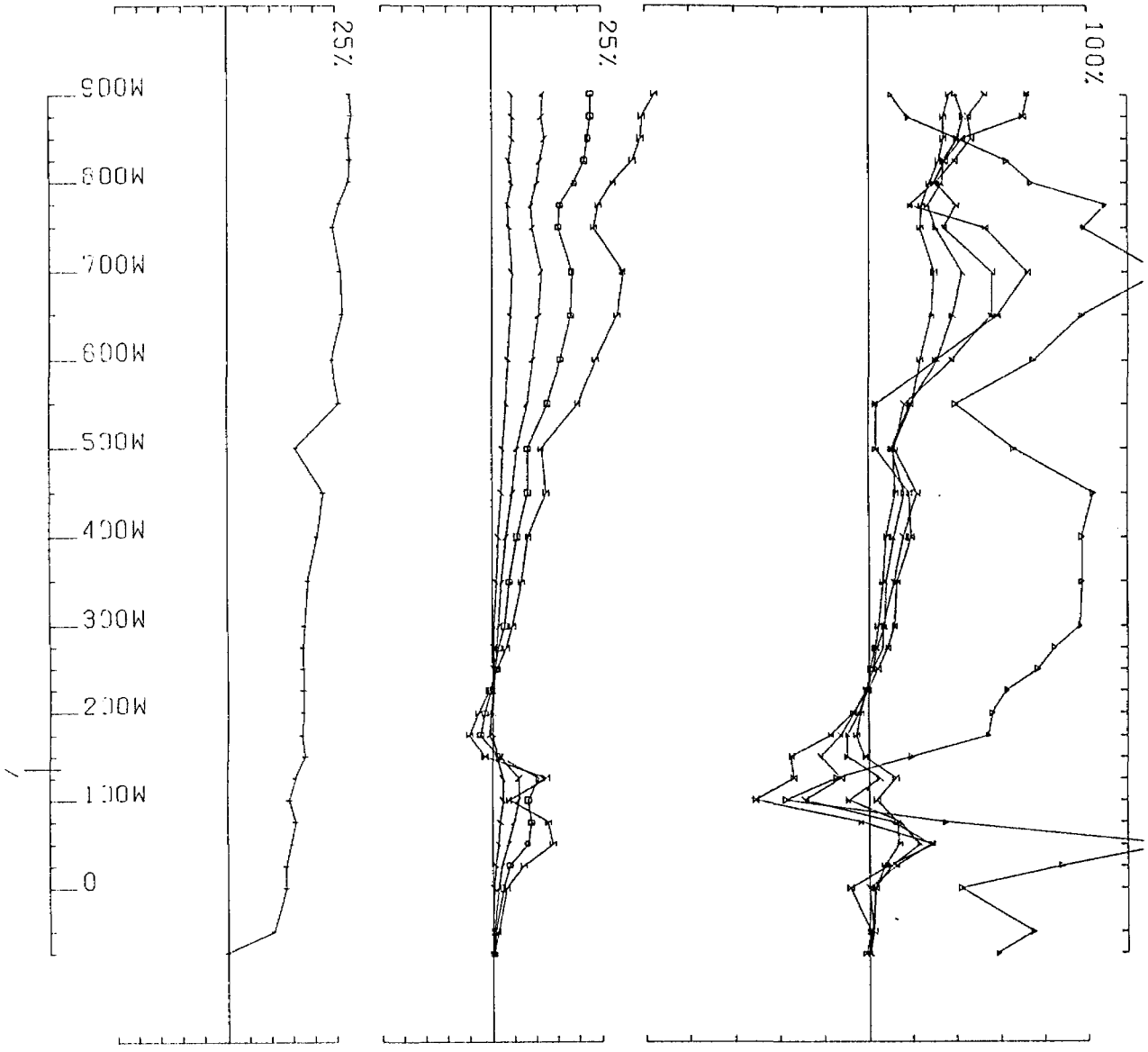


LOOP LOCATION MAP
SHUN PROJECT
figure 2

UTEM System Mean Delay Time

Channel Number	Delay Time (msec)	Symbol
1	12.8	
2	6.4	
3	3.2	
4	1.6	
5	0.8	
6	0.4	
7	0.2	
8	0.1	
9	0.05	
10	0.025	

Base Frequency = 31 Hz



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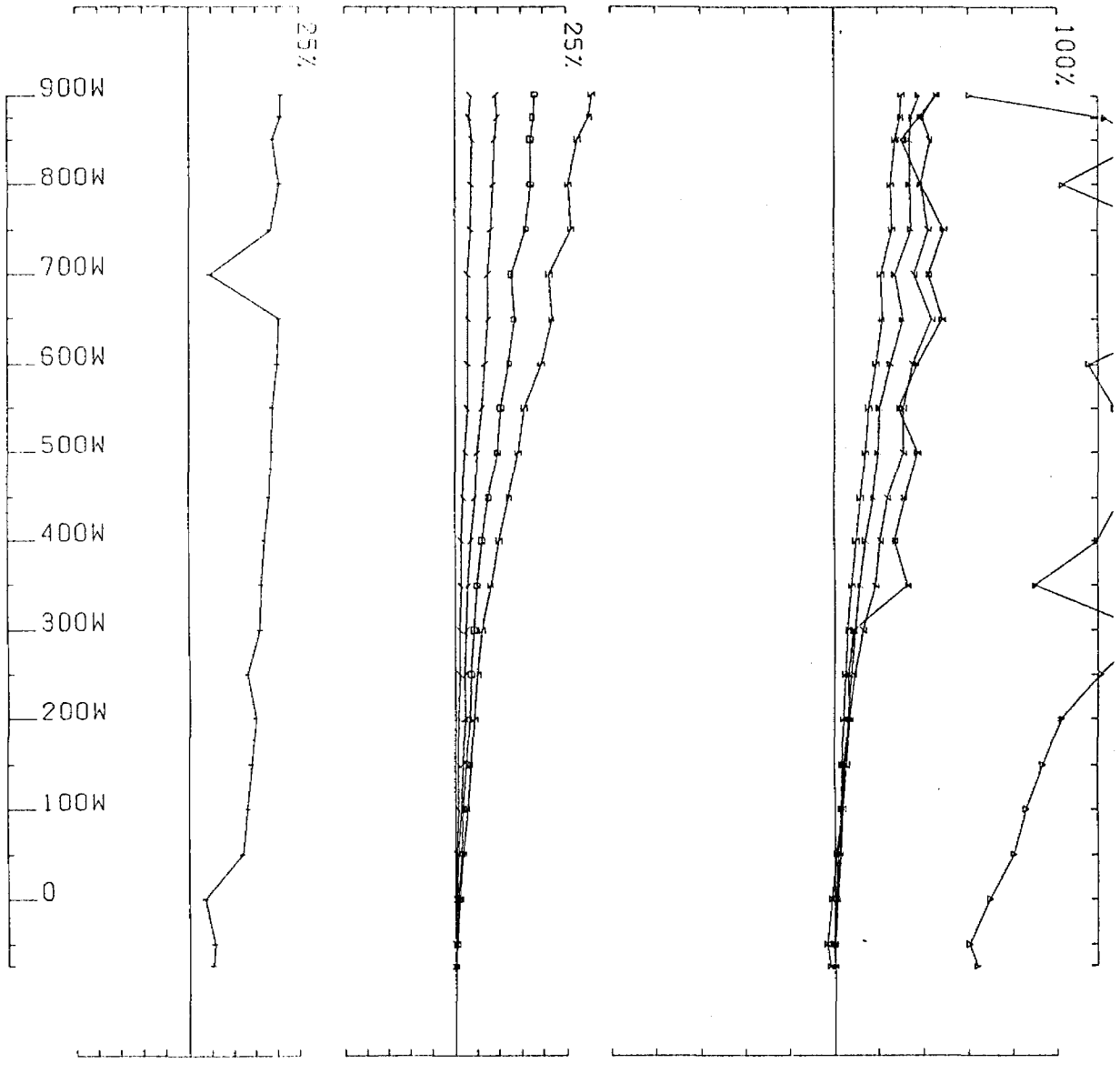

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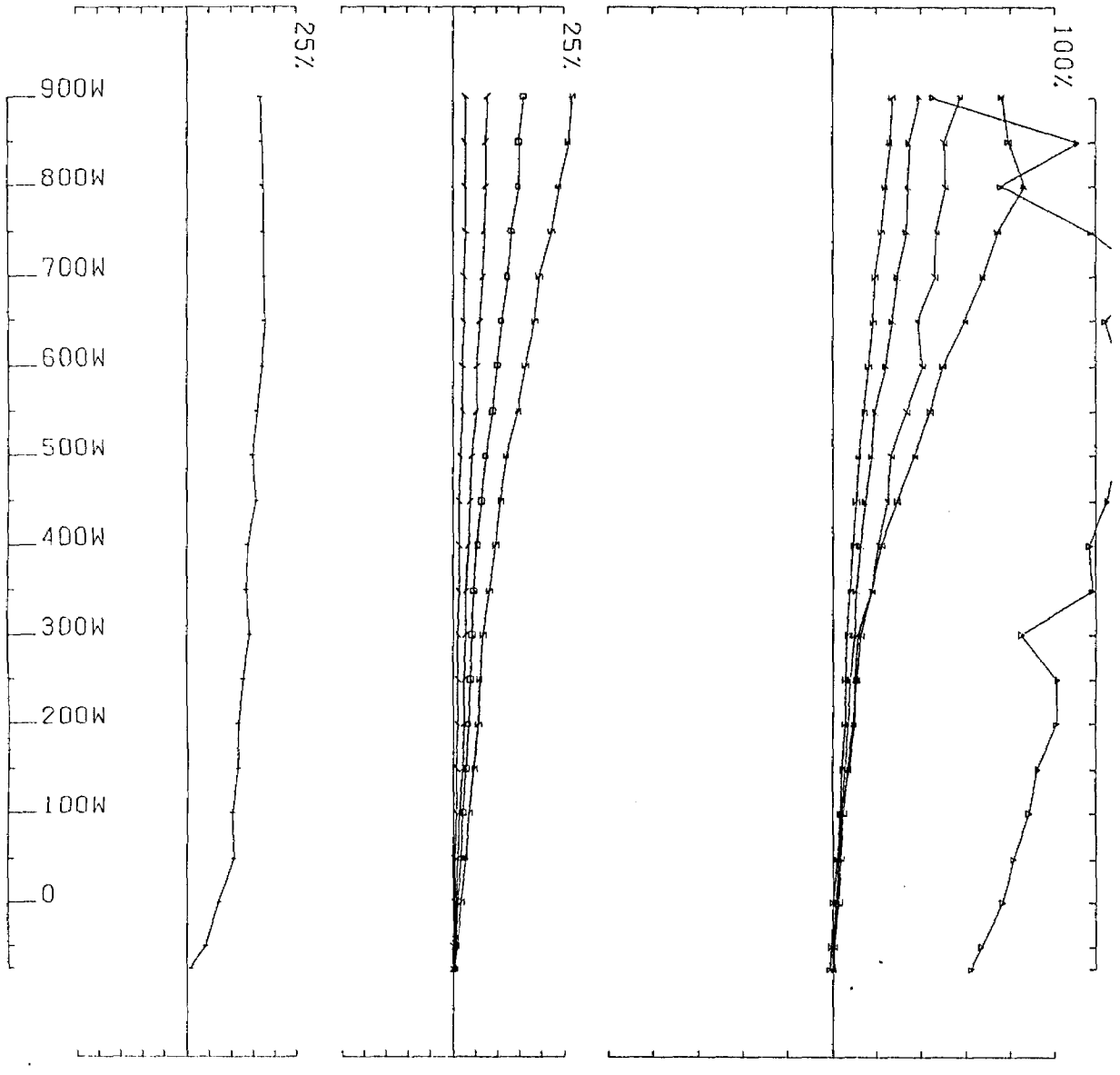

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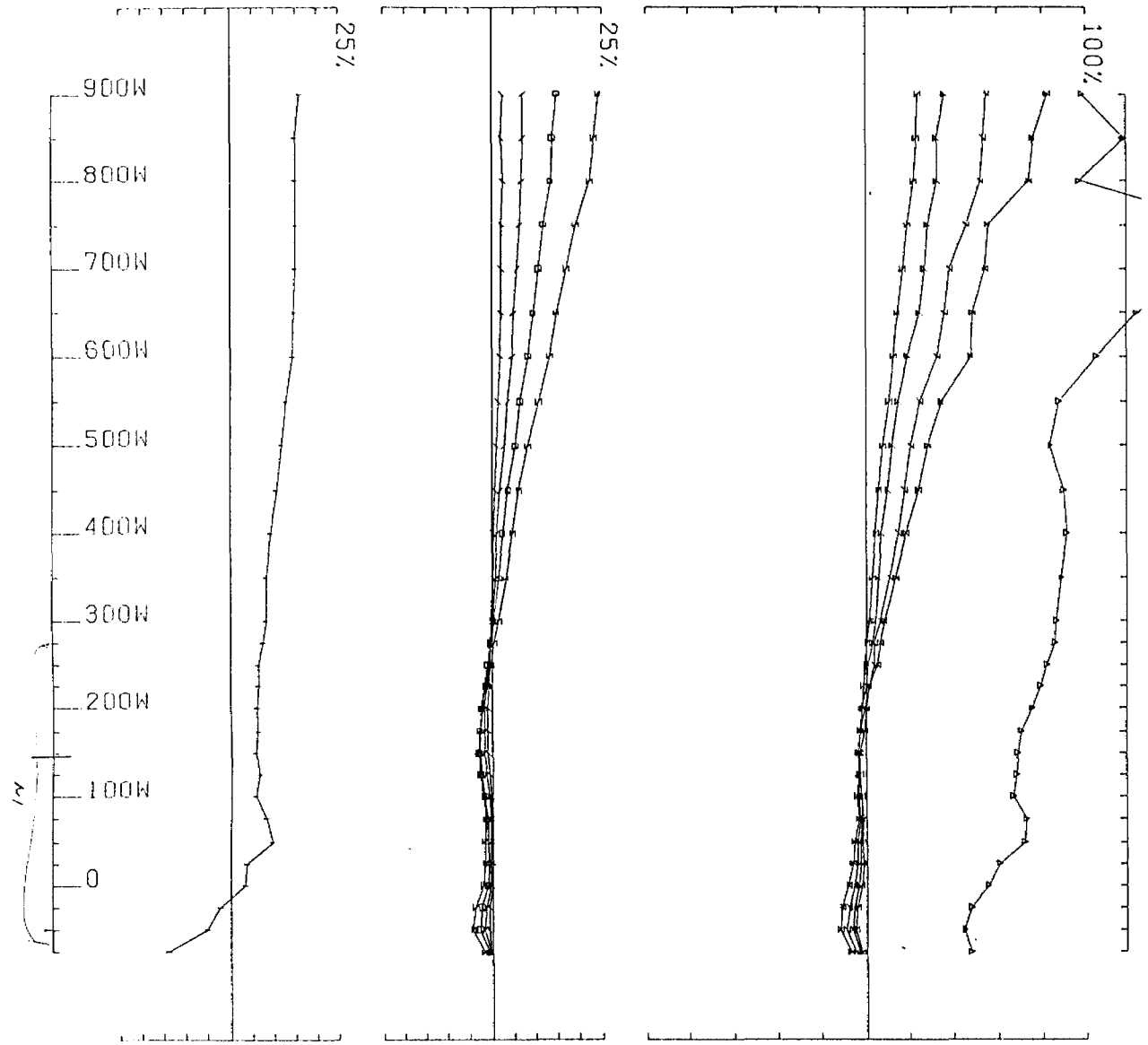
LOOP NO 1 LINE 200 S COMPONENT HZ SECONDARY FIELD CH1 CONTIN. NORM.



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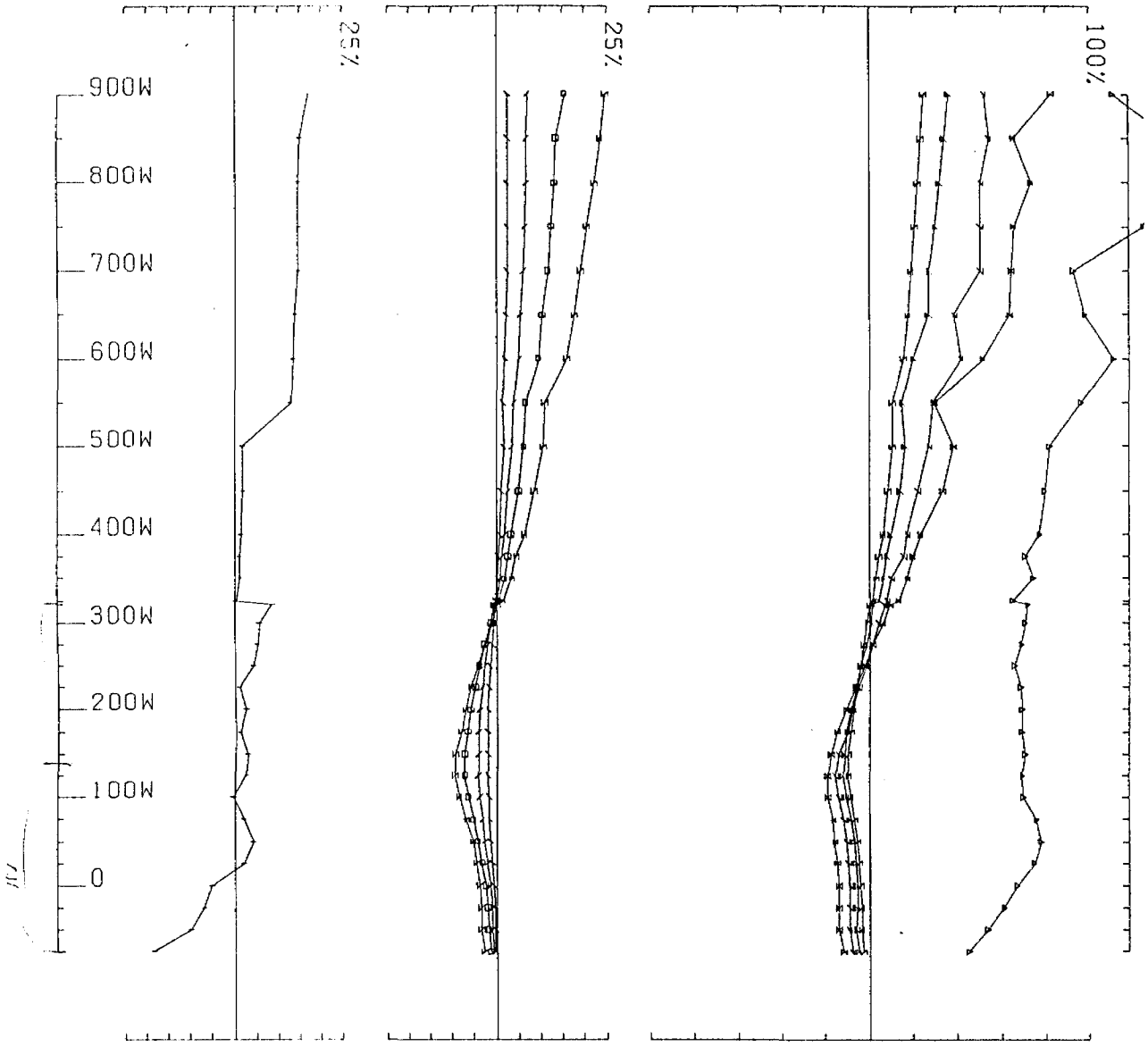
LOOP NO 1 LINE 400 S COMPONENT HZ SECONDARY FIELD CH1 CONTIN. NORM.



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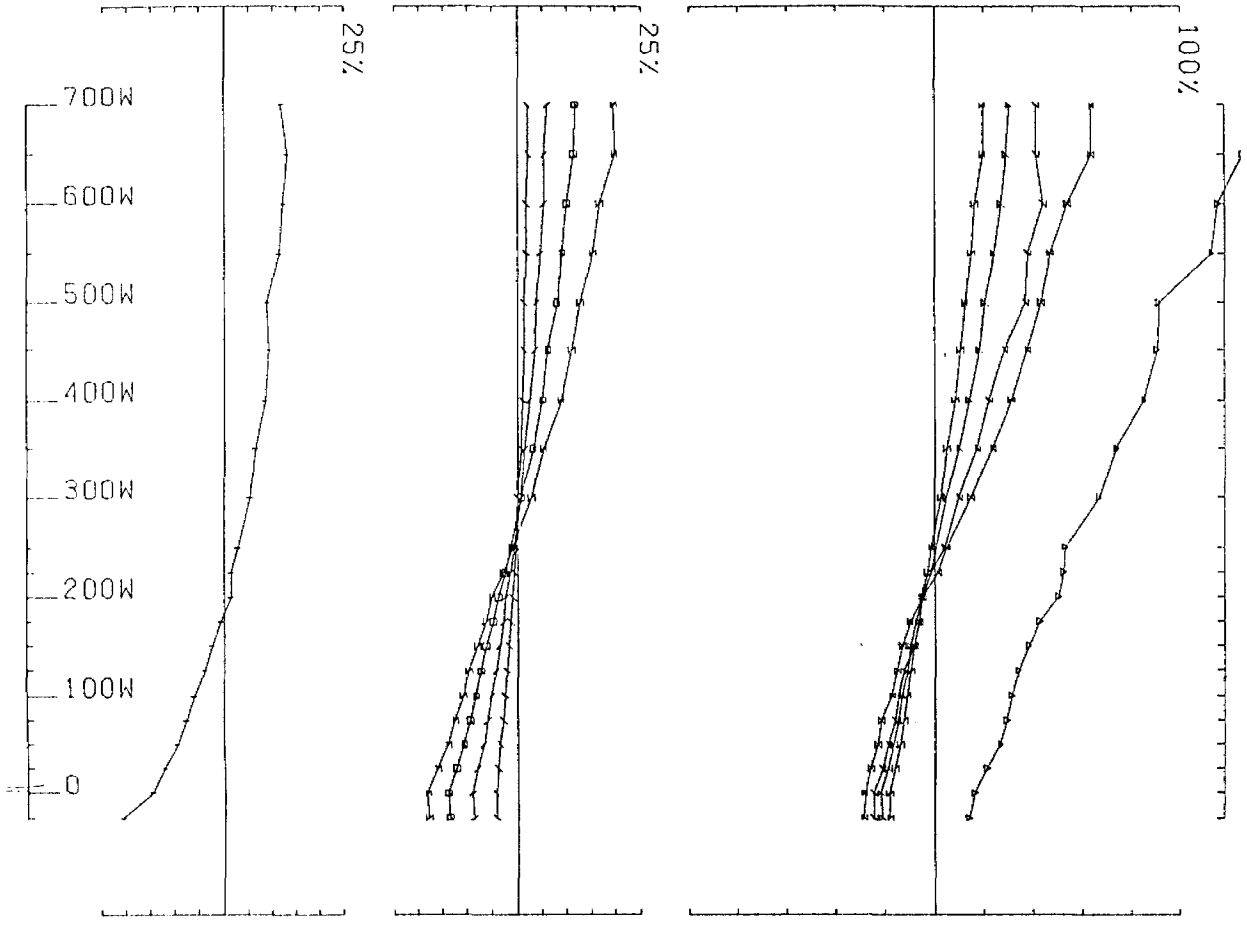
LOOP NO 1 LINE 600 S COMPONENT HZ SECONDARY FIELD CH1 CONTIN. NORM.



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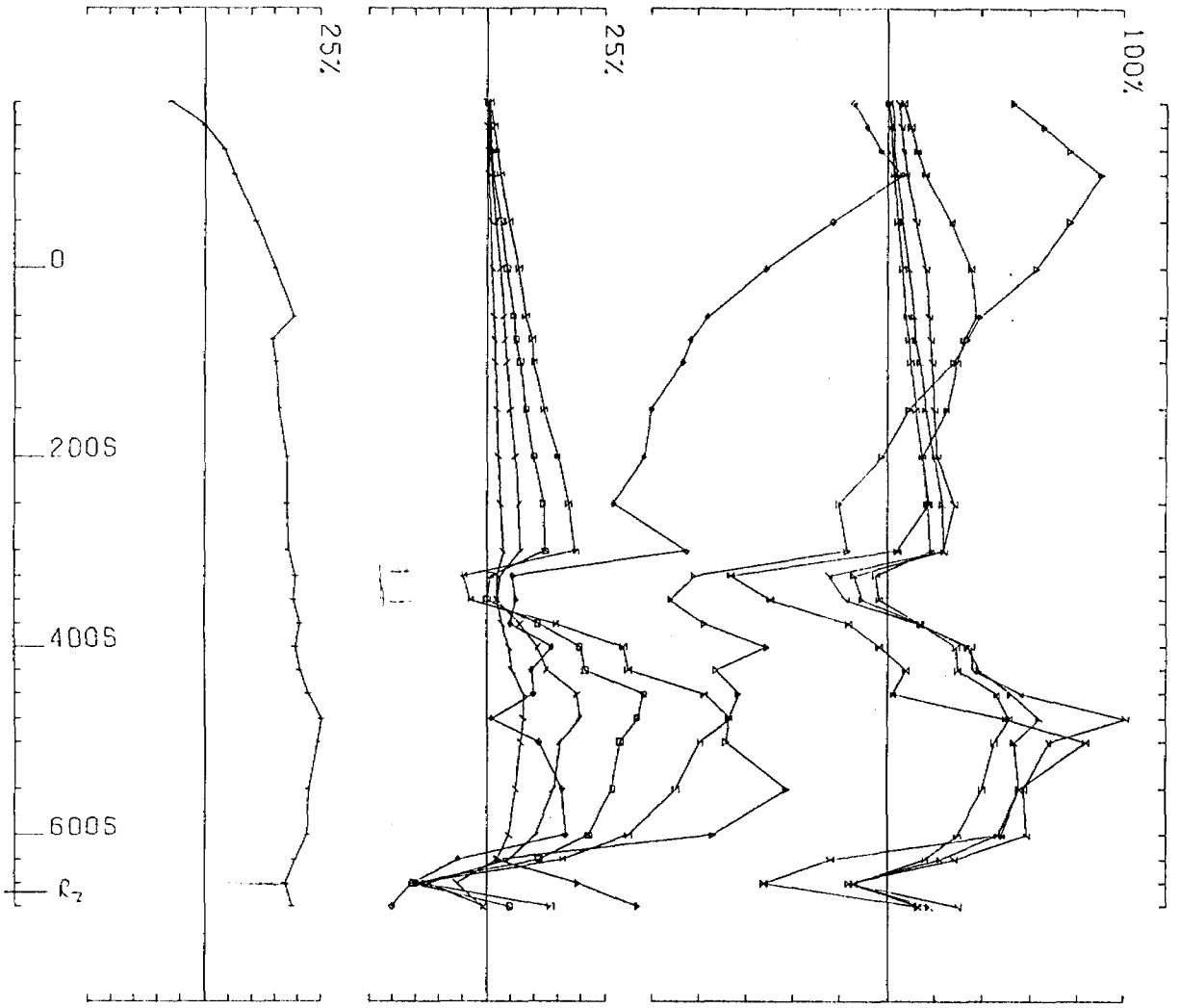
LOOP NO 1 LINE 800 S COMPONENT HZ SECONDARY FIELD CH1 CONTIN. NORM.



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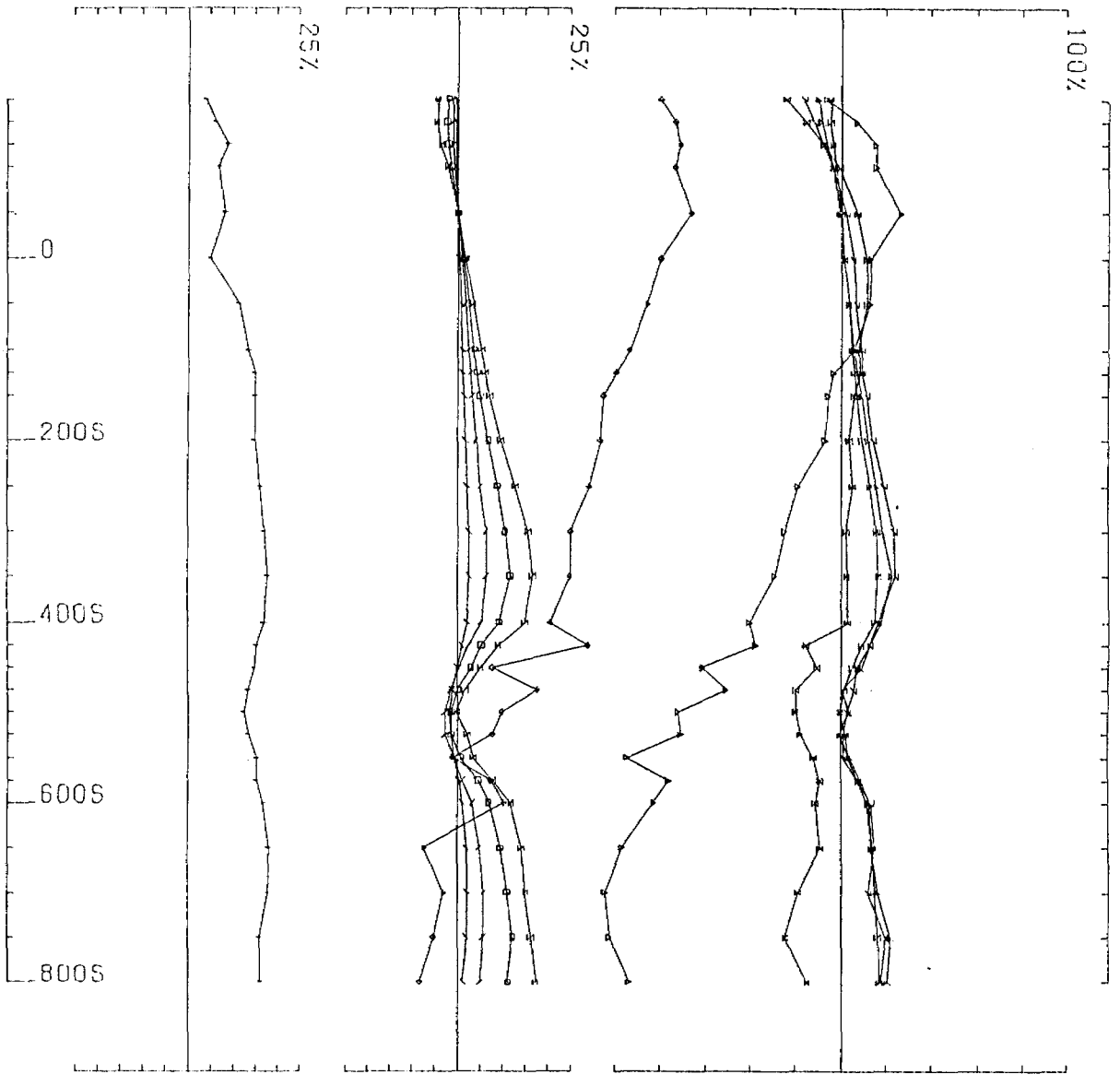
LOOP NO 2 LINE 100 E COMPONENT HZ SECONDARY FIELD CHI CONTIN. NORM.



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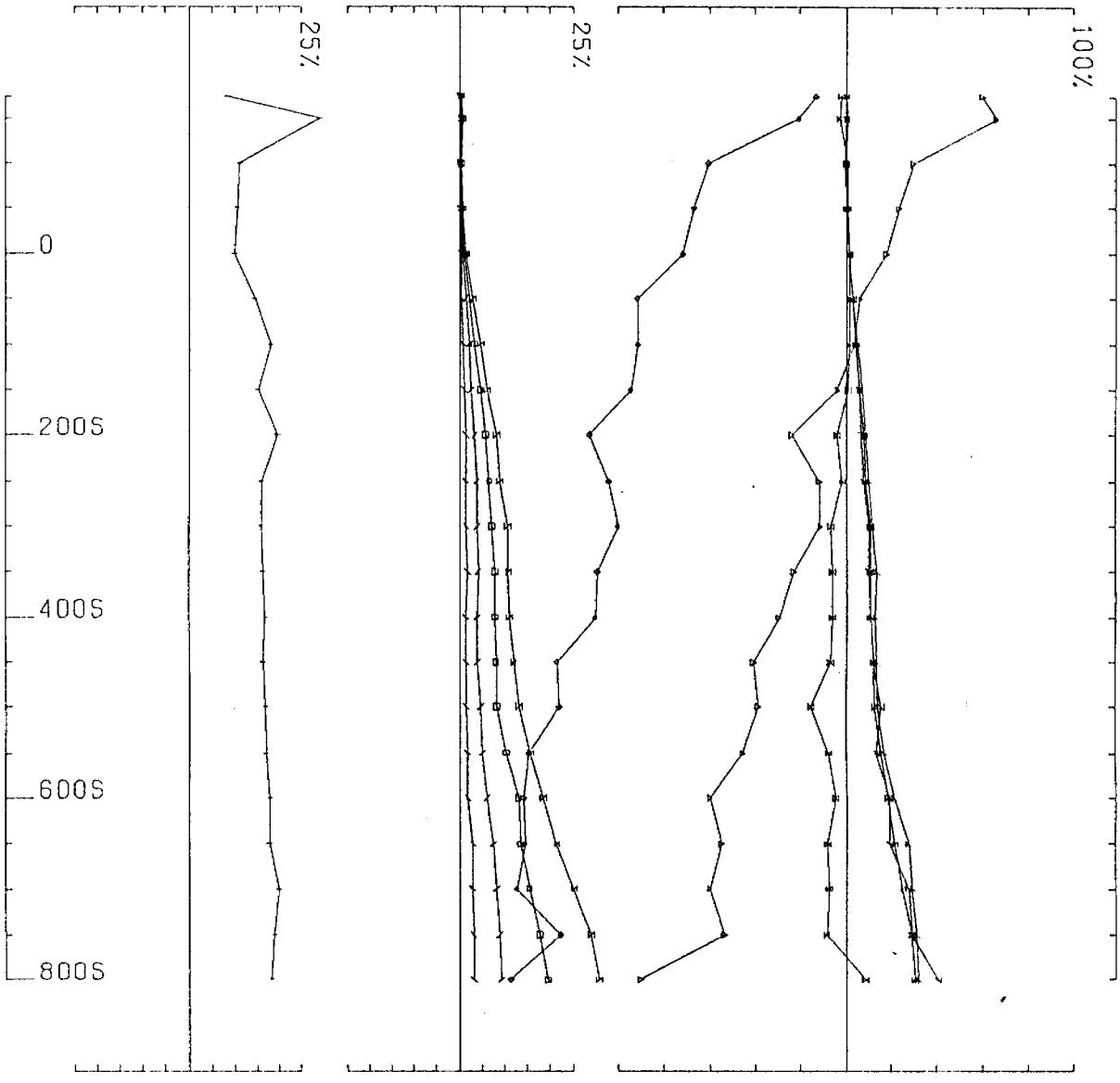
LOOP NO 2 LINE 100 W COMPONENT HZ SECONDARY FIELD CH1 CONTIN. NORM.



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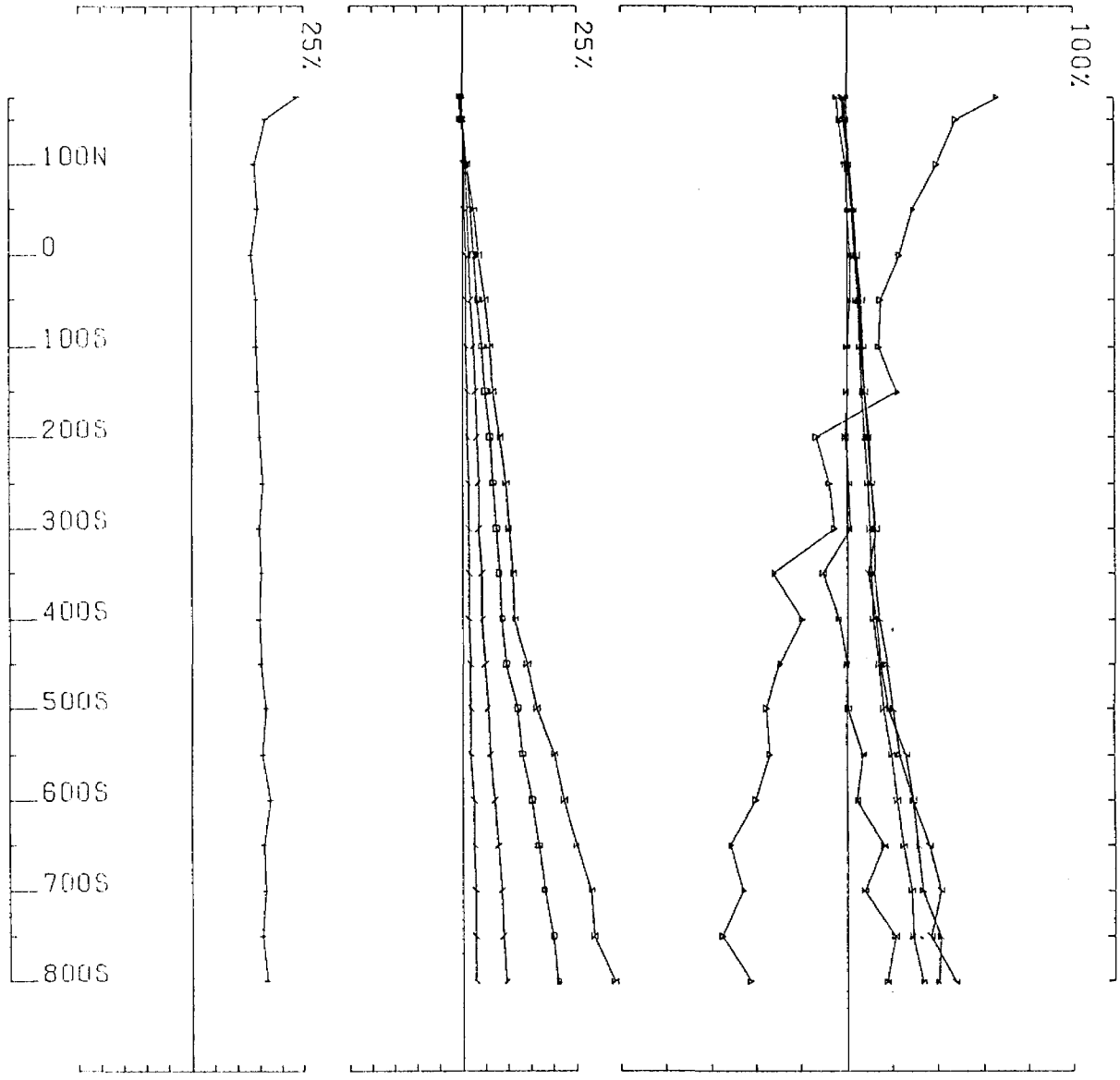
LOOP NO 2 LINE 300 W COMPONENT HZ SECONDARY FIELD CH1 CONTIN. NORM.



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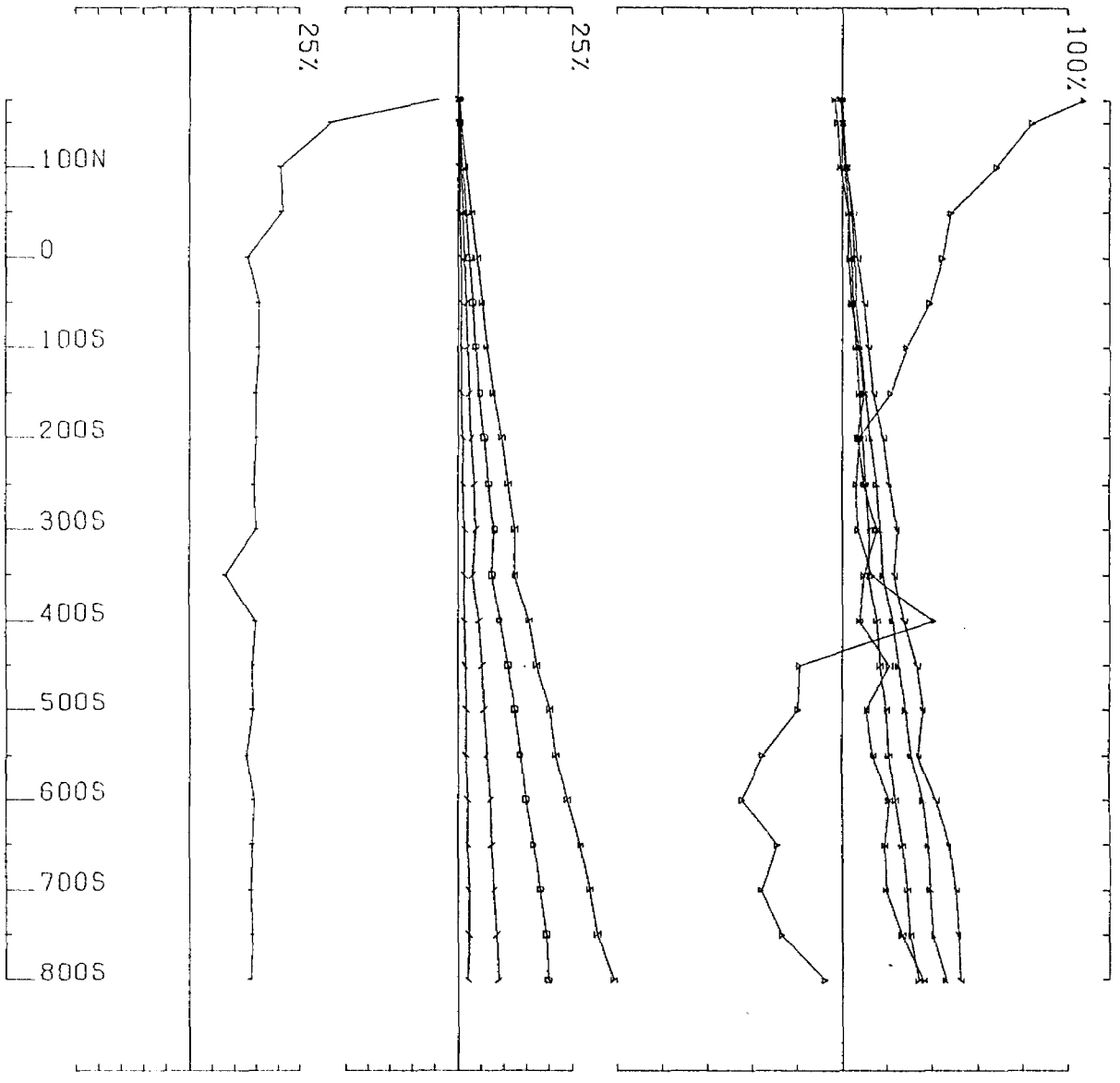
LOOP NO 2 LINE 500 W COMPONENT HZ SECONDARY FIELD CH1 CONTIN. NORM.



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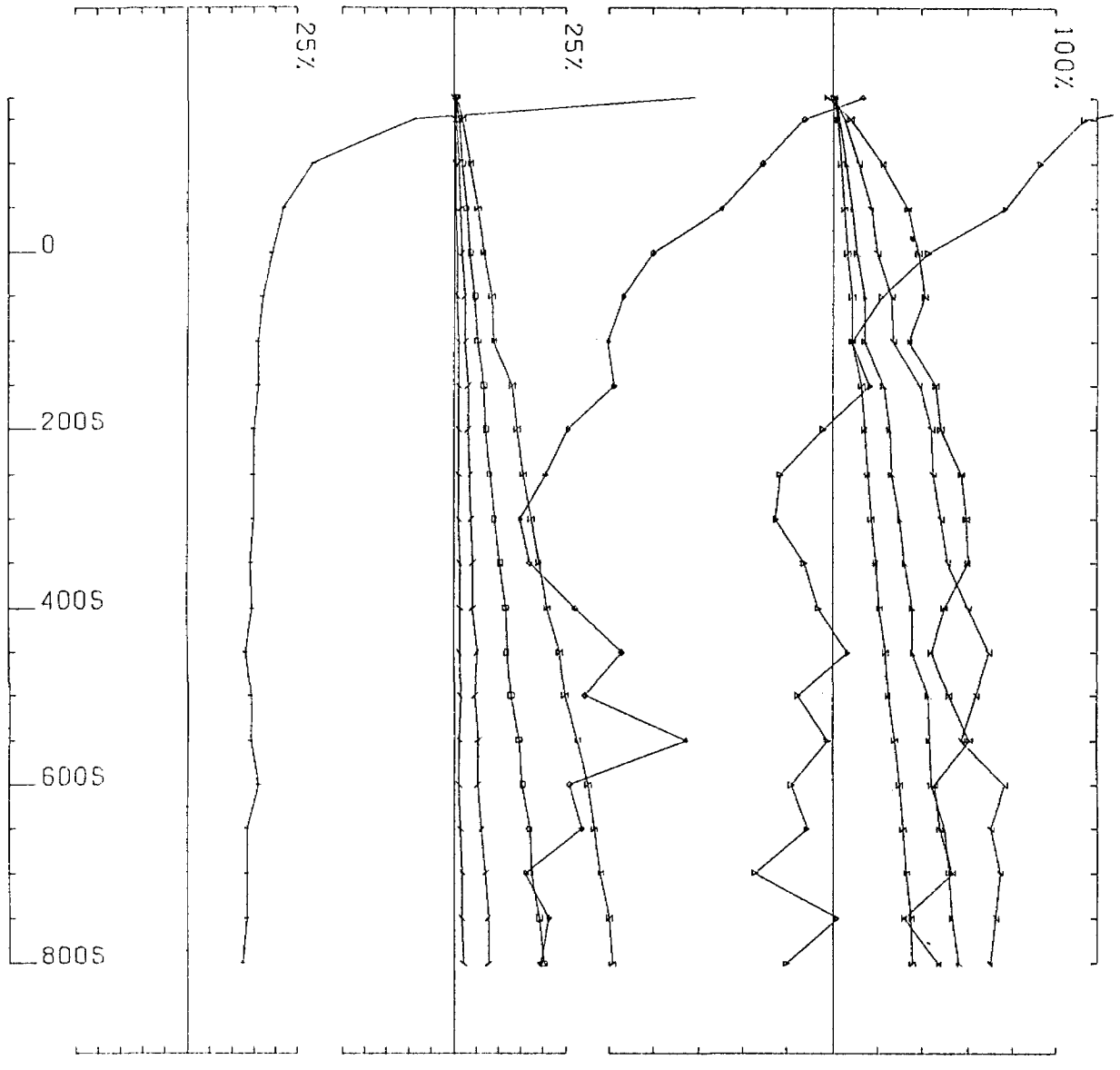

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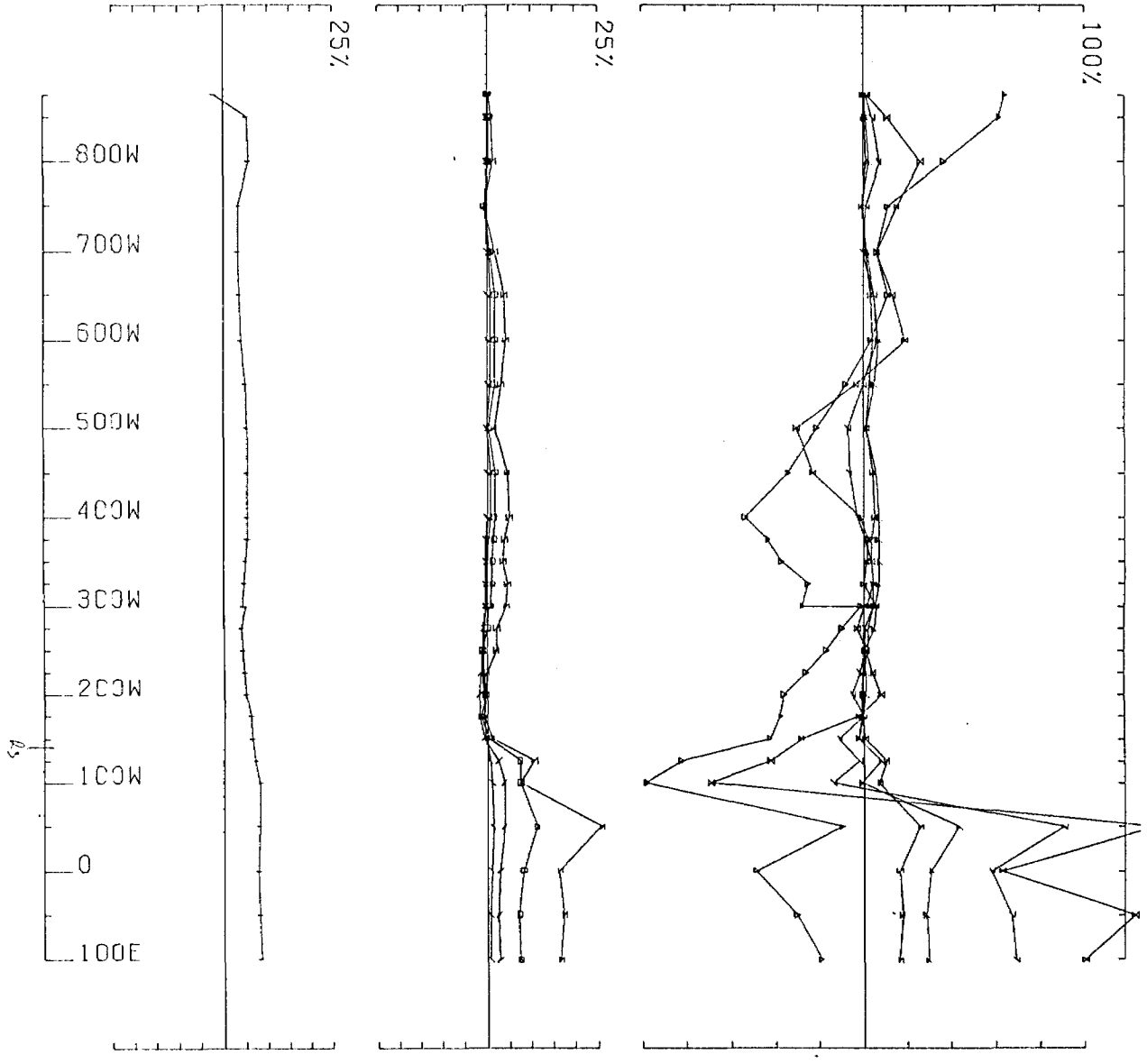
LOOP NO 2 LINE 900 W COMPONENT HZ SECONDARY FIELD CH1 CONTIN. NORM.



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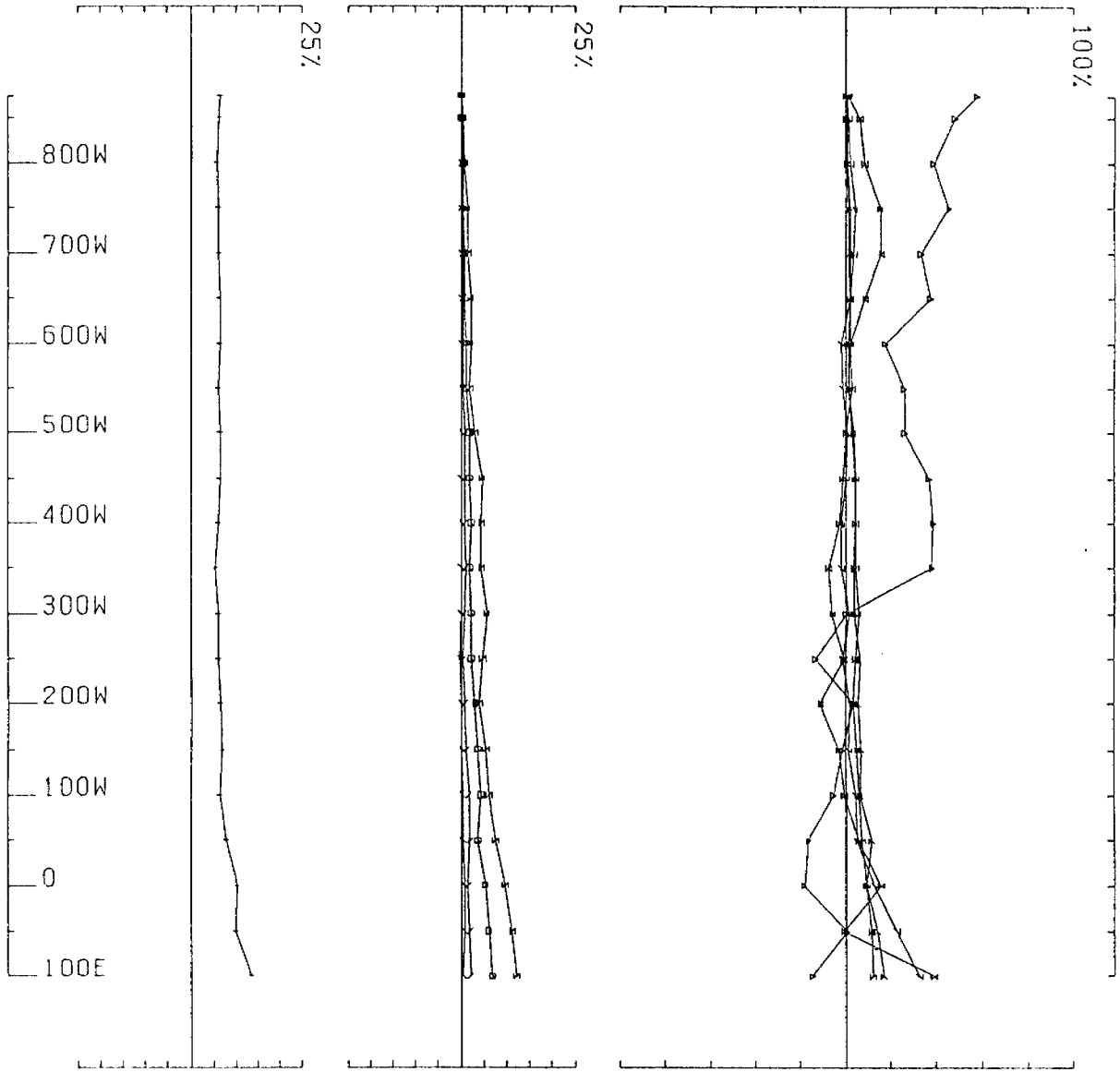

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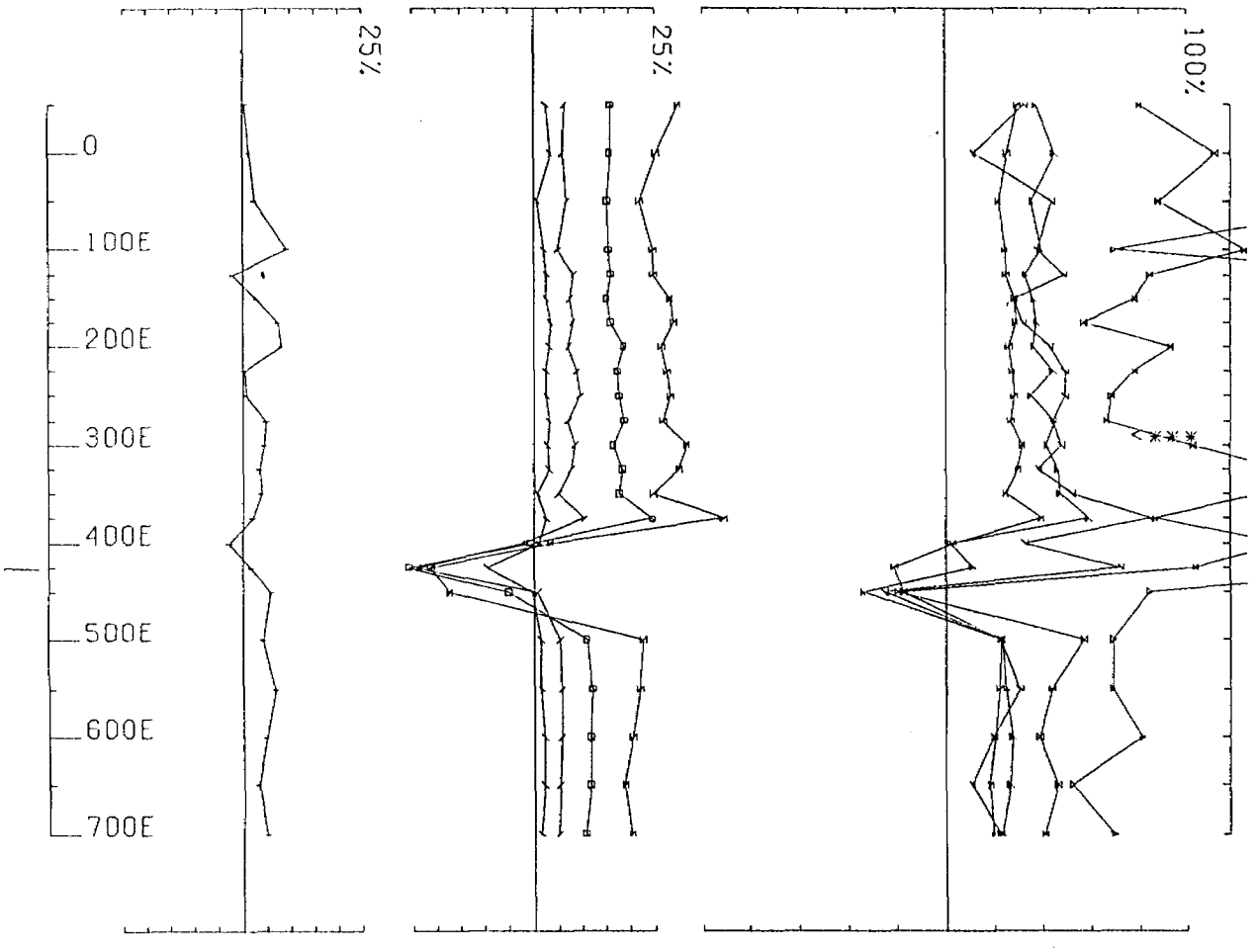

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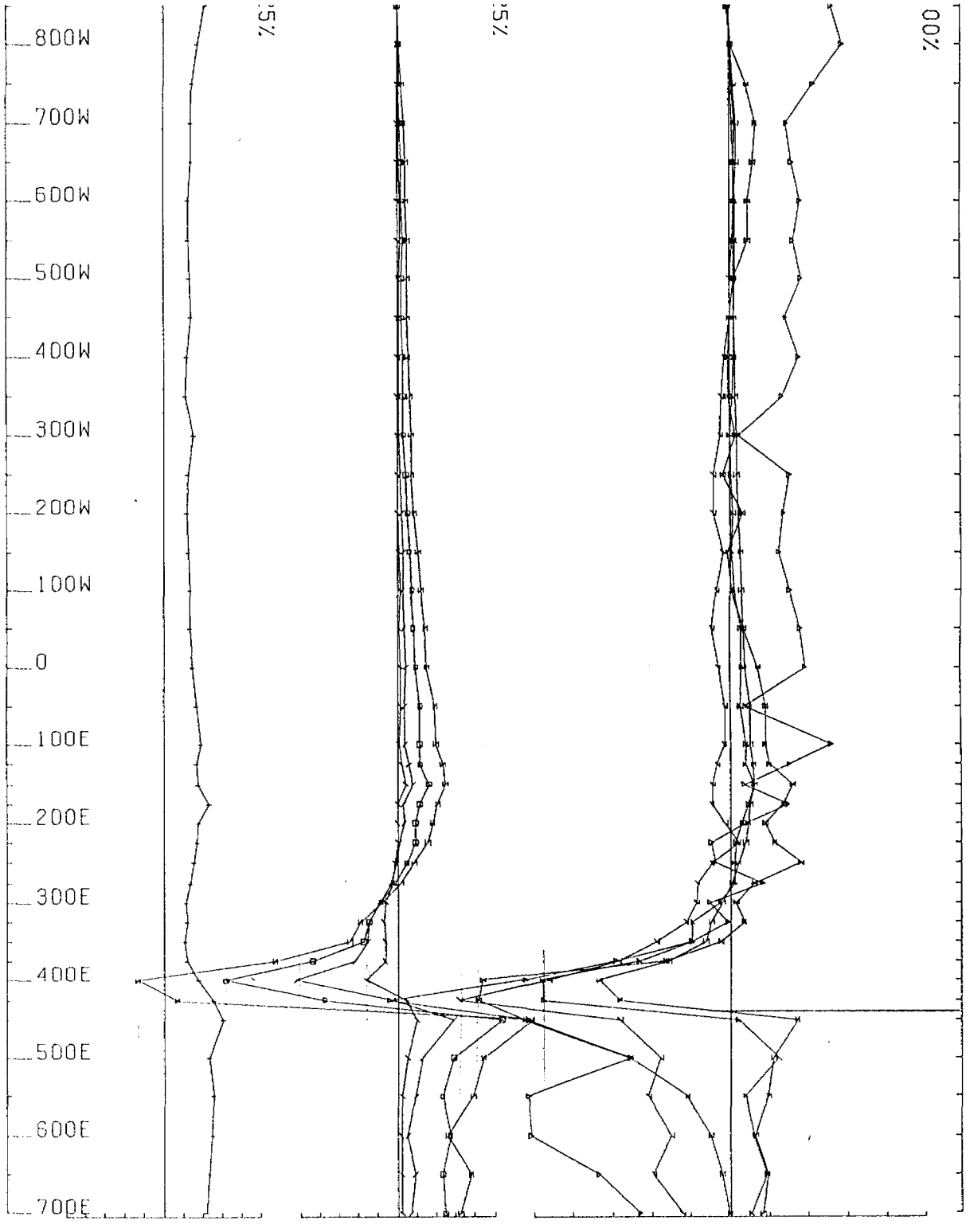
LOOP NO 3 LINE 200 S COMPONENT HX SECONDARY FIELD CH1 POINT NORM.



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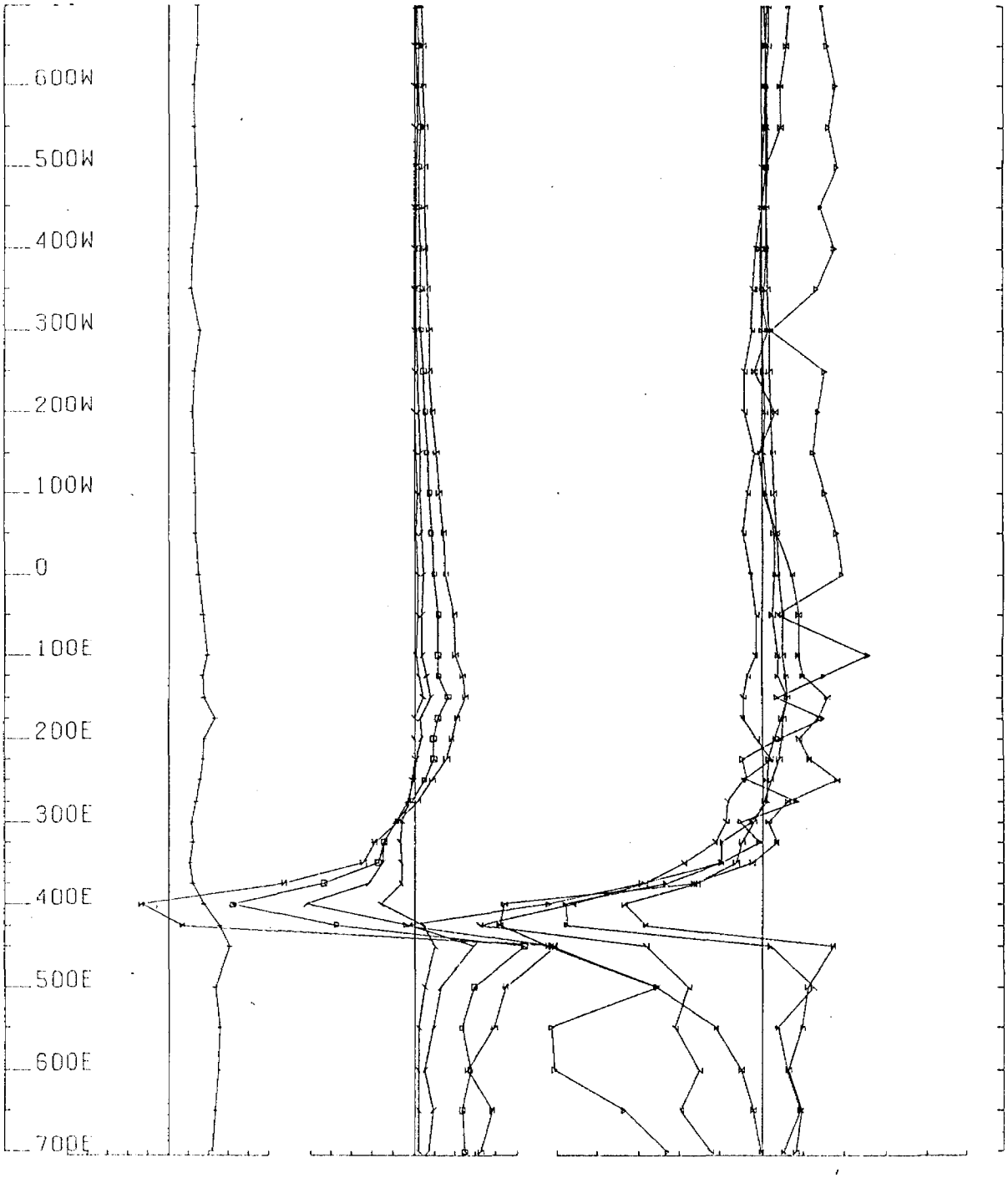

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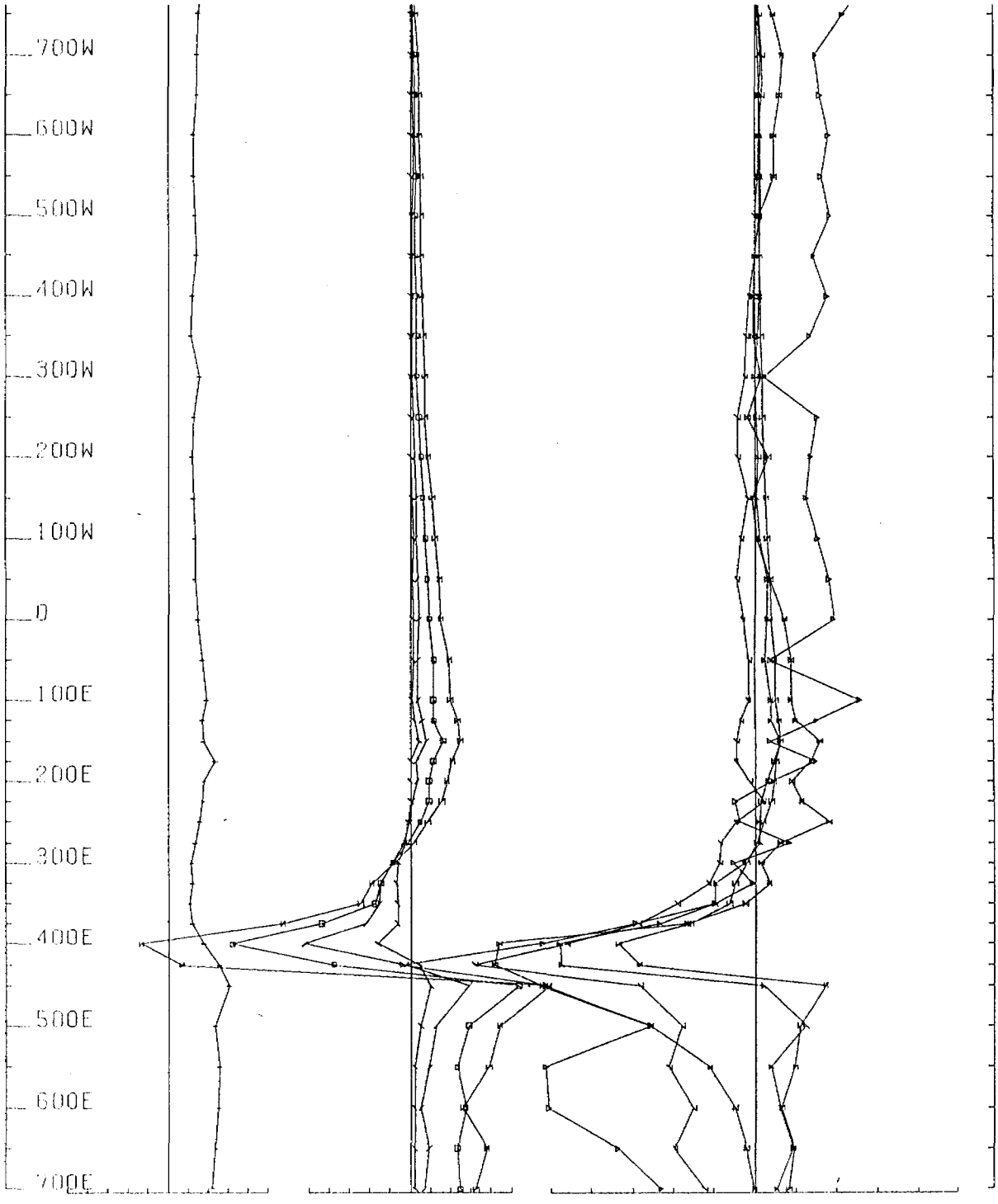
LOOP NO 3 LINE 200 S COMPONENT HZ SECONDARY FIELD CH1 CONTIN. NORM.



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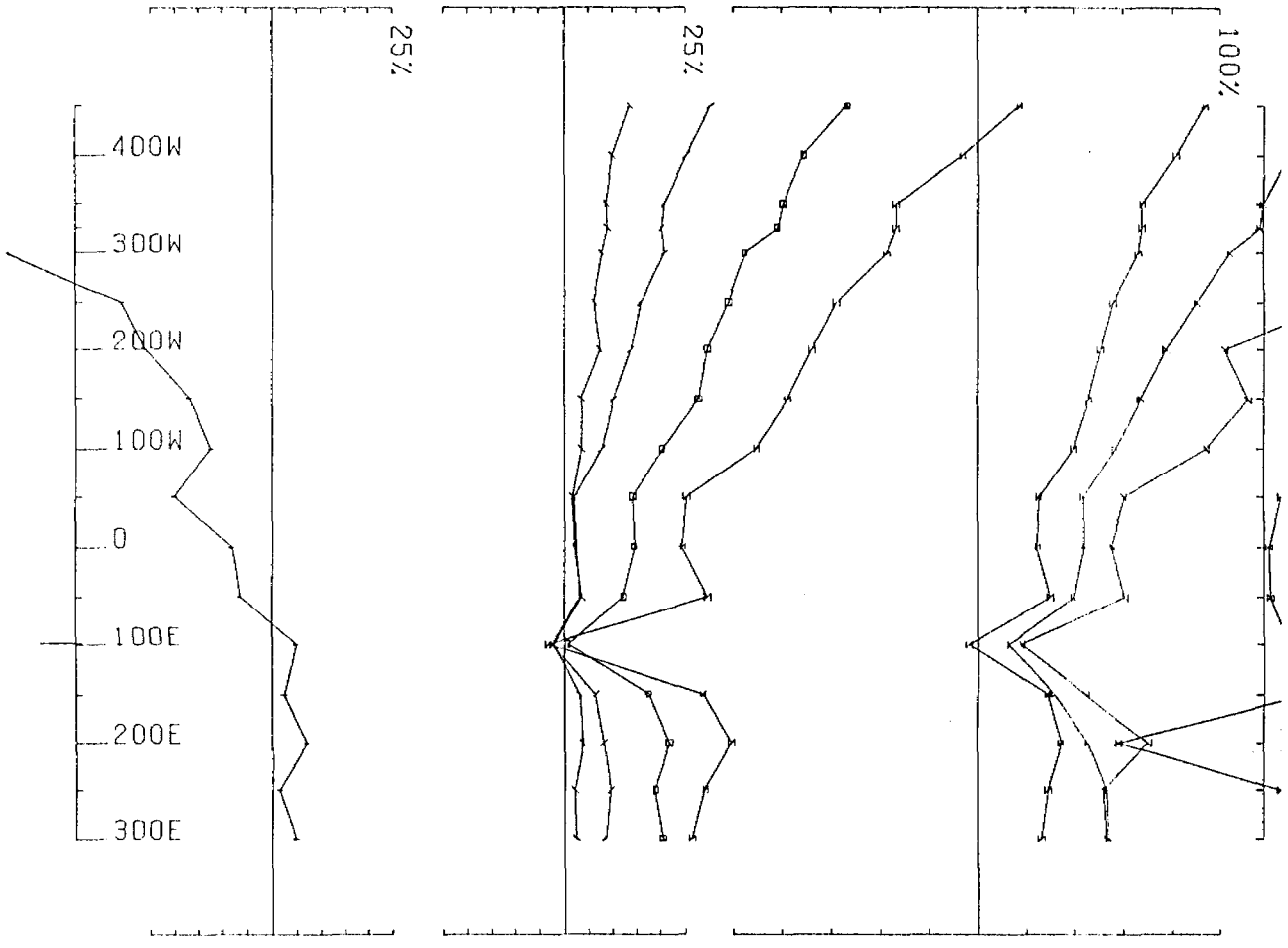
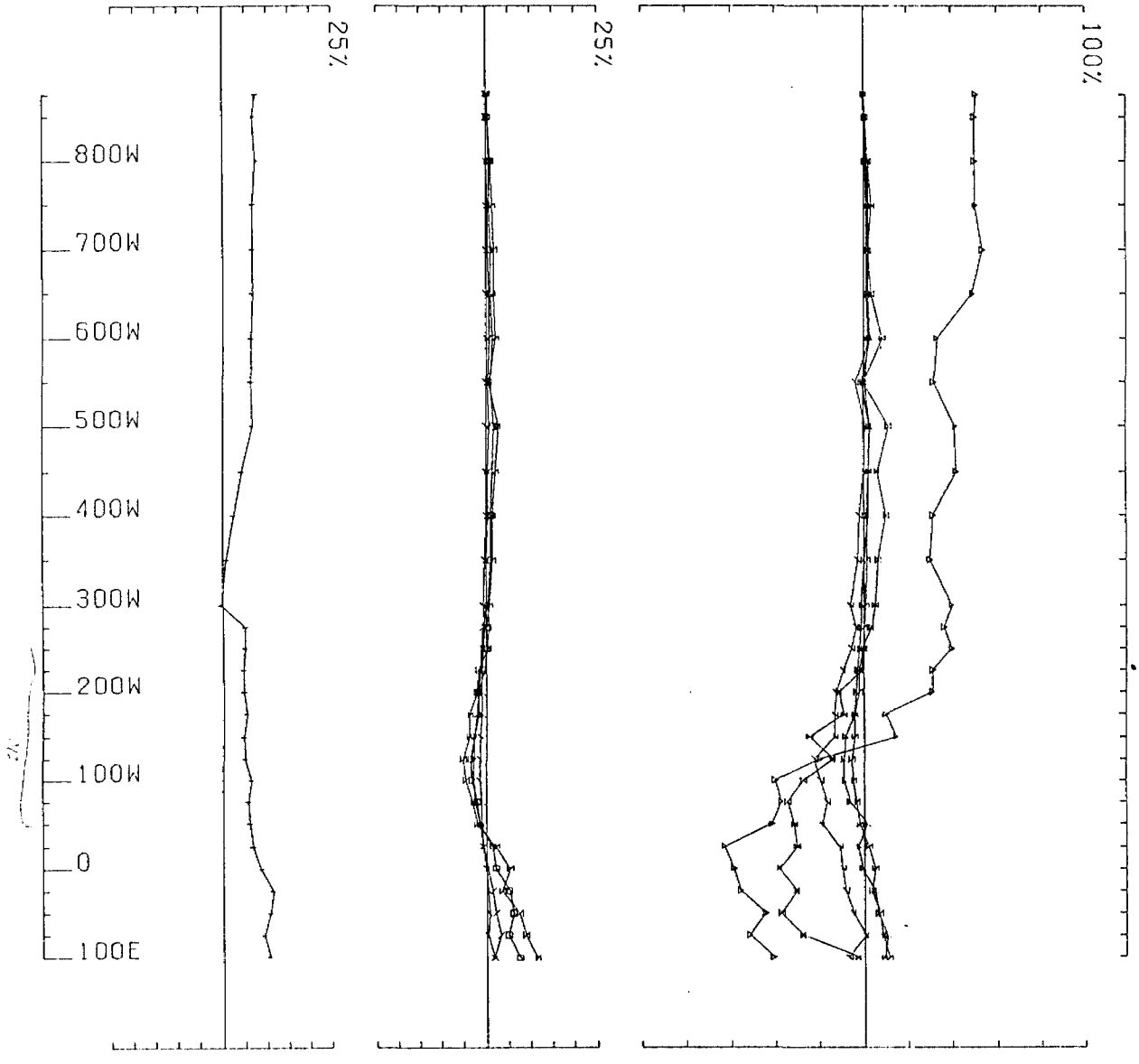
LOOP NO 3 LINE 200 S COMPONENT HZ SECONDARY FIELD CH1 CONTIN. NORM.



UTEM SURVEY AT SHUN PROJECT FOR COMINCO EXPLORATION <***

CONDUCTED BY LAMONTAGNE GEOPHYSICS LTD JOB 9016 BASE FREQ (HZ) 30.97

LOOP NO 3 LINE 400 S COMPONENT HX SECONDARY FIELD CH1 POINT NORM.



UTEM SURVEY AT SHUN PROJECT FOR COMINCO EXPLORATION
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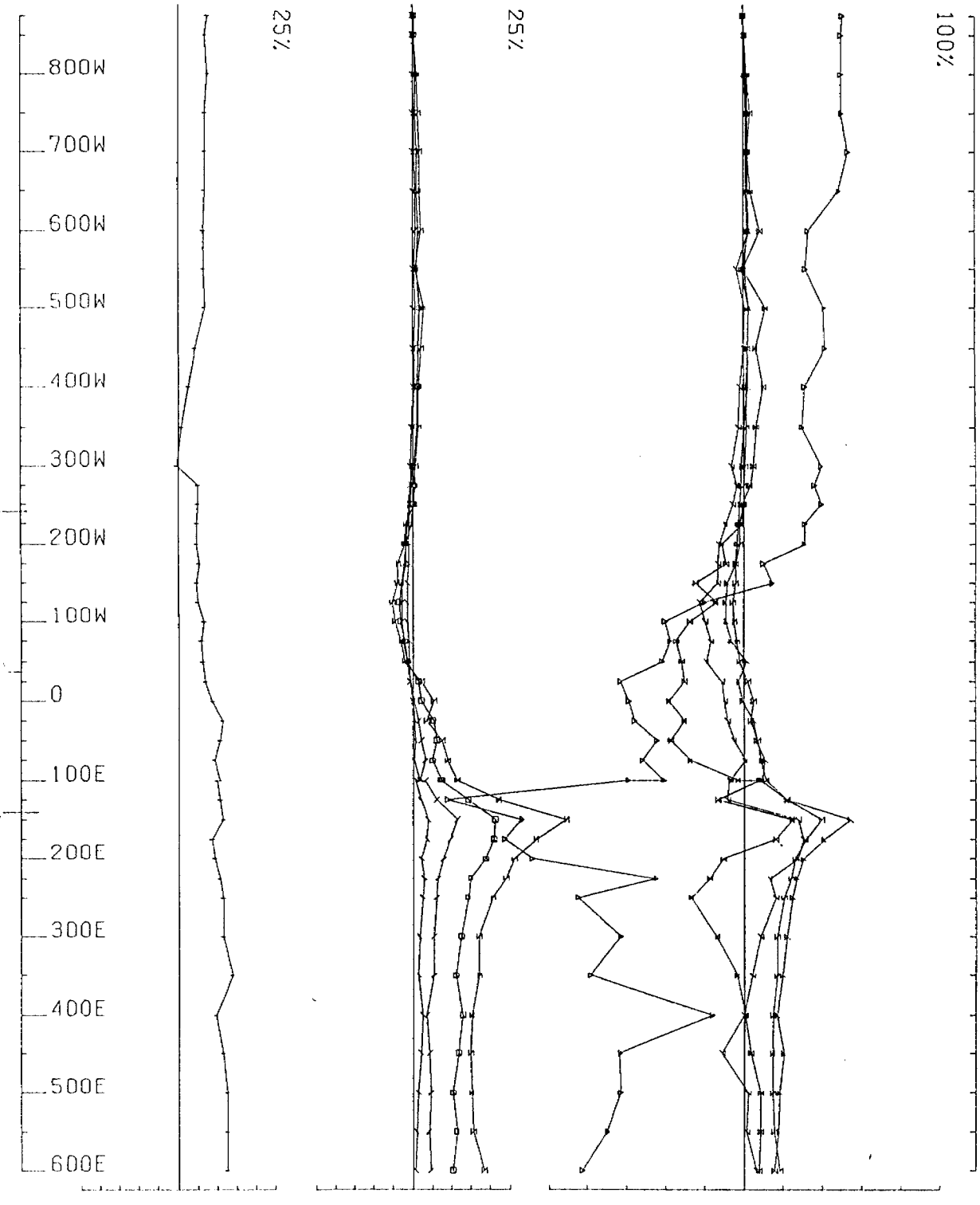
LOOP NO 3 LINE 600 S COMPONENT HZ SECONDARY FIELD CHI CONTIN. NORM.



UTEM SURVEY A1 SHUN PROJECT FOR COMINCO EXPLORATION
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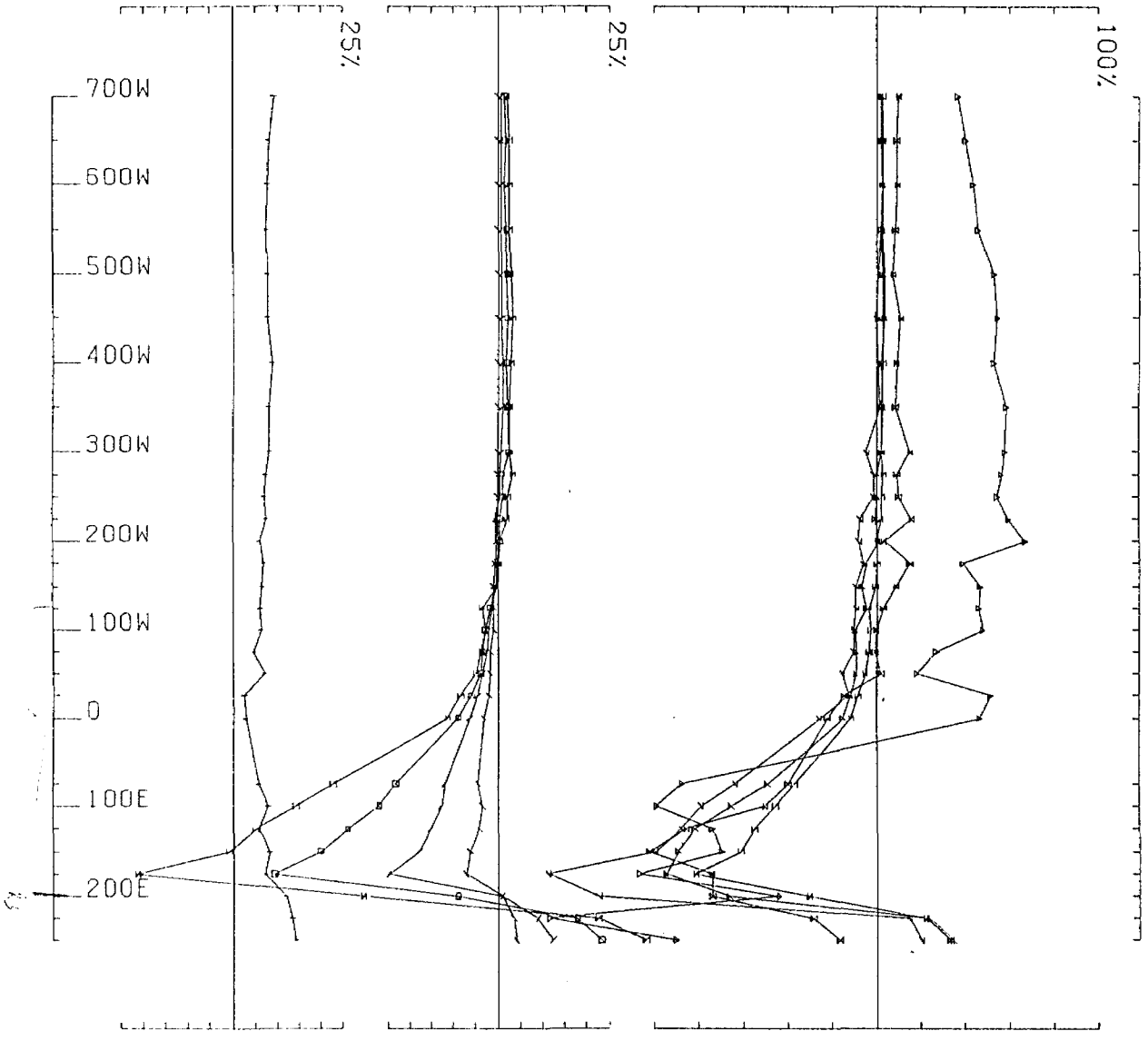
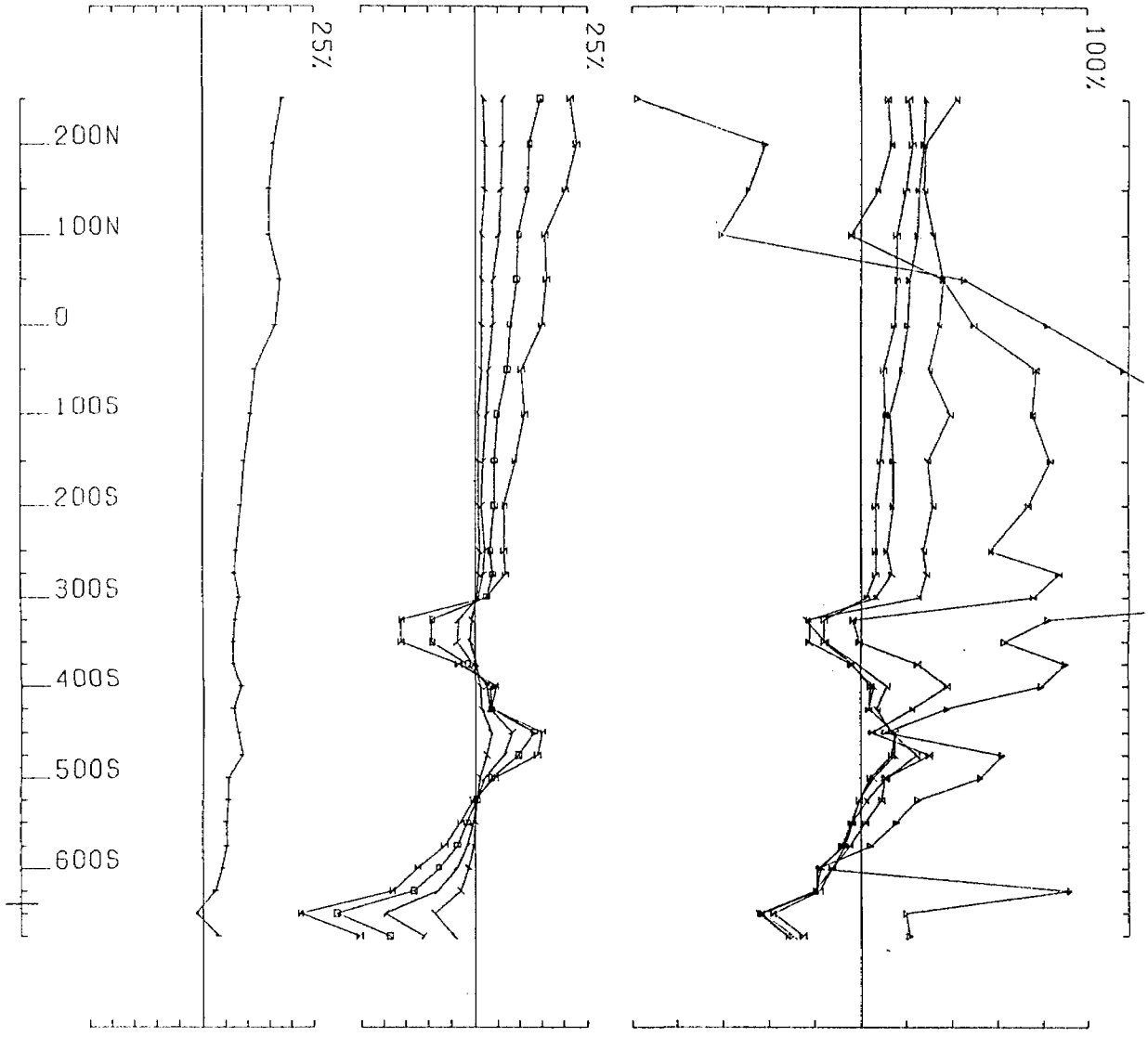
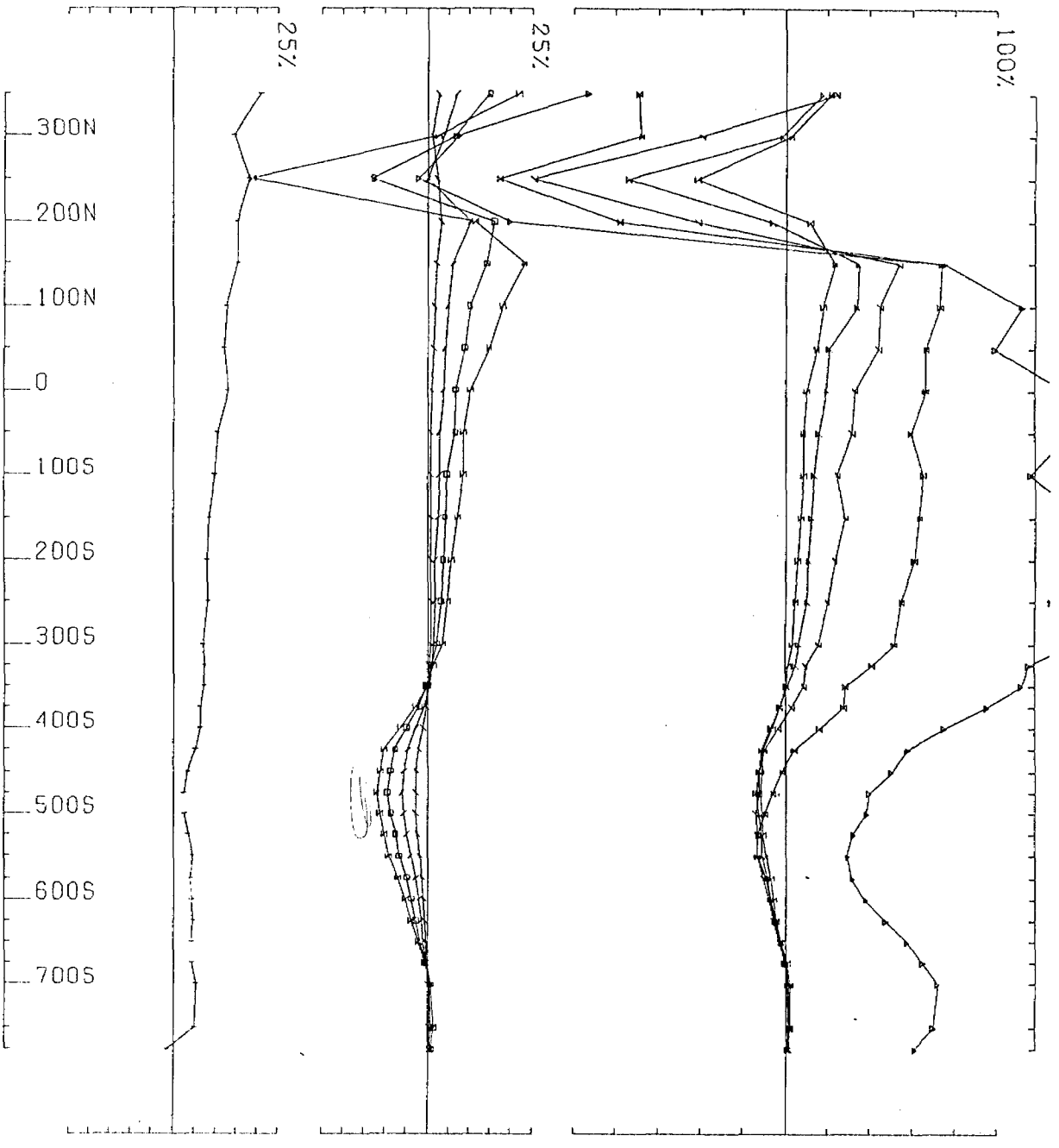


UTEM SURVEY AT SHUN PROJECT FOR COMINCO EXPLORATION
CONDUCTED BY LAMONTAGNE GEOPHYSICS LTD JOB 9016 BASE FREQ (HZ) 30.97
LOOP NO 3 LINE 800 S COMPONENT HZ SECONDARY FIELD CH1 CONTIN. NORM.



UTEM SURVEY AT SHUN GRID FOR COMINCO EXPLORATION
CONDUCTED BY LAMONTAGNE GEOPHYSICS LTD JOB 9010 BASE FREQ (HZ) 30.97
LOOP NO 4 LINE 100 E COMPONENT HZ SECONDARY FIELD CH1 CONTIN. NORM.



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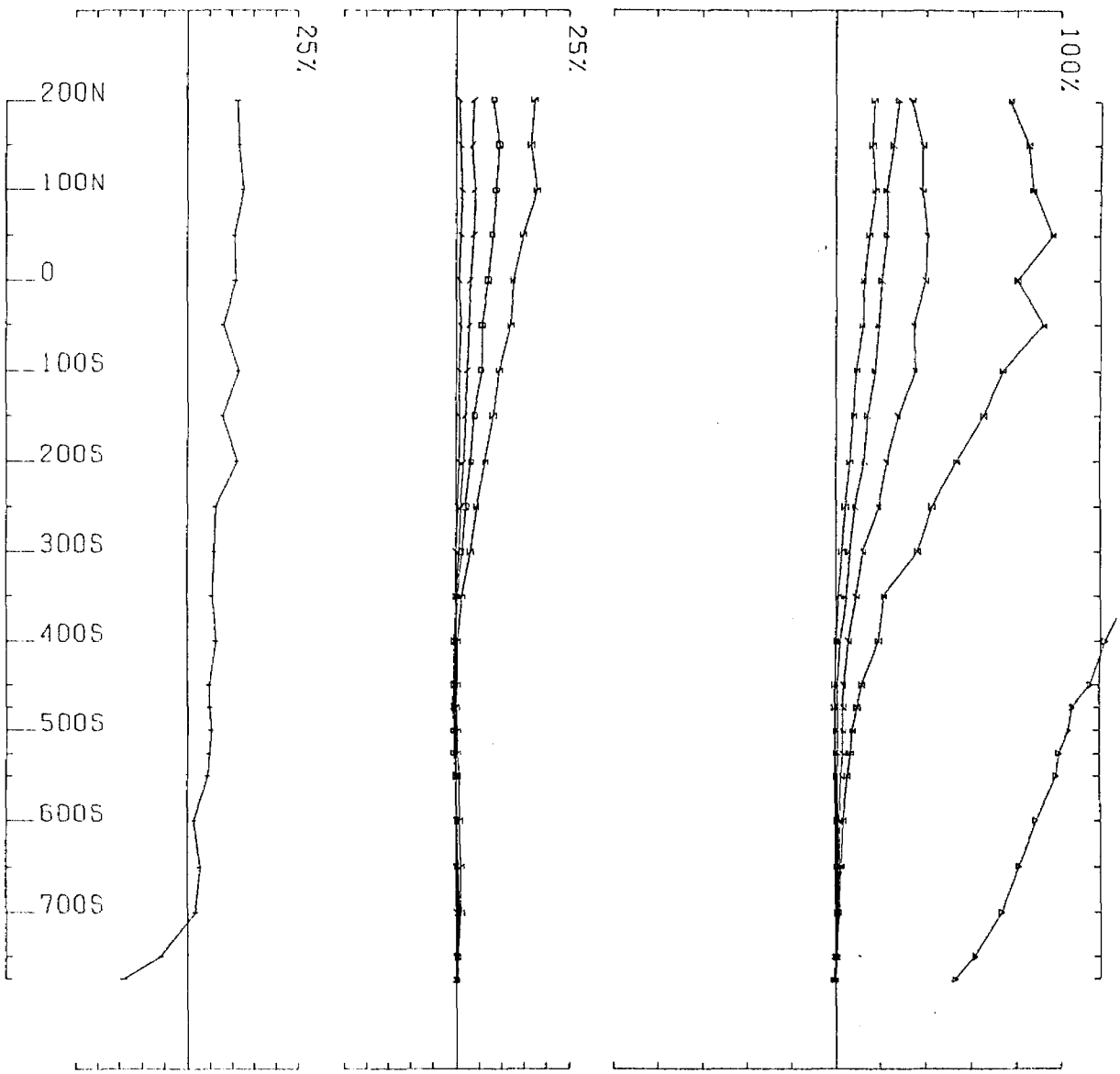
CONDUCTED BY LAMONTAGNE GEOPHYSICS LTD JOB 9016 BASE FREQ (HZ) 30.97
LOOP NO 4 LINE 100 W COMPONENT HZ SECONDARY FIELD - CH1 CONTIN. NORM.



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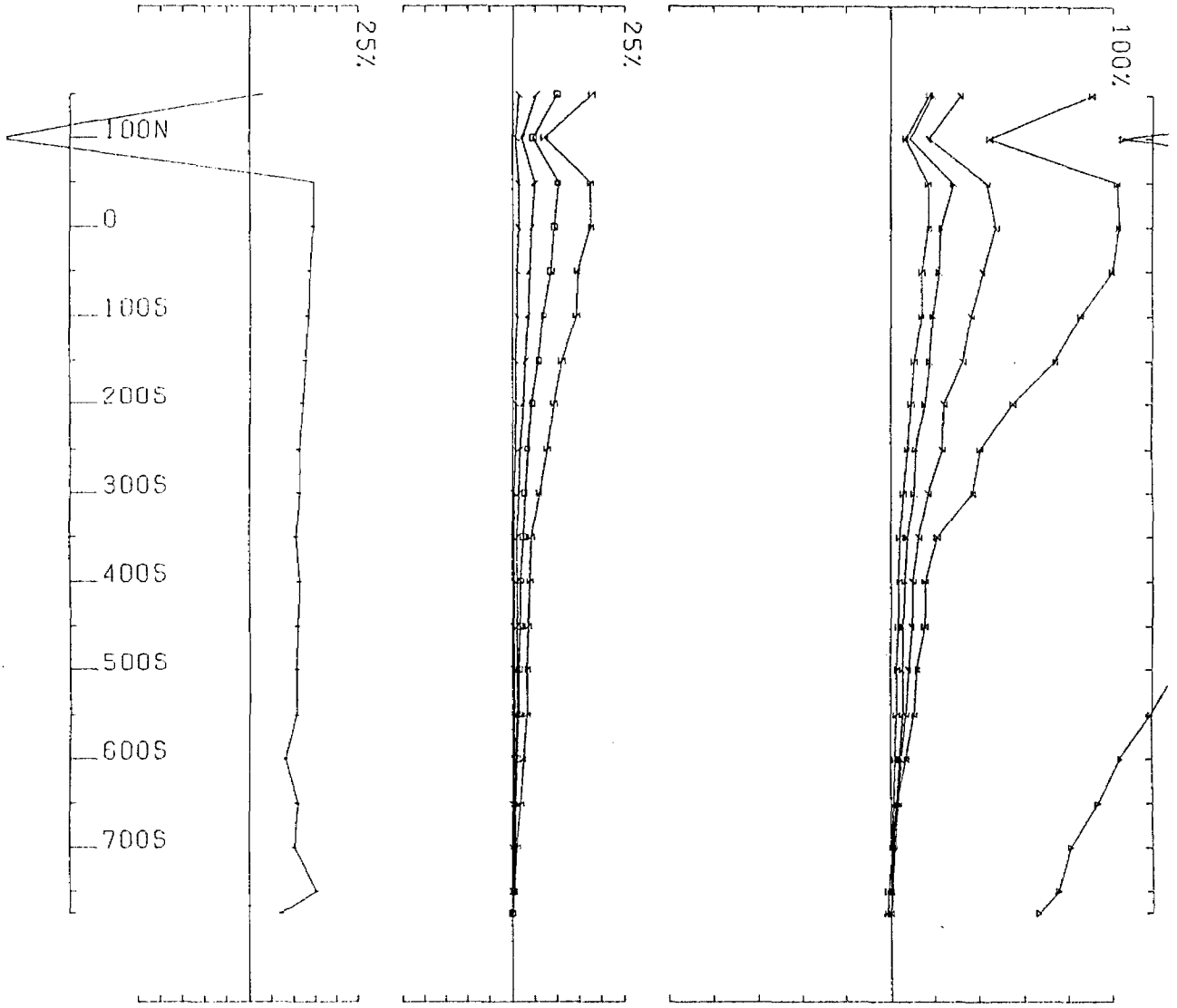
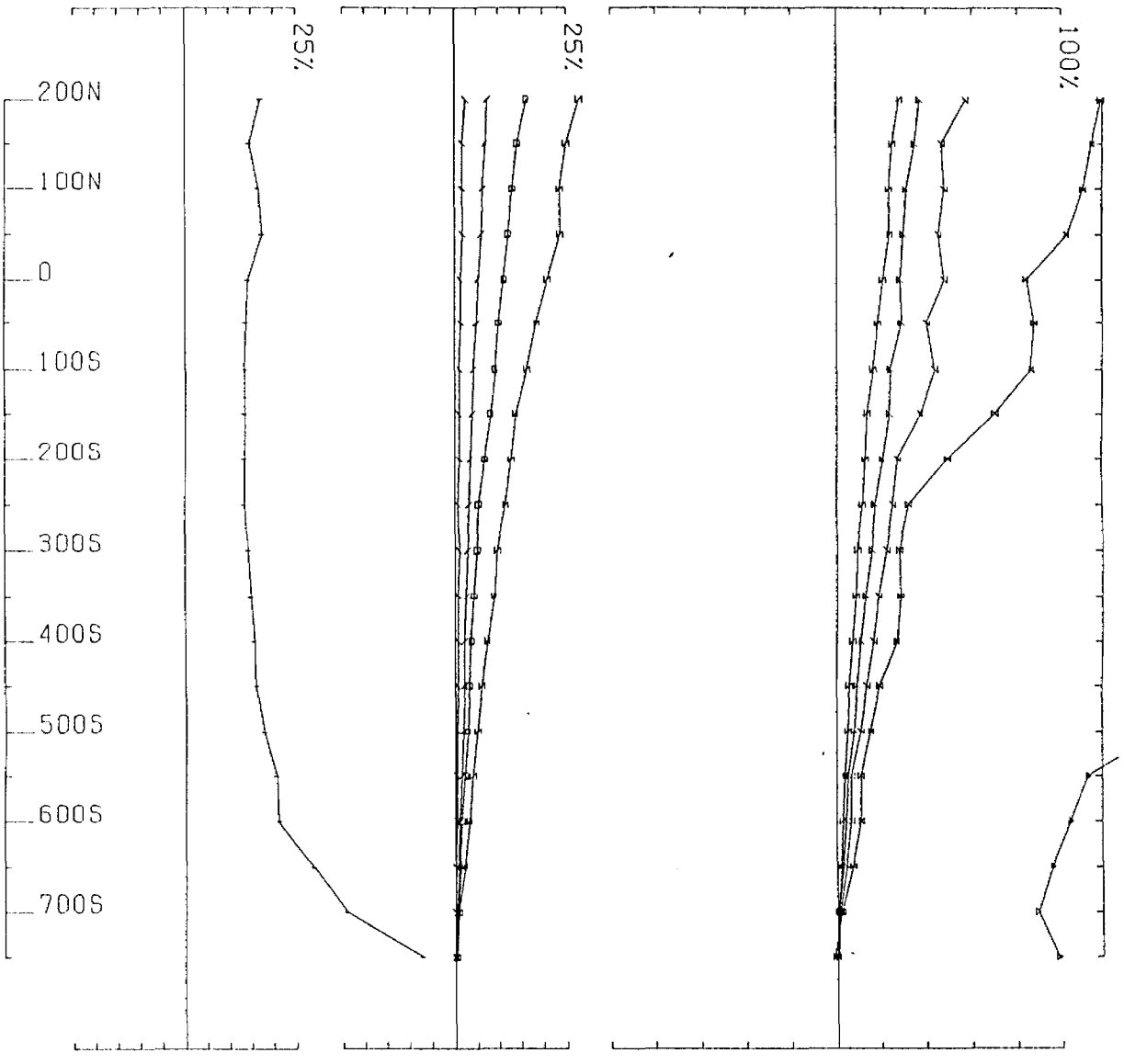
CONDUCTED BY LAMONTAGNE GEOPHYSICS LTD JOB 9016 BASE FREQ (HZ) 30.97
LOOP NO 4 LINE 300 W COMPONENT HZ SECONDARY FIELD CH1 CONTIN. NORM.



UTEM SURVEY AT SHUN GRID FOR COMINCO EXPLORATION
CONDUCTED BY LAMONTAGNE GEOPHYSICS LTD JOB 9016 BASE FREQ (HZ) 30.97
LOOP NO 4 LINE 500 W COMPONENT HZ SECONDARY FIELD CH1 CONTIN. NORM.



UTEM SURVEY AT SHUN GRID FOR COMINCO EXPLORATION
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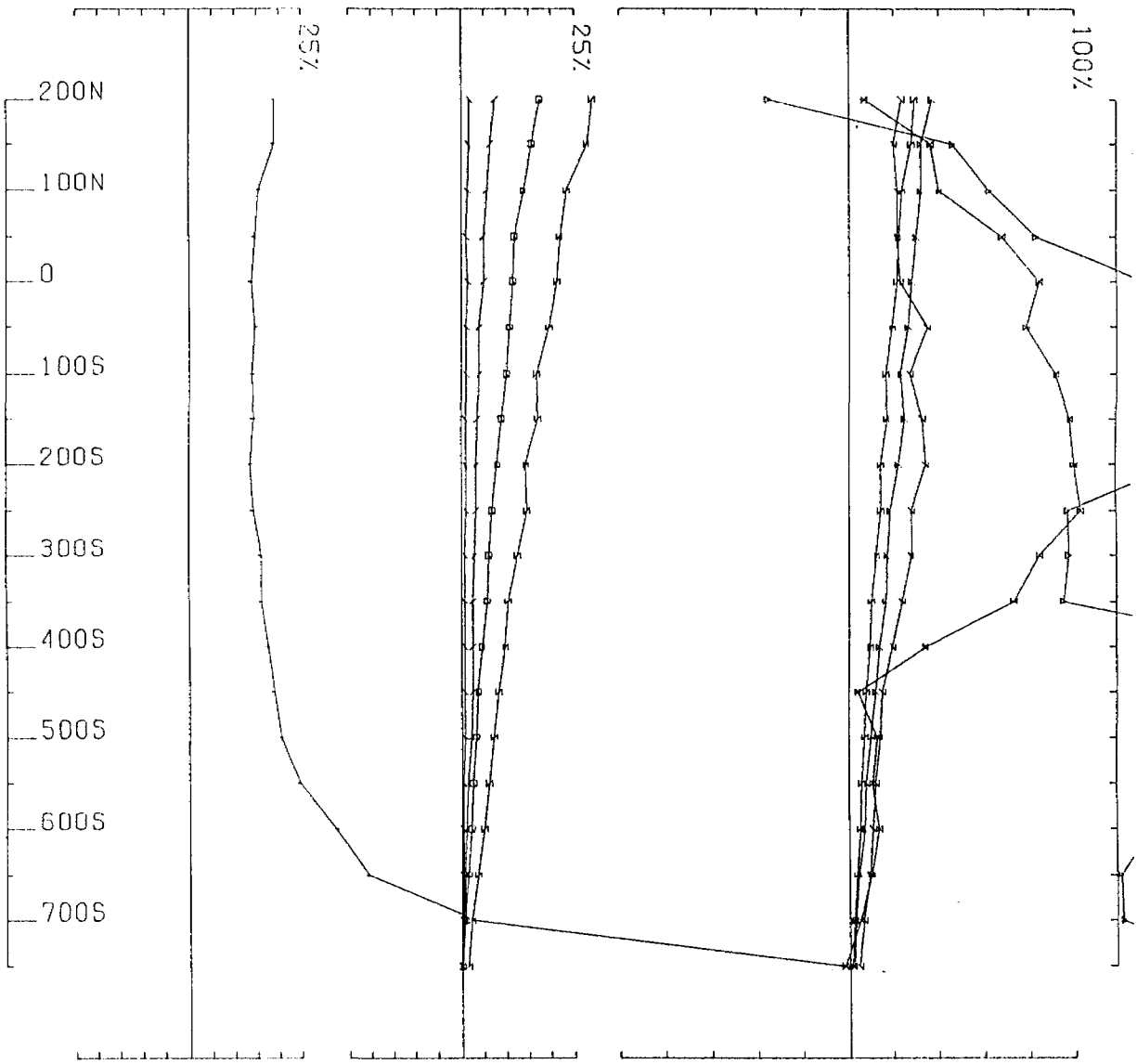
LOOP NO 4 LINE 700 W COMPONENT HZ SECONDARY FIELD CH1 CONTIN. NORM.



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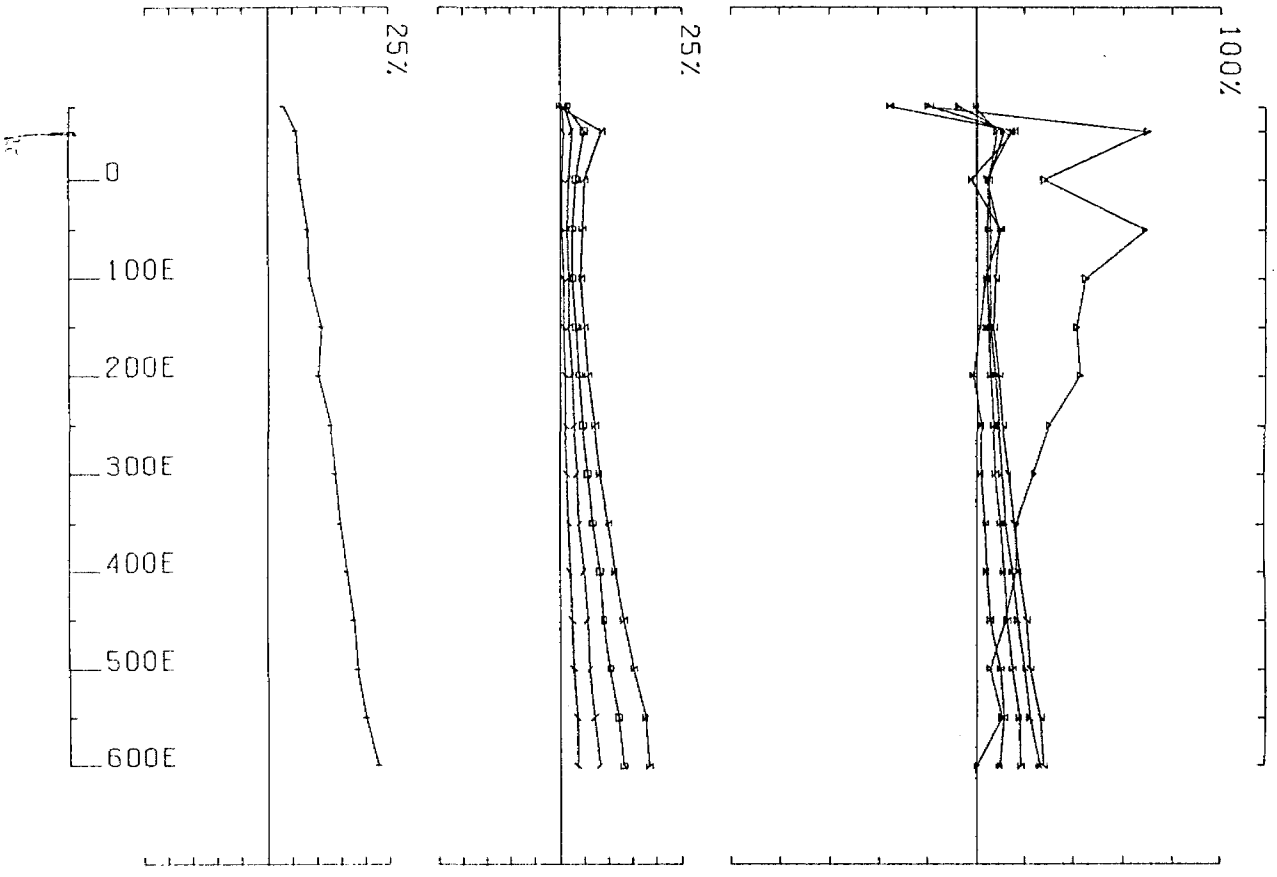
LOOP NO 4 LINE 900 W COMPONENT HZ SECONDARY FIELD CH1 CONTIN. NORM.



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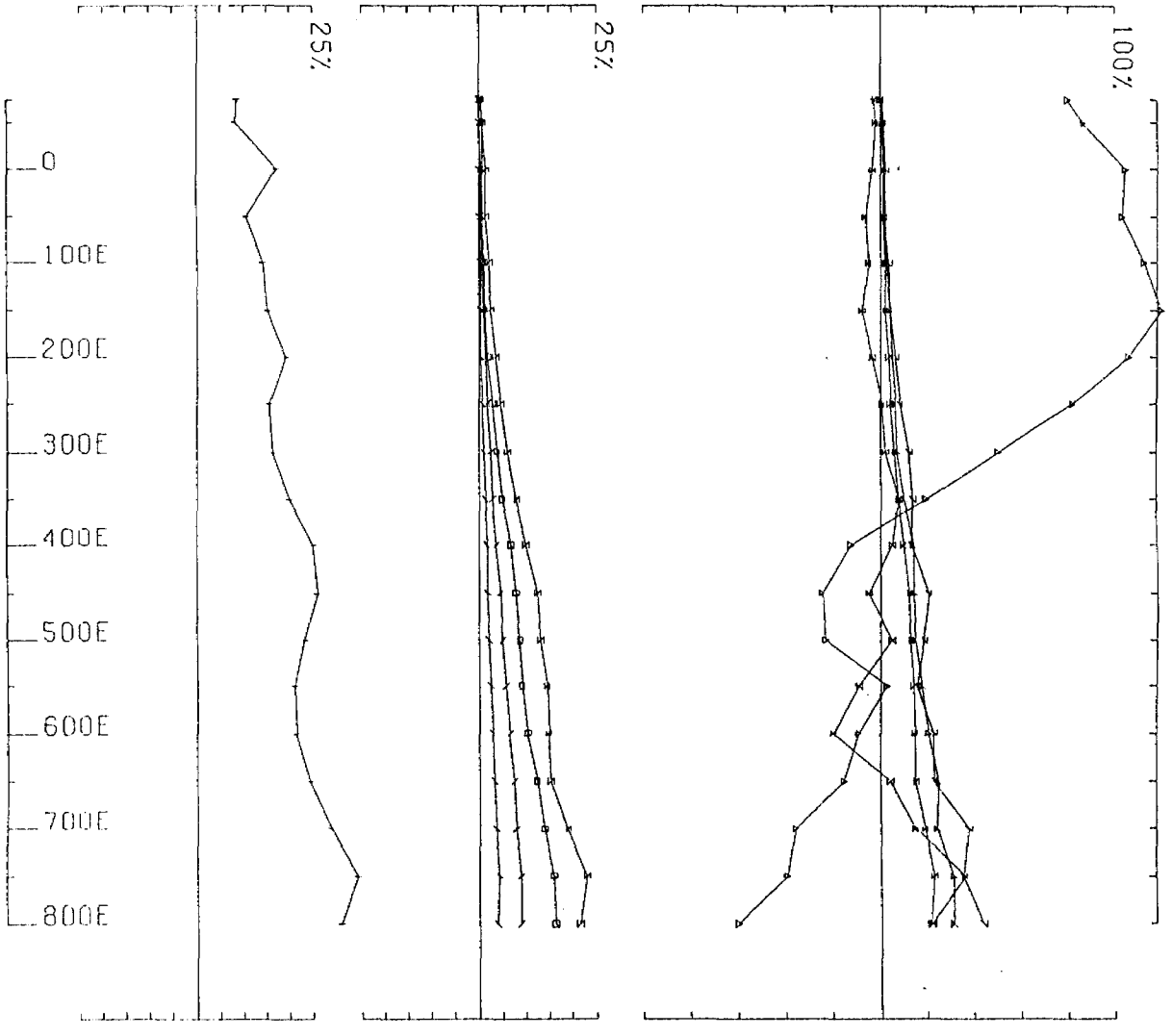
LOOP NO 5 LINE 200 N COMPONENT HZ SECONDARY FIELD CH1 CONTIN. NORM.



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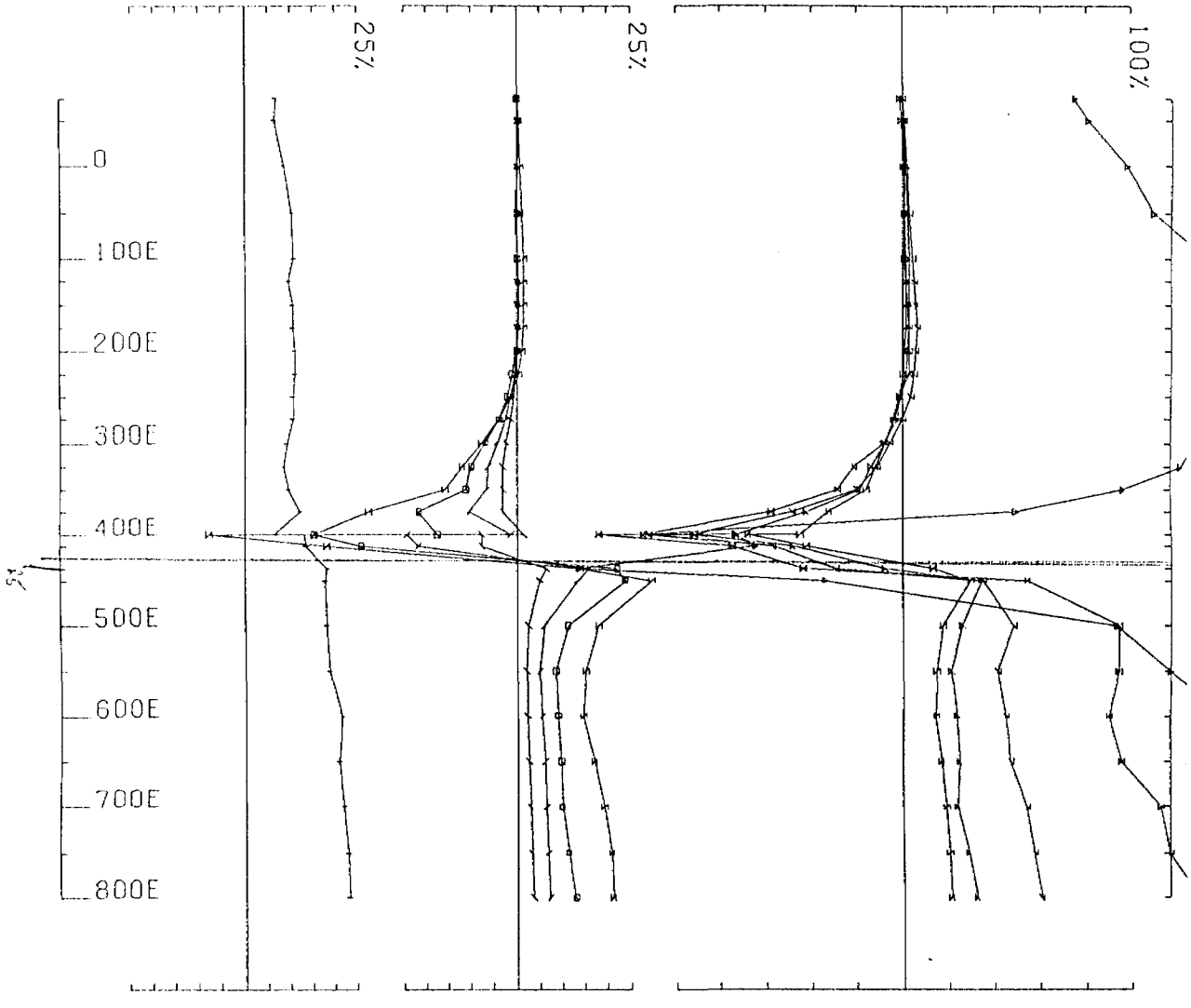
LOOP NO 5 LINE 0 N COMPONENT HZ SECONDARY FIELD CH1 CONTIN. NORM.



UTEM SURVEY AT SHUN GRID FOR COMINCO EXPLORATION
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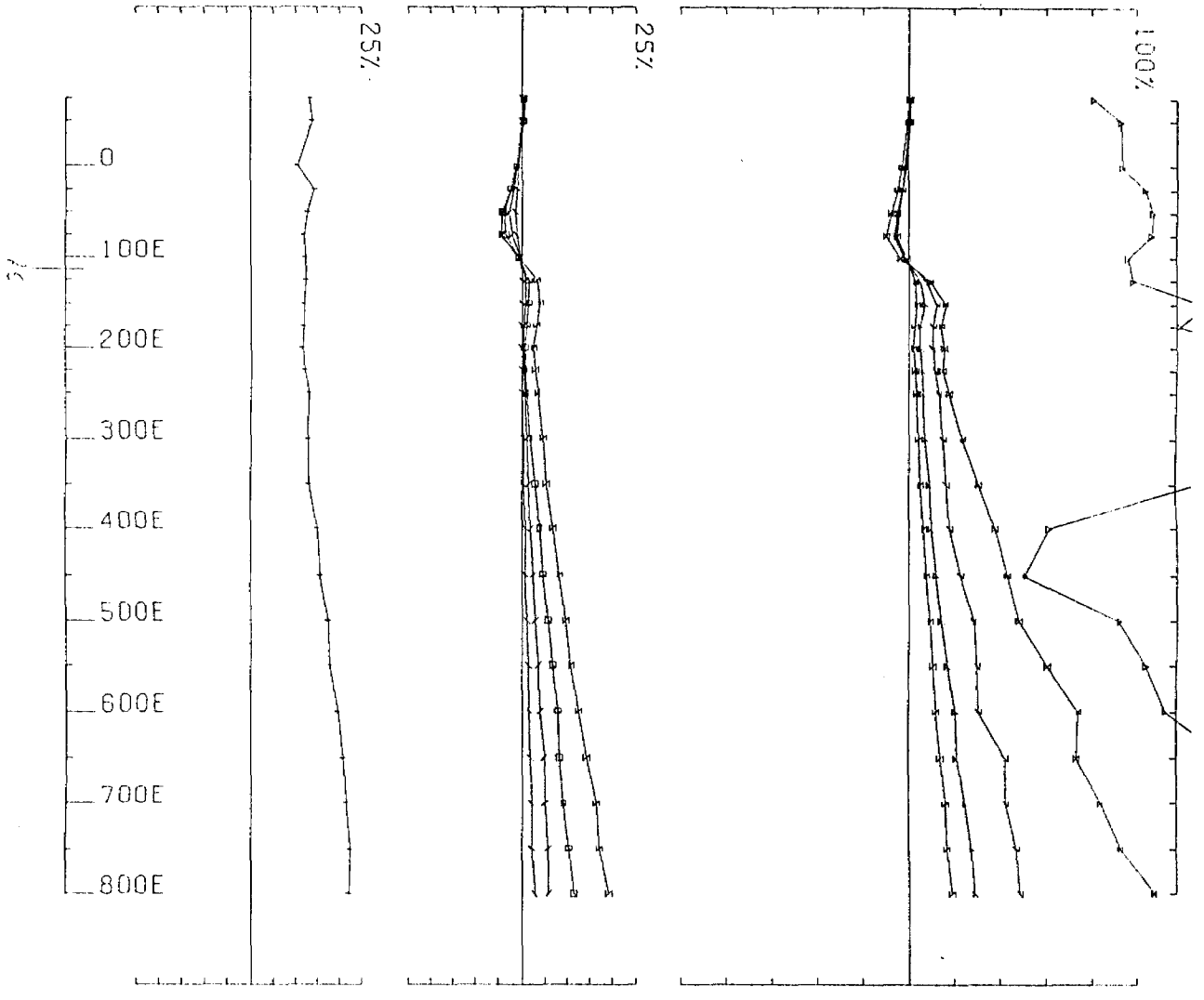
LOOP NO 5 LINE 200 S COMPONENT HZ SECONDARY FIELD CH1 CONTIN. NORM.



UTEM SURVEY AT SHUN GRID FOR COMINCO EXPLORATION
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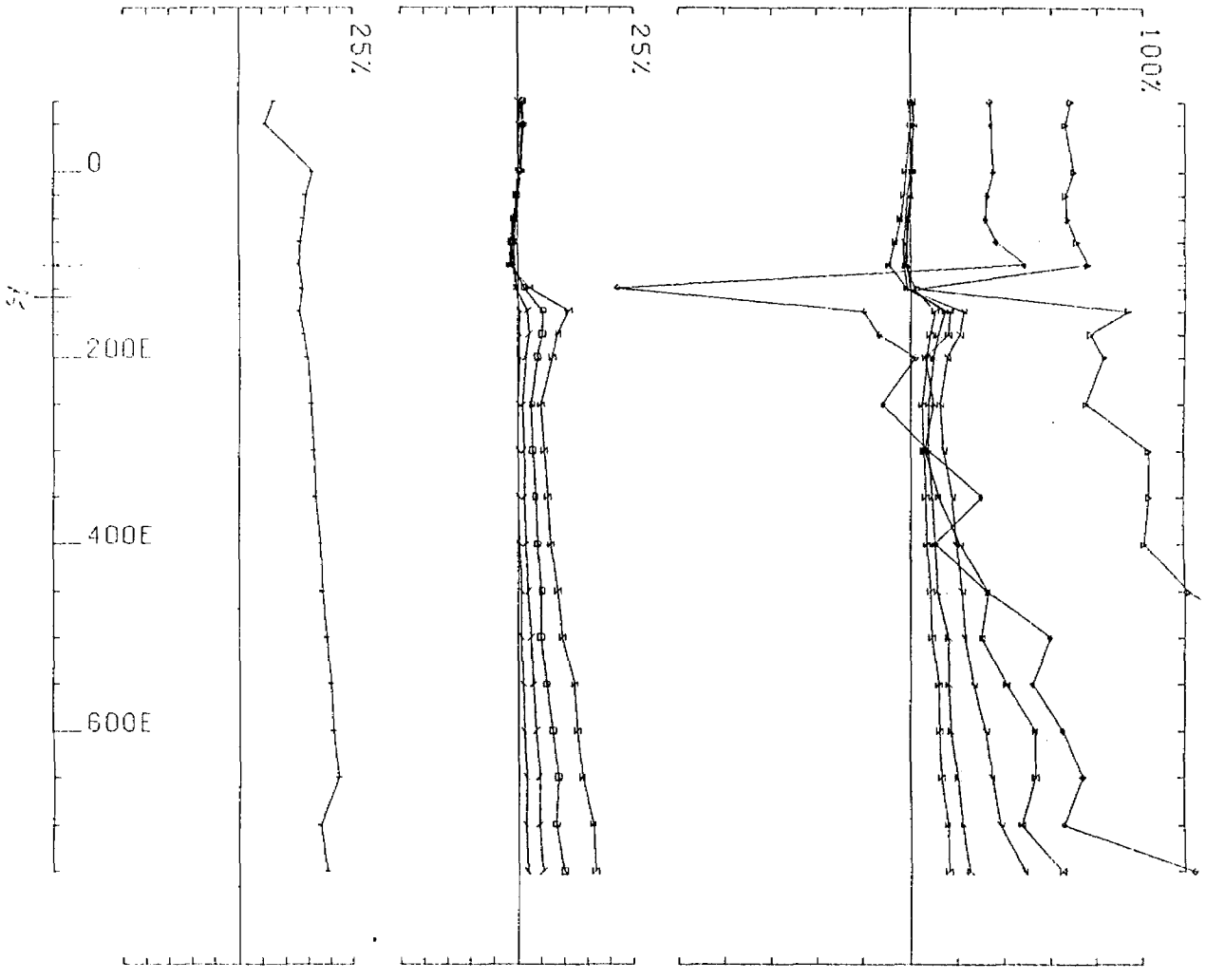
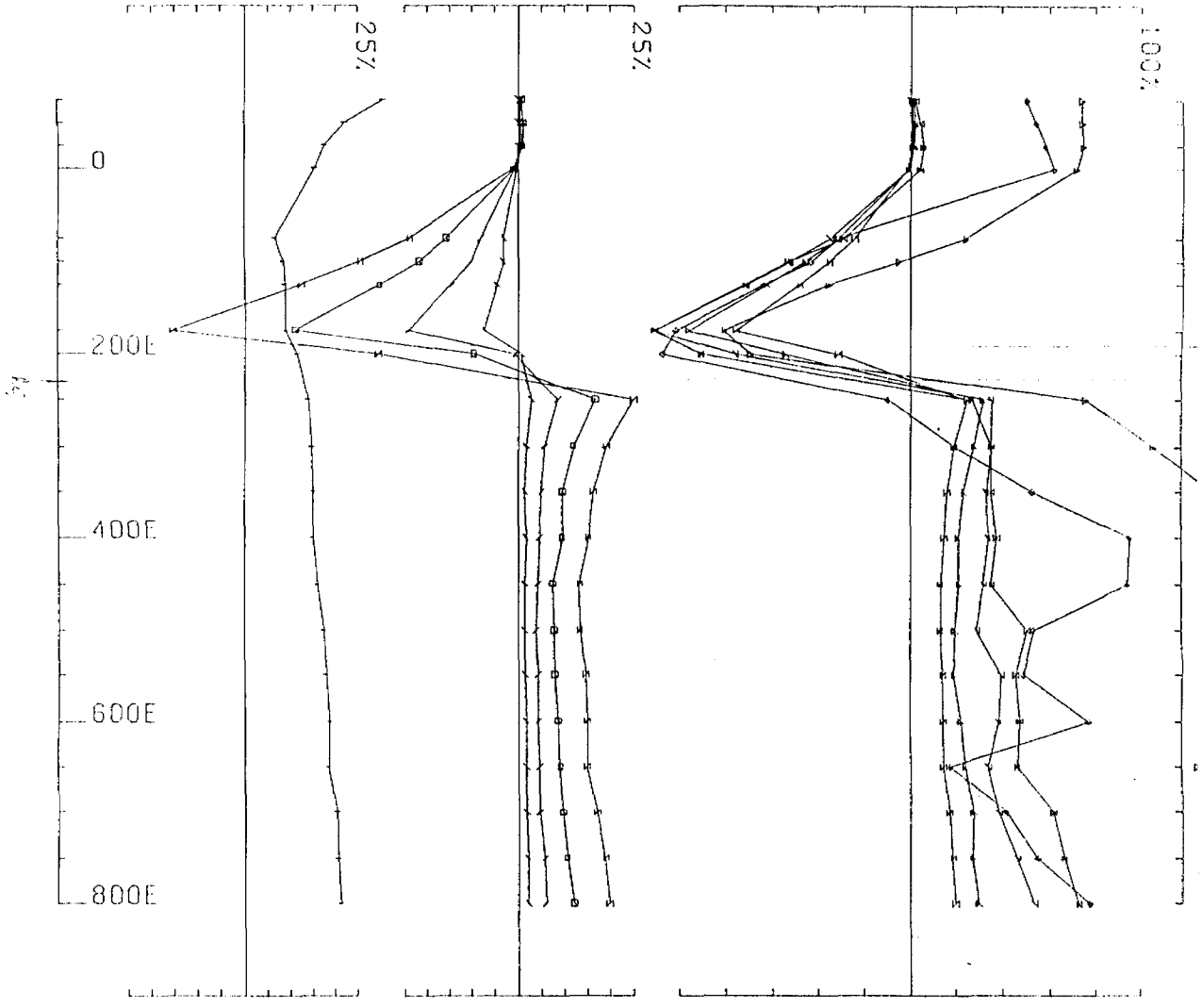
LOOP NO 5 LINE 400 S COMPONENT HZ SECONDARY FIELD CH1 CONTIN. NORM.



UTEM SURVEY AT SHUN GRID FOR COMINCO EXPLORATION
CONDUCTED BY LAMONTAGNE GEOPHYSICS LTD JOB 9016 BASE FREQ (HZ) 30.97
LOOP NO 5 LINE 600 S COMPONENT HZ SECONDARY FIELD CH1 CONTIN. NORM.



UTEM SURVEY AT SHUN GRID FOR COMINCO EXPLORATION
CONDUCTED BY LAMONTAGNE GEOPHYSICS LTD JOB 9016 BASE FREQ (HZ) 30.97
LOOP NO 5 LINE 800 S COMPONENT HZ SECONDARY FIELD CH1 CONTIN. NORM.

File 2.13564

Logistics Report
an a UTEM Survey at
Shun Lake, Ontario
for
Cominco Ltd.

SUMMARY

In July of 1990, some 31.4 kilometres of UTEM data were collected on the Shun property. The work was carried out by Lamontagne Geophysics Limited on behalf of Cominco Ltd. The UTEM survey was successful in delineating a shallow west plunging folded conductive zone.

CONCLUSIONS

The results of the UTEM survey outlined a folded conductive zone which plunges west at a shallow angle. This zone appears to have a down dip extent of at least 400 to 500 metres. The conductivities are strongest near surface, but diminishes significantly at depth.

Ontario

900

Ministry of
Northern Development
and Mines

Ministère du
Développement du Nord
et des Mines

Mining Lands Section
159 Cedar Street, 4th Floor
SUDBURY, Ontario
P3E 6A5

Telephone: (705) 670-7264
Fax: (705) 670-7262

Your File: W9006.60496
Our File : 2.13564

January 22, 1991

Mining Recorder
Ministry of Northern Development and Mines
60 Wilson Avenue
TIMMINS, Ontario
P4N 2S7

Dear Madam/Sir:

RE: Notice of Intent dated December 19, 1990 for Geophysical (UTEM) Survey submitted on Mining Claim P 1116718 et al in Cunningham Township.

The assessment work credits, as listed with the above mentioned Notice of Intent have been approved as of the above date.

Please inform the recorded holder of these mining claims and so indicate on your records.

Yours sincerely

R. C. Gashinski
Provincial Manager, Mining Lands
Mines and Minerals Division

LJS/dvl
Enclosure

cc: Mr. W. D. Tieman
Mining and Lands Commissioner
Toronto, Ontario

Resident Geologist
Timmins, Ontario

Cominco Ltd.
Toronto, Ontario

James Macnae
Toronto, Ontario

Ministry of Northern Development and Mines
Ontario

Technical Assessment Work Credits

File: 2.13564

Date: Dec. 19/90

Mining Recorder's Report of Work No.: W9006.60496

Recorded Holder: Cominco Ltd.

Township or Area: Cunningham

Type of survey and number of Assessment days credit per claim	Mining Claims Assessed
Geophysical	P 1116718 to 727 incl. 1116731 - 32 1116734 to 737 incl. 1116739 - 40
Electromagnetic _____ days	
Magnetometer _____ days	
Radiometric _____ days	
Induced polarization _____ days	
Other UTEM 14.6 days	
Section 77 (19) See "Mining Claims Assessed" column	
Geological _____ days	
Geochemical _____ days	
Man days ☐ Airborne ☐	
Special provision ☒ Ground ☒	
☒ Credits have been reduced because of partial coverage of claims.	Credits may be reduced by Mining Recorder if maximum of 80 days geophysical credits have been reached.
☐ Credits have been reduced because of corrections to work dates and figures of applicant.	

Special credits under section 77 (16) for the following mining claims

No credits have been allowed for the following mining claims

☐ not sufficiently covered by the survey ☐ Insufficient technical data filed

The Mining Recorder may reduce the above credits if necessary in order that the total number of approved assessment days recorded on each claim does not exceed the maximum allowed as follows: Geophysical - 80; Geologocal - 40; Geochemical - 40; Section 77(19) - 60.

Ministry of Northern Development and Mines

Ontario

2.13564

Report of Work (Geophysical, Geological and Geochemical Surveys)

DOCUMENT No. W9006·60496

Mining Act

Instructions
- Please type or print.
- Refer to Section 77, the Mining Act for assessment work requirements and maximum credits allowed per survey type.
- If number of mining claims traversed exceeds space on this form, attach a list.
- Technical Reports and maps in duplicate should be submitted to Mining Lands Section, Mineral Development and Lands Branch.

Type of Survey(s)	Mining Division	Township or Area
UTEM	Porcupine	Cunningham

Recorded Holder(s)	Prospector's Licence No.
Cominco Ltd. 2.13564	A 10043

Address	Telephone No.
2200- 120 Adelaide St. West Toronto, Ontario M5H 1T1	869-1850

Survey Company: Lamontagne Geophysics Ltd. - 24 Mowat Ave Toronto, Ontario M6K 3J4

Name and Address of Author (of Geo-Technical Report): James Macnae - as above

Date of Survey (from & to): Day 05 Mo 07 Yr 90 — Day 14 Mo 07 Yr 90

Credits Requested per Each Claim in Columns at right

Special Provisions		Days per Claim
For first survey: Enter 40 days. (This includes line cutting)	Geophysical · Electromagnetic	
	Geophysical · Magnetometer	
For each additional survey: using the same grid: Enter 20 days (for each)	Geophysical · Other UTEM	20
	Geological	
	Geochemical	
Man Days Complete reverse side and enter total(s) here	Geophysical	Days per Claim
	Geophysical · Electromagnetic	
	Geophysical · Magnetometer	
	Geophysical · Other	
	Geological	
	Geochemical	
Airborne Credits Note: Special provisions credits do not apply to Airborne Surveys.		Days per Claim
	Electromagnetic	
	Magnetometer	
	Other	
Total miles flown over claim(s).		

Date: Sept. 20/90 — Recorded Holder or Agent (Signature): R.C. LaRoche

Mining Claims Traversed (List in numerical sequence)

Mining Claim Prefix	Mining Claim Number	Mining Claim Prefix	Mining Claim Number	Mining Claim Prefix	Mining Claim Number
P	1116718	P	1116740		
P	1116719				
P	~~1116720~~	MAX REACHED			
P	~~1116721~~	MAX REACHED			
P	~~1116722~~	MAX REACHED			
P	~~1116723~~				
P	1116724				
P	1116725				
P	~~1116726~~	MAX REACHED			
P	1116727				
P	1116731				
P	1116732				
P	1116734				
P	1116735				
P	~~1116736~~				
P	1116737				
P	1116739				

RECEIVED OCT 22 1990 MINING LANDS SECTION

RECORDED SEP 28 1990

Total number of mining claims covered by this report of work: 18

Certification Verifying Report of Work

I hereby certify that I have a personal and intimate knowledge of the facts set forth in this Report of Work, having performed the work or witnessed same during and/or after its completion and annexed report is true.

Name and Address of Person Certifying: R.C. LaRoche -2200 - 120 Adelaide St. West, Toronto, Ontario M5H 1T1

Telephone No.: 416-869-1850 — Date: Sept. 20/90 — Certified By (Signature): R.C. LaRoche

For Office Use Only

" ACT6 "

Total Days Cr. Recorded	Date Recorded	Mining Recorder
280	SEPT 28/90	Robert Bowling
	Date Approved as Recorded	Provincial Manager, Mining Lands
	See revised work statement.	

Received Stamp: RECEIVED SEP 28 1990