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2.15112

ASSESSMENT REPORT ON GROUND ELECTROMAGNETIC GEOPHYSICAL SURVEY CASSELS AND STRATHY TOWNSHIPS (BOOT BAY/MANDERSTROM PROJECT)

Qual. This Report
2.15112

By

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TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

PROPERTY

The survey was performed on a cut grid covering parts of Strathy and Cassels Townships, Sudbury Mining Division. The grid and geophysical survey are underlain by the following claims which form a contiguous block:

Strathy Twp.	Cassels Twp.			
S1186032	S1186007	S1186021	S1186035	S494573
S1186034	S1186008	S1186022	S1186036	S494574
S1186038	S1186011	S1186023	S1186037	S494575
	S1186012	S1186024	S494564	S494576
	S1186013	S1186025	S494565	S494577
	S1186014	S1186026	S494566	S494578
	S1186015	S1186027	S494567	
	S1186016	S1186028	S494568	
	S1186017	S1186029	S494569	
	S1186018	S1186030	S494570	
	S1186019	S1186031	S494571	
	S1186020	S1186033	S494572	

These claims are owned by Falconbridge Limited, whose head office is located at Suite 1200, 95 Wellington Street West, Toronto, Ontario, M5J 2V4.

LOCATION AND ACCESS

The claim block encompasses the border between Strathy and Cassels Townships, with the majority in Cassels Township and 3 claims in Strathy Township (Figure 1 & 2). The property is located 3.5 km NE of the town of Temagami. During the summer months the area can be accessed by a 2-wheel drive truck via a 4 km dirt road parallel to the northwest shore of Cassels Lake, or alternatively by boat across Net Lake. In the winter the above routes may be traversed by snowmobile, as was the case for this survey.

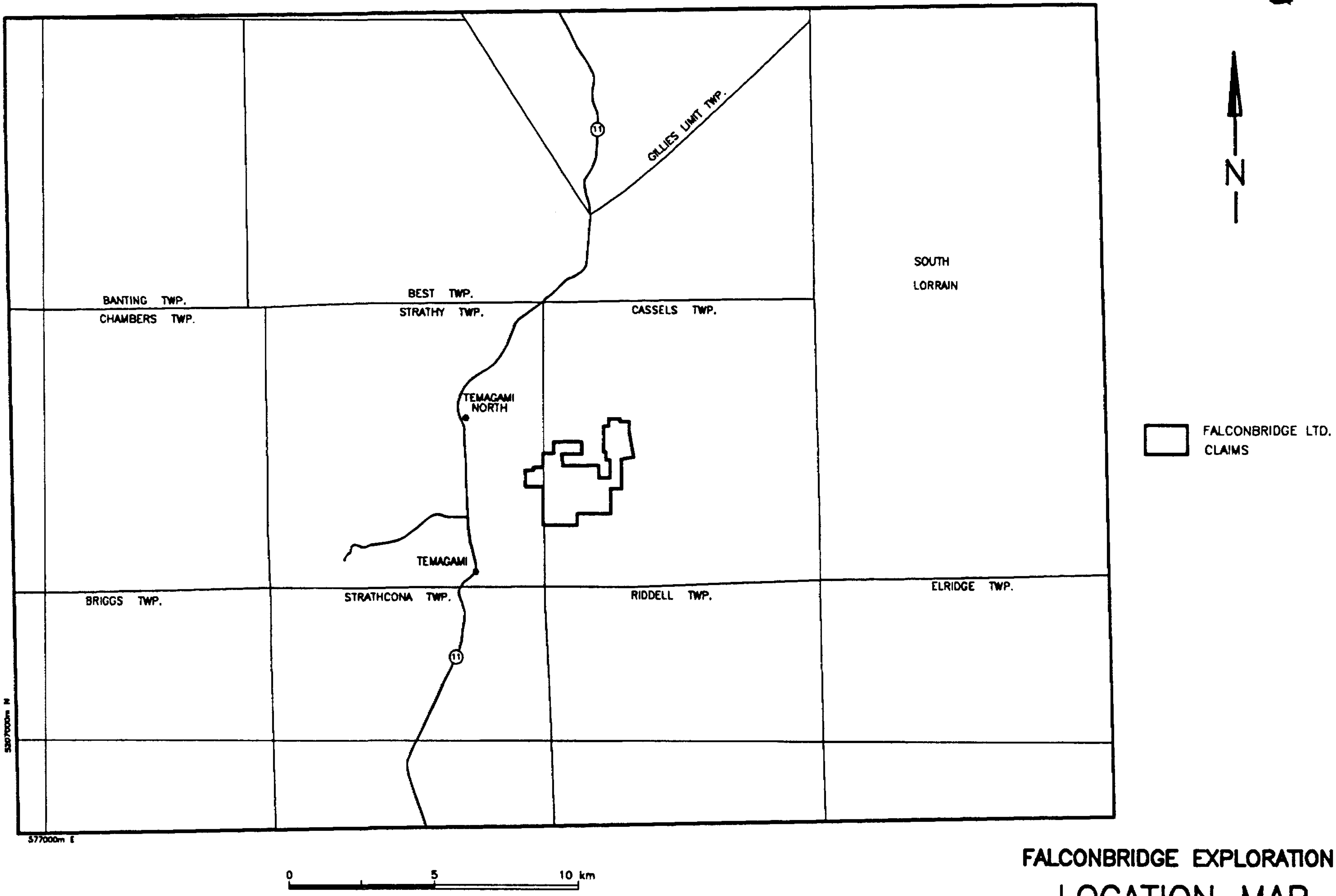

FIGURE 1

FALCONBRIDGE EXPLORATION

LOCATION MAP

TEMAGAMI AREA

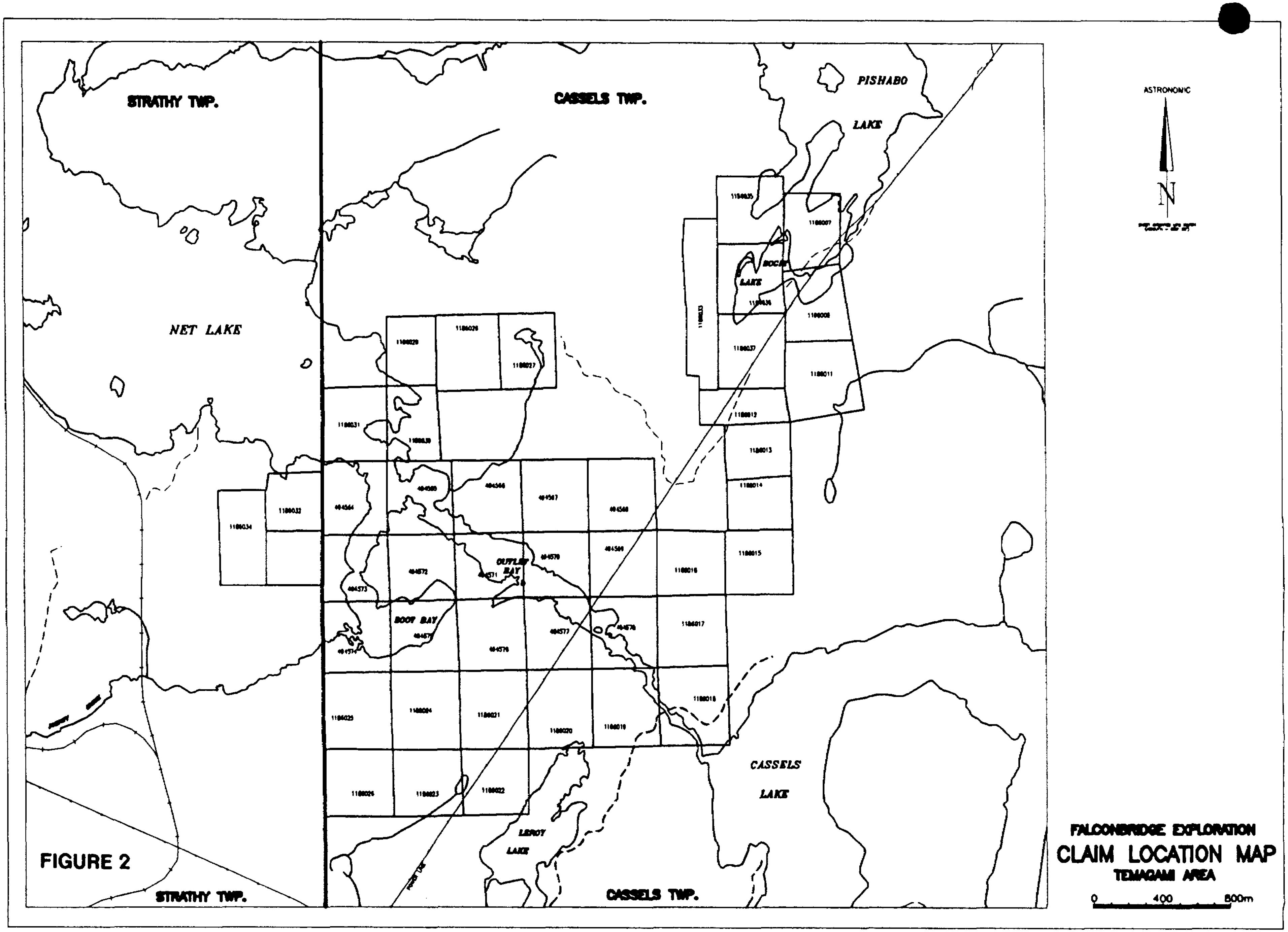

FIGURE 2

FALCONBRIDGE EXPLORATION

CLAIM LOCATION MAP

TEMAGAMI AREA

0 400 800m

SUMMARY OF PREVIOUS WORK

These claims were either staked for Falconbridge Limited in January and February, 1992 or were optioned from William A. Manderstrom to Falconbridge on March 4, 1992.

History of Exploration and Development

1955 - **Brochu/Hermes Minest**

- Five diamond drill holes up to 0.86% Cu over 4.6 m shear, hosted in Quartz-carbonate veins.

1956 - **New Athona**

- Soil geochemistry and ground geophysics.
- 12 major and 4 minor trenches.
- Up to 2.06% Cu and 0.12% Zn in massive sulphide seam hosted by Archean metavolcanics adjacent to feldspar porphyritic dyke.

1969 - **Silver Leader Mines Limited**

- ? Diamond drill holes.
- Up to 18.8 g/t Ag in 3 meter diamond drill sludge sample.
- Minor stringers of 1-2% Cp within Coleman member.

1970 - **Rio Tinto**

- 6 Diamond drill holes and ground geophysics.
- Beds of massive pyrite and trace chalcopyrite and sphalerite in mafic volcanic.
- Quartz veins hosting minor chalcopyrite.

1974 - **INCO**

- Ground geophysics and minor trenching.
- 0.6 m discontinuous seam of pyrite with minor pyrrhotite, chalcopyrite and sphalerite along rhyolite/rhyodacite contact.
- Heavy disseminated pyrite along shear zone.

1978 - **William A. Manderstrom**

- Ground geophysics (Electromagnetic) survey.

SURVEY PARAMETERS AND RESULTS

The survey was performed to detect conductors which may represent base metal bearing massive sulphide deposits. Some weak conductors were encountered. For a description of the conductors encountered along with the survey parameters, methodology, equipment descriptions and data obtained see Appendix I - Crone Report.

CONCLUSIONS AND RECOMMENDATIONS
(Extracted from Crone Report, D. Watson)

The conductors in the northeast part of the survey area are coincident with sulphide occurrences that have been previously trenched. These conductors are small with little depth extent and do not warrant further investigation. Two weak, but relatively prominent, norwest striking conductors, one from 9024W/10850N to 9390W/11150N and the other from 10122W/9600N to 9756W/9500N may warrant further investigation. Other conductors identified in this survey are too weak to be considered likely base metal targets.

EXPENDITURES

The appended invoices are for linecutting, the geophysical survey, accommodations for geophysics crew (paid by Falconbridge) and the salaries of 2 helpers for the geophysics crew (paid by Falconbridge to linecutting contractors).

Linecutting	56 km x $170/km = $9,250.00 2 helpers @ $80/day x 12 days = $1,920.00
Geophysical Survey	Survey = $17,712.99 Accommodations = $2,520.00
Assessment Report/Map Preparation	2 days x $250/day = $500
TOTAL	$32,172.99
	(to be spread roughly evenly among 45 claims)

STATEMENT OF QUALIFICATIONS

I, Steven Eric Kormos, am currently employed by Falconbridge Limited (Exploration) as a Field Geologist and declare that:

1. I have been continuously employed by falconbridge Limited as a Geologist since May, 1988.
2. I graduated with a B. Sc. (Honours) in Geological Sciences from Queen's University in 1988.

DATED May 10, 1993, at Chelmsford, Ontario

Steven E. Kormos

BIBLIOGRAPHY

Watson, D. 1992,	Deepem Survey - Falconbridge Exploration, Boot Bay Project. Crone Geophysics
MacNeil, J. 1992,	Operator's Field Report. Boot Bay Project. Crone Geophysics

APPENDIX I - Crone Geophysics Report

Operator's Field Report

Client : Falconbridge Exploration
Chelmsford, Ontario

Property : Boot Bay Project, Cassels Twp, Ontario

Survey : Surface (DEEPEM) PEM Survey

Surveyed By : Crone Geophysics & Exploration Limited

Survey Period : March 18 - March 31, 1992

Operator : Jim MacNeil

Second Operator : Brad Malpage

Report Date : April 2, 1991

Crone Geophysics carried out a DEEPEM survey for Falconbridge Exploration on the Boot Bay Project near Temagami during the period of March 18 to March 31, 1992. A total of 58.612 line kilometres were surveyed.

Survey Crew and Equipment

Crone Geophysics provided the two operators and all the PEM equipment needed for the survey, including enough wire for two 1000 x 500 meter transmit loops. Crone also supplied two snowmobiles with sleighs. Falconbridge left another snowmobile on the project that could be used when required.

Falconbridge had arranged for two helpers to lay wire, Leonard and Scott McBride. They were originally on the line cutting crew.

Surveying

The Deepem method of surveying was used for the surface work. This type of survey reads lines outside and perpendicular to the long side of the transmit loop. In some areas the lines extended for a short distance inside the loop. As in all Deepem surveys, the PP is set to positive in the vertical position outside the loop, and the head of the receive coil in the horizontal position points towards the loop (position does not change inside the loop).

On this project, there were no specific zones of interest. The survey was to cover the entire area as effectively as possible. What was know of the geology was that the dips could vary from vertical to 60° south. Considering this and the powerline that runs through the grid, lines were read off the south side of the loops except for loop 8. The survey line was limited to about twice the loop width for the best depth detection. Loops could have been placed on the down dip side, but if the dips were near 60° detection would fall off quickly after 750 meters from the loop.

The line spacing was 122 meters because some of the lines of an old 400 foot grid were refurbished. Some lines crossed other properties and were only flagged and chained. Stations were put in every 25 meters. All pickets on the lakes had to be removed when the survey was finished.

The survey used two operators for better production. Since the survey was being done at the end of March, time was important. Luckily, the weather cooperated and there were only two days that were wet and slushy.

The transmitter and receivers were synchronized with crystal clocks. The timing is more precise than the radio sync but there is the potential of drift with the clocks. To monitor for any changes in the timing, a PP test was done at the start of every line. In this test, a decay curve of the shut-off ramp indicates the exact ZTS (zero time set). If there is any drift the ZTS can be adjusted. During the entire survey the ZTS had to be adjusted only twice. Once, there was alittle drift near the end of the day. And another time the ZTS was adjusted after a receiver shut-down and had to be resynced. Normally the drift was not detectable.

The receivers were periodically checked together to ensure that the results were the same. During the survey a pin on a tuning pot in one of the receive coils came loose and the coil had to be replaced. The last three lines read with the coil were repeated. The repeats were very similar except on the vertical component near the loop. Later another coil started to develop a similar problem. Since it was near the end of the job, the rest of the survey was done with one receiver. The problems, almost certainly, were a result of the sleigh ride to the grid, and the repeated pounding they received.

The lines were read at 50 meter station intervals. Occasionally, 25 meter stations were read over near surface anomalies.

There were some difficulties with the line positions and numbering. It would have been better to have a final grid map before starting but that was not possible since the grid was still being cut and time did not allow for the survey to wait. The preliminary grid map did not correspond exactly to the final line positions. The most obvious effect was the loop lay out. They were positioned according to topography, and line and station numbers on the preliminary map. Since the final lines are not in the same position, the loops came out with odd shapes. It does not affect the survey. Some lines were not cut as far as was expected by the survey crew, lines: 9024, 8902, 8292, and 8170. As a result, some time was lost looking for the ends that did not exist or extending them by pace and compass.

The line numbers in the field were labelled backwards. They should have been numbered increasingly east starting at the most westerly line 10366E. However, the lines were numbered decreasingly east but still labelled as east. The line numbers on the survey were changed to west.

There were several chaining errors. Most should have been accounted for in the survey. Still, when the powerline is plotted on the grid map based on the station numbers it crossed (corrected for known errors), the powerline does not appear as a straight line. Though it does not really affect the survey, it should be noted for connecting anomalies from line to line. Comments on individual lines can be found in the file header listings.

SURVEY PARAMETERS

Loop size: 1000 x 500 meters (actual loop sizes varies)
Time base: 16.66 ms
Ramp time: 1.00 ms
Peak current: 8 amps
Channels: 20
Sync: crystal clock
Stn. interval: 50 meters
Line spacing: 122 meters

Survey Data

The data was plotted on a linear scale at 1cm = 25 nanoteslas/sec. Most of the anomalies were weak and in the early channels so the linear scale showed them better than the normal log scale. There were some very strong but small and at surface anomalies on the north end of the grid between 8414 and 7438. Some trenches were noted at a couple of the anomalies.

Accommodations

The crew stayed at Northland Paradise Lodge in Temagami.
Expenses were covered by Falconbridge.

From the lodge it was a 6 km snowmobile drive to the center of the grid.

Respectfully submitted,

Survey operator

Deepem Survey - Falconbridge Exploration
Boot Bay Project

Brief Comments of the Survey Results :

Line and colour contour maps in addition to stacked profiles of the vertical and horizontal components have been produced. In addition individual profiles of each line of data have been plotted.

A few conductors have been detected in the north east part of the survey area and are assumed to be coincident with sulphide occurrences that have been trenched. These conductors are considered small (short, narrow with little depth extent).

In the rest of the area some conductors exist but are considered weak (maximum of seven channels) and are not recommended as prime base metal targets. Of these conductors the most prominent are the one striking in a northwest direction in the southwest corner of the area striking from 9024W/10850W and ending at 9390W/11150N and another in the southwest corner of the area striking from 10122W/9600N to 9756W/9500N. Possibly these two conductors warrant an investigation.

For conductors of 20 mhos or more the minimum detection depth in this area would be 150 meters.

D. Watson

Surface PEM Survey

GRID	LOOP	SIZE	COORDINATES	LINES SURVEYED	LENGTH	DATE READ	COMMENTS
BOOT BAY	1	976 x 500	L9390W,11250N;	L10366W:10000N-11200N	1.200km	Mar 21	Loop at 11300N
			L9390W,11825N;	L10244W:10000N-11275N	1.275km	Mar 21	Loop at 11300N
			L10366W,11750N;	L10122W:10000N-11200N	1.200km	Mar 21	Loop at 11275N
			L10366W,11300.	L10000W:10200N-11175N	0.975km	Mar 21	Loop at 11275N
				L9878W:10200N-11250N	1.050km	Mar 19	Loop at 11275N
				L9756W:10200N-11250N	1.050km	Mar 19	Loop at 11275N
				L9634W:10200N-11200N	1.000km	Mar 19	Loop at 11260N
				L9512W:10200N-11450N	1.250km	Mar 19	Loop at 11250N
	2	976 x 500	L9268W,10000N;	L10122W:9350N-9950N	0.600km	Mar 20	Loop at 10000N
			L9268W,10500N;	L10000W:9300N-10150N	0.850km	Mar 20	Loop at 10000N
			L10244W,10500N;	L9878W:9250N-10150N	0.900km	Mar 20	Loop at 10000N
			L10244W,10000N.	L9756W:9150N-10150N	1.000km	Mar 20	Loop at 10000N
				L9634W:9250N-10150N	0.900km	Mar 20	Loop at 10000N
				L9512W:9250N-10150N	0.900km	Mar 20	Loop at 10000N
				L9390W:9000N-10150N	1.150km	Mar 20	Powerline at 9300N
	3	854 x 500	L8414W,11450N;	L9390W:10100N-11450N	1.350km	Mar 21	The line is off the edge of loop
			L8414W,11950N;	L9268W:10400N-11425N	1.025km	Mar 21	Loop at 11475N
			L9390W,11950N;	L9146W:10350N-11425N	1.175km	Mar 22	Loop at 11475N
			L9268W,11450N.	L9024W:10350N-11437N	1.012km	Mar 22	Cut line ends at 11050N
				L8902W:10350N-11450N	1.000km	Mar 22	Cut line ends at 10875N
				L8780W:10350N-11600N	1.250km	Mar 22	Loop at 11465N
				L8658W:10350N-11550N	1.200km	Mar 22	Chained errors north of 11000N
				L8536W:10350N-11450N	1.100km	Mar 22	Claim line at 11510N

GRID	LOOP	SIZE	COORDINATES	LINES SURVEYED	LENGTH	DATE READ	COMMENTS
BOOT BAY	4	976 x 500	L8414W,10350N;	L9268W:9000N-10350N	1.350km	Mar 24	Loop at 10375N
			L8414W,10850N;	L9146W:9275N-10350N	1.075km	Mar 24	Loop at 10375N
			L9390W,10850N;	L9024W:9250N-10300N	1.050km	Mar 24	Loop at 10350N
			L9390W,10350N.	L8902W:9200N-10300N	1.000km	Mar 23	Powerline at 9575N
				L8780W:9200N-10300N	1.100km	Mar 23	Loop at 10350N
				L8658W:9100N-10300N	1.200km	Mar 23	Claim line at 9075N
				L8536W:9000N-10300N	1.300km	Mar 23	Powerline at 9825N
	5	854 x 500	L8414W,11450N;	L8414W:10300N-11500N	1.200km	Mar 26	Line is 50m S and 50m W of loop
			L8414W,11950N;	L8048W:10350N-11700N	1.350km	Mar 25	Adjusted ZTS to tie-in
			L7560W,11950N;	L7804W:10350N-11550N	1.200km	Mar 26	Powerline at 10250N
			L7560W,11450N.	L7682W:10400N-11550N	1.150km	Mar 25	Flagged line
				L7560W:10450N-11425N	0.975km	Mar 25	Flagged line
	6	976 x 500	L8414W,10350N;	L8414W:9375N-10275N	0.900km	Mar 26	Line ends at 9350N at dam
			L8414W,10850N;	L8292W:8875N-10600N	1.725km	Mar 26	Powerline at 9975N
			L7438W,10850N;	L8170W:9100N-10625N	1.525km	Mar 26	Cut line ends at 10575N
			L7438W,10350N.	L8048W:9225N-10300N	1.075km	Mar 27	
				L7926W:9300N-10050N	0.750km	Mar 27	Loop at 10350N
				L7804W:9400N-10150N	0.750km	Mar 27	Powerline at 10250N
				L7682W:9550N-10250N	0.700km	Mar 27	Powerline at 10350N
				L7560W:9500N-10300N	0.800km	Mar 27	Line ends at 9500N on claim line
				L7438W:9400N-10300N	0.900km	Mar 27	Powerline at 10450N

GRID	LOOP	SIZE	COORDINATES	LINES SURVEYED	LENGTH	DATE READ	COMMENTS
BOOT BAY	7	976 x 500	L6584W,11550N;	L7438W:10500N-11500N	1.000km	Mar 29	Powerline at 10450N
			L6584W,12050N;	L7316W:10600N-10975N	1.375km	Mar 29	Line ends at 10975N
			L7560W,12050N;	L7194W:10650N-11450N	0.800km	Mar 29	Line ends at claim line 11200N
			L7560W,11550N.	L7072W:10725N-11500N	0.775km	Mar 28	Powerline at 10700N
				L6950W:10800N-11450N	0.650km	Mar 28	Loop at 10750N
				L6828W:10950N-11425N	0.475km	Mar 28	Powerline at 10875N
				L6706W:11050N-11550N	0.500km	Mar 28	Powerline at 11000N
				L6584W:11150N-11650N	0.500km	Mar 28	Loop at 11675N
	8	976 x 500	L6584W,10000N;	L7194W:9900N-10500N	0.600km	Mar 29	Powerline at 10575N
			L6584W,9500N;	L7072W:10075N-10625N	0.550km	Mar 30	Loop at baseline 10000N
			L7560W,9500N;	L6950W:10050N-10700N	0.650km	Mar 30	Powerline at 10750N
			L7560W,10000N.	L6828W:10050N-10800N	0.750km	Mar 30	Powerline at 10875N
				L6706W:10050N-10900N	0.850km	Mar 30	Powerline at 11000N
				L6584W:10350N-10975N	0.625km	Mar 30	Powerline at 11075N

APPENDIX II - Contractor Invoices

CRONE GEOPHYSICS & EXPLORATION LTD

[illegible] WOLFEDALE ROAD, MISSISSAUGA, ONTARIO, CANADA L5C 1V8
TEL: (416) 270-0096 • FAX: (416) 270-[illegible] • TELEX: 06-961260

10470

LD TO:

Falconrbdige Limited
eneral Delivery
977 McKenzie Road
R R #2
helmsford, Ontario
OM 1L0

SHIP TO:

SULTING ☐ CONTRACT ☒ SALE ☐ RENTAL ☐ REPAIR ☐ CREDIT ☐

TE	SALESMAN	CUSTOMER P.O.	SHIP VIA	TERMS
5/92				30 DAYS NET

QTY.	DESCRIPTION	PERIOD COVERED	UNIT PRICE	AMOUNT
	Deepem PEM Survey Boot Bay Project Temaami Area, Ontario Operators: Jim MacNeil Brad Malpage	March 19-30/92		
	Survey Charces:			
11	Ist operator survey days		$1030.00	$11,330.00
8	2nd operator survey days		540.00	4,320.00
3	Field helper days		180.00	540.00
				$16,190.00
	Survey Expenses:			
	Meals			$ 25.83
	Gas			428.94
				$ 454.77
	15% Handling charge			68.22
	GST on survey charges (101208858)			1,133.30
			TOTAL	$17,846.29

FALCONBRIDGE LIMITED
10470 2005
602 600 006274 6 585.20
602 600 006223 10 027.79
113330

CRONE GEOPHYSICS & EXPLORATION LTD

3607 WOLFEDALE ROAD, MISSISSAUGA, ONTARIO, CANADA L5C 1V8
TEL: (416) 270-0096 • FAX: (416) 270-[illegible] • TELEX: 06-961260

10471

SOLD TO:

Falconbridge Limited
General Delivery
1977 McKenzie Road
R R #2
Chelmsford, Ontario POM 1LO

SHIP TO:

ONSULTING ☒ CONTRACT ☐ SALE ☐ RENTAL ☐ REPAIR ☐ CREDIT ☐

DATE	SALESMAN	CUSTOMER P.O.	SHIP VIA	TERMS
15/92				30 DAYS NET

EM	QTY.	DESCRIPTION	PERIOD COVERED	UNIT PRICE	AMOUNT
	2	Days - Reports & Maps preparation		$500.00	$1,000.00
		7% GST (101208858)			70.00
				TOTAL	$1,070.00

FALCONBRIDGE LIMITED

VOUCHER NUMBER	10471	VENDOR NUMBER	2005

ACCOUNT	COST CENTRE	AMOUNT	CR X
6102 6000	006273	600.00	
6102 6000	006274	400.00	
1321 10035	GST	70.00	

DUE DATE	CURRENCY

APPROVED	CODED	EXT & ADDS	A/PAY	CHECKED
	GS			

DE COMPTE – STATEMENT

Boot Bay. Cassels Tw.

McBRIDE
KING, LINECUTTING PROSPECTING
BLASTING PERMIT
BOX 112, NOTRE DAME DU NORD QUEBEC
(819) 723-2420

DATE April 8 19 92

Gregg Synder.

Falconbridge Exploration.

Chelmsford Ont.

DATE	DETAILS	DEBIT	CREDIT	BALANCE
	2 men @ 80.00 per day 12 days			1 920 00
				9 520 00
	56 Km @ 170.00			
	9.0 Km Flagged Lines @ 85.00			765 00
				12 205 00
	Total			
	G.S.T. # 129 606 158	854.35		861 49
	Plus G.S.T. Total			13 168 49
				13 059 35
	Thank you			

Norman McBride

BLUELINE DB 106

13,059.35*

Northland Paradise
BOX 472, STEVENS ROAD
TEMAGAMI, ONTARIO
P0H 2H0 (705) 569-3791

Date April 6 1992

M Falconbridge

SOLD BY	C.O.D.	CHARGE	ON ACC'T.	ACCT. FWD.

1	4 men	
2	accommodation pkg	
3		
4	Mar 18 - 31	2400 00
5	GST	168 00
6	PST	120 00
7		2688 00
8		
9	③	
10		
11		
12	R123602316	
13		
14	for Crone Geophysics	
15	Crew	

50

REDIFORM · 5S632E

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CRONE GEOPHYSICS & EXPLORATION LTD
3607 WOLFEDALE ROAD, MISSISSAUGA, ONTARIO, CANADA L5C 1V8
TEL: (416) 270-0096 • FAX: (416) 270-3472 • TELEX: 06-961260

PULSE ELECTROMAGNETIC SYSTEM
(PEM)

System Description, Survey Methods, and Equipment

August 1990

I. SYSTEM DESCRIPTION

OVERVIEW

The Crone Pulse EM system is a time domain electromagnetic method (TDEM) that utilizes an alternating pulsed primary current with a controlled shut-off and measures the rate of decay of the induced secondary field across a series of time windows during the off-time. The system uses a transmit loop of any size or shape. A portable power source feeds a transmitter which provides a precise current waveform through the loop. The receiver apparatus is moved along surface lines or down boreholes.

The transmitter cycle consists of slowly increasing the current over a few milliseconds, a constant current, abrupt linear termination of the current, and finally zero current for a selected length of time in milliseconds. The EMF created by the shutting-off of the current induces eddy currents in nearby conductive material thus setting-up a secondary magnetic field. When the primary field is terminated, this magnetic field will decay with time. The amplitude of the secondary field and the decay rate are dependent on the quality and size of the conductor. The receiver, which is synchronized to the off-time of the transmitter, measures this transient magnetic field where it cuts the surface coil or borehole probe. These readings are across fixed time windows or "channels".

RAMP TIMES

The term "ramp time" refers to the controlled shut-off of the transmitter current. Three ramp times are selectable by the operator; 0.5ms, 1.0ms, and 1.5ms. By controlling the shut-off rather than having it depend on the loop size and current ensures that the same waveform is maintained for different loops so data can be properly compared.

The 1.5ms ramp is the normally used setting for good conductors. It keeps the early channel responses on scale and decreases the chance of overload. The faster ramp times of 1.0ms and 0.5ms will enhance the early time responses. This can be useful for weak conductors when data from the higher end of the frequency spectrum is desired.

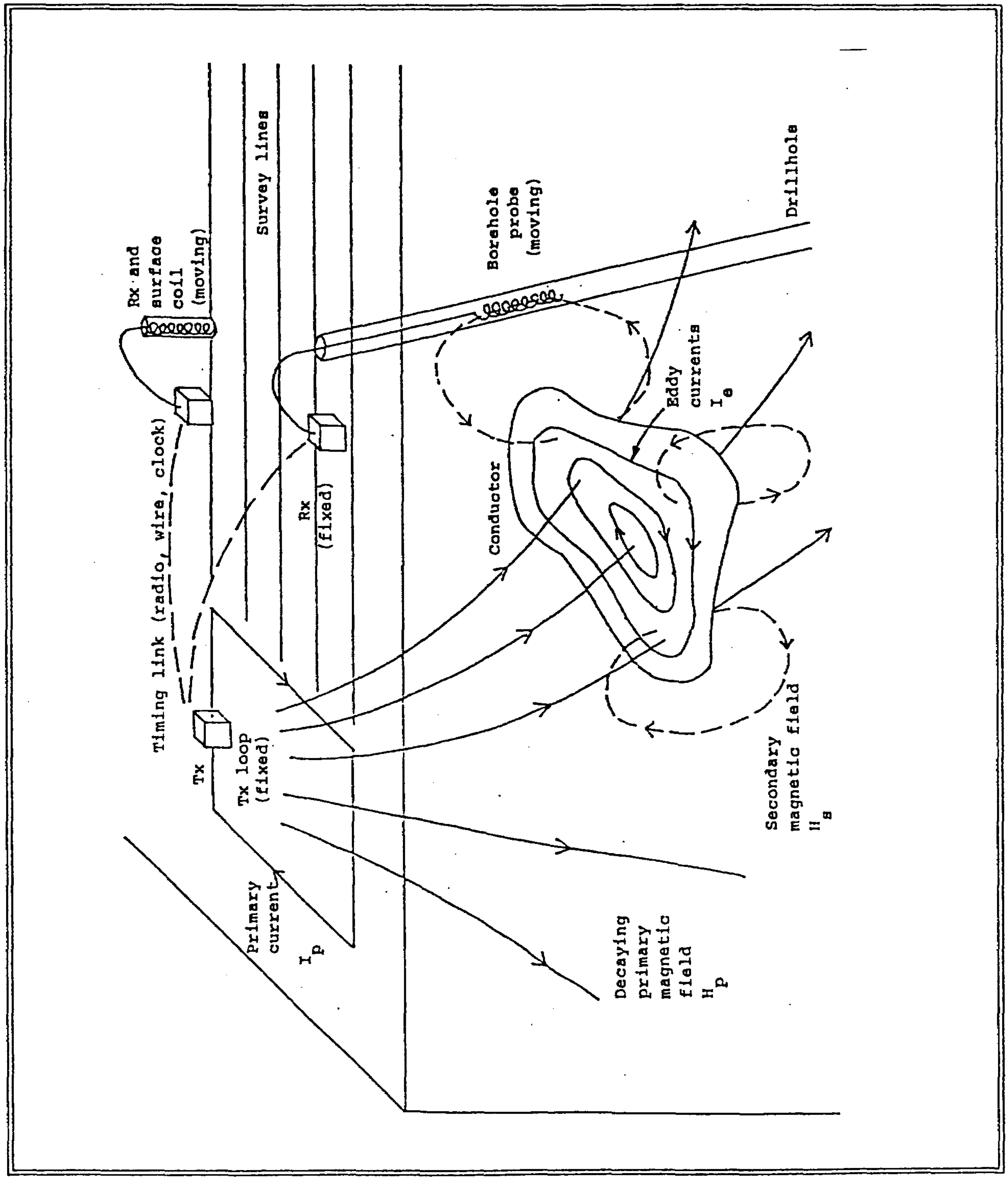


FIGURE 1: Typical operation of fixed loop TDEM systems.
A large transmit loop is placed to best couple with conductive bodies. As the current in the transmit loop is shut off, eddy currents are induced in the conductor. When the current is zero the secondary field begins to decay, and it is this rate of decay which is measured by the borehole probe or the surface coil.

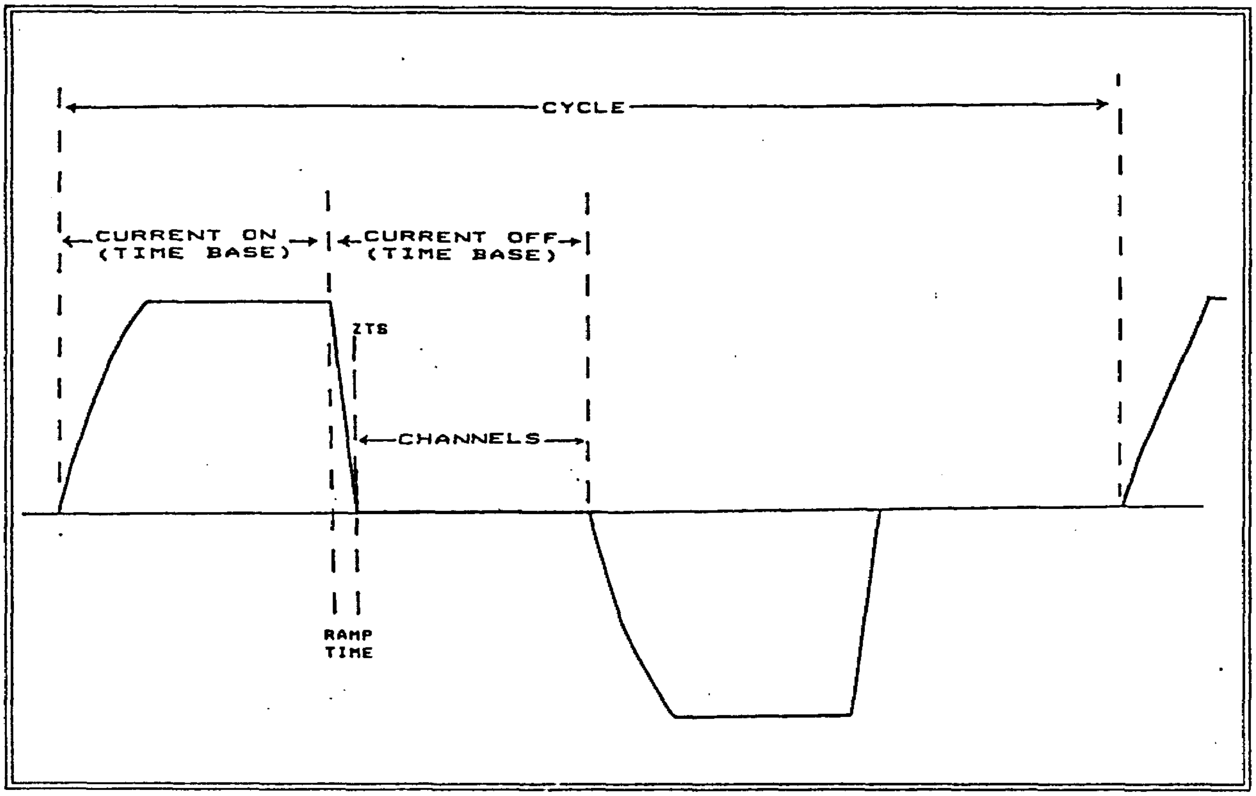


FIGURE 2: PEM transmitter current waveform and receiver measurements.

PP CHANNEL

The PEM system monitors the primary field by taking a measurement during the current ramp and storing this information in a "PP channel". This means that data can be presented in either normalized or unnormalized formats, and additional information is available during interpretation. The PP channel data can provide useful diagnostic information and helps avoid critical errors in field polarity.

SYNCHRONIZATION

Since the PEM system measures the secondary field in the absence of the primary field, the receiver must be in "sync" with the transmitter to read during the off-time. There are three synchronization methods available: cable connection, radio telemetry, and crystal clock. This flexibility enhances the operational capabilities of the system.

TIME BASES

The "time base" is the length of time the transmitter current is off (it includes the ramp time). This also equals the on time of the current. Eight time bases are selectable by the operator. They include the original time bases used in the analog system as well as time bases to eliminate the effects of powerline interference. The eight time bases are as follows:

- compatible to analog Rx:	10.89ms
	21.79ms
- 60hz powerline noise reduction:	8.33ms
	16.66ms
	33.33ms
- 50hz powerline noise reduction:	10.00ms
	20.00ms
	30.00ms

Since readings are taken during the off cycles, the time base will have an effect on the receiver channels. Normally a standard time base is selected for the type of system and survey being used, but this can be changed to suit a particular situation. A longer time base is preferred for conductors of greater time constants, and in surveys such as resistive soundings where more channels are desired.

ZERO TIME SET

The term "zero time set" or "ZTS" refers to the starting point for the receiver channel measurements. It is manually set on the receiver by the operator thus allowing adjustments for the ramp times and fine tuning for any fluctuations in the transmitter signal.

RECEIVER CHANNELS

The rate of decay of the secondary field is measured across fixed time windows which occupy most of the off-time of the transmitter. These time windows are referred to as "channels". These channels are numbered in sequence with "1" being the earliest. The analog and datalogger receivers measured eight fixed channels. The digital receiver, being under software control, offers more flexibility in the channel positioning, channel width, and number of channels.

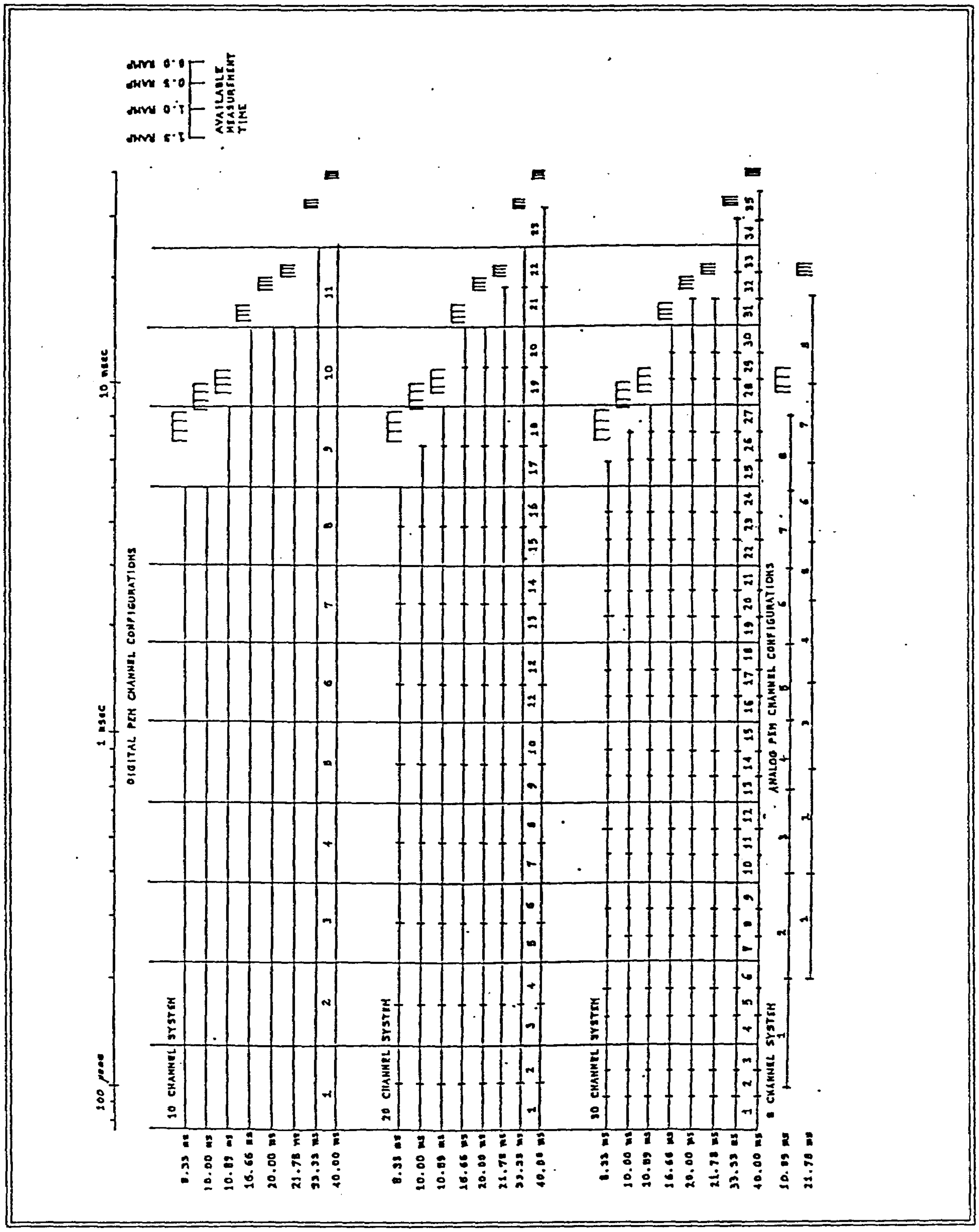


FIGURE 3: Receiver channel configuration.

II. SURVEY METHODS

The wide frequency spectrum of data produced by a Pulse EM survey can be used to provide structural geological information as well as the direct detection of conductive or conductive associated ore deposits. The various types of survey methods, from surface and borehole, have greatly improved the chances of success in deep exploration programs. There are eight basic profiling methods as well as a resistivity sounding mode.

MOVING COIL

A small, multi-turn transmitter loop (13.7m diameter) is moved for each reading while the receiver remains a fixed distance away. This method is ideal for quick reconnaissance in areas of high background conductivity.

MOVING LOOP

Same as Moving Coil method, but with a larger transmit loop (100 to 300 meters square). This method provides deeper penetration in areas of high background conductivity, and works best for near-vertical conductors. This method can be used in conjunction with the Moving In-loop survey for increased sensitivity to horizontal conductors.

MOVING IN-LOOP

A transmit loop of size 100 to 300 meters square is moved for each reading while the receiver remains at the center of the loop. This method provides deep penetration in areas of very high background conductivity, and works best for near-horizontal conductors. It can be used in conjunction with the Moving Loop survey.

LARGE IN-LOOP

A very large, stationary transmit loop (800m square or more) is used, and survey lines are run inside the loop. This mode provides very deep penetration (700m or more) and couples best with shallow dip conductors (<45 deg.) under the loop.

DEEPEM

A large, stationary transmit loop is used, and survey lines are run outside the loop. This mode provides very deep penetration, and couples best with steeply dipping conductors (>45 deg.) outside the loop.

ISOLATED BOREHOLE

A drill hole is surveyed by lowering a probe down a hole and surveying it with a number of transmit loops laid out on surface. The data from multiple loops gives directional information on the conductors. This method has detected conductors to depths of 2500m from surface and up to 200m from the hole.

MULTIPLE BOREHOLE

One large transmit loop is used to survey a number of closely spaced holes. The change in anomaly from hole to hole provides directional information. The method has detected conductors to depths of 2500m from surface and up to 200m from the hole.

UNDERGROUND BOREHOLE

One large transmit loop is used to survey a number of exploration holes drilled from underground mine workings. Near-horizontal holes can be surveyed using our push-rod system. The change in anomaly from hole to hole provides directional information.

RESISTIVITY SOUNDINGS

By measuring a large number of channels along a profile outside a transmit loop, it is possible to track the downward and outward velocity of the "ring currents" and determine from this an apparent conductivity section.

A single station decay curve analysis can also be preformed either inside or outside a loop, giving a best-fit layer earth model.

III. EQUIPMENT

TRANSMIT LOOPS

The PEM system can operate with practically any size of transmit loop, from a multi-turn circular loop 13.7m in diameter, to a 1 or 2 turn loop of any shape up to 1 or 2 kilometers square using standard insulated copper wire of 10 or 12 gauge. The multi-turn loop is made in two sections with screw connectors. The 10 or 12 gauge loop wire comes on spools in either 300m or 400m lengths. The spools can be mounted on packframe winders for laying out or retrieving.

POWER SUPPLY

The PEM system operates with an input voltage from 24v to 120v. A 20amp/hr 24v battery can be used for low power surveys where portability is important. Higher power surveys use a motor generator and voltage regulator to provide input voltage up to 120v. The generator is always connected to a voltage regulator which controls and filters the output. The equipment now in use for most surveys is a variable voltage regulator and a 4.5hp, 2000w motor generator.

Specifications: 2000w PEM Motor Generator

- 4.5 hp Wisconsin, 4 cycle engine
- belt drive to D.C. alternator
- cable output to regulator
- maximum output: 120v, 30amp
- fuse type overload protection
- steel frame
- external gas tank
- unit weight: 33kg
- optional packframe
- wooden shipping box
- shipping weight: 47kg

Specifications: PEM Variable Voltage Regulator

- selectable voltage between 24v and 120v
- 20amp maximum current
- fuse and internal circuit breaker protection
- cable connections to motor generator and transmitter
- anodized aluminum case
- unit weight 10kg; shipping weight 18kg
- padded wooden shipping box

TRANSMITTER

The transmitter controls the bi-polar on-off waveform and linear current shut-off ramp. The latest 2000w PEM Transmitter has the following specifications:

Specifications: 2000w PEM Transmitter

- time bases: 10.89ms, 21.79ms, 8.33ms, 16.66ms, 33.33ms, 10ms, 20ms, 30ms
- ramp times: 0.5ms, 1.0ms, 1.5ms
- operating voltage: 24v to 120v
- output current: 5amp to 20amp
- monitors for input voltage, output current, shut-off ramp, tx loop continuity, instrument temperature, and overload output current
- automatic shut-off for open loop, high instrument temperature, and overload
- fuse and circuit breaker overload protection
- three sync modes: 1) built-in radio and antenna
  2) cable sync output for direct wire link to receiver or remote radio
  3) connectors for optional crystal clock
- anodized aluminum case
- optional packframe
- unit weight 12.5kg; shipping weight 22kg
- padded wooden shipping box

RECEIVER

The receivers measure the rate of decay of the secondary field across several time channels. Three types of receivers are available with the PEM system: Analog Rx, Datalogger Rx, and Digital Rx. The Analog Rx and Datalogger Rx read eight fixed time channels while the Digital Rx, under software control, offers a variety of channel configurations. The Digital Rx has been used in the field for contract surveys since 1987.

Specifications: Digital PEM Receiver

- operating temperature -40°C to 50°C
- optional packframe
- unit weight 15kg; shipping weight 23kg
- padded wooden shipping box

Hardware:

- 24v rechargeable gel cell battery supply
- two CMOS microprocessors (NSC800)
- alphanumeric keyboard
- 2 x 16 character cold weather display
- 16 x 42 character (256 x 128 pixels graphic) display
- 64k byte solid state memory storage
- cable, radio or crystal clock synchronization
- RS-232 serial I/O

Sampling process features:

- 16 bit A/D conversion
- digital recording of data in nano-tesla/sec
- rejection of atmospheric noise samples based on digital threshold detection
- automatic gain control to optimize receiver signal to noise ratio

Menu driven operating software system offering the following functions:

- controls channel positions, channel widths, and number of channels using a basic slice of 4.5µsec
- time bases: 10.89ms, 21.79ms, 8.33ms, 16.66ms, 33.33ms, 10ms, 20ms, and 30ms
- ramp time selectable in 4.5µsec steps
- sample stacking from 512 to 65536
- scrolling routines for viewing data
- graphic display of decay curve and profile with various plotting options
- routines for memory management
- control of data transmission
- provides information on instrument and operating status

SYNC EQUIPMENT

There are three modes of synchronization available; radio and cable sync are standard and crystal sync is optional. The radio sync signal can be transmitted through a booster antenna from either the PEM Transmitter internal radio or through a Remote Radio.

Specifications: Sync Cable

- 2 conductor, 24awg, teflon coated
- approx. 900m per aluminum spool with connectors

Specifications: Remote Radio

- operating frequency 27.12mhz
- 12v rechargeable gel cell battery supply
- fuse protection
- sync wire link to transmitter
- coaxial link to booster antenna
- anodized aluminum case
- unit weight 2.7kg

Specifications: Booster Antenna

- 8m, 4 section aluminum mast
- guide rope support
- ¼ wave CB fiberglass antenna
- range up to 2km
- coaxial connection to transmitter or remote radio

Specification: Crystal Clocks

- heat stabilized crystals
- 24v rechargeable gel cell battery supply
- anodized aluminum case
- rx unit can be separate or housed in the receiver
- outlet for external supplementary battery supply

SURFACE PEM RECEIVE COIL

The Surface PEM Receive Coil picks up the EM field to be measured by the receiver. The coil is mounted on a tripod that can be positioned to take readings of any component of the field.

Specifications: Surface PEM Receive Coil

- ferrite core antenna
- built-in preamplifier
- VLF filter
- 10khz bandwidth
- 23:1 amplifier gain
- two 9v transistor battery supply
- tripod adjustable to all planes
- unit weight 4.5kg; shipping weight 13.5kg
- padded wooden shipping box

BOREHOLE PEM RECEIVE PROBE

The probe is the ferrite core antenna that is lowered down a drill hole. It detects the in-line component of the EM field that will then be measured by the receiver.

Specifications: Borehole PEM Receive Probe

- ferrite core
- built-in preamplifier
- dimensions: length - 1.6m; dia - 3.02cm (3.15cm for high pressure tested probes)
- internal rechargeable ni-cad battery supply
- replaceable heat shrink tubing for abrasion protection
- pressure tested for depths 1300m, 2000m, and 2800m
- packaged in padded cover and aluminum tube
- shipped in padded wooden box; total weight 17kg

BOREHOLE EQUIPMENT

To lower the probe down a drill hole requires a cable and spool, winch assembly frame and cable counter. Borehole surveys also require equipment to "dummy probe" the hole before doing the survey.

Specifications: Borehole Cable

- two conductor shielded cable
- kevlar strengthened
- lengths are available up to 2600m on three sizes of spools.
- shipped in wooden box

Specifications: Slip Ring

- attaches to side of borehole cable spool providing a connection to the receiver while allowing the spool to turn.
- VLF filter
- pure silver contacts

Specifications: Borehole Frame

- welded aluminum frame
- removable axle
- chain driven, 3 speed gear box
- hand or optional power winding
- hand brake and lock
- two sizes: standard for up to 1300m cable; larger for longer cables
- shipped in wooden box

Specifications: Borehole Counter

- attaches to the drill hole casing
- calibrated in meters
- shipped in wooden box; total weight 13kg

Specifications: Dummy Probe and Cable

- solid steel or steel pipe
- same dimensions as borehole probe
- shear pin connection to dummy cable
- steel dummy cable on aluminum spool
- cable mounts on borehole frame
- various lengths to 2600m on 3 spool sizes

Since 1962

COMPANY PROFILE
INSTRUMENTS AND SERVICES

SERVICES

PULSE EM SPECIALISTS

- 3-D Borehole – X, Y and Z Components to more than 2500m depth.
- Surface – fixed or moving loops; sounding or profiling.
- Underground – crystal clock timing; pushrods for flat holes.
- Small to Large Systems – various operational modes for all TEM applications.
- Fully Digital Receiver – graphical LCD displays; software-controlled operation.

METHOD DEVELOPMENT

- Invented Shootback EM.
- Pioneered Surface & Borehole Time-domain EM methods.
    - 5 Surface and 3 Borehole Pulse EM operational modes.
    - 3-Dimensional Borehole Pulse EM.

GEOPHYSICAL R & D

- Equipment design and testing.
- Interpretational aids & techniques including numerical and scale modelling.

MANUFACTURING, SALES, RENTALS, TRAINING

- Pulse EM – Surface and Borehole.
- Induced Polarization – Surface and Borehole.
- RADEM VLF.
- CEM/Shootback EM; Vertical Loop and other Dip-Angle EM.

CONTRACT SURVEYS

- Worldwide EM, I.P., Magnetics, VLF, and Gravity surveys.
- Specialists in Surface and Borehole Time-domain EM surveys.

CONSULTING

- Planning and Management of worldwide exploration programs.
- Presentation and Interpretation of geophysical data.
- Training and Supervision of survey operations.
- Extensive experience in Airborne, Surface, and Borehole Time-domain EM.

PROFILE

Crone Geophysics has been involved in mining exploration, and numerous other geophysical investigations since its founding in 1962 by J. Duncan Crone. It is probably best known for its high quality instrumentation, for the invention of Shootback EM, and the pioneering of surface, borehole, and underground time-domain EM methods and instrumentation (Pulse EM). In June 1990, Duncan Crone sold the assets and business of Crone Geophysics Ltd. to the employees, and a new company was formed, called Crone Geophysics & Exploration Ltd. Ownership is widely spread among the employees, creating an enthusiastic team, and a solid Canadian identity. J. D. Crone remains as President.

Over the years, the company has provided surface and borehole geophysical instruments, consulting services, and contract surveys to leading exploration groups throughout the world. Our data interpretation, based on the latest computerized techniques, combined with our long and varied experience, has assisted in geological mapping, the definition of subsurface zones of interest, and the discovery of numerous orebodies.

For many years, Crone was the only company to successfully build and operate down-hole PEM equipment capable of surveying deep holes. Duncan Crone is responsible for promoting the use of downhole PEM surveys routinely in exploration programs. Now, downhole PEM surveys are an integral part of the exploration philosophy of many mining companies searching for base metals and has helped in the discovery or definition of several such deposits such as Winston Lake, Lindsley, and Louvicourt.

Our unique position of being both a manufacturer and a survey contractor has been a tremendous benefit to both sides of the business. As a contractor, we can rely on the full support of our technical and manufacturing department to provide the most up-to-date equipment, technical excellence, minimal down time, and high field efficiency. As a manufacturer, we can continually improve our gear as a result of direct feedback and rigorous field testing by our most demanding customer - our own survey crews.

INSTRUMENTS

The instruments manufactured by Crone have earned a reputation for being portable, reliable, and durable, as well as simple to operate and maintain. They have been used by our crews and by our many satisfied customers in desert, jungle, arctic, mountainous, and underground mining conditions. This success is a result of quality construction, rigorous field testing, and a straightforward design.

RADEM VLF EM RECEIVER

This rugged, one-man EM unit can be used without accurate survey lines for reconnaissance surveys. It measures the dip-angle, field strength, and quadrature components of the VLF field.

SHOOTBACK EM

The system consists of two identical battery-powered CEM transceiver coils operating on three frequencies. The Shootback method does not require accurate survey lines, and is effective even in rugged terrain, since elevation and distance errors are nullified. It is the perfect tool for grass-roots exploration, reconnaissance, or airborne followup for conductors up to 60m deep.

VERTICAL LOOP EM AND OTHER DIP-ANGLE METHODS

For Vertical Loop surveys, one of the CEM coils can be replaced with a high-powered, vertical transmit loop, which increases the operating range to 800m. The CEM coils can also be used in various standard dip-angle configurations.

I.P. RECEIVER AND TRANSMITTER

This Newmont-designed receiver is a time-domain, analog, single-dipole receiver, designed to be portable and simple to operate. It provides M and N chargeability values as well as the primary voltage. The 250 Watt transmitter is battery-powered, can be carried by one person, and can provide up to 850 V output.

BOREHOLE I.P.

Two borehole I.P. logging systems are available. The simplest one is a 2 - electrode probe which uses the standard Borehole PEM cable and head. It can function as a potential dipole in a gradient configuration, or it can be used in a pole - pole configuration with one current and one potential down the hole. Various separations are available.

The other system allows for 5 potential electrodes and one current electrode down the hole. The four potential dipoles (or 5 poles) are positioned at various spacings, including a logarithmic spread.

PULSE EM

Crone was the first manufacturer to develop surface and borehole PEM systems. This lead has been maintained by constant research and testing of equipment, field methods, applications, and interpretation.

Our latest innovation is the world's first time-domain EM cross-component (X-Y) borehole probe with the same diameter and depth capabilities as our standard probes. The probe was developed with support from Noranda Exploration Co. Ltd., and provides 3-component information down the hole when used in conjunction with our axial (Z) probes. These three dimensional borehole surveys allow for more reliable directional information to off-hole conductors and give the direction to the centre of in-hole conductors, thereby allowing for more cost effective diamond drilling.

Receiving equipment has changed over the years, from the original analog unit, to the new state-of-the-art Digital PEM Receiver which is software-controlled, and is therefore tremendously flexible, and easily upgradeable. Features include: true data units; programmable channel times, 8 time bases; noise rejection; automatic gain control; and a high-quality graphic display of the decay curve, and profile data. The Digital Receiver has been used by our field crews since 1986. Transmitting equipment has evolved from the original 500 Watt battery-powered unit, to a 2000 Watt system with 8 selectable time bases, 3 selectable linear ramp times, 3 different synchronization options, and an ability to power any size loop up to 1 or 2 kilometers square.

Field methods have been developed to allow Pulse EM to be used in virtually any physical or geological environment. Boreholes can be surveyed to depths of 2500m with one or more transmit loops; horizontal underground holes can be surveyed with a push-rod system; surface profiling can be done in at least five different ways, depending on the geological conditions, to depths of 600m or more; and layered-earth environments can be explored through resistivity sounding with the new Digital Receiver to depths of 1000m or more.

IBM-PC and compatible computer software packages for a variety of PEM data presentations, as well as PEM data processing, filtering and interpretation, are available with the system.

Since 1962

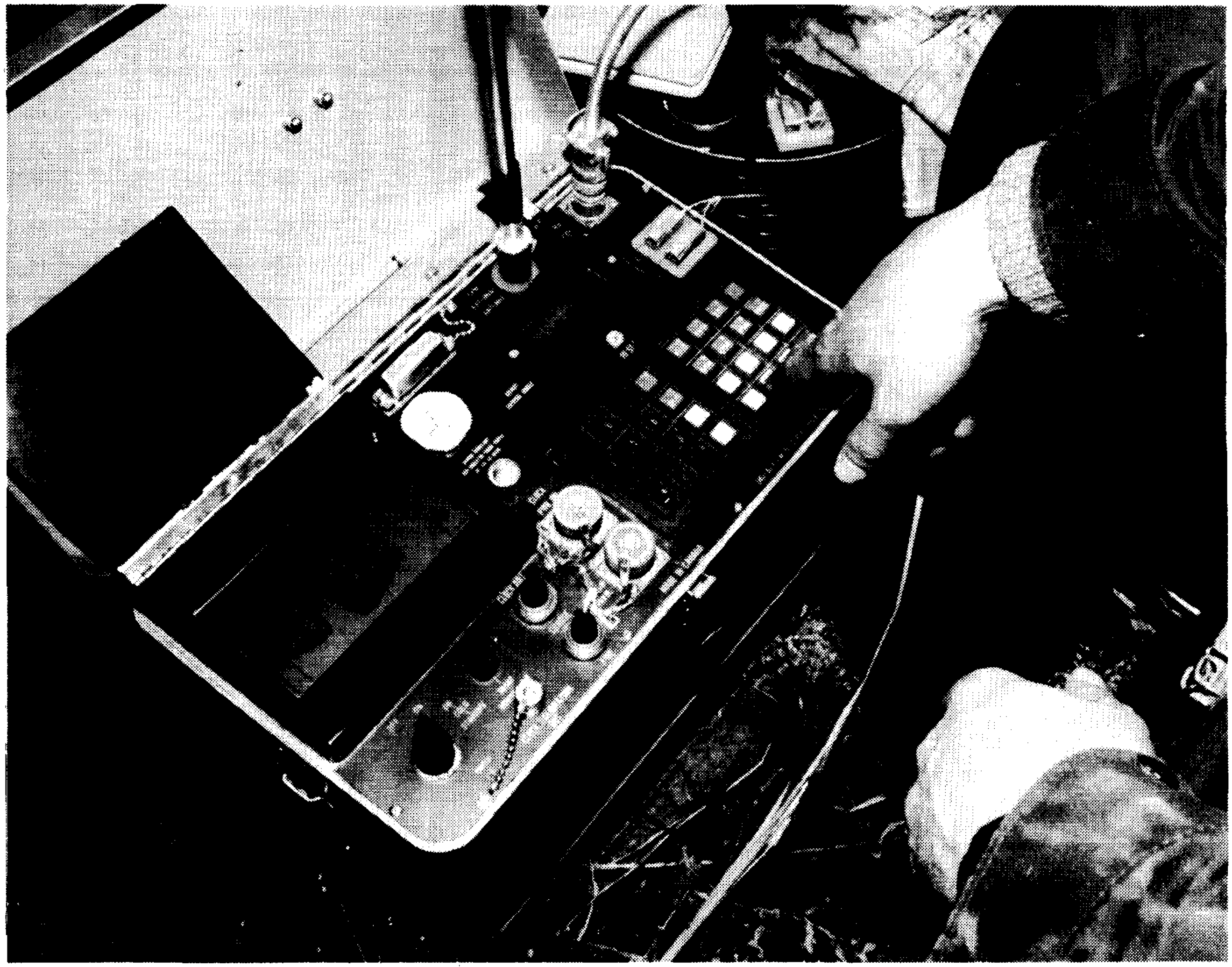
CRONE GEOPHYSICS & EXPLORATION LTD.

3607 WOLFEDALE ROAD, MISSISSAUGA, ONTARIO, CANADA L5C 1V8
TEL:(416) 270-0096 • FAX: (416) 270-3472 • TELEX: 06-961260

Since 1962

DIGITAL PULSE EM RECEIVER

- Flexible, fully digital receiver for all types of surface and borehole time-domain EM surveys.
- Measures time rate of change of a component of the magnetic field vector within programmable time channels. Measured component is defined by the orientation of the surface coil or borehole probe.
- Standard 10, 20, and 30 channel configurations; five 37-channel tables programmable in the field.
- Primary field "PP" channel always used. Provides indispensable polarity and amplitude information.
- Decay curve and profile plot on graphic LCD: excellent quality; line or bar; linear or log; numerous scales; scrolling; grid lines; superimpose mode; vertical line cursor steps through channels or stations.
- Automatic gain control. No data scaling or reduction. Output is in nanoTesla/sec (nV/m^2).
- Researched, designed, and tested since 1982. Field proven since 1986. Feedback and rigorous field testing under all conditions from our most demanding customer - our own survey crews.



Decay curves and profile plots of some or all channels can be viewed on the spot for excellent data quality control and survey decision-making.

SPECIFICATIONS - DIGITAL PULSE EM RECEIVER

HARDWARE:
Modular board design for easy software and hardware upgrades.
Small LCD - 2 lines, 16 characters. Heated for operation below -20°C. LCD viewing adjustment.
Large LCD - 16 lines, 42 characters or 256 x 128 pixels graphics. Lid for sunlight. LCD viewing adjustment.
32 key alphanumeric keyboard with arrows and special function keys. Positive feedback key action.
Two CMOS microprocessors in parallel; 16 bit A/D conversion; Dynamic range: 138 dB; Max input voltage: ± 1V.

SOFTWARE CONTROLS:
Menu-driven functions: easy selection with moving highlight or letter code on 16 x 42 character LCD.
Pre-survey file preparation: up to 32 files can be set up with header information before surveying.
File switching and expansion; continue reading in any file at any time - until memory is full.
Extensive file and data handling routines; Selectively delete files or station readings.

VIEWING DATA IN THE FIELD (LISTS AND PLOTS):
List all channel reading simultaneously for 1 decay curve, or list data 3 channels at a time over all stations.
Plot channel readings as a decay curve at one station, or as a profile over several stations.
Excellent quality plots on 256 x 128 pixel graphic LCD; line or bar; linear or log; numerous scales; scrolling; grid lines; superimpose mode, vertical line cursor steps through channels or stations.

TIME BASE (ON-TIME – RAMP, or OFF-TIME + RAMP):
8.33 msec, 16.66 msec, 33.33 msec for 60 Hz noise areas (30 Hz, 15 Hz, 7.5 Hz base frequencies).
10.0 msec, 20.0 msec, 40.0 msec for 50 Hz noise areas (25 Hz, 12.5 Hz, 6.25 Hz base frequencies).
10.89 msec, 21.79 msec for compatibility with Analog and Datalogger PEM Receivers.

CHANNEL CONFIGURATION:
Three logarithmic configurations each starting at 76.5 µsec. (10, 20, or 30 channels in 16.66 msece)
- each of 10 channels is split in 2 (20 channels) or 3 (30 channels) for ease of data comparison.
Five programmable configurations - each with a minimum time interval of 4.5 µsec, and a maximum of 37 channels
- each can be configured in the field, and changed after dumping data
One 8 channel configuration identical to Analog PEM channels.
One preset 45 channel configuration over 202 µsec for current ramp analysis and zero-time-set procedure.
Time base can be changed without affecting the channel configuration.

PRIMARY FIELD MONITOR: A Primary Pulse "PP" channel is always used in addition to the above configurations as it provides indispensable primary field polarity and amplitude information. It measures during the current ramp.

ZERO-TIME-SET: The current shut-off is measured using 45 channels 4.5 µsec wide. A linear plot on the large LCD clearly shows the shape of the ramp, and the zero time (end of ramp) can be set.

SYNCHRONIZATION: Cable and Radio are standard. Optional internal crystal clock.

CALIBRATION OF DATA: Effective area of coil or probe is entered into the Receiver in square metres. Thereafter, readings are measured and stored in nanoTeslas/sec (=nV/m^2).

GAINS: 10-1280; Internally selected for each channel for best Signal-to-Noise, or manual override. Internal scaling of data.

NOISE REJECTION: Automatic spike rejection. Powerline rejection typically 78dB.

STACKING: 512 to 65,536 readings in seven doubling steps.

STATISTICAL ANALYSIS: Calculation and display of statistical reading error.

STORAGE: 64 KBytes data storage (approximately 500 readings of 20 channel data).

DATA TRANSFER: RS232 connection to computer with menu-selectable serial parameters.

BATTERIES: 2 rechargeable 12V gel cells. Battery test and low battery warning. Minimum 8 hours of field use.

TEMPERATURE RANGE: Operational from -40°C to +50°C.

HUMIDITY: Refillable desiccant container with colour indicator accessible from top panel.

WEIGHT: 15 kg., shipping: 23kg.

TRANSPORT: Plywood box for shipping and field transport with closed cell foam shock protection.

ACCESSORIES: Battery charger; RS 232 cable; Uploading software; Data presentation software; optional packframe.

* Specifications subject to change without notice.

CRONE Since 1962

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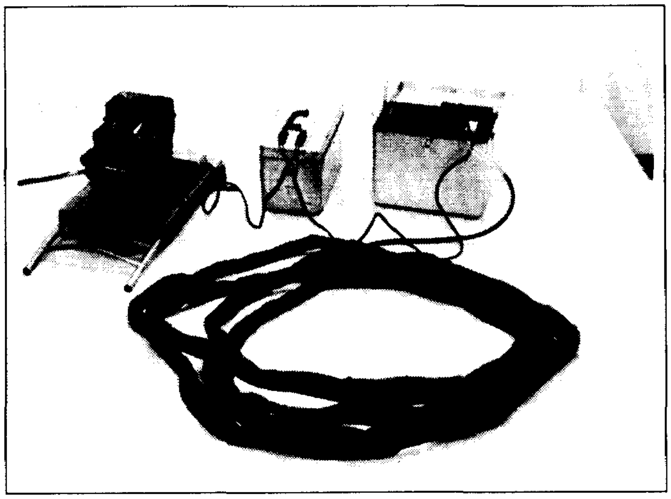
PULSE EM TRANSMITTER EQUIPMENT

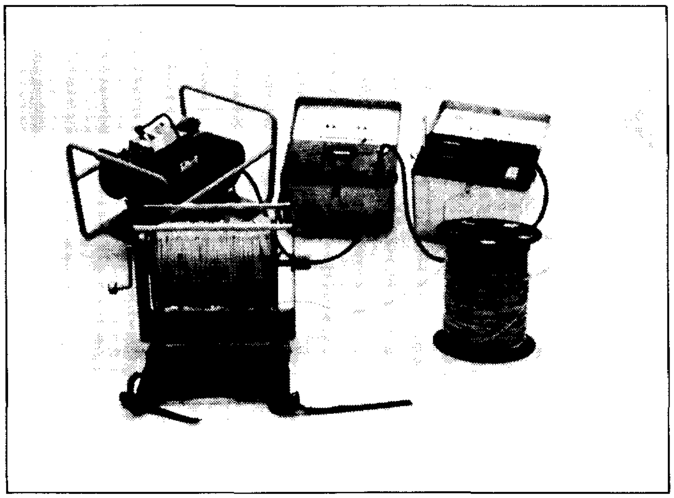
- Flexible, multi-purpose transmitter and complete transmitting equipment for all types of surface and borehole time-domain EM surveys.
- 2000 Watt Transmitter can be powered 3 ways:
  - 24V rechargeable Battery Pack.
  - 24V Battery and 500W Motor Generator.
  - 24V-120V from 2000 W Motor Generator and Voltage Regulator.
- 24V input for Low-Power PEM surveys:

  18 Amps through 7-turn, 14m diameter Moving Coil (19,000 Am^2 dipole moment)
  - locates shallow (up to 150m deep) conductors even in conductive environments when used in profiling mode (Slingram method).
  - shallow resistivity soundings to 200m or more.

  18 Amps through 100m x 100m loop (180,000 Am^2 dipole moment)
  - Moving Loop or Moving In-Loop surveys for deeper conductor detection even in conductive environments.
  - Borehole logging to 300m or 300m long surface lines outside loop (small scale DEEPEM).
  - Resistivity sounding to hundreds of metres.
- 24V-120V input for High-Power PEM surveys:
  - Any loop size from 100m x 100m to 1 or 2 km square.
  - Can be used for all Surface and Borehole PEM surveys for deep conductor detection or deep resistivity sounding.
- 3 selectable current ramp times, 8 selectable time bases, and 3 synchronization methods.
- **Ramp times are fixed** to allow for proper data comparisons from loop to loop.
- Cleared for safe use in producing mines for underground borehole surveys.



Lower Power Gear
The 500W Motor Generator is required if the Transmitter is on for long periods. It is optional for the Moving Coil method.



2000 Watt Gear
Can power any size loop from 100m x 100m to 1 or 2 km square

SPECIFICATIONS - PULSE EM TRANSMITTER EQUIPMENT

2000 WATT PEM TRANSMITTER:

Controls bipolar, on-off waveform and linear current shut-off ramp time. Operating voltage: 24V to 120V.

Synchronization: Radio and cable synchronization are standard. Internal radio powers 1 metre long telescoping antenna (standard) or optional 1/4 Wave CB booster antenna on mast. In hilly terrain, use external (remote) radio and booster antenna on high point of grid, controlled by cable sync. Optional external crystal clock sync system.

On-Off times for 60 Hz powerline filtering: 8.33ms, 16.66ms, 33.33ms; for 50 Hz powerline filtering: 10.0ms, 20.0ms, 40ms; for analog PEM operation: 10.9ms, 21.8ms.

Linear controlled current shut-off ramp times of 0.5, 1.0 and 1.5ms. Ramp time is fixed and non-drifting with temperature and loop size to allow for accurate data comparison and interpretation.

Monitors for shut-off ramp operation, instrument temperature, Tx loop continuity, and overload output current.

Meters for loop current, input voltage, sync test.
Automatic shut-down for open Tx loop, high instrument temperature, and overload.

Net weight: 12.5 kg, shipping: 22 kg.

2000WATT MOTOR GENERATOR:

4 1/2 H.P. Wisconsin Robin, 4 cycle engine with belt drive to D.C. alternator; both mounted on frame; output: 120V, 20 Amps; external gas tank with hose and valve for full day of unattended operation; Net weight: 33 kg; shipping: 47 kg.

24V-120V VARIABLE VOLTAGE REGULATOR:

Controls and filters the alternator output; continuously variable between 24V and 120V D.C., 20 Amp maximum current; Net weight: 10kg, shipping: 20 kg.

WIRE, SPOOLS AND WINDERS:

Transmitter wire is usually No. 10 or 12 AWG insulated copper wire in 300m or 400m lengths, 1 length per spool; 2 spools in a shipping box; winder is mounted on a magnesium packframe.

MULTI-TURN MOVING COIL:

7 turn, 14 meter diameter Tx loop; plugs to break loop into 2 sections for easy station-to-station movement. Aluminum or copper wire and various coverings depending on area being used.

BATTERY POWER SUPPLY:

24V, 20 amp hour; rechargeable battery supply for use with PEM Transmitter as power source rather than motor-generator-regulator. In aluminum case, with clamp connectors. Net weight: 20.5 kg, shipping: 29 kg.

500 WATT, LOW-POWER MOTOR GENERATOR:

For continuous transmitter operation in Low-power PEM surveys. 3.5 H.P. Motor with belt drive to Alternator and Regulator; mounted on frame; output: 24V DC, 500W; connect to transmitter in parallel with 24V Battery Pack.

- Battery chargers supplied for all rechargeable battery units.
- All instruments and equipment operational from -40°C to +50°C.
- Plywood boxes for shipping and field transport with closed cell foam shock protection.

* Specifications subject to change without notice.

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Since 1962

FEATURES OF THE CRONE PULSE EM SYSTEM

The following is a list of features which we believe set the Crone PEM system apart from other similar time-domain electromagnetic systems.

1. First with 3-Dimensional Borehole Pulse EM.
2. First with Fully Digital Pulse EM Receiver.
3. Field Programmable Channel Times.
4. Primary Field Measurement with Each Reading.
5. Superior Quality Decay Curve Plot in Field.
6. Superior Quality Profile Plot in Field.
7. Operation and Survey Mode Flexibility.
    - 5 Surface Profiling Methods
    - 3 Axial Borehole Methods
    - 3-D Borehole Method
    - Sounding
8. 1 Receiver and 1 Transmitter for All Survey Modes.
9. 3 Synchronization Options.
10. Atomic-Accuracy Crystal Clock Calibration Station.
11. Loop Size Flexibility.
12. Fixed Ramp Times.
13. 8 Time Bases.
14. No Data Reduction.
15. No Primary Field Removal.
16. Optional Normalization.
17. Extensive Microcomputer Software.
18. Reliable, Durable, & Portable Equipment.
19. Physical Scale Model Facility.
20. Accurate Conductive Thin Plate Numerical Modelling.

1. FIRST WITH 3-DIMENSIONAL BOREHOLE PULSE EM

With the development of the Crone X-Y borehole probe (supported by Noranda Exploration Co. Ltd.) it is now possible to measure all three components of the time-domain EM field down boreholes. This is a tremendous advantage in pinpointing the direction to off-hole conductors and to the centre of in-hole conductors.

2. FIRST WITH FULLY DIGITAL PULSE EM RECEIVER

The Digital PEM receiver can be used for all types of Surface and Borehole time-domain EM surveys. It has a flexible, fully digital design, which has allowed for several unique features to be incorporated. Some of these are listed below. Others include: menu-driven functions; extensive file and data handling routines; accurate and convenient zero time set; automatic noise rejection; statistical analysis; and internal scaling and calibration of data. The instrument has been researched, designed, and tested since 1982. It has been field proven under the most demanding conditions since 1986.

3. FIELD PROGRAMMABLE CHANNEL TIMES

The Digital PEM receiver provides in - field programmability of channel positioning (in 4.5 usec steps), channel widths (minimum of 4.5 usec), and number of channels.

- custom design your channel configuration for a particular job.
- study the early, late, or intermediate transients in detail by concentrating channels in these times.
- use the channel times of other transient EM systems.
- use one of the built-in channel configurations for routine surveying.

4. PRIMARY FIELD MONITOR WITH EACH READING

The primary field is monitored by measuring and recording a Primary Pulse or "PP" channel during the current ramp in the transmit loop. This means that data can be presented in either PP normalized or unnormalized formats, and additional information is available during interpretation.

As far as we know, Crone PEM is the only system which routinely monitors and records the primary field without normalizing to it. We have noted that by doing this, critical errors can be avoided in field polarity, and important diagnostic information can often be provided from the data in the PP channel.

5. SUPERIOR QUALITY DECAY CURVE PLOT IN FIELD

The Digital PEM receiver provides a visual display of the decay curve on its 256 x 128 pixel graphic LCD before or after the data is stored.

- quickly inspect the data for anomalous decay rates or noise.
- superimpose previous readings for comparison.
- keep sampling and superimpose to see effect on noise.
- numerous scales; linear or log; line or bar graph; grid lines; scrolling; vertical line cursor steps through channels and shows time and value.

6. SUPERIOR QUALITY PROFILE PLOT IN FIELD

The Digital PEM receiver provides a visual display of the line or borehole profile on its 256 x 128 pixel graphic LCD.

- quickly inspect the data for anomalous readings.
- can increase station density or extend line, based on plot.
- view any one or all channels (superimpose 3 at a time).
- change plot scales and type; move viewing window up and down.
- numerous scales; linear or log; line or bar graph; grid lines; scrolling; vertical line cursor steps through stations.

7. OPERATION AND SURVEY MODE FLEXIBILITY

The PEM system has tremendous operational flexibility due to the fact that the receiver, transmitter, and many other items can be used in more than one mode of operation.

SOUNDING - this can be done both inside and outside the transmit loop and one can make use of our Digital Receiver's unique ability to use various channel configurations in various time bases.

PROFILING - there are 8 basic profiling methods:

i) **Moving Coil** - A small, 7-turn transmitter loop (14m diameter) is moved for each reading while the receiver remains a fixed distance away. This method is ideal for quick reconnaissance in areas of high background conductivity.

ii) **Moving Loop** - Same as Moving Coil methods, but with a larger transmit loop (100 to 300 meters square). This method provides deeper penetration in areas of high background conductivity, and works best for near-vertical conductors. It can be combined with Moving In-Loop.

iii) **Moving In-Loop** - A transmit loop of size 100 to 300 meters square is moved for each reading while the receiver remains at the centre of the loop. This method provides deep penetration in areas of very high background conductivity, and works best for near-horizontal conductors. It can be combined with Moving Loop.

iv) **Large In-Loop** - A very large, stationary transmit loop (1000m square or more) is used, and survey lines are run inside the loop. This mode provides very deep penetration (700m or more) and couples best with shallow dip conductors under the loop.

v) **DEEPEM** - A large, stationary transmit loop is used, and survey lines are run outside the loop. This provides very deep penetration, and couples best with steeply dipping conductors (>45 deg.) outside the loop.

vi) **Isolated Borehole** - A borehole probe is used to survey the hole from a number of transmit loops. The data from multiple loops gives directional information. This method can detect conductors to depths of 2500m from surface and up to 200m from the hole.

vii) **Multiple Borehole** - One large transmit loop is used to survey a number of closely spaced holes. The change in anomaly from hole to hole provides directional information. The method can detect conductors to depths of 2500m from surface and up to 200m from the hole.

viii) **Underground Borehole** - One large transmit loop is used to survey a number of exploration holes drilled from underground mine workings. Near-horizontal holes can be surveyed using our push-rod system. The change in anomaly from hole to hole provides directional information.

ix) **3-D Borehole Method** - All 3 components can be read in any of the 3 previous borehole methods, with only the addition of an X-Y probe and a switch box. This provides a great deal of additional information with little extra effort. As well as better detection of sub-parallel conductors, it also provides more accurate directions to conductors.

8. 1 RECEIVER AND 1 TRANSMITTER FOR ALL SURVEY MODES

The Digital PEM Receiver and the 2000 Watt PEM transmitter can be used in all the Pulse EM survey modes. This means that a Pulse EM system can be upgraded to perform additional surveys easily and cost - effectively.

9. 3 SYNCHRONIZATION OPTIONS

Crone provides three methods for synchronizing the PEM receiver and transmitter: Radio, Cable and Crystal Clocks. Radio sync is suitable for fixed loop profiling and can be run in 3 ways: built-in antenna; booster antenna; and remote radio. Cable sync is used where the receiver and transmitter separation is fixed or high accuracy is required. Crystal clocks are used for underground surveys, or for increased accuracy over radio sync.

10. ATOMIC ACCURACY CRYSTAL CLOCK CALIBRATION STATION

At considerable expense, Crone Geophysics has set up a crystal calibration station for in-house testing and analysis of clock aging and drift. Each clock is compared to the atomic standard over a period of several days to confirm the manufacturer's specifications and to check that it meets our own special requirements. This analysis and screening allows us to achieve a much higher accuracy than by ordering the so called "matched pairs" from the clock manufacturer. It also allows us to use more than one receiver clock with each transmitter clock without sacrificing accuracy. By collecting this information, we have learned some surprising things about the clocks used routinely in geophysical equipment, and we have put this knowledge to use in continually upgrading all our clock systems to new standards in accuracy.

By properly analyzing the characteristics of crystals, and by having the proper tools to make these tests, Crone PEM crystal clocks can be used with confidence for full days of worry-free operation.

11. LOOP SIZE FLEXIBILITY

The PEM system can operate with practically any size transmitter loop, from the 7-turn circular loop 14 meters in diameter, to a 1- or multi-turn loop of any shape, up to 1 or 2 kilometres square. We do not routinely use loops larger than 1 km square. Our studies have shown that the small advantage in depth penetration gained by a loop size beyond 1 km square is outweighed by the decrease in loop current (not to mention the increase in labour), and penetration decreases.

- use a 24V Battery Pack (with optional generator) for Moving Coil and 100m Moving Loop surveys.
- or use 2000W Motor Generator with Variable Voltage Regulator (24V to 120V) for any loop.
- use standard insulated copper wire of 10 or 12 gauge AWG.

12. FIXED RAMP TIMES

The linear current ramp time is chosen by the operator as 0.5ms, 1.0ms, or 1.5ms instead of having the ramp time depend on loop size and current.

This ensures that the same current waveform is used in all loops, so that data can be properly compared from one loop to another even if they are slightly different in size. The ramp time does not drift with temperature.

13. 8 TIME BASES

The Digital PEM receiver can read on eight different time bases (request software change for more).

- to improve powerline noise rejection:
  use 8.33ms, 16.66ms, or 33.33ms off-times for 60 Hz noise.
  use 10.00ms, 20.00ms, or 40.00ms off-times for 50 Hz noise.
- use 10.89ms and 21.78ms for comparison with Analog PEM data.

14. NO DATA REDUCTION

There is no need for data scaling. The data recorded in the Digital receiver is in nanoTeslas/sec which is the required format for interpretation. The data seen on the receiver in the field will be the data seen in the final presentation.

15. NO PRIMARY FIELD REMOVAL

The use of a "Pulsed" waveform ensures that the primary field does not have to be removed from the data. This is a tremendous advantage in borehole work where the exact location of the probe with respect to the loop is not always known. In both surface and borehole methods, the removal of a primary field can introduce significant geometrical errors.

16. PRIMARY FIELD NORMALIZATION IS OPTIONAL

We do not recommend normalizing to the primary field except for the Moving Coil, Moving Loop, and Moving In-Loop methods where the primary field should be constant anyway. In these cases it removes slight errors in loop current and loop shape. For fixed loop surveys, normalization is occasionally useful for anomaly comparison, but in general, it defeats the purpose of time domain electromagnetics which is to eliminate the primary field from the data.

Normalization based on a calculated primary field introduces geometrical errors because the exact location and orientation of the transmit loop and receive coil must be known. In many cases, such as borehole surveys or rough topography, this information is not available.

Normalization based on a measured value of the primary field will introduce errors just when they are least wanted - when a conductive zone is near the receive coil. This is because any measurement of the primary field contains some secondary field as well. Also, this type of normalization assumes that the total primary field is being measured, and therefore cannot be used for borehole surveys or for the horizontal component in surface surveys since the measured primary field can be zero in these cases

Normalization of either type is comparable to increasing the receiver gain as the primary field decreases. Thus, it emphasizes measurement errors, and obscures the measurement limitations of the equipment as readings are taken further and further from the transmit loop. It also complicates interpretation because it skews the anomalies with respect to the loop location. We believe that it is critical, especially in borehole surveys, to use unnormalized data.

17. EXTENSIVE MICROCOMPUTER SOFTWARE

Software for data presentation, processing, and interpretation, has evolved through many years of use by our field personnel and geophysicists. This in-house user feedback has resulted in user-friendly, flexible, and reliable software for use on IBM-PC compatible microcomputers.

18. RELIABLE, DURABLE & PORTABLE EQUIPMENT

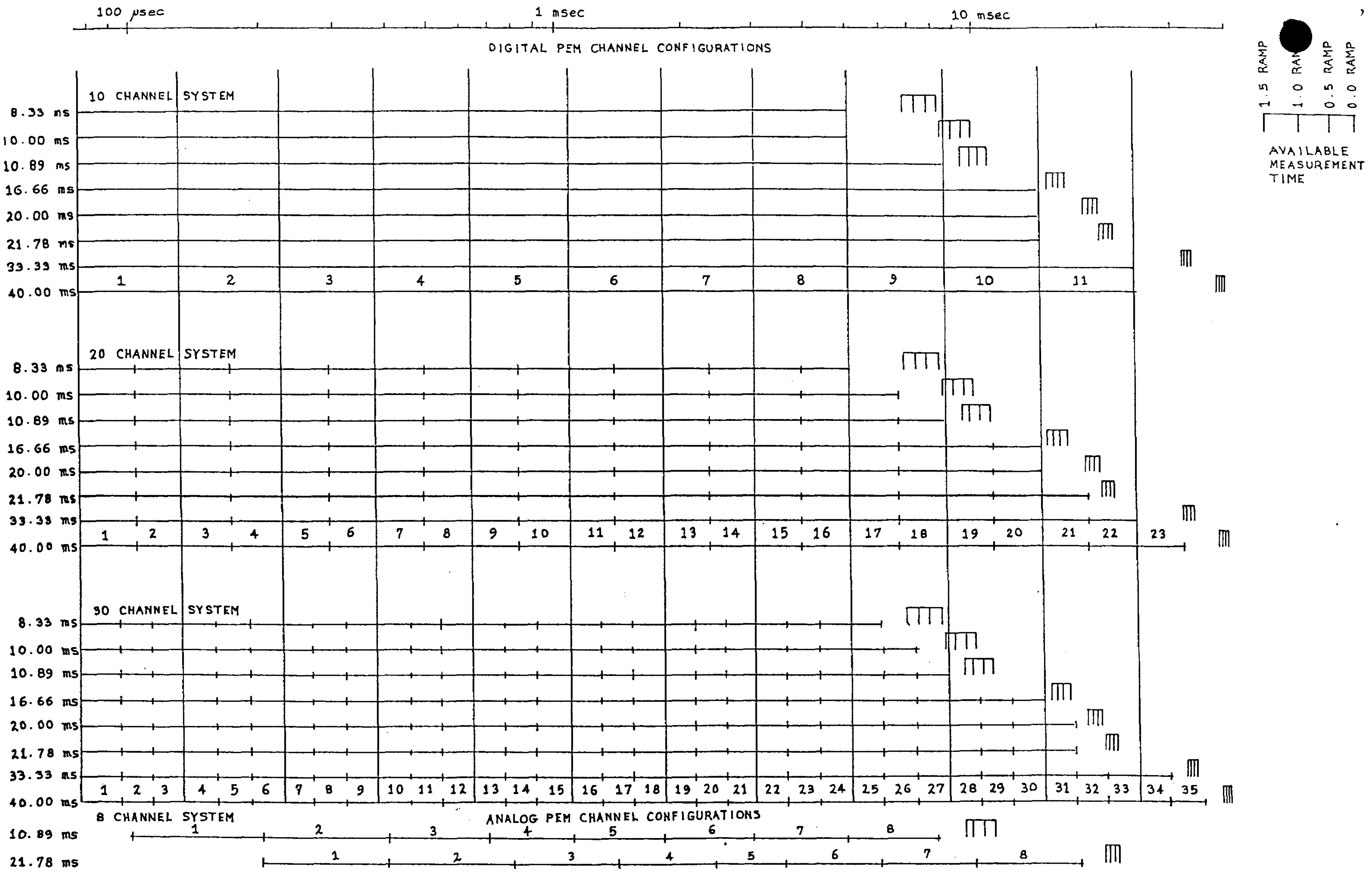
The Crone PEM system has proven to be reliable, durable, and portable, as well as easy to operate and maintain throughout its extensive field use on a worldwide basis. This is due to its quality of construction, extensive field testing, and a straight - forward design. The system is designed to be broken down as much as possible into pieces which can be carried by hand or on backpacks. The PEM system has operated successfully within temperature extremes of -40 deg. C to +50 deg. C, and in desert, jungle, arctic, mountainous, and underground mining conditions.

19. PHYSICAL SCALE MODEL FACILITY

Crone has constructed a physical scale model facility which allows for the modelling of odd shaped conductors which cannot be easily handled on a computer. The facility was designed to use our Digital Receiver and 2000 watt Transmitter without modification.

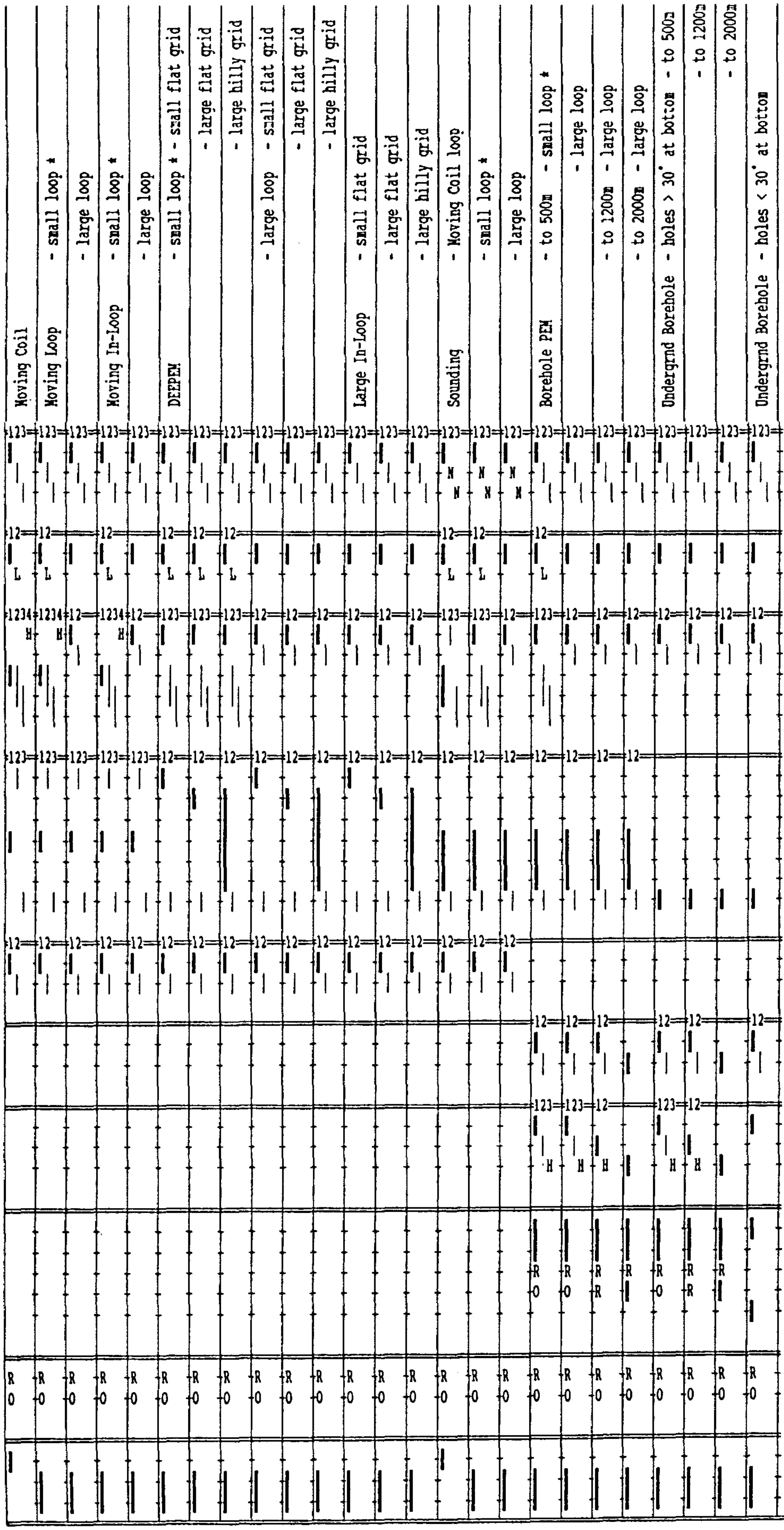
20. ACCURATE CONDUCTIVE THIN PLATE NUMERICAL MODELLING

The Crone Conductive Thin Plate Modelling software will run on PC compatible computers, and models a thin, rectangular plate in free space. All geometrical parameters are flexible (hole or line position, plate position and orientation, loop position and coordinates, plate dimensions). The program is based on the University of Toronto PLATE program and maintains the same accuracy as that program by using 15 eigencurrents in the solution. In this way odd-coupling, and current diffusion with time, are accurately calculated.



PULSE EM - Standard Channel Configuration

CRONE PEM - EQUIPMENT AND METHODS



METHOD

- Moving Coil
- Moving Loop - small loop *
  - large loop
- Moving In-Loop - small loop *
  - large loop
- DEEPEM - small loop * - small flat grid
  - large flat grid
  - large hilly grid
  - large loop - small flat grid
  - large flat grid
  - large hilly grid
- Large In-Loop - small flat grid
  - large flat grid
  - large hilly grid
- Sounding - Moving Coil loop
  - small loop *
  - large loop
- Borehole PEM - to 500m - small loop *
  - large loop
  - to 1200m - large loop
  - to 2000m - large loop
- Undergrnd Borehole - holes > 30° at bottom - to 500m
  - to 1200m
  - to 2000m
- Undergrnd Borehole - holes < 30° at bottom

KEY

1234 - Each of 4 columns between double lines contains 1 optional equipment configuration.
| - Best choice or only choice.
| - Alternate choice.
N - Not recommended for sounding - 8 channels only.
L - Low power - 24V battery power only.
H - Heavy - possible to use, but not recommended.
R - Recommended.
O - Optional.
* - Refers to a 100m X 100m loop of 10 AWG wire (1.3 Ω).
** - Out of production - available while quantities last.

EQUIPMENT

RECEIVER
- Digital Receiver
- Datalogger Receiver **
- Analog Receiver **

TRANSMITTER
- 2000W Transmitter (24V - 120V input)
- 500W Transmitter (24V input) **

POWER SOURCE
- 24V-120V Variable Voltage Regulator and 2000W Motor Alternator
- 120V Non-Variable Voltage Regulator and "Georator" system **
- 24V, 20A·Hr Battery Pack.
- 500W, 24V Motor Alternator.
- 24V, 9A·Hr Battery Pack **

SYNCHRONIZATION
- Built-in Radio
- Booster Antenna with Mast and Ropes
- Remote Radio.
- Sync Cable
- Sync Cable spool
- Wire winder (can also be used for loop wire)
- Crystal clock system

SURFACE COIL
- New-style surface coil with rotatable tripod.
- Old-style surface coil with fixed tripod. **

BOREHOLE PROBE
- Standard Borehole Probe
- Heavy-Duty Borehole Probe

BOREHOLE CABLE
- 500m Borehole Cable on small spool and standard winch
- 1200m Borehole Cable on medium spool and standard winch
- 2000m Borehole Cable on large spool and large winch

BOREHOLE ACCESSORIES
- Slip Ring
- Depth Counter (metric)
- Dummy Probes, Steel Wire, Retrieval tool
- Power Winding Accessories
- Pushrod system

GENERAL ACCESSORIES
- Tools, Maintenance Kit, Spare Parts, Testers
- Packframes

TRANSMIT LOOPS
- Moving Coil Tx Loop
- Transmit Wire (10 or 12 AWG)
- Wire Winders

Since 1962

CRONE GEOPHYSICS & EXPLORATION LTD.

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Project: Falconbridge Exploration
Boot Bay Survey PEM Survey

General Conductor Recognition and Analysis

Steeply dipping conductors are generally recognized by peaks on the horizontal component coincident with cross-overs or inflections on the vertical component. The peak of the horizontal component would be directly above the axis of the conductor. A good example of the anomaly pattern occurs on line 9268W at 10900N. Note the positive peak at this location on the horizontal component and a well defined cross-over on the vertical component.

Flat lying conductors have a different pattern: a cross-over on the horizontal component and a broad peak on the vertical component. The cross-over is near the centre of the conductor. No flat lying conductors are obvious in the area.

These patterns may be different if conductors are quite small and close to surface as appears to be the case for the response on line 8048W to 11100N. In this case the anomaly wave length is short (ie. only occurs at a couple of stations) which suggests that the conductor has little depth extent and strike length.

The strength or conductivity of a conductor can be measured by how many channels are influenced by the conductor and the ratio of a channel amplitude to the succeeding channel amplitude. For general purposes the higher conductivity conductors such as massive sulphide will respond on all twenty channels whereas a clay-filled fault may only respond on five or six channels. In this area most of the conductors are only recognized on the first seven channels. This would suggest poorly conductive material such as clay along a fault or a shear zone.

A "rule of thumb" measurement for calculating the depth to the top of the conductor can be made by measuring the 1/2 width at 1/2 of the amplitude on the horizontal component response and multiplying this number by 1.3. Most of the conductors that have been identified in this area are considered to be at or near surface.

COMPANY PROFILE
INSTRUMENTS AND SERVICES

SERVICES

PULSE EM SPECIALISTS

- 3-D Borehole – X, Y and Z Components to more than 2500m depth.
- Surface – fixed or moving loops; sounding or profiling.
- Underground – crystal clock timing; pushrods for flat holes.
- Small to Large Systems – various operational modes for all TEM applications.
- Fully Digital Receiver – graphical LCD displays; software-controlled operation.

METHOD DEVELOPMENT

- Invented Shootback EM.
- Pioneered Surface & Borehole Time-domain EM methods.
    - 5 Surface and 3 Borehole Pulse EM operational modes.
    - 3-Dimensional Borehole Pulse EM.

GEOPHYSICAL R & D

- Equipment design and testing.
- Interpretational aids & techniques including numerical and scale modelling.

MANUFACTURING, SALES, RENTALS, TRAINING

- Pulse EM – Surface and Borehole.
- Induced Polarization – Surface and Borehole.
- RADEM VLF.
- CEM/Shootback EM; Vertical Loop and other Dip-Angle EM.

CONTRACT SURVEYS

- Worldwide EM, I.P., Magnetics, VLF, and Gravity surveys.
- Specialists in Surface and Borehole Time-domain EM surveys.

CONSULTING

- Planning and Management of worldwide exploration programs.
- Presentation and Interpretation of geophysical data.
- Training and Supervision of survey operations.
- Extensive experience in Airborne, Surface, and Borehole Time-domain EM.

PROFILE

Crone Geophysics has been involved in mining exploration, and numerous other geophysical investigations since its founding in 1962 by J. Duncan Crone. It is probably best known for its high quality instrumentation, for the invention of Shootback EM, and the pioneering of surface, borehole, and underground time-domain EM methods and instrumentation (Pulse EM). In June 1990, Duncan Crone sold the assets and business of Crone Geophysics Ltd. to the employees, and a new company was formed, called Crone Geophysics & Exploration Ltd. Ownership is widely spread among the employees, creating an enthusiastic team, and a solid Canadian identity. J. D. Crone remains as President.

Over the years, the company has provided surface and borehole geophysical instruments, consulting services, and contract surveys to leading exploration groups throughout the world. Our data interpretation, based on the latest computerized techniques, combined with our long and varied experience, has assisted in geological mapping, the definition of subsurface zones of interest, and the discovery of numerous orebodies.

For many years, Crone was the only company to successfully build and operate down-hole PEM equipment capable of surveying deep holes. Duncan Crone is responsible for promoting the use of downhole PEM surveys routinely in exploration programs. Now, downhole PEM surveys are an integral part of the exploration philosophy of many mining companies searching for base metals and has helped in the discovery or definition of several such deposits such as Winston Lake, Lindsley, and Louvicourt.

Our unique position of being both a manufacturer and a survey contractor has been a tremendous benefit to both sides of the business. As a contractor, we can rely on the full support of our technical and manufacturing department to provide the most up-to-date equipment, technical excellence, minimal down time, and high field efficiency. As a manufacturer, we can continually improve our gear as a result of direct feedback and rigorous field testing by our most demanding customer - our own survey crews.

INSTRUMENTS

The instruments manufactured by Crone have earned a reputation for being portable, reliable, and durable, as well as simple to operate and maintain. They have been used by our crews and by our many satisfied customers in desert, jungle, arctic, mountainous, and underground mining conditions. This success is a result of quality construction, rigorous field testing, and a straightforward design.

RADEM VLF EM RECEIVER

This rugged, one-man EM unit can be used without accurate survey lines for reconnaissance surveys. It measures the dip-angle, field strength, and quadrature components of the VLF field.

SHOOTBACK EM

The system consists of two identical battery-powered CEM transceiver coils operating on three frequencies. The Shootback method does not require accurate survey lines, and is effective even in rugged terrain, since elevation and distance errors are nullified. It is the perfect tool for grass-roots exploration, reconnaissance, or airborne followup for conductors up to 60m deep.

VERTICAL LOOP EM AND OTHER DIP-ANGLE METHODS

For Vertical Loop surveys, one of the CEM coils can be replaced with a high-powered, vertical transmit loop, which increases the operating range to 800m. The CEM coils can also be used in various standard dip-angle configurations.

I.P. RECEIVER AND TRANSMITTER

This Newmont-designed receiver is a time-domain, analog, single-dipole receiver, designed to be portable and simple to operate. It provides M and N chargeability values as well as the primary voltage. The 250 Watt transmitter is battery-powered, can be carried by one person, and can provide up to 850 V output.

BOREHOLE I.P.

Two borehole I.P. logging systems are available. The simplest one is a 2 - electrode probe which uses the standard Borehole PEM cable and head. It can function as a potential dipole in a gradient configuration, or it can be used in a pole - pole configuration with one current and one potential down the hole. Various separations are available.

The other system allows for 5 potential electrodes and one current electrode down the hole. The four potential dipoles (or 5 poles) are positioned at various spacings, including a logarithmic spread.

PULSE EM

Crone was the first manufacturer to develop surface and borehole PEM systems. This lead has been maintained by constant research and testing of equipment, field methods, applications, and interpretation.

Our latest innovation is the world's first time-domain EM cross-component (X-Y) borehole probe with the same diameter and depth capabilities as our standard probes. The probe was developed with support from Noranda Exploration Co. Ltd., and provides 3-component information down the hole when used in conjunction with our axial (Z) probes. These three dimensional borehole surveys allow for more reliable directional information to off-hole conductors and give the direction to the centre of in-hole conductors, thereby allowing for more cost effective diamond drilling.

Receiving equipment has changed over the years, from the original analog unit, to the new state-of-the-art Digital PEM Receiver which is software-controlled, and is therefore tremendously flexible, and easily upgradeable. Features include: true data units; programmable channel times, 8 time bases; noise rejection; automatic gain control; and a high-quality graphic display of the decay curve, and profile data. The Digital Receiver has been used by our field crews since 1986. Transmitting equipment has evolved from the original 500 Watt battery-powered unit, to a 2000 Watt system with 8 selectable time bases, 3 selectable linear ramp times, 3 different synchronization options, and an ability to power any size loop up to 1 or 2 kilometers square.

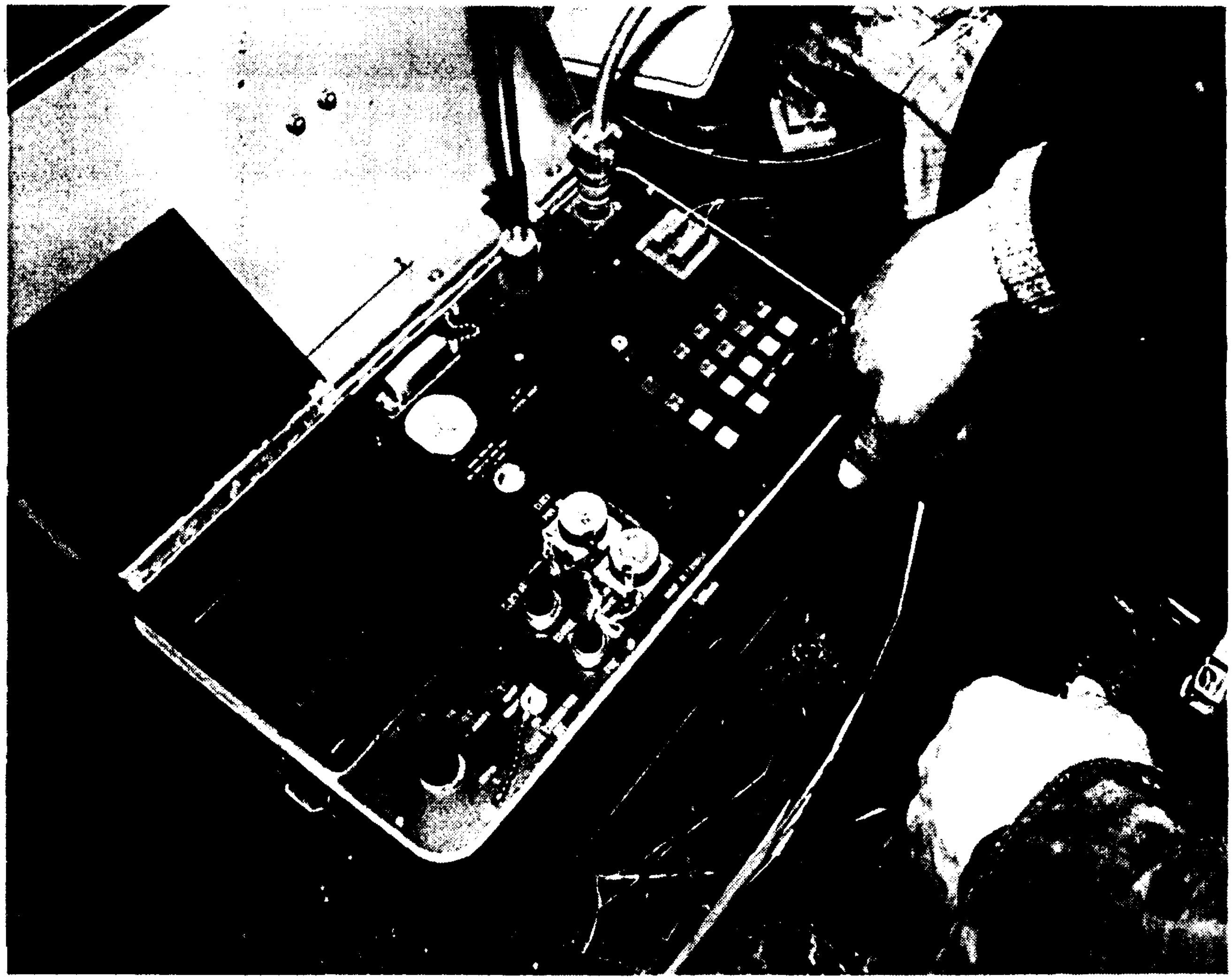
Field methods have been developed to allow Pulse EM to be used in virtually any physical or geological environment. Boreholes can be surveyed to depths of 2500m with one or more transmit loops; horizontal underground holes can be surveyed with a push-rod system; surface profiling can be done in at least five different ways, depending on the geological conditions, to depths of 600m or more; and layered-earth environments can be explored through resistivity sounding with the new Digital Receiver to depths of 1000m or more.

IBM-PC and compatible computer software packages for a variety of PEM data presentations, as well as PEM data processing, filtering and interpretation, are available with the system.

CRONE
Since 1962

DIGITAL PULSE EM RECEIVER

- Flexible, fully digital receiver for all types of surface and borehole time-domain EM surveys.
- Measures time rate of change of a component of the magnetic field vector within programmable time channels. Measured component is defined by the orientation of the surface coil or borehole probe.
- Standard 10, 20, and 30 channel configurations; five 37-channel tables programmable in the field.
- Primary field "PP" channel always used. Provides indispensable polarity and amplitude information.
- Decay curve and profile plot on graphic LCD: excellent quality; line or bar; linear or log; numerous scales; scrolling; grid lines; superimpose mode; vertical line cursor steps through channels or stations.
- Automatic gain control. No data scaling or reduction. Output is in nanoTesla/sec (nV/m^2).
- Researched, designed, and tested since 1982. Field proven since 1986. Feedback and rigorous field testing under all conditions from our most demanding customer - our own survey crews.



Decay curves and profile plots of some or all channels can be viewed on the spot for excellent data quality control and survey decision-making.

SPECIFICATIONS - DIGITAL PULSE EM RECEIVER

HARDWARE:
Modular board design for easy software and hardware upgrades.
Small LCD - 2 lines, 16 characters. Heated for operation below -20°C. LCD viewing adjustment.
Large LCD - 16 lines, 42 characters or 256 x 128 pixels graphics. Lid for sunlight. LCD viewing adjustment.
32 key alphanumeric keyboard with arrows and special function keys. Positive feedback key action.
Two CMOS microprocessors in parallel; 16 bit A/D conversion; Dynamic range: 138 dB; Max input voltage: ± 1V.

SOFTWARE CONTROLS:
Menu-driven functions: easy selection with moving highlight or letter code on 16 x 42 character LCD.
Pre-survey file preparation: up to 32 files can be set up with header information before surveying.
File switching and expansion; continue reading in any file at any time - until memory is full.
Extensive file and data handling routines; Selectively delete files or station readings.

VIEWING DATA IN THE FIELD (LISTS AND PLOTS):
List all channel reading simultaneously for 1 decay curve, or list data 3 channels at a time over all stations.
Plot channel readings as a decay curve at one station, or as a profile over several stations.
Excellent quality plots on 256 x 128 pixel graphic LCD; line or bar; linear or log; numerous scales; scrolling; grid lines; superimpose mode, vertical line cursor steps through channels or stations.

TIME BASE (ON-TIME – RAMP, or OFF-TIME + RAMP):
8.33 msec, 16.66 msec, 33.33 msec for 60 Hz noise areas (30 Hz, 15 Hz, 7.5 Hz base frequencies).
10.0 msec, 20.0 msec, 40.0 msec for 50 Hz noise areas (25 Hz, 12.5 Hz, 6.25 Hz base frequencies).
10.89 msec, 21.79 msec for compatibility with Analog and Datalogger PEM Receivers.

CHANNEL CONFIGURATION:
Three logarithmic configurations each starting at 76.5 µsec. (10, 20, or 30 channels in 16.66 msece)
- each of 10 channels is split in 2 (20 channels) or 3 (30 channels) for ease of data comparison.
Five programmable configurations - each with a minimum time interval of 4.5 µsec, and a maximum of 37 channels
- each can be configured in the field, and changed after dumping data
One 8 channel configuration identical to Analog PEM channels.
One preset 45 channel configuration over 202 µsec for current ramp analysis and zero-time-set procedure.
Time base can be changed without affecting the channel configuration.

PRIMARY FIELD MONITOR: A Primary Pulse "PP" channel is always used in addition to the above configurations as it provides indispensable primary field polarity and amplitude information. It measures during the current ramp.

ZERO-TIME-SET: The current shut-off is measured using 45 channels 4.5 µsec wide. A linear plot on the large LCD clearly shows the shape of the ramp, and the zero time (end of ramp) can be set.

SYNCHRONIZATION: Cable and Radio are standard. Optional internal crystal clock.

CALIBRATION OF DATA: Effective area of coil or probe is entered into the Receiver in square metres. Thereafter, readings are measured and stored in nanoTeslas/sec (=nV/m^2).

GAINS: 10-1280; Internally selected for each channel for best Signal-to-Noise, or manual override. Internal scaling of data.

NOISE REJECTION: Automatic spike rejection. Powerline rejection typically 78dB.

STACKING: 512 to 65,536 readings in seven doubling steps.

STATISTICAL ANALYSIS: Calculation and display of statistical reading error.

STORAGE: 64 KBytes data storage (approximately 500 readings of 20 channel data).

DATA TRANSFER: RS232 connection to computer with menu-selectable serial parameters.

BATTERIES: 2 rechargeable 12V gel cells. Battery test and low battery warning. Minimum 8 hours of field use.

TEMPERATURE RANGE: Operational from -40°C to +50°C.

HUMIDITY: Refillable desiccant container with colour indicator accessible from top panel.

WEIGHT: 15 kg., shipping: 23kg.

TRANSPORT: Plywood box for shipping and field transport with closed cell foam shock protection.

ACCESSORIES: Battery charger; RS 232 cable; Uploading software; Data presentation software; optional packframe.

- Specifications subject to change without notice.

CRONE Since 1962

CRONE GEOPHYSICS & EXPLORATION LTD.
3607 WOLFEDALE ROAD, MISSISSAUGA, ONTARIO, CANADA L5C 1V8
TEL:(416) 270-0096 • FAX: (416) 270-3472 • TELEX: 06-961260

CRONE
Since 1962

PULSE EM
TRANSMITTER EQUIPMENT

- Flexible, multi-purpose transmitter and complete transmitting equipment for all types of surface and borehole time-domain EM surveys.

- 2000 Watt Transmitter can be powered 3 ways:
  - 24V rechargeable Battery Pack.
  - 24V Battery and 500W Motor Generator.
  - 24V-120V from 2000 W Motor Generator and Voltage Regulator.

- 24V input for Low-Power PEM surveys:

  18 Amps through 7-turn, 14m diameter Moving Coil (19,000 Am^2 dipole moment)
    - locates shallow (up to 150m deep) conductors even in conductive environments when used in profiling mode (Slingram method).
    - shallow resistivity soundings to 200m or more.

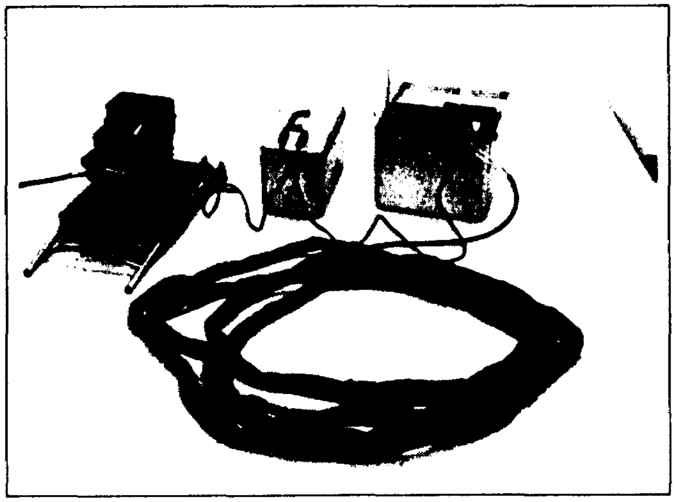
  18 Amps through 100m x 100m loop (180,000 Am^2 dipole moment)
    - Moving Loop or Moving In-Loop surveys for deeper conductor detection even in conductive environments.
    - Borehole logging to 300m or 300m long surface lines outside loop (small scale DEEPEM).
    - Resistivity sounding to hundreds of metres.

- 24V-120V input for High-Power PEM surveys:
    - Any loop size from 100m x 100m to 1 or 2 km square.
    - Can be used for all Surface and Borehole PEM surveys for deep conductor detection or deep resistivity sounding.

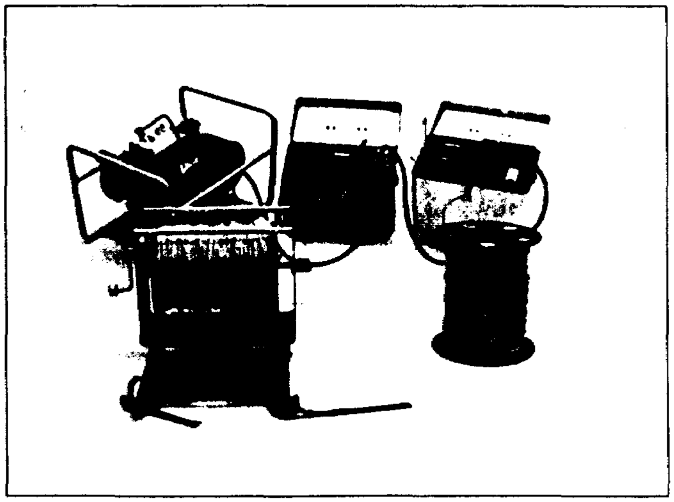
- 3 selectable current ramp times, 8 selectable time bases, and 3 synchronization methods.

- **Ramp times are fixed** to allow for proper data comparisons from loop to loop.

- Cleared for safe use in producing mines for underground borehole surveys.



Lower Power Gear
The 500W Motor Generator is required if the Transmitter is on for long periods. It is optional for the Moving Coil method.



2000 Watt Gear
Can power any size loop from 100m x 100m to 1 or 2 km square

SPECIFICATIONS - PULSE EM TRANSMITTER EQUIPMENT

2000 WATT PEM TRANSMITTER:

Controls bipolar, on-off waveform and linear current shut-off ramp time. Operating voltage: 24V to 120V.

Synchronization: Radio and cable synchronization are standard. Internal radio powers 1 metre long telescoping antenna (standard) or optional 1/4 Wave CB booster antenna on mast. In hilly terrain, use external (remote) radio and booster antenna on high point of grid, controlled by cable sync. Optional external crystal clock sync system.

On-Off times for 60 Hz powerline filtering: 8.33ms, 16.66ms, 33.33ms; for 50 Hz powerline filtering: 10.0ms, 20.0ms, 40ms; for analog PEM operation: 10.9ms, 21.8ms.

Linear controlled current shut-off ramp times of 0.5, 1.0 and 1.5ms. Ramp time is fixed and non-drifting with temperature and loop size to allow for accurate data comparison and interpretation.

Monitors for shut-off ramp operation, instrument temperature, Tx loop continuity, and overload output current.

Meters for loop current, input voltage, sync test.
Automatic shut-down for open Tx loop, high instrument temperature, and overload.

Net weight: 12.5 kg, shipping: 22 kg.

2000WATT MOTOR GENERATOR:

4 1/2 H.P. Wisconsin Robin, 4 cycle engine with belt drive to D.C. alternator; both mounted on frame; output: 120V, 20 Amps; external gas tank with hose and valve for full day of unattended operation; Net weight: 33 kg; shipping: 47 kg.

24V-120V VARIABLE VOLTAGE REGULATOR:

Controls and filters the alternator output; continuously variable between 24V and 120V D.C., 20 Amp maximum current; Net weight: 10kg, shipping: 20 kg.

WIRE, SPOOLS AND WINDERS:

Transmitter wire is usually No. 10 or 12 AWG insulated copper wire in 300m or 400m lengths, 1 length per spool; 2 spools in a shipping box; winder is mounted on a magnesium packframe.

MULTI-TURN MOVING COIL:

7 turn, 14 meter diameter Tx loop; plugs to break loop into 2 sections for easy station-to-station movement. Aluminum or copper wire and various coverings depending on area being used.

BATTERY POWER SUPPLY:

24V, 20 amp hour; rechargeable battery supply for use with PEM Transmitter as power source rather than motor-generator-regulator. In aluminum case, with clamp connectors. Net weight: 20.5 kg, shipping: 29 kg.

500 WATT, LOW-POWER MOTOR GENERATOR:

For continuous transmitter operation in Low-power PEM surveys. 3.5 H.P. Motor with belt drive to Alternator and Regulator; mounted on frame; output: 24V DC, 500W; connect to transmitter in parallel with 24V Battery Pack.

- Battery chargers supplied for all rechargeable battery units.
- All instruments and equipment operational from -40°C to +50°C.
- Plywood boxes for shipping and field transport with closed cell foam shock protection.

* Specifications subject to change without notice.

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Since 1962

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Project: Falconbridge Exploration
Boot Bay Survey PEM Survey

General Conductor Recognition and Analysis

Steeply dipping conductors are generally recognized by peaks on the horizontal component coincident with cross-overs or inflections on the vertical component. The peak of the horizontal component would be directly above the axis of the conductor. A good example of the anomaly pattern occurs on line 9268W at 10900N. Note the positive peak at this location on the horizontal component and a well defined cross-over on the vertical component.

Flat lying conductors have a different pattern: a cross-over on the horizontal component and a broad peak on the vertical component. The cross-over is near the centre of the conductor. No flat lying conductors are obvious in the area.

These patterns may be different if conductors are quite small and close to surface as appears to be the case for the response on line 8048W to 11100N. In this case the anomaly wave length is short (ie. only occurs at a couple of stations) which suggests that the conductor has little depth extent and strike length.

The strength or conductivity of a conductor can be measured by how many channels are influenced by the conductor and the ratio of a channel amplitude to the succeeding channel amplitude. For general purposes the higher conductivity conductors such as massive sulphide will respond on all twenty channels whereas a clay-filled fault may only respond on five or six channels. In this area most of the conductors are only recognized on the first seven channels. This would suggest poorly conductive material such as clay along a fault or a shear zone.

A "rule of thumb" measurement for calculating the depth to the top of the conductor can be made by measuring the 1/2 width at 1/2 of the amplitude on the horizontal component response and multiplying this number by 1.3. Most of the conductors that have been identified in this area are considered to be at or near surface.

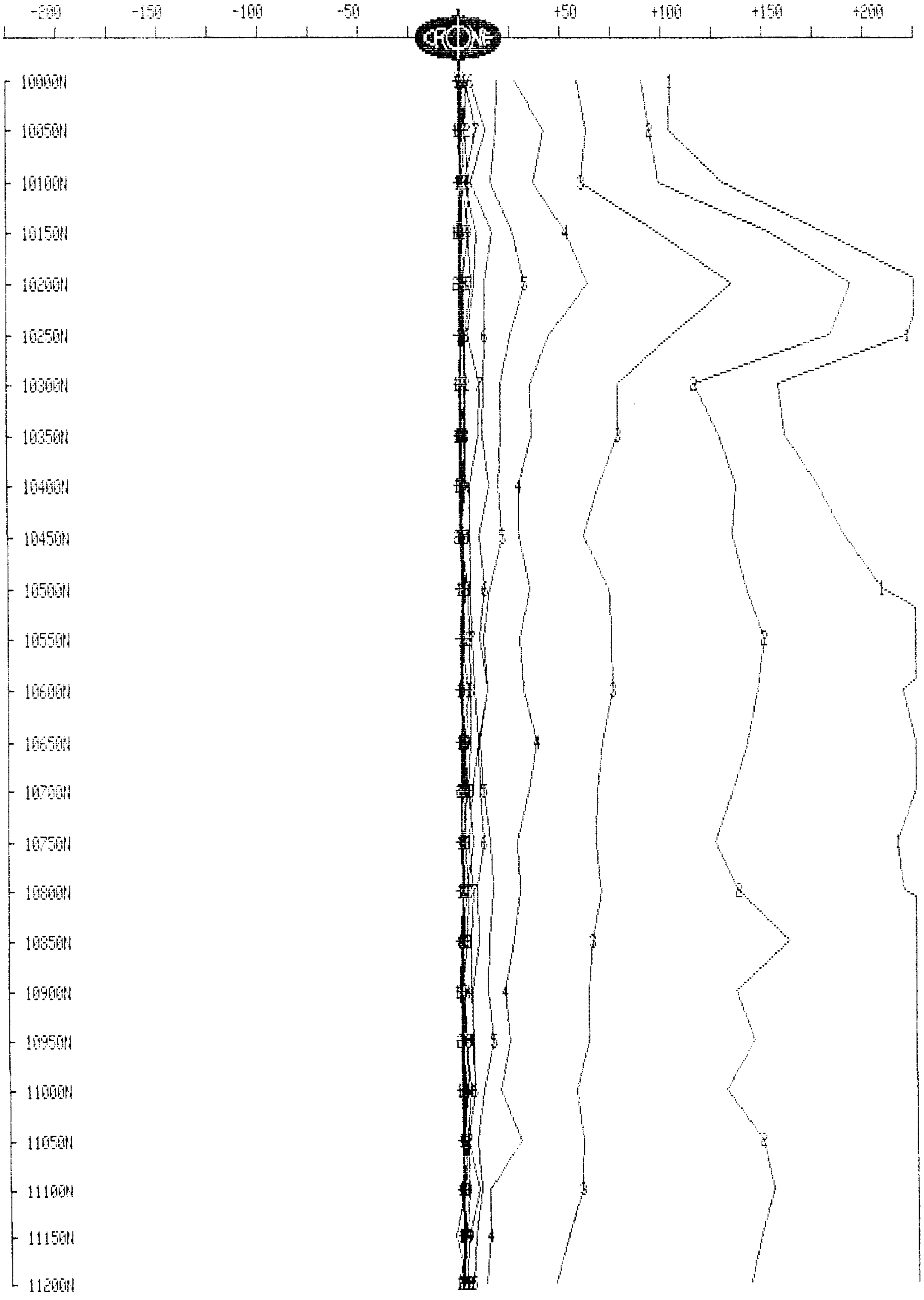
CRONE GEOPHYSICS & EXPLORATION LTD

SURFACE PEM

Client : FALCONBRIDGE
Grid : BOOT-BAY
Date : Mar 21, 1992

Line : 10366W
Tx Loop : 1
File name : L10366W1.PEM

IN-LINE HORIZONTAL COMPONENT dBx/dt nanoTesla/sec - 20 channels
Scale: 1:5000
Unit Scale: 1cm = 25 nT/s

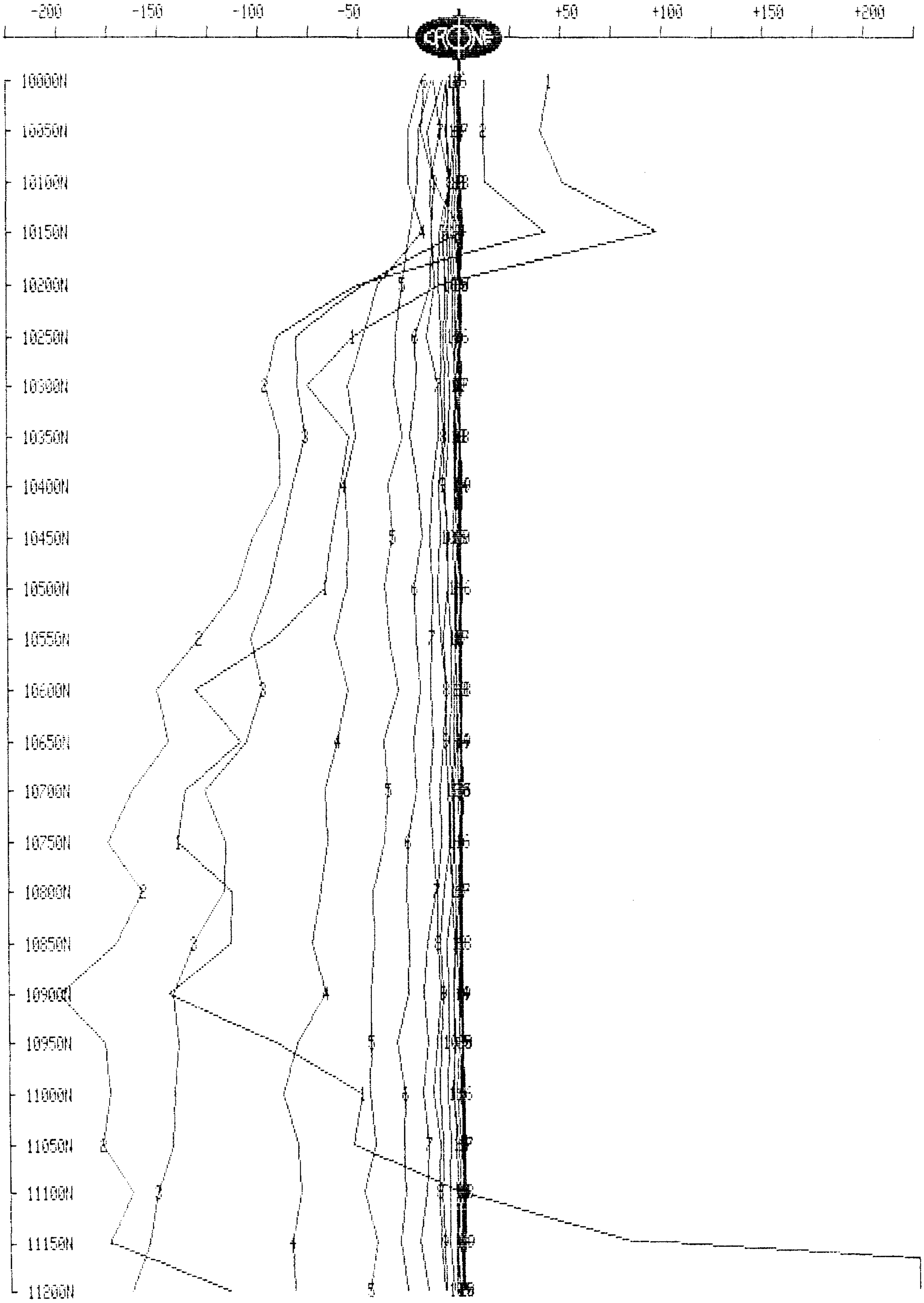


CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

Client :	FALCONBRIDGE	Line :	**10366W**
Grid :	BOOT-BAY	Tx Loop :	1
Date :	Mar 21, 1992	File name :	L10366W1.PEM

VERTICAL COMPONENT dBz/dt nanoTesla/sec - 20 channels

Scale: 1:5000 Unit Scale: 1cm = 25 nT/s

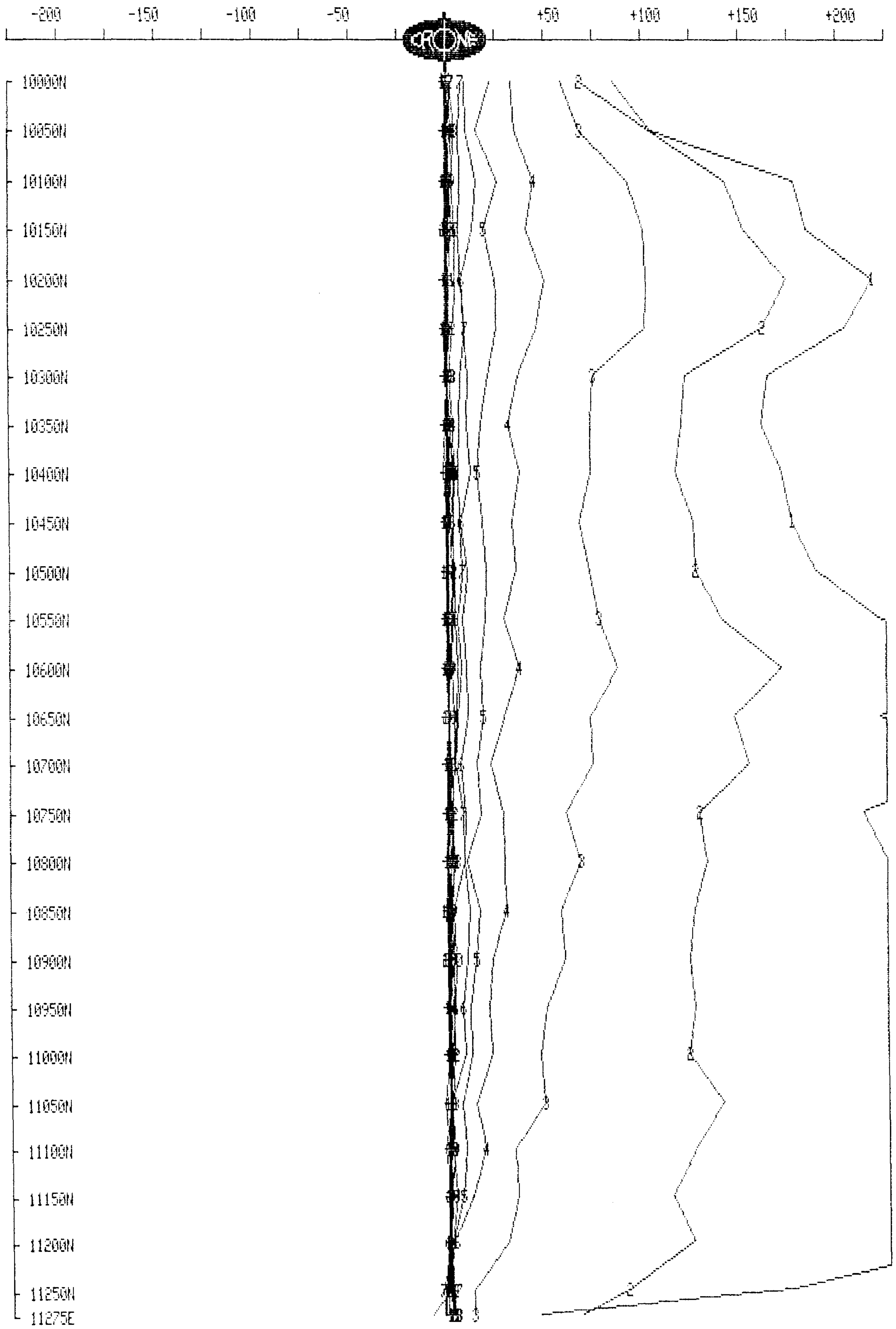


CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

Client : **FALCONBRIDGE**
Grid : BOOT-BAY
Date : Mar 21, 1992

Line : **10244W**
Tx Loop : 1
File name : L10244W1.PEM

IN-LINE HORIZONTAL COMPONENT dBx/dt nanoTesla/sec - 20 channels
Scale: 1:5000
Unit Scale: 1cm = 25 nT/s

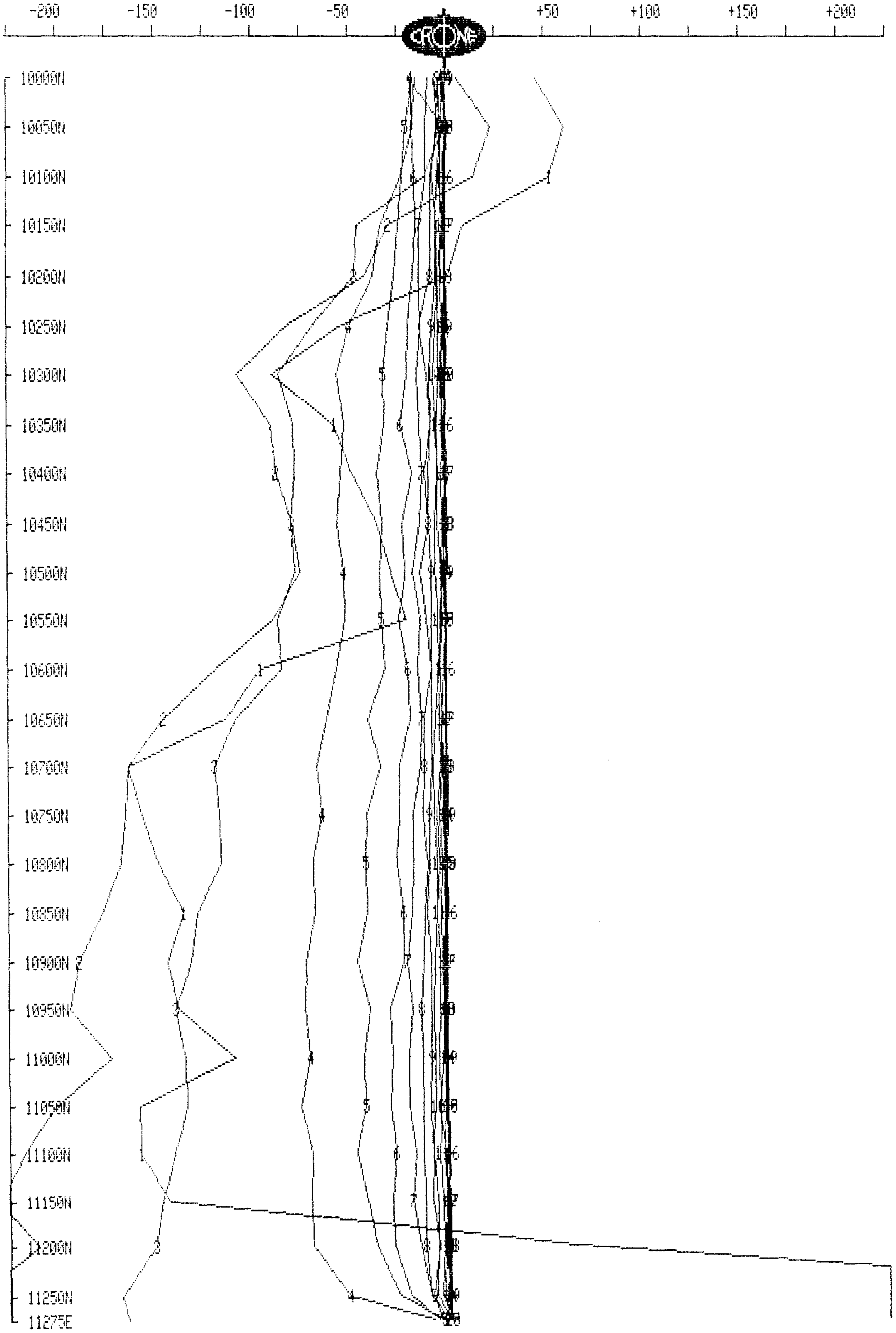


CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

Client : FALCONBRIDGE		Line : 10244W	
Grid : BOOT-BAY		Tx Loop : 1	
Date : Mar 21, 1992		File name : L10244W1.PEM	

VERTICAL COMPONENT dBz/dt nanoTesla/sec - 20 channels

Scale: 1:5000 Unit Scale: 1cm = 25 nT/s

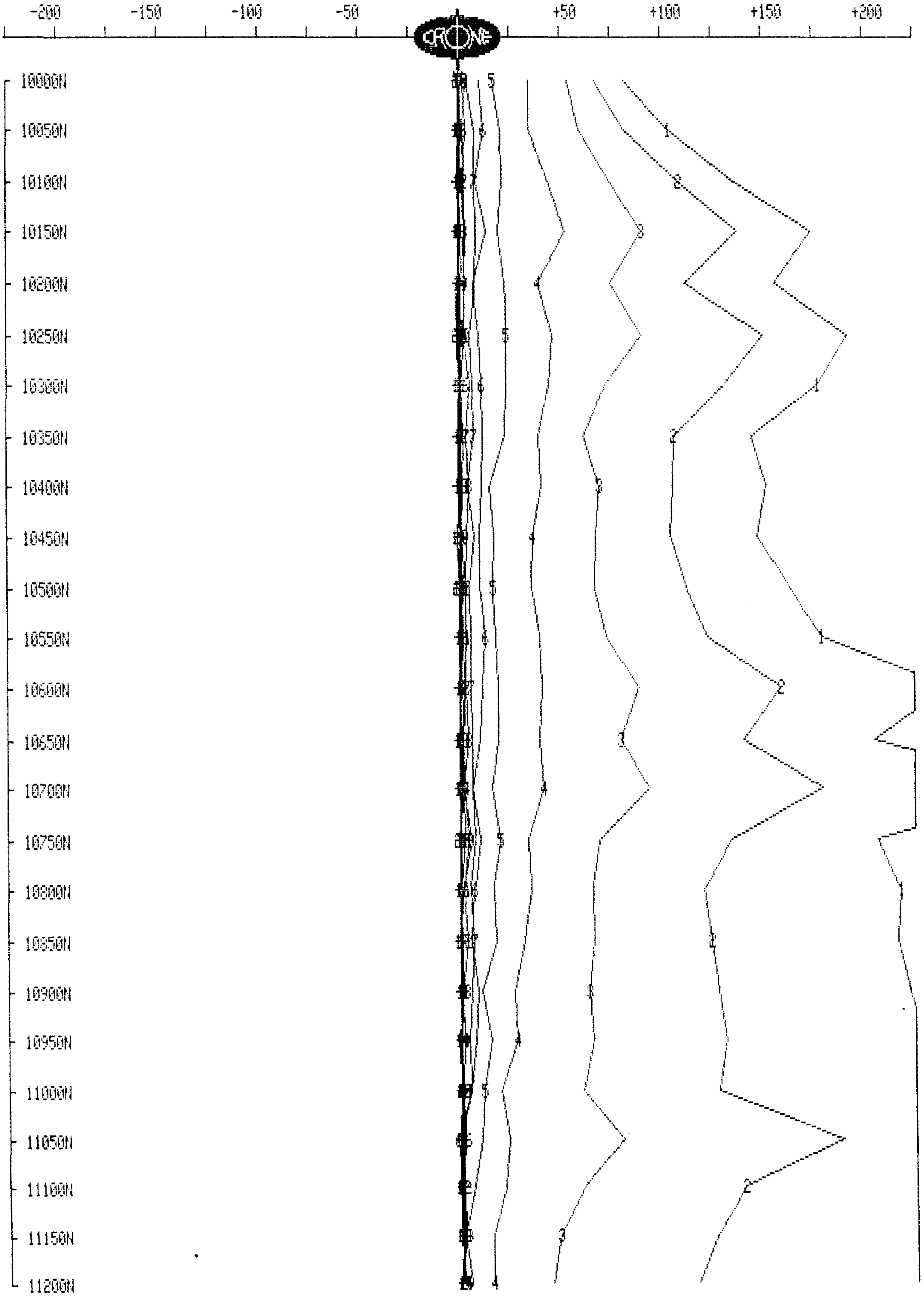


CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

Client : FALCONBRIDGE
Grid : BOOT-BAY
Date : Mar 21, 1992

Line : 10122W
Tx Loop : 1
File name : L10122W1.PEM

IN-LINE HORIZONTAL COMPONENT dBx/dt nanoTesla/sec - 20 channels
Scale: 1:5000 Unit Scale: 1cm = 25 nT/s

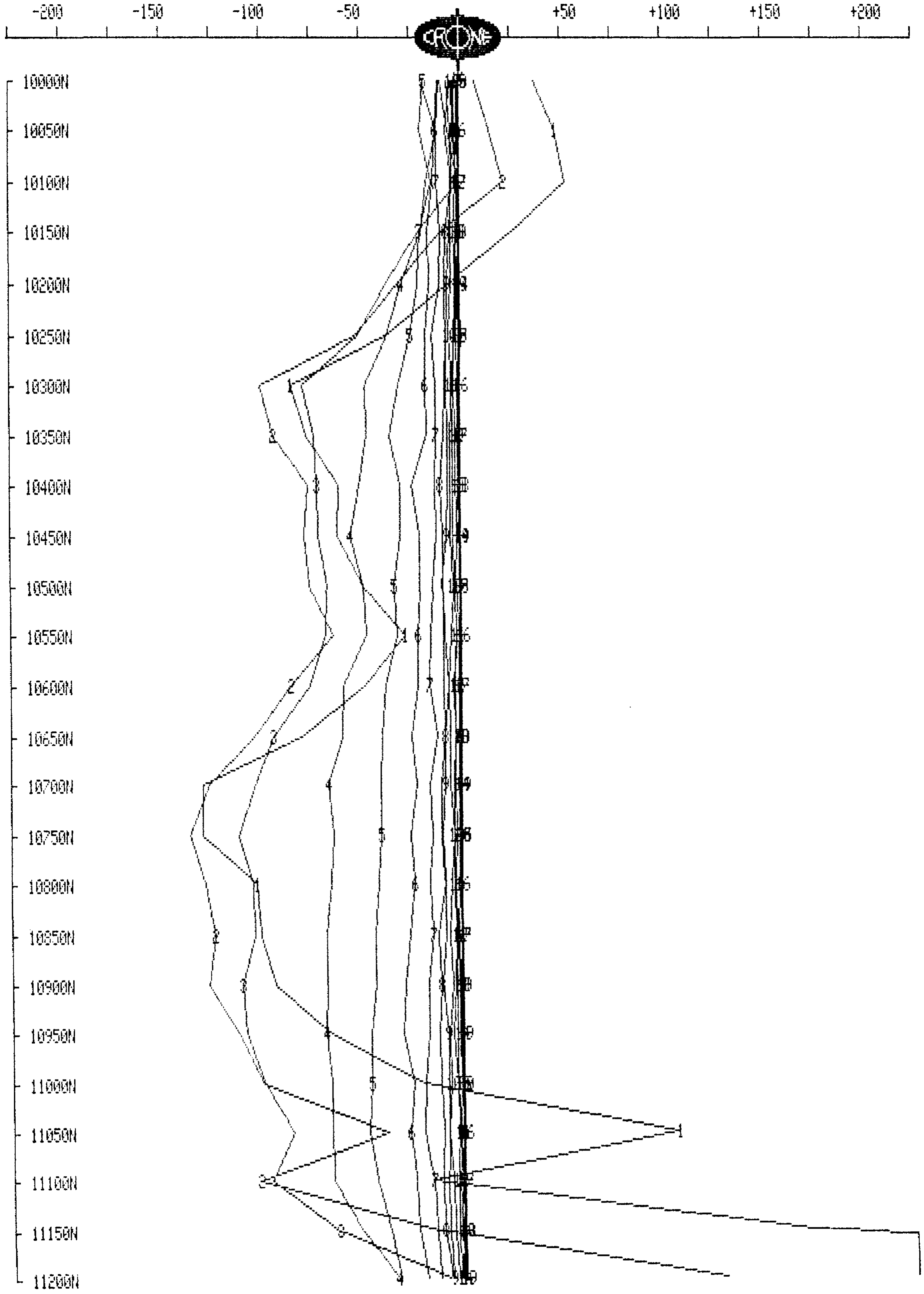


CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

Client	: FALCONBRIDGE	Line	: 10122W
Grid	: BOOT-BAY	Tx Loop	: 1
Date	: Mar 21, 1992	File name	: L10122W1.PEM

VERTICAL COMPONENT dBz/dt nanoTesla/sec - 20 channels

Scale: 1:5000 Unit Scale: 1cm = 25 nT/s

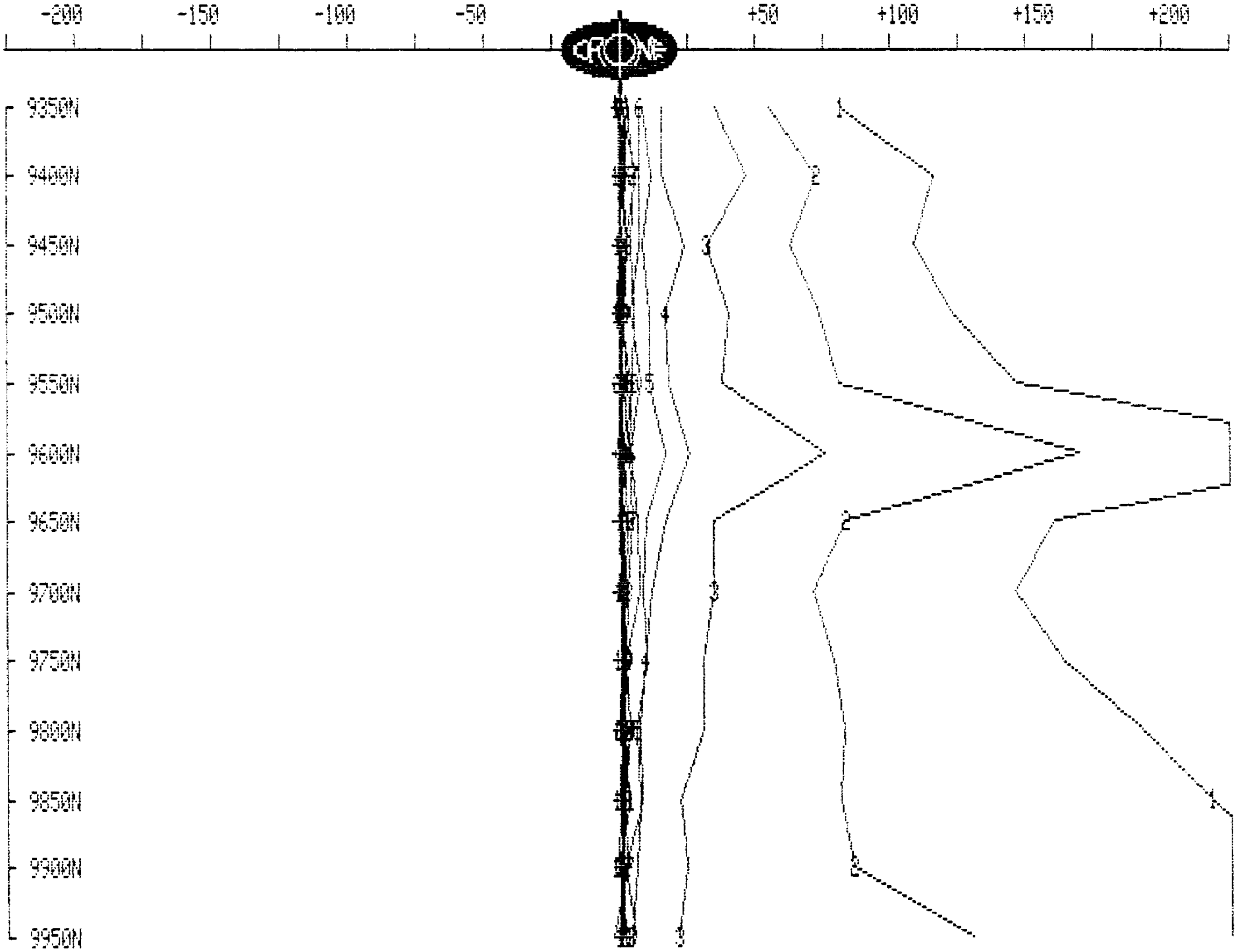


CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

Client : FALCONBRIDGE
Grid : BOOT-BAY
Date : Mar 20, 1992

Line : 10122W
Tx Loop : 2
File name : L10122W2.PEM

IN-LINE HORIZONTAL COMPONENT dBx/dt nanoTesla/sec - 20 channels
Scale: 1:5000 Unit Scale: 1cm = 25 nT/s



CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

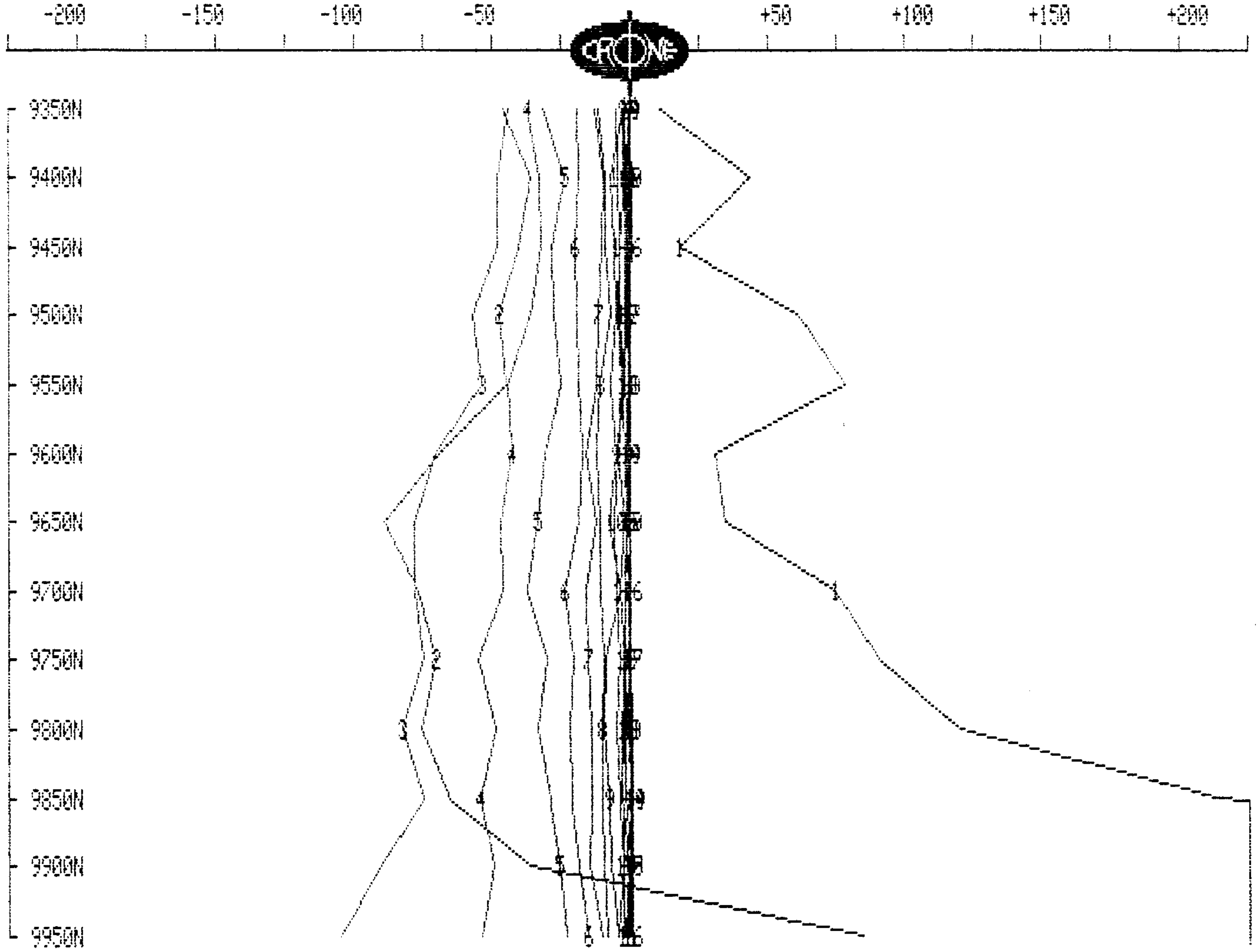
Client : FALCONBRIDGE
Grid : BOOT-BAY
Date : Mar 20, 1992

Line : 10122W
Tx Loop : 2
File name : L10122W2.PEM

VERTICAL COMPONENT dBz/dt nanoTesla/sec - 20 channels

Scale: 1:5000

Unit Scale: 1cm = 25 nT/s

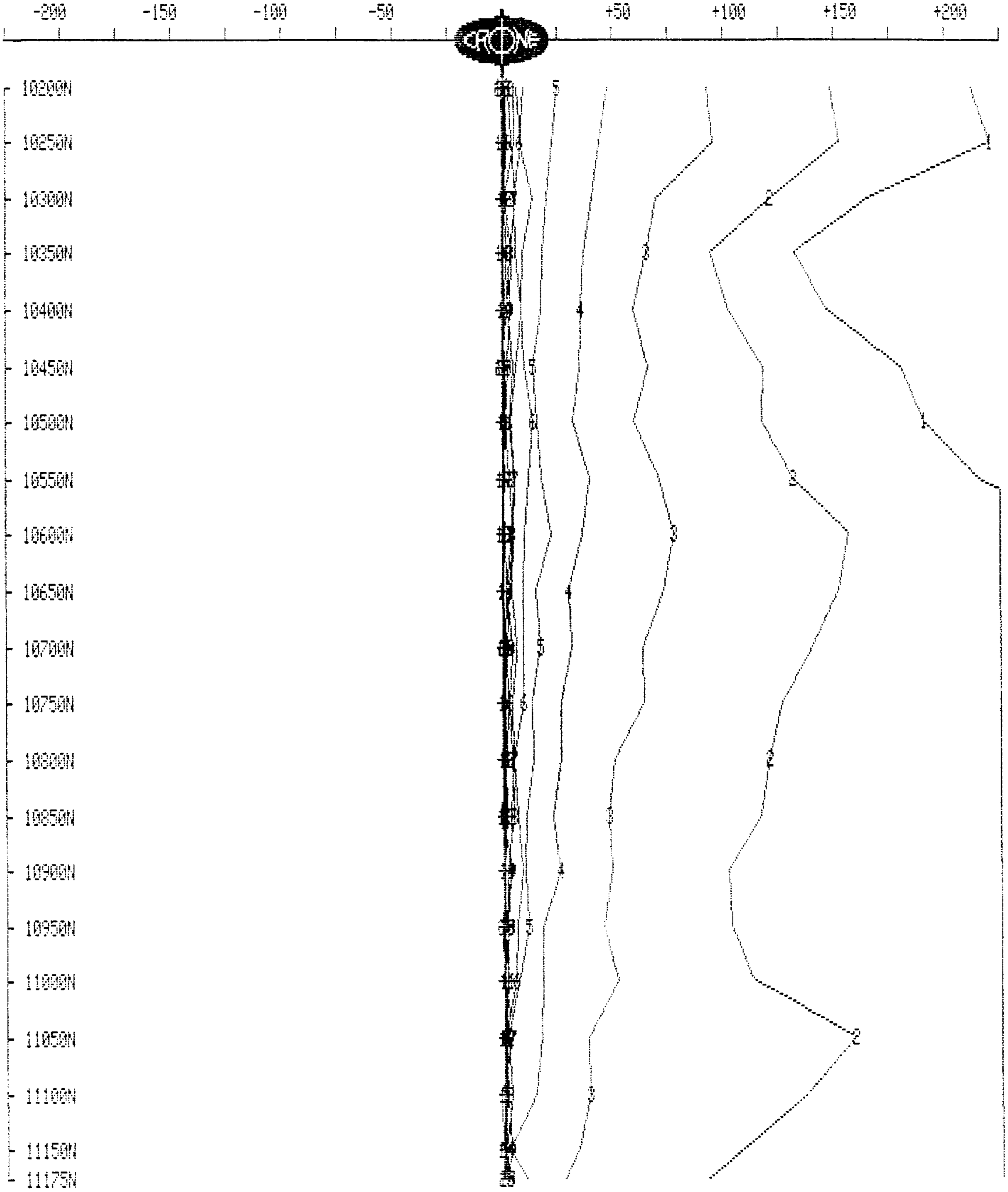


CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

Client	: FALCONBRIDGE	Line	: 10000W
Grid	: BOOT-BAY	Tx Loop	: 1
Date	: Mar 21, 1992	File name	: L10000W1.PEM

IN-LINE HORIZONTAL COMPONENT dBx/dt nanoTesla/sec - 20 channels

Scale: 1:5000 Unit Scale: 1cm = 25 nT/s



CRONE GEOPHYSICS & EXPLORATION LTD

SURFACE PEM

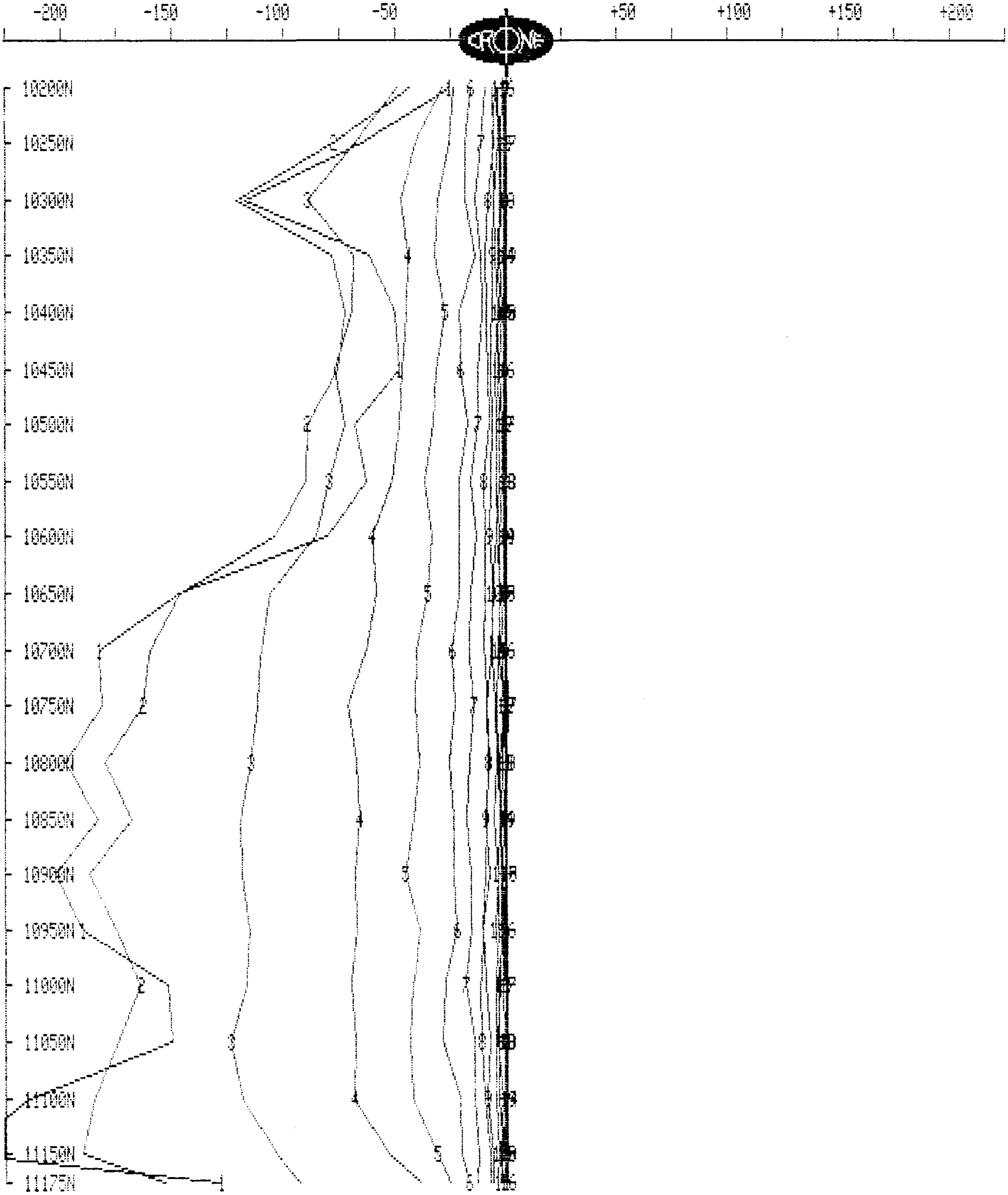
Client : FALCONBRIDGE
Grid : BOOT-BAY
Date : Mar 21, 1992

Line : 10000W
Tx Loop : 1
File name : L10000W1.PEM

VERTICAL COMPONENT dBz/dt nanoTesla/sec - 20 channels

Scale: 1:5000

Unit Scale: 1cm = 25 nT/s



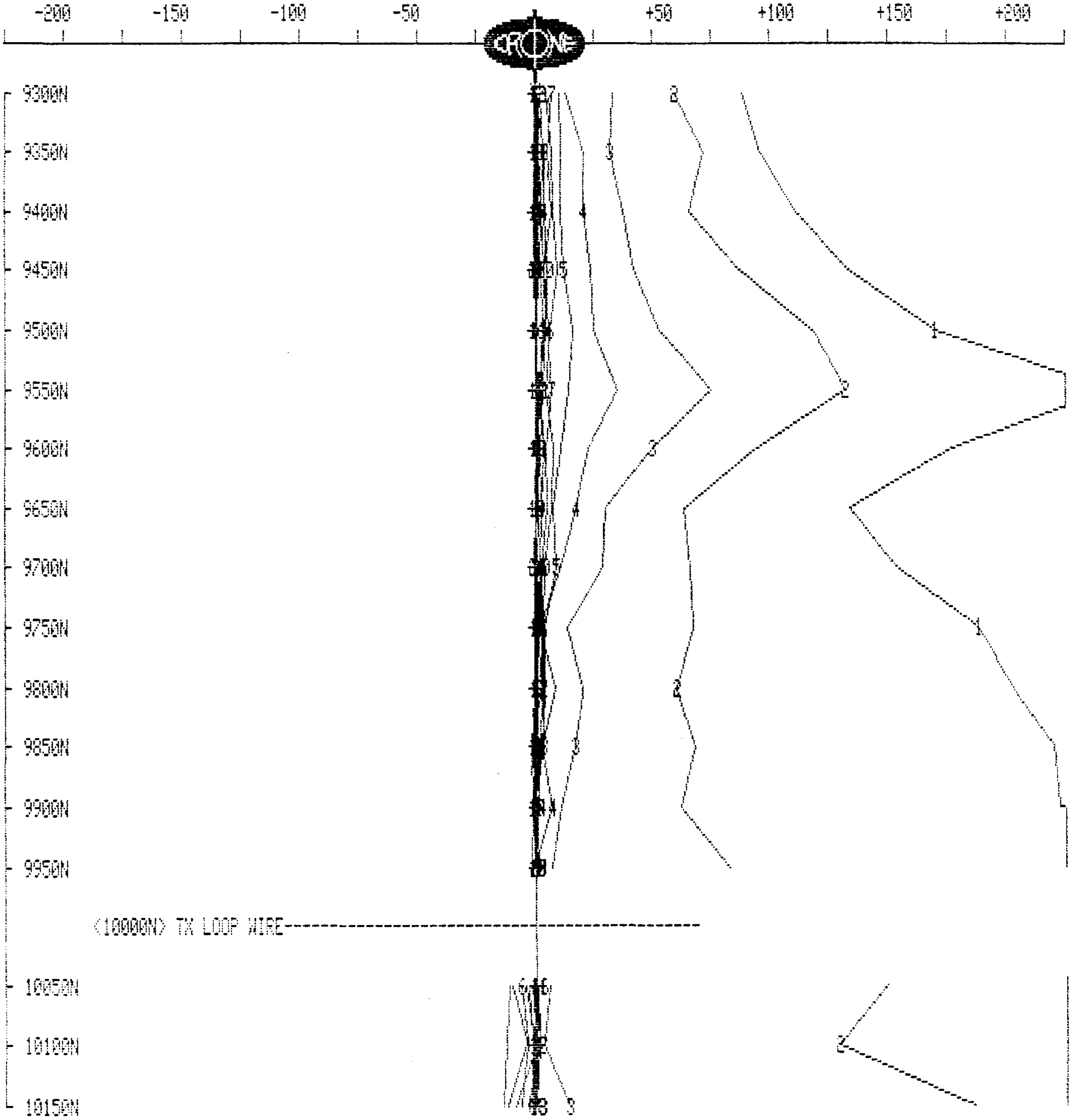
CRONE GEOPHYSICS & EXPLORATION LTD

SURFACE PEM

Client : FALCONBRIDGE
Grid : BOOT-BAY
Date : Mar 20, 1992

Line : 10000W
Tx Loop : 2
File name : L10000W2.PEM

IN-LINE HORIZONTAL COMPONENT dBx/dt nanoTesla/sec - 20 channels
Scale: 1:5000
Unit Scale: 1cm = 25 nT/s



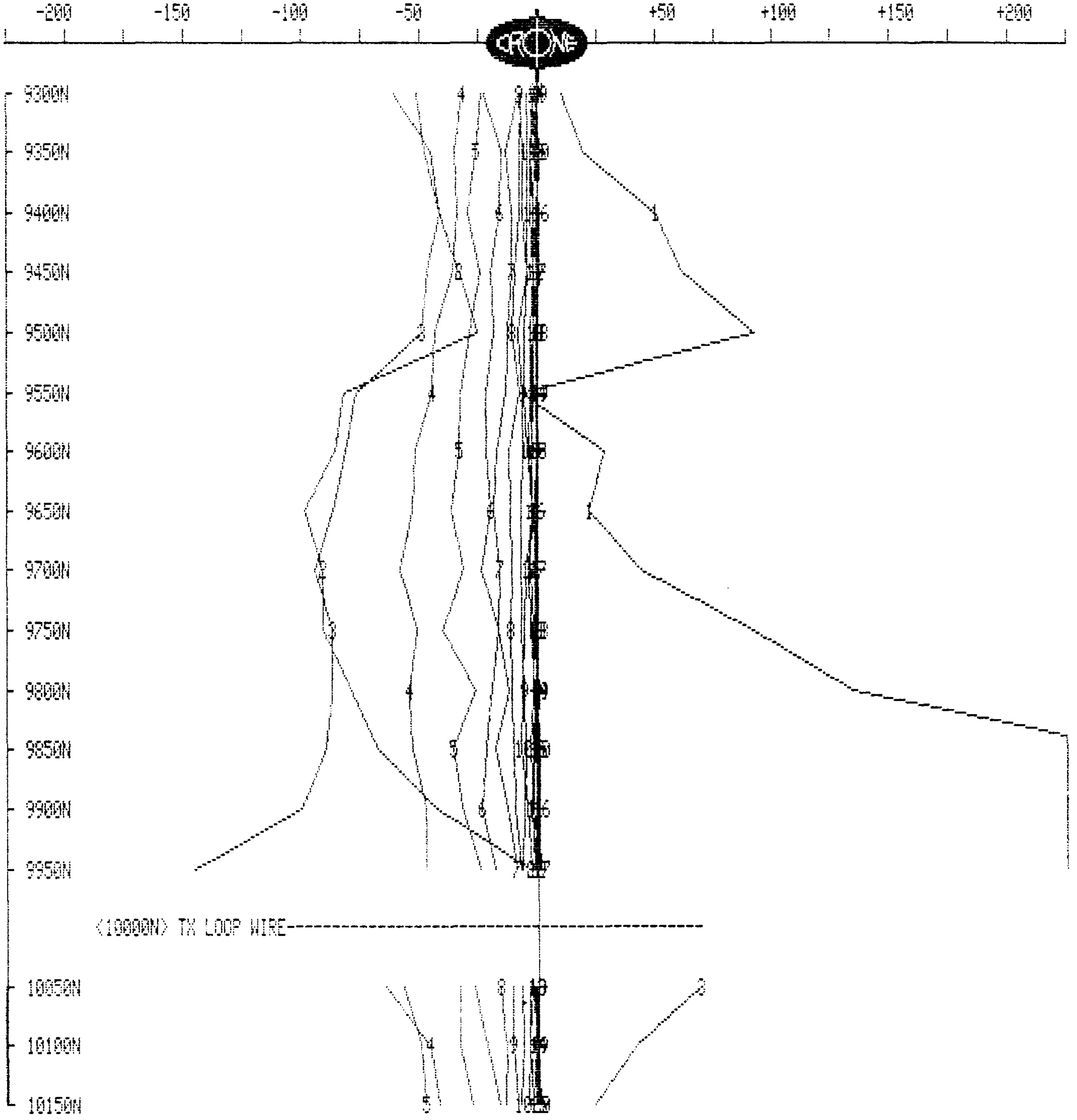
CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

Client	: FALCONBRIDGE	Line	: 10000W
Grid	: BOOT-BAY	Tx Loop	: 2
Date	: Mar 20, 1992	File name	: L10000W2.PEM

VERTICAL COMPONENT dBz/dt nanoTesla/sec - 20 channels

Scale: 1:5000

Unit Scale: 1cm = 25 nT/s

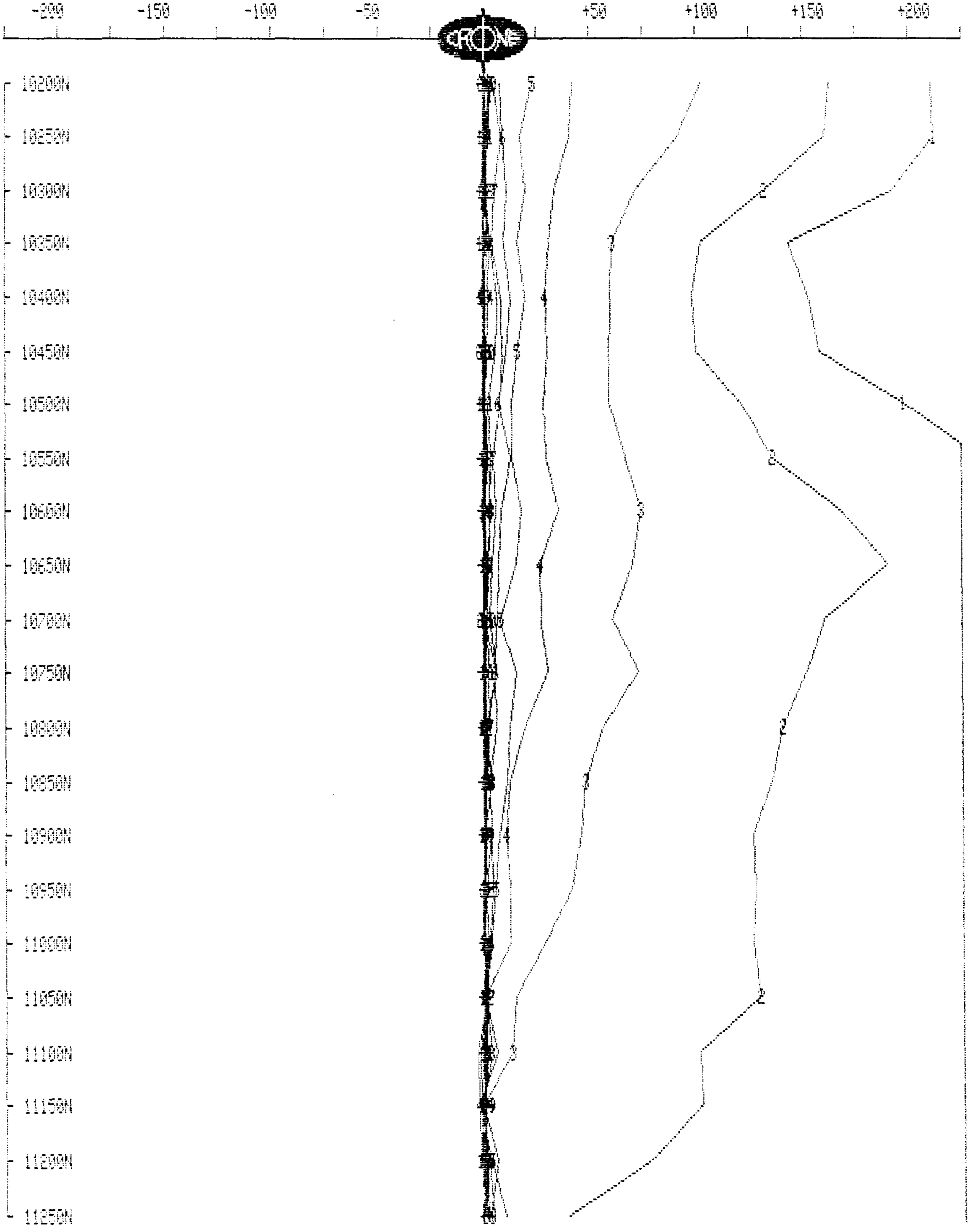


CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

Client	: FALCONBRIDGE	Line	: 9878W
Grid	: BOOT-BAY	Tx Loop	: 1
Date	: Mar 19, 1992	File name	: L9878W1.PEM

IN-LINE HORIZONTAL COMPONENT dBx/dt nanoTesla/sec - 20 channels

Scale: 1:5000 Unit Scale: 1cm = 25 nT/s

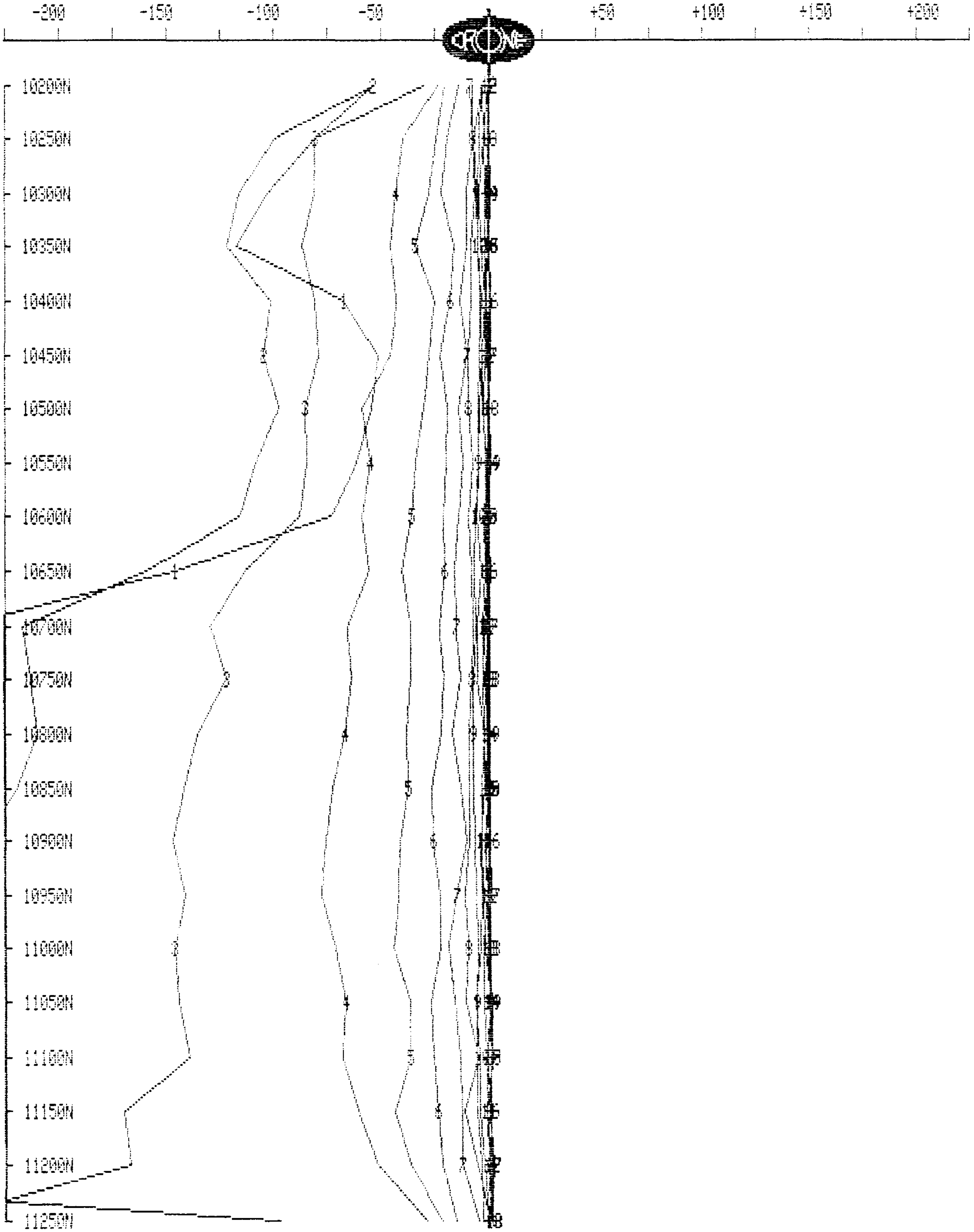


CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

Client : FALCONBRIDGE		Line	: 9878W
Grid : BOOT-BAY		Tx Loop	: 1
Date : Mar 19, 1992		File name	: L9878W1.PEM

VERTICAL COMPONENT dBz/dt nanoTesla/sec - 20 channels

Scale: 1:5000 Unit Scale: 1cm = 25 nT/s



CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

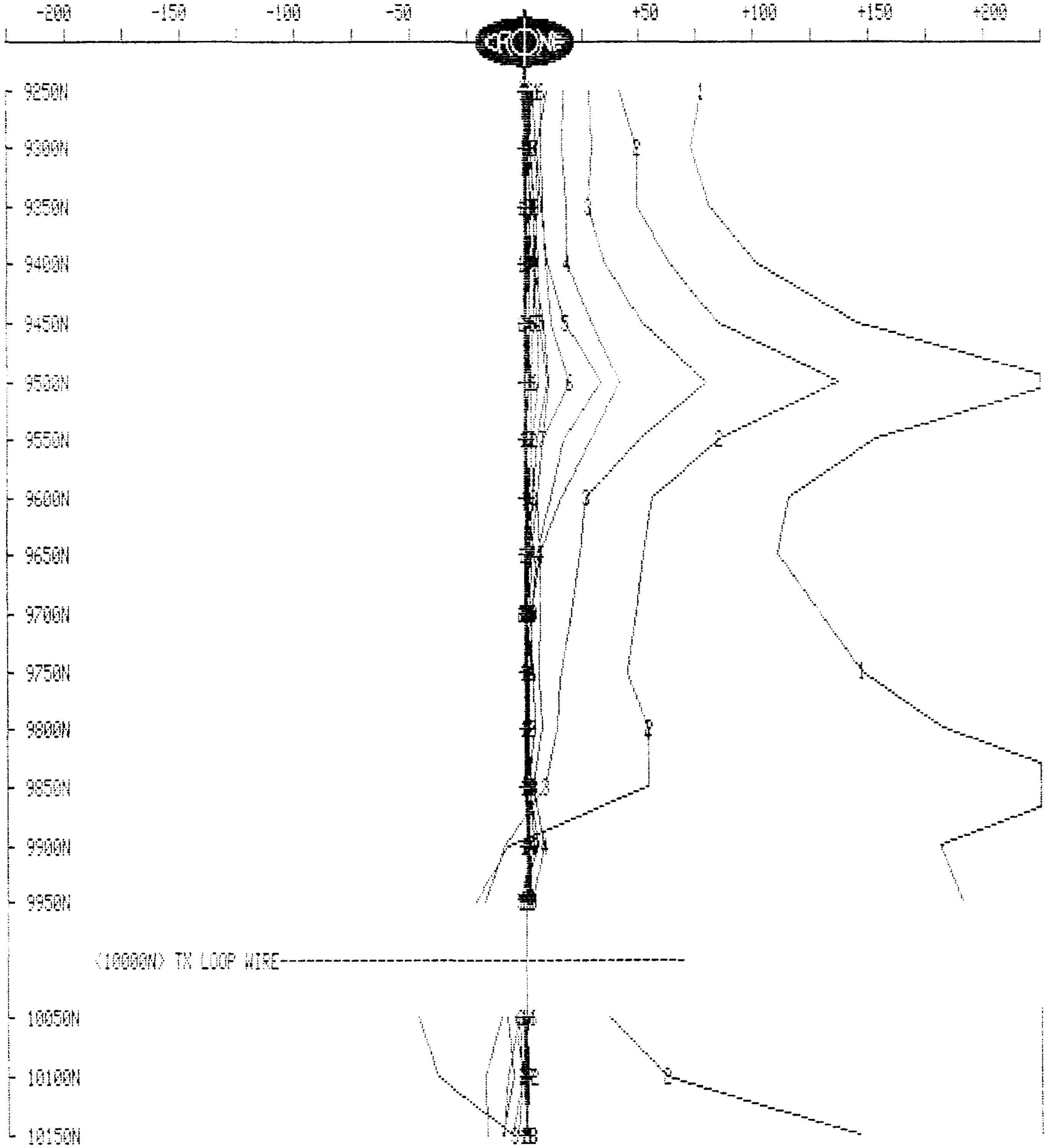
Client : FALCONBRIDGE
Grid : BOOT-BAY
Date : Mar 20, 1992

Line : 9878W
Tx Loop : 2
File name : L9878W2.PEM

IN-LINE HORIZONTAL COMPONENT dBx/dt nanoTesla/sec - 20 channels

Scale: 1:5000

Unit Scale: 1cm = 25 nT/s



CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

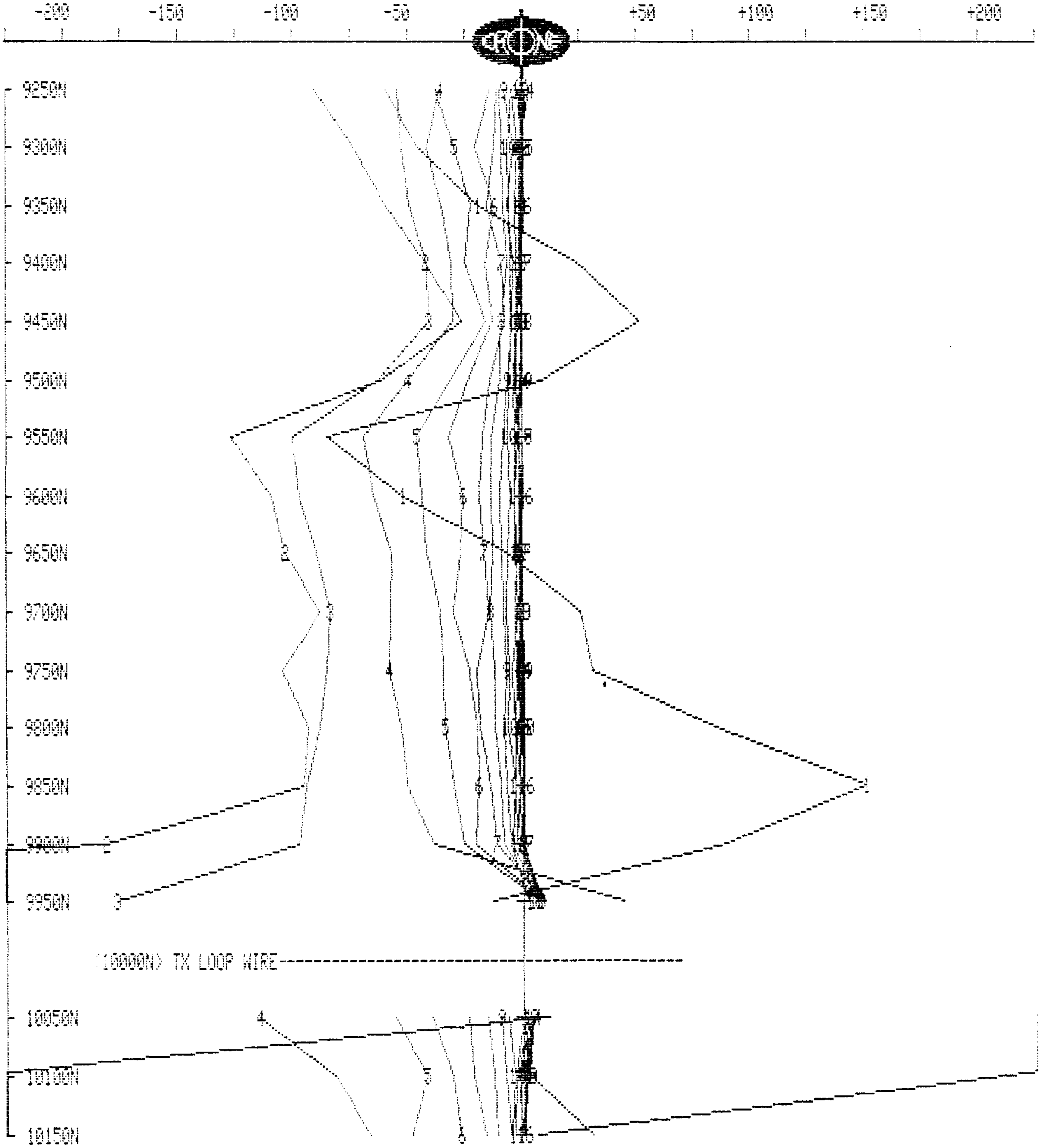
Client : FALCONBRIDGE
Grid : BOOT-BAY
Date : Mar 20, 1992

Line : 9878W
Tx Loop : 2
File name : L9878W2.PEM

VERTICAL COMPONENT dBz/dt nanoTesla/sec - 20 channels

Scale: 1:5000

Unit Scale: 1cm = 25 nT/s



CRONE GEOPHYSICS & EXPLORATION LTD

SURFACE PEM

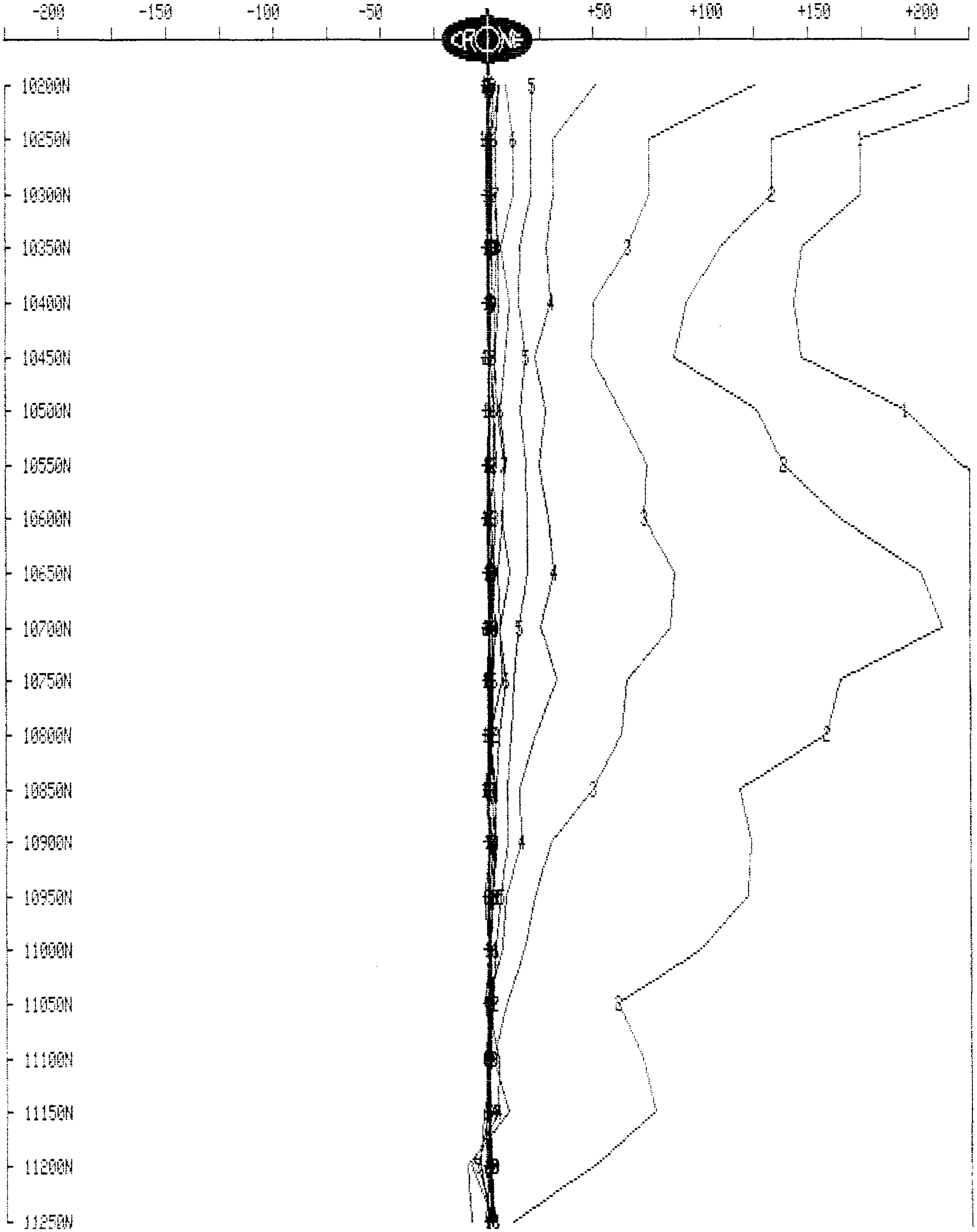
Client : FALCONBRIDGE
Grid : BOOT-BAY
Date : Mar 19, 1992

Line : 9756W
Tx Loop : 1
File name : L9756W1.PEM

IN-LINE HORIZONTAL COMPONENT dBx/dt nanoTesla/sec - 20 channels

Scale: 1:5000

Unit Scale: 1cm = 25 nT/s

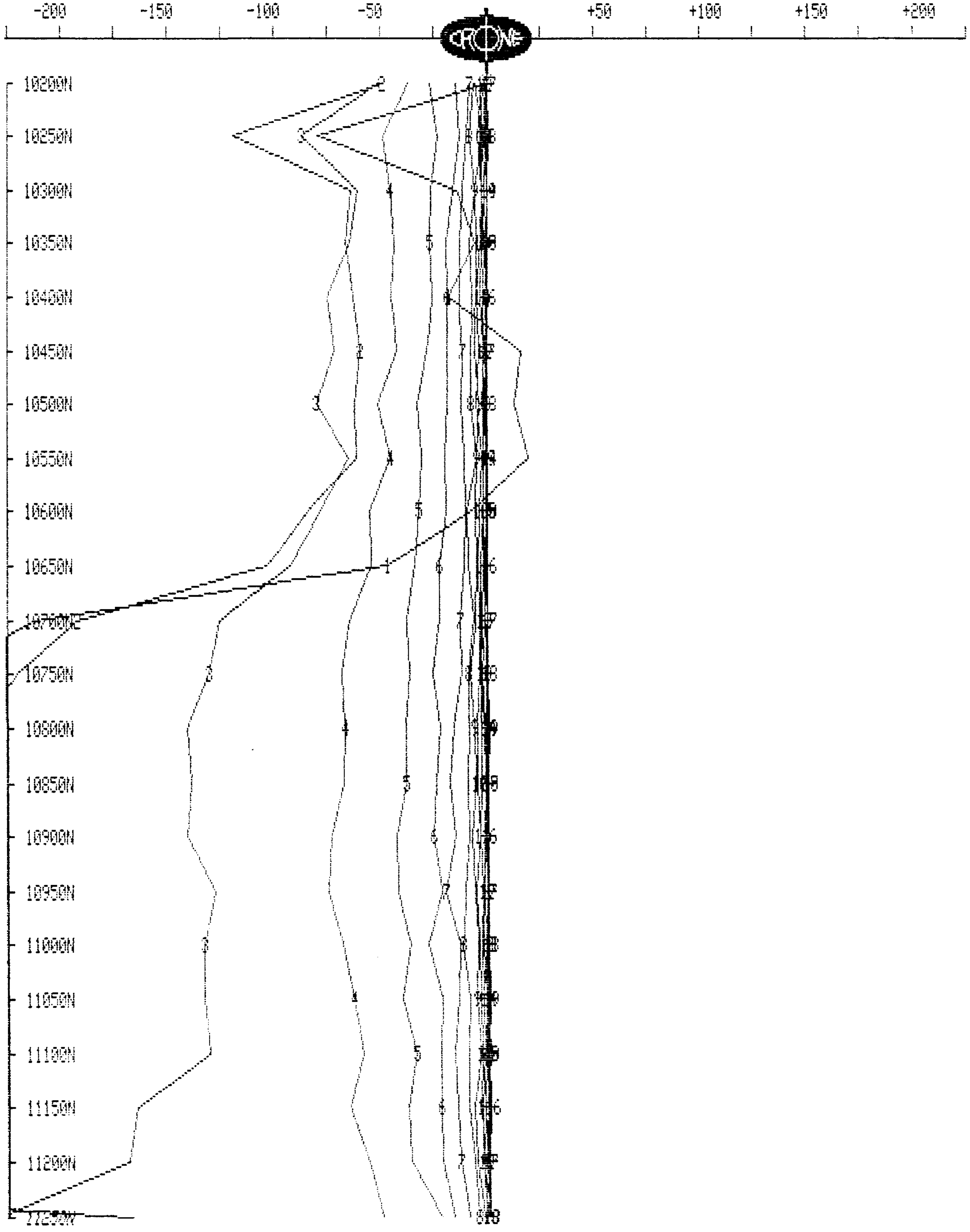


CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

Client : FALCONBRIDGE
Grid : BOOT-BAY
Date : Mar 19, 1992

Line : 9756W
Tx Loop : 1
File name : L9756W1.PEM

VERTICAL COMPONENT dBz/dt nanoTesla/sec - 20 channels
Scale: 1:5000
Unit Scale: 1cm = 25 nT/s

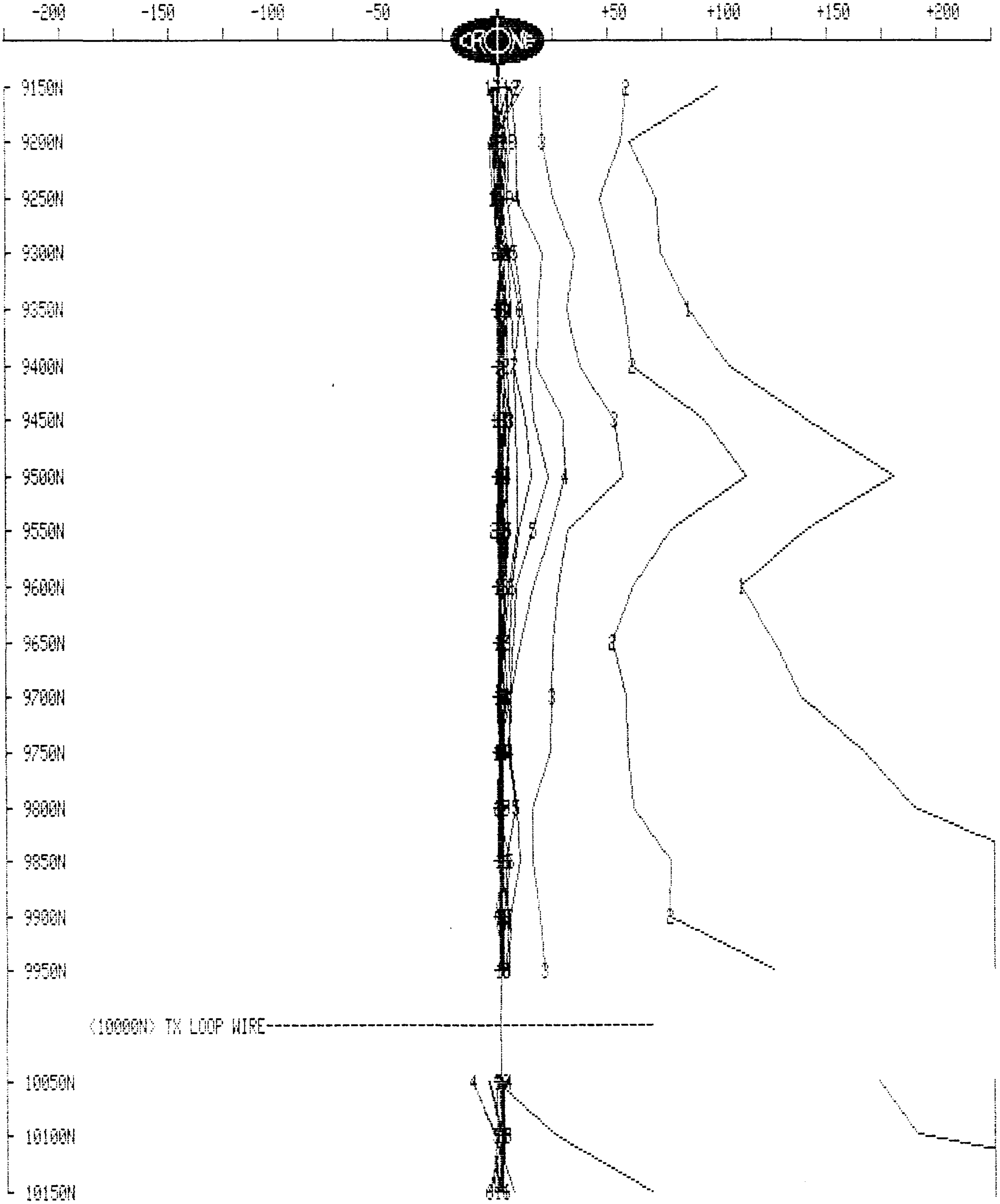


CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

Client	:	FALCONBRIDGE	Line	:	9756W
Grid	:	BOOT-BAY	Tx Loop	:	2
Date	:	Mar 20, 1992	File name	:	L9756W2.PEM

IN-LINE HORIZONTAL COMPONENT dBx/dt nanoTesla/sec - 20 channels

Scale: 1:5000 Unit Scale: 1cm = 25 nT/s

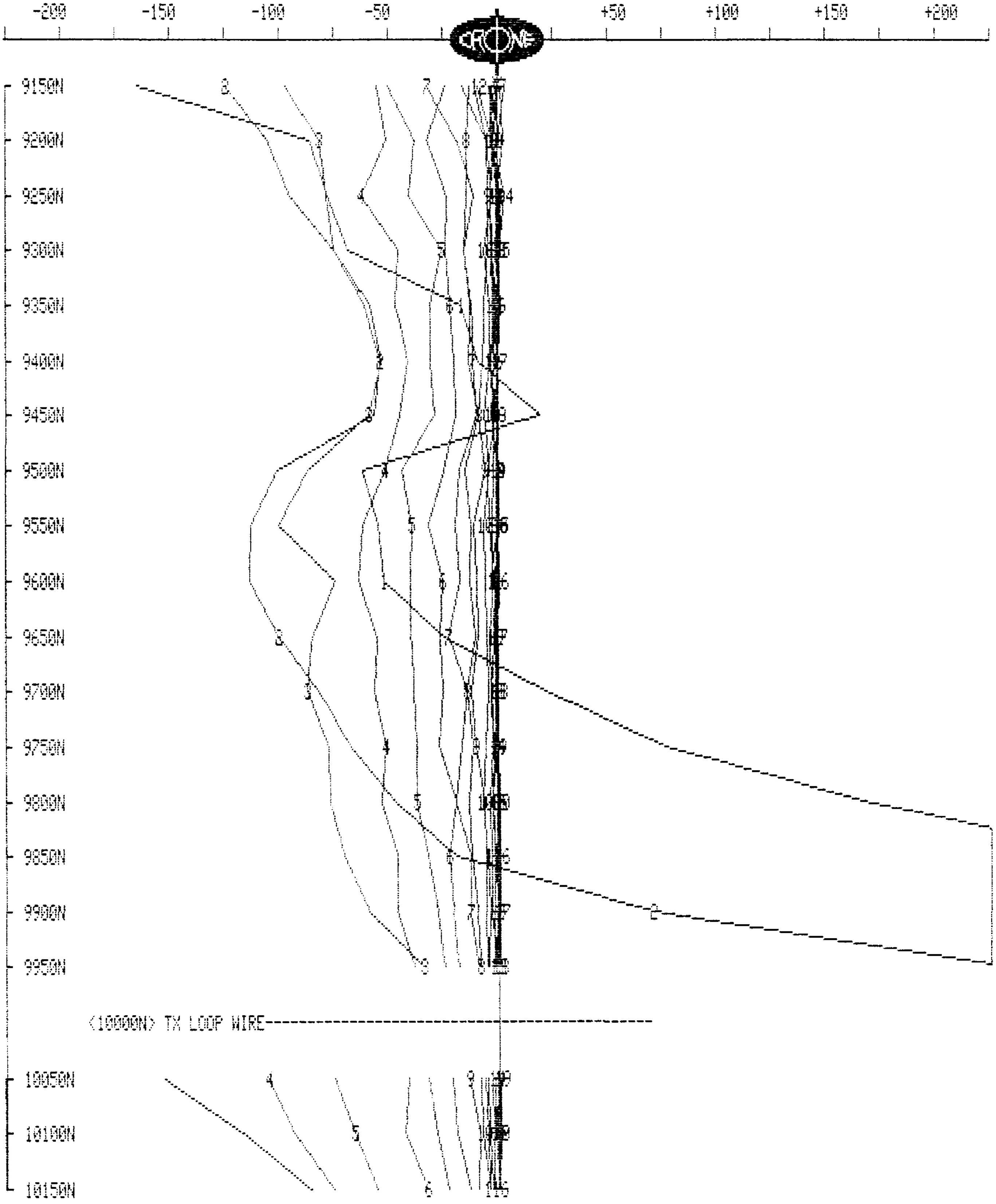


CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

Client : FALCONBRIDGE
Grid : BOOT-BAY
Date : Mar 20, 1992

Line : 9756W
Tx Loop : 2
File name : L9756W2.PEM

VERTICAL COMPONENT dBz/dt nanoTesla/sec - 20 channels
Scale: 1:5000
Unit Scale: 1cm = 25 nT/s



CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

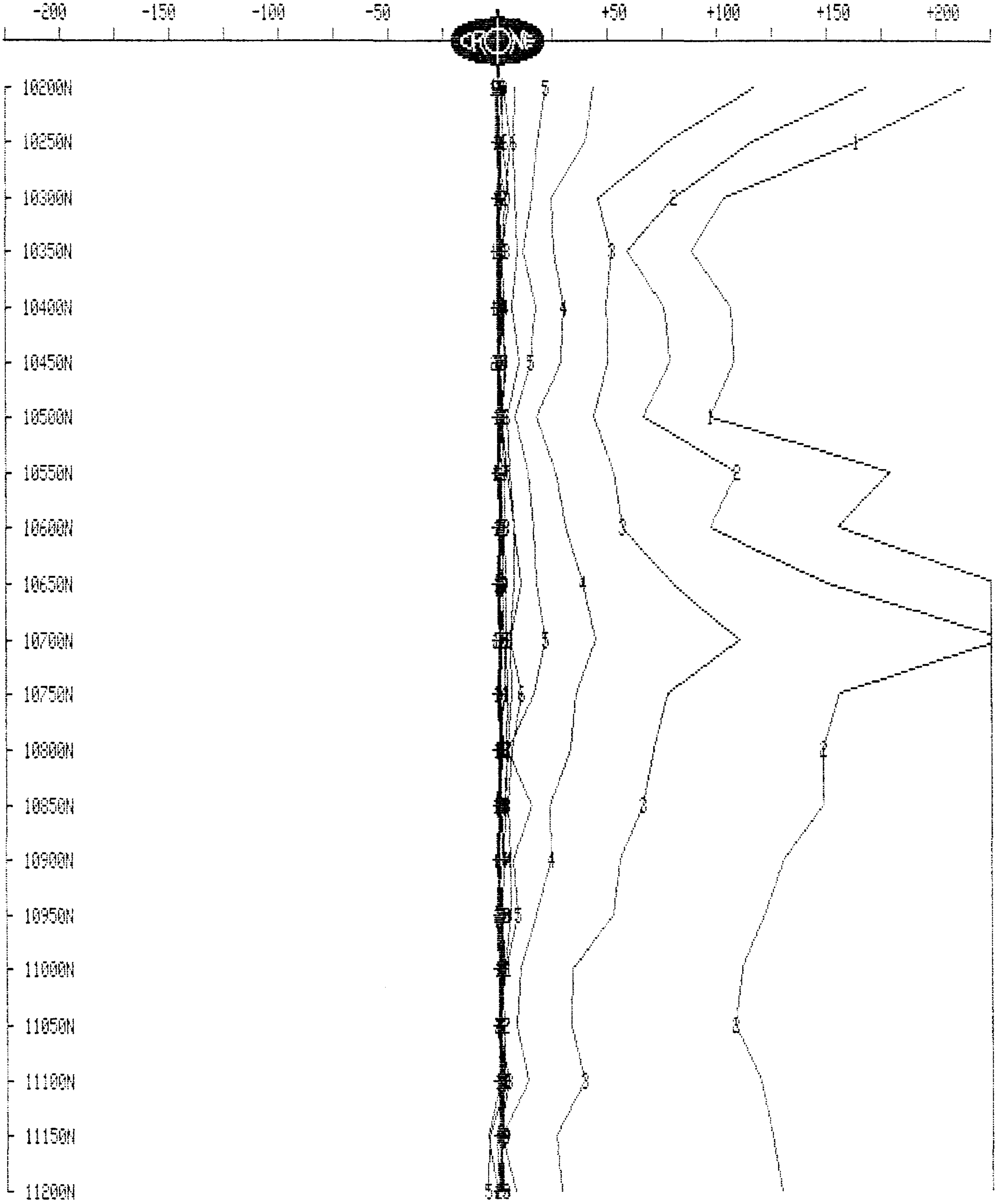
Client : FALCONBRIDGE
Grid : BOOT-BAY
Date : Mar 19, 1992

Line : **9634W**
Tx Loop : 1
File name : L9634W1.PEM

IN-LINE HORIZONTAL COMPONENT dBx/dt nanoTesla/sec - 20 channels

Scale: 1:5000

Unit Scale: 1cm = 25 nT/s



CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

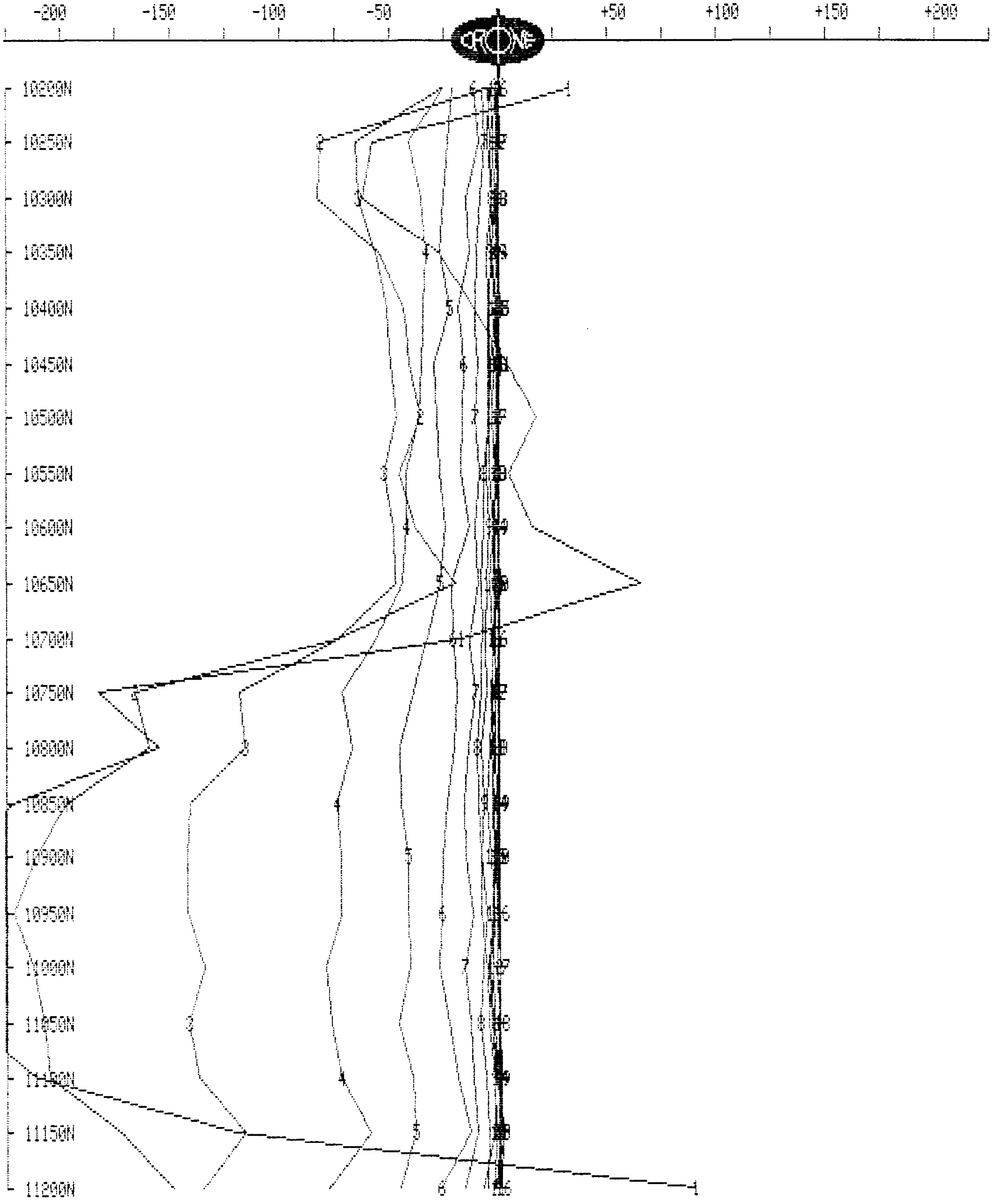
Client : FALCONBRIDGE
Grid : BOOT-BAY
Date : Mar 19, 1992

Line : 9634W
Tx Loop : 1
File name : L9634W1.PEM

VERTICAL COMPONENT dBz/dt nanoTesla/sec - 20 channels

Scale: 1:5000

Unit Scale: 1cm = 25 nT/s



CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

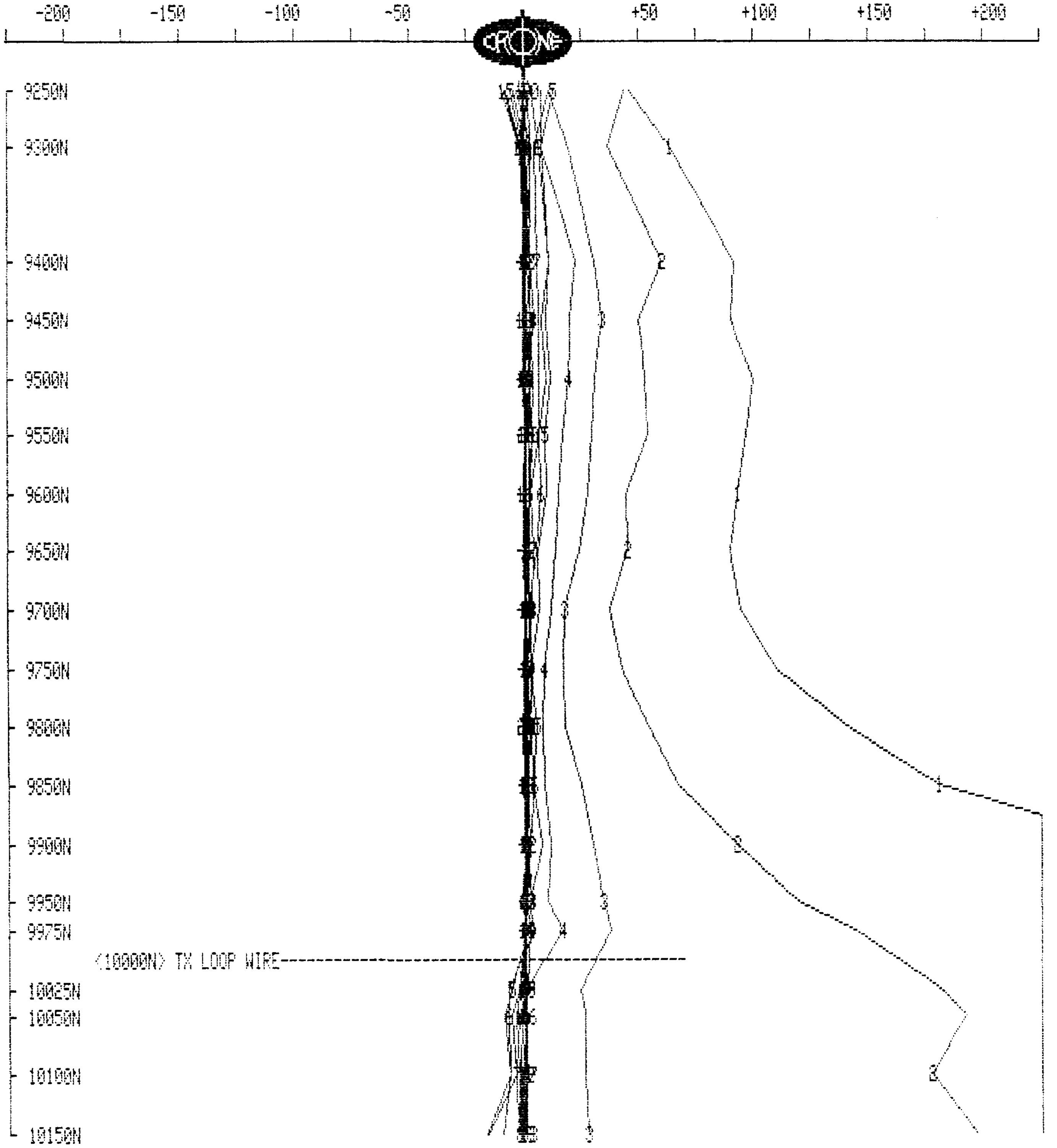
Client : FALCONBRIDGE
Grid : BOOT-BAY
Date : Mar 20, 1992

Line : 9634W
Tx Loop : 2
File name : L9634W2.PEM

IN-LINE HORIZONTAL COMPONENT dBx/dt nanoTesla/sec - 20 channels

Scale: 1:5000

Unit Scale: 1cm = 25 nT/s



CRONE GEOPHYSICS & EXPLORATION LTD

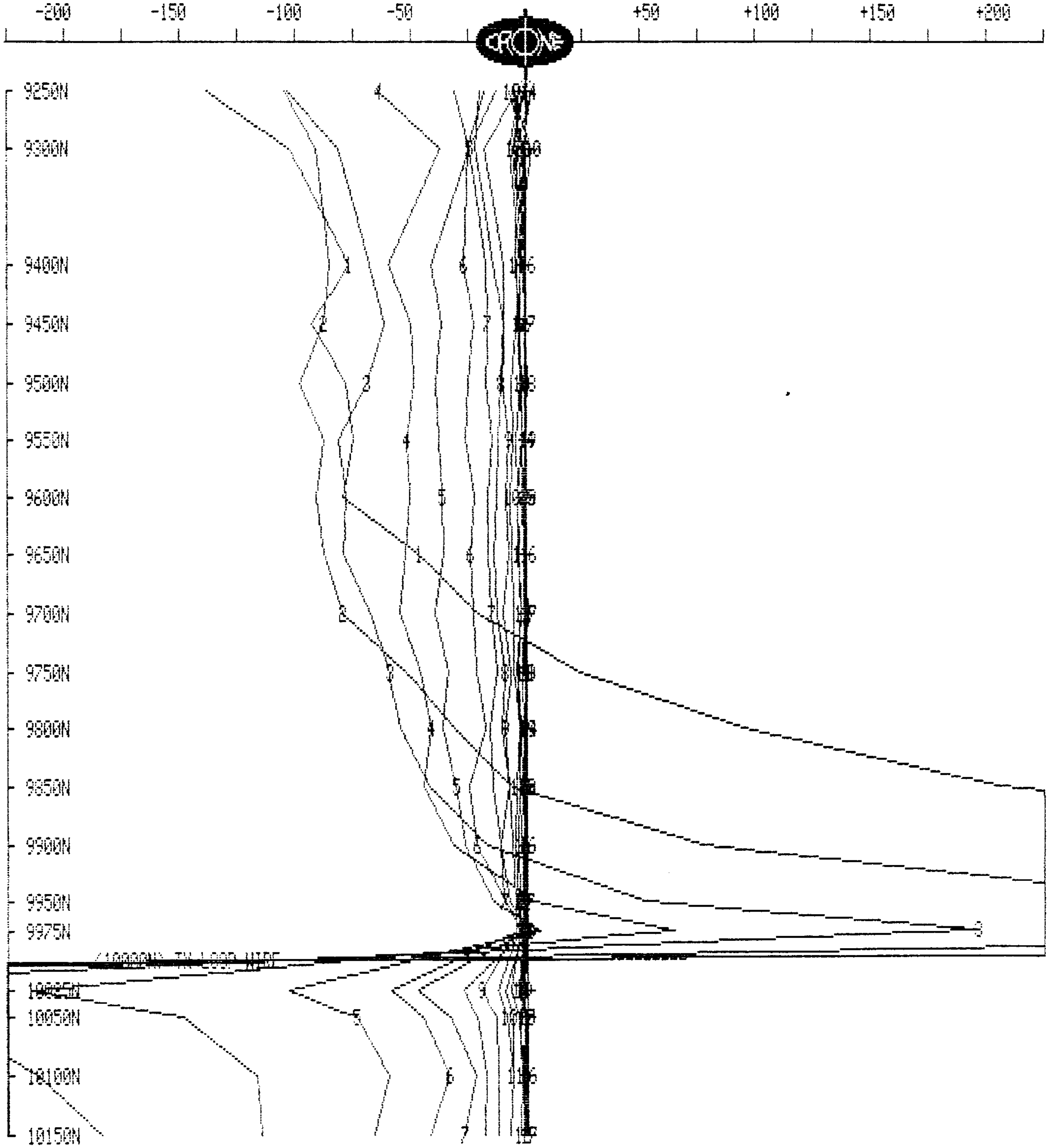
SURFACE PEM

Client : FALCONBRIDGE		Line : **9634W**	
Grid : BOOT-BAY		Tx Loop : 2	
Date : Mar 20, 1992		File name : L9634W2.PEM	

VERTICAL COMPONENT dBz/dt nanoTesla/sec - 20 channels

Scale: 1:5000

Unit Scale: 1cm = 25 nT/s



CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

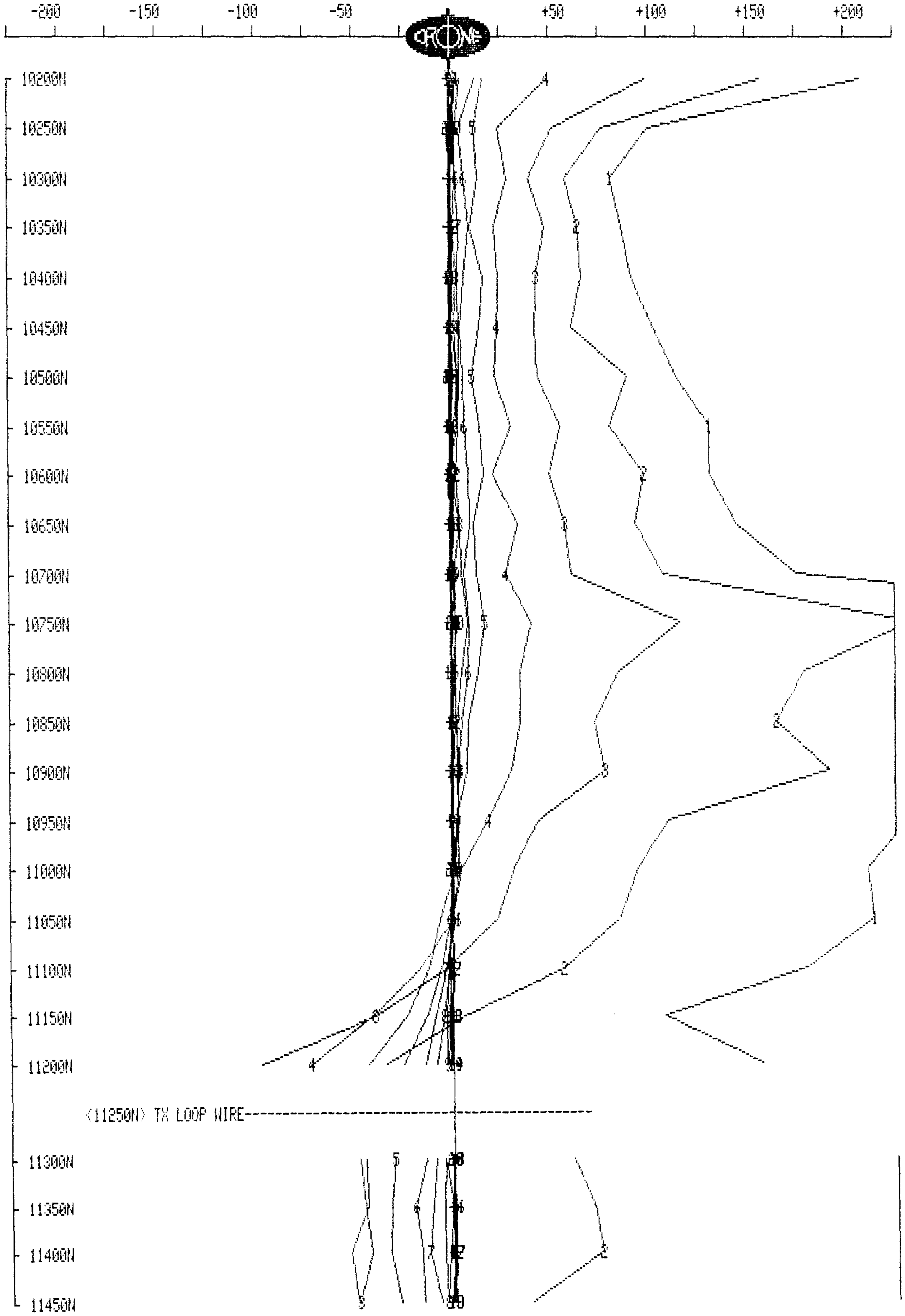
Client : FALCONBRIDGE
Grid : BOOT-BAY
Date : Mar 19, 1992

Line : 9512W
Tx Loop : 1
File name : L9512W1.PEM

IN-LINE HORIZONTAL COMPONENT dBx/dt nanoTesla/sec - 20 channels

Scale: 1:5000

Unit Scale: 1cm = 25 nT/s

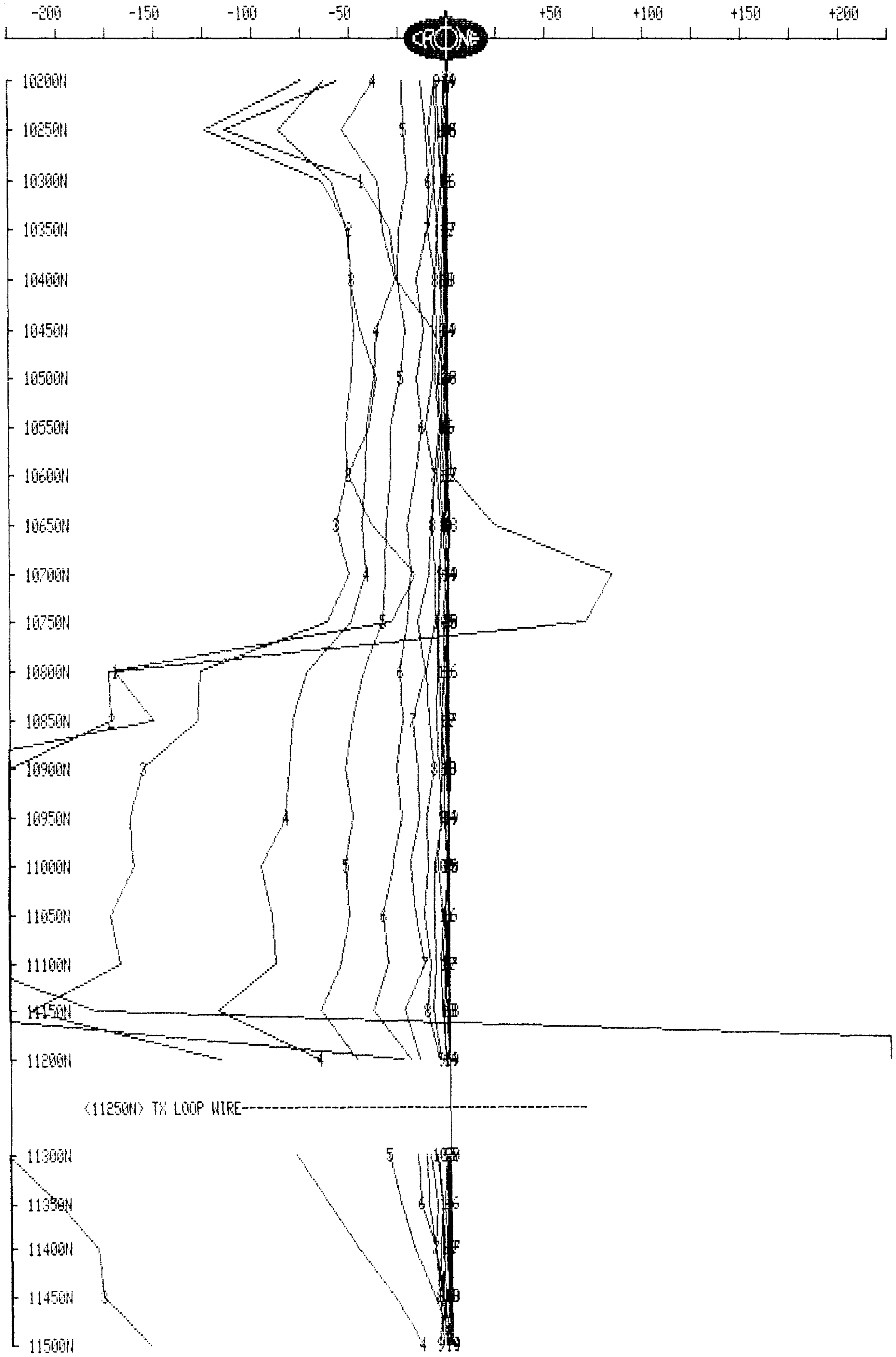


CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

Client	: FALCONBRIDGE	Line	: 9512W
Grid	: BOOT-BAY	Tx Loop	: 1
Date	: Mar 19, 1992	File name	: L9512W1.PEM

VERTICAL COMPONENT dBz/dt nanoTesla/sec - 20 channels

Scale: 1:5000 Unit Scale: 1cm = 25 nT/s



CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

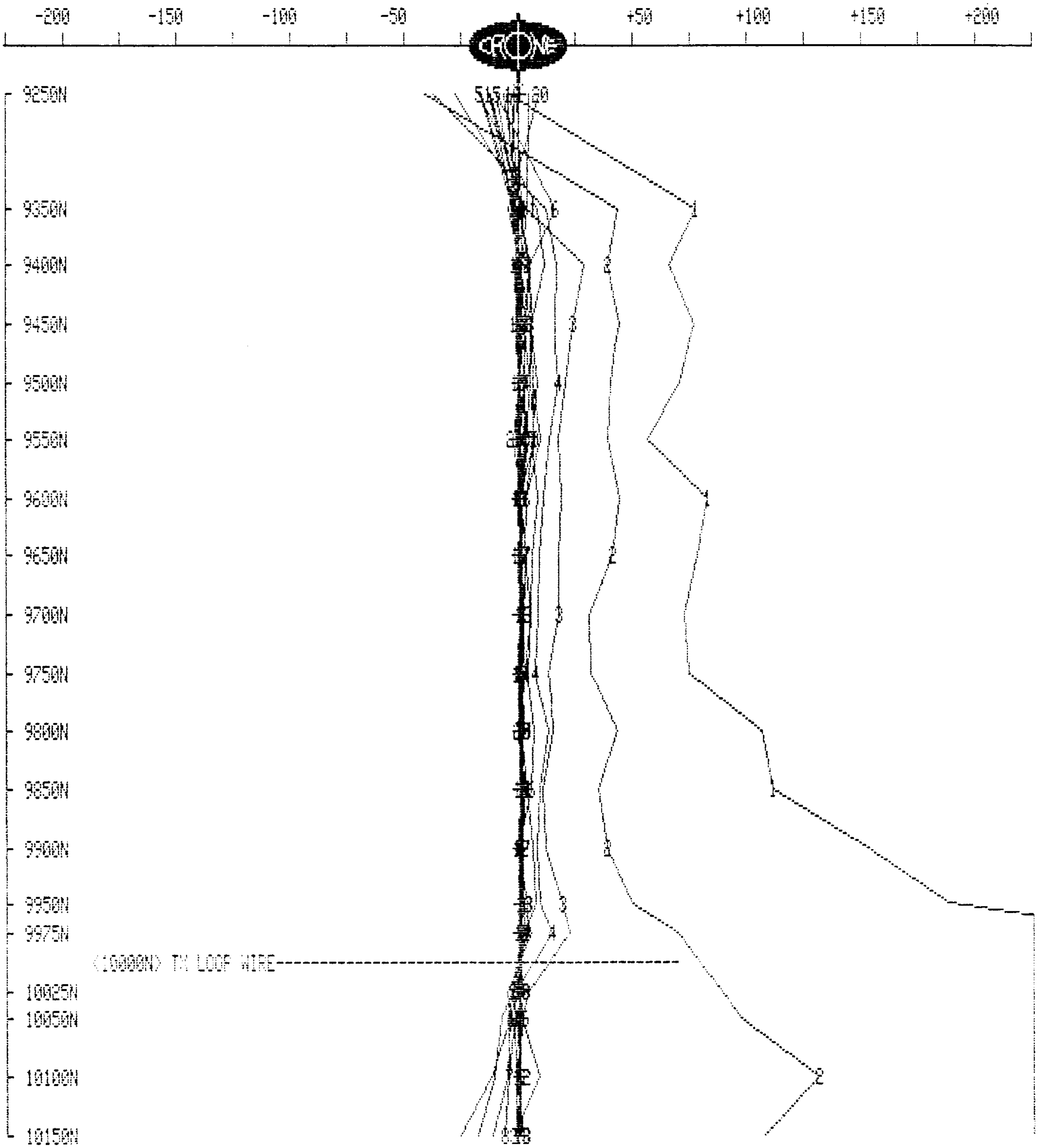
Client : FALCONBRIDGE
Grid : BOOT-BAY
Date : Mar 20, 1992

Line : 9512W
Tx Loop : 2
File name : L9512W2.PEM

IN-LINE HORIZONTAL COMPONENT dBx/dt nanoTesla/sec - 20 channels

Scale: 1:5000

Unit Scale: 1cm = 25 nT/s



CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

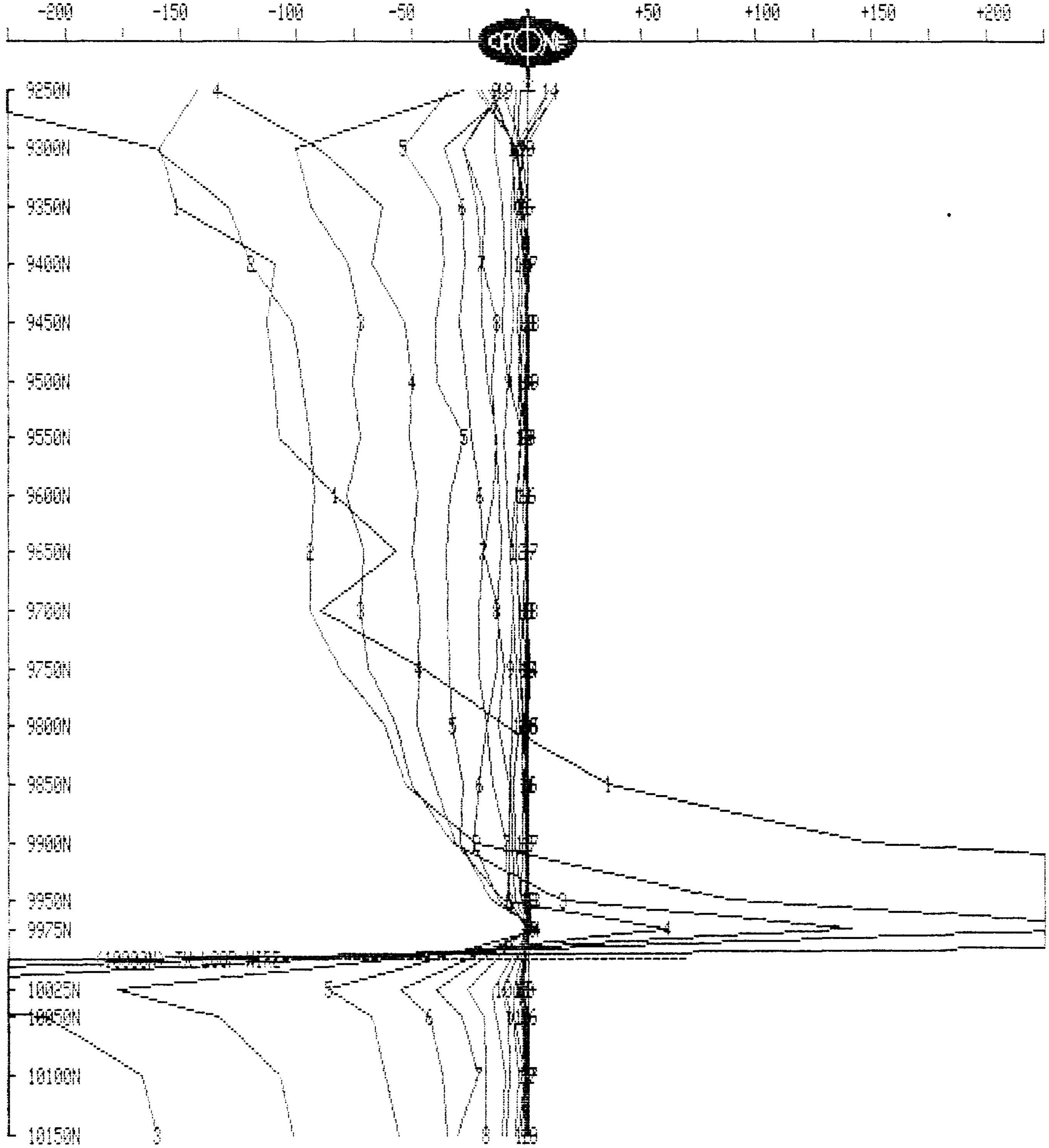
Client : FALCONBRIDGE
Grid : BOOT-BAY
Date : Mar 20, 1992

Line : 9512W
Tx Loop : 2
File name : L9512W2.PEM

VERTICAL COMPONENT dBz/dt nanoTesla/sec - 20 channels

Scale: 1:5000

Unit Scale: 1cm = 25 nT/s

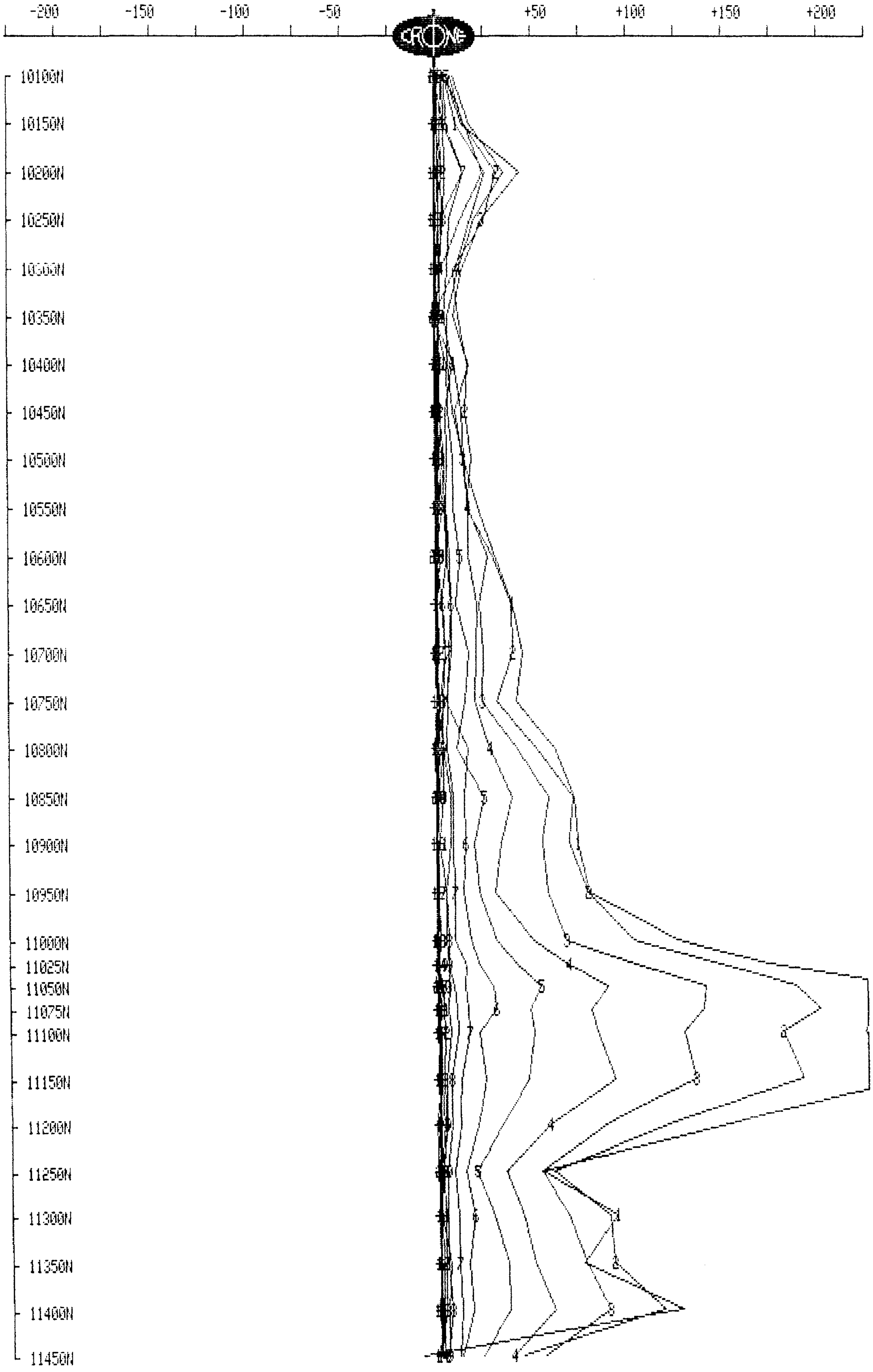


CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

Client	: FALCONBRIDGE	Line	: 9390W
Grid	: BOOT-BAY	Tx Loop	: 3
Date	: Mar 21, 1992	File name	: L9390W3.PEM

IN-LINE HORIZONTAL COMPONENT dBx/dt nanoTesla/sec - 20 channels

Scale: 1:5000 Unit Scale: 1cm = 25 nT/s

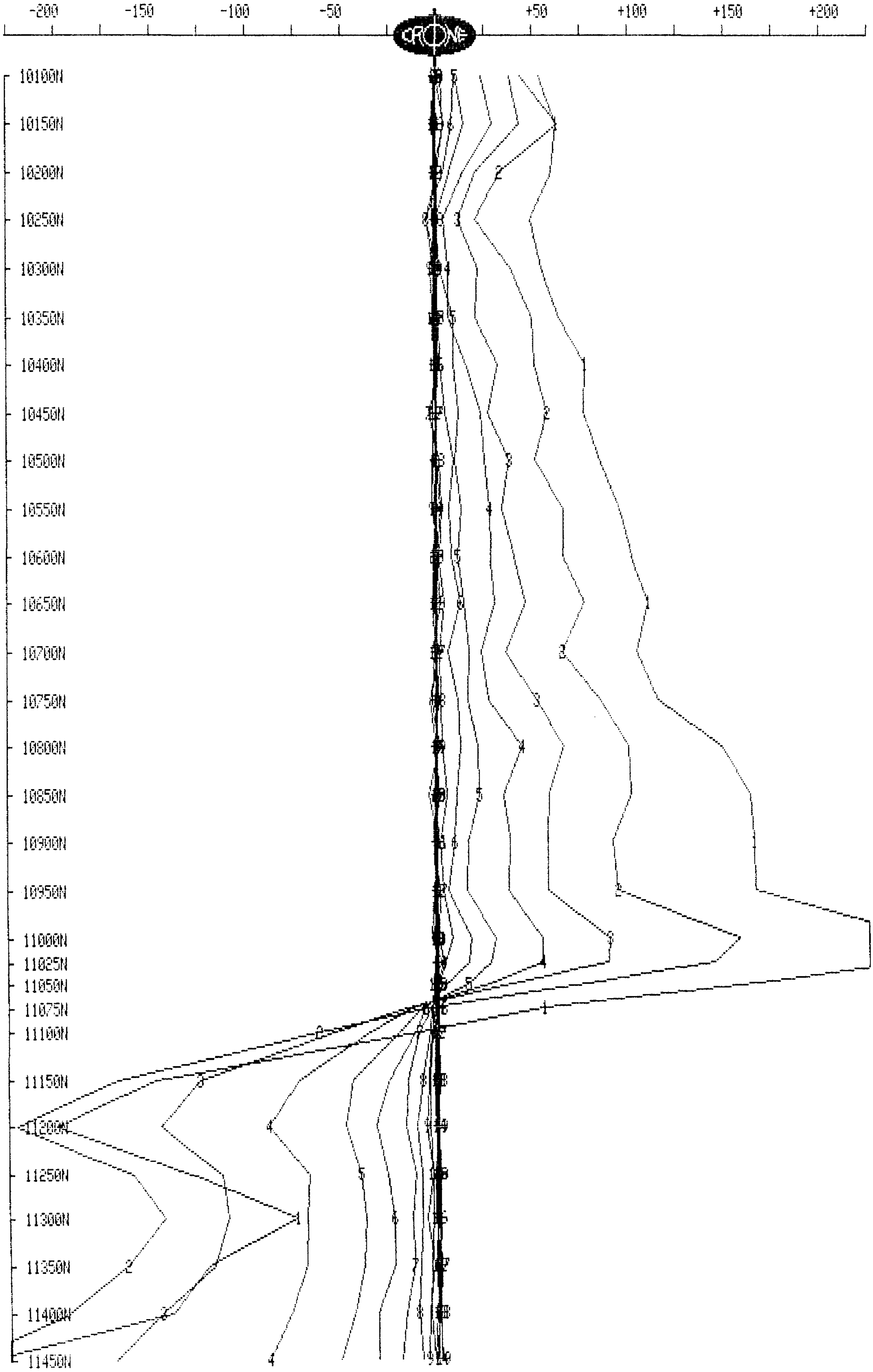


CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

Client	: FALCONBRIDGE	Line	: 9390W
Grid	: BOOT-BAY	Tx Loop	: 3
Date	: Mar 21, 1992	File name	: L9390W3.PEM

VERTICAL COMPONENT dBz/dt nanoTesla/sec - 20 channels

Scale: 1:5000 Unit Scale: 1cm = 25 nT/s

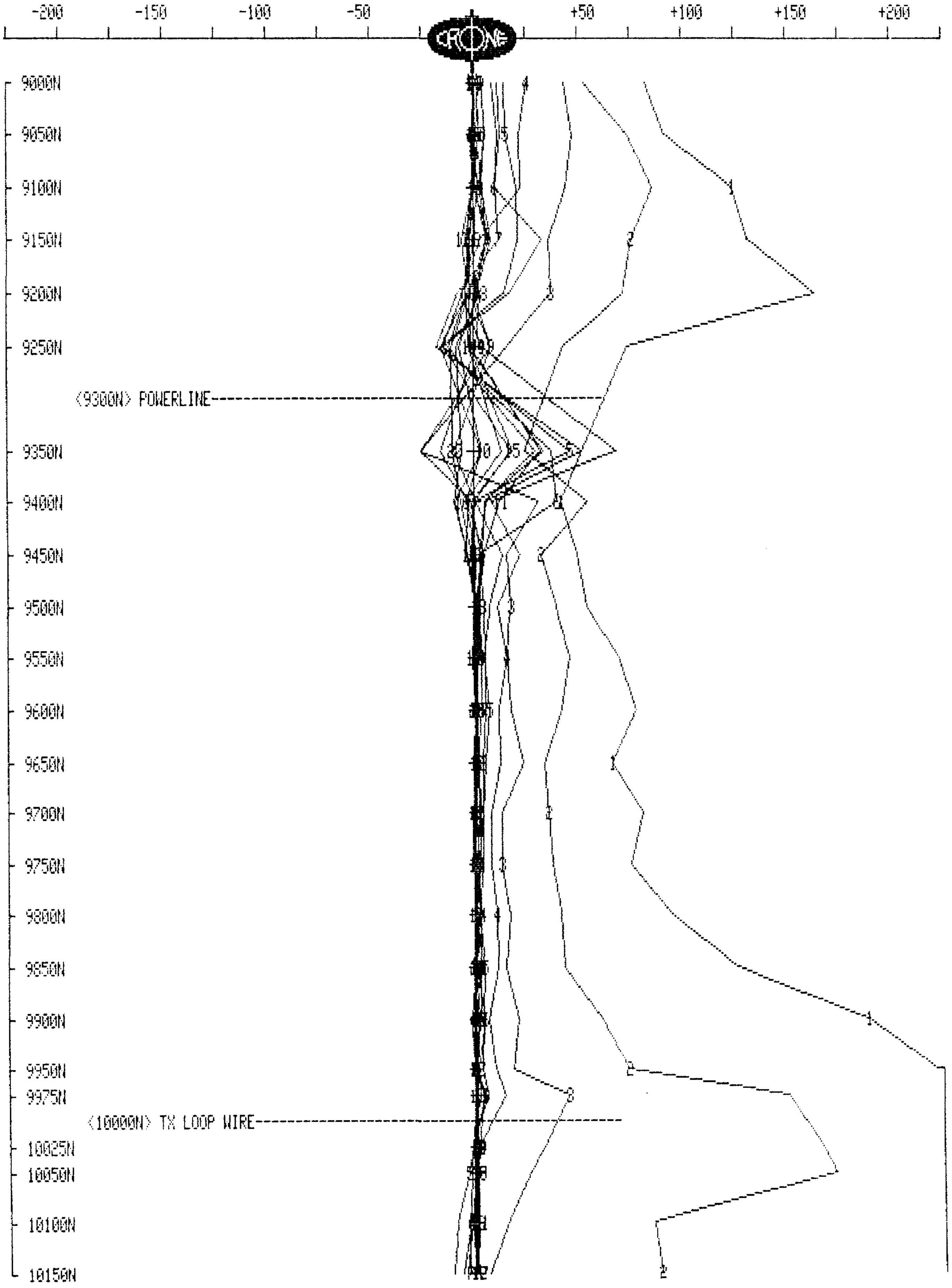


CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

Client : FALCONBRIDGE
Grid : BOOT-BAY
Date : Mar 20, 1992

Line : 9390W
Tx Loop : 2
File name : L9390W2.PEM

IN-LINE HORIZONTAL COMPONENT dBx/dt nanoTesla/sec - 20 channels
Scale: 1:5000
Unit Scale: 1cm = 25 nT/s



CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

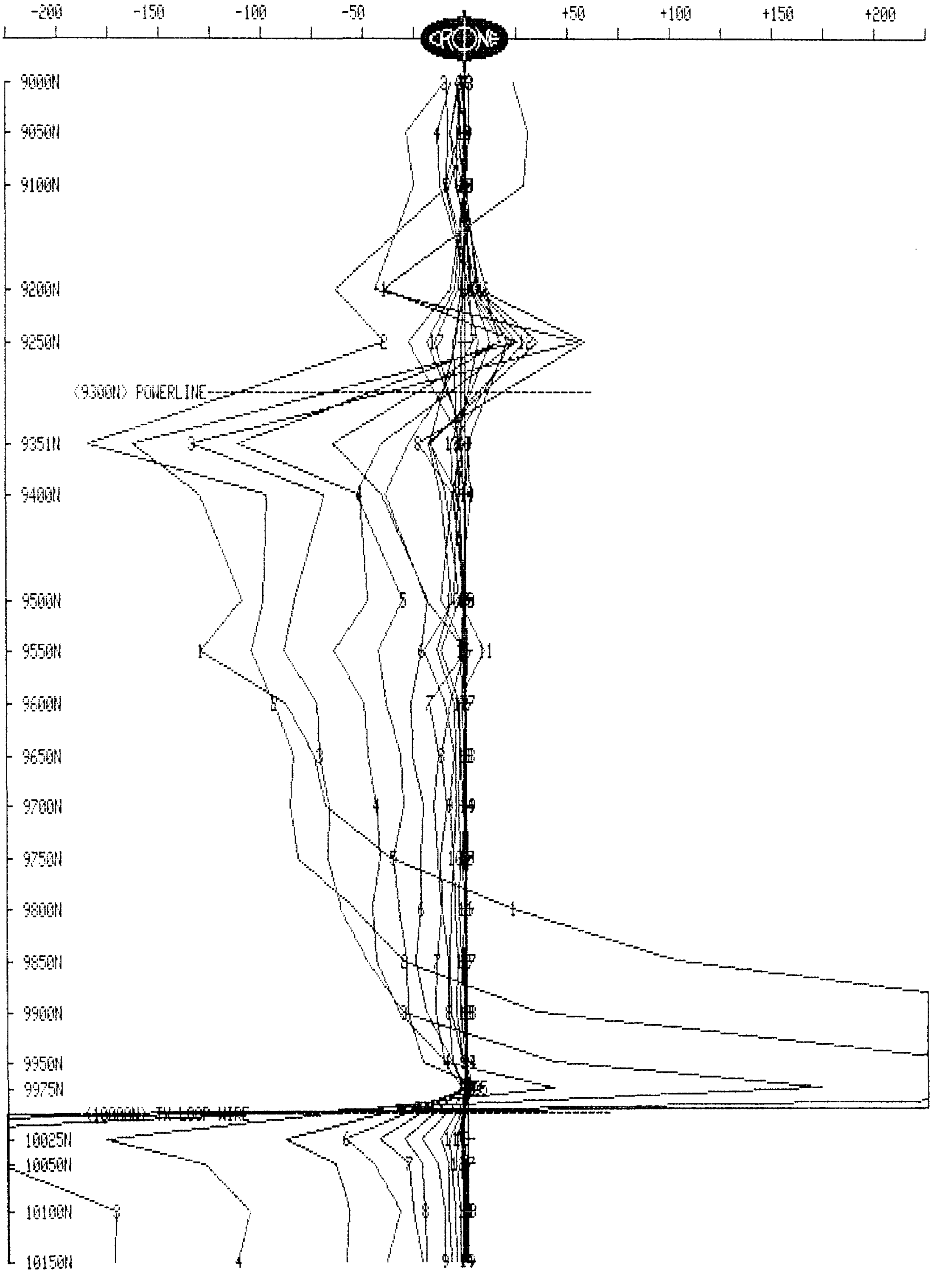
Client : FALCONBRIDGE
Grid : BOOT-BAY
Date : Mar 20, 1992

Line : 9390W
Tx Loop : 2
File name : L9390W2.PEM

VERTICAL COMPONENT dBz/dt nanoTesla/sec - 20 channels

Scale: 1:5000

Unit Scale: 1cm = 25 nT/s



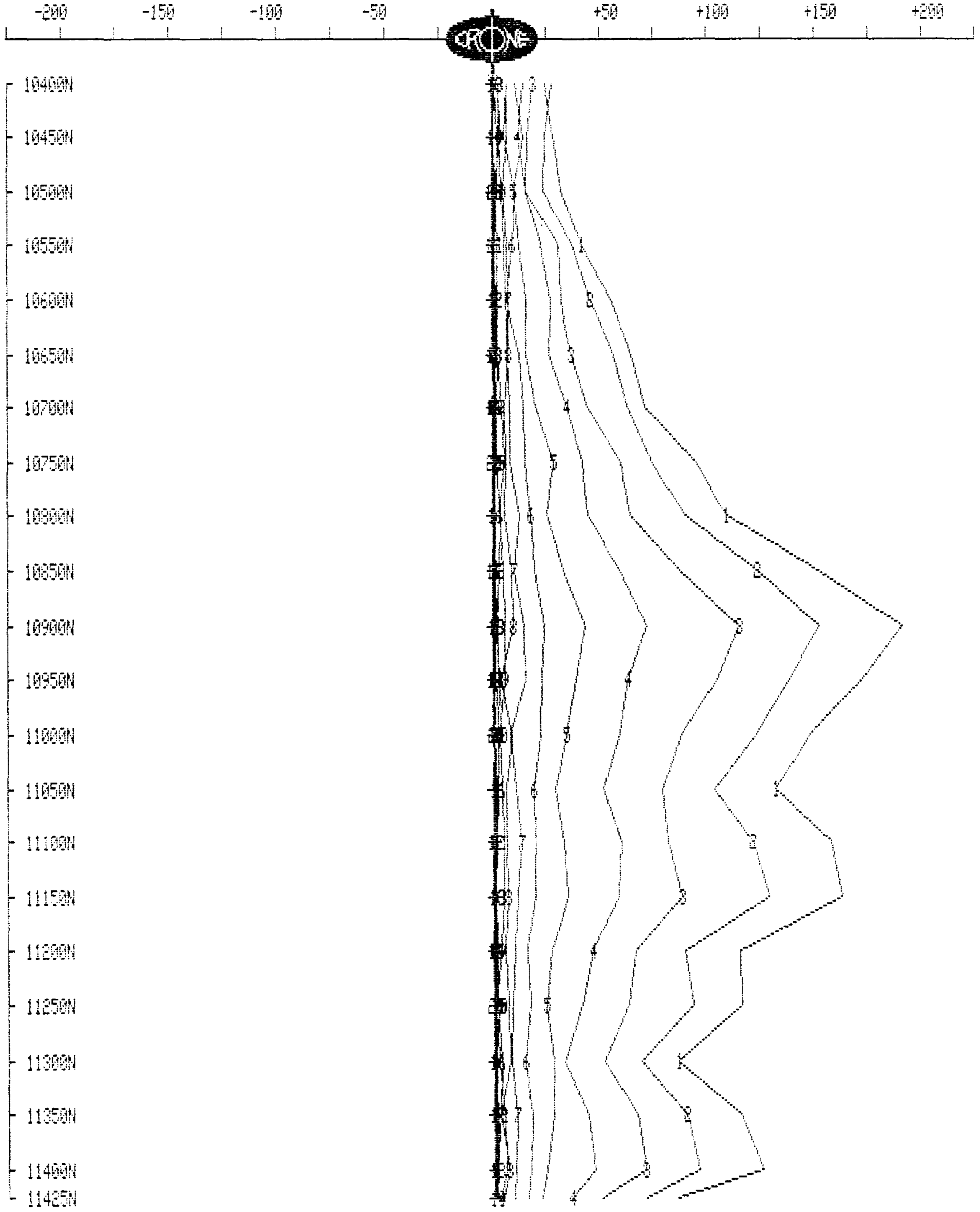
CRONE GEOPHYSICS & EXPLORATION LTD

SURFACE PEM

Client : FALCONBRIDGE
Grid : BOOT-BAY
Date : Mar 21, 1992

Line : 9268W
Tx Loop : 3
File name : L9268W3.PEM

IN-LINE HORIZONTAL COMPONENT dBx/dt nanoTesla/sec - 20 channels
Scale: 1:5000
Unit Scale: 1cm = 25 nT/s



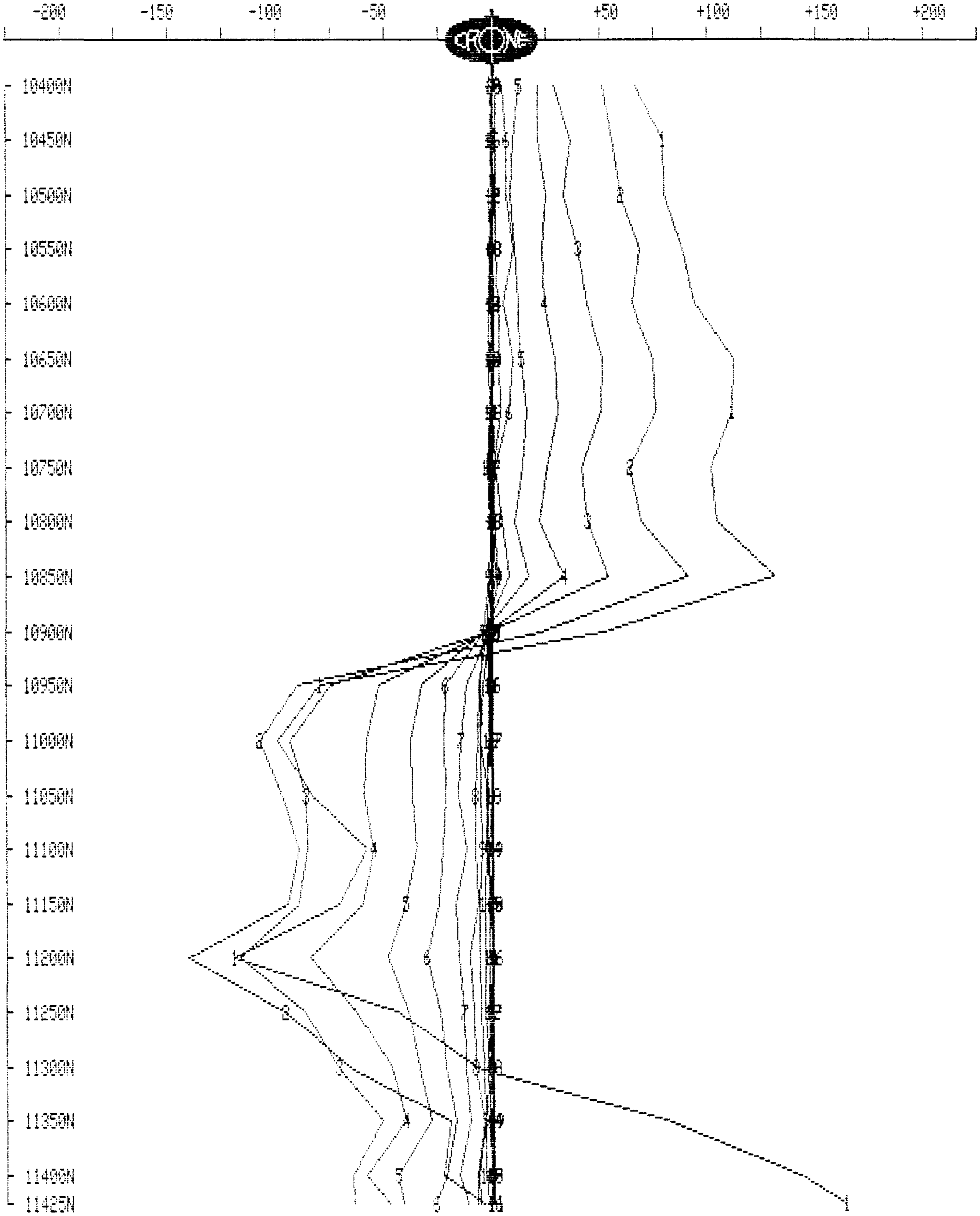
CRONE GEOPHYSICS & EXPLORATION LTD

SURFACE PEM

Client	: FALCONBRIDGE	Line	: 9268W
Grid	: BOOT-BAY	Tx Loop	: 3
Date	: Mar 21, 1992	File name	: L9268W3.PEM

VERTICAL COMPONENT dBz/dt nanoTesla/sec - 20 channels

Scale: 1:5000 Unit Scale: 1cm = 25 nT/s

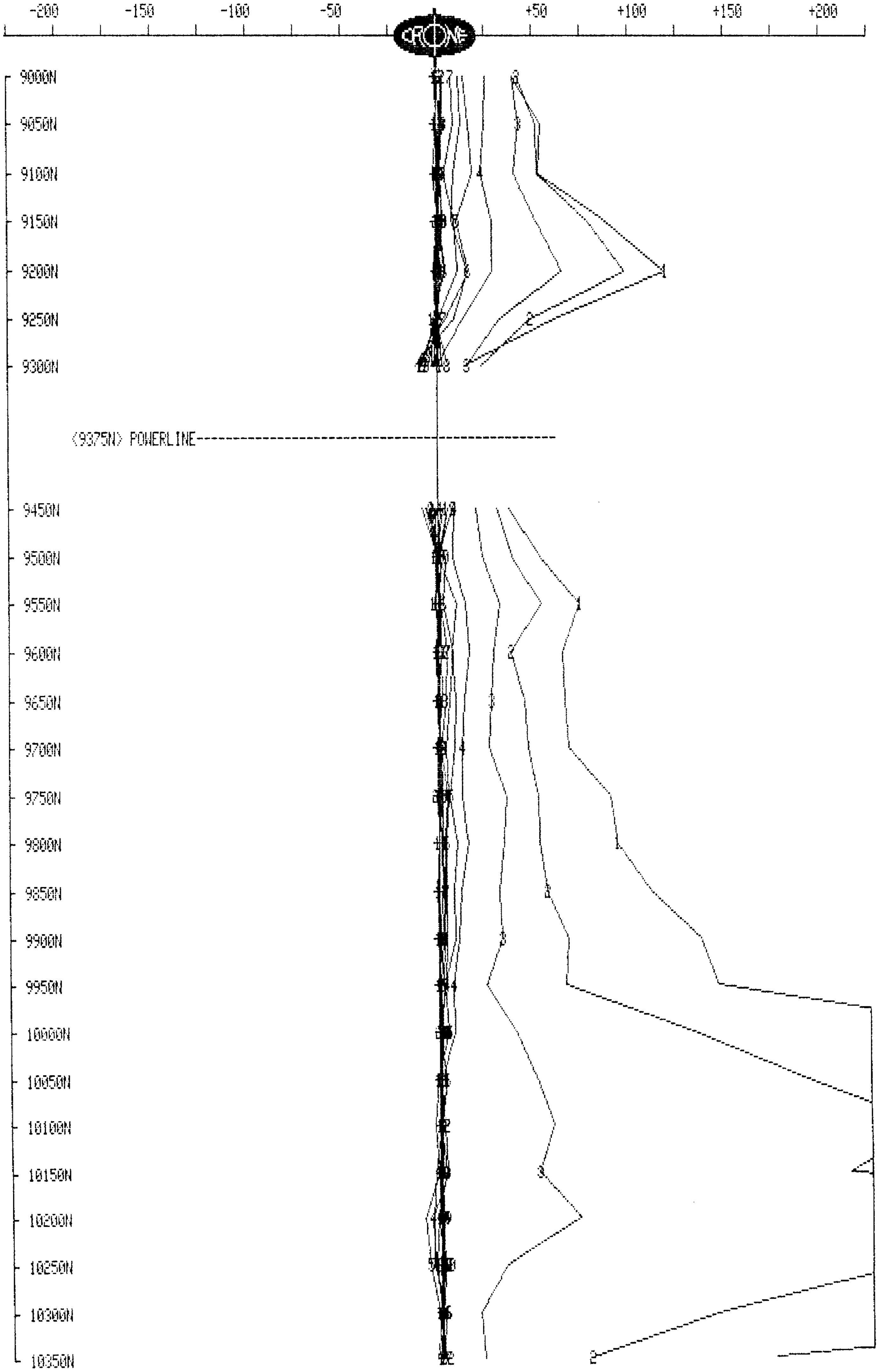


CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

Client : **FALCONBRIDGE**
Grid : **BOOT-BAY**
Date : Mar 24, 1992

Line : **9268W**
Tx Loop : **4**
File name : L9268W4.PEM

IN-LINE HORIZONTAL COMPONENT dBx/dt nanoTesla/sec - 20 channels
Scale: 1:5000
Unit Scale: 1cm = 25 nT/s



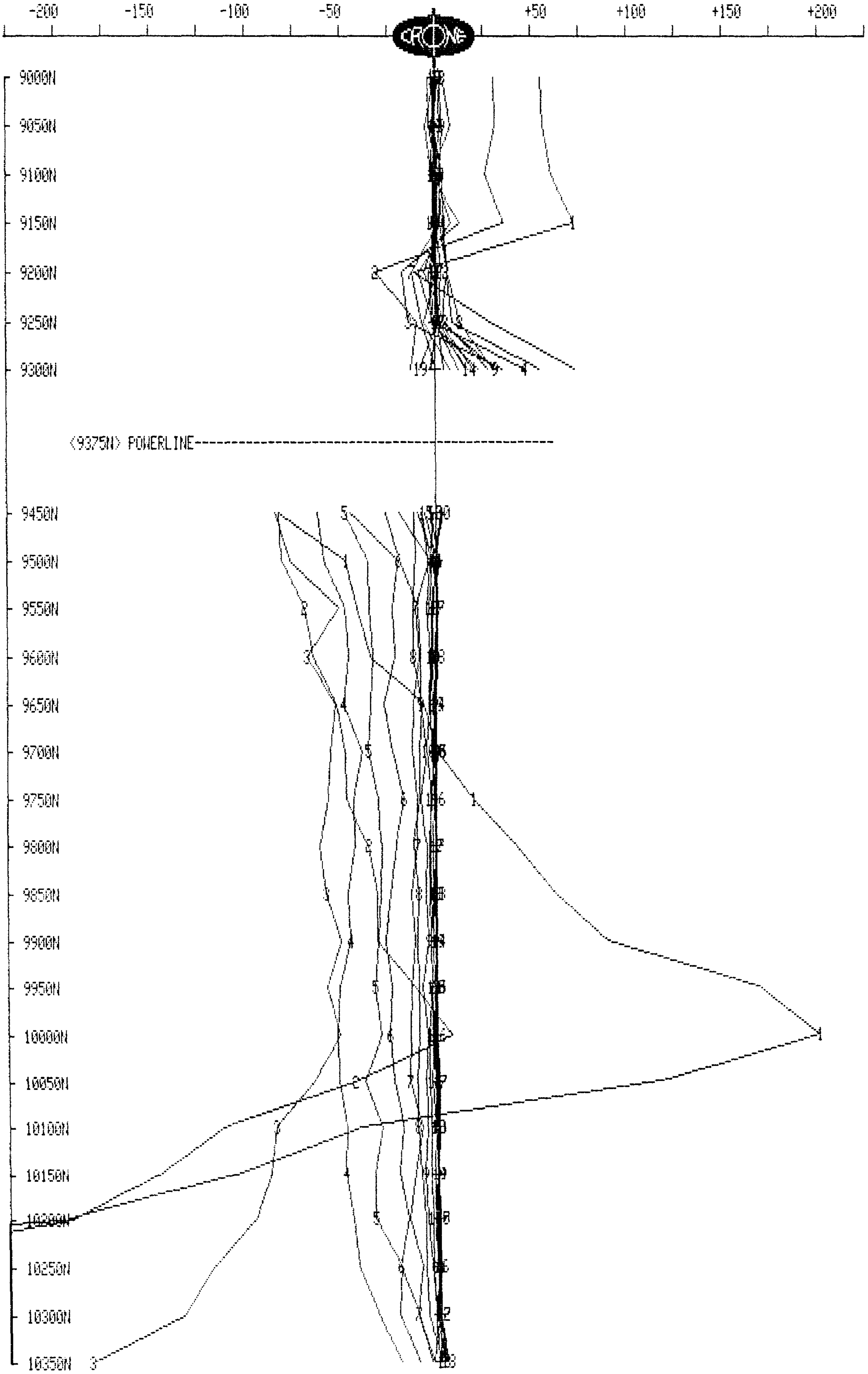
CRONE GEOPHYSICS & EXPLORATION LTD

SURFACE PEM

Client : FALCONBRIDGE		Line : 9268W	
Grid : BOOT-BAY		Tx Loop : 4	
Date : Mar 24, 1992		File name : L9268W4.PEM	

VERTICAL COMPONENT dBz/dt nanoTesla/sec - 20 channels

Scale: 1:5000 Unit Scale: 1cm = 25 nT/s

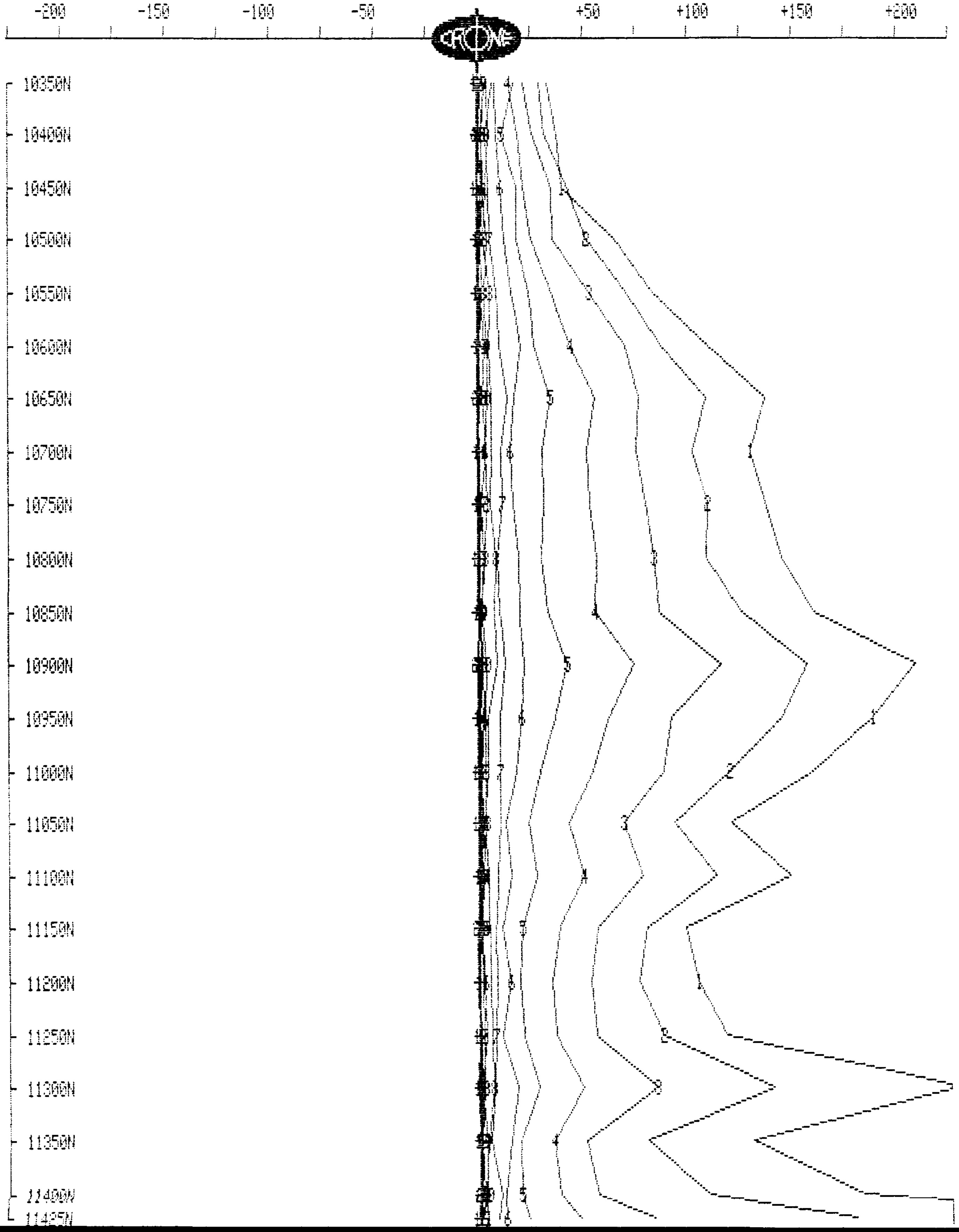


CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

Client : FALCONBRIDGE
Grid : BOOT-BAY
Date : Mar 22, 1992

Line : **9146W**
Tx Loop : 3
File name : L9146W3.PEM

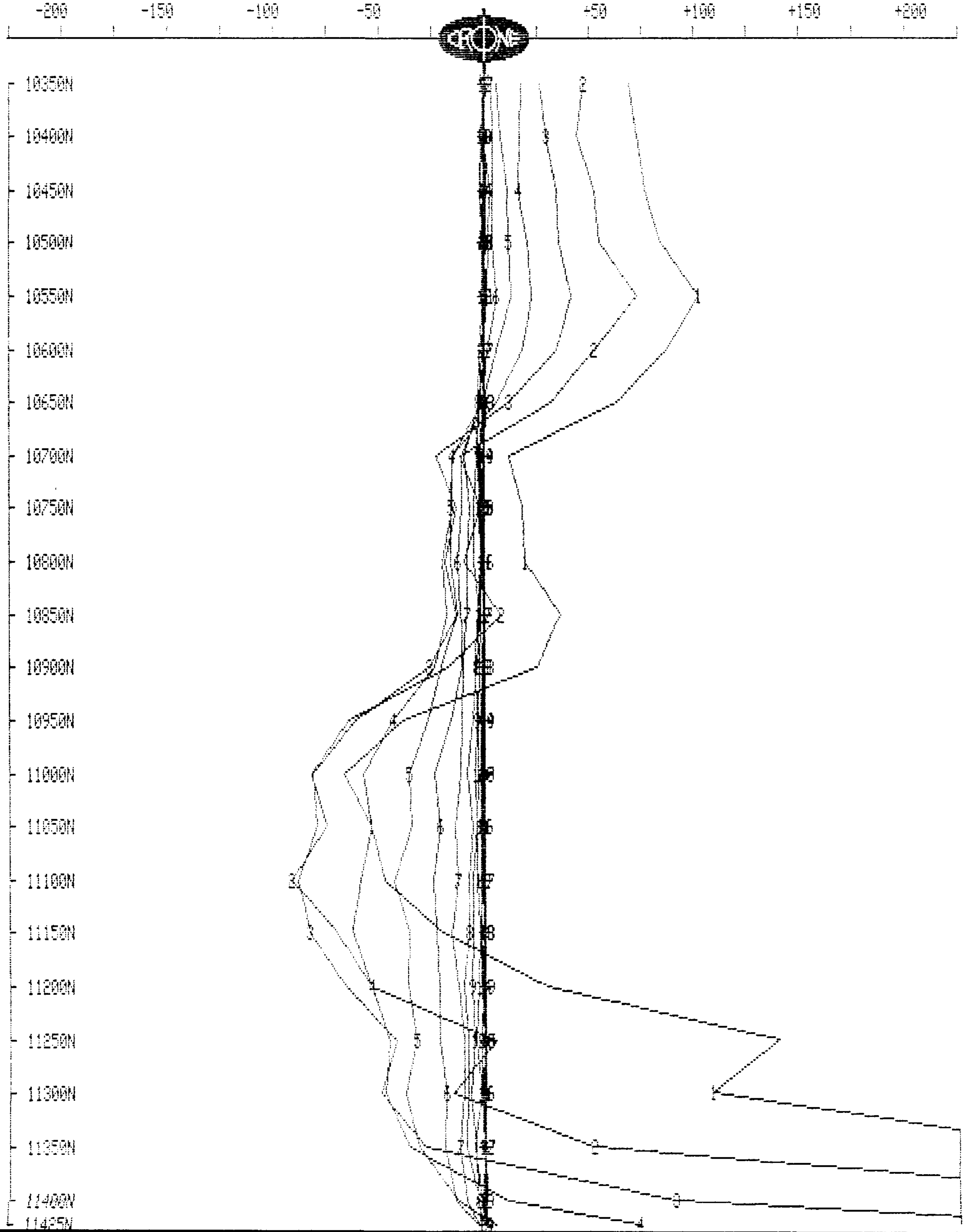
IN-LINE HORIZONTAL COMPONENT dBx/dt nanoTesla/sec - 20 channels
Scale: 1:5000 Unit Scale: 1cm = 25 nT/s



CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

Client : FALCONBRIDGE
Grid : BOOT-BAY
Date : Mar 22, 1992
Line : 9146W
Tx Loop : 3
File name : L9146W3.PEM

VERTICAL COMPONENT dBz/dt nanoTesla/sec - 20 channels
Scale: 1:5000
Unit Scale: 1cm = 25 nT/s

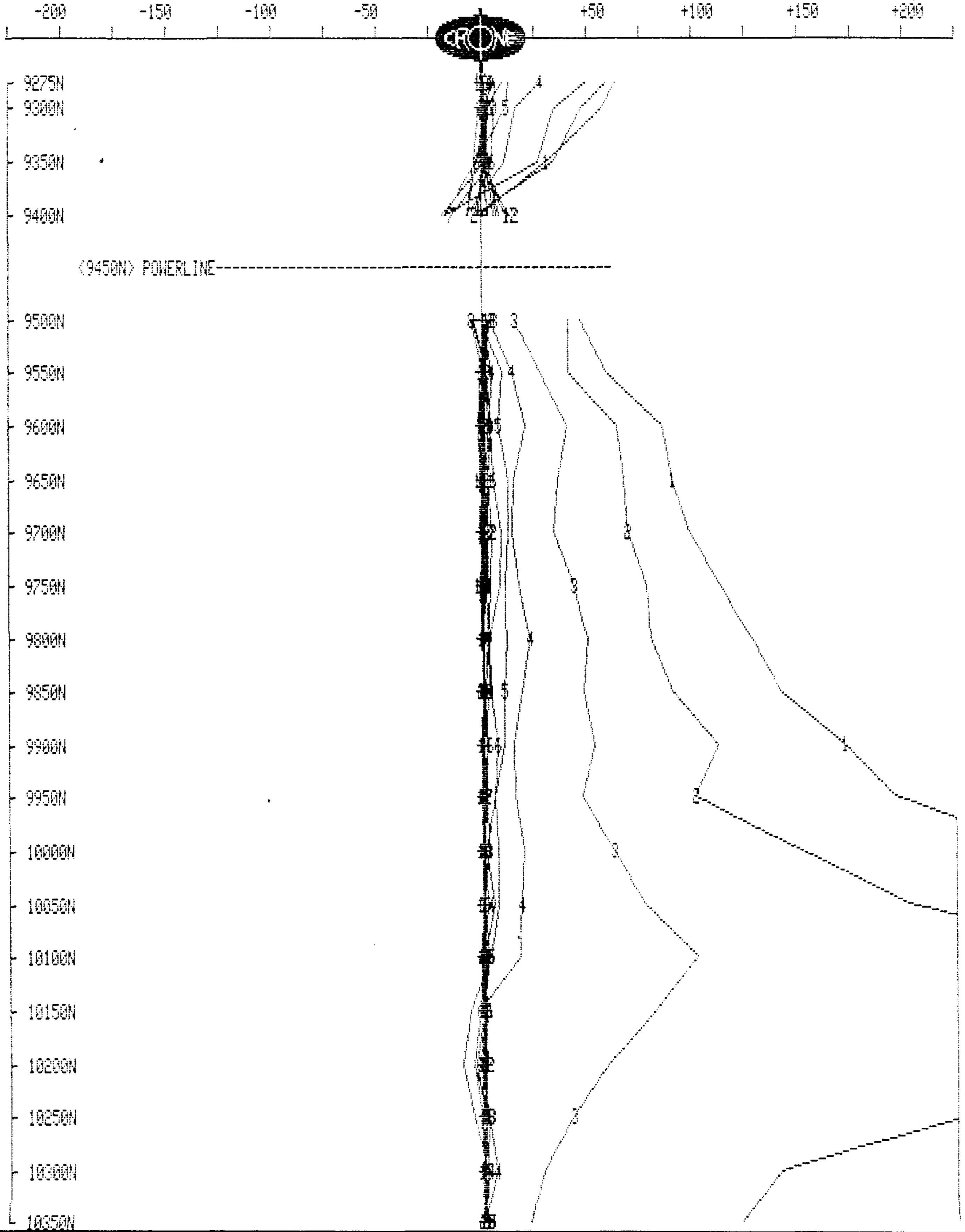


CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

Client : FALCONBRIDGE
Grid : BOOT-BAY
Date : Mar 24, 1992

Line : 9146W
Tx Loop : 4
File name : L9146W4.PEM

IN-LINE HORIZONTAL COMPONENT dBx/dt nanoTesla/sec - 20 channels
Scale: 1:5000
Unit Scale: 1cm = 25 nT/s



CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

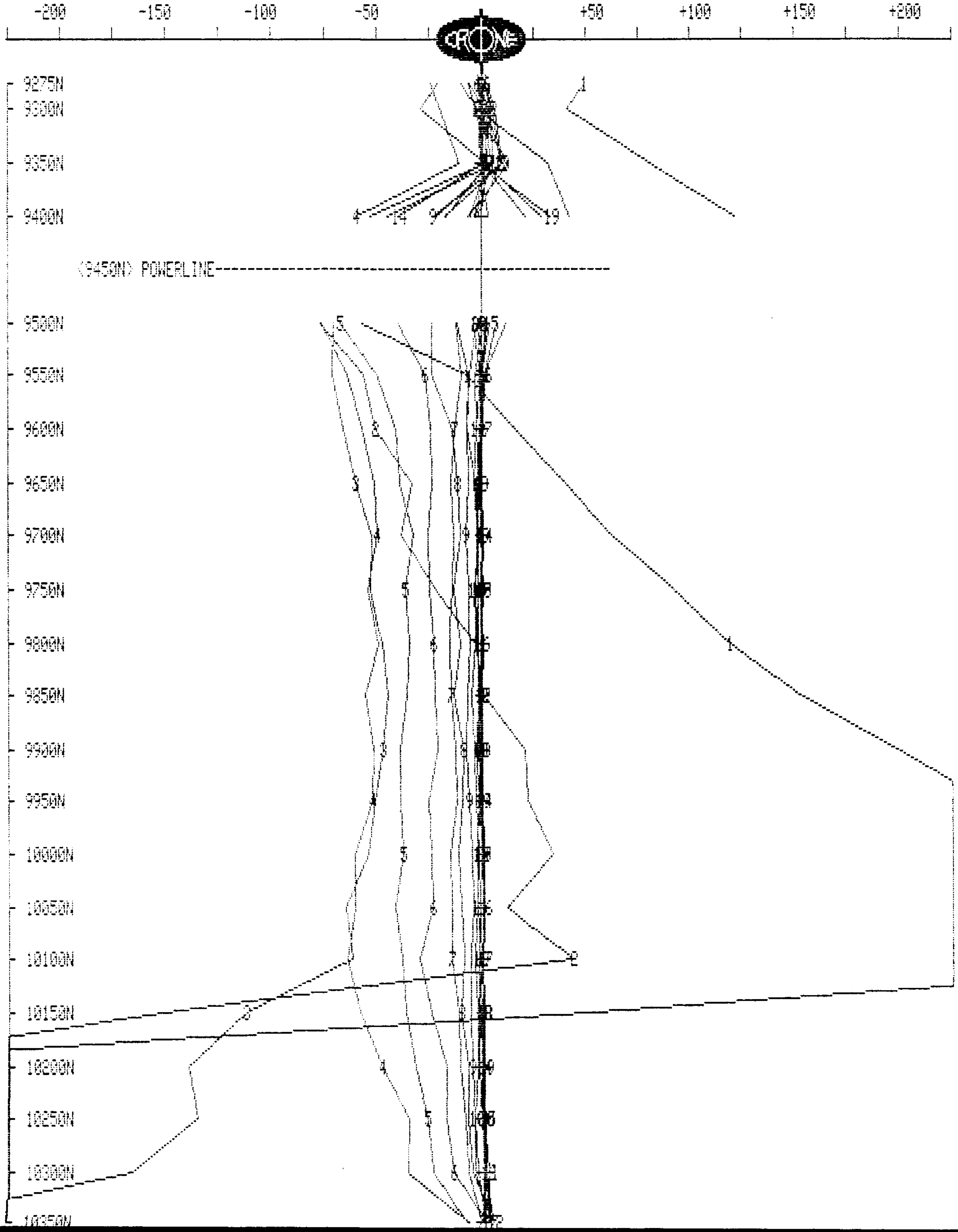
Client : FALCONBRIDGE
Grid : BOOT-BAY
Date : Mar 24, 1992

Line : 9146W
Tx Loop : 4
File name : L9146W4.PEM

VERTICAL COMPONENT dBz/dt nanoTesla/sec - 20 channels

Scale: 1:5000

Unit Scale: 1cm = 25 nT/s

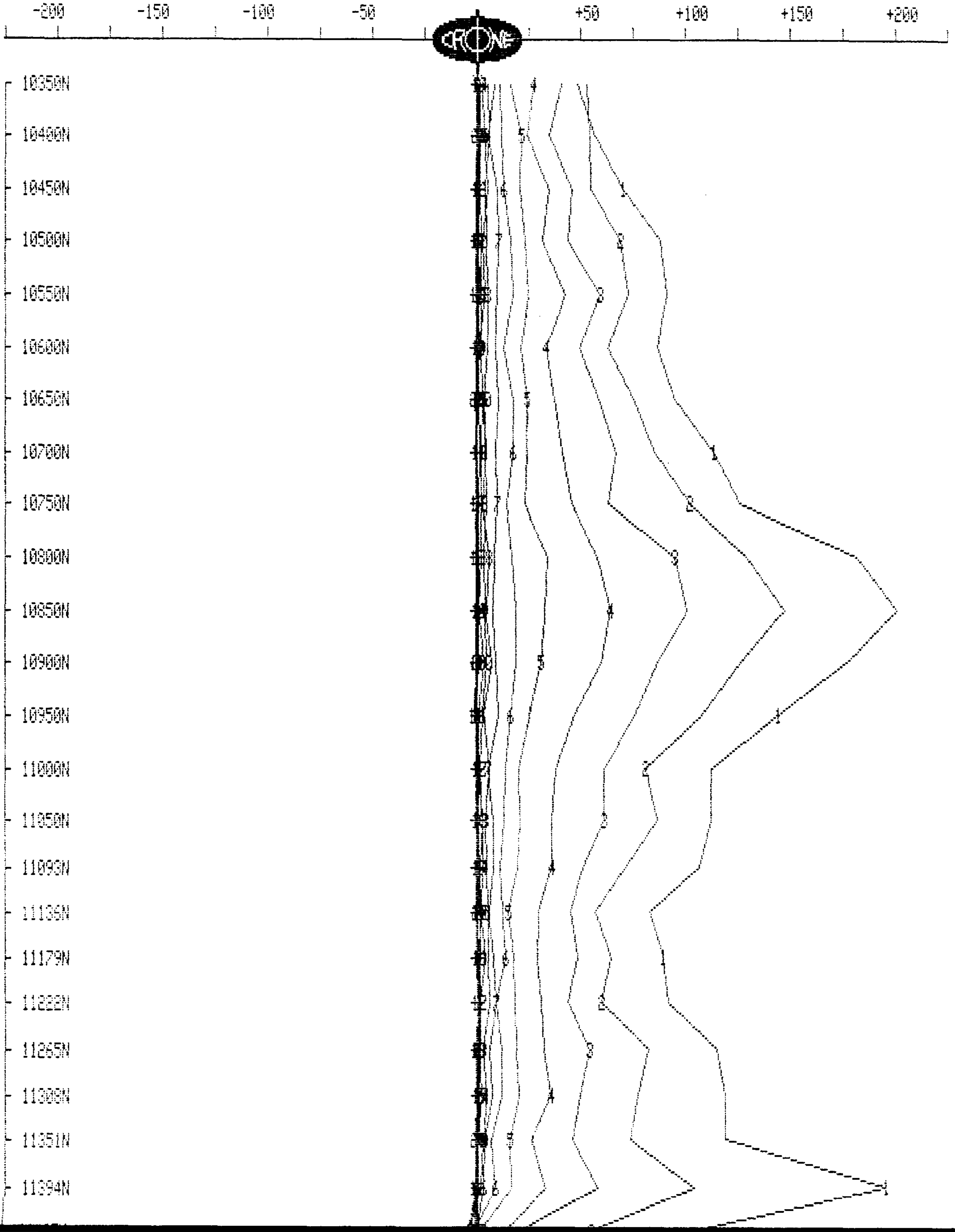


CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

Client : FALCONBRIDGE
Grid : BOOT-BAY
Date : Mar 22, 1992

Line : 9024W
Tx Loop : 3
File name : L9024W3.PEM

IN-LINE HORIZONTAL COMPONENT dBx/dt nanoTesla/sec - 20 channels
Scale: 1:5000
Unit Scale: 1cm = 25 nT/s



CRONE GEOPHYSICS & EXPLORATION LTD

SURFACE PEM

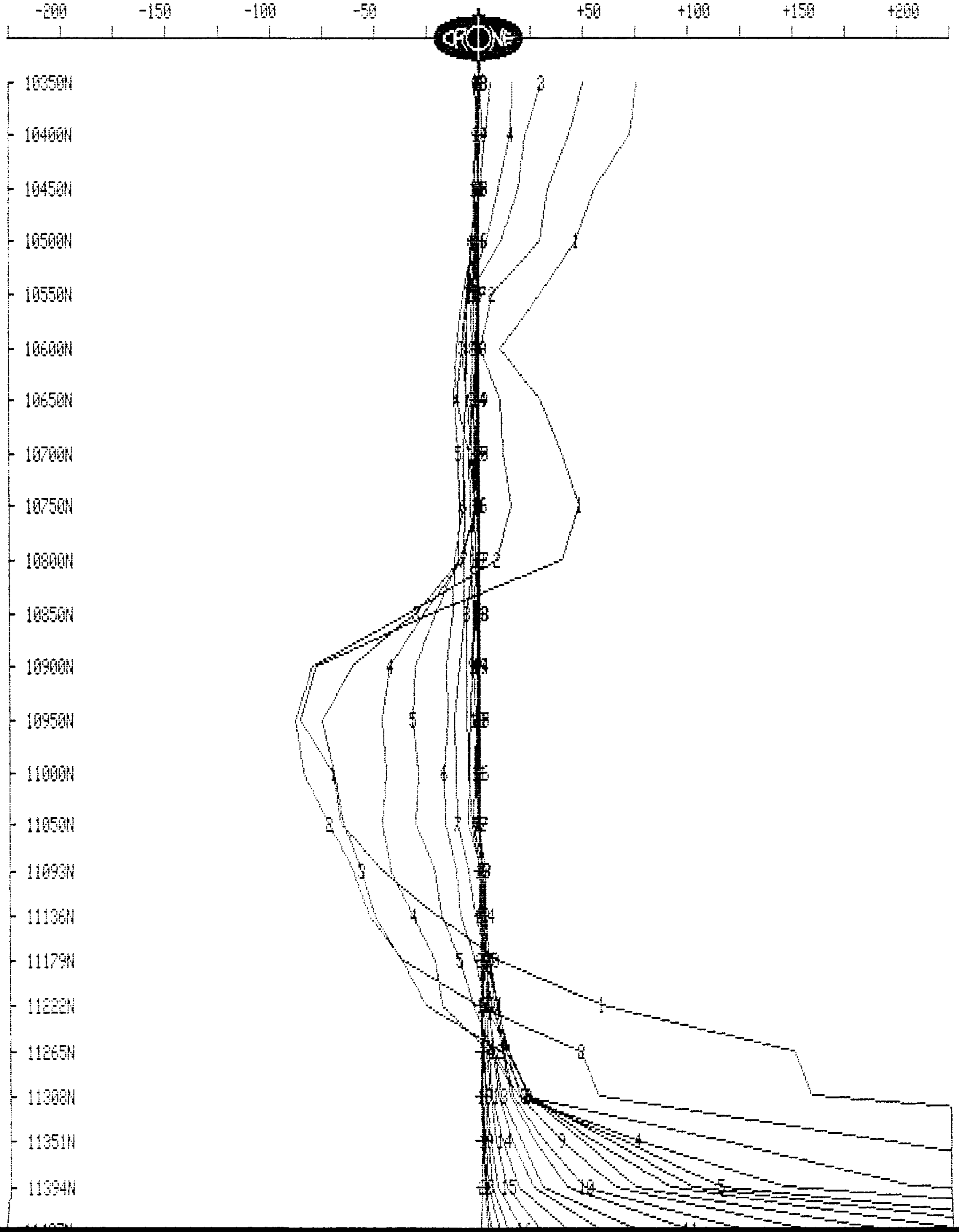
Client : FALCONBRIDGE
Grid : BOOT-BAY
Date : Mar 22, 1992

Line : 9024W
Tx Loop : 3
File name : L9024W3.PEM

VERTICAL COMPONENT dBz/dt nanoTesla/sec - 20 channels

Scale: 1:5000

Unit Scale: 1cm = 25 nT/s

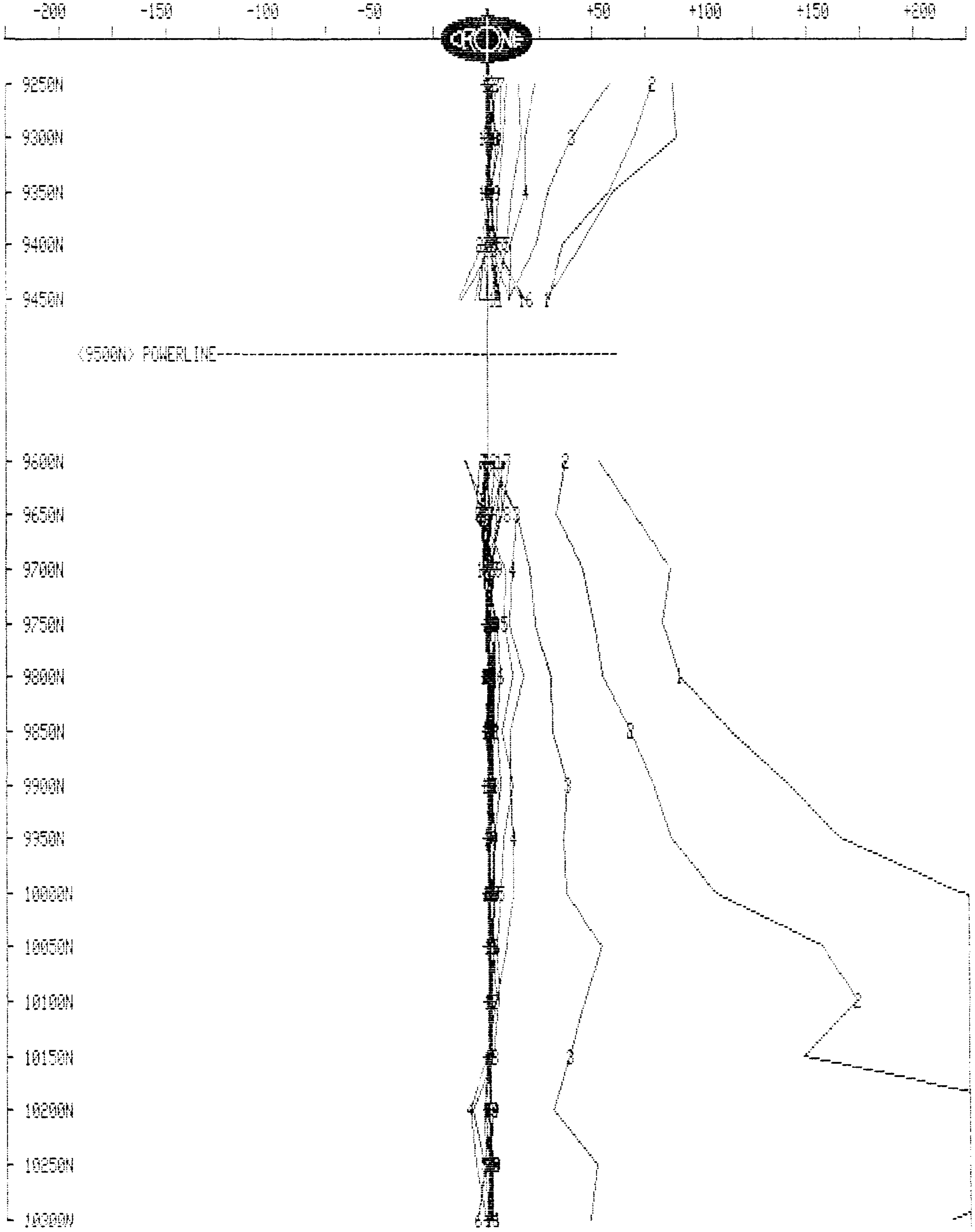


CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

Client : FALCONBRIDGE
Grid : BOOT-BAY
Date : Mar 24, 1992

Line : 9024W
Tx Loop : 4
File name : L9024W4.PEM

IN-LINE HORIZONTAL COMPONENT dBx/dt nanoTesla/sec - 20 channels
Scale: 1:5000
Unit Scale: 1cm = 25 nT/s



CRONE GEOPHYSICS & EXPLORATION LTD

SURFACE PEM

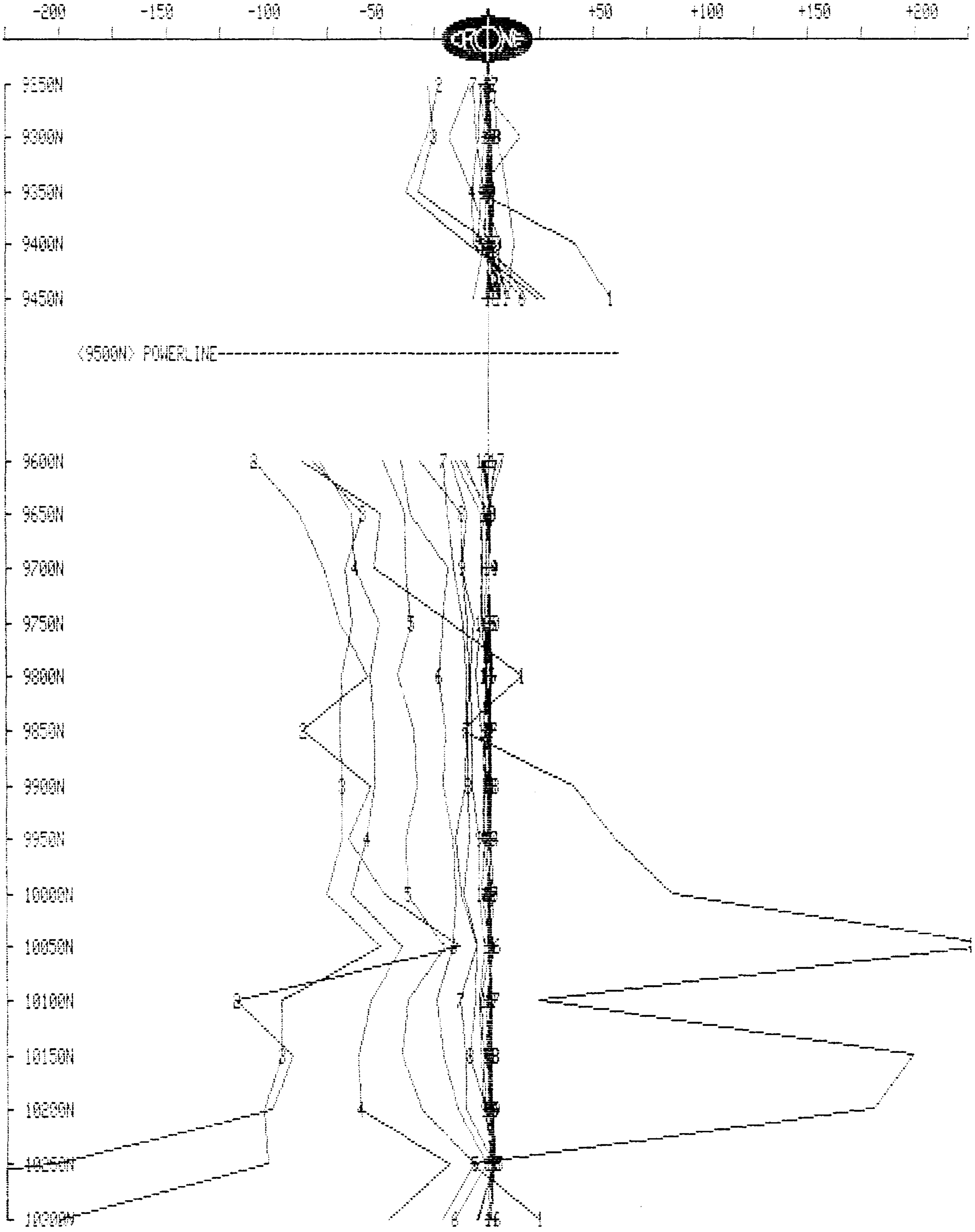
Client : FALCONBRIDGE
Grid : BOOT-BAY
Date : Mar 24, 1992

Line : 9024W
Tx Loop : 4
File name : L9024W4.PEM

VERTICAL COMPONENT dBz/dt nanoTesla/sec - 20 channels

Scale: 1:5000

Unit Scale: 1cm = 25 nT/s

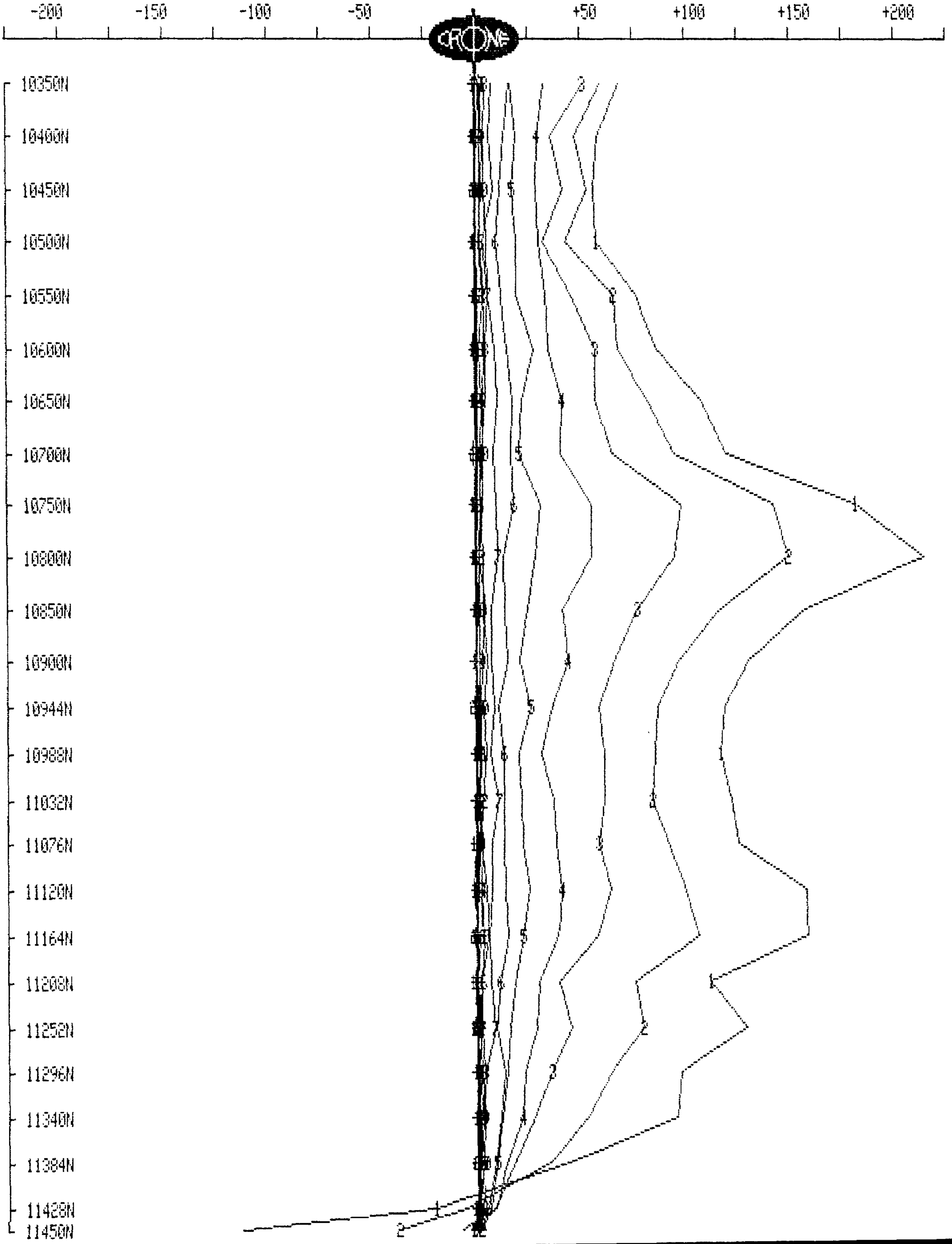


CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

Client : FALCONBRIDGE
Grid : BOOT-BAY
Date : Mar 22, 1992

Line : 8902W
Tx Loop : 3
File name : L8902W3.PEM

IN-LINE HORIZONTAL COMPONENT dBx/dt nanoTesla/sec - 20 channels
Scale: 1:5000
Unit Scale: 1cm = 25 nT/s



CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

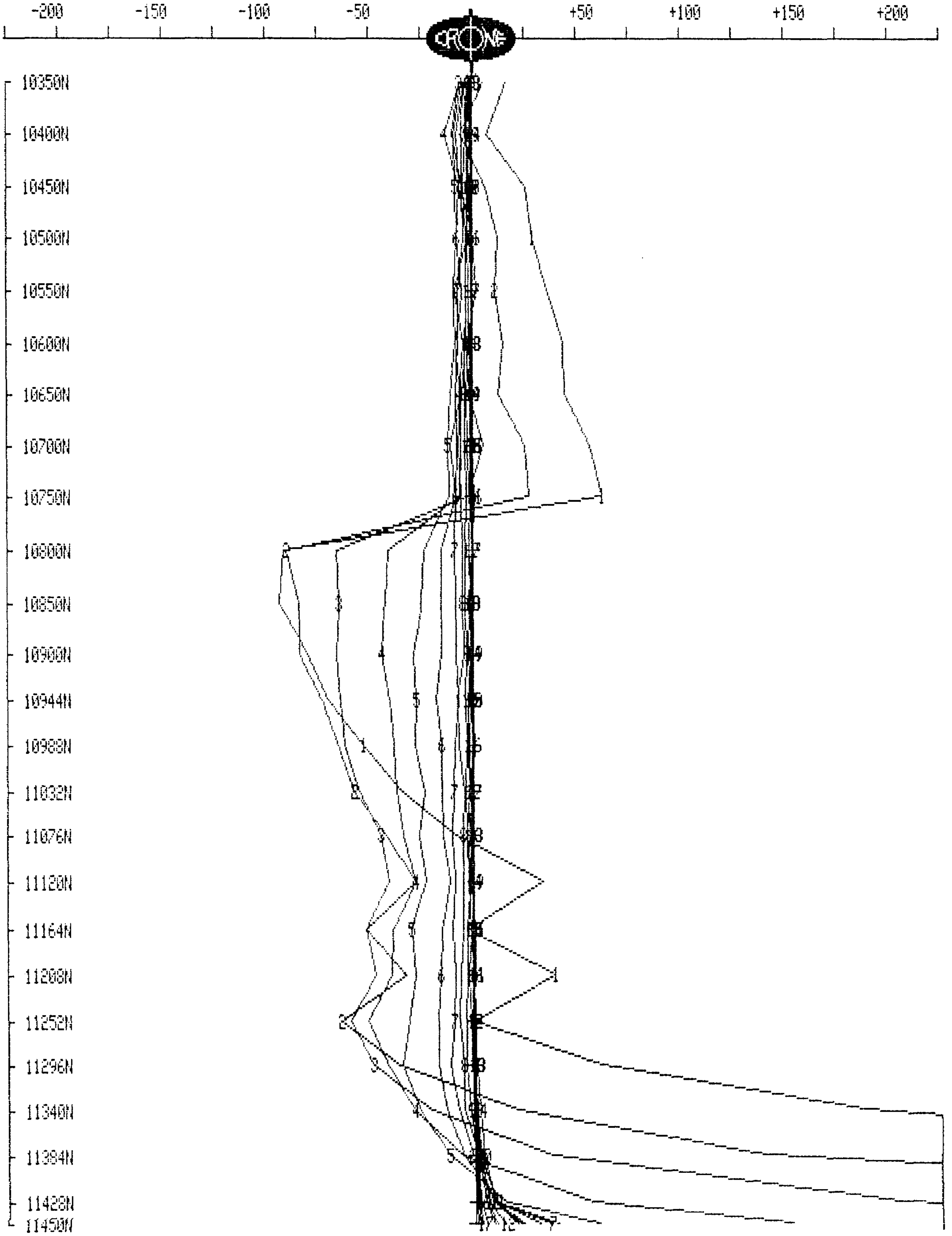
Client : **FALCONBRIDGE**
Grid : **BOOT-BAY**
Date : Mar 22, 1992

Line : **8902W**
Tx Loop : 3
File name : L8902W3.PEM

VERTICAL COMPONENT dBz/dt nanoTesla/sec - 20 channels

Scale: 1:5000

Unit Scale: 1cm = 25 nT/s

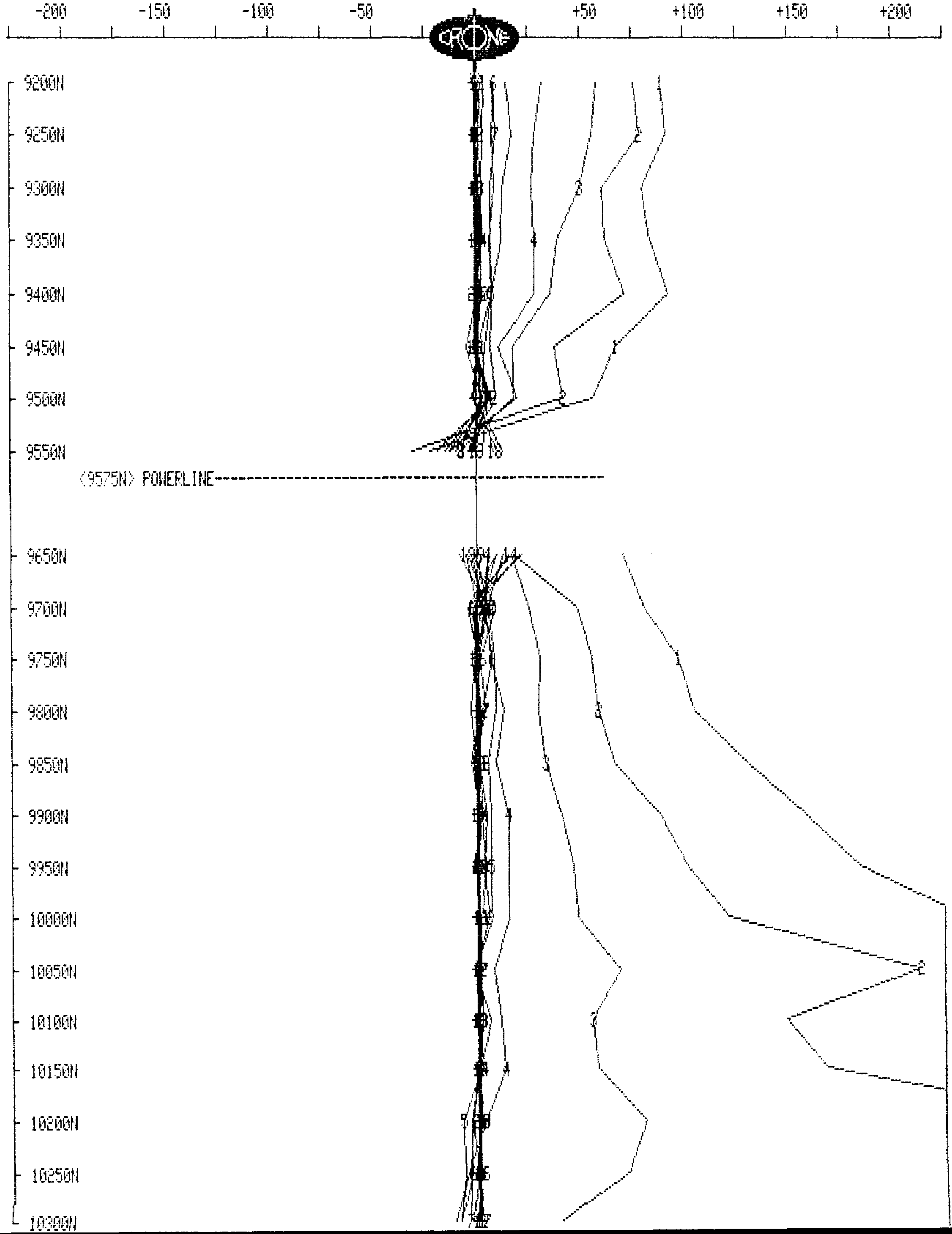


CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

Client	: **FALCONBRIDGE**	Line	: **8902W**
Grid	: **BOOT-BAY**	Tx Loop	: **4**
Date	: Mar 23, 1992	File name	: L8902W4.PEM

IN-LINE HORIZONTAL COMPONENT dBx/dt nanoTesla/sec **- 20 channels**

Scale: 1:5000 Unit Scale: 1cm = 25 nT/s



CRONE GEOPHYSICS & EXPLORATION LTD

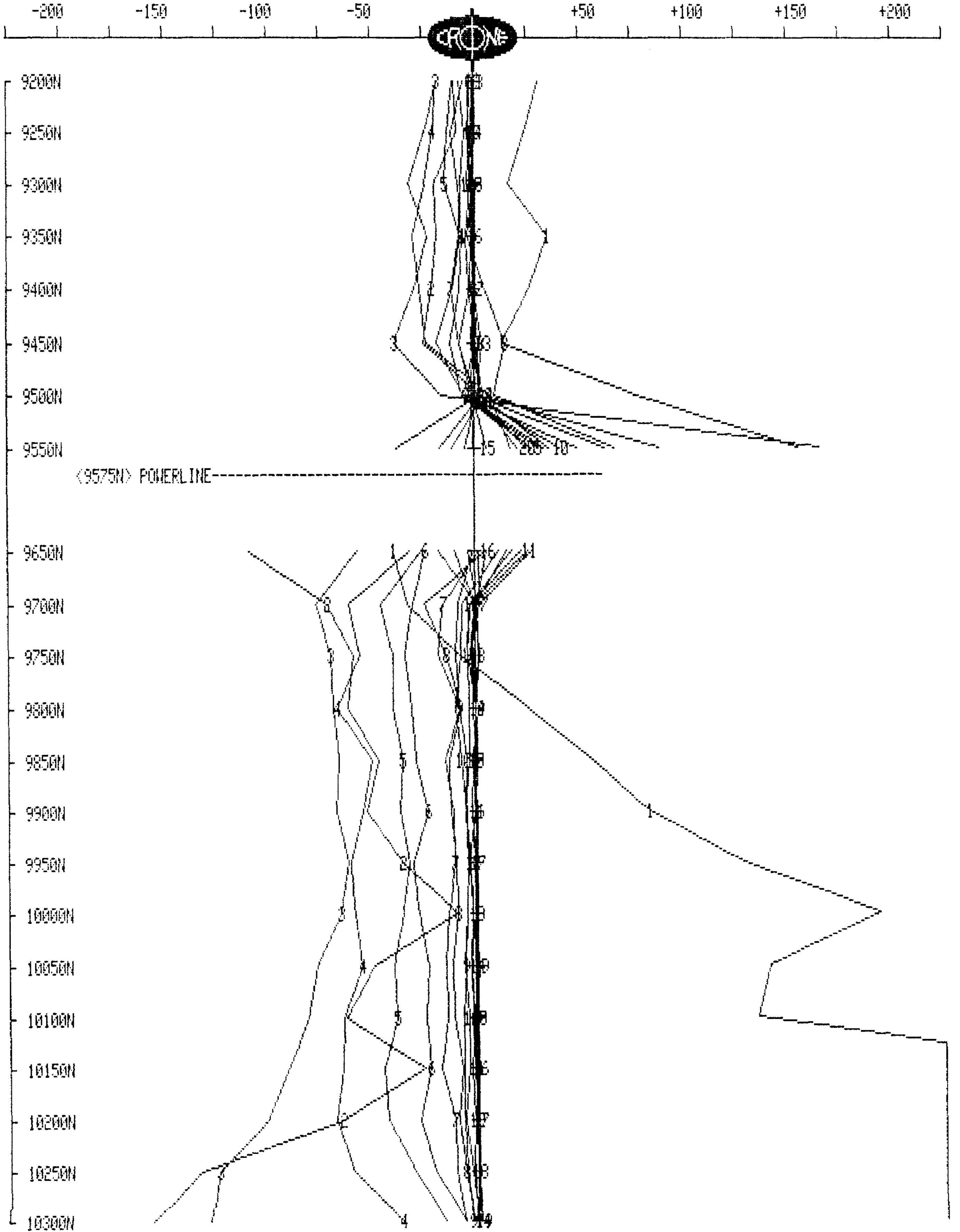
SURFACE PEM

Client	: FALCONBRIDGE	Line	: 8902W
Grid	: BOOT-BAY	Tx Loop	: 4
Date	: Mar 23, 1992	File name	: L8902W4.PEM

VERTICAL COMPONENT dBz/dt nanoTesla/sec - 20 channels

Scale: 1:5000

Unit Scale: 1cm = 25 nT/s



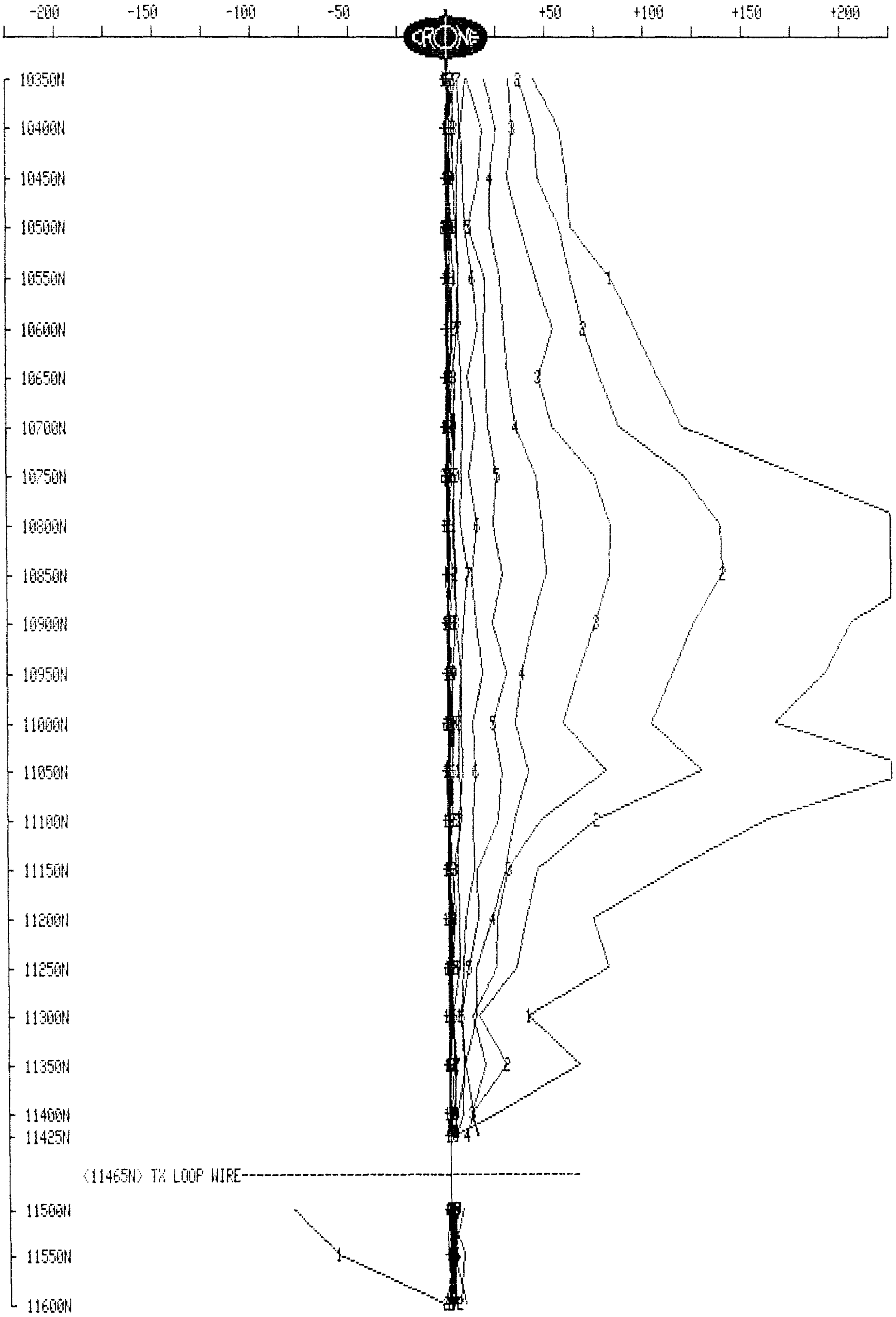
CRONE GEOPHYSICS & EXPLORATION LTD

SURFACE PEM

Client	:	FALCONBRIDGE	Line	:	8780W
Grid	:	BOOT-BAY	Tx Loop	:	3
Date	:	Mar 22, 1992	File name	:	L8780W3.PEM

IN-LINE HORIZONTAL COMPONENT dBx/dt nanoTesla/sec - 20 channels

Scale: 1:5000 Unit Scale: 1cm = 25 nT/s



CRONE GEOPHYSICS & EXPLORATION LTD

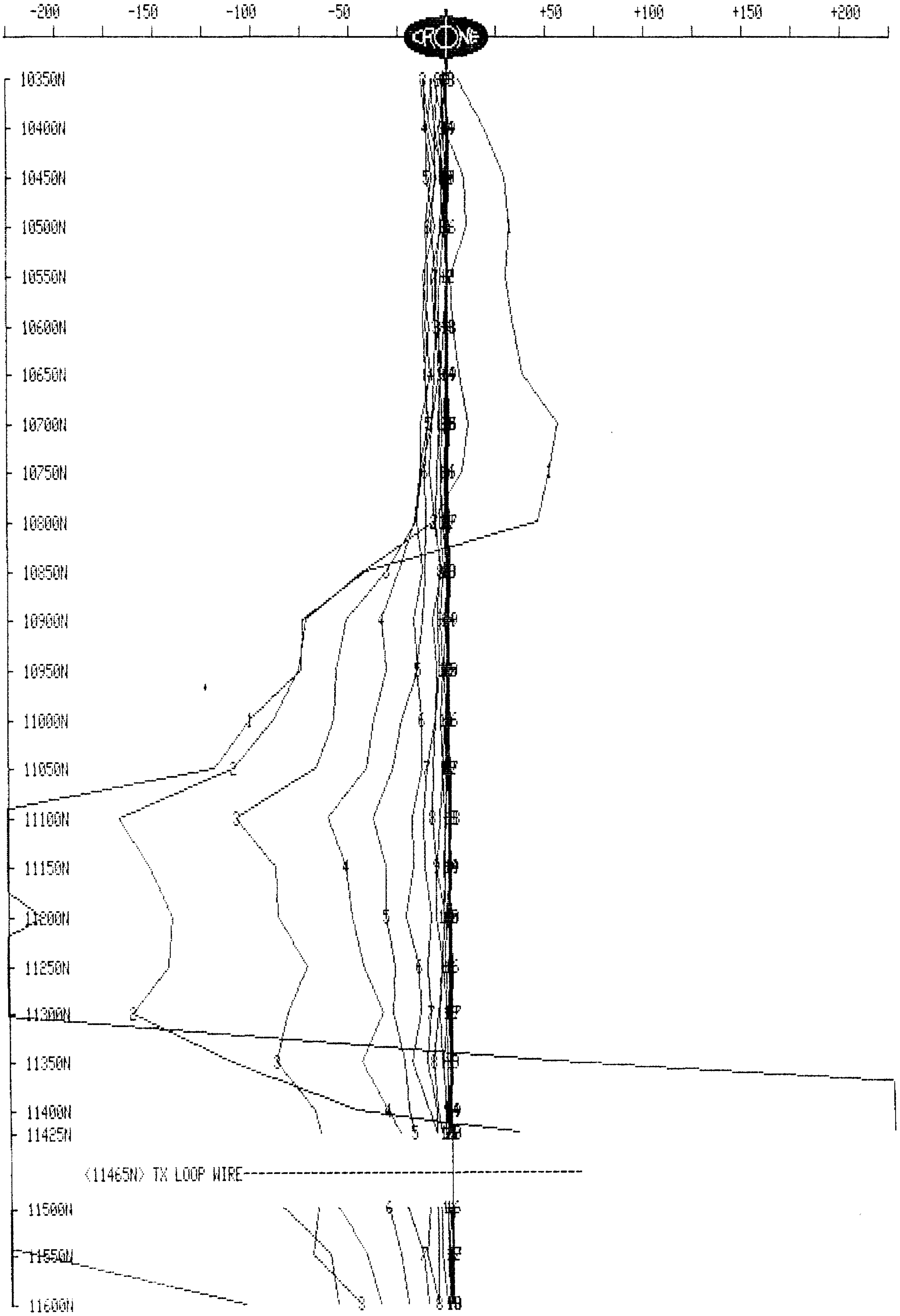
SURFACE PEM

Client	:	FALCONBRIDGE	Line	:	**8780W**
Grid	:	BOOT-BAY	Tx Loop	:	3
Date	:	Mar 22, 1992	File name	:	L8780W3.PEM

VERTICAL COMPONENT dBz/dt nanoTesla/sec - 20 channels

Scale: 1:5000

Unit Scale: 1cm = 25 nT/s

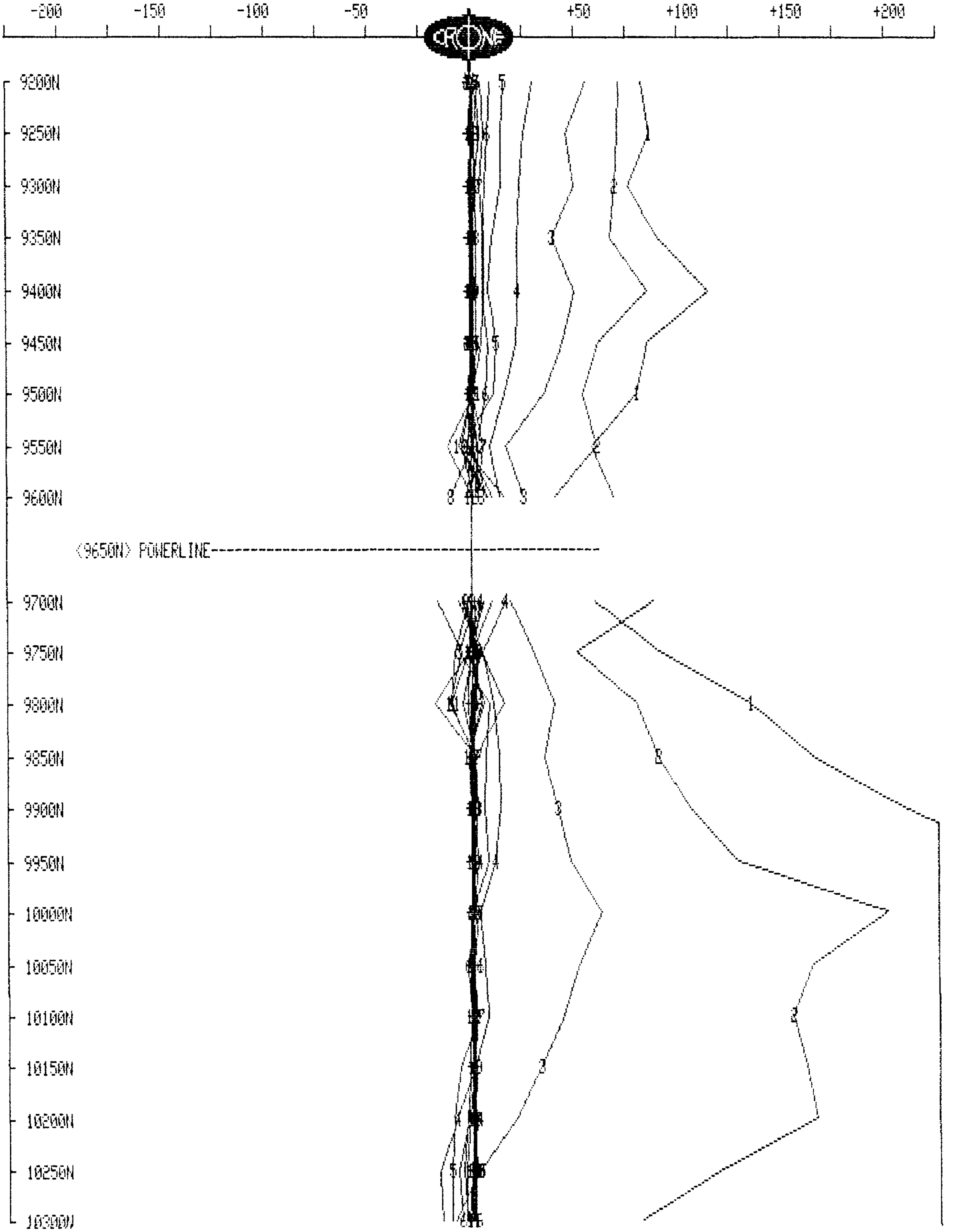


CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

Client : FALCONBRIDGE
Grid : BOOT-BAY
Date : Mar 23, 1992

Line : 8780W
Tx Loop : 4
File name : L8780W4.PEM

IN-LINE HORIZONTAL COMPONENT dBx/dt nanoTesla/sec - 20 channels
Scale: 1:5000
Unit Scale: 1cm = 25 nT/s

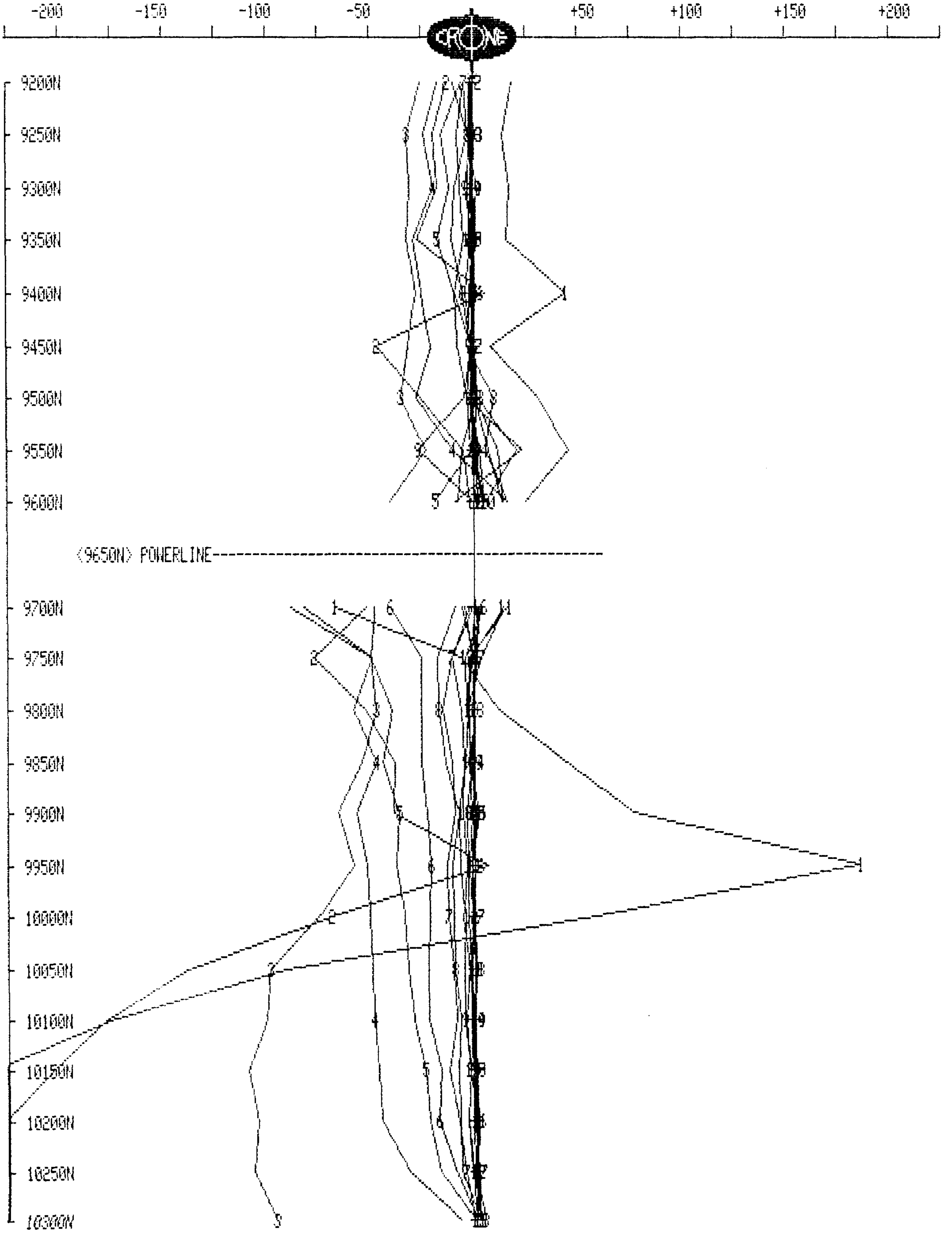


CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

Client	: **FALCONBRIDGE**	Line	: **8780W**
Grid	: **BOOT-BAY**	Tx Loop	: **4**
Date	: Mar 23, 1992	File name	: L8780W4.PEM

VERTICAL COMPONENT dBz/dt nanoTesla/sec - 20 channels

Scale: 1:5000 Unit Scale: 1cm = 25 nT/s



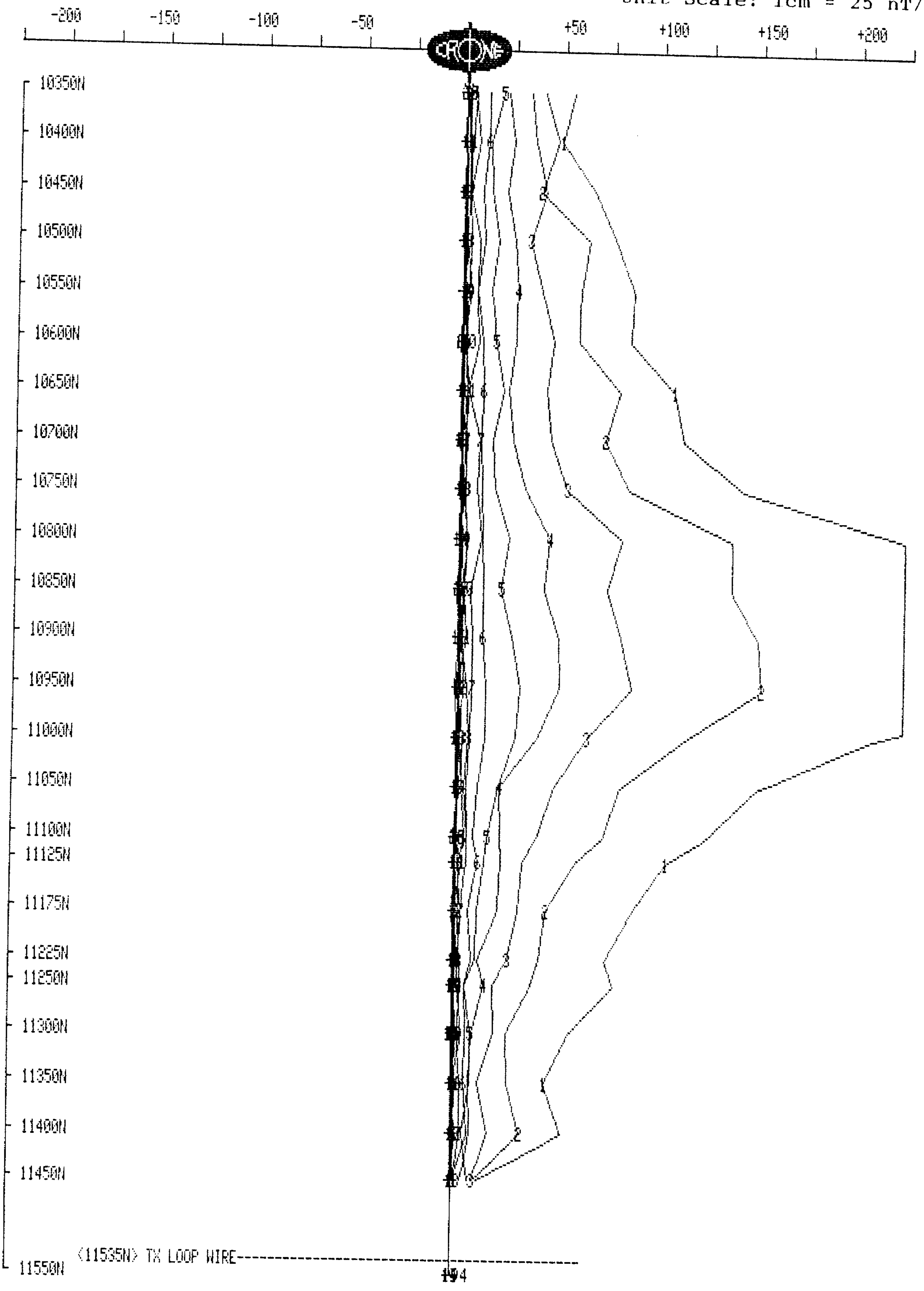
CRONE GEOPHYSICS & EXPLORATION LTD

SURFACE PEM

Client : **FALCONBRIDGE**
Grid : **BOOT-BAY**
Date : Mar 22, 1992

Line : **8658W**
Tx Loop : 3
File name : L8658W3.PEM

IN-LINE HORIZONTAL COMPONENT dBx/dt nanoTesla/sec - **20 channels**
Scale: 1:5000
Unit Scale: 1cm = 25 nT/s

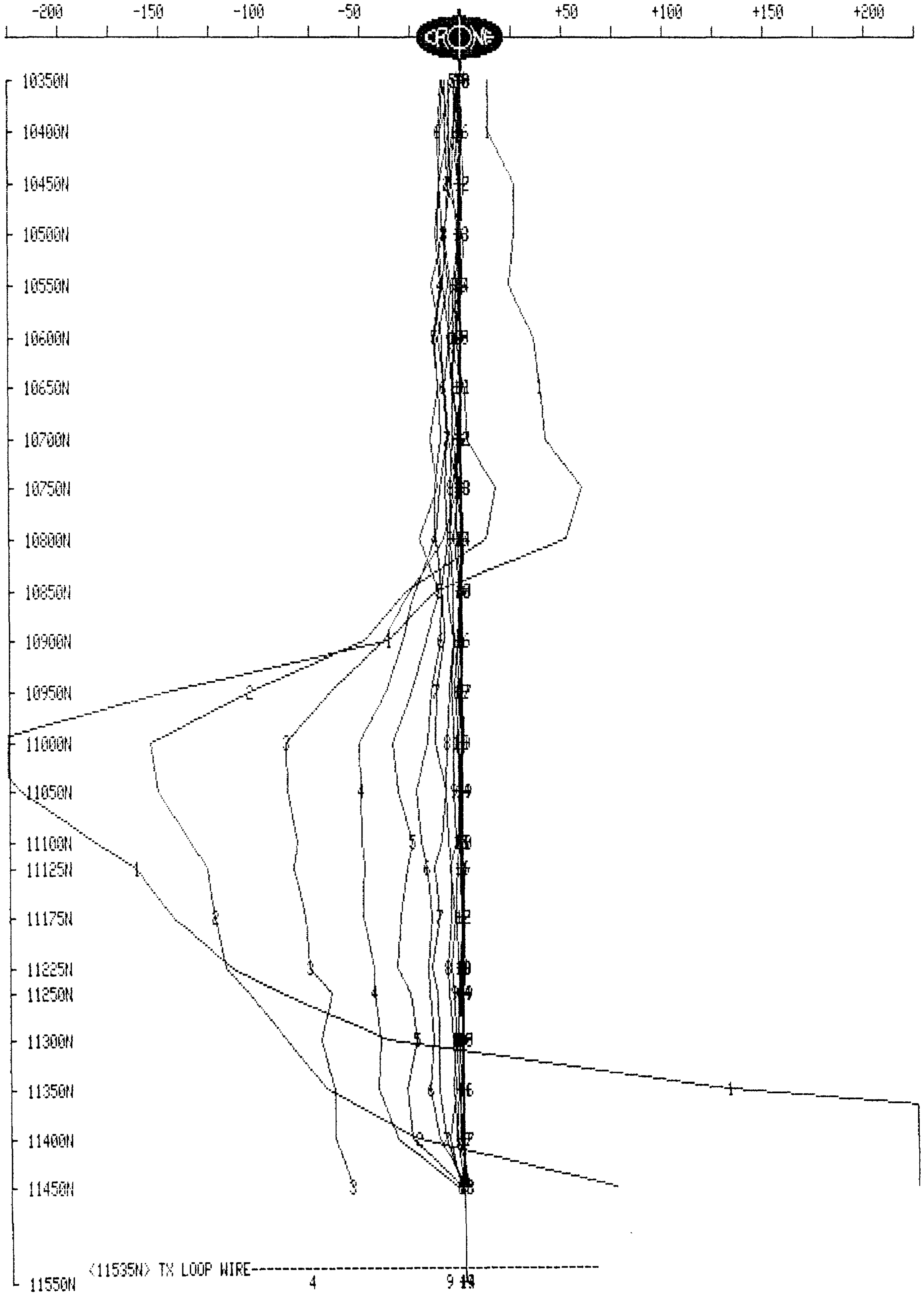


CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

Client	: FALCONBRIDGE		Line	:	8658W
Grid	: BOOT-BAY		Tx Loop	:	3
Date	: Mar 22, 1992		File name	:	L8658W3.PEM

VERTICAL COMPONENT dBz/dt nanoTesla/sec - 20 channels

Scale: 1:5000 Unit Scale: 1cm = 25 nT/s

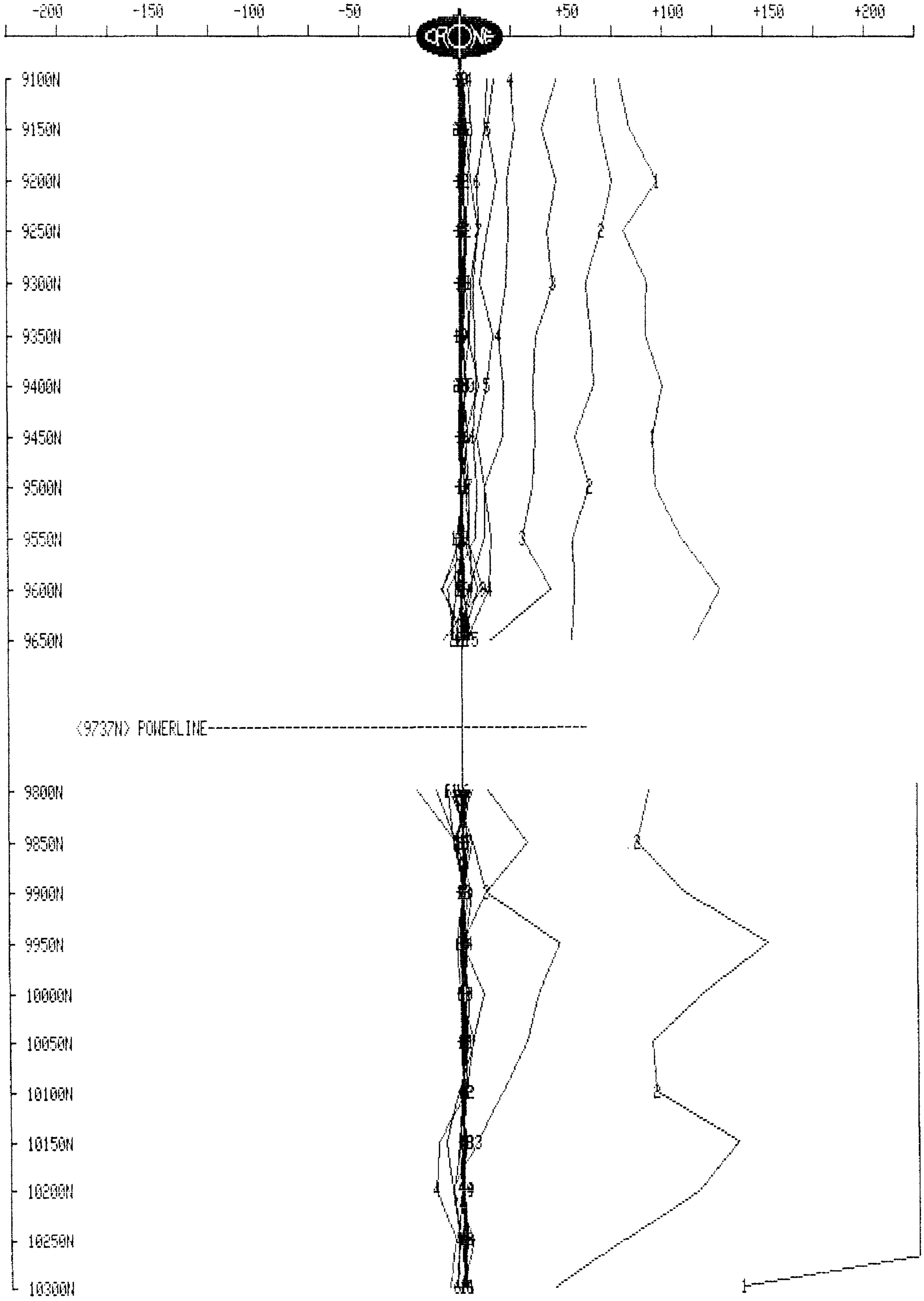


CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

Client	: **FALCONBRIDGE**	Line	: **8658W**
Grid	: BOOT-BAY	Tx Loop	: **4**
Date	: Mar 23, 1992	File name	: L8658W4.PEM

IN-LINE HORIZONTAL COMPONENT dBx/dt nanoTesla/sec - 20 channels

Scale: 1:5000 Unit Scale: 1cm = 25 nT/s

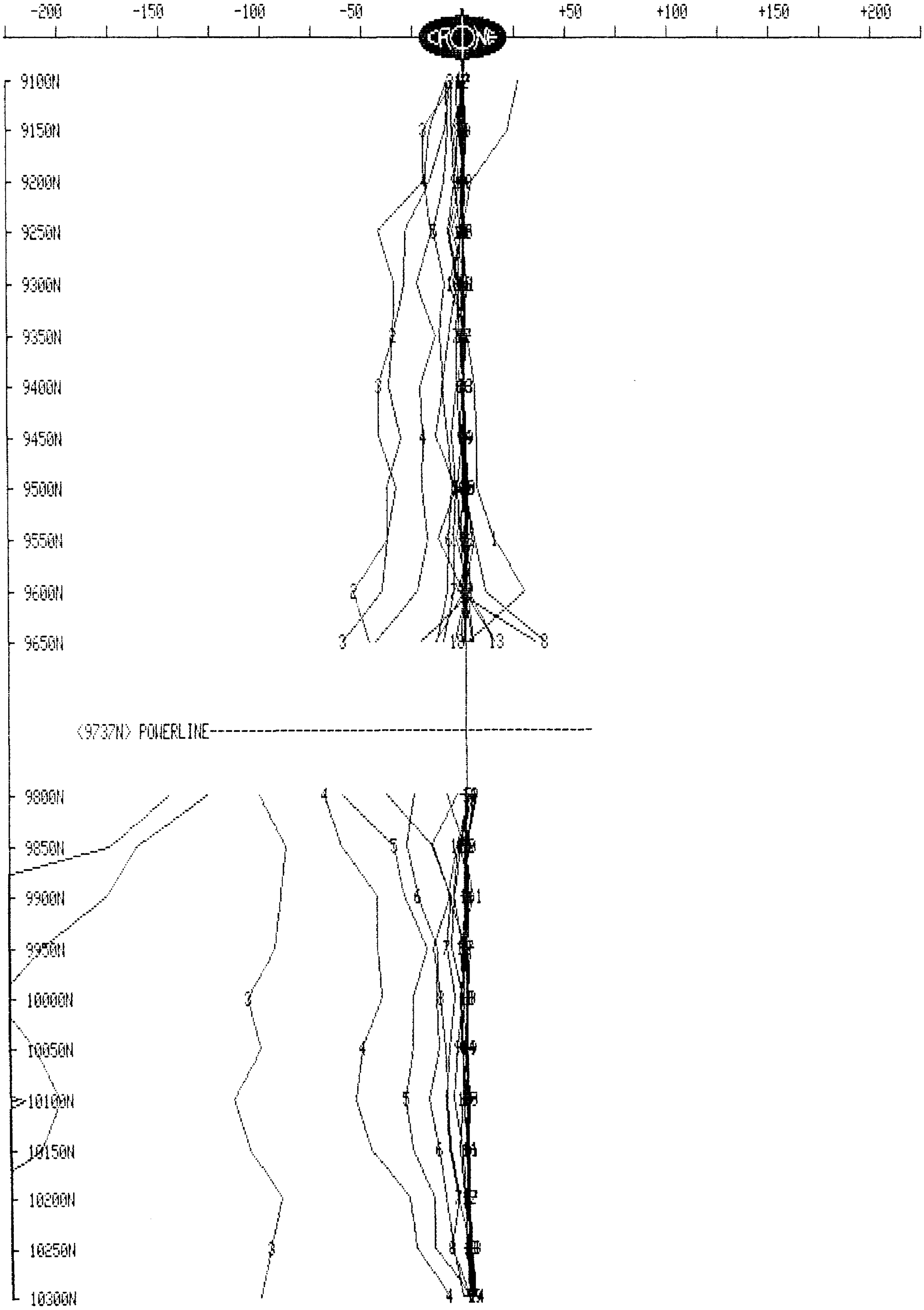


CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

Client	:	FALCONBRIDGE	Line	:	8658W
Grid	:	BOOT-BAY	Tx Loop	:	4
Date	:	Mar 23, 1992	File name	:	L8658W4.PEM

VERTICAL COMPONENT dBz/dt nanoTesla/sec - 20 channels

Scale: 1:5000 Unit Scale: 1cm = 25 nT/s



CRONE GEOPHYSICS & EXPLORATION LTD

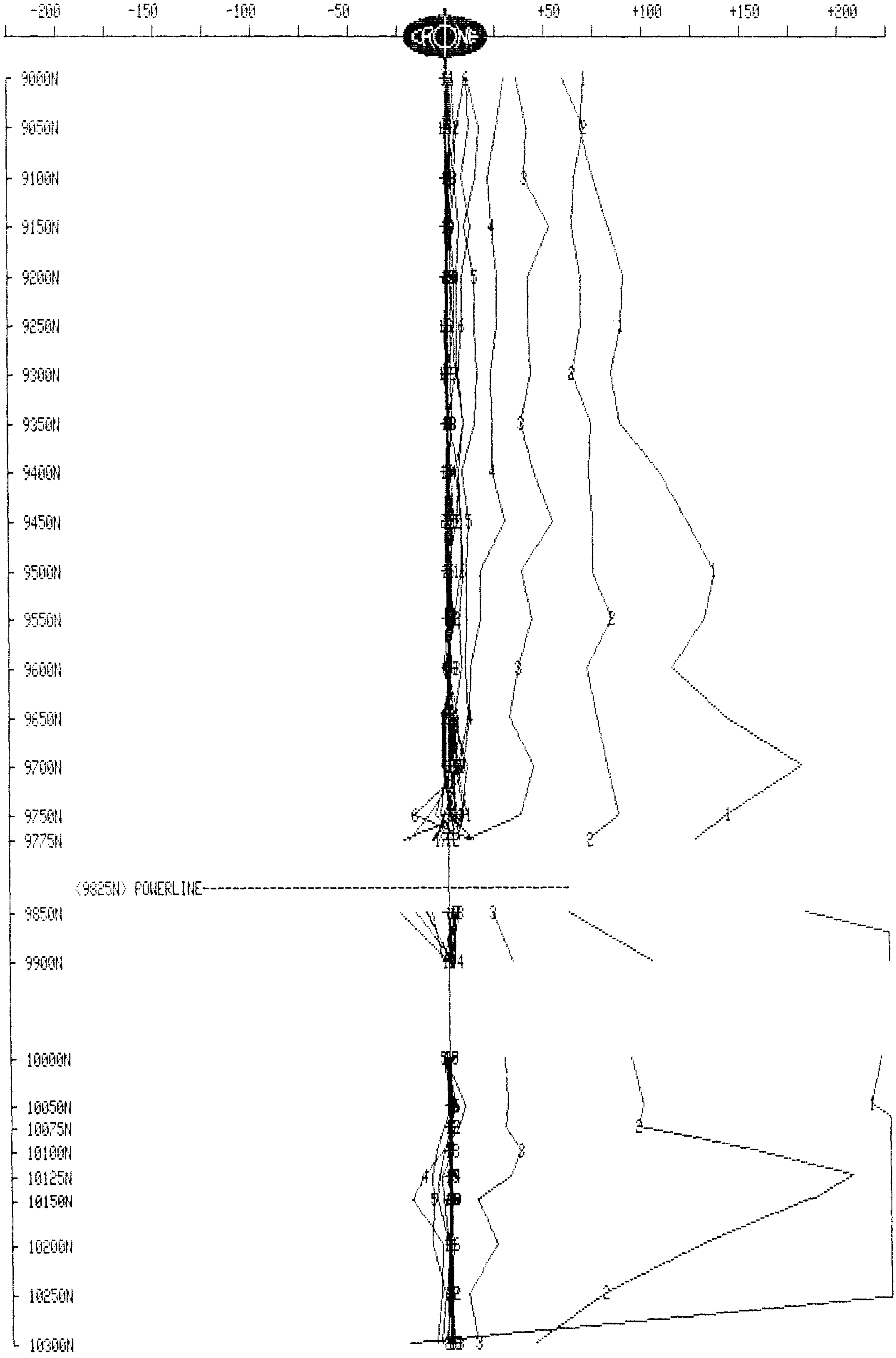
SURFACE PEM

Client : FALCONBRIDGE
Grid : BOOT-BAY
Date : Mar 23, 1992

Line : 8536W
Tx Loop : 4
File name : L8536W4.PEM

IN-LINE HORIZONTAL COMPONENT dBx/dt nanoTesla/sec - 20 channels

Scale: 1:5000 Unit Scale: 1cm = 25 nT/s

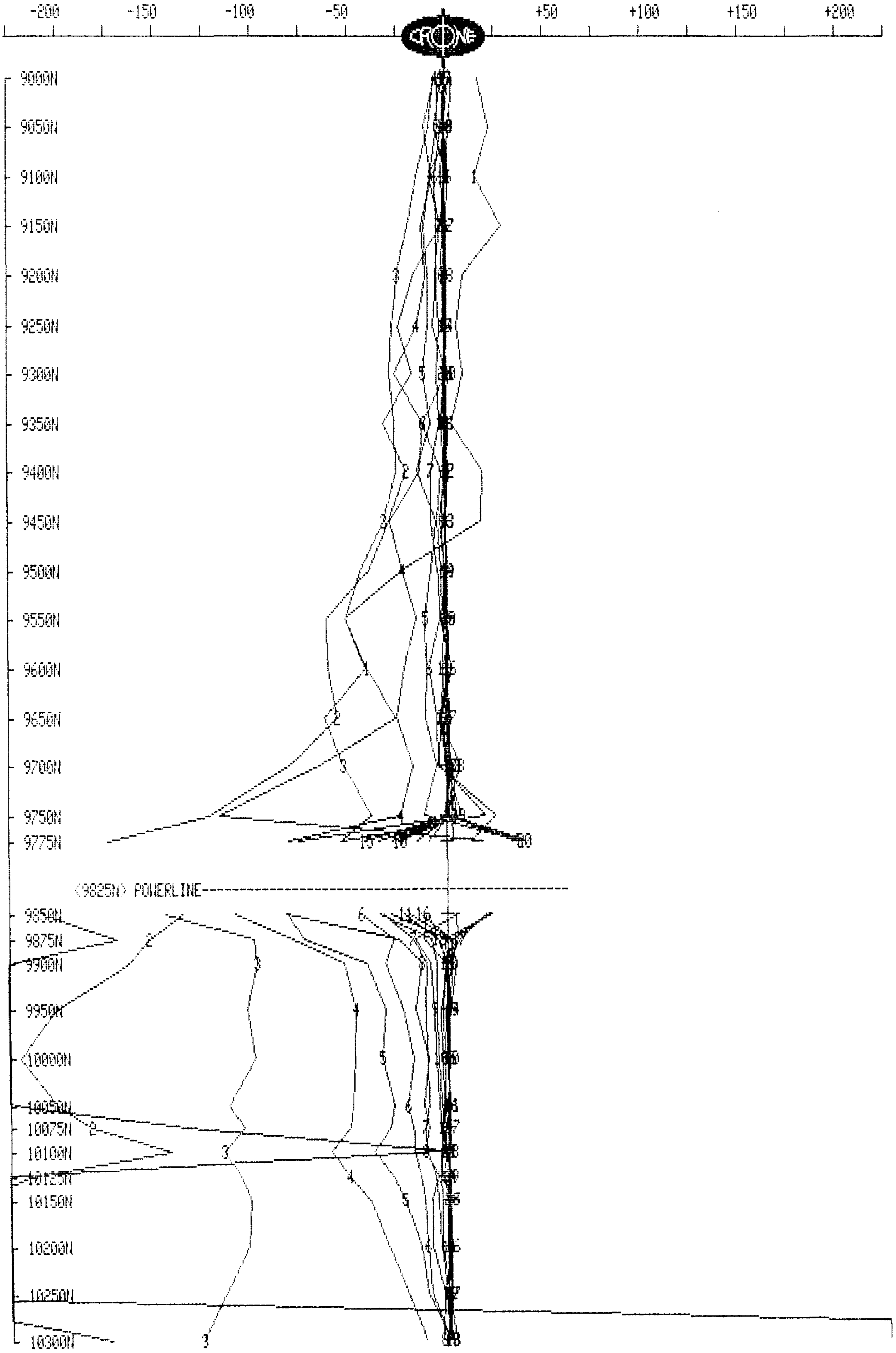


CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

Client	: FALCONBRIDGE		Line	:	8536W
Grid	: BOOT-BAY		Tx Loop	:	4
Date	: Mar 23, 1992		File name	:	L8536W4.PEM

VERTICAL COMPONENT dBz/dt nanoTesla/sec - 20 channels

Scale: 1:5000 Unit Scale: 1cm = 25 nT/s



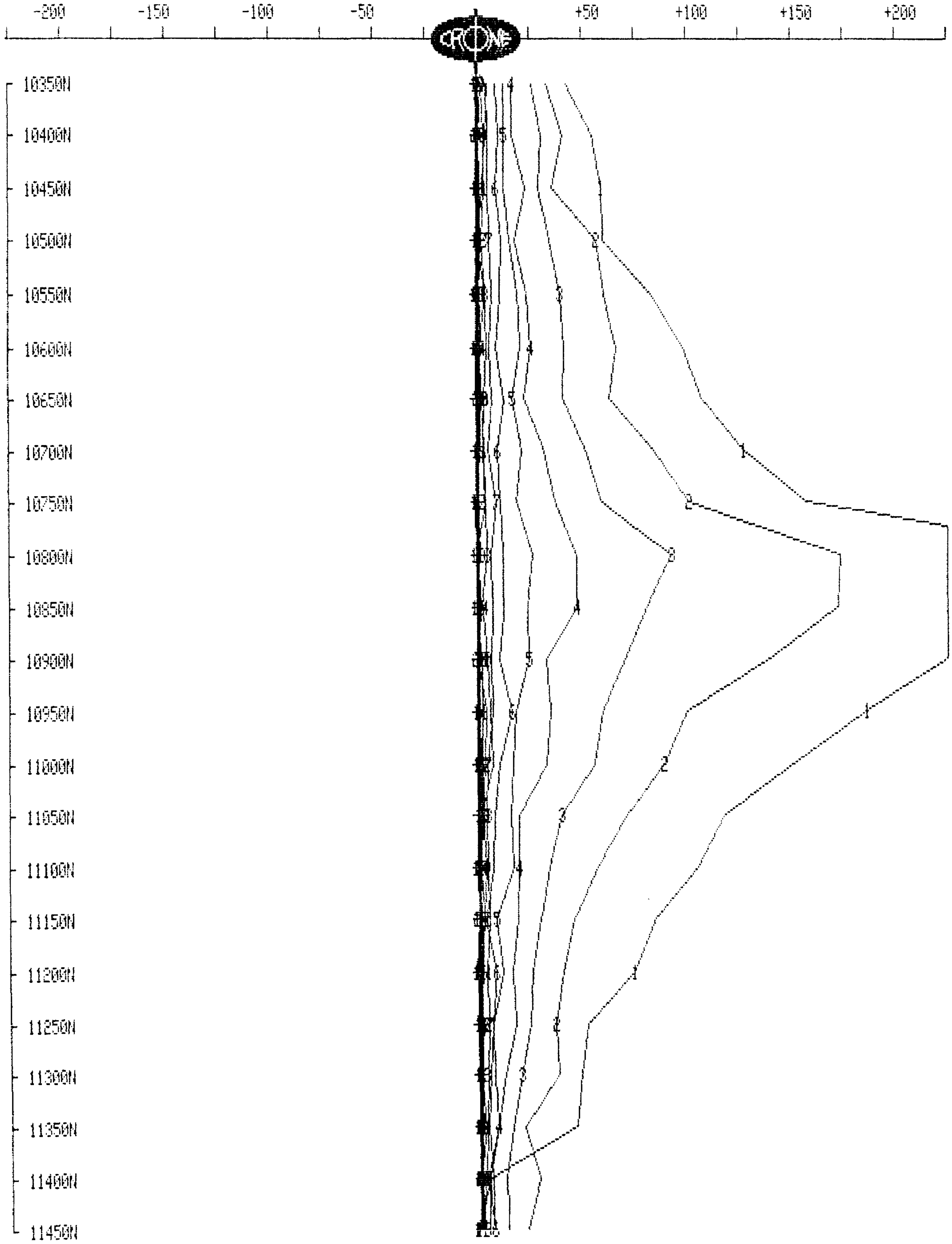
CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

Client	: FALCONBRIDGE	Line	: 8536W
Grid	: BOOT-BAY	Tx Loop	: 3
Date	: Mar 22, 1992	File name	: L8536W3.PEM

IN-LINE HORIZONTAL COMPONENT dBx/dt nanoTesla/sec - 20 channels

Scale: 1:5000

Unit Scale: 1cm = 25 nT/s



CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

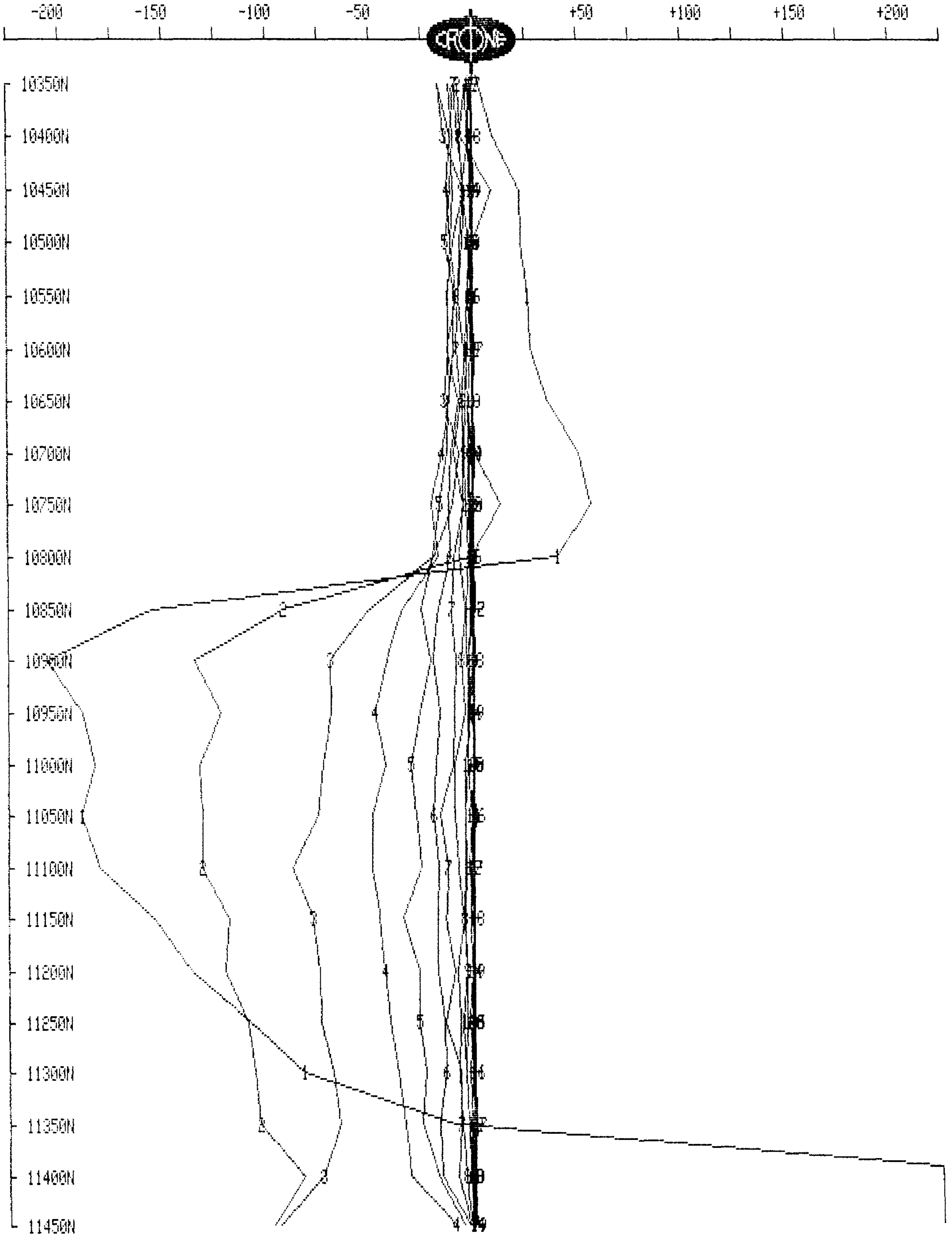
Client : FALCONBRIDGE
Grid : BOOT-BAY
Date : Mar 22, 1992

Line : 8536W
Tx Loop : 3
File name : L8536W3.PEM

VERTICAL COMPONENT dBz/dt nanoTesla/sec - 20 channels

Scale: 1:5000

Unit Scale: 1cm = 25 nT/s



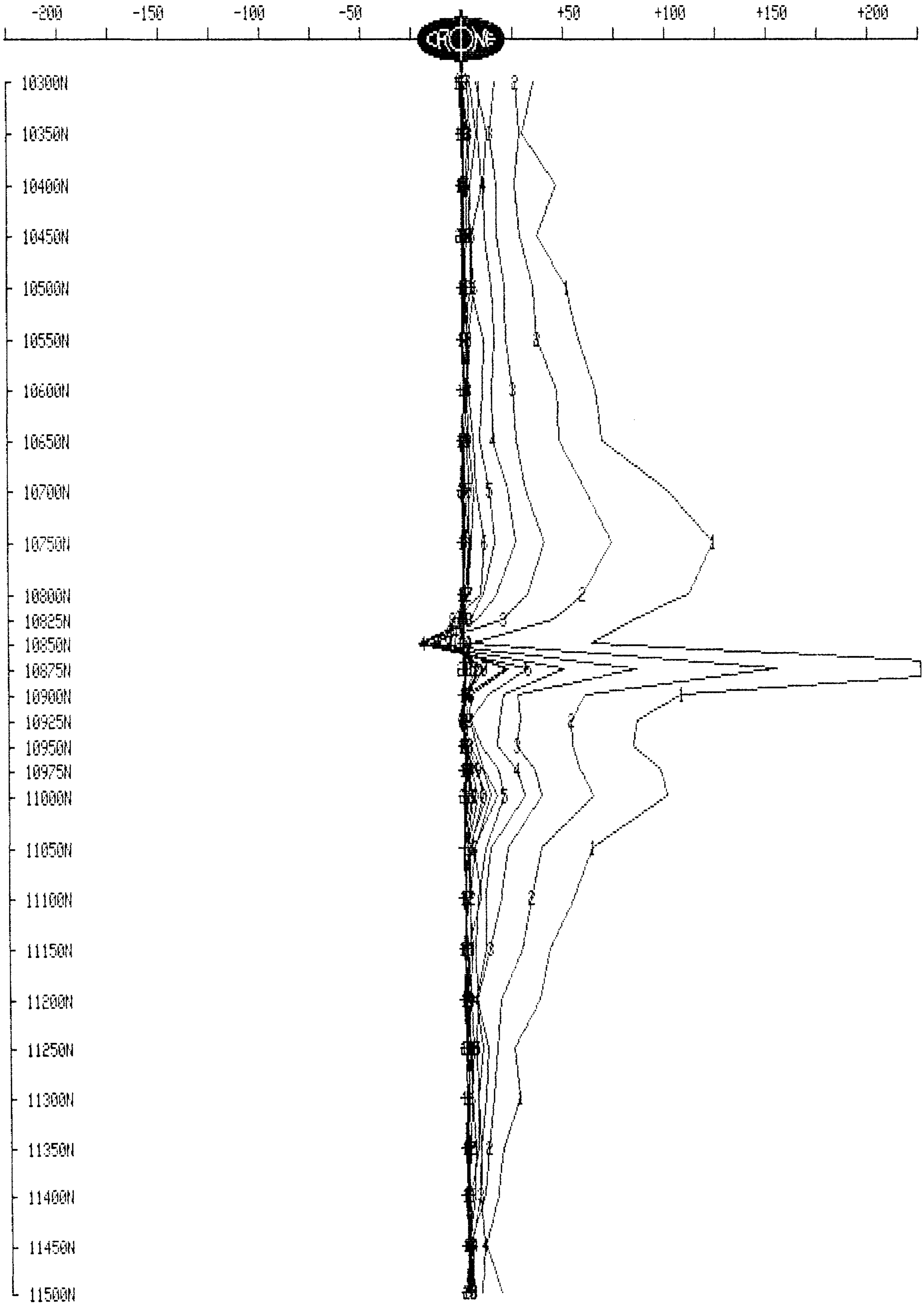
CRONE GEOPHYSICS & EXPLORATION LTD

SURFACE PEM

Client	: **FALCONBRIDGE**	Line	: **8414W**
Grid	: BOOT-BAY	Tx Loop	: 5
Date	: Mar 26, 1992	File name	: L8414W5.PEM

IN-LINE HORIZONTAL COMPONENT dBx/dt nanoTesla/sec - 20 channels

Scale: 1:5000 Unit Scale: 1cm = 25 nT/s



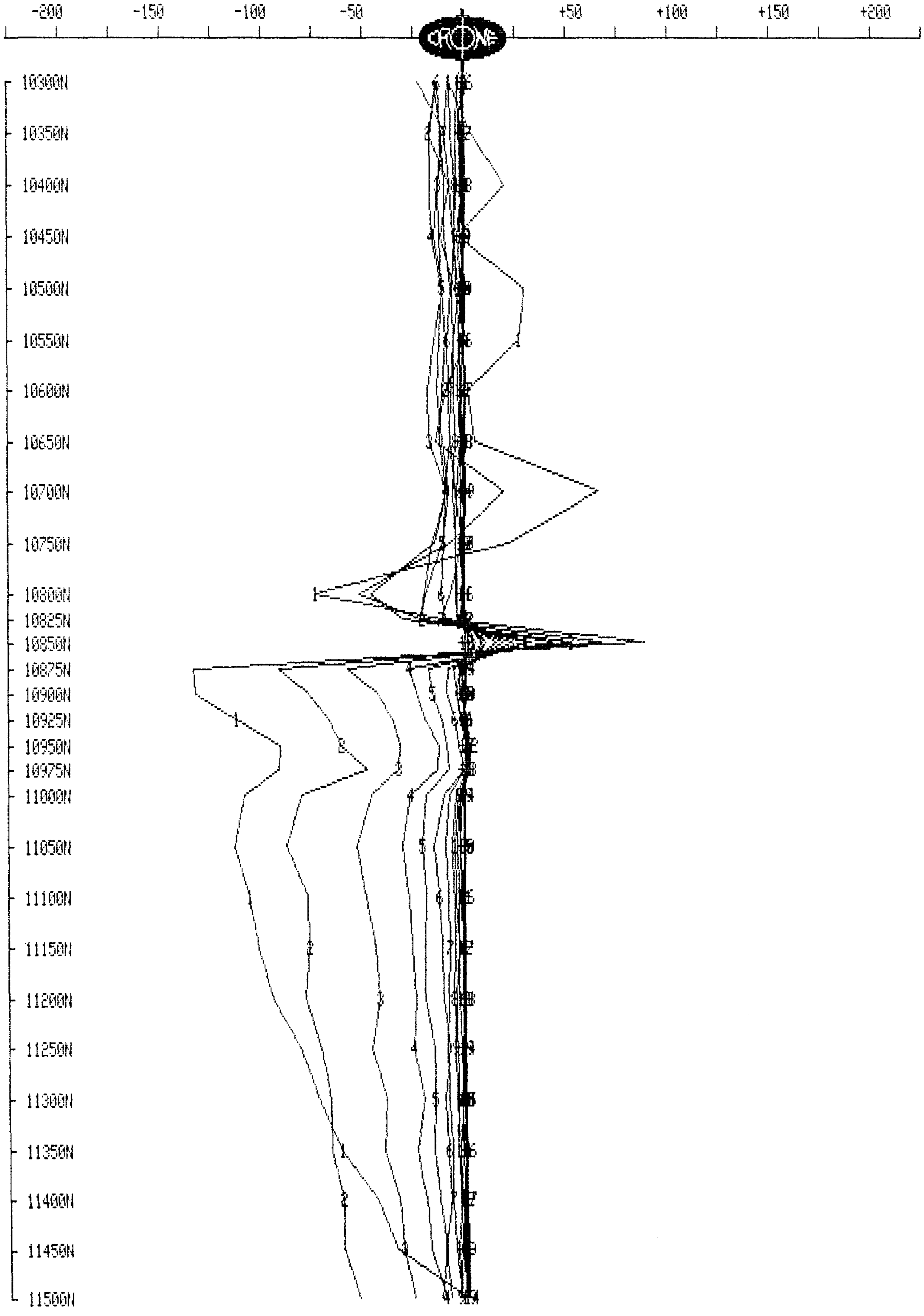
CRONE GEOPHYSICS & EXPLORATION LTD

SURFACE PEM

Client	: FALCONBRIDGE	Line	: **8414W**
Grid	: BOOT-BAY	Tx Loop	: 5
Date	: Mar 26, 1992	File name	: L8414W5.PEM

VERTICAL COMPONENT dBz/dt nanoTesla/sec - 20 channels

Scale: 1:5000 Unit Scale: 1cm = 25 nT/s



CRONE GEOPHYSICS & EXPLORATION LTD

SURFACE PEM

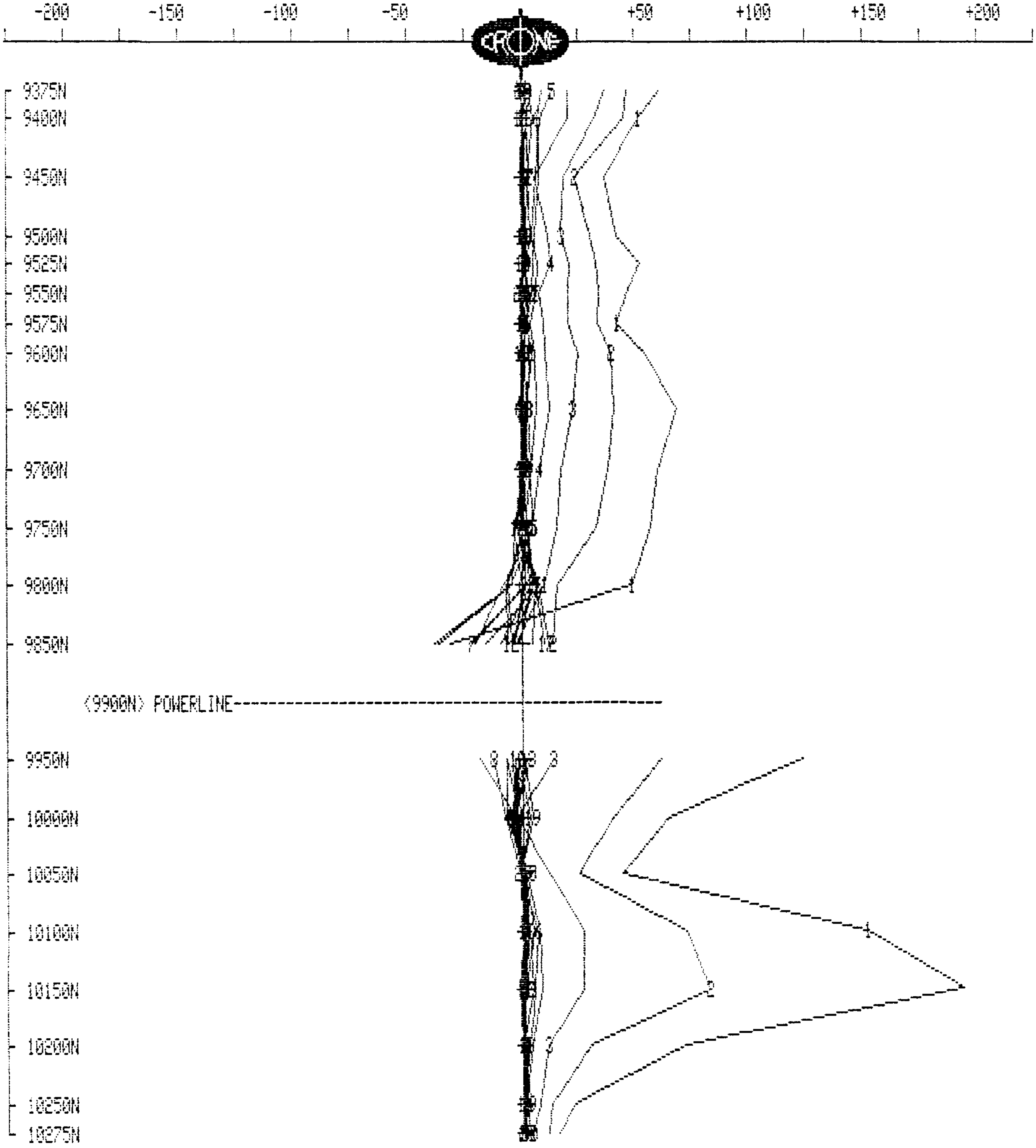
Client : FALCONBRIDGE
Grid : BOOT-BAY
Date : Mar 26, 1992

Line : 8414W
Tx Loop : 6
File name : L8414W6.PEM

IN-LINE HORIZONTAL COMPONENT dBx/dt nanoTesla/sec - 20 channels

Scale: 1:5000

Unit Scale: 1cm = 25 nT/s

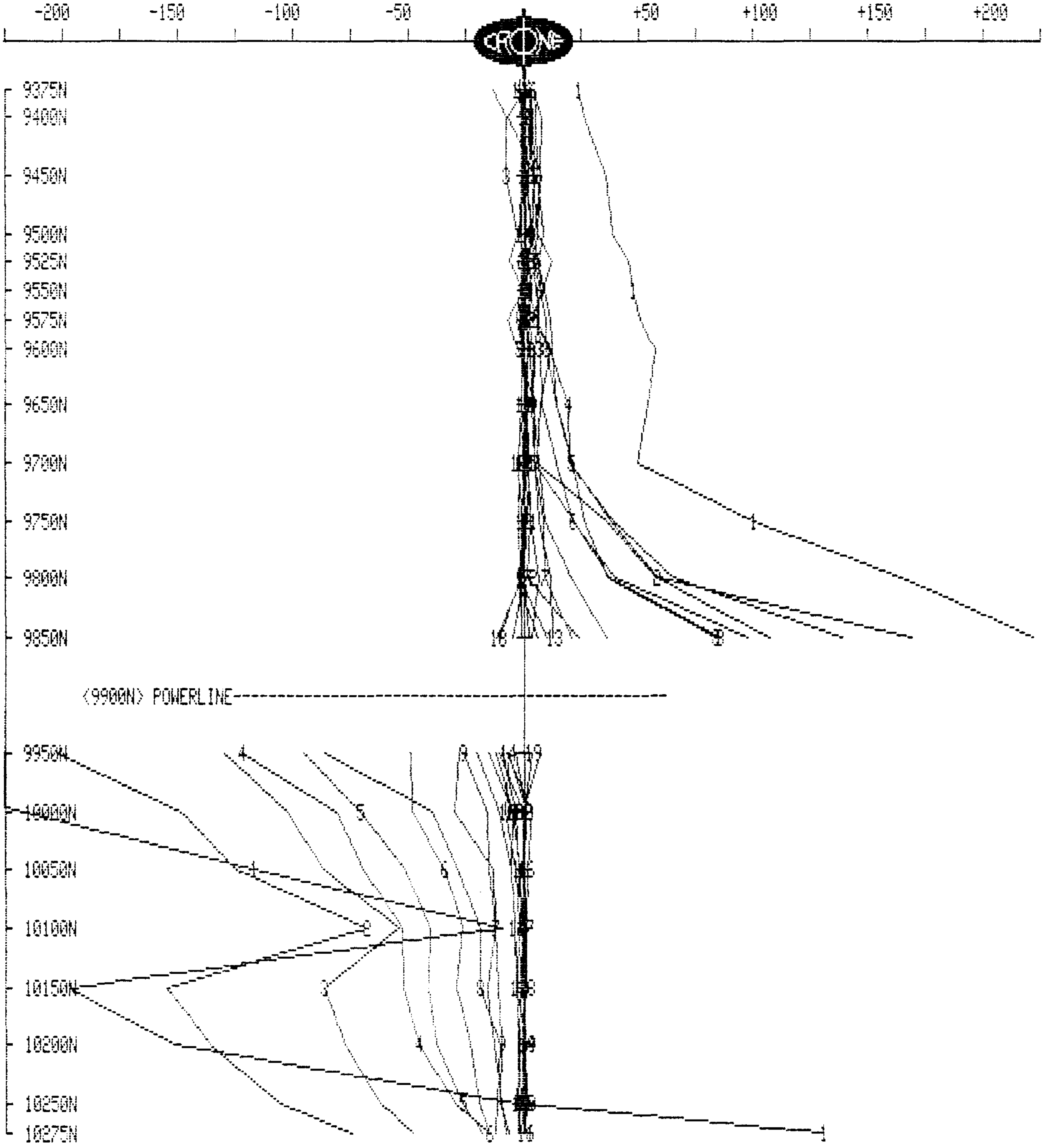


CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

Client	: FALCONBRIDGE	Line	: 8414W
Grid	: BOOT-BAY	Tx Loop	: 6
Date	: Mar 26, 1992	File name	: L8414W6.PEM

VERTICAL COMPONENT dBz/dt nanoTesla/sec - 20 channels

Scale: 1:5000 Unit Scale: 1cm = 25 nT/s

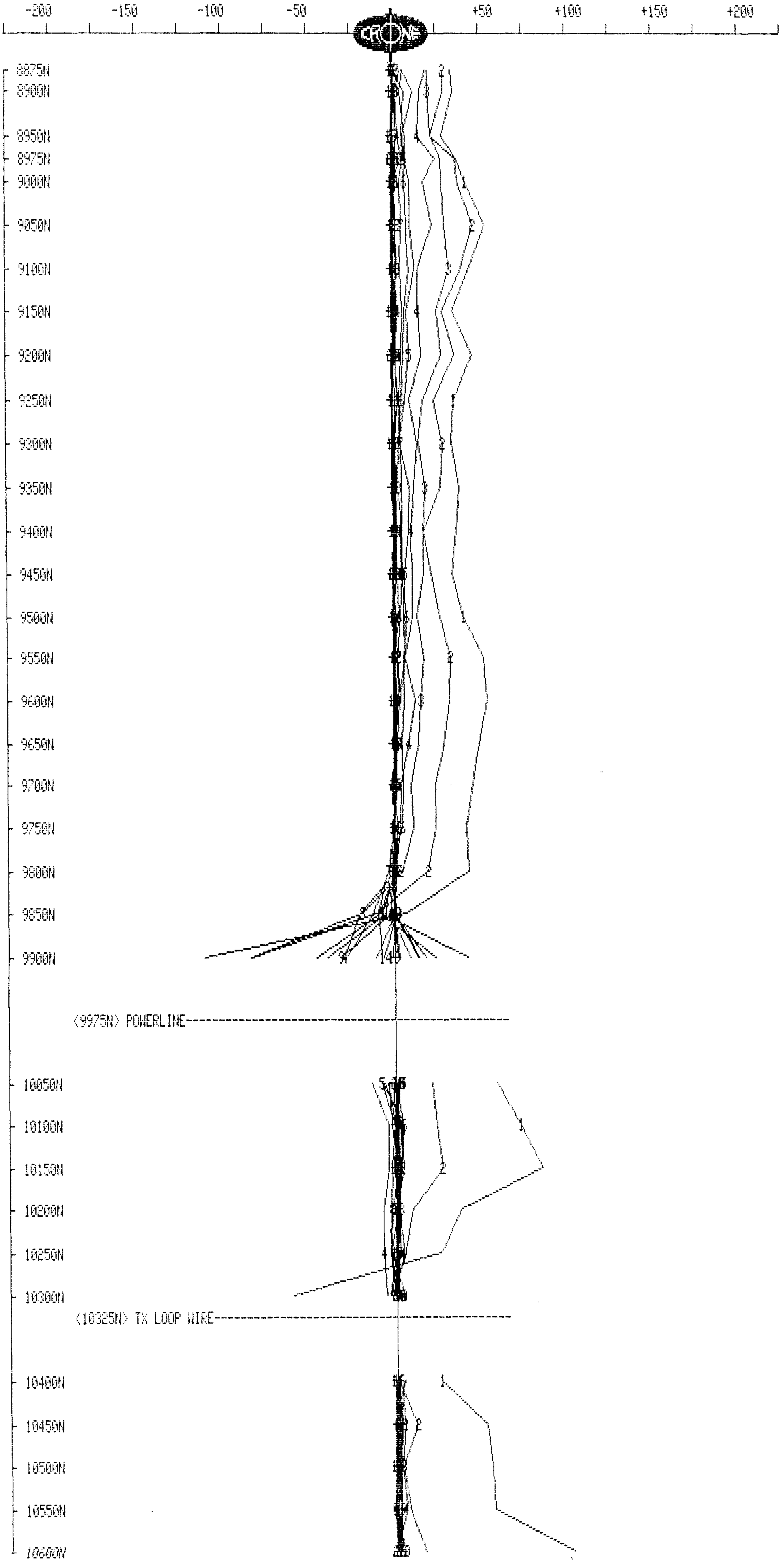


CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

Client : FALCONBRIDGE
Grid : BOOT-BAY
Date : Mar 26, 1992

Line : 8292W
Tx Loop : 6
File name : L8292W6.PEM

IN-LINE HORIZONTAL COMPONENT dBx/dt nanoTesla/sec - 20 channels
Scale: 1:5000 Unit Scale: 1cm = 25 nT/s

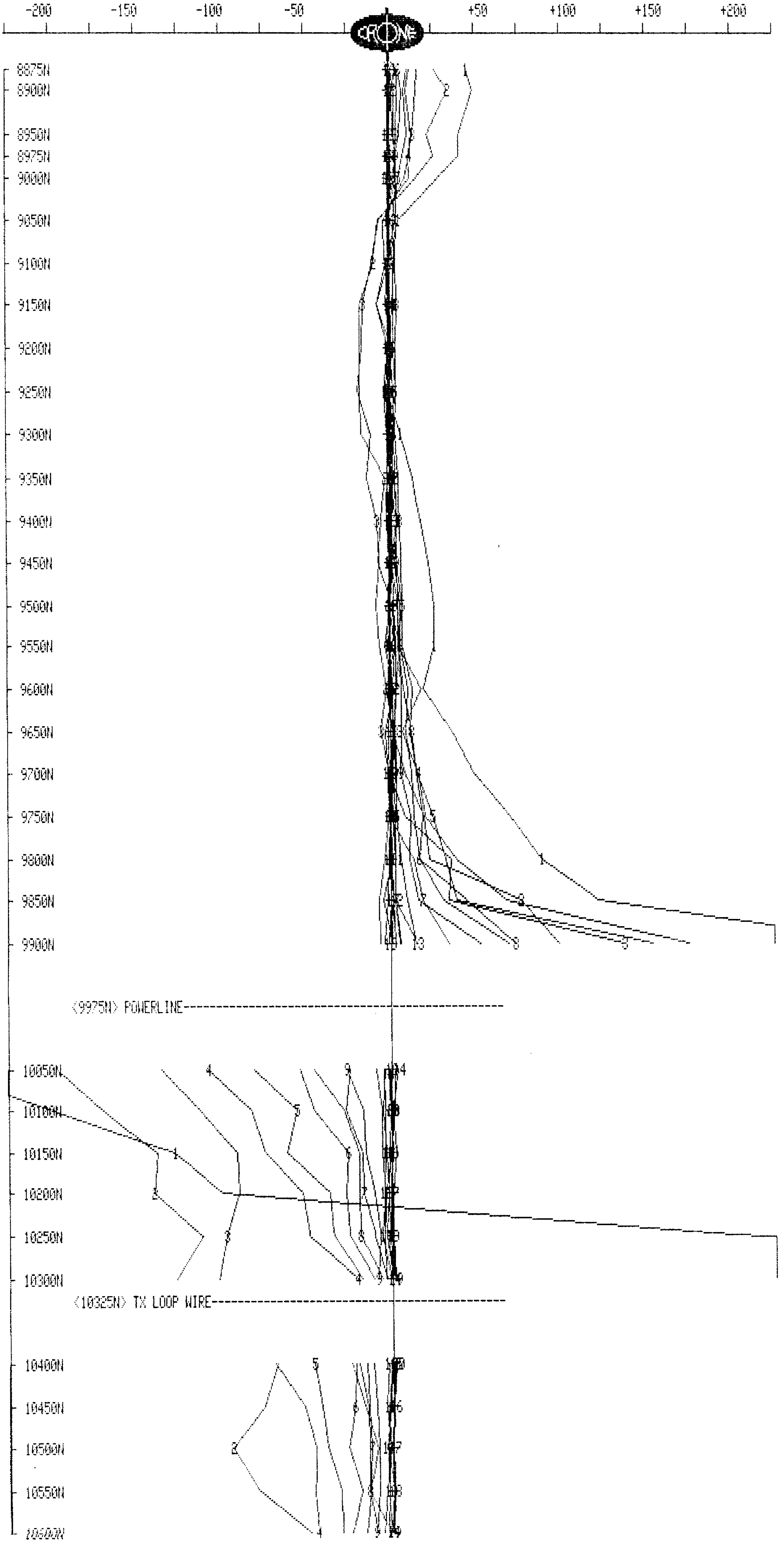


CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

Client	:	FALCONBRIDGE	Line	:	8292W
Grid	:	BOOT-BAY	Tx Loop	:	6
Date	:	Mar 26, 1992	File name	:	L8292W6.PEM

VERTICAL COMPONENT dBz/dt nanoTesla/sec - 20 channels

Scale: 1:5000 Unit Scale: 1cm = 25 nT/s



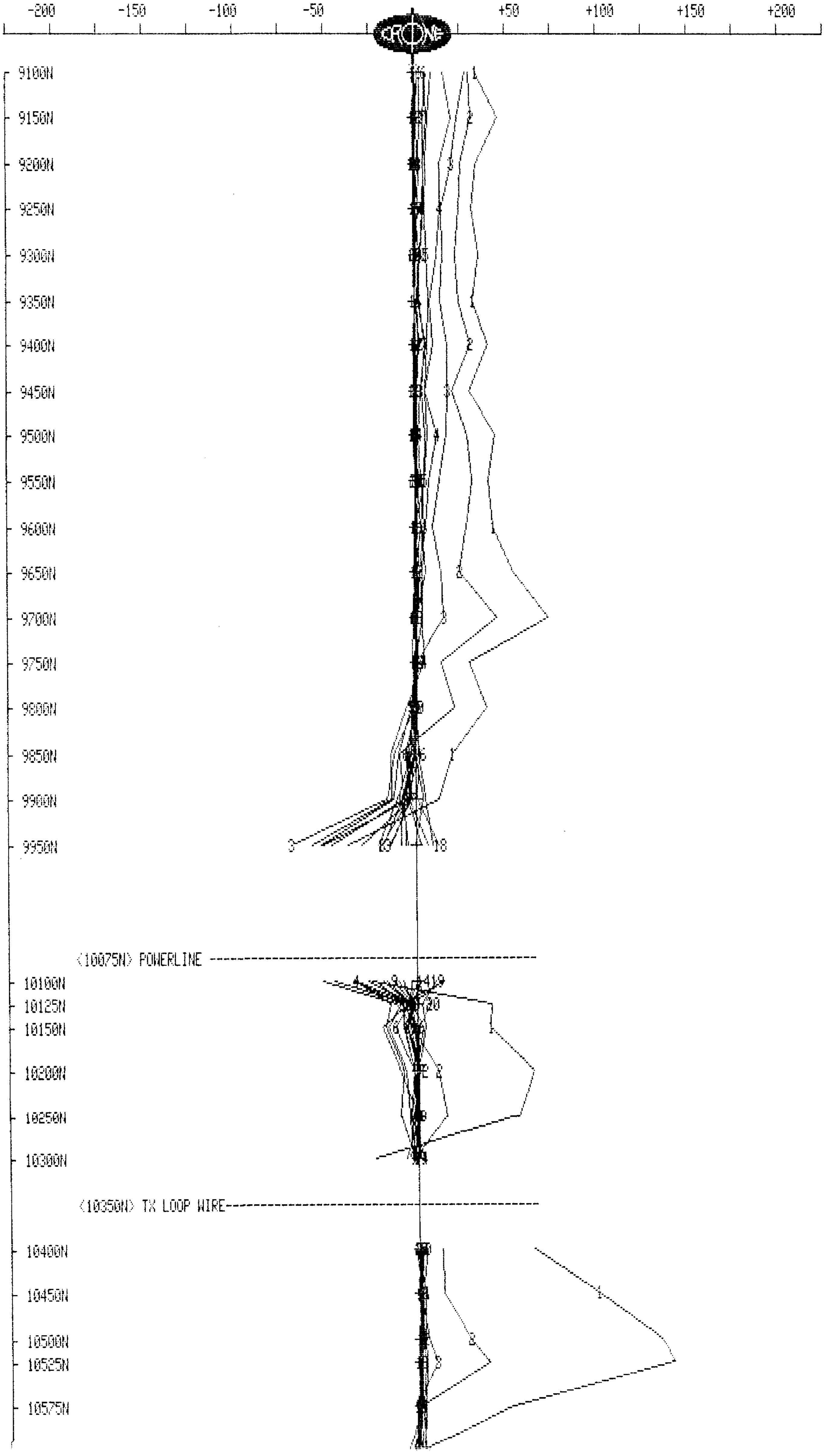
Client : FALCONBRIDGE
Grid : BOOT-BAY
Date : Mar 26, 1992

Line : 8170W
Tx Loop : 6
File name : L8170W6.PEM

IN-LINE HORIZONTAL COMPONENT dBx/dt nanoTesla/sec - 20 channels

Scale: 1:5000

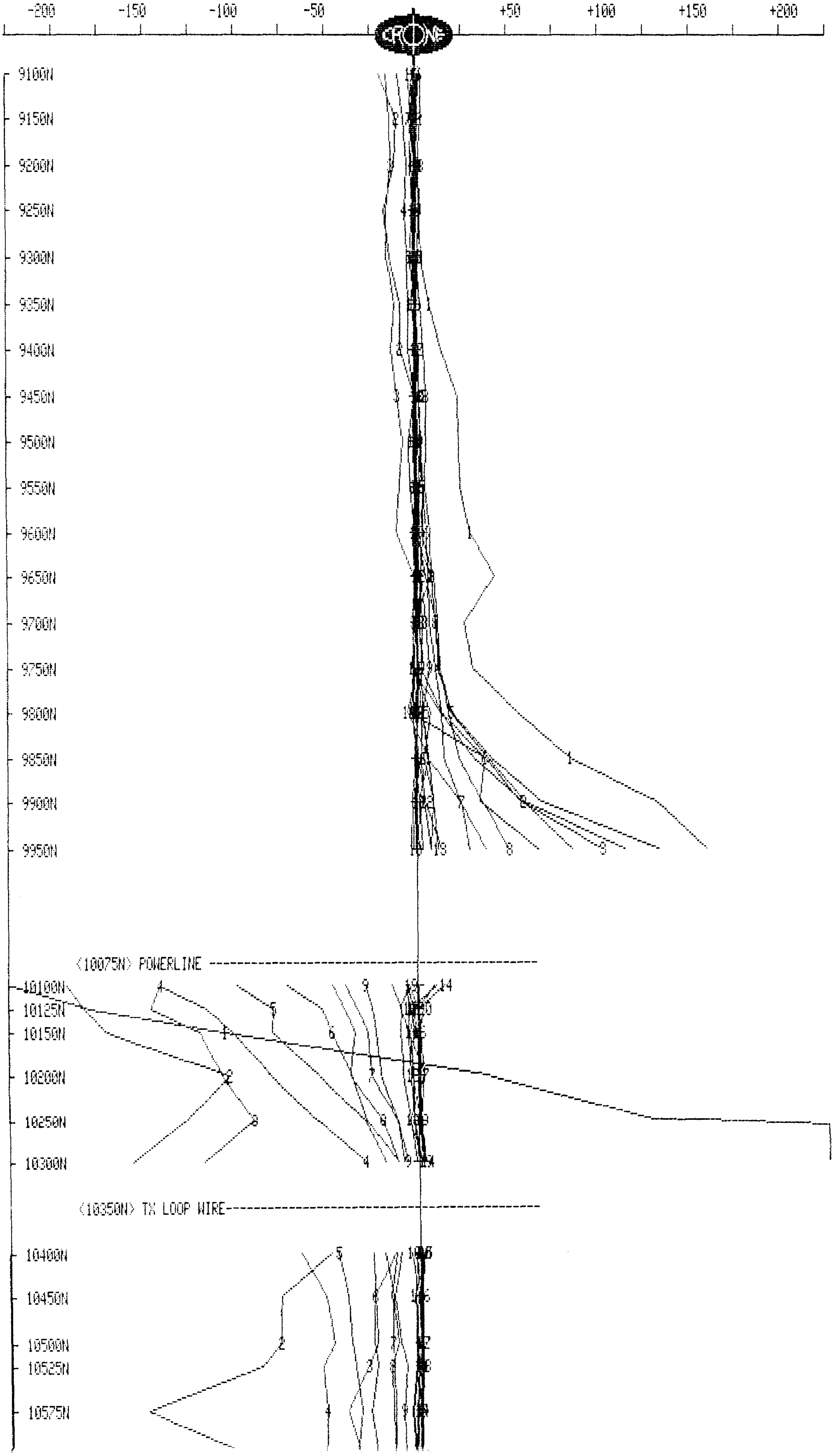
Unit Scale: 1cm = 25 nT/s



Client : FALCONBRIDGE
Grid : BOOT-BAY
Date : Mar 26, 1992

Line : 8170W
Tx Loop : 6
File name : L8170W6.PEM

VERTICAL COMPONENT dBz/dt nanoTesla/sec - 20 channels
Scale: 1:5000 Unit Scale: 1cm = 25 nT/s



CRONE GEOPHYSICS & EXPLORATION LTD

SURFACE PEM

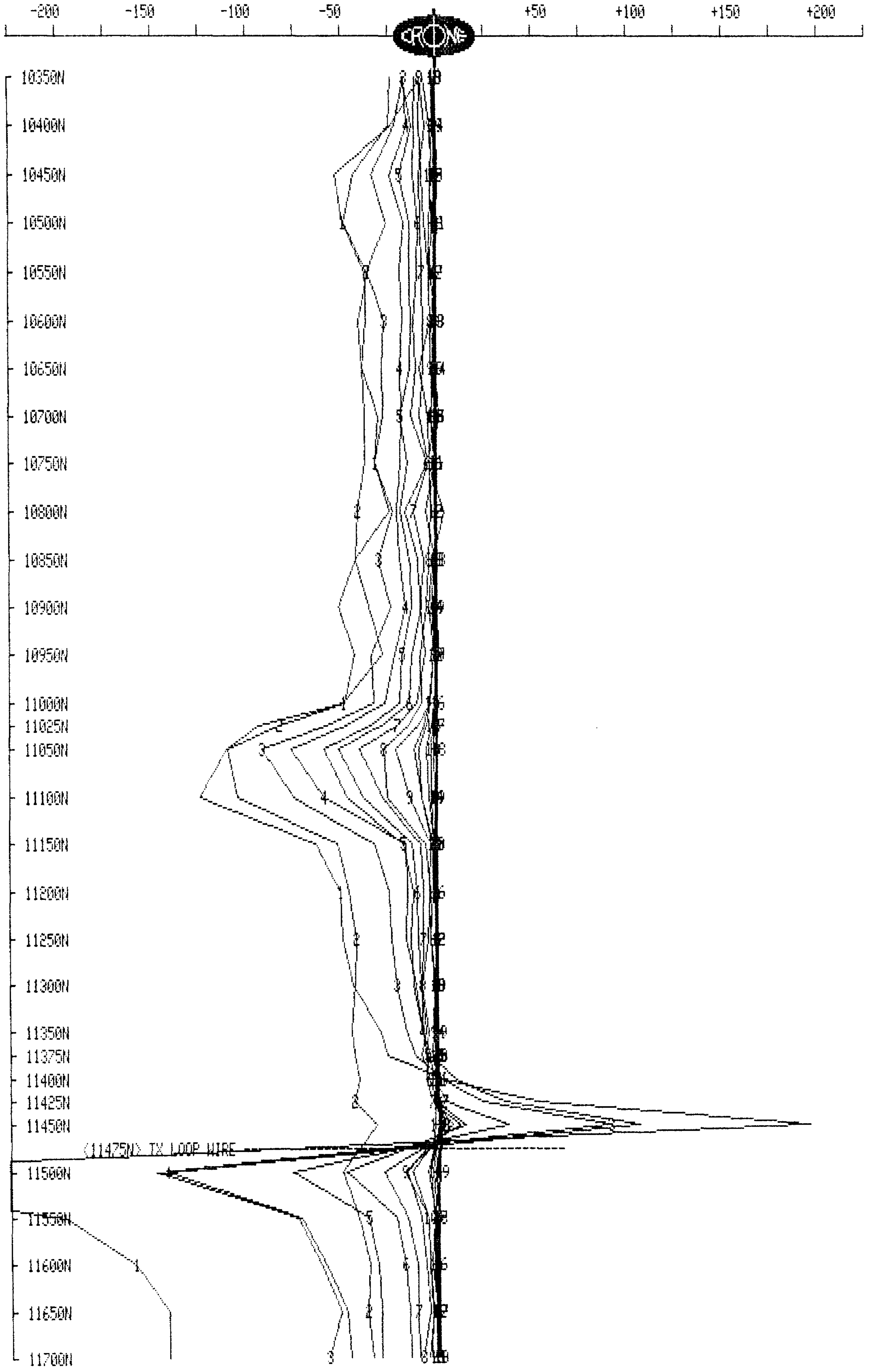
Client : FALCONBRIDGE
Grid : BOOT-BAY
Date : Mar 25, 1992

Line : 8048W
Tx Loop : 5
File name : L8048W5.PEM

VERTICAL COMPONENT dBz/dt nanoTesla/sec - 20 channels

Scale: 1:5000

Unit Scale: 1cm = 25 nT/s

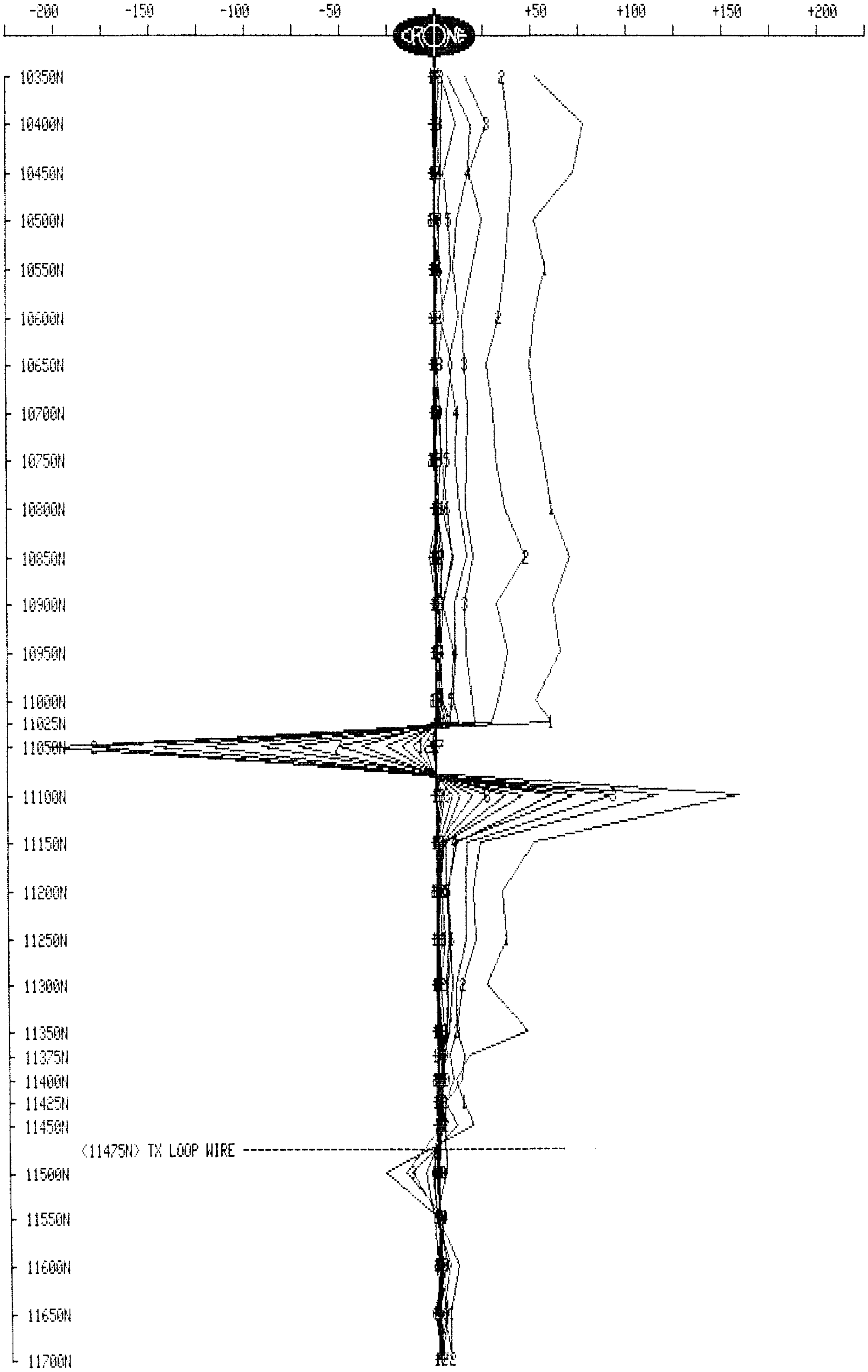


CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

Client : FALCONBRIDGE
Grid : BOOT-BAY
Date : Mar 25, 1992

Line : 8048W
Tx Loop : 5
File name : L8048W5.PEM

IN-LINE HORIZONTAL COMPONENT dBx/dt nanoTesla/sec - 20 channels
Scale: 1:5000
Unit Scale: 1cm = 25 nT/s



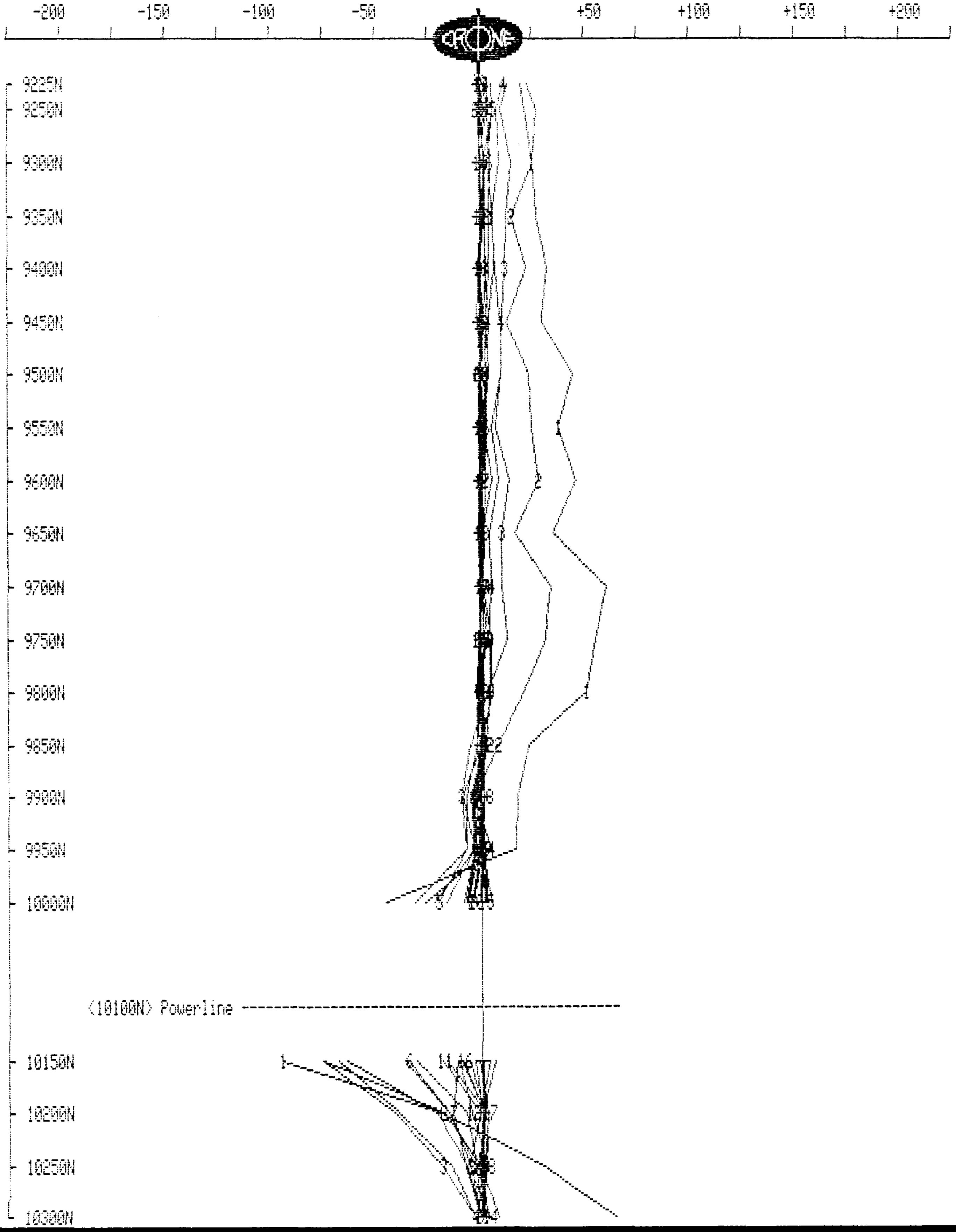
CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

Client : FALCONBRIDGE
Grid : BOOT-BAY
Date : Mar 27, 1992

Line : 8048W
Tx Loop : 6
File name : L8048W6.PEM

IN-LINE HORIZONTAL COMPONENT dBx/dt nanoTesla/sec - 20 channels

Scale: 1:5000 Unit Scale: 1cm = 25 nT/s



CRONE GEOPHYSICS & EXPLORATION LTD

SURFACE PEM

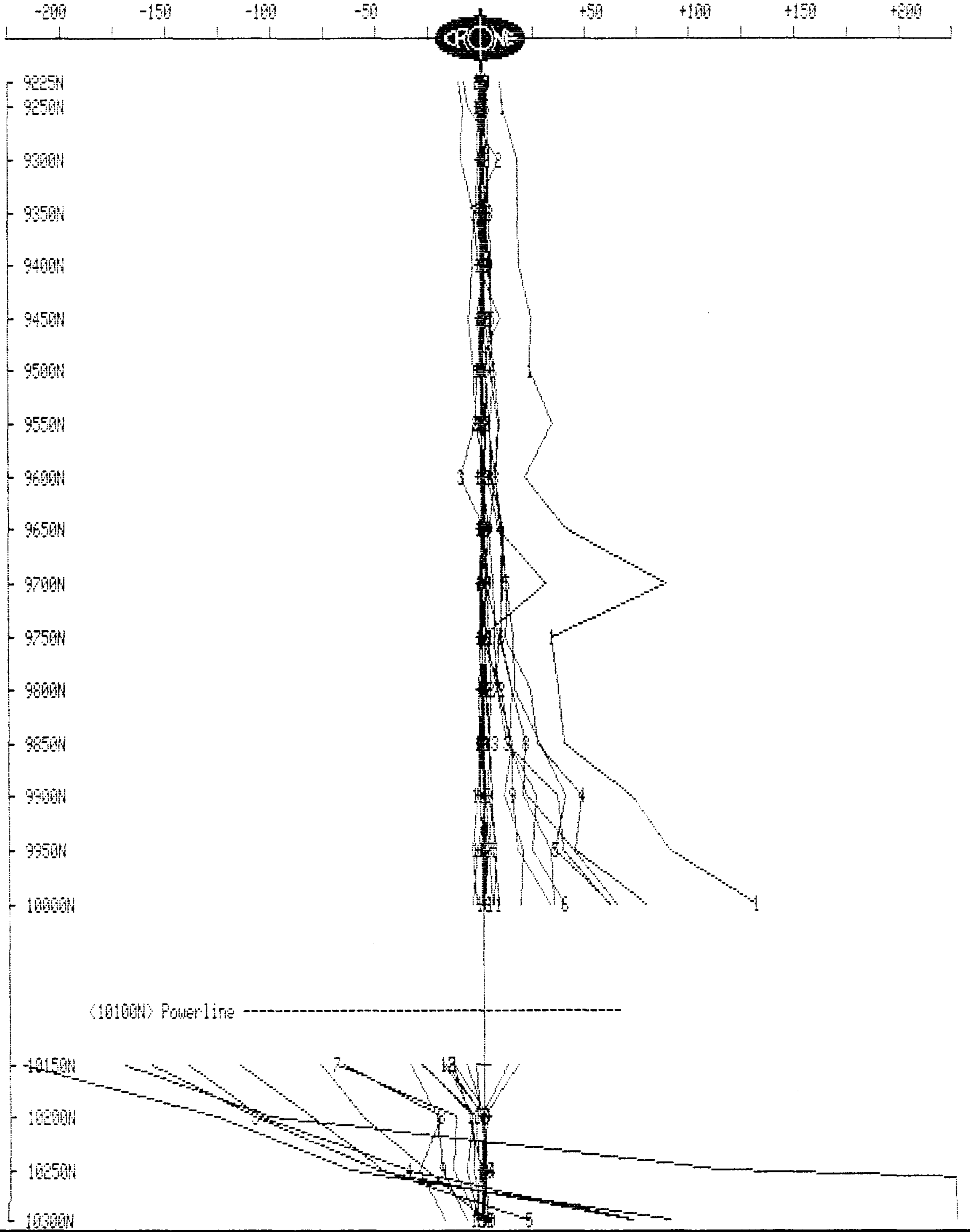
Client : FALCONBRIDGE
Grid : BOOT-BAY
Date : Mar 27, 1992

Line : 8048W
Tx Loop : 6
File name : L8048W6.PEM

VERTICAL COMPONENT dBz/dt nanoTesla/sec - 20 channels

Scale: 1:5000

Unit Scale: 1cm = 25 nT/s



CRONE GEOPHYSICS & EXPLORATION LTD

SURFACE PEM

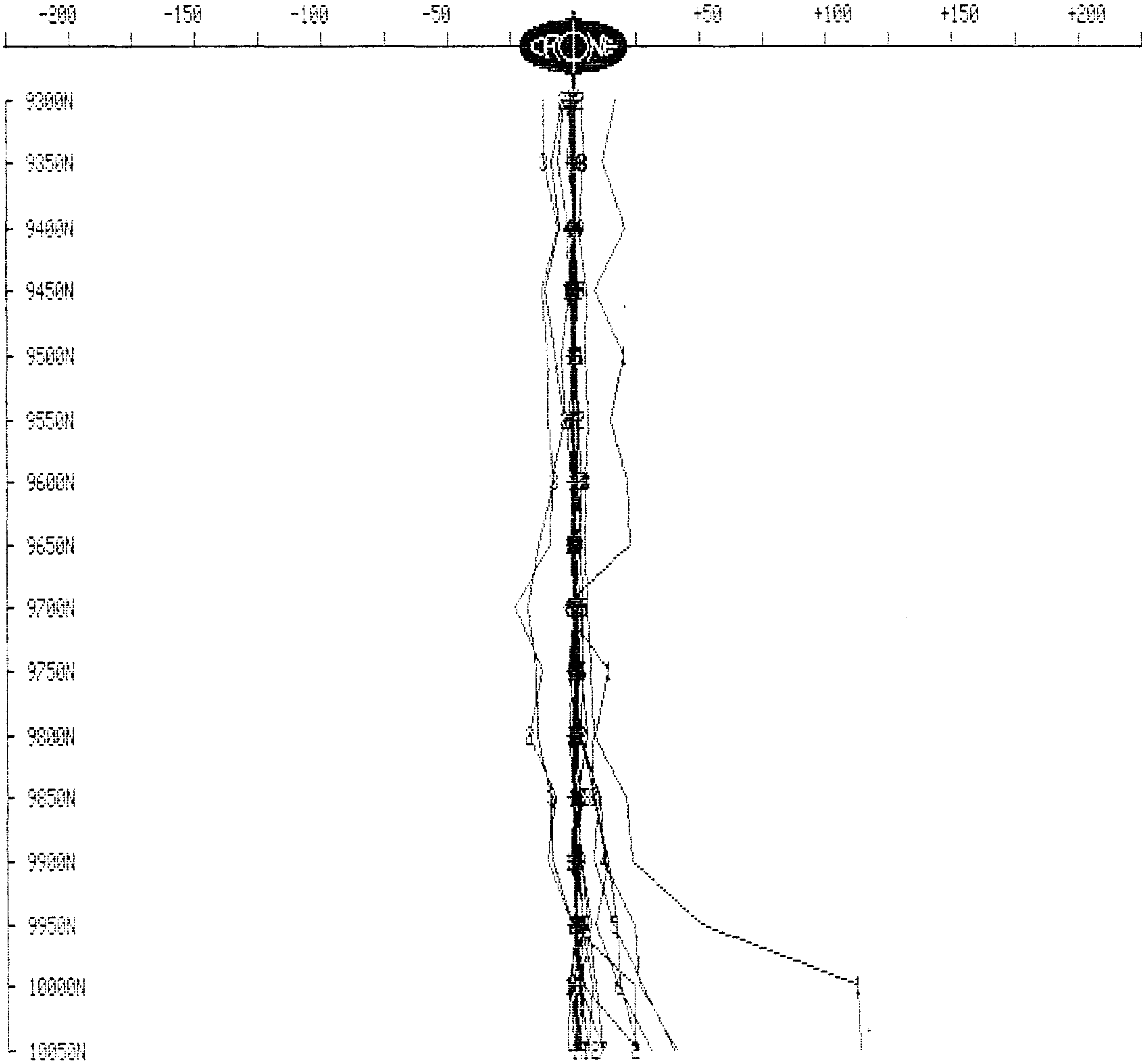
Client : FALCONBRIDGE
Grid : BOOT-BAY
Date : Mar 27, 1992

Line : 7926W
Tx Loop : 6
File name : L7926W6.PEM

VERTICAL COMPONENT dBz/dt nanoTesla/sec - 20 channels

Scale: 1:5000

Unit Scale: 1cm = 25 nT/s

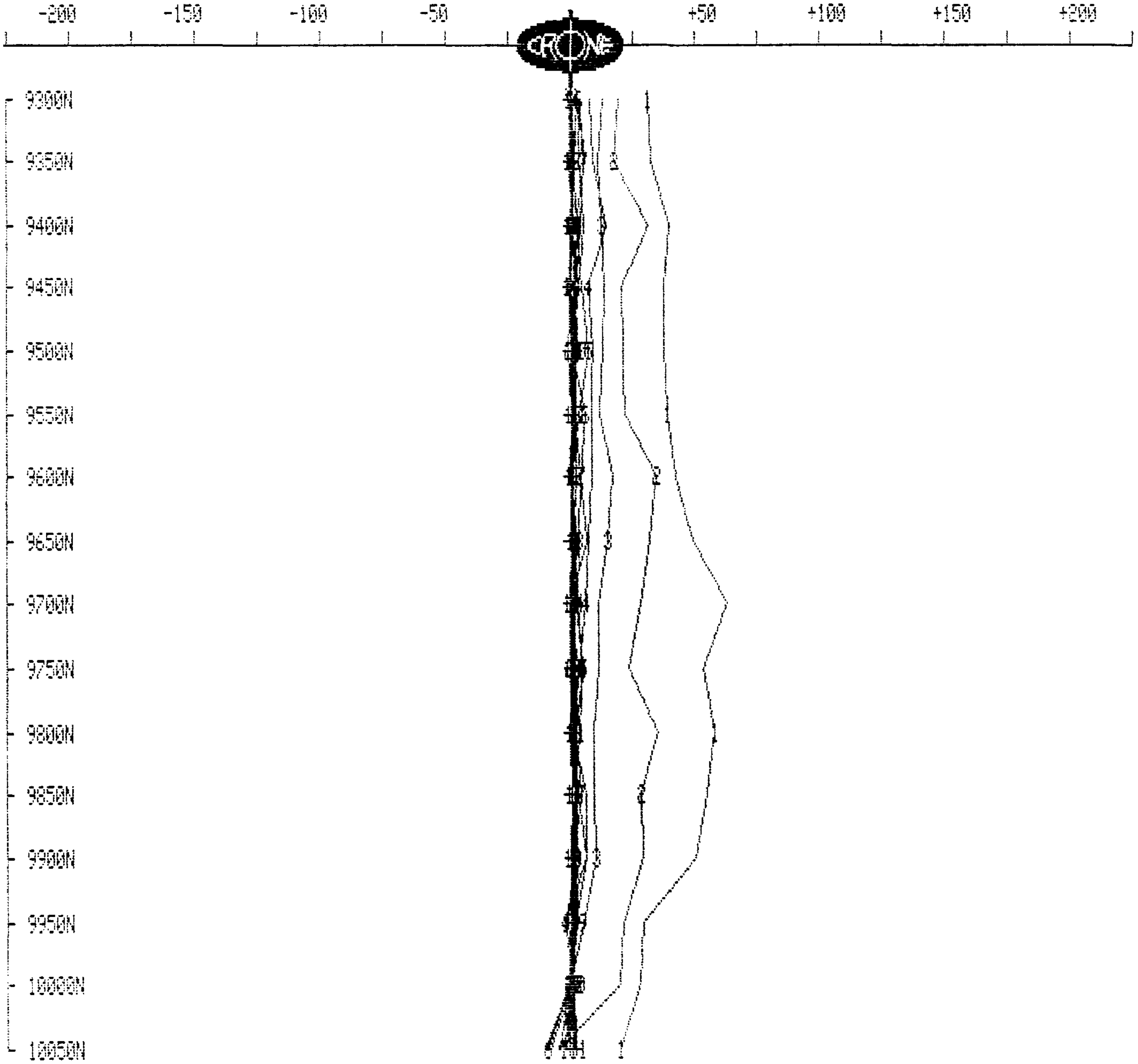


CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

Client : FALCONBRIDGE		Line : 7926W	
Grid : BOOT-BAY		Tx Loop : 6	
Date : Mar 27, 1992		File name : L7926W6.PEM	

IN-LINE HORIZONTAL COMPONENT dBx/dt nanoTesla/sec - 20 channels

Scale: 1:5000 Unit Scale: 1cm = 25 nT/s

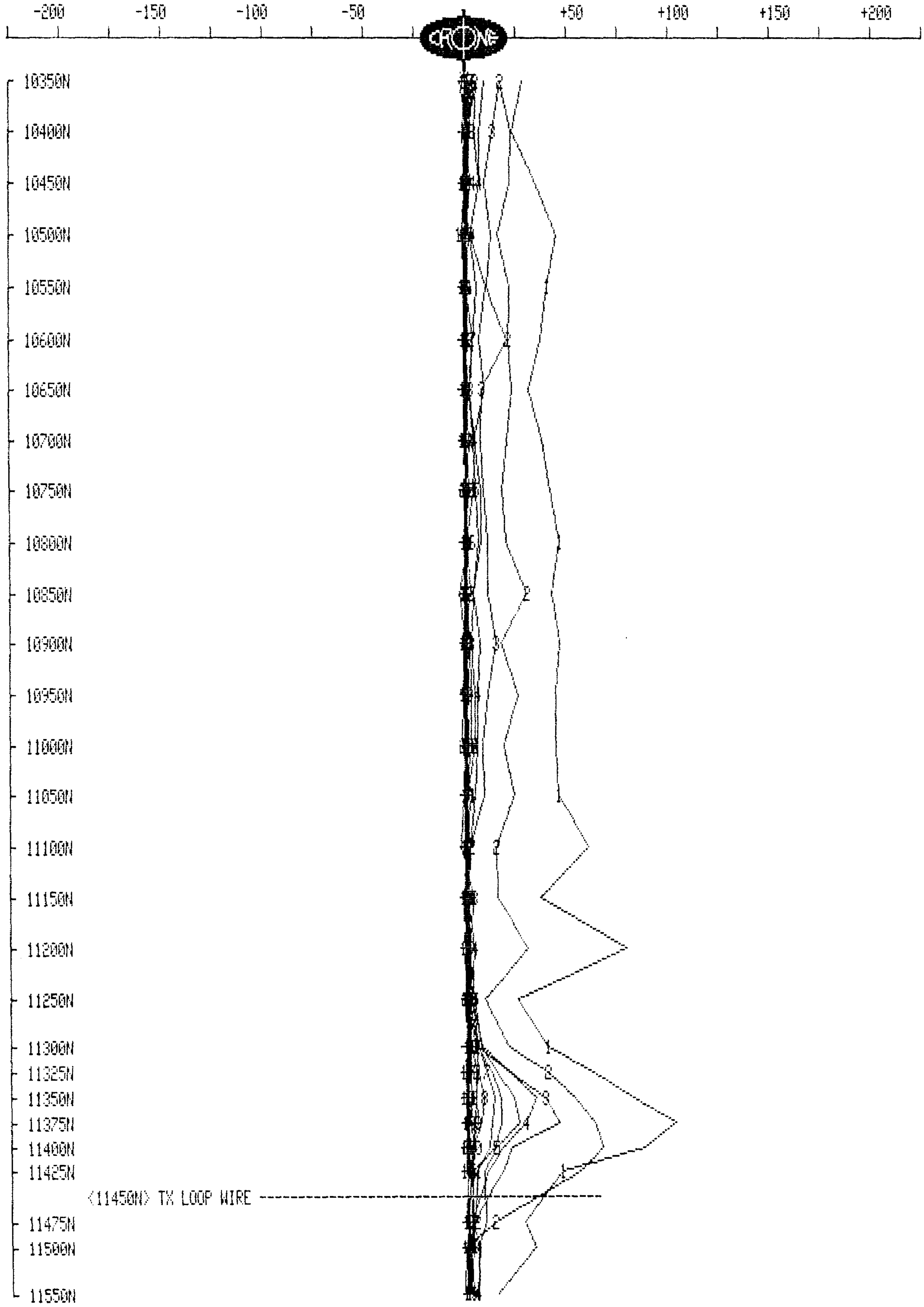


CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

Client	: **FALCONBRIDGE**	Line	: **7804W**
Grid	: BOOT-BAY	Tx Loop	: 5
Date	: Mar 26, 1992	File name	: L7804W5.PEM

IN-LINE HORIZONTAL COMPONENT dBx/dt nanoTesla/sec - 20 channels

Scale: 1:5000 Unit Scale: 1cm = 25 nT/s



CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

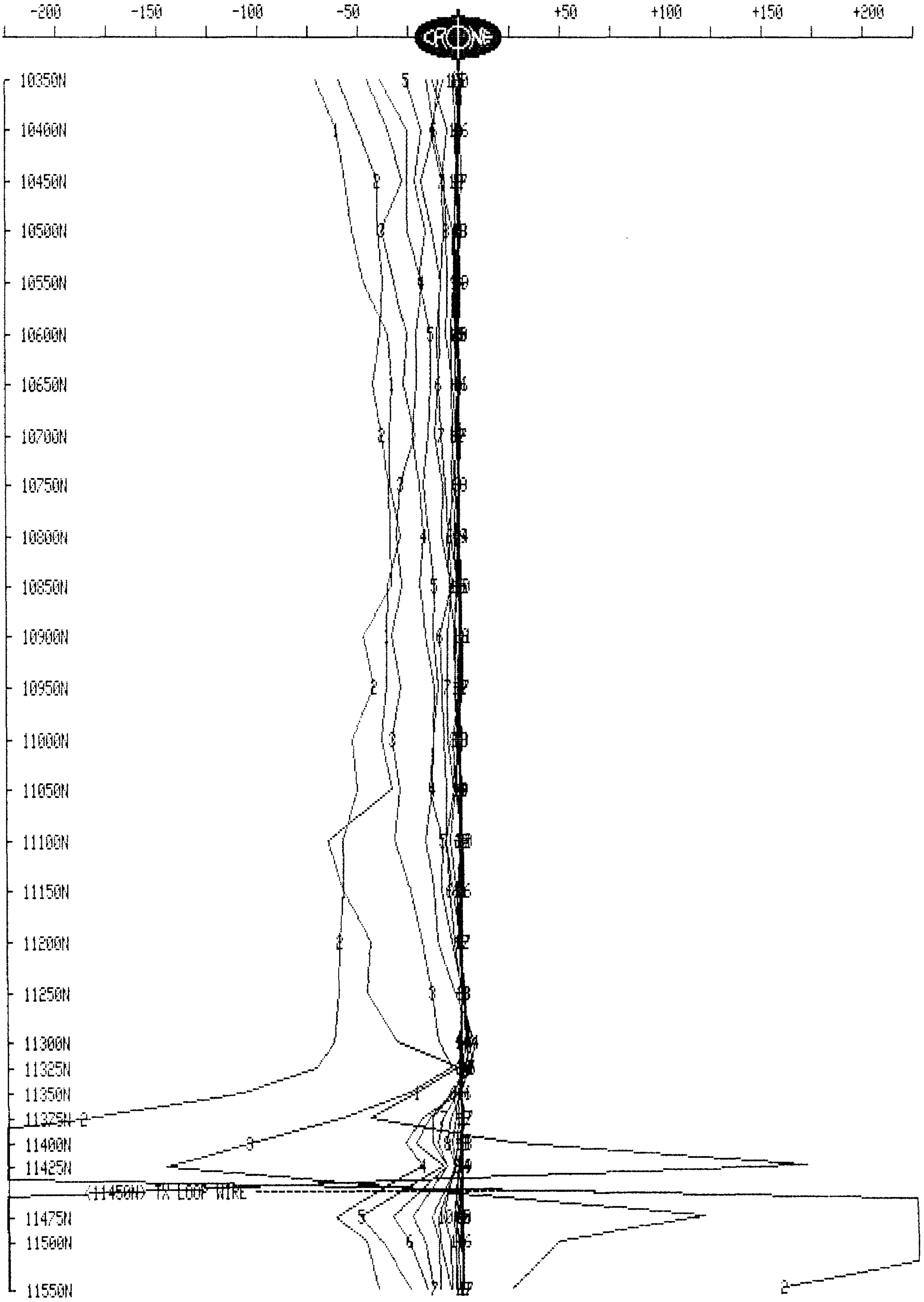
Client : FALCONBRIDGE
Grid : BOOT-BAY
Date : Mar 26, 1992

Line : **7804W**
Tx Loop : 5
File name : L7804W5.PEM

VERTICAL COMPONENT dBz/dt nanoTesla/sec - 20 channels

Scale: 1:5000

Unit Scale: 1cm = 25 nT/s

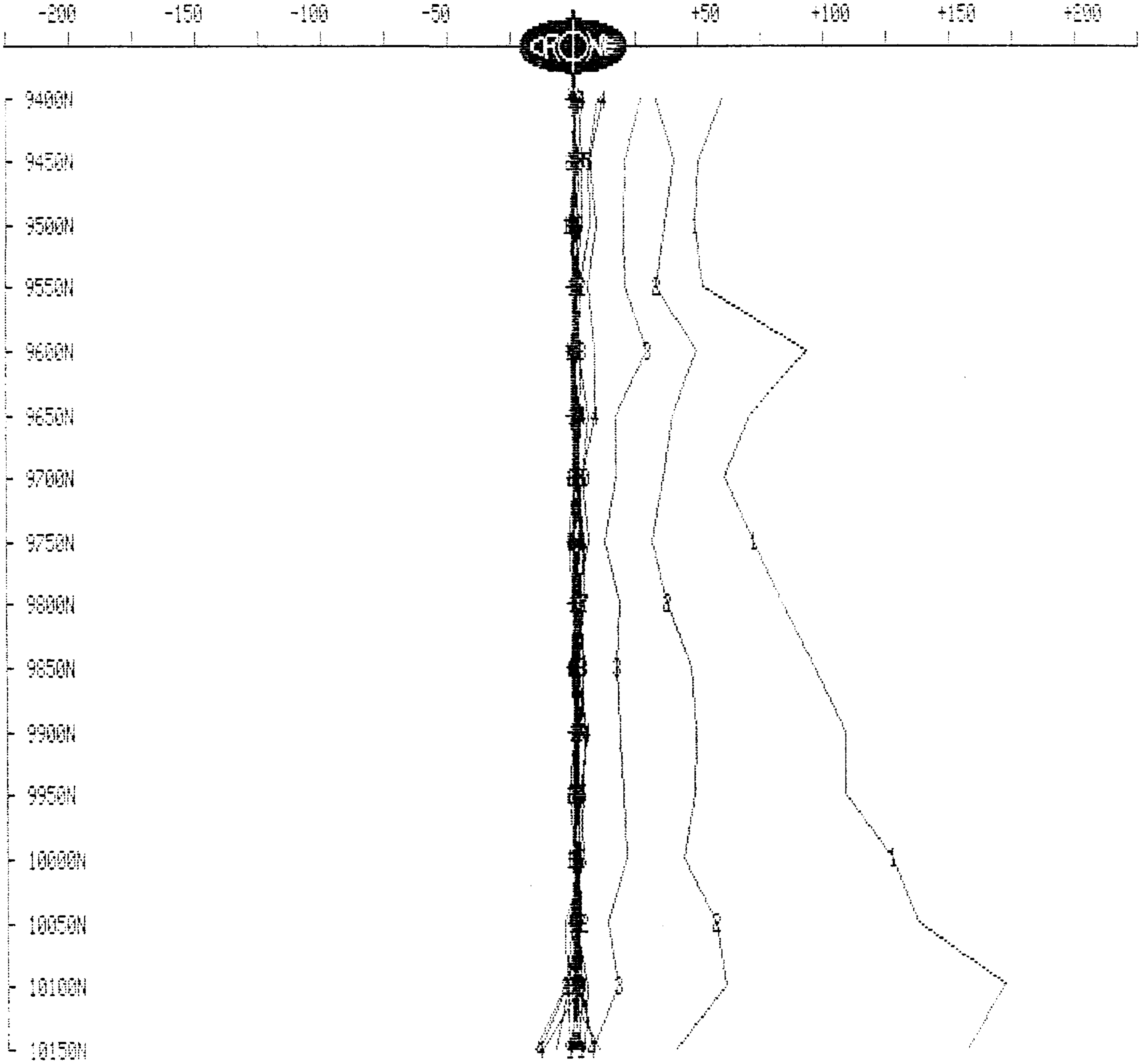


CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

Client : FALCONBRIDGE
Grid : BOOT-BAY
Date : Mar 27, 1992

Line : **7804W**
Tx Loop : 6
File name : L7804W6.PEM

IN-LINE HORIZONTAL COMPONENT dBx/dt nanoTesla/sec - 20 channels
Scale: 1:5000
Unit Scale: 1cm = 25 nT/s



CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

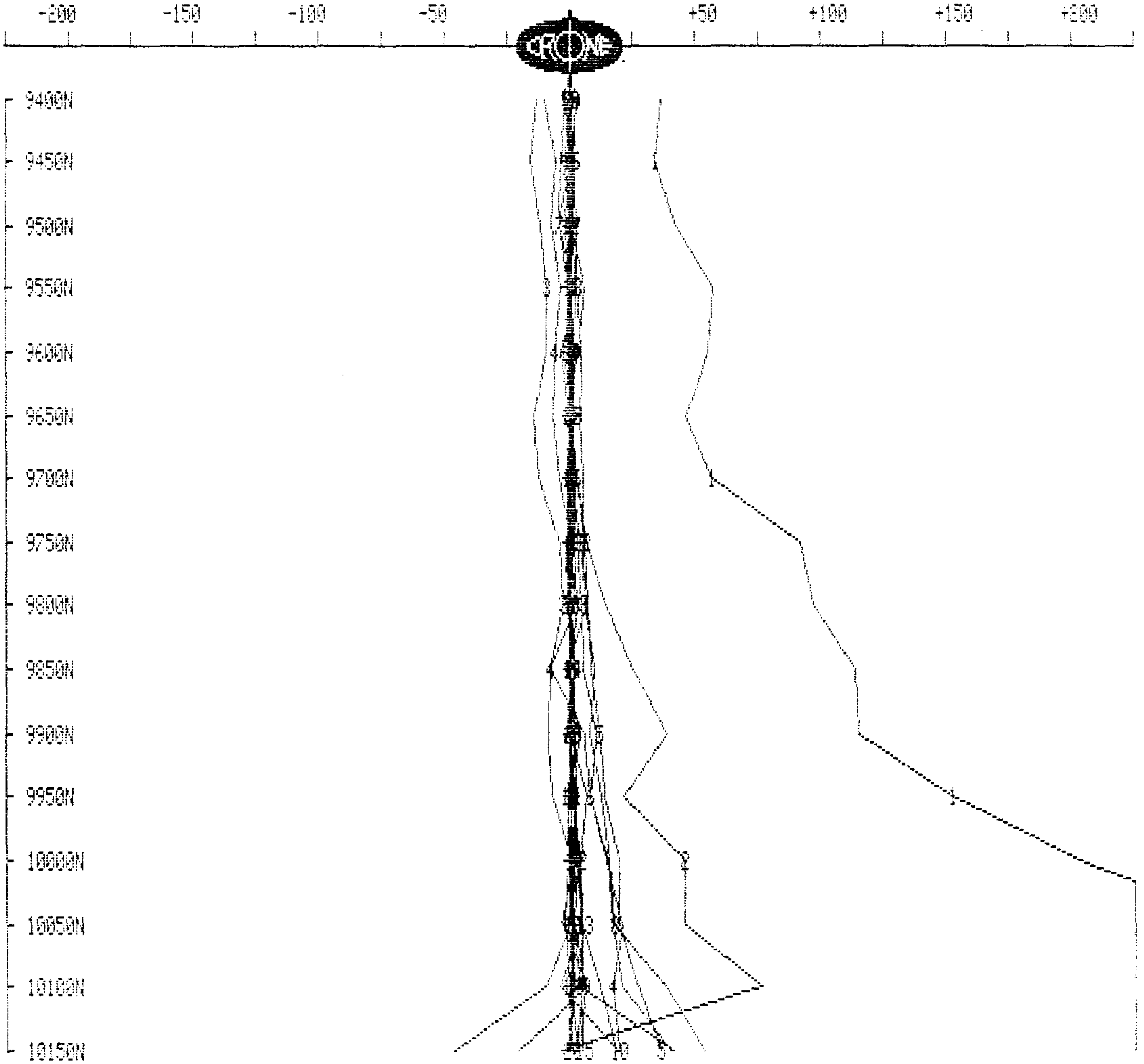
Client : FALCONBRIDGE
Grid : BOOT-BAY
Date : Mar 27, 1992

Line : 7804W
Tx Loop : 6
File name : L7804W6.PEM

VERTICAL COMPONENT dBz/dt nanoTesla/sec - 20 channels

Scale: 1:5000

Unit Scale: 1cm = 25 nT/s

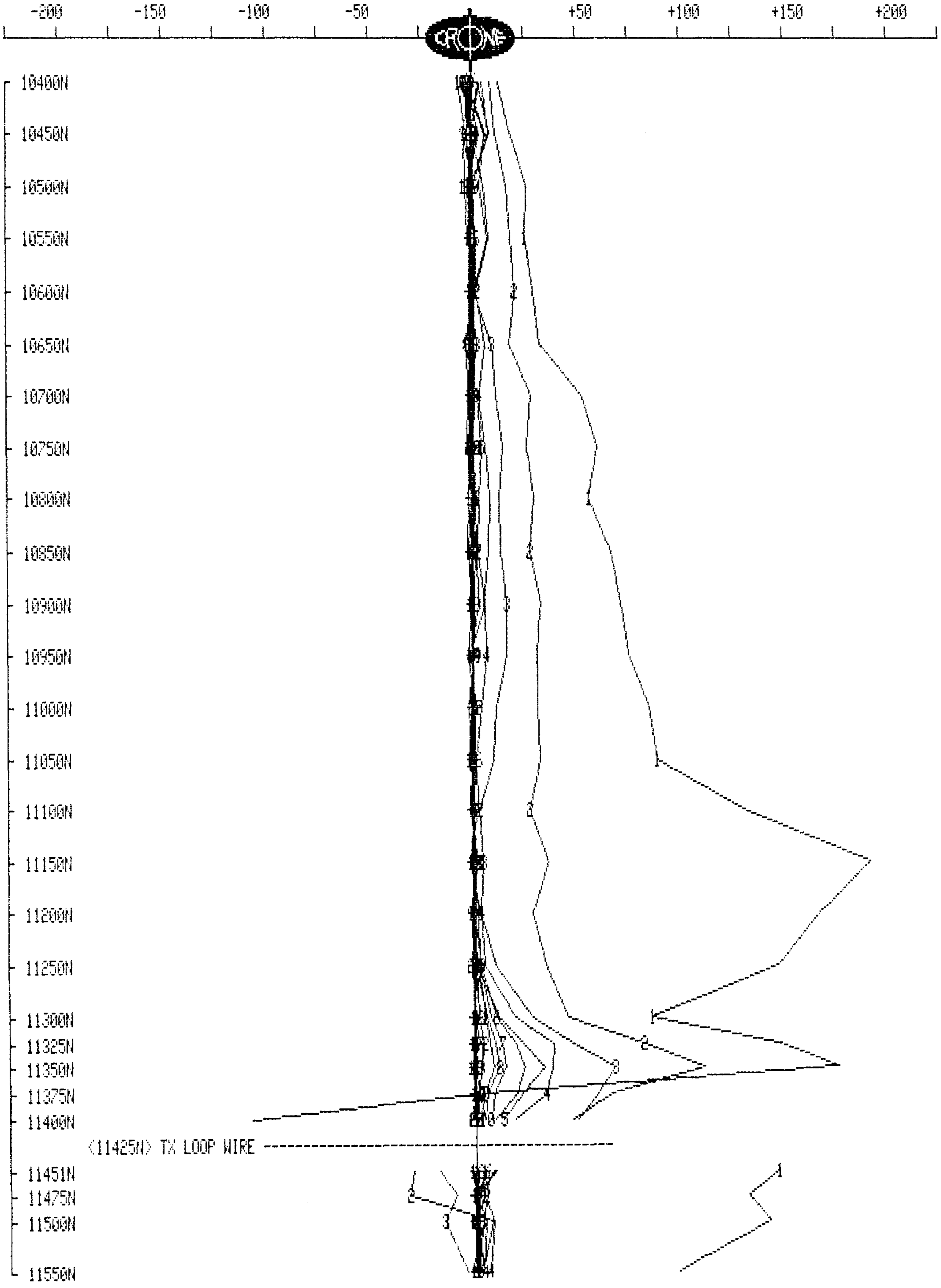


CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

Client : FALCONBRIDGE
Grid : BOOT-BAY
Date : Mar 25, 1992

Line : 7682W
Tx Loop : 5
File name : L7682W5.PEM

IN-LINE HORIZONTAL COMPONENT dBx/dt nanoTesla/sec - 20 channels
Scale: 1:5000 Unit Scale: 1cm = 25 nT/s

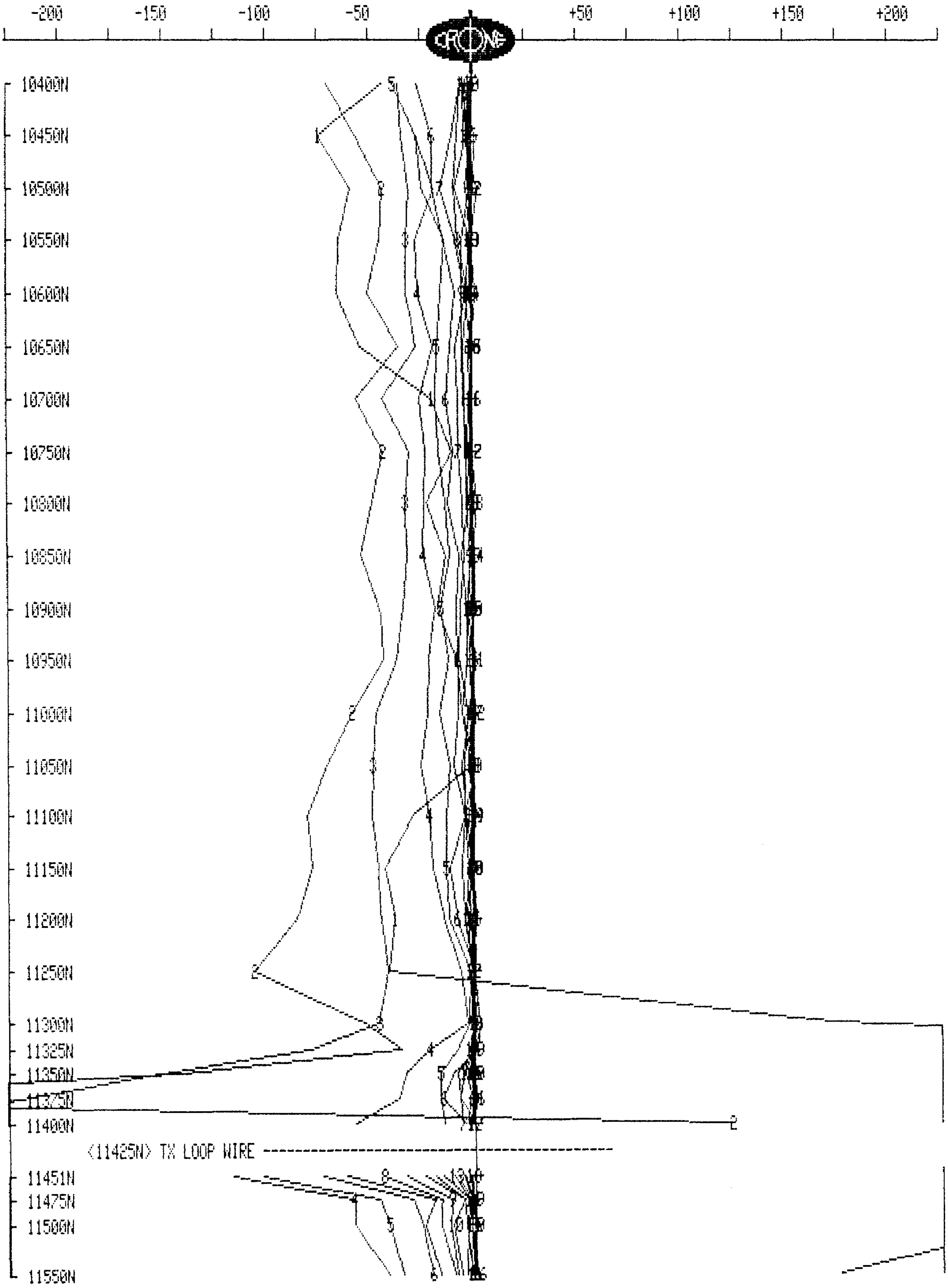


CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

Client	: **FALCONBRIDGE**	Line	: **7682W**
Grid	: **BOOT-BAY**	Tx Loop	: 5
Date	: Mar 25, 1992	File name	: L7682W5.PEM

VERTICAL COMPONENT dBz/dt nanoTesla/sec - 20 channels

Scale: 1:5000 Unit Scale: 1cm = 25 nT/s

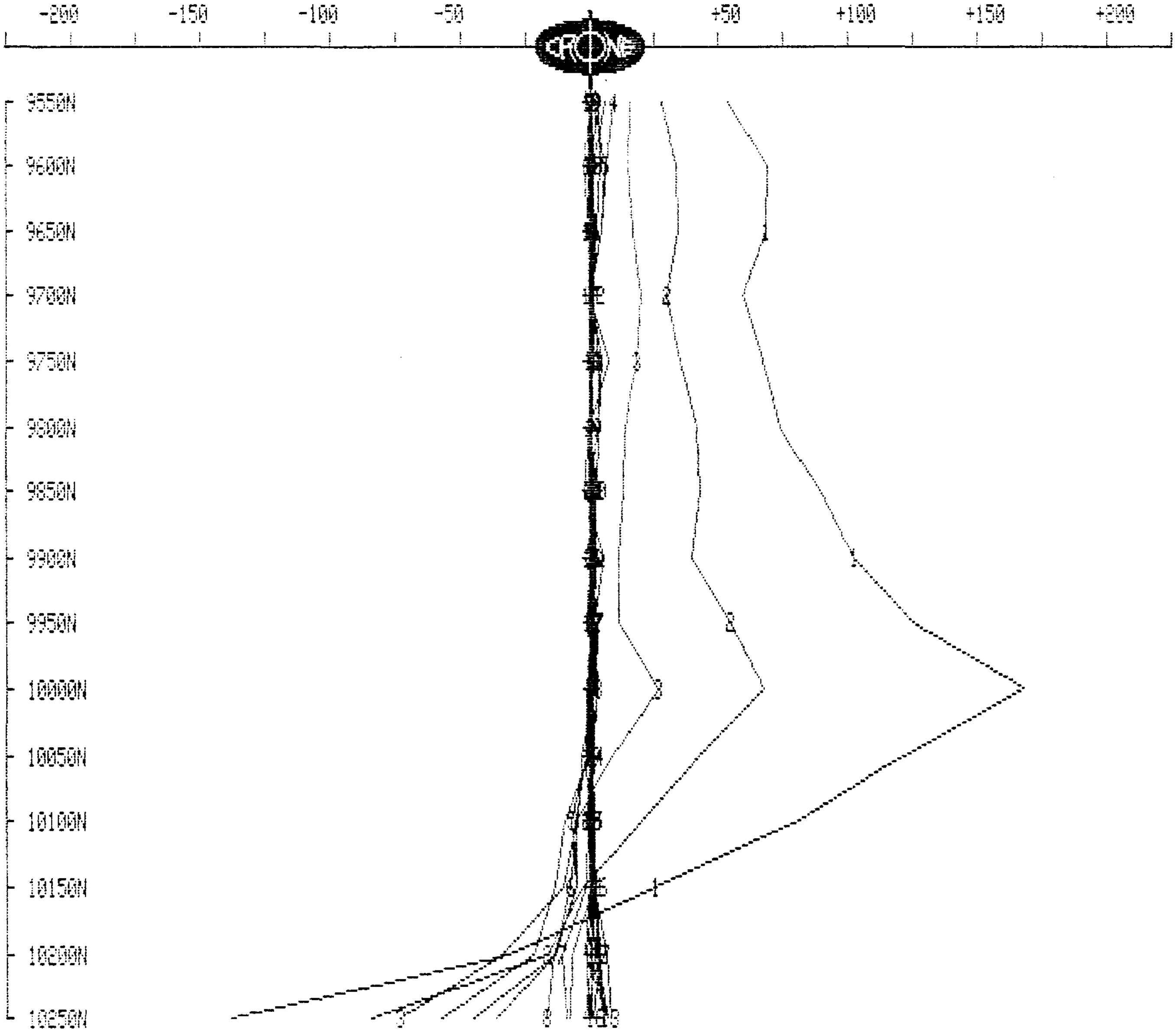


CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

Client	: FALCONBRIDGE		Line	:	7682W
Grid	: BOOT-BAY		Tx Loop	:	6
Date	: Mar 27, 1992		File name	:	L7682W6.PEM

IN-LINE HORIZONTAL COMPONENT dBx/dt nanoTesla/sec - 20 channels

Scale: 1:5000 Unit Scale: 1cm = 25 nT/s

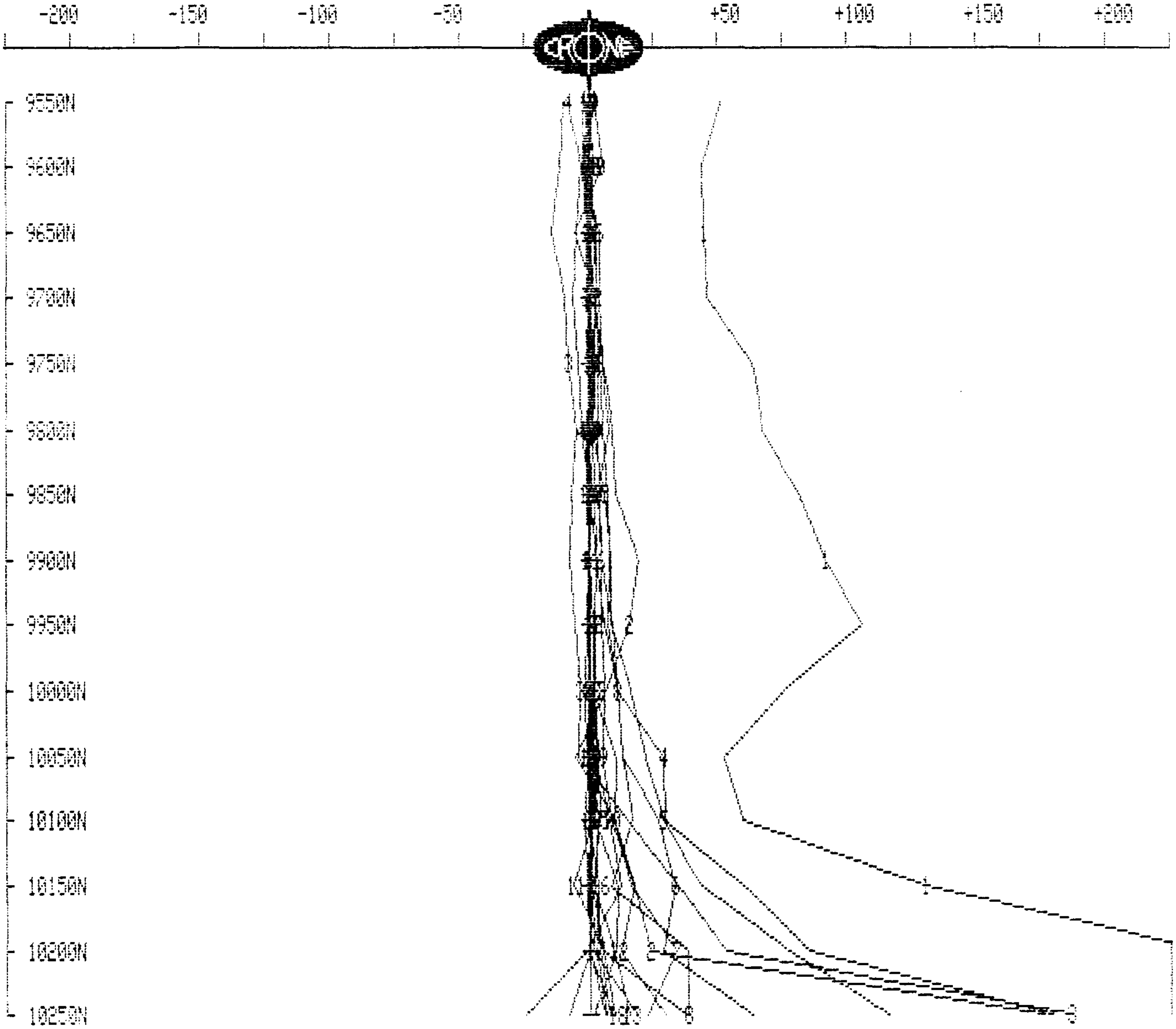


CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

Client : FALCONBRIDGE
Grid : BOOT-BAY
Date : Mar 27, 1992

Line : 7682W
Tx Loop : 6
File name : L7682W6.PEM

VERTICAL COMPONENT dBz/dt nanoTesla/sec - 20 channels
Scale: 1:5000
Unit Scale: 1cm = 25 nT/s

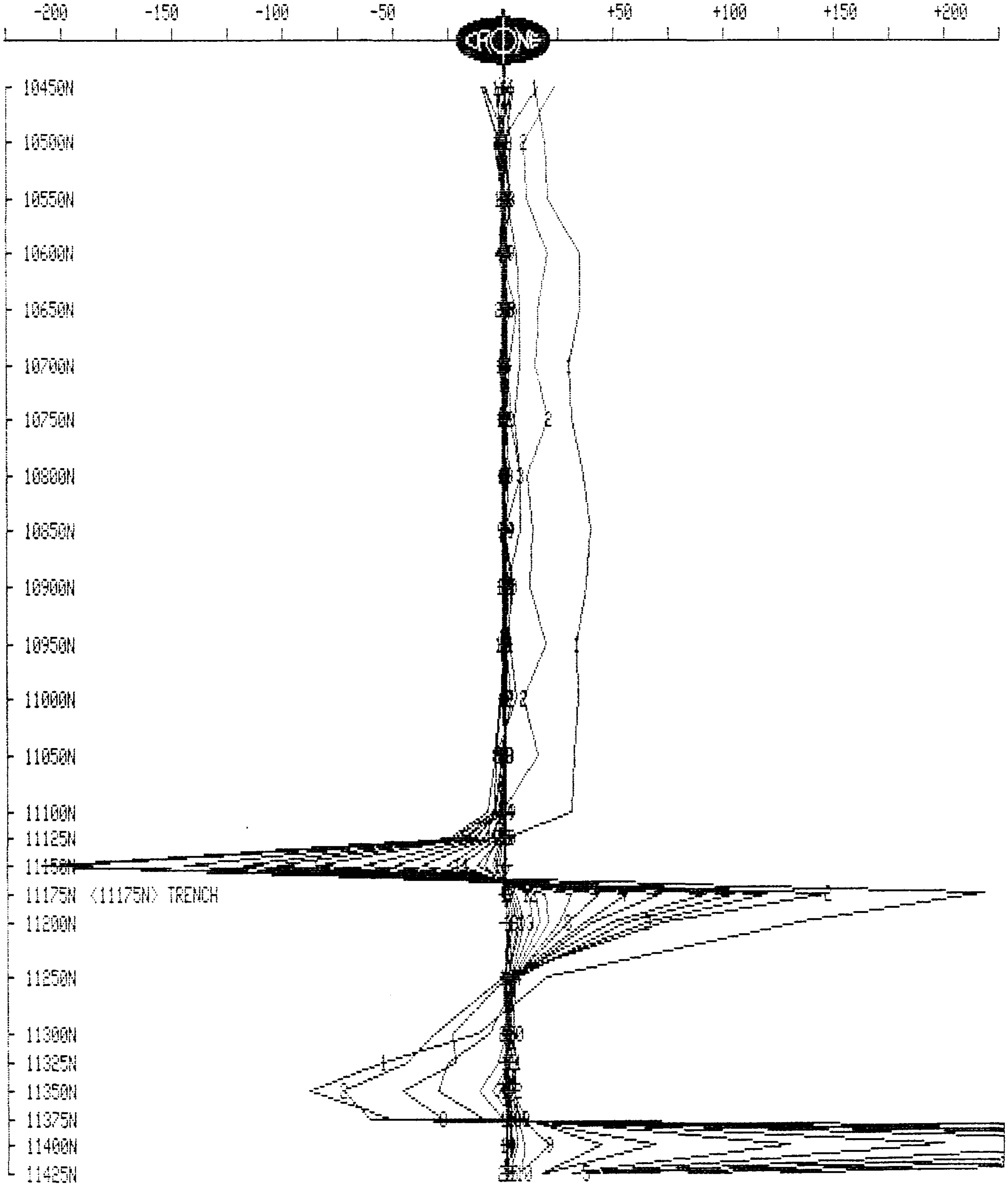


CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

Client	: FALCONBRIDGE	Line	: 7560W
Grid	: BOOT-BAY	Tx Loop	: 5
Date	: Mar 25, 1992	File name	: L7560W5.PEM

IN-LINE HORIZONTAL COMPONENT dBx/dt nanoTesla/sec - 20 channels

Scale: 1:5000 Unit Scale: 1cm = 25 nT/s

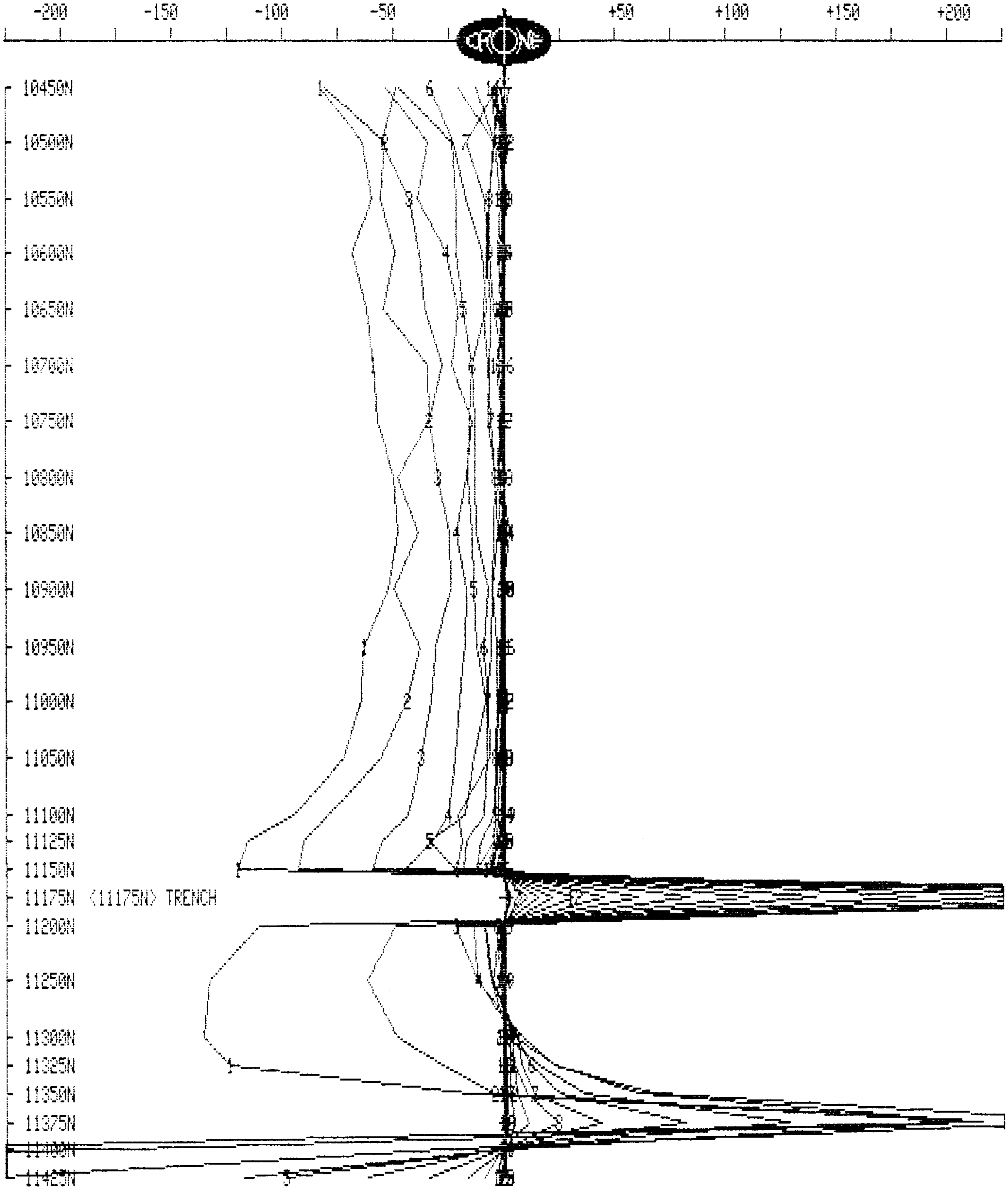


CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

Client	: FALCONBRIDGE	Line	: 7560W
Grid	: BOOT-BAY	Tx Loop	: 5
Date	: Mar 25, 1992	File name	: L7560W5.PEM

VERTICAL COMPONENT dBz/dt nanoTesla/sec - 20 channels

Scale: 1:5000 Unit Scale: 1cm = 25 nT/s



CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

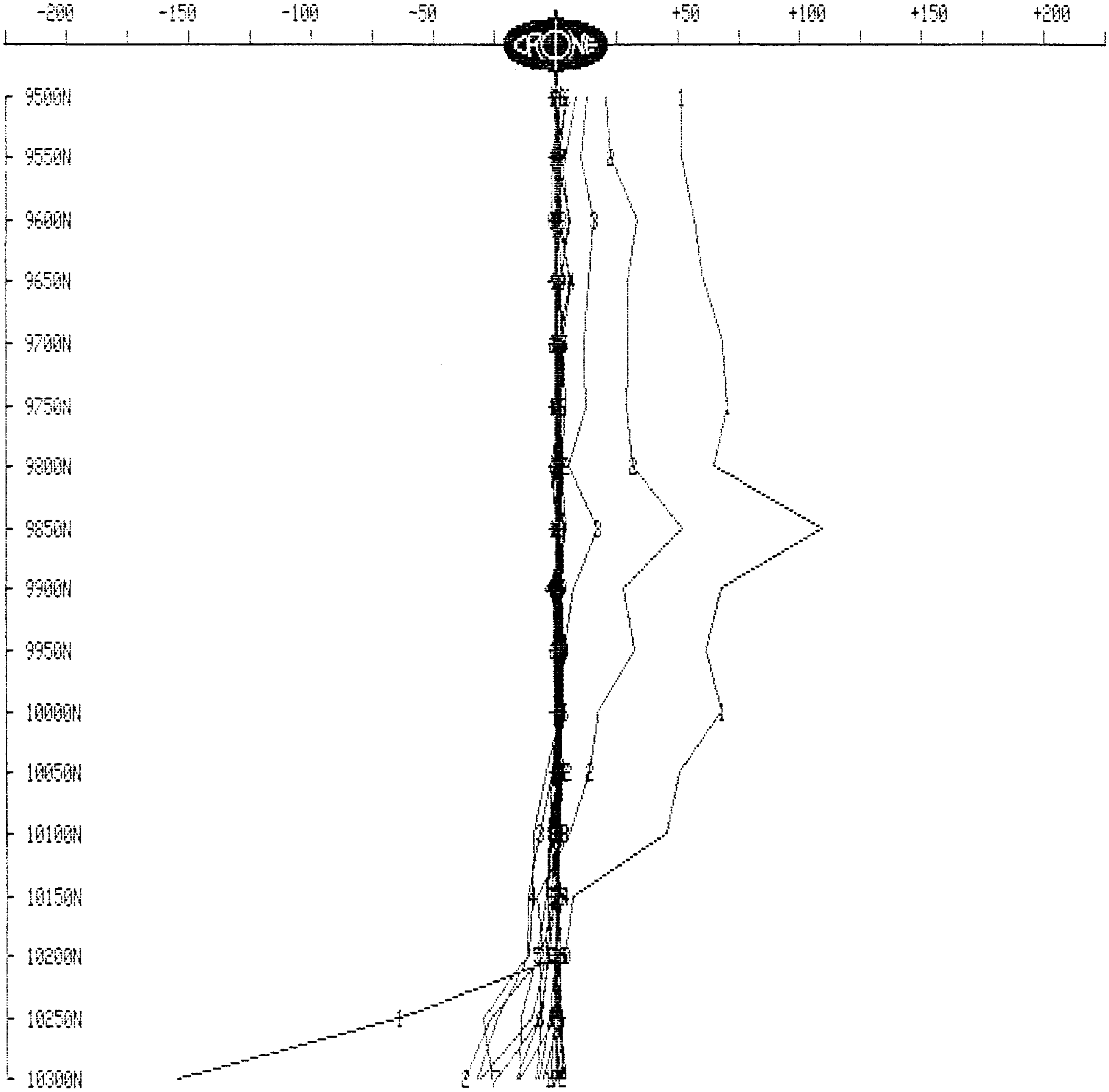
Client : FALCONBRIDGE
Grid : BOOT-BAY
Date : Mar 27, 1992

Line : 7560W
Tx Loop : 6
File name : L7560W6.PEM

IN-LINE HORIZONTAL COMPONENT dBx/dt nanoTesla/sec - 20 channels

Scale: 1:5000

Unit Scale: 1cm = 25 nT/s



CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

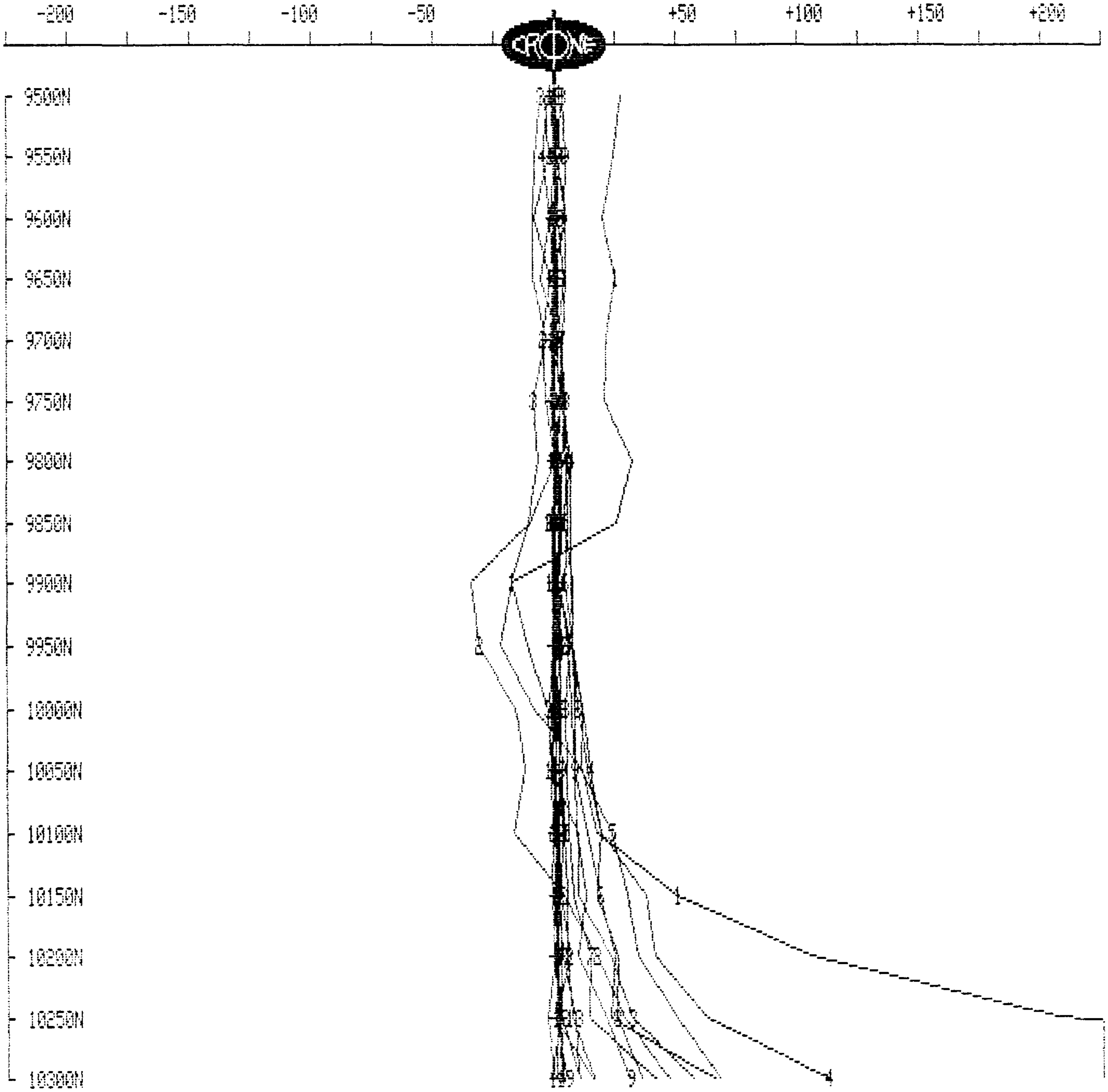
Client : FALCONBRIDGE
Grid : BOOT-BAY
Date : Mar 27, 1992

Line : 7560W
Tx Loop : 6
File name : L7560W6.PEM

VERTICAL COMPONENT dBz/dt nanoTesla/sec - 20 channels

Scale: 1:5000

Unit Scale: 1cm = 25 nT/s



CRONE GEOPHYSICS & EXPLORATION LTD

SURFACE PEM

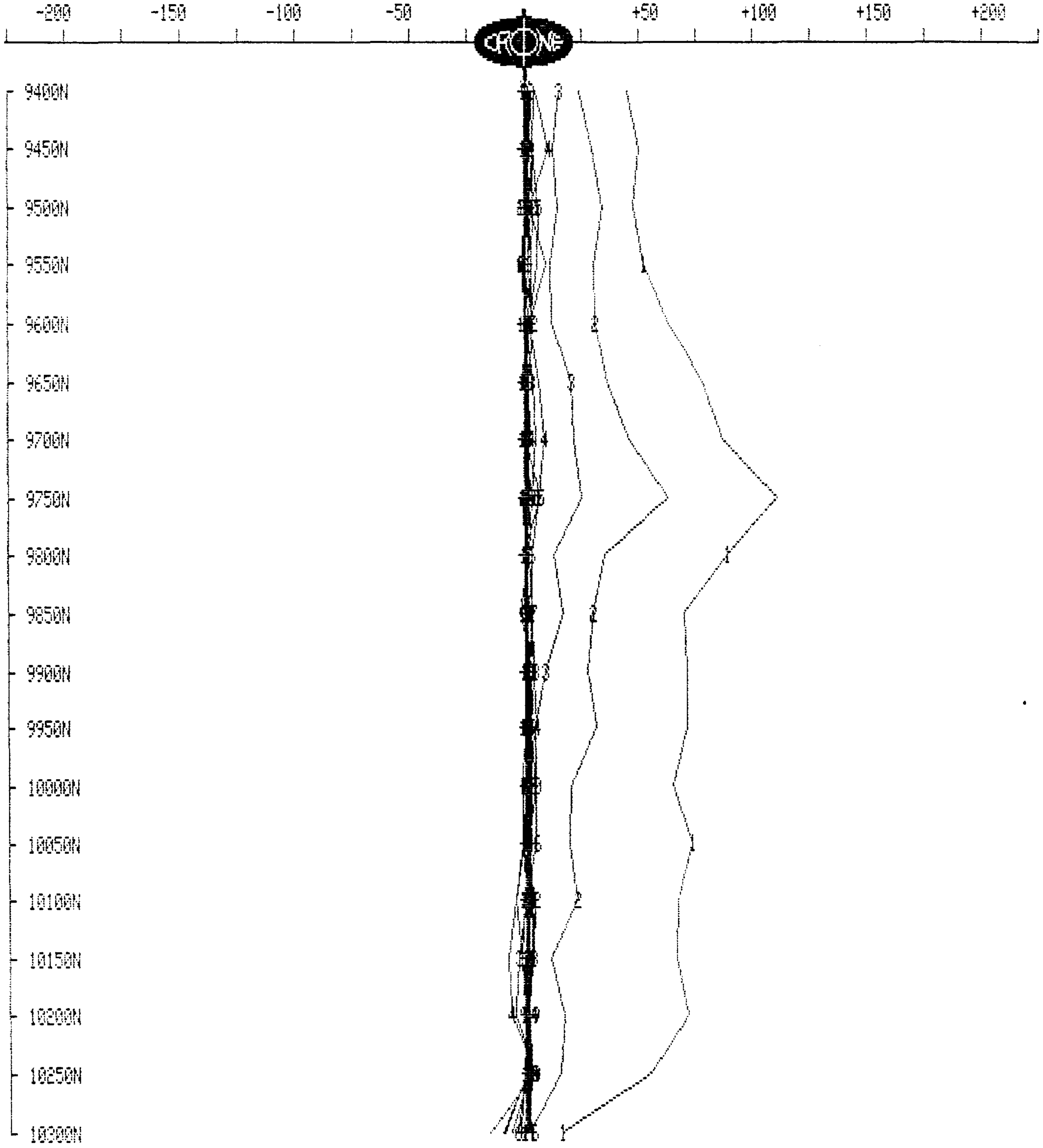
Client : FALCONBRIDGE
Grid : BOOT-BAY
Date : Mar 27, 1992

Line : **7438W**
Tx Loop : 6
File name : L7438W6.PEM

IN-LINE HORIZONTAL COMPONENT dBx/dt nanoTesla/sec - 20 channels

Scale: 1:5000

Unit Scale: 1cm = 25 nT/s



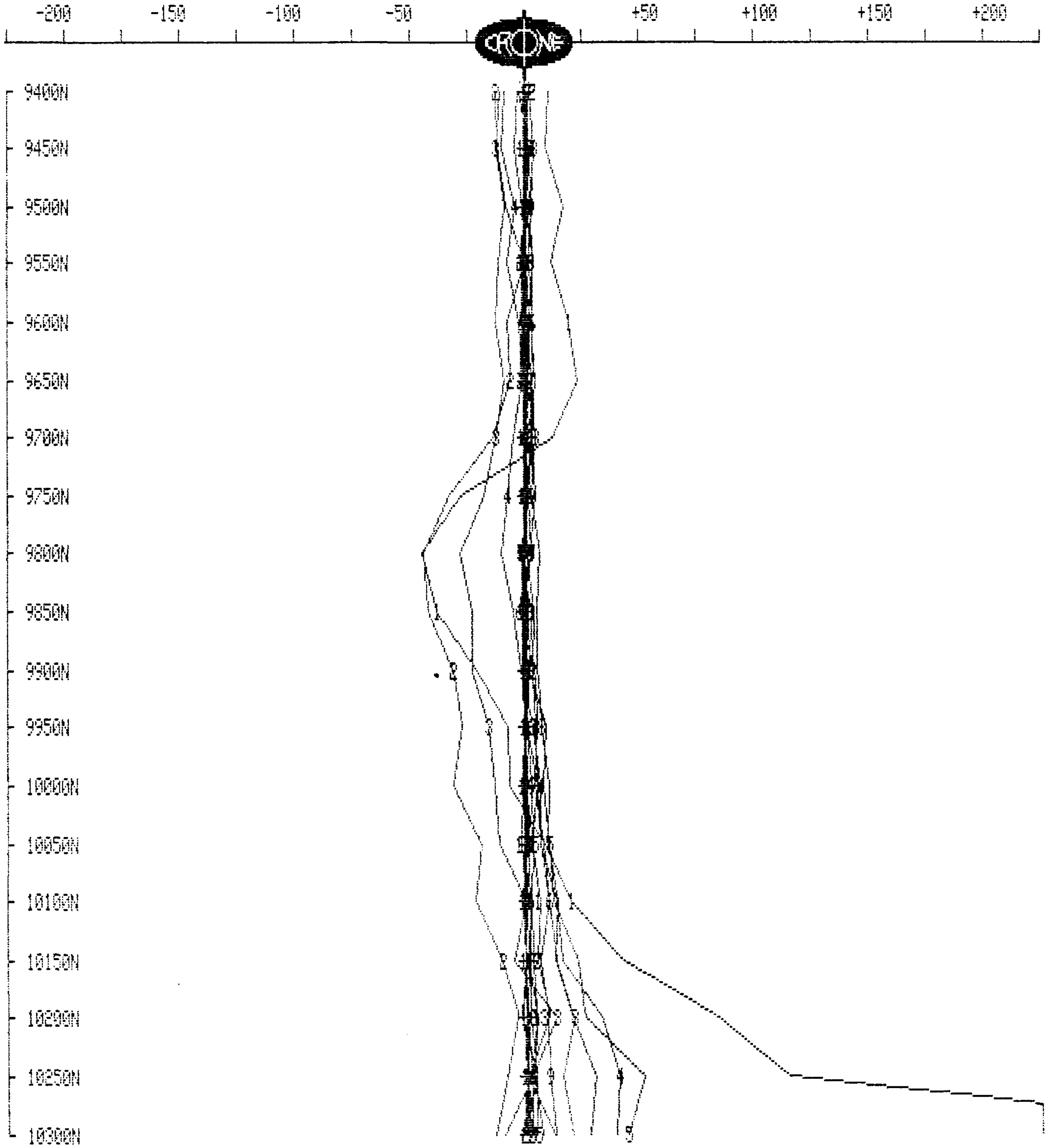
CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

Client	: FALCONBRIDGE	Line	: 7438W
Grid	: BOOT-BAY	Tx Loop	: 6
Date	: Mar 27, 1992	File name	: L7438W6.PEM

VERTICAL COMPONENT dBz/dt nanoTesla/sec - 20 channels

Scale: 1:5000

Unit Scale: 1cm = 25 nT/s



CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

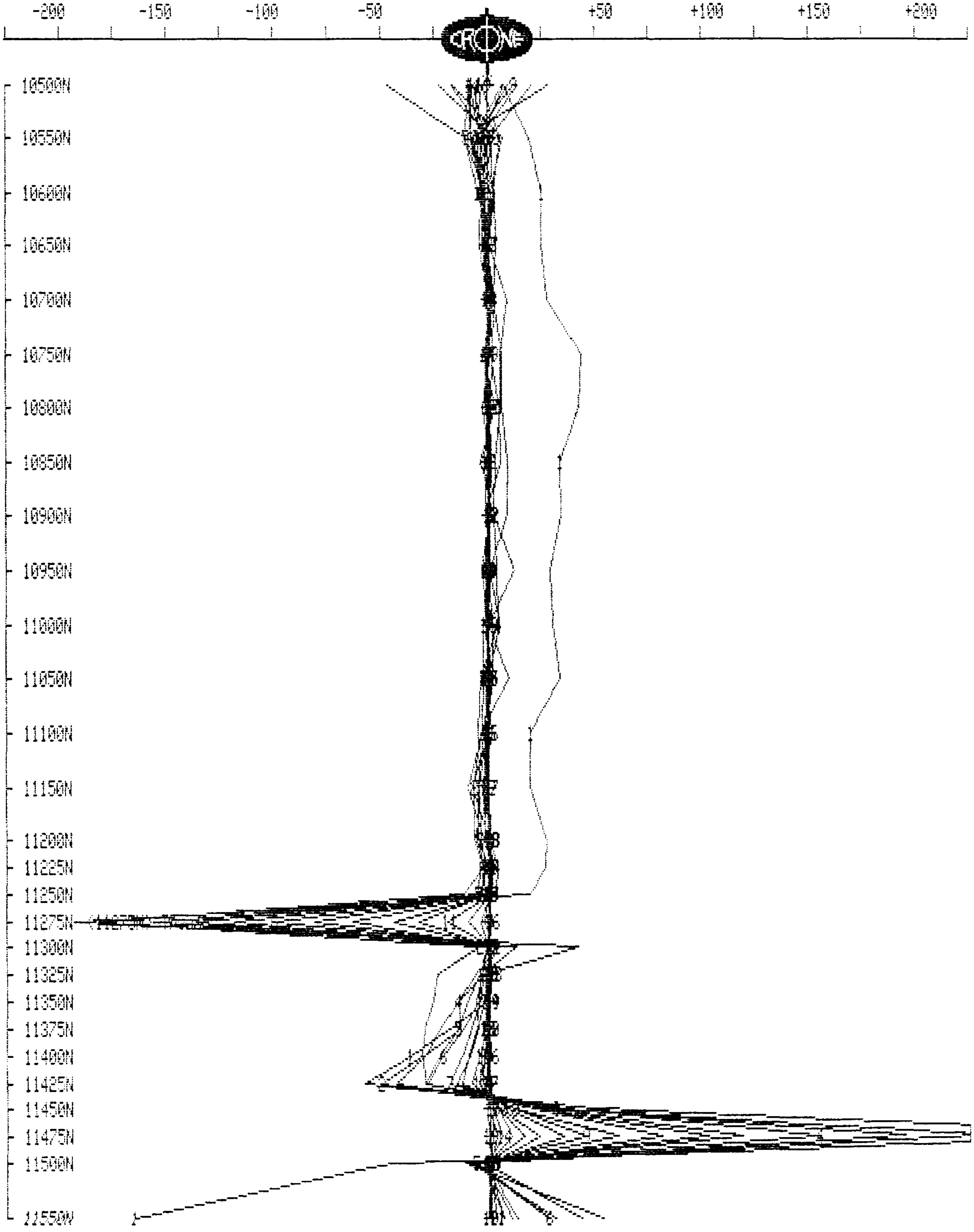
Client : FALCONBRIDGE
Grid : BOOT-BAY
Date : Mar 29, 1992

Line : 7438W
Tx Loop : 7
File name : L7438W7.PEM

IN-LINE HORIZONTAL COMPONENT dBx/dt nanoTesla/sec - 20 channels

Scale: 1:5000

Unit Scale: 1cm = 25 nT/s



CRONE GEOPHYSICS & EXPLORATION LTD

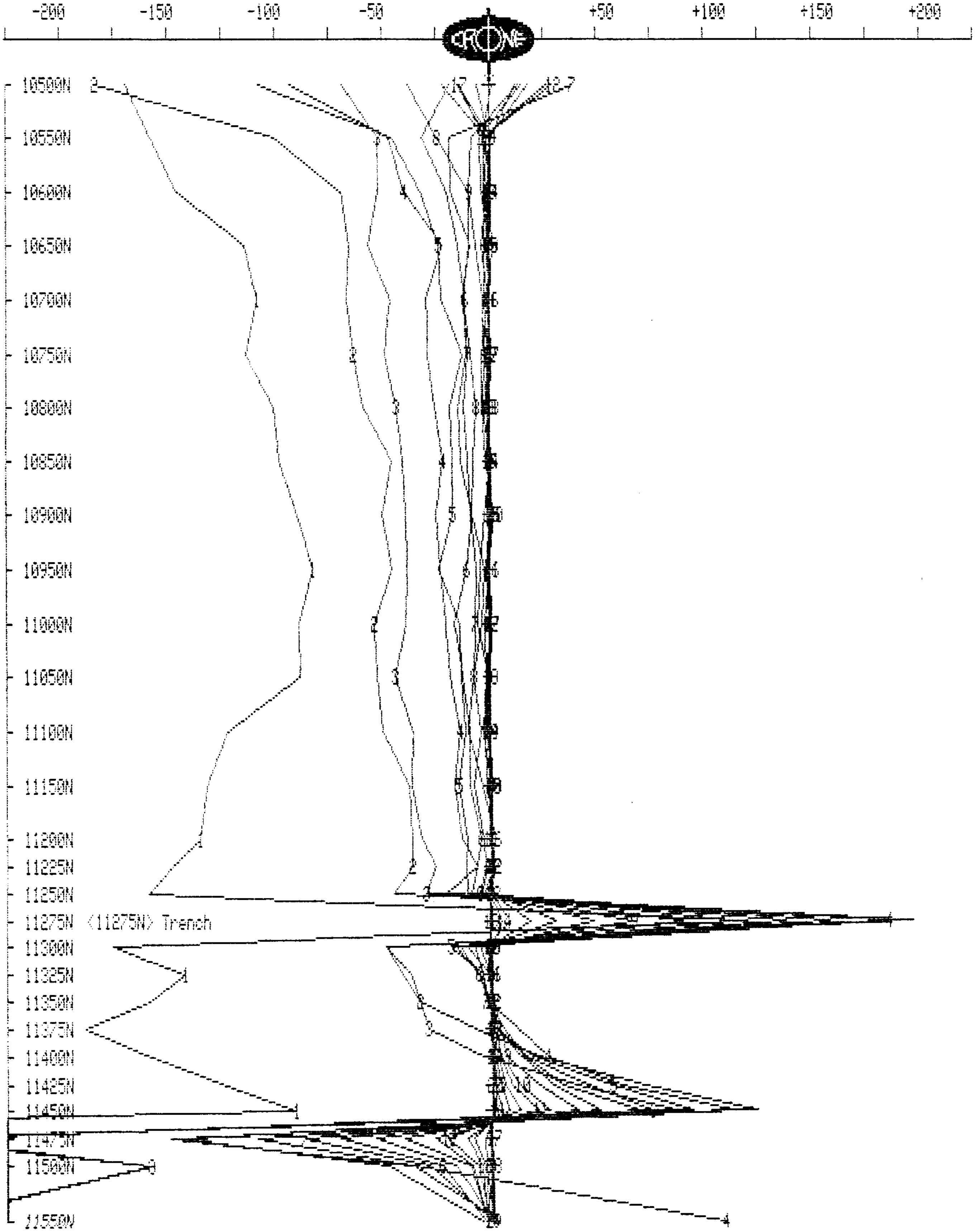
SURFACE PEM

Client	: FALCONBRIDGE	Line	: 7438W
Grid	: BOOT-BAY	Tx Loop	: 7
Date	: Mar 29, 1992	File name	: L7438W7.PEM

VERTICAL COMPONENT dBz/dt nanoTesla/sec - 20 channels

Scale: 1:5000

Unit Scale: 1cm = 25 nT/s



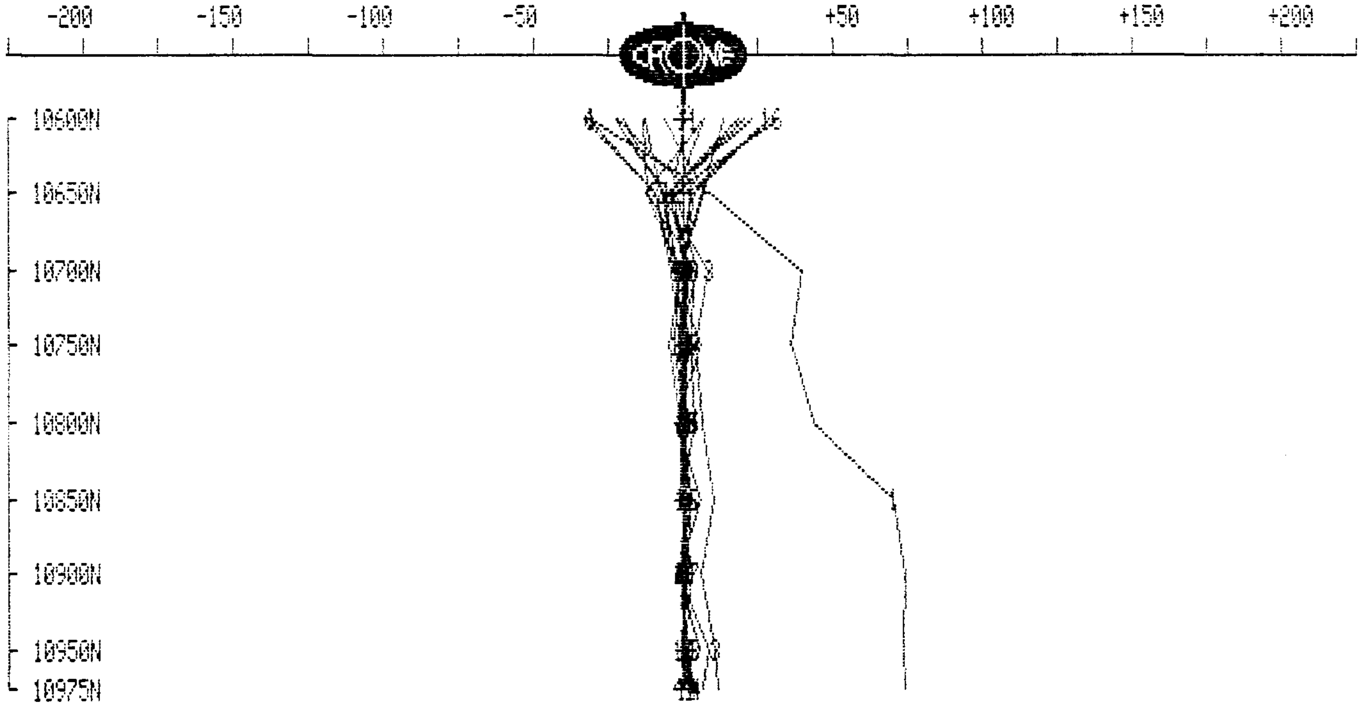
CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

Client	: FALCONBRIDGE	Line	: 7316W
Grid	: BOOT-BAY	Tx Loop	: 7
Date	: Mar 29, 1992	File name	: L7316W7.PEM

IN-LINE HORIZONTAL COMPONENT dBx/dt nanoTesla/sec - 20 channels

Scale: 1:5000

Unit Scale: 1cm = 25 nT/s



CRONE GEOPHYSICS & EXPLORATION LTD

SURFACE PEM

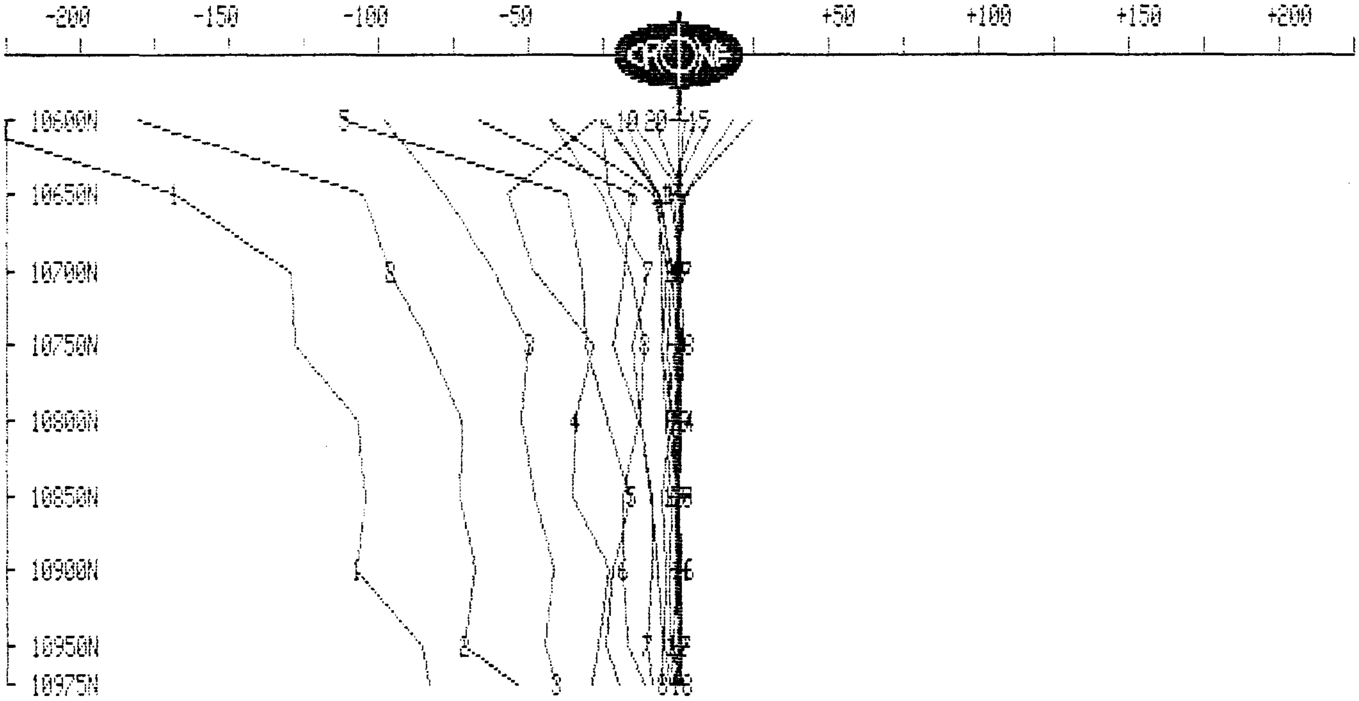
Client : FALCONBRIDGE
Grid : BOOT-BAY
Date : Mar 29, 1992

Line : 7316W
Tx Loop : 7
File name : L7316W7.PEM

VERTICAL COMPONENT dBz/dt nanoTesla/sec - 20 channels

Scale: 1:5000

Unit Scale: 1cm = 25 nT/s



CRONE GEOPHYSICS & EXPLORATION LTD

SURFACE PEM

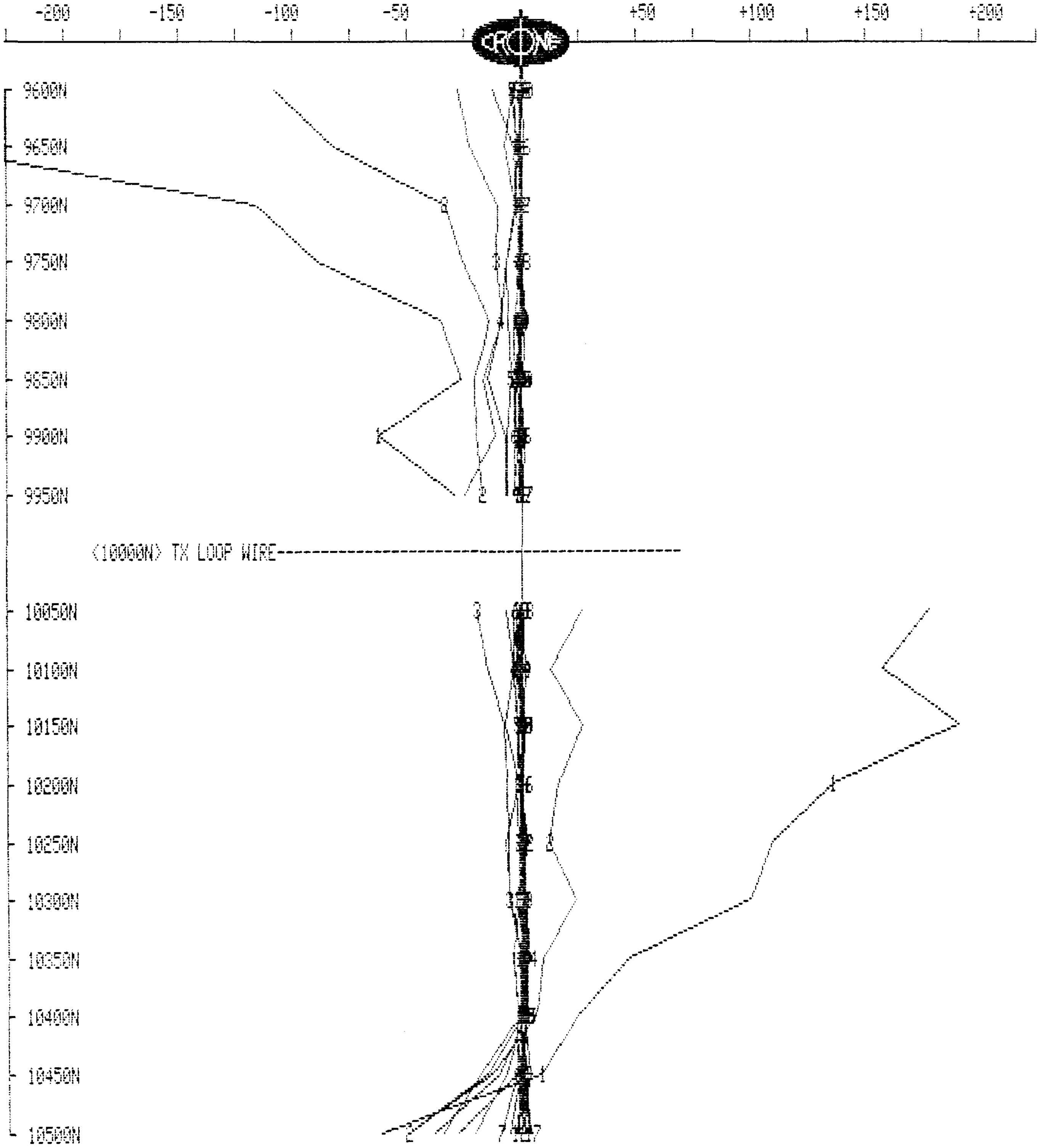
Client : FALCONBRIDGE
Grid : BOOT-BAY
Date : Mar 29, 1992

Line : 7316W
Tx Loop : 8
File name : L7316W8.PEM

IN-LINE HORIZONTAL COMPONENT dBx/dt nanoTesla/sec - 20 channels

Scale: 1:5000

Unit Scale: 1cm = 25 nT/s



CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

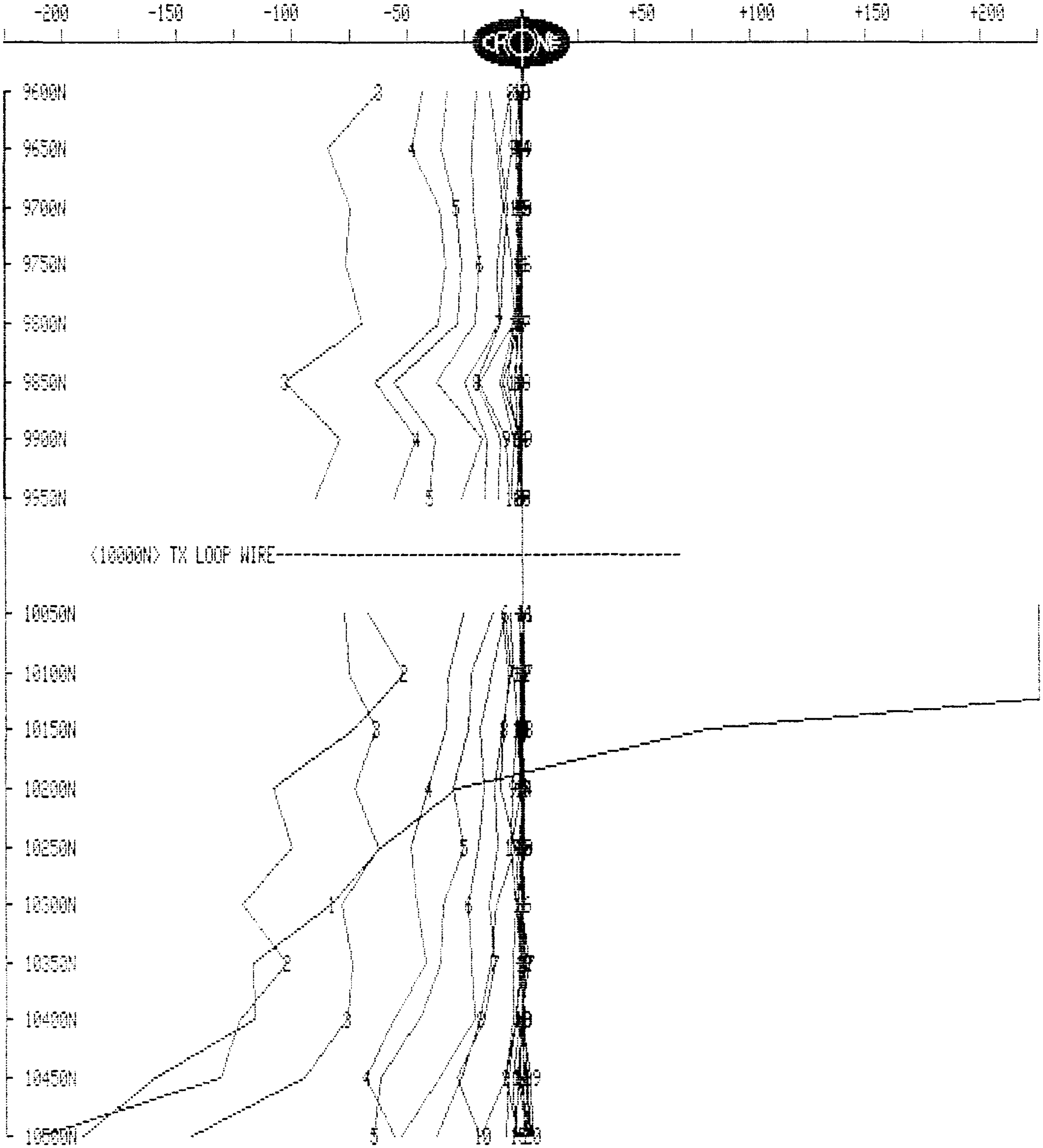
Client : FALCONBRIDGE
Grid : BOOT-BAY
Date : Mar 29, 1992

Line : 7316W
Tx Loop : 8
File name : L7316W8.PEM

VERTICAL COMPONENT dBz/dt nanoTesla/sec - 20 channels

Scale: 1:5000

Unit Scale: 1cm = 25 nT/s



CRONE GEOPHYSICS & EXPLORATION LTD

SURFACE PEM

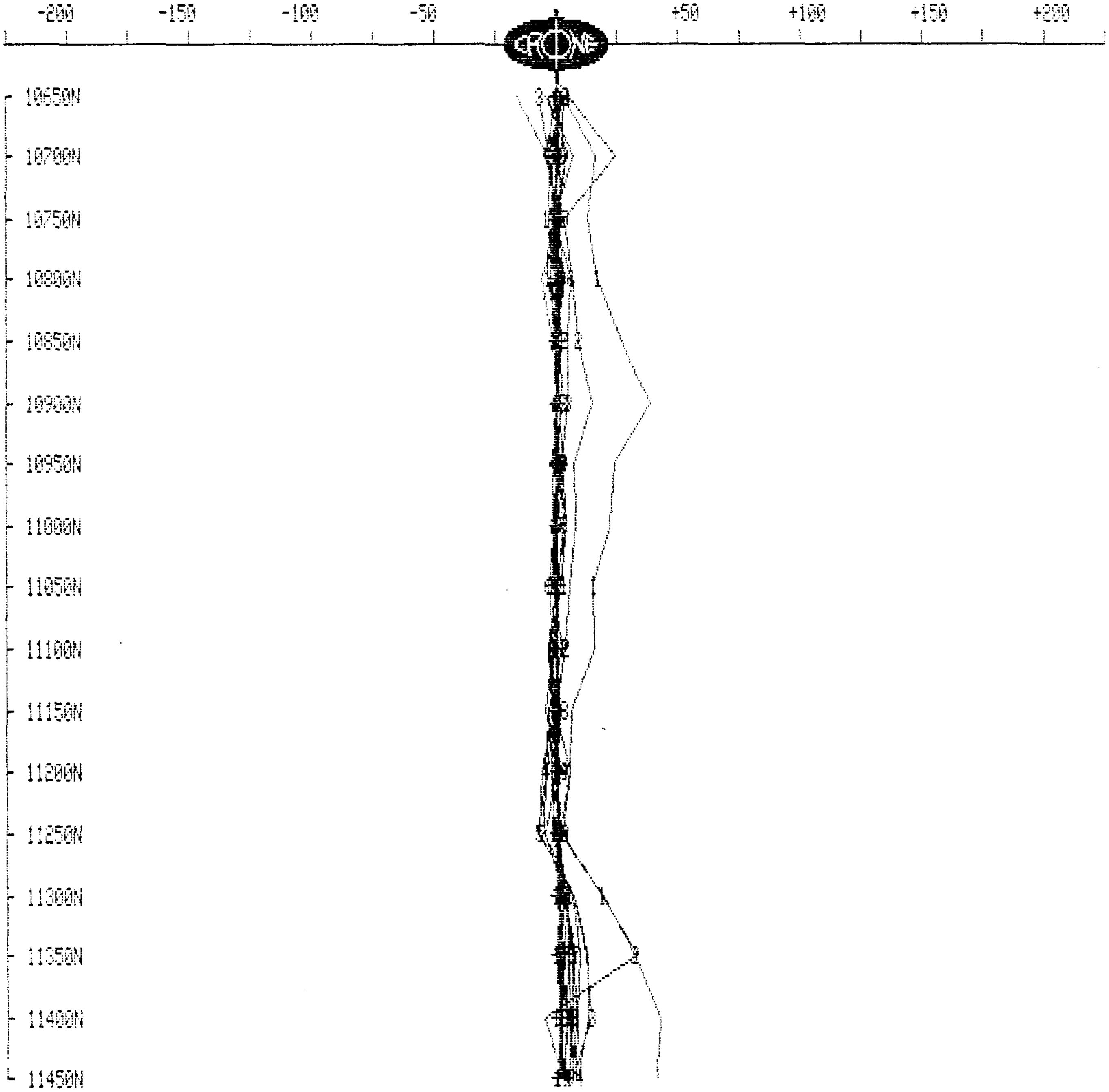
Client : FALCONBRIDGE
Grid : BOOT-BAY
Date : Mar 29, 1992

Line : 7194W
Tx Loop : 7
File name : L7194W7.PEM

IN-LINE HORIZONTAL COMPONENT dBx/dt nanoTesla/sec - 20 channels

Scale: 1:5000

Unit Scale: 1cm = 25 nT/s



CRONE GEOPHYSICS & EXPLORATION LTD

SURFACE PEM

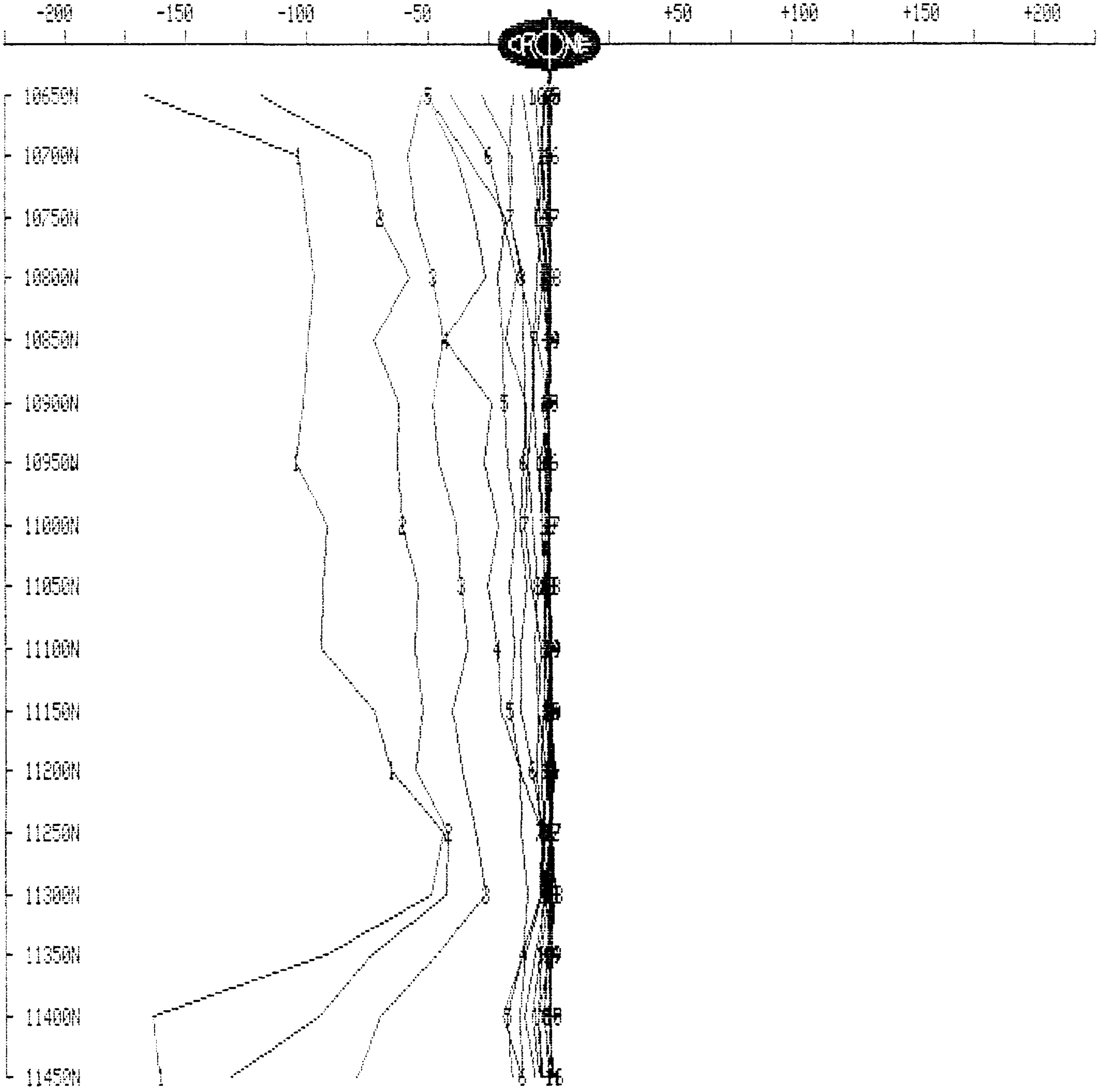
Client : FALCONBRIDGE
Grid : BOOT-BAY
Date : Mar 29, 1992

Line : 7194W
Tx Loop : 7
File name : L7194W7.PEM

VERTICAL COMPONENT dBz/dt nanoTesla/sec - 20 channels

Scale: 1:5000

Unit Scale: 1cm = 25 nT/s



CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

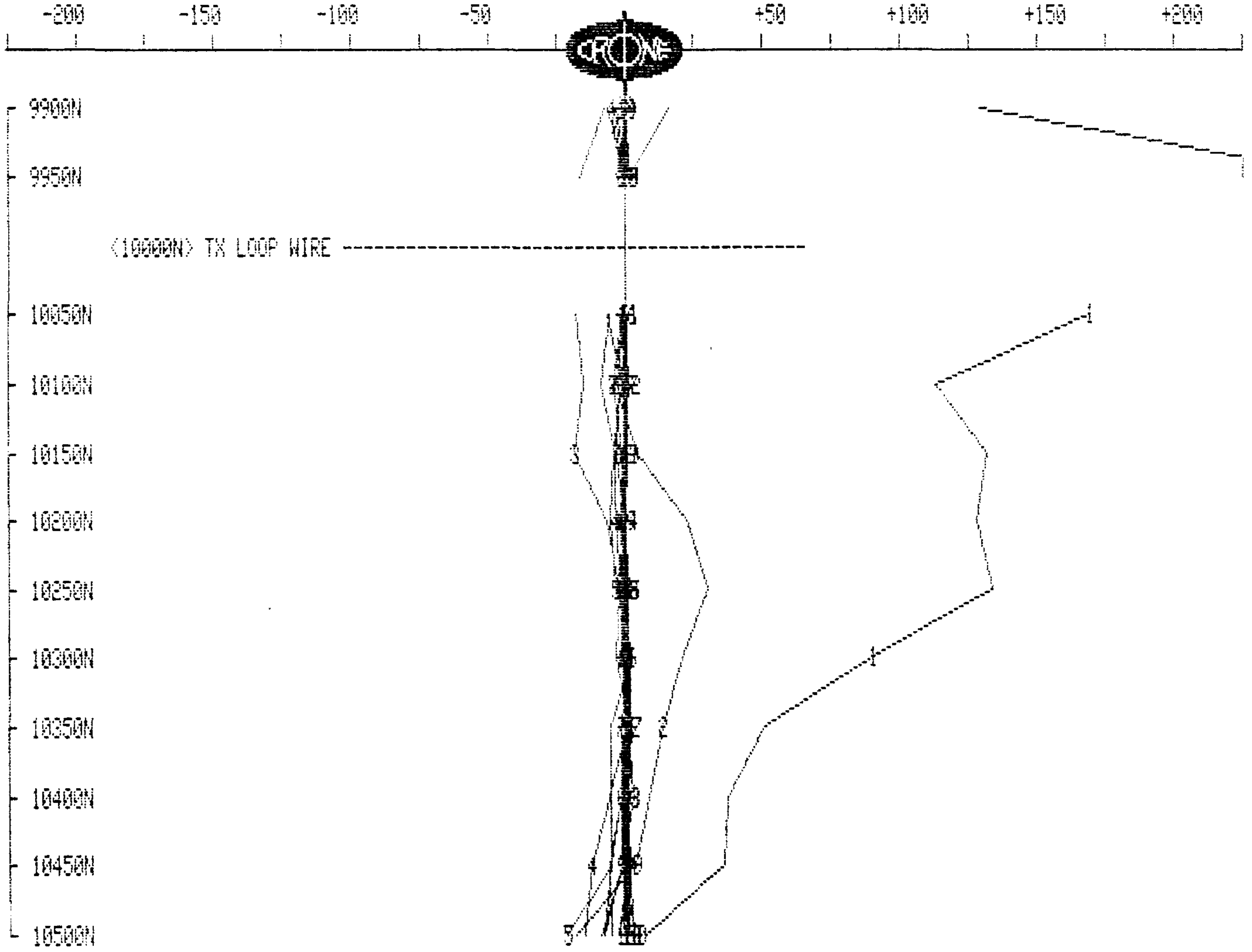
Client : FALCONBRIDGE
Grid : BOOT-BAY
Date : Mar 29, 1992

Line : **7194W**
Tx Loop : **8**
File name : L7194W8.PEM

IN-LINE HORIZONTAL COMPONENT dBx/dt nanoTesla/sec - 20 channels

Scale: 1:5000

Unit Scale: 1cm = 25 nT/s



CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

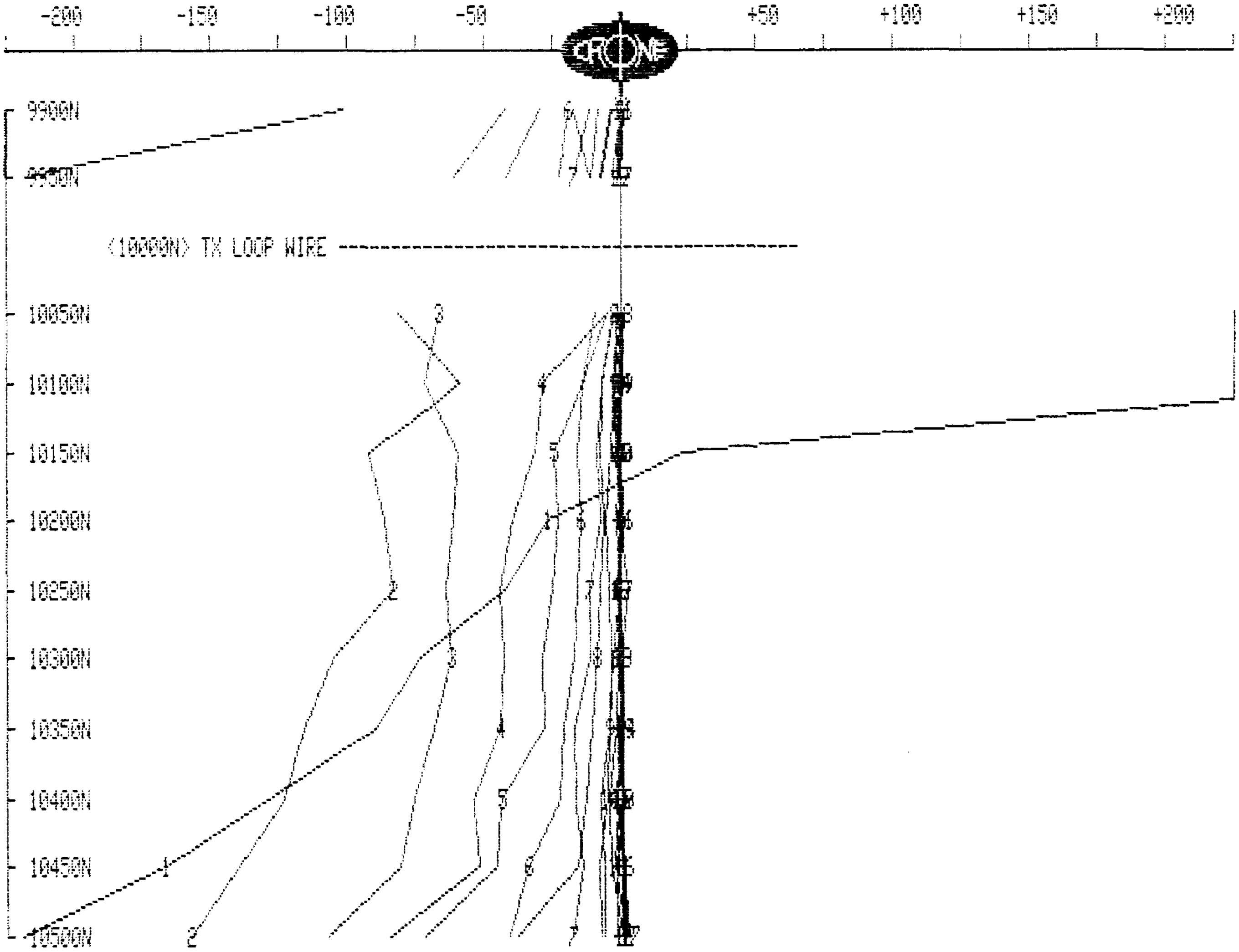
Client : FALCONBRIDGE
Grid : BOOT-BAY
Date : Mar 29, 1992

Line : 7194W
Tx Loop : 8
File name : L7194W8.PEM

VERTICAL COMPONENT dBz/dt nanoTesla/sec - 20 channels

Scale: 1:5000

Unit Scale: 1cm = 25 nT/s

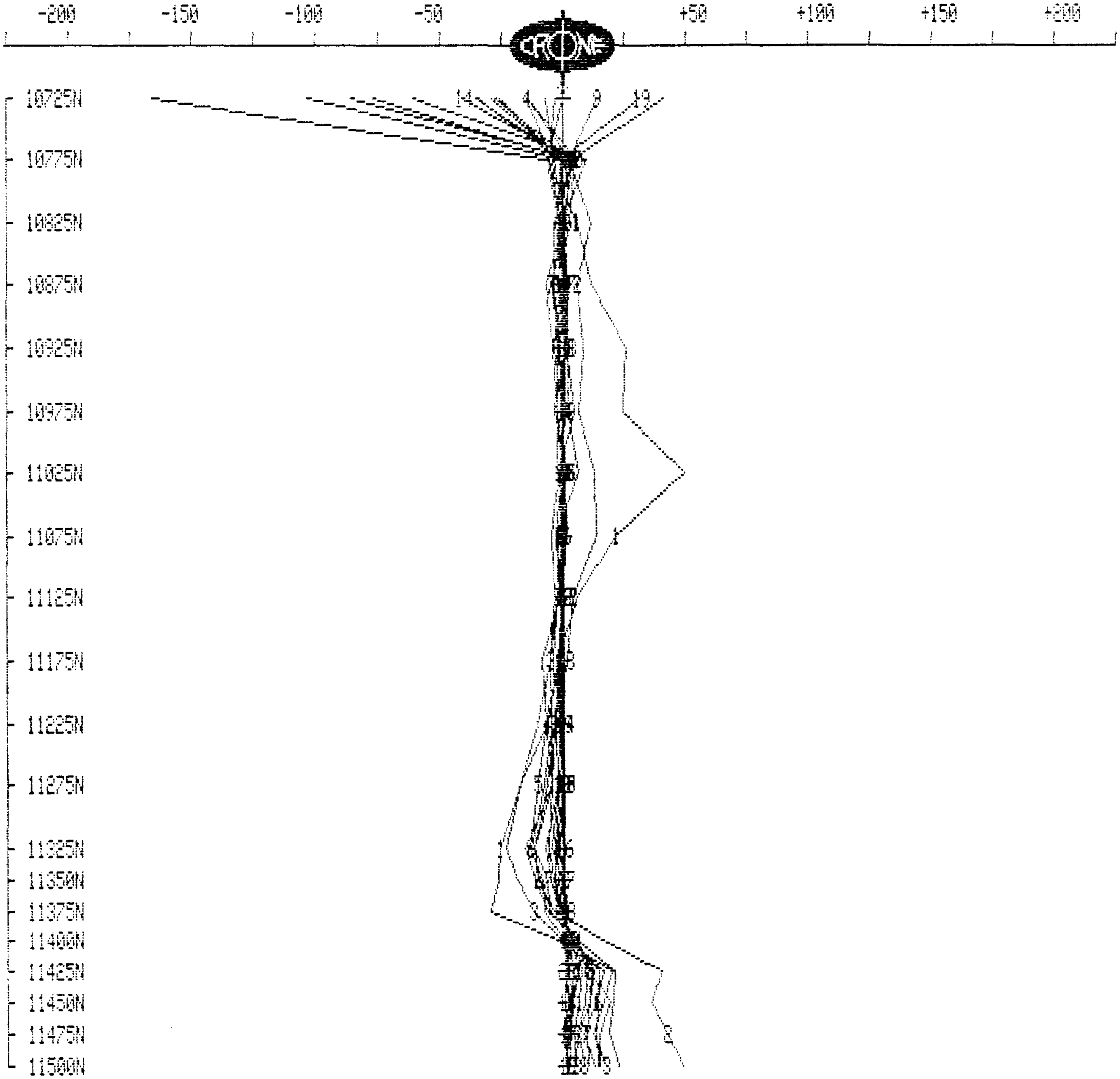


CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

Client	: FALCONBRIDGE	Line	: 7072W
Grid	: BOOT-BAY	Tx Loop	: 7
Date	: Mar 28, 1992	File name	: L7072W7.PEM

IN-LINE HORIZONTAL COMPONENT dBx/dt nanoTesla/sec - 20 channels

Scale: 1:5000 Unit Scale: 1cm = 25 nT/s



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SURFACE PEM

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Grid : BOOT-BAY		Tx Loop : 7	
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VERTICAL COMPONENT dBz/dt nanoTesla/sec - 20 channels

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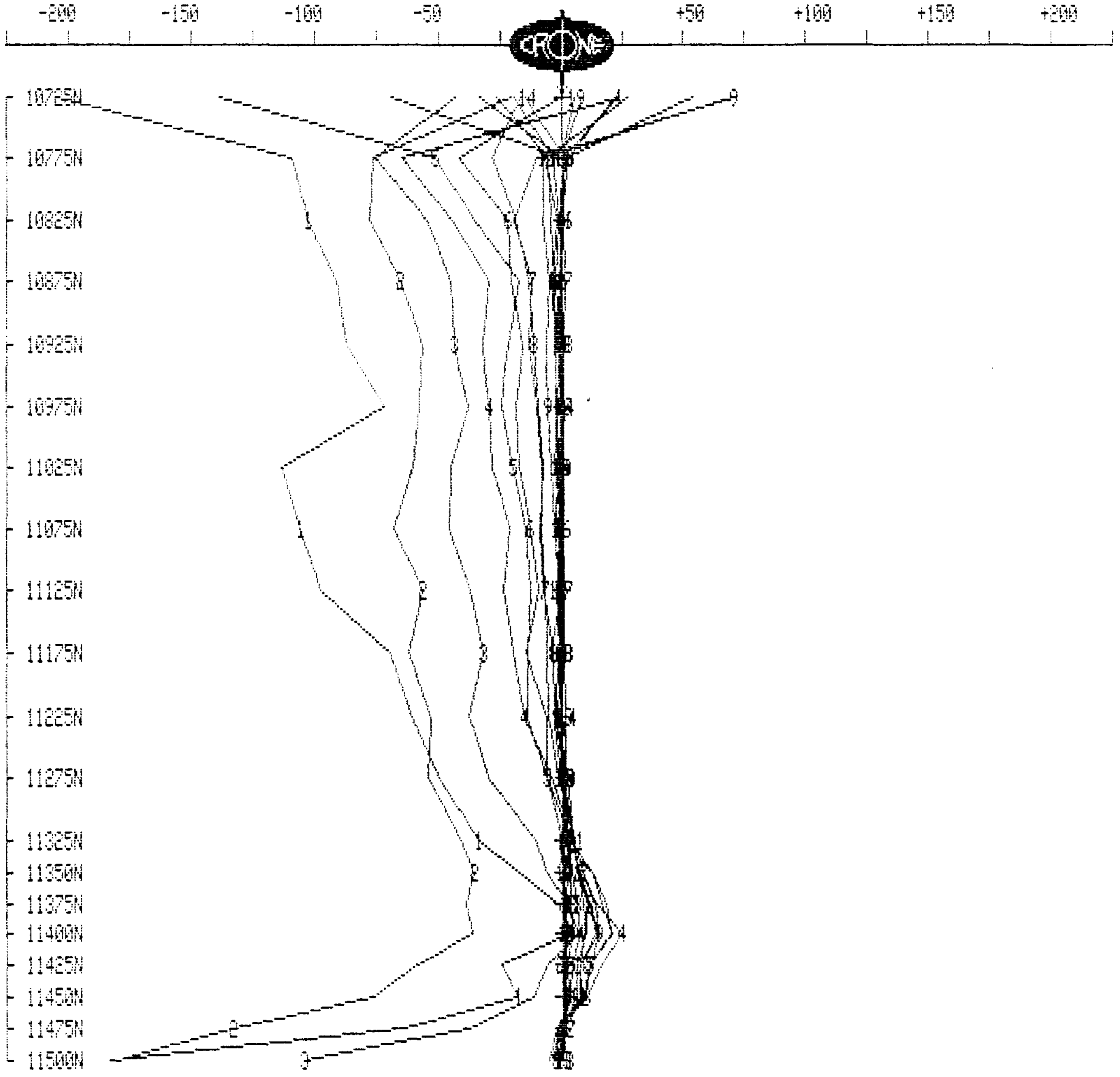

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Grid : BOOT-BAY
Date : Mar 30, 1992

Line : 7072W
Tx Loop : 8
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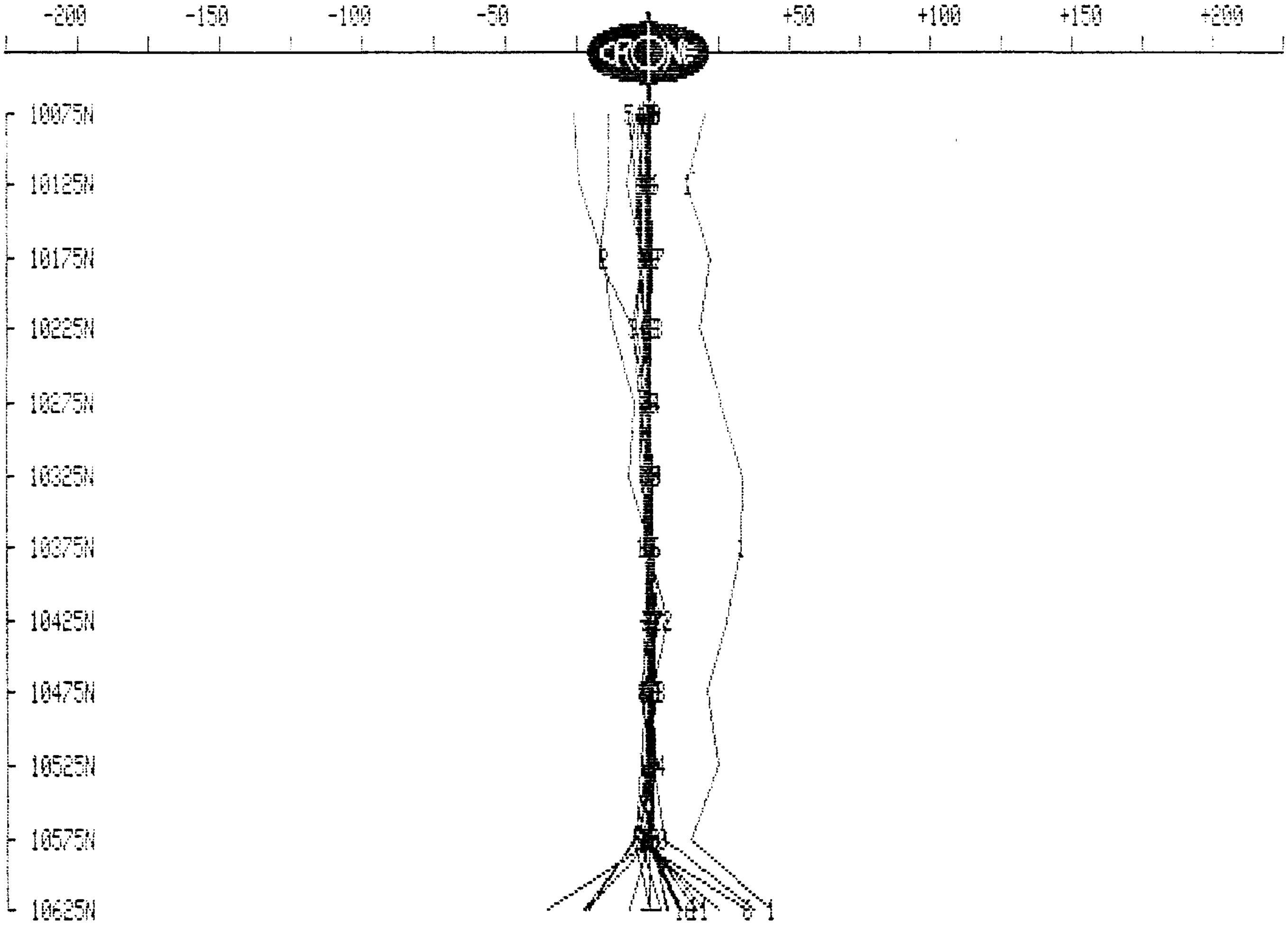
IN-LINE HORIZONTAL COMPONENT dBx/dt nanoTesla/sec - 20 channels

Scale: 1:5000

Unit Scale: 1cm = 25 nT/s



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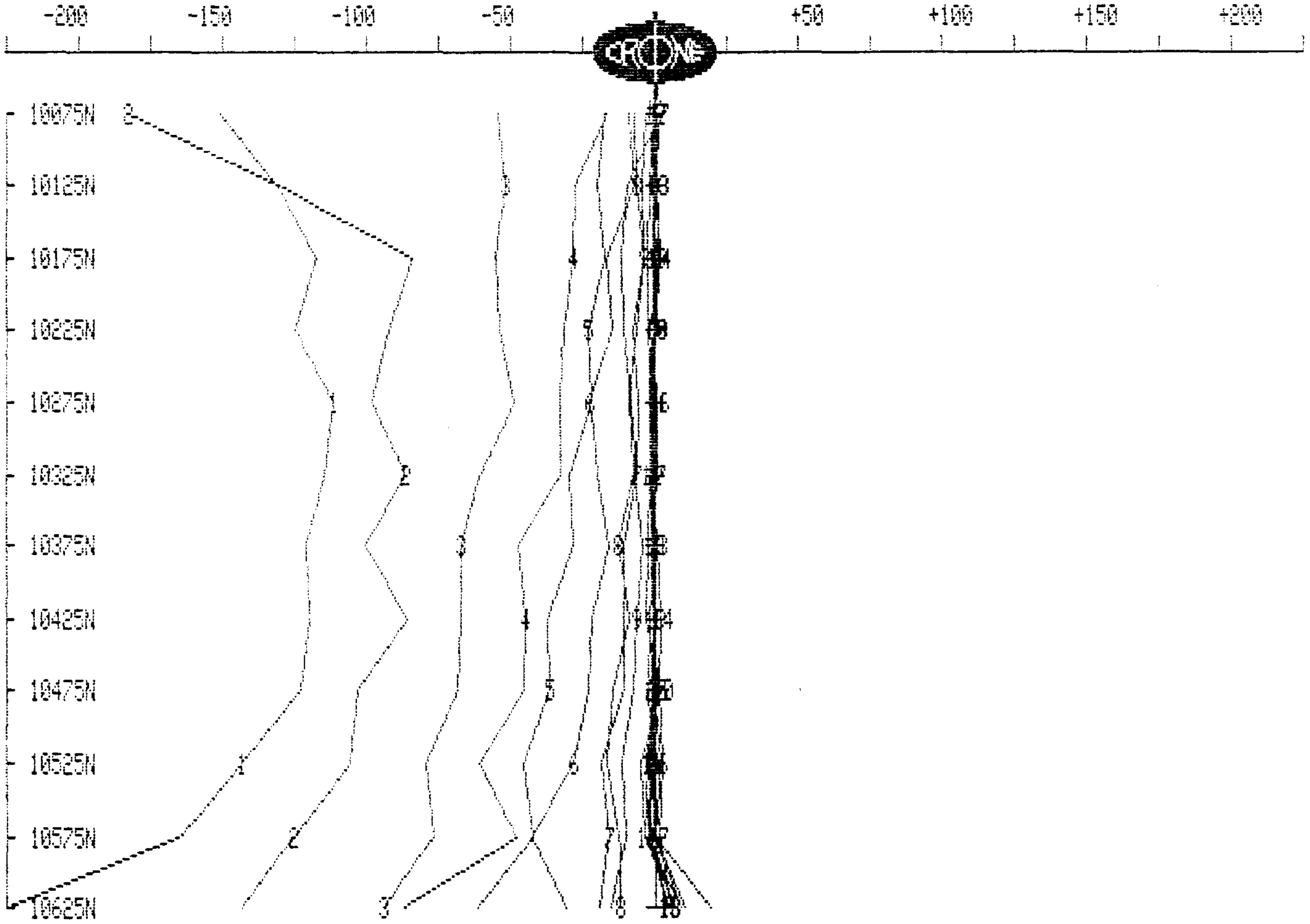
VERTICAL COMPONENT dBz/dt nanoTesla/sec - 20 channels

Scale: 1:5000

Unit Scale: 1cm = 25 nT/s



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SURFACE PEM

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Date : Mar 28, 1992

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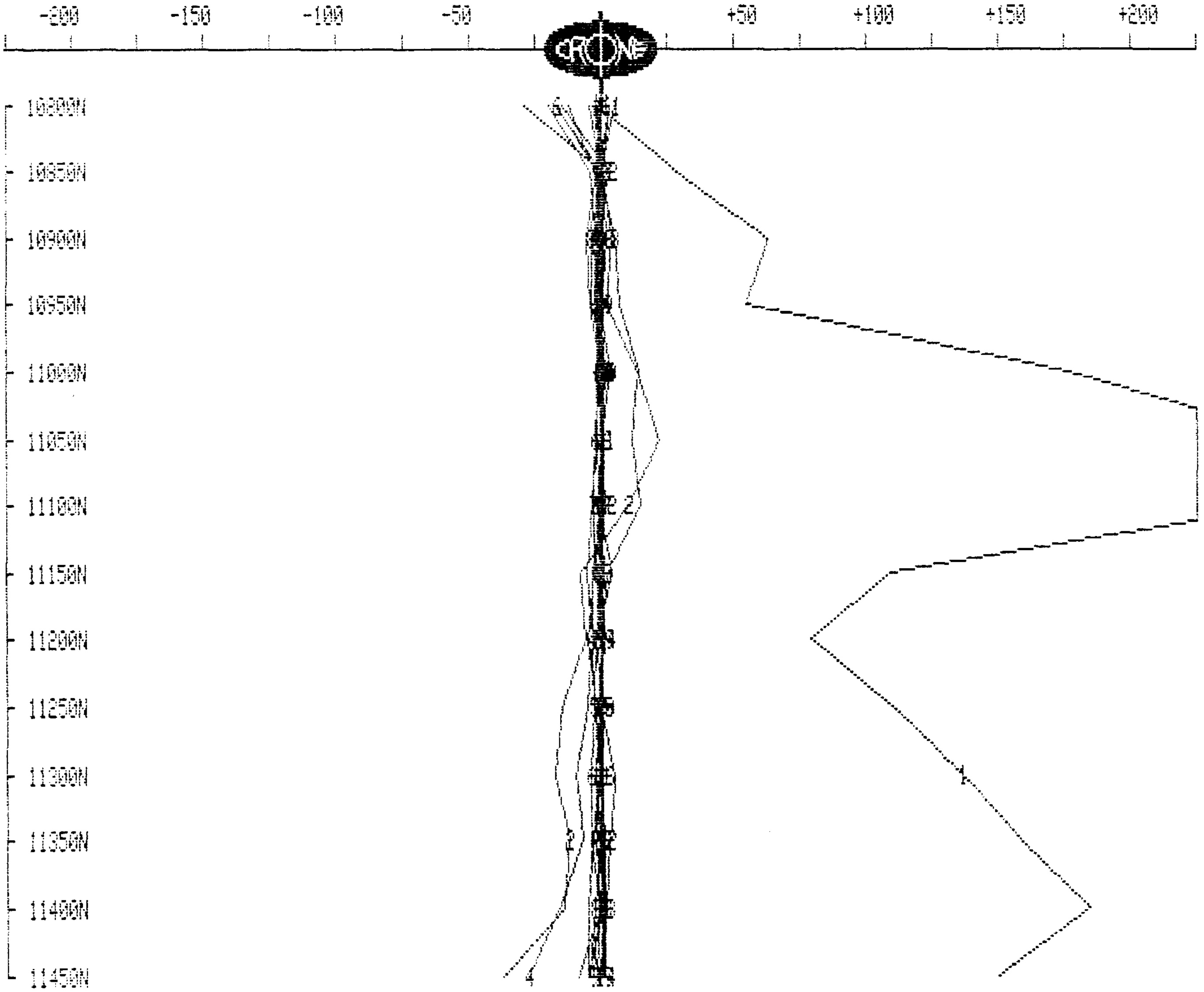
Unit Scale: 1cm = 25 nT/s



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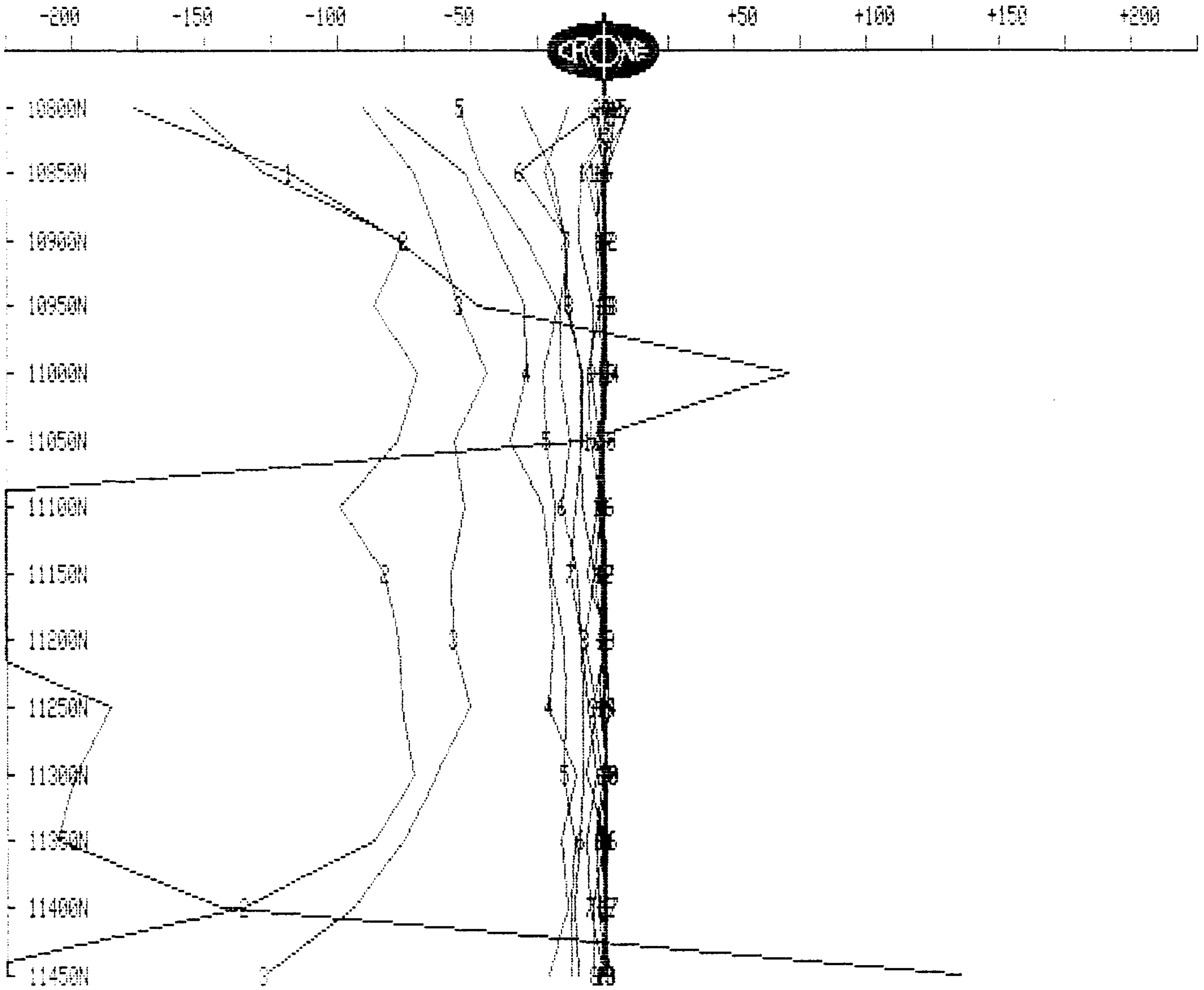
VERTICAL COMPONENT dBz/dt nanoTesla/sec - 20 channels

Scale: 1:5000

Unit Scale: 1cm = 25 nT/s



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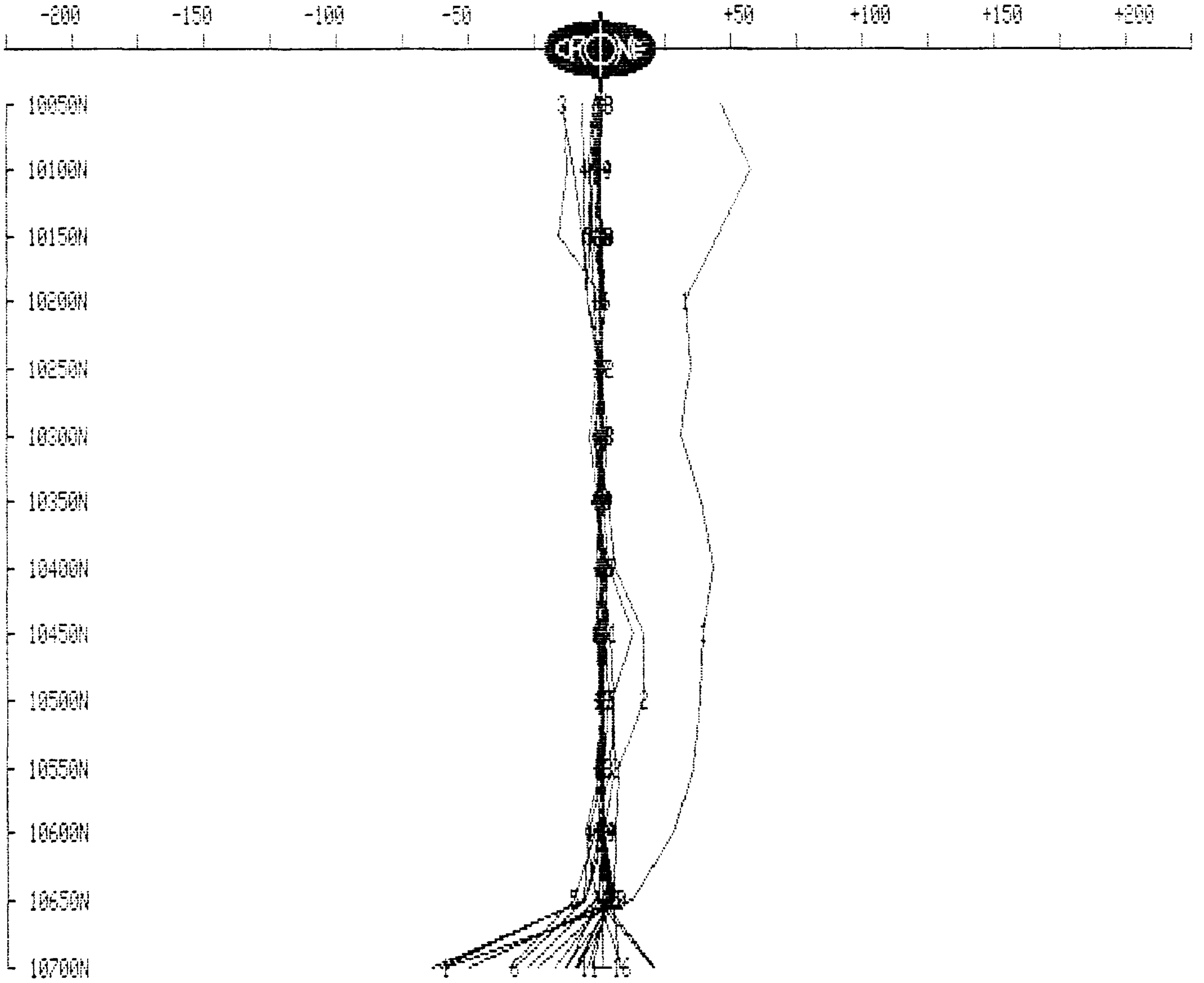
Scale: 1:5000
Unit Scale: 1cm = 25 nT/s



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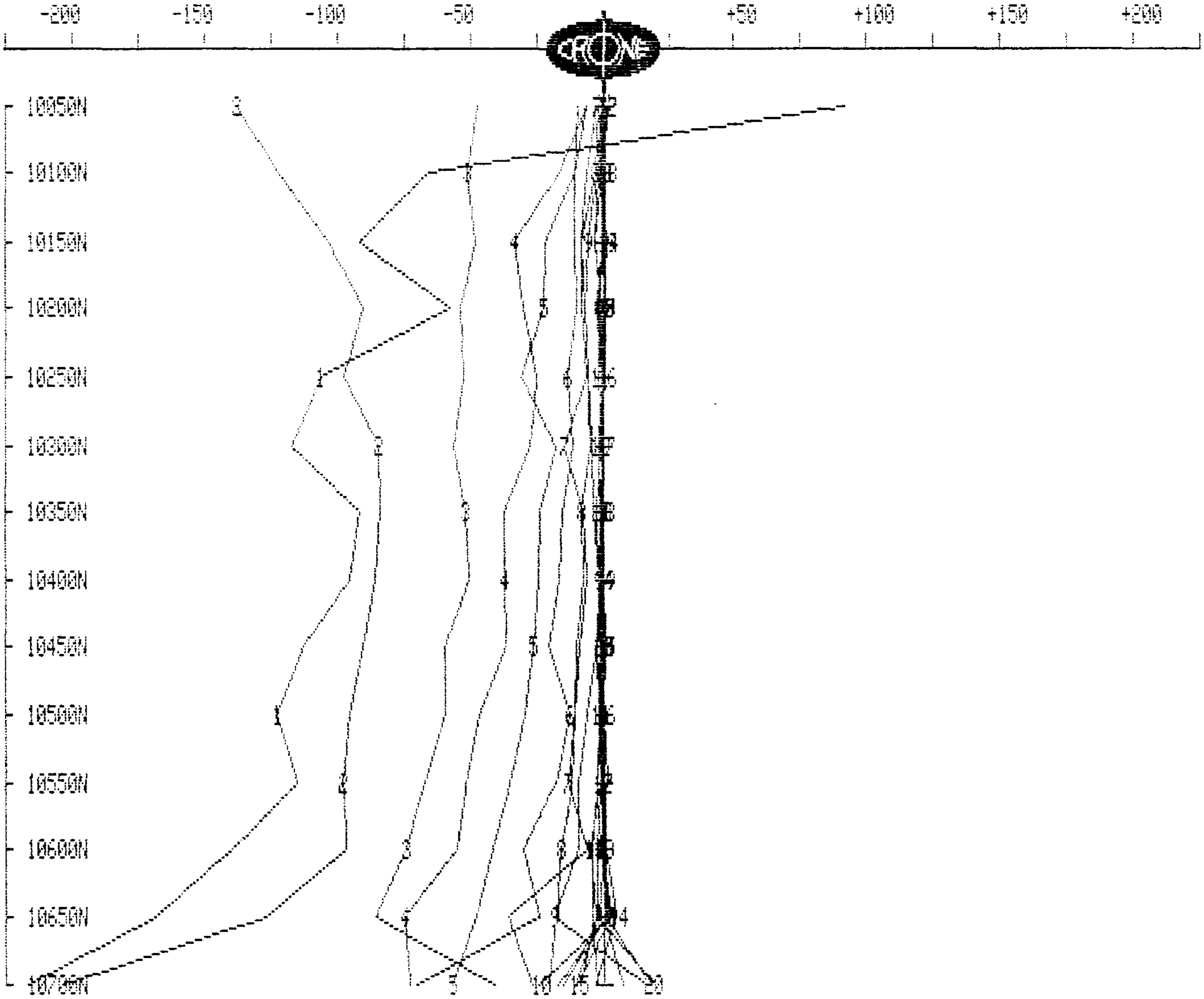
Grid	: BOOT-BAY	Tx Loop	: 8
Date	: Mar 30, 1992	File name	: L6950W8.PEM

VERTICAL COMPONENT dBz/dt nanoTesla/sec - 20 channels

Scale: 1:5000 Unit Scale: 1cm = 25 nT/s



CRONE GEOPHYSICS & EXPLORATION LTD

SURFACE PEM

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Grid : BOOT-BAY
Date : Mar 28, 1992

Line : 6828W
Tx Loop : 7
File name : L6828W7.PEM

IN-LINE HORIZONTAL COMPONENT dBx/dt nanoTesla/sec - 20 channels

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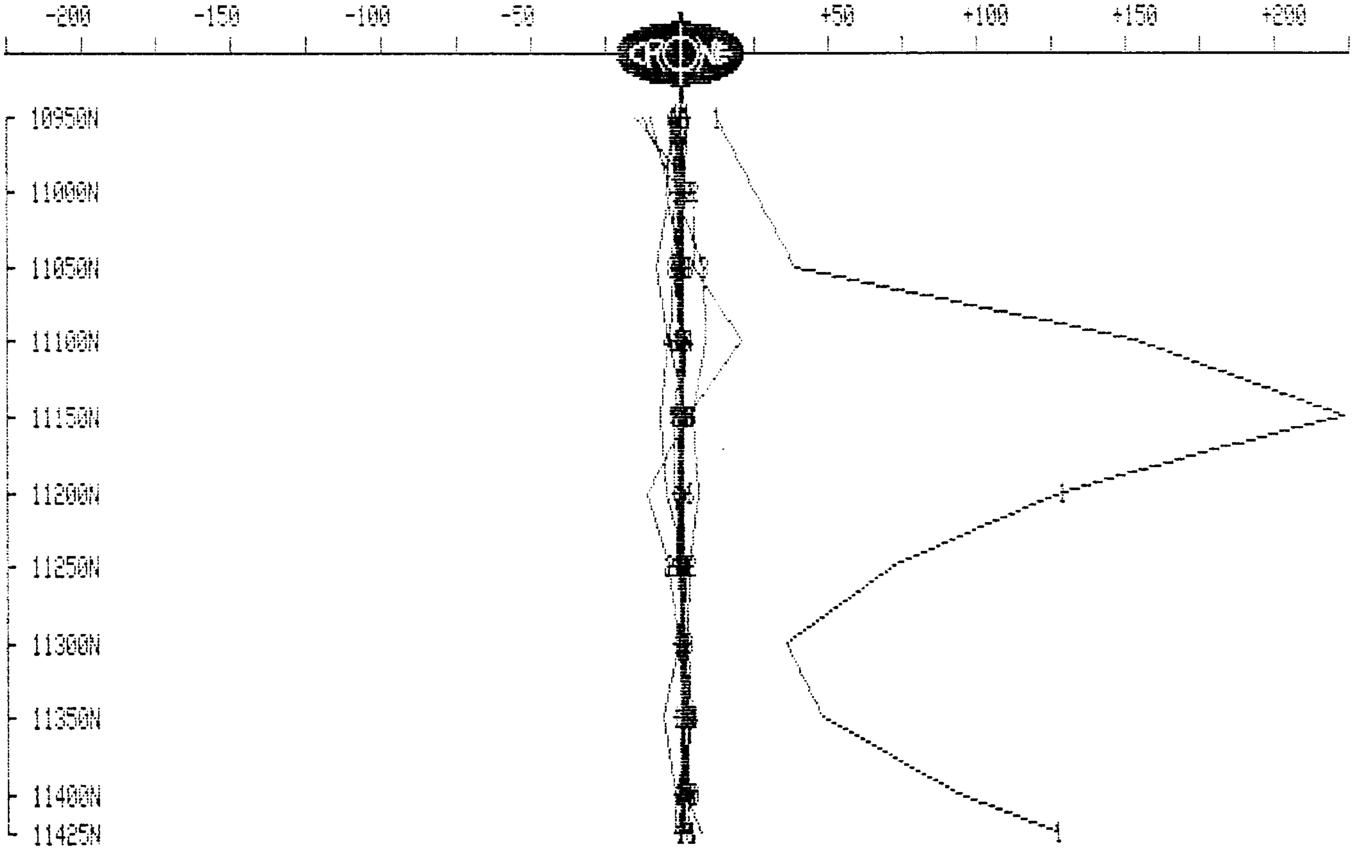
Unit Scale: 1cm = 25 nT/s



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SURFACE PEM

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Grid : BOOT-BAY
Date : Mar 28, 1992

Line : 6828W
Tx Loop : 7
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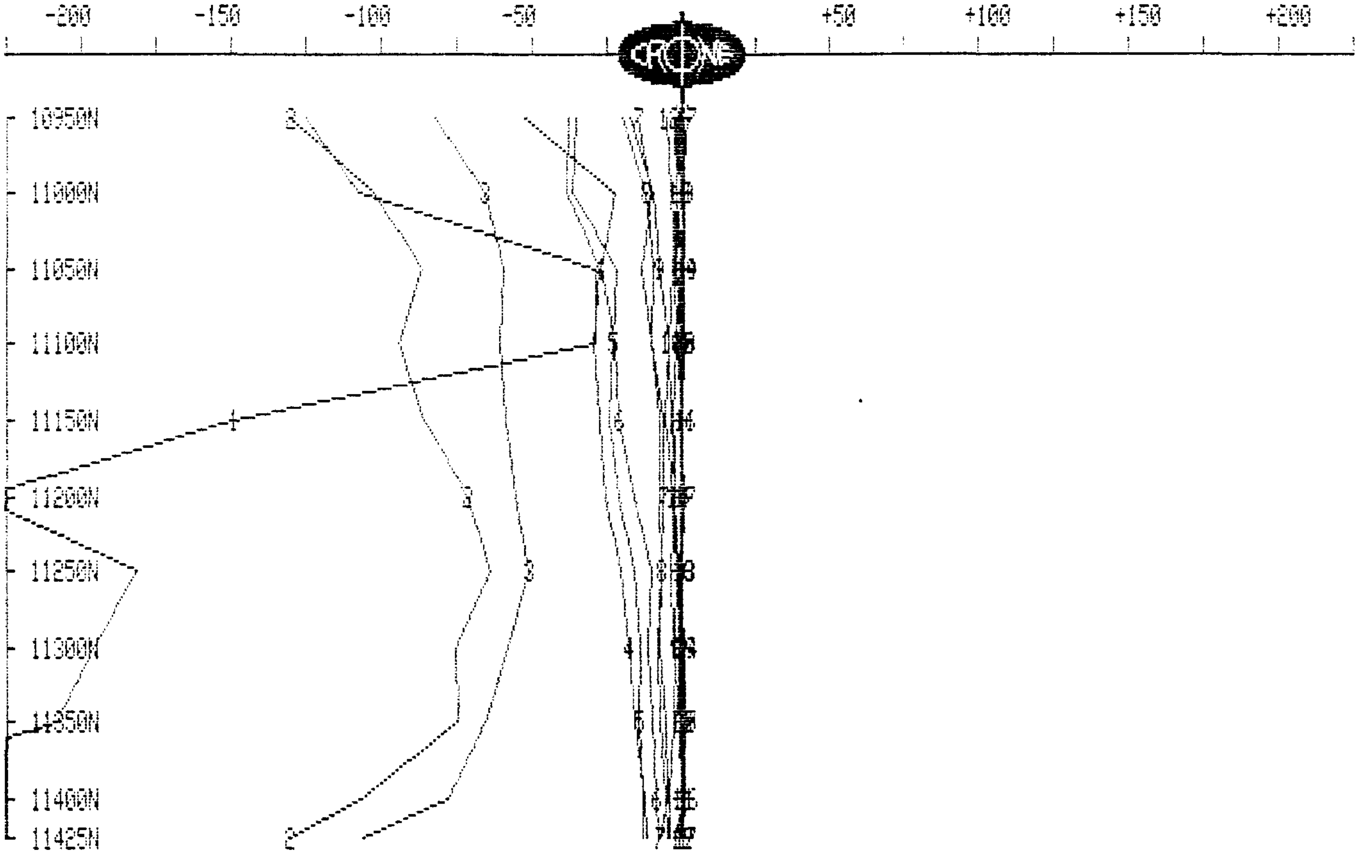
VERTICAL COMPONENT dBz/dt nanoTesla/sec - 20 channels

Scale: 1:5000

Unit Scale: 1cm = 25 nT/s



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SURFACE PEM

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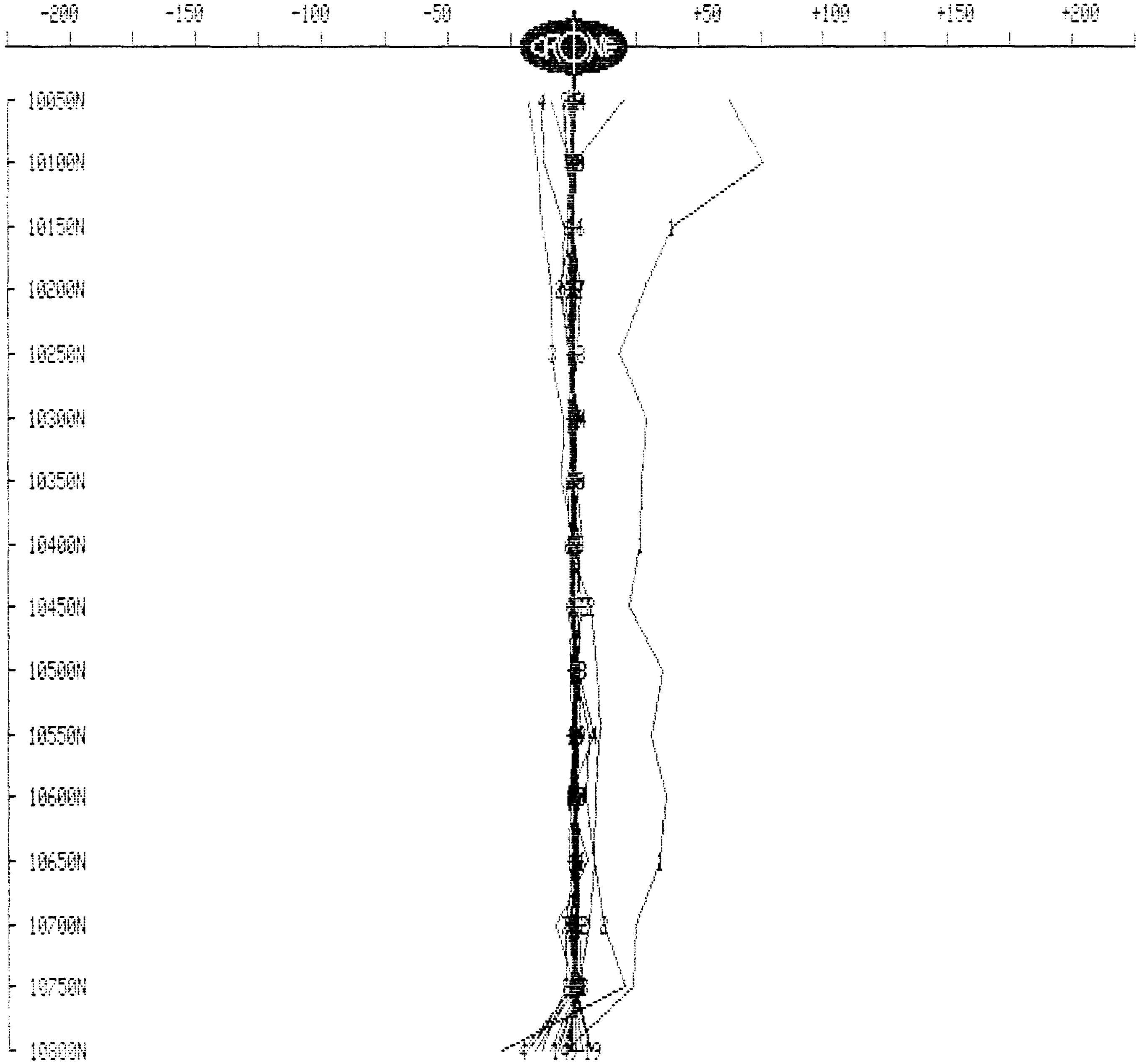
Grid	: BOOT-BAY	Tx Loop	: 8
Date	: Mar 30, 1992	File name	: L6828W8.PEM

IN-LINE HORIZONTAL COMPONENT dBx/dt nanoTesla/sec - 20 channels

Scale: 1:5000 Unit Scale: 1cm = 25 nT/s



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Grid : BOOT-BAY
Date : Mar 30, 1992

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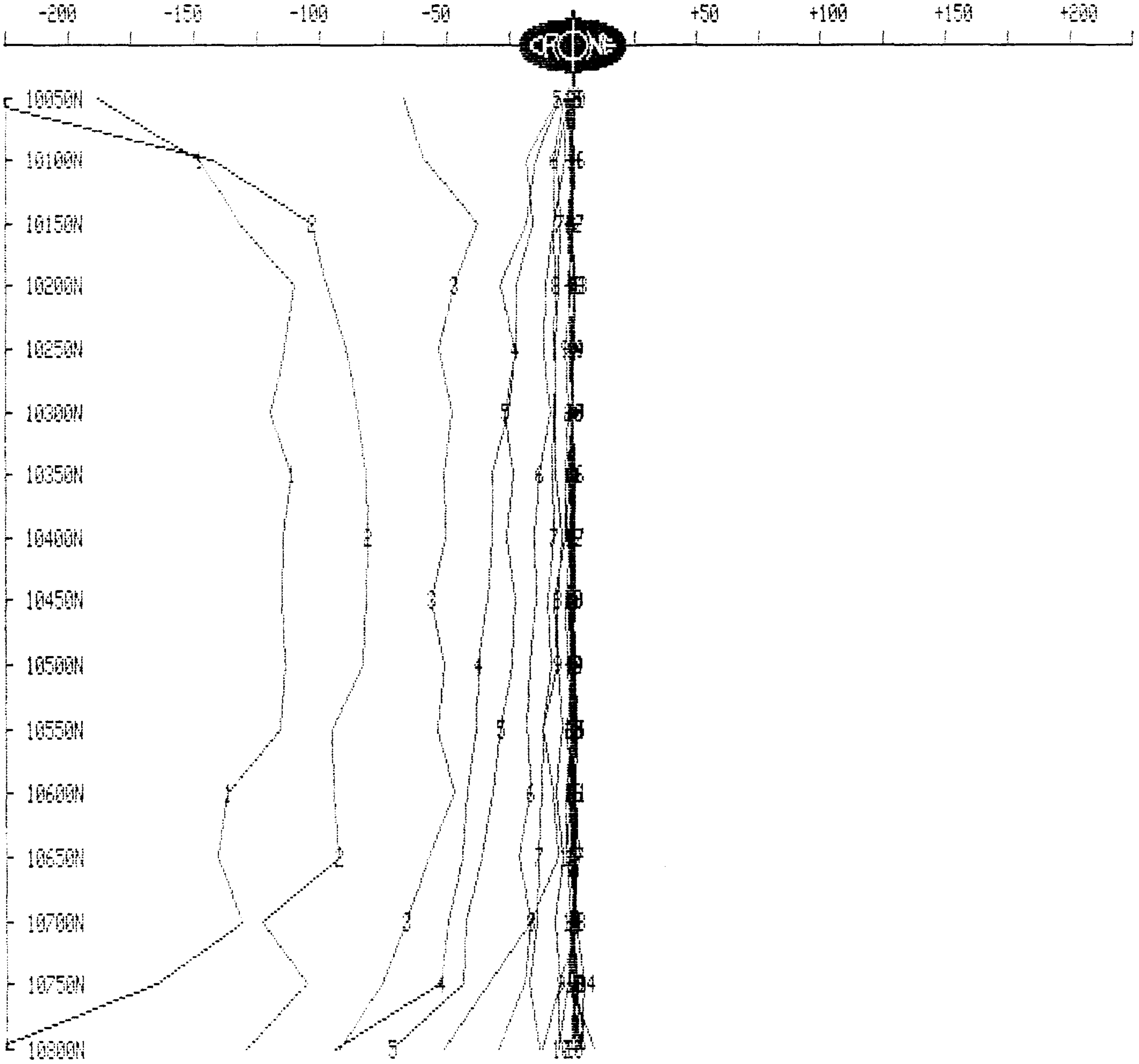
Scale: 1:5000

Unit Scale: 1cm = 25 nT/s



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SURFACE PEM

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Grid : BOOT-BAY
Date : Mar 28, 1992

Line : 6706W
Tx Loop : 7
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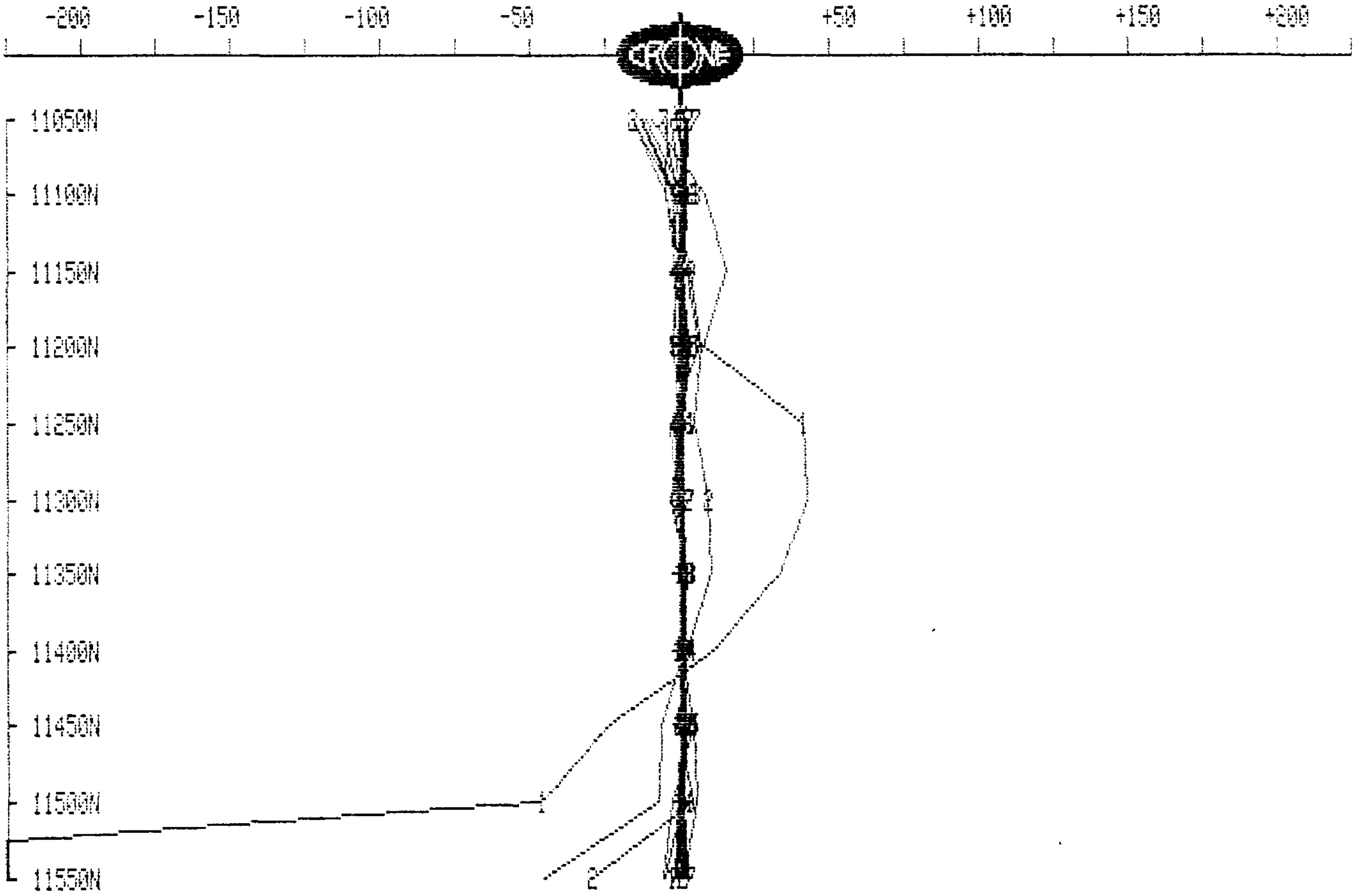
Unit Scale: 1cm = 25 nT/s



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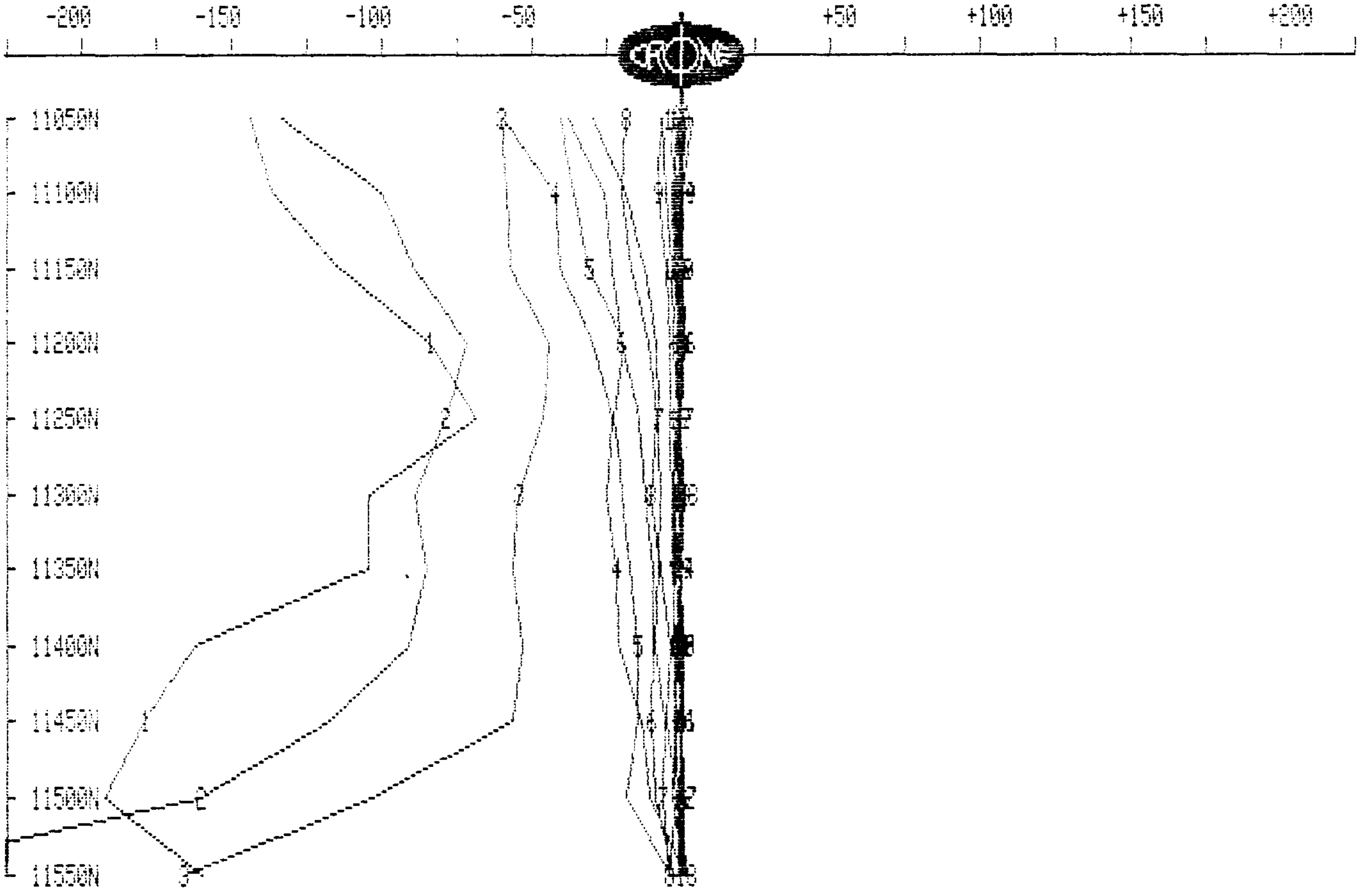
Unit Scale: 1cm = 25 nT/s



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Tx Loop : 8
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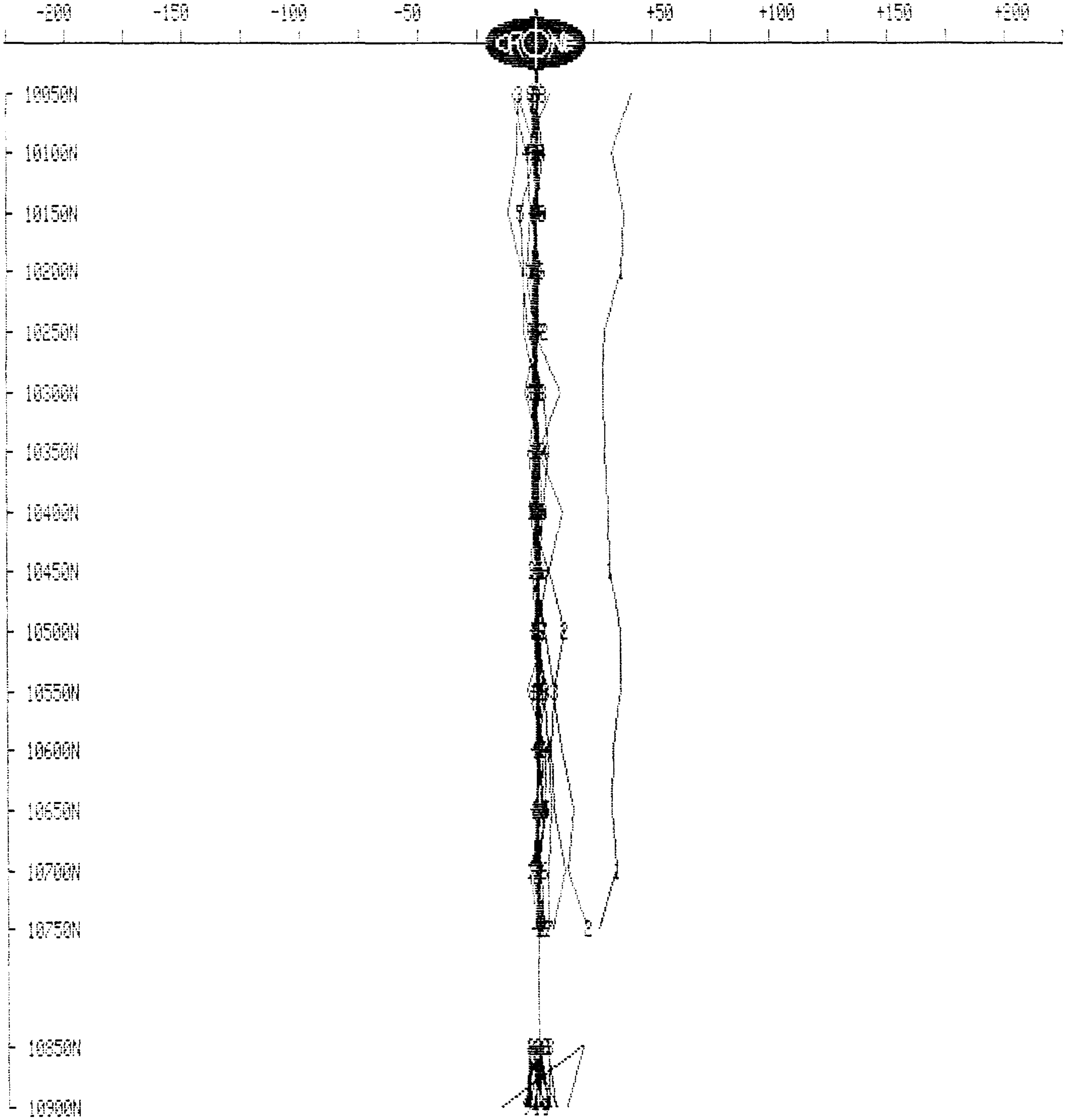
IN-LINE HORIZONTAL COMPONENT dBx/dt nanoTesla/sec - 20 channels

Scale: 1:5000

Unit Scale: 1cm = 25 nT/s



CRONE GEOPHYSICS & EXPLORATION LTD
SURFACE PEM

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Grid : **BOOT-BAY**
Date : Mar 30, 1992

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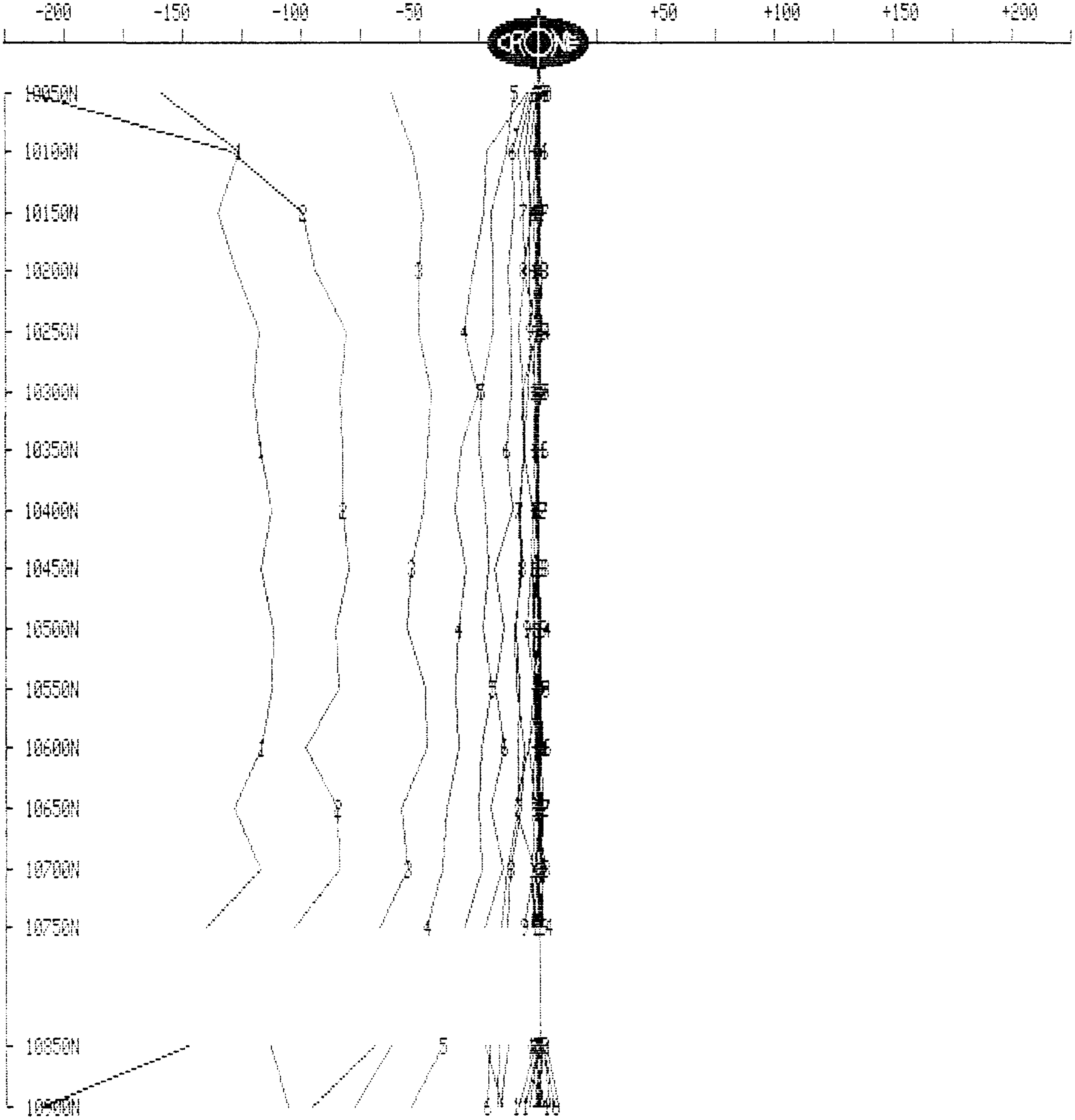
Unit Scale: 1cm = 25 nT/s



CRONE GEOPHYSICS & EXPLORATION LTD

SURFACE PEM

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Grid : BOOT-BAY
Date : Mar 28, 1992

Line : 6584W
Tx Loop : 7
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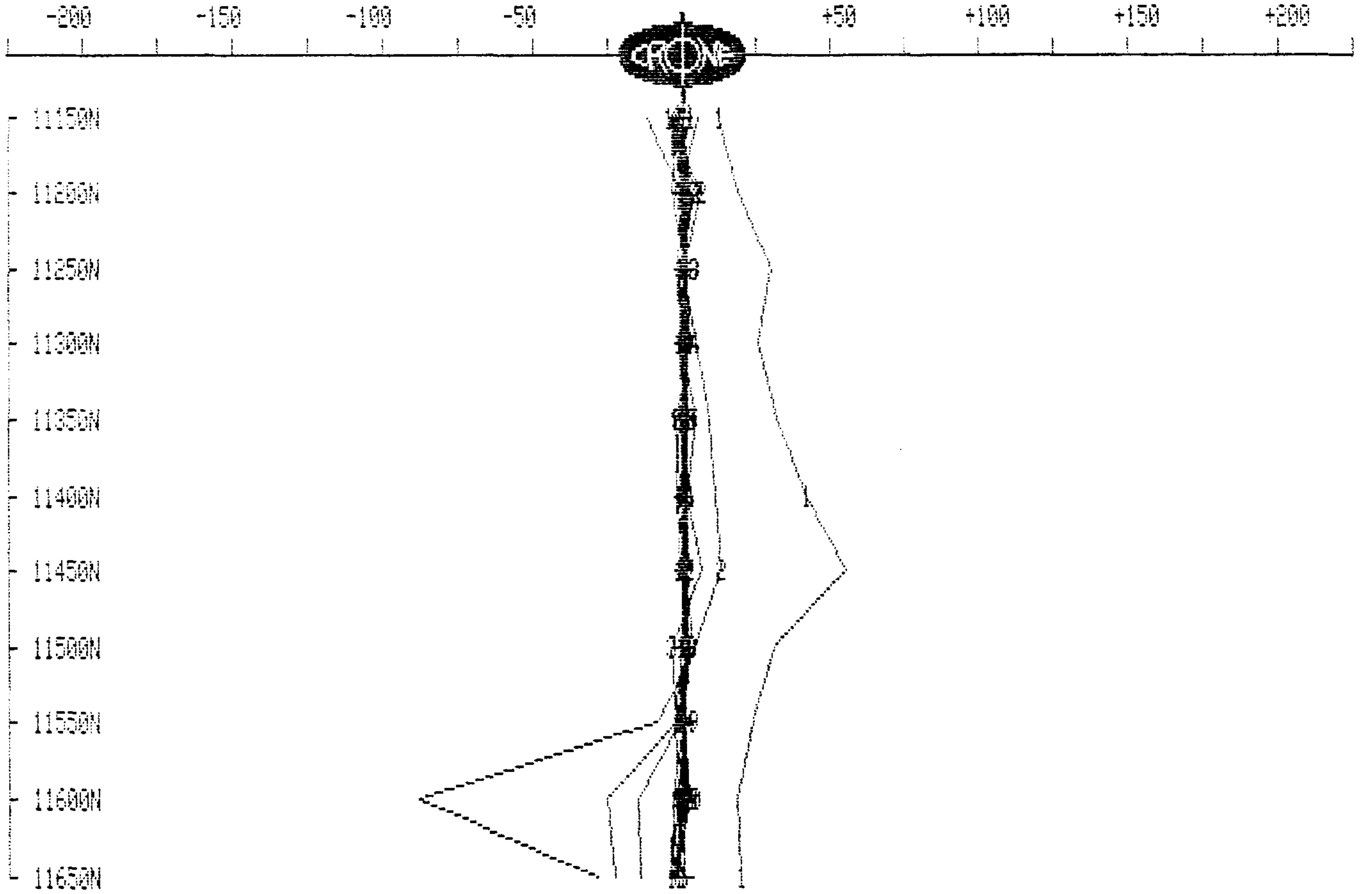
IN-LINE HORIZONTAL COMPONENT dBx/dt nanoTesla/sec - 20 channels

Scale: 1:5000

Unit Scale: 1cm = 25 nT/s



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Date	: Mar 28, 1992	File name	: L6584W7.PEM

VERTICAL COMPONENT dBz/dt nanoTesla/sec - 20 channels

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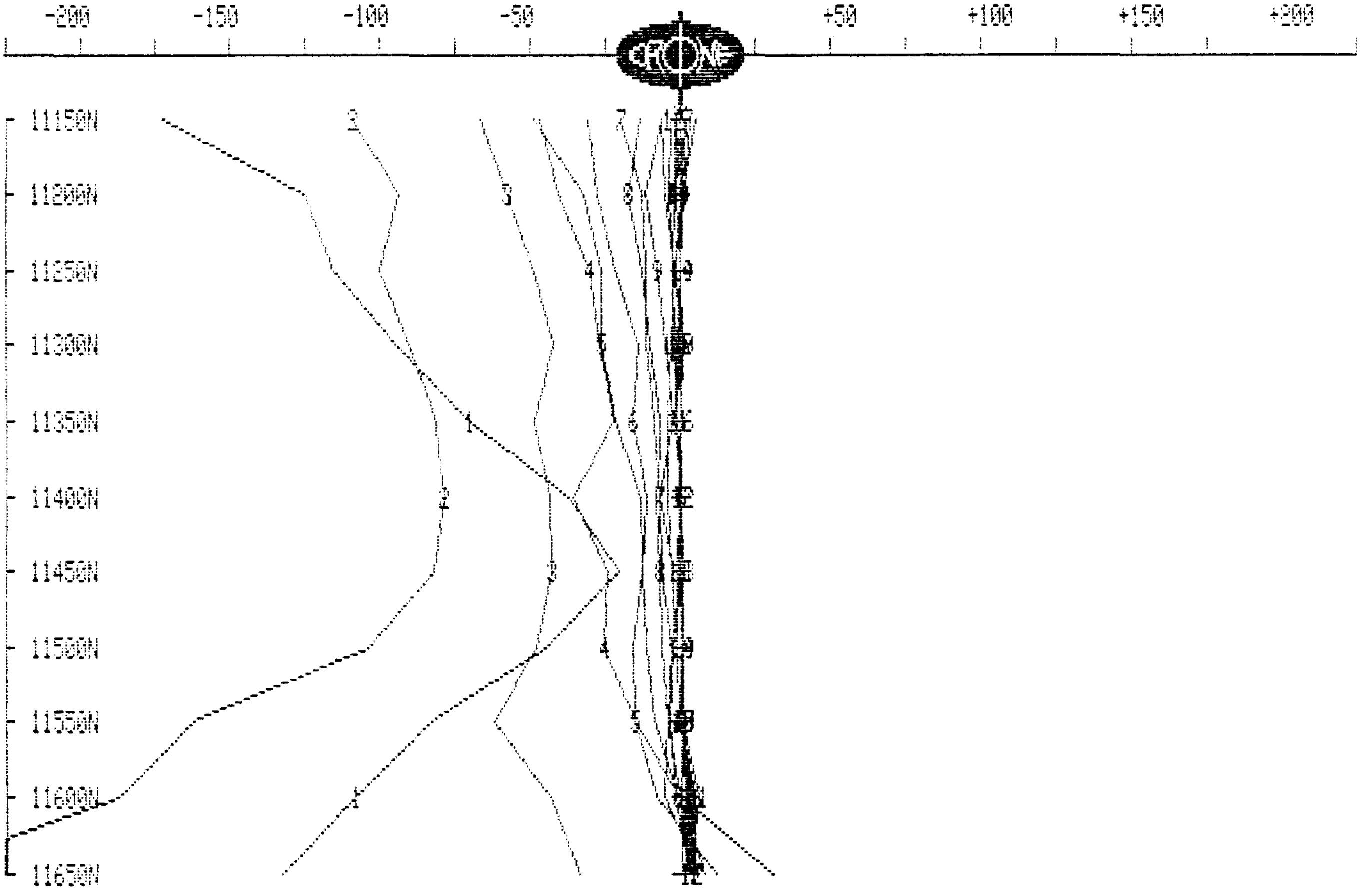
Unit Scale: 1cm = 25 nT/s



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Grid : BOOT-BAY
Date : Mar 30, 1992

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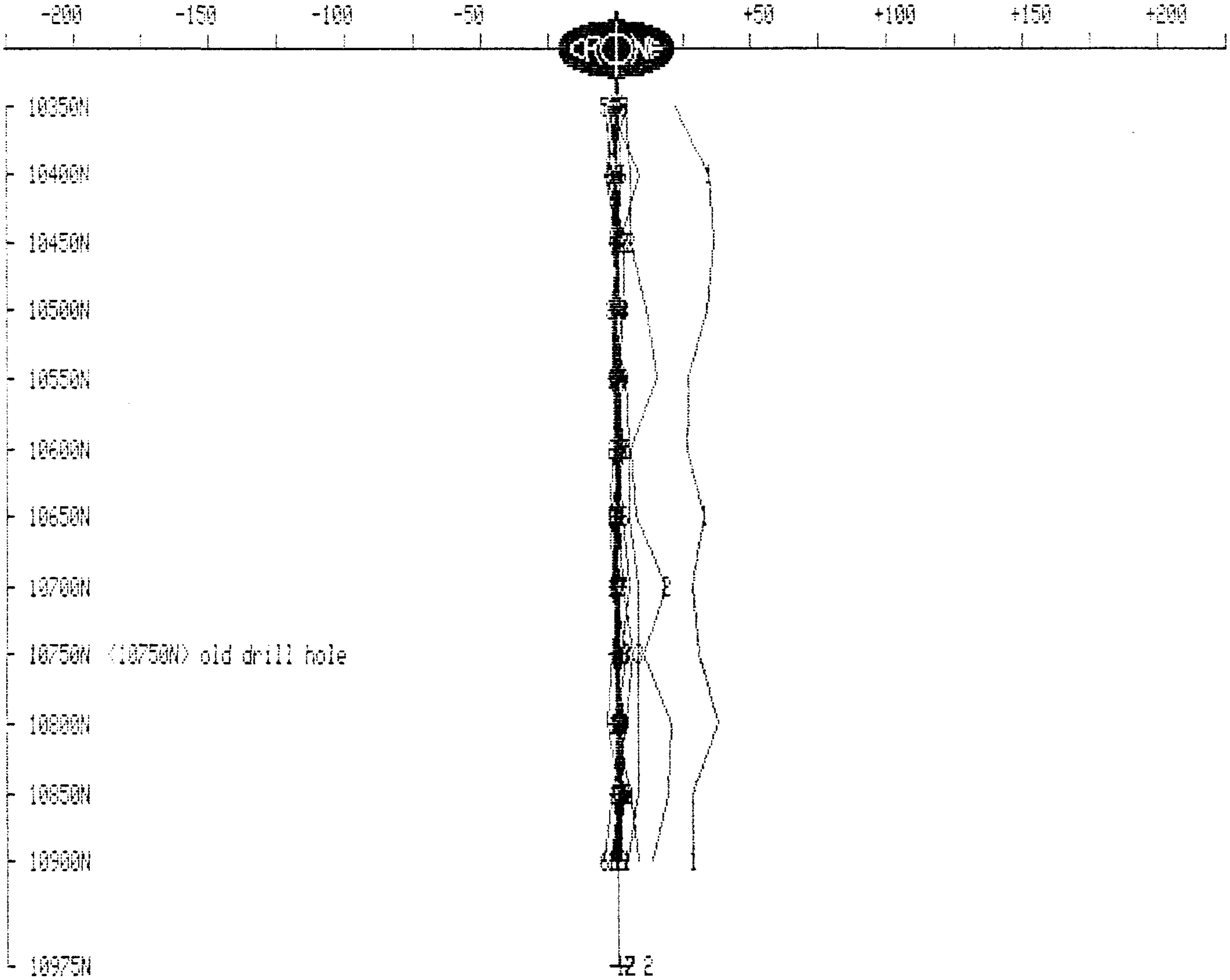

CRONE GEOPHYSICS & EXPLORATION LTD

SURFACE PEM

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Grid : BOOT-BAY
Date : Mar 30, 1992

Line : 6584W
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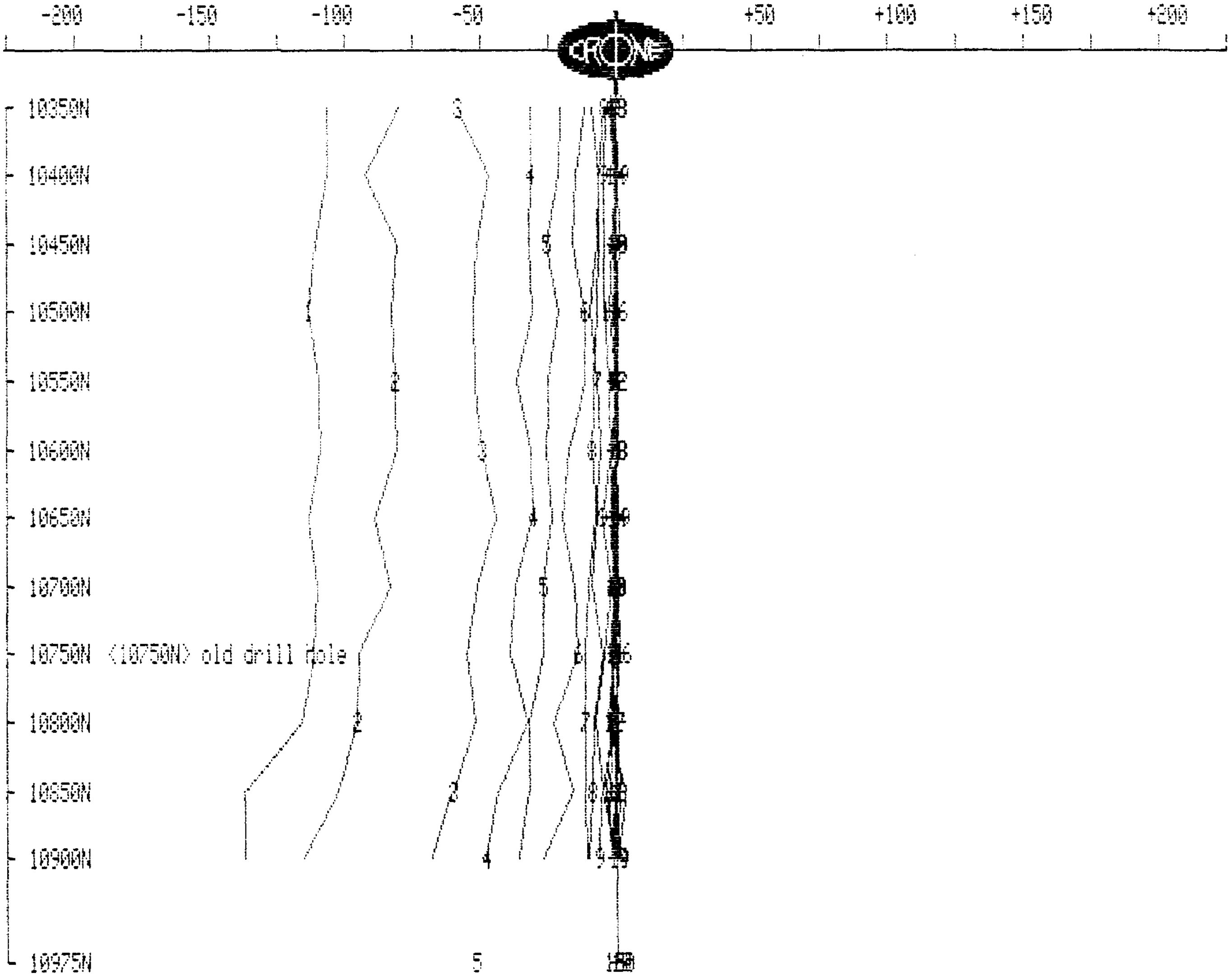

FALCONBRIGE LIMITED EXPLORATION

2.15 [illegible]

GEOLOGY OF THE MANDERSTROM PROPERTY ASSESSMENT REPORT

May 28, 1993

STRATHY TOWNSHIP
SUDBURY MINING DIVISON
NTS 31M/5

Ovd 2.14013

CHELMSFORD OFFICE

JEAN-DENIS FOURNIER

SUMMARY

This report describes the work performed on the Manderstrom property, from May 5th to 17th 1993, by Falconbridge Limited.

The property consists of five claims numbered S38943 to S38947.

The work consists of line-cutting (8.93 Km) and geological mapping at a scale of 1:2000.

The subaqueous pillowed basaltic sequence, interbedded with felsic volcanics is considered a favourable target for volcanic hosted massive sulphide deposits.

Ground magnetic and electromagnetic geophysical surveys are recommended.

TABLE OF CONTENTS

LIST OF FIGURES AND MAPS

MANDERSTROM CLAIM BLOCK

INTRODUCTION

Purpose of the Report

The purpose of this document is to outline the work performed by Falconbridge Limited on the Manderstrom claim group in 1993. The report describes the nature of the work performed and summarizes the results obtained.

Location Access and Physiography

The property is located in Strathy Township approximately three kilometre due northwest of the townsite of Temagami (Fig. 1).
Access to the property is excellent. It is crossed by a paved road which joins Highway 11 one kilometre to the east of the property. It is also cut by a gas pipeline, a power line and an abandonned railroad line (Fig. 1).

The physiography of the property consists of gently rolling hills and ridges. The higher areas are covered with coniferous and mixed forests whereas the low lying areas are covered with cedar swamps and marshes.

Bedrock exposure is less than 5%, however the distribution of outcrops throughout is evenly scattered and provides a good overview of the geology.

Property Definition

The Manderstrom claim block consists of 5 claims listed below (Fig. 2). All claims are owned by Falconbridge Limited. Although a significant amount of work was devoted to the locating of claim posts and property boundaries, many posts could not be found. It appears that a number of the missing posts may have been destroyed by cultural activities such as logging, housing development and pipe line construction. Posts which were found are plotted on Map.1.

Manderstrom claims: S 38943
S 38944
S 38945
S 38946
S 38947

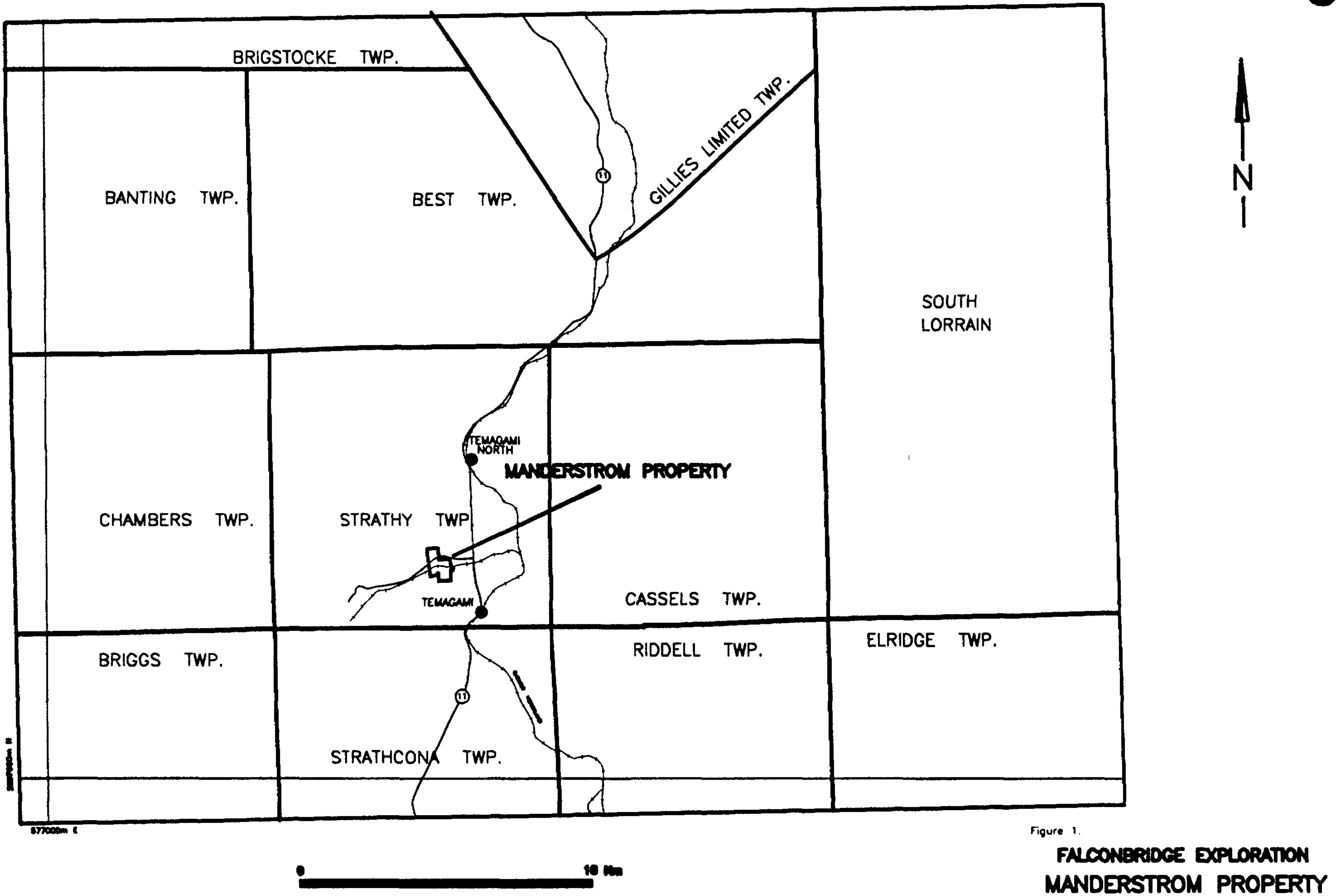

Figure 1.

FALCONBRIDGE EXPLORATION

MANDERSTROM PROPERTY

PROPERTY LOCATION MAP

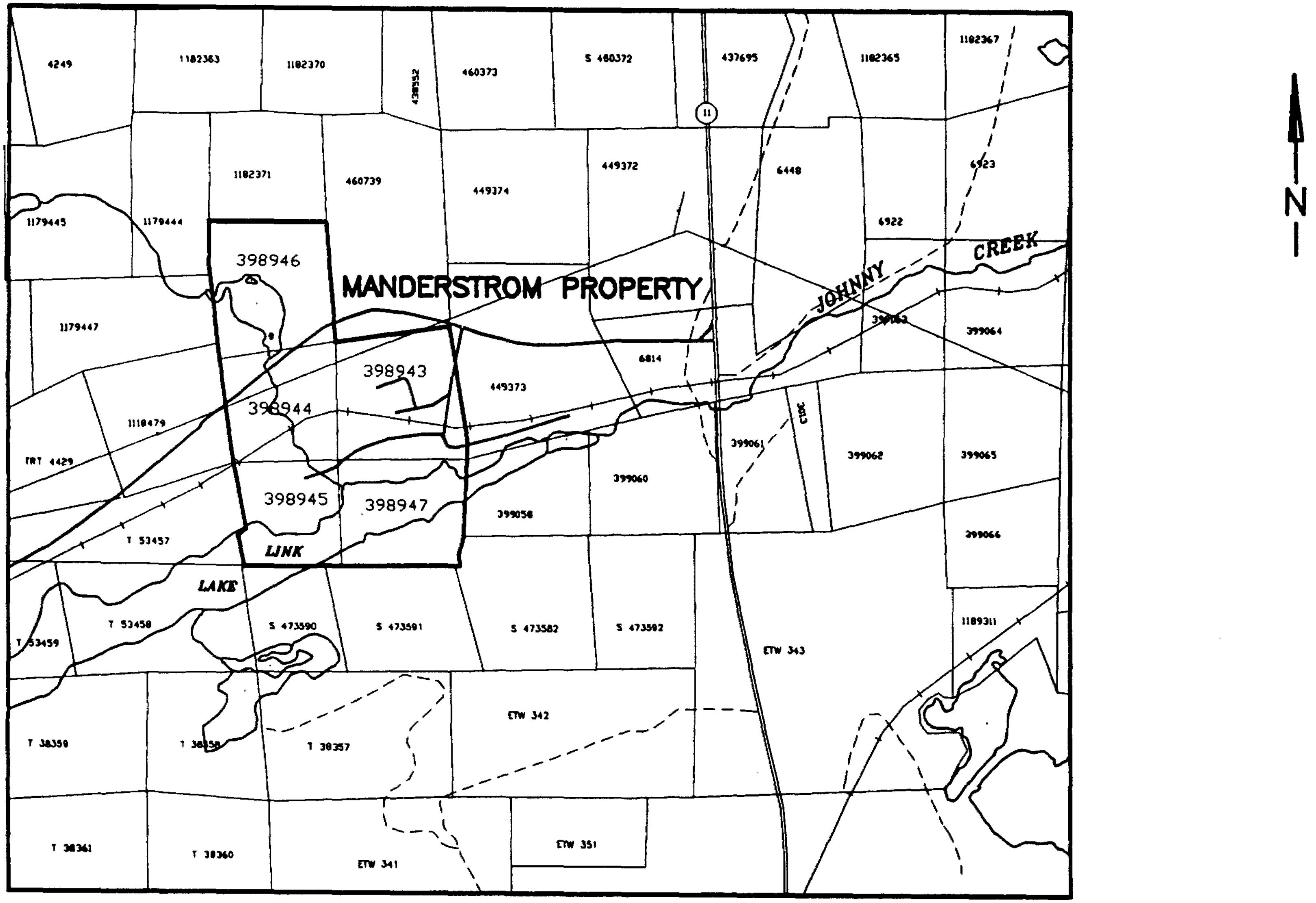

Figure 2.

FALCONBRIDGE EXPLORATION
MANDERSTROM PROPERTY
CLAIM MAP

1993 Program

In the spring of 1993 a grid was cut over the entire property. The base-line was cut along the power line. Cross lines spaced 100 metres were oriented perpendicular to the base-line at 340 degrees. Tie lines, parallel to the base line, were cut every 400 metres. A total of 8.93 line kilometres were cut on the property. The linecutting was contracted to N. McBride Staking and Line Cutting of Notre Dame du Nord. The entire area was geologically mapped at a scale of 1:2000. Field supervision of the line cutting and mapping were performed by Jean-Denis Fournier, Senior Field Geologist with Falconbridge Limited, with assistance from Kevin Wells, summer student. All work was completed between May 5 and 17, 1993. James K. Cecchetto, Project Geologist with Falconbridge Limited, supervised the project.

History of Exploration

Regional geological studies which covered the area included the work of Moorehouse (1942), Bennett (1978) and Fyon and Crocket (1986).

The most significant mineral occurence on the property is the gold, silver Milne showing which has been trenched in the past. Geological and geophysical surveys which covered the claim group were conducted by Hollinger Mines in 1978 and Maralgo Mines in 1956.

GEOLOGY

Regional Geology

The geology of The Strathy Township is summarized in the work of Fyon and Crocket (1986) as follows: " The volcano-sedimentary stratigraphy of Strathy Township is informally subdivided into two terranes which are called the Older and Younger volcanic complexes. The Younger Volcanic Complex has been subdivided into four formations: 1) a lower iron-rich, tholeiitic basalt cycle; 2) a calc-alkaline cycle consisting of basalt/andesite flows and felsic pyroclastic deposits; 3) a clastic sedimentary sequence; and 4) an upper, iron rich, tholeiitic basalt cycle. Oxide facies iron formations occur at the top of both the Older and Younger Volcanic Complexes." Subdivisions 1) and 2), which overly the Manderstrom property, were respectively named by these authors the Arsenic Lake and Link Lake formations.

Property Geology and Mineralization

The property is underlain mostly by Archean metavolcanic rocks of the Link Lake and Arsenic Lake formations as defined by Fyon and Crocket (1986). A northwesterly striking diabase dike crosscuts the property. The metamorphic grade of the property is greenschist.

The northern half of the property, up to about 2+00N (grid coordinates), is underlain by rocks of the Arsenic Lake Formation. The unit consists mostly of pillowed to massive mafic volcanic flows. Primary features such as pillows, pillow breccia, hyaloclastites and amygdules are well preserved and display no major evidence of structural deformation. The rocks are weakly to moderately carbonatized and locally silicified. The alteration is mostly pervasive, however it is usually stronger along pillow selvages, porous clasts and other similar porous channelways. Mineralization consists of disseminated pyrite most commonly along pillow selvages, giving the selvages a rusty appearance.

Overlying the Arsenic Lake formation (to the south) is a complex package of fine grained mafic intrusives, felsic volcanics and mafic volcanics which corresponds to the Link Lake Formation (Fyon and Crocket, 1986).

The fine grained mafic intrusive rocks are most common near the contact zone between the two formations. The unit is dark green, feldspar porphyritic (<1mm) and weakly to moderately carbonatized along fracture planes.

The felsic rocks on the property can be divided into two groups.

The most northerly group forms an irregular band roughly parallel to and located along the base line. Felsic rocks within this group are mostly quartz-phyric (2-3mm quartz eyes) and massive. Irregular contact relationships and diking by similar material elsewhere in the Arsenic Lake formation suggest that this unit may be intrusive.

The southern group of felsic rocks is exposed along and south of the railroad line (Map.1). The unit consists mostly of felsic fragmental, with rhyolite and pumice clasts (1-5cm). Due to the proximity of the Link Lake Shear Zone, the unit has developed a strong foliation associated with moderate silicification and sericitization. Carbonatization is weak to moderate and fracture controlled. The foliation strikes parallel to the shear zone at 075 to 085 degrees and a flattening ratio between 3:1 and 6:1 can be estimated from clast elongation. The unit is weakly (usually <1%) mineralized with pyrite. The pyrite occurs as disseminations and as preferential replacement of clasts within the fragmental unit.

The southern group of felsic rocks mentioned above is overlain by pillowed and fragmental mafic volcanics. These rocks are moderately to strongly silicified. The best exposure of silicified pillowed mafics is along the south shore of Link Lake. Amygdules, when present are generally filled with silica and/or calcite. Disseminated pyrite, up to 1%, occurs in the more strongly silicified areas.

A northwesterly ternding diabase dike crosscuts the property. The unit is coarse grained, equigranular, magnetite rich and unaltered. The dike has a hornfelsed halo (not exceeding 50m wide) characterized by the presence of fine biotite and a depletion of the otherwise almost ubiquitous calcite. The dike is probably part of the Proterozoic Sudburry Dike swarm.

BIBLIOGRAPHY

Bennett, G., Geology of the Northeast Temegami Area; Ontario Geological Survey Report 163, 1978.

Fyon, A.J., Crocket, J.H., Exploration Potential for Base and Precious Metal Mineralization in Part of Strathy Township, Temagami Area; Ontario Geological Survey, Open File Report 5991, 1986.

Moorhouse, W.M., The Northeastern portion of the Timagami Lake Area; Ontario department of Mines, Volume 51, 1942.

APPENDIX I

SUMMARY OF EXPENDITURES

SUMMARY OF EXPENDITURES

Line-Cutting	
8.93 Km @ $220.00 / Km	$1964.60
Geological Mapping and Sampling	
Senior Field Geologist 10 Days @ $250.00 / Day	$2500.00
Junior Field Assistant 10 Days @ $150.00 / Day.	$1500.00
TOTAL	$5964.60

APPENDIX II

STATEMENT OF QUALIFICATIONS

STATEMENT OF QUALIFICATIONS

I, Jean-Denis Fournier, of Winnipeg , Manitoba hereby certify that:

1. I graduated from the university of Alberta in 1987 with Bachelor of Science Degree with Specialization in Geology Degree.
2. I am employed as Senior Field Geologist with Falconbridge Limited.
3. Since graduation I have been practising my profession in Canada and overseas.
4. I have no financial interests in the Manderstrom claim group.
5. I personally conducted or supervised the work described in this report.

Dated at SUDBURY this 28Th day of MAY 1993

Jean-Denis Fournier

900

Ontario

Ministry of
Northern Development
and Mines

Ministère du
Développement du Nord
et des Mines

~~Geoscience Approvals Section~~
933 Ramsey Lake Road
6th Floor
Sudbury, Ontario
P3E 6B5

Telephone: (705) 670-5853
Fax: (705) 670-5863

Our File: 2.15112
Transaction #: W9370.00043
: W9370.00045

September 10, 1993

Mining Recorder
Ministry of Northern
Development and Mines
933 Ramsey Lake Road
3rd Floor
Sudbury, Ontario
P3E 6B5

Dear Sir:

RE: APPROVAL OF ASSESSMENT WORK ON MINING CLAIMS S 398943 ET AL. IN STRATHY AND CASSELS TOWNSHIPS.

The Assessment Credits for GEOLOGY and GEOPHYSICS, sections 12, and 14 of the Mining Act Regulations, as listed on the above reports of work, have been approved.

The approval date for W9370.00045 is August 9, 1993 and for W9370.00043 it is August 30, 1993.

Please indicate this approval on the claim record sheets.

If you have any questions please call Clive Stephenson at (705) 670-5856.

Yours sincerely,

Ron C. Gashinski
Senior Manager, Mining Lands Section
Mining and Land Management Branch
Mines and Minerals Division

CDS/dm

cc: Assessment Files Office
Toronto, Ontario

Resident Geologist
Cobalt, Ontario

W.J.

Ministry of Northern Development and Mines
Ontario

Report of Work Conducted After Recording Claim

Mining Act

Transaction Number
W9370.00043

2.15112

Personal information collected on this form is obtained under the authority of the Mining Act. This information will be used for correspondence. Questions about this collection should be directed to the Provincial Manager, Mining Lands, Ministry of Northern Development and Mines, Fourth Floor, 159 Cedar Street, Sudbury, Ontario, P3E 6A5, telephone (705) 670-7264.

Instructions:
- Please type or print and submit in duplicate.
- Refer to the Mining Act and Regulations for requirements of filing assessment work or consult the Mining Recorder.
- A separate copy of this form must be completed for each Work Group.
- Technical reports and maps must accompany this form in duplicate.
- A sketch, showing the claims the work is assigned to, must accompany this form.

Recorded Holder(s): FALCONBRIDGE LIMITED
Client No.: 130 679
Address: SUITE 1200, 95 WELLINGTON STREET W. TORONTO
Telephone No.: 416-956-5700
Mining Division: SUDBURY
Township/Area: STRATHY/CASSELS
M or G Plan No.: G-3415/G-3451
Dates Work Performed From: MARCH 6/92 To: APRIL 2/92

Work Performed (Check One Work Group Only)

	Work Group	Type
☑	Geotechnical Survey	-GRID CUTTING -GROUND ELECTROMAGNETIC (PEM) GEOPHYSICAL SURVEY
☐	Physical Work, Including Drilling	
☐	Rehabilitation	
☐	Other Authorized Work	
☐	Assays	
☐	Assignment from Reserve	

RECEIVED
JUL 27 1993
MINING LANDS BRANCH

0153

RECORDED
MAY 11 1993
Receipt — W.J.

Total Assessment Work Claimed on the Attached Statement of Costs $ 32,172.99

Note: The Minister may reject for assessment work credit all or part of the assessment work submitted if the recorded holder cannot verify expenditures claimed in the statement of costs within 30 days of a request for verification.

Persons and Survey Company Who Performed the Work (Give Name and Address of Author of Report)

Name	Address
NORM McBRIDE - LINE CUTTING	BOX 112, NOTRE DAME DU NORD, QUEBEC J0Z 3B0
CRONE GEOPHYSICS J. McNIBL (SURVEY) D. WATSON (REPORT)	CRONE GEOPHYSICS, 3607 WOLFDALE RD. MISSISSAUGA, ONT L5C 1V8
S. KORMOS (FALCONBRIDGE) - ASSESSMENT REPORT	FALCONBRIDGE EXPLORATION, GENERAL DELIVERY, 1977
	McKENZIE ROAD, R.R. #2 CHELMSFORD, ONT P0M 1L0

(attach a schedule if necessary)

Certification of Beneficial Interest * See Note No. 1 on reverse side

I certify that at the time the work was performed, the claims covered in this work report were recorded in the current holder's name or held under a beneficial interest by the current recorded holder.

Date: May 11, 1993
Recorded Holder or Agent (Signature): David P. Money

Certification of Work Report

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

Name and Address of Person Certifying: STEVE KORMOS GENERAL DELIVERY, 1977 McKENZIE RD. R.R. #2 CHELMSFORD ONT.
Telepone No.: 705-855-0311
Date: APRIL 14/1993
Certified By (Signature): Steve Kormos

For Office Use Only

Total Value Cr. Recorded: $32,173-
Date Recorded: MAY 11, 1993
Mining Recorder:
Deemed Approval Date: August 9/93
Date Approved:
Date Notice for Amendments Sent:
Received Stamp: SUDBURY MINING DIV. RECEIVED MAY 11 1993 A.M. P.M.

Ontario

Ministry of
[illegible]hern Development
[illegible] Mines

Ministère du
Développement du Nord
et des mines

Statement of Costs for Assessment Credit

État des coûts aux fins du crédit d'évaluation

Mining Act/Loi sur les mines

Transaction No./N° de transaction W9370.00043

Personal information collected on this form is obtained under the authority of the **Mining Act**. *This information will be used to maintain a record and ongoing status of the mining claim(s). Questions about this collection should be directed to the Provincial Manager, Minings Lands, Ministry of Northern Development and Mines, 4th Floor, 159 Cedar Street, Sudbury, Ontario P3E 6A5, telephone (705) 670-7264.*

Les renseignements personnels contenus dans la présente formule sont recueillis en vertu de la **Loi sur les mines** et serviront à tenir à jour un registre des concessions minières. Adresser toute quesiton sur la collece de ces renseignements au chef provincial des terrains miniers, ministère du Développement du Nord et des Mines, 159, rue Cedar, 4e étage, Sudbury (Ontario) P3E 6A5, téléphone (705) 670-7264.

1. Direct Costs/Coûts directs

Type	Description	Amount Montant	Totals Total global
Wages Salaires	Labour (REPORT WRITING) Main-d'oeuvre	$500	
	Field Supervision Supervision sur le terrain	—	$500
Contractor's and Consultant's Fees Droits de l'entrepreneur et de l'expert-conseil	Type LINECUTTING	$9,520	
	GEOPHYSICS	$17,712.99	
	HELPERS (GEOPH. CREW)	$1,920	$29152.99
Supplies Used Fournitures utilisées	Type		
Equipment Rental Location de matériel	Type		
		Total Direct Costs Total des coûts directs	$29,652.99

2. Indirect Costs/Coûts indirects

** **Note:** When claiming Rehabilitation work Indirect costs are not allowable as assessment work.
Pour le remboursement des travaux de réhabilitation, les coûts indirects ne sont pas admissibles en tant que travaux d'évaluation.

Type	Description	Amount Montant	Totals Total global
Transportation Transport	Type		
Food and Lodging Nourriture et hébergement	2 WEEKS - GEOPHYSICS CREW	$2520	2520
Mobilization and Demobilization Mobilisation et démobilisation			
		Sub Total of Indirect Costs Total partiel des coûts indirects	2520
		Amount Allowable (not greater than 20% of Direct Costs) Montant admissible (n'excédant pas 20 % des coûts directs)	
		Total Value of Assessment Credit (Total of Direct and Allowable indirect costs) Valeur totale du crédit d'évaluation (Total des coûts directs et indirects admissibles)	$32,172.99

Note: The recorded holder will be required to verify expenditures claimed in this statement of costs within 30 days of a request for verification. If verification is not made, the Minister may reject for assessment work all or part of the assessment work submitted.

Note : Le titulaire enregistré sera tenu de vérifier les dépenses demandées dans le présent état des coûts dans les 30 jours suivant une demande à cet effet. Si la vérification n'est pas effectuée, le ministre peut rejeter tout ou une partie des travaux d'évaluation présentés.

Filing Discounts

1. Work filed within two years of completion is claimed at 100% of the above Total Value of Assessment Credit.
2. Work filed three, *four or five years after completion* is claimed at 50% of the above Total Value of Assessment Credit. See calculations below:

Total Value of Assessment Credit		Total Assessment Claimed
	× 0.50 =	

Remises pour dépôt

1. Les travaux déposés dans les deux ans suivant leur achèvement sont remboursés à 100 % de la valeur totale susmentionnée du crédit d'évaluation.
2. Les travaux *déposés trois, quatre ou cinq ans après leur achèvement* sont remboursés à 50 % de la valeur totale du crédit d'évaluation susmentionné. Voir les calculs ci-dessous.

Valeur totale du crédit d'évaluation		Évaluation totale demandée
	× 0,50 =	

Certification Verifying Statement of Costs

I hereby certify:
that the amounts shown are as accurate as possible and these costs were incurred while conducting assessment work on the lands shown on the accompanying Report of Work form.

that as STEVE KORMOS FIELD GEOLOGIST I am authorized
(Recorded Holder, Agent, Position in Company)

to make this certification

Attestation de l'état des coûts

J'atteste par la présente :
que les montants indiqués sont le plus exact possible et que ces dépenses ont été engagées pour effectuer les travaux d'évaluation sur les terrains indiqués dans la formule de rapport de travail ci-joint.

Et qu'à titre de ____________________ je suis autorisé
(titulaire enregistré, représentant, poste occupé dans la compagnie)

à faire cette attestation.

Signature	Date
	APRIL 14/93

Work Report Number for Applying Reserve	Claim Number (see Note 2)	Number of Claim Units	Value of Assessment Work Done on this Claim	Value Applied to this Claim	Value Assigned from this Claim	Reserve: Work to be Claimed at a Future Date
	STRATHY TWP. S1186032	1	709 ~~708.56~~	800.00	0	0
	S1186034	1	709 ~~708.56~~	800.00	0	0
	S1186038	1	709 ~~708.56~~	800.00	0	0
	CASSELS TWP. S494564	1	708.56	800.00	0	0
	S494565	1	708.56	800.00	0	0
	S494566	1	708.56	800.00	0	0
	S494567	1	708.56	800.00	0	0
	S494568	1	708.56	800.00	0	0
	S494569	1	708.56	800.00	0	0
	S494570	1	708.56	800.00	0	0
	S494571	1	708.56	800.00	0	0
	S494572	1	708.56	800.00	0	0
	S494573	1	708.56	800.00	0	0
	S494574	1	708.56	800.00	0	0
	S494575	1	708.56	800.00	0	0
	S494576	1	708.56	800.00	0	0
	S494577	1	708.56	800.00	0	0
	(CONT) Total Number of Claims		(CONT) Total Value Work Done	(CONT) Total Value Work Applied	(CONT) Total Assigned From	(CONT) Total Reserve

Credits you are claiming in this report may be cut back. In order to minimize the adverse effects of such deletions, please indicate from which claims you wish to priorize the deletion of credits. Please mark (✓) one of the following:

1. ☐ Credits are to be cut back starting with the claim listed last, working backwards.
2. ☐ Credits are to be cut back equally over all claims contained in this report of work.
3. ☐ Credits are to be cut back as priorized on the attached appendix.

In the event that you have not specified your choice of priority, option one will be implemented.

Note 1: Examples of beneficial interest are unrecorded transfers, option agreements, memorandum of agreements, etc., with respect to the mining claims.

Note 2: If work has been performed on patented or leased land, please complete the following:

Signature	Date

[illegible]

Work Report Number for Applying Reserve	Claim Number (see Note 2)	Number of Claim Units	Value of Assessment Work Done on this Claim	Value Applied to this Claim	Value Assigned from this Claim	Reserve: Work to be Claimed at a Future Date
	S494578	1	708.56	800.00	0	0
	S1186007	1	708.56	800.00	0	0
	S1186008	1	708.56	800.00	0	0
	S1186011	1	709 ~~708.56~~	800.00	0	0
	S1186012	1	709 ~~708.56~~	800.00	0	0
	S1186013	1	709 ~~708.56~~	800.00	0	0
	S1186014	1	709 ~~708.56~~	800.00	0	0
	S1186015	1	709 ~~708.55~~	800.00	0	0
	S1186016	1	709 ~~708.55~~	800.00	0	0
	S1186017	1	709 ~~708.55~~	800.00	0	0
	S1186018	1	709 ~~708.55~~	800.00	0	0
	S1186019	1	709 ~~708.55~~	800.00	0	0
	S1186020	1	709 ~~708.55~~	800.00	0	0
	S1186021	1	709 ~~708.55~~	800.00	0	0
	S1186022	1	709 ~~708.55~~	800.00	0	0
	S1186023	1	709 ~~708.55~~	800.00	0	0
	S1186024	1	709 ~~708.55~~	800.00	0	0
	(CONT) Total Number of Claims		(CONT) Total Value Work Done	(CONT) Total Value Work Applied	(CONT) Total Assigned From	(CONT) Total Reserve

Credits you are claiming in this report may be cut back. In order to minimize the adverse effects of such deletions, please indicate from which claims you wish to priorize the deletion of credits. Please mark (✓) one of the following:

1. ☐ Credits are to be cut back starting with the claim listed last, working backwards.
2. ☐ Credits are to be cut back equally over all claims contained in this report of work.
3. ☐ Credits are to be cut back as priorized on the attached appendix.

In the event that you have not specified your choice of priority, option one will be implemented.

Note 1: **Examples of beneficial interest are unrecorded transfers, option agreements, memorandum of agreements, etc., with respect to the mining claims.**

Note 2: ***If work has been performed on patented or leased land, please complete the following:***

I certify that the recorded holder had a beneficial interest in the patented or leased land at the time the work was performed	Signature	Date

Work Report Number for Applying Reserve	Claim Number (see Note 2)	Number of Claim Units	Value of Assessment Work Done on this Claim	Value Applied to this Claim	Value Assigned from this Claim	Reserve: Work to be Claimed at a Future Date
	S1186025	1	709 ~~708.55~~	400.00	309 ~~308.55~~	0
	S1186026	1	709 ~~708.55~~	400.00	309 ~~308.55~~	0
	S1186027	1	709 ~~708.55~~	400.00	309 ~~308.55~~	0
	S1186028	1	709 ~~708.55~~	400.00	309 ~~308.55~~	0
	S1186029	1	709 ~~708.55~~	400.00	309 ~~308.55~~	0
	S1186030	1	709 ~~708.55~~	400.00	309 ~~308.55~~	0
	S1186031	1	709 ~~708.55~~	400.00	309 ~~308.55~~	0
	S1186033	1	709 ~~708.55~~	400.00	308.55	0
	S1186035	1	708.55	400.00	308.55	0
	S1186036	1	997 ~~996.55~~	688.00	309 ~~308.55~~	0
	S1186037	1	708.56	684.99	23.56	0
			32,173	32,173		
	45		~~32,172.99~~	~~32,172.99~~	3,111 ~~3,109.06~~	0
	Total Number of Claims		Total Value Work Done	Total Value Work Applied	Total Assigned From	Total Reserve

Credits you are claiming in this report may be cut back. In order to minimize the adverse effects of such deletions, please indicate from which claims you wish to priorize the deletion of credits. Please mark (✓) one of the following:

1. ☐ Credits are to be cut back starting with the claim listed last, working backwards.
2. ☐ Credits are to be cut back equally over all claims contained in this report of work.
3. ☐ Credits are to be cut back as priorized on the attached appendix.

In the event that you have not specified your choice of priority, option one will be implemented.

Note 1: Examples of beneficial interest are unrecorded transfers, option agreements, memorandum of agreements, etc., with respect to the mining claims.

Note 2: If work has been performed on patented or leased land, please complete the following:

I certify that the recorded holder had a beneficial interest in the patented	Signature	Date

Ministry of Northern Development and Mines
Ontario
Ministère du Développement du Nord et des mines

Statement of Costs for Assessment Credit
État des coûts aux fins du crédit d'évaluation

Mining Act/Loi sur les mines

Transaction No./N° de transaction
W9370.00043

Personal information collected on this form is obtained under the authority of the **Mining Act**. This information will be used to maintain a record and ongoing status of the mining claim(s). Questions about this collection should be directed to the Provincial Manager, Minings Lands, Ministry of Northern Development and Mines, 4th Floor, 159 Cedar Street, Sudbury, Ontario P3E 6A5, telephone (705) 670-7264.

Les renseignements personnels contenus dans la présente formule sont recueillis en vertu de la **Loi sur les mines** et serviront à tenir à jour un registre des concessions minières. Adresser toute quesiton sur la collece de ces renseignements au chef provincial des terrains miniers, ministère du Développement du Nord et des Mines, 159, rue Cedar, 4e étage, Sudbury (Ontario) P3E 6A5, téléphone (705) 670-7264.

1. Direct Costs/Coûts directs

Type	Description	Amount Montant	Totals Total global
Wages Salaires	Labour (REPORT WRITING) Main-d'oeuvre	$500	
	Field Supervision Supervision sur le terrain	—	$500
Contractor's and Consultant's Fees Droits de l'entrepreneur et de l'expert-conseil	Type LINECUTTING	$9,520	
	GEOPHYSICS	$17,712.99	
	HELPERS (GEOPH. CREW)	$1,920	$29152.99
Supplies Used Fournitures utilisées	Type		
Equipment Rental Location de matériel	Type		

Total Direct Costs
Total des coûts directs $29,652.99

2. Indirect Costs/Coûts indirects

** Note: When claiming Rehabilitation work Indirect costs are not allowable as assessment work.
Pour le remboursement des travaux de réhabilitation, les coûts indirects ne sont pas admissibles en tant que travaux d'évaluation.

Type	Description	Amount Montant	Totals Total global
Transportation Transport	Type		
Food and Lodging Nourriture et hébergement	2 WEEKS - GEOPHYSICS CREW	$2520	2520
Mobilization and Demobilization Mobilisation et démobilisation			

Sub Total of Indirect Costs
Total partiel des coûts indirects 2520

Amount Allowable (not greater than 20% of Direct Costs)
Montant admissible (n'excédant pas 20 % des coûts directs)

Total Value of Assessment Credit (Total of Direct and Allowable Indirect costs)
Valeur totale du crédit d'évaluation (Total des coûts directs et indirects admissibles) $32,172.99

Note: The recorded holder will be required to verify expenditures claimed in this statement of costs within 30 days of a request for verification. If verification is not made, the Minister may reject for assessment work all or part of the assessment work submitted.

Note : Le titulaire enregistré sera tenu de vérifier les dépenses demandées dans le présent état des coûts dans les 30 jours suivant une demande à cet effet. Si la vérification n'est pas effectuée, le ministre peut rejeter tout ou une partie des travaux d'évaluation présentés.

Filing Discounts

1. Work filed within two years of completion is claimed at 100% of the above Total Value of Assessment Credit.
2. Work filed three, four or five years after completion is claimed at 50% of the above Total Value of Assessment Credit. See calculations below:

Total Value of Assessment Credit		Total Assessment Claimed
	× 0.50 =	

Remises pour dépôt

1. Les travaux déposés dans les deux ans suivant leur achèvement sont remboursés à 100 % de la valeur totale susmentionnée du crédit d'évaluation.
2. Les travaux déposés trois, quatre ou cinq ans après leur achèvement sont remboursés à 50 % de la valeur totale du crédit d'évaluation susmentionné. Voir les calculs ci-dessous.

Valeur totale du crédit d'évaluation		Évaluation totale demandée
	× 0,50 =	

Certification Verifying Statement of Costs

I hereby certify:
that the amounts shown are as accurate as possible and these costs were incurred while conducting assessment work on the lands shown on the accompanying Report of Work form.

that as STEVE KORMOS FIELD GEOLOGIST I am authorized
(Recorded Holder, Agent, Position in Company)

to make this certification

Attestation de l'état des coûts

J'atteste par la présente :
que les montants indiqués sont le plus exact possible et que ces dépenses ont été engagées pour effectuer les travaux d'évaluation sur les terrains indiqués dans la formule de rapport de travail ci-joint.

Et qu'à titre de ______________________ je suis autorisé
(titulaire enregistré, représentant, poste occupé dans la compagnie)

à faire cette attestation.

Signature

Date APRIL 14/93

Nota : Dans cette formule, lorsqu'il désigne des personnes, le masculin est utilisé au sens neutre.

Ministry of Northern Development and Mines

Ontario

Report of Work Conducted After Recording Claim

Mining Act

Transaction Number

W9370.00045

Personal information collected on this form is obtained under the authority of the Mining Act. This information will be used for correspondence. Questions about this collection should be directed to the Provincial Manager, Mining Lands, Ministry of Northern Development and Mines, Fourth Floor, 159 Cedar Street, Sudbury, Ontario, P3E 6A5, telephone (705) 670-7264.

2.15112

Instructions:
- Please type or print and submit in duplicate.
- Refer to the Mining Act and Regulations for requirements of filing assessment work or consult the Mining Recorder.
- A separate copy of this form must be completed for each Work Group.
- Technical reports and maps must accompany this form in duplicate.
- A sketch, showing the claims the work is assigned to, must accompany this form.

Recorded Holder(s) FALCONBRIDGE LIMITED		Client No. 130 679
Address SUITE 1200, 95 WELLINGTON STREET W TORONTO		Telephone No. 416-956-5700
Mining Division SUDBURY	Township/Area STRATHY	M or G Plan No. G3451
Dates Work Performed From: MAY-05-1993	To: MAY-17-1993	

Work Performed (Check One Work Group Only)

	Work Group	Type
✓	Geotechnical Survey	- GRID CUTTING - GEOLOGICAL MAPPING
☐	Physical Work, Including Drilling	
☐	Rehabilitation	
☐	Other Authorized Work	
☐	Assays	
☐	Assignment from Reserve	

RECEIVED
JUL 27 1993
MINING LANDS BRANCH

RECORDED
MAY 28 1993
Receipt

Total Assessment Work Claimed on the Attached Statement of Costs $ 5964.60

Note: The Minister may reject for assessment work credit all or part of the assessment work submitted if the recorded holder cannot verify expenditures claimed in the statement of costs within 30 days of a request for verification.

Persons and Survey Company Who Performed the Work (Give Name and Address of Author of Report)

Name	Address
NORM McBRIDE - GRID CUTTING	BOX 112, NOTRE DAME DU NORD, QUEBEC J0Z 3B0
JEAN-DENIS FOURNIER (FALCONBRIDGE) - GEOL MAPPING - REPORT	FALCONBRIDGE LIMITED EXPLORATION, GENERAL DELIVERY
	1977 McKENZIE ROAD, RR#2, CHELMSFORD, ONT, P0M 1L0

(attach a schedule if necessary)

Certification of Beneficial Interest * See Note No. 1 on reverse side

I certify that at the time the work was performed, the claims covered in this work report were recorded in the current holder's name or held under a beneficial interest by the current recorded holder.	Date May 28, 1993	Recorded Holder or Agent (Signature) David P. Money

Certification of Work Report

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

Name and Address of Person Certifying

JEAN-DENIS FOURNIER, GENERAL DELIVERY, 1977 McKENZIE RD, RR#2, CHELMSFORD ONT P0M 1L0

Telepone No. 705-855-0311	Date MAY-28-1993	Certified By (Signature)

For Office Use Only

Total Value Cr. Recorded 84,000	Date Recorded MAY 28, 1993	Mining Recorder	Received Stamp
	Deemed Approval Date AUGUST 26, 1993	Date Approved	
	Date Notice for Amendments Sent		

SUDBURY
MINING DIV.
RECEIVED
MAY 28 1993
A.M. P.M.
7|8|9|10|11|12|1|2|3|4|5|6

4:10 mlt

0241 (03/91)

Work Report Number for Applying Reserve	Claim Number (see Note 2)	Number of Claim Units	Value of Assessment Work Done on this Claim	Value Applied to this Claim	Value Assigned from this Claim	Reserve: Work to be Claimed at a Future Date
	S 398943	1	1231.~~20~~	800.00		431.~~20~~
	S 398944	1	~~1169.60~~ 1170	800.00		~~369.60~~ 370
	S 398945	1	~~1147.60~~ 1148	800.00		~~347.60~~ 348
	S 398946	1	1253.~~20~~	800.00		453.~~20~~
	S 398947	1	1163.~~90~~	800.00		363.~~90~~
			5,965			1,965
			~~5964.60~~	4000.00		~~1964.60~~
	Total Number of Claims		Total Value Work Done	Total Value Work Applied	Total Assigned From	Total Reserve

Credits you are claiming in this report may be cut back. In order to minimize the adverse effects of such deletions, please indicate from which claims you wish to priorize the deletion of credits. Please mark (✓) one of the following:

1. ☐ Credits are to be cut back starting with the claim listed last, working backwards.
2. ☑ Credits are to be cut back equally over all claims contained in this report of work.
3. ☐ Credits are to be cut back as priorized on the attached appendix.

In the event that you have not specified your choice of priority, option one will be implemented.

Note 1: Examples of beneficial interest are unrecorded transfers, option agreements, memorandum of agreements, etc., with respect to the mining claims.

Note 2: If work has been performed on patented or leased land, please complete the following:

I certify that the recorded holder had a beneficial interest in the patented or leased land at the time the work was performed.	Signature	Date

Ontario

Ministry of
Northern Development
and Mines

[illegible]ère du
D[illegible]ppement du Nord
et des mines

Statement of Costs for Assessment Credit

État des coûts aux fins du crédit d'évaluation

Mining Act/Loi sur les mines

Transaction No./N° de transaction
W9370.00045

Personal information collected on this form is obtained under the authority of the **Mining Act**. This information will be used to maintain a record and ongoing status of the mining claim(s). Questions about this collection should be directed to the Provincial Manager, Minings Lands, Ministry of Northern Development and Mines, 4th Floor, 159 Cedar Street, Sudbury, Ontario P3E 6A5, telephone (705) 670-7264.

Les renseignements personnels contenus dans la présente formule sont recueillis en vertu de la **Loi sur les mines** et serviront à tenir à jour un registre des concessions minières. Adresser toute quesiton sur la collece de ces renseignements au chef provincial des terrains miniers, ministère du Développement du Nord et des Mines, 159, rue Cedar, 4e étage, Sudbury (Ontario) P3E 6A5, téléphone (705) 670-7264.

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1. Direct Costs/Coûts directs

Type	Description	Amount Montant	Totals Total global
Wages Salaires	Labour Main-d'oeuvre	4000.00	
	Field Supervision Supervision sur le terrain		4000.00
Contractor's and Consultant's Fees Droits de l'entrepreneur et de l'expert-conseil	Type LINE CUTTING	1964.60	
			1964.60
Supplies Used Fournitures utilisées	Type		
Equipment Rental Location de matériel	Type		

Total Direct Costs Total des coûts directs 5964.60

2. Indirect Costs/Coûts indirects

** Note: When claiming Rehabilitation work Indirect costs are not allowable as assessment work.
Pour le remboursement des travaux de réhabilitation, les coûts indirects ne sont pas admissibles en tant que travaux d'évaluation.

Type	Description	Amount Montant	Totals Total global
Transportation Transport	Type		
Food and Lodging Nourriture et hébergement			
Mobilization and Demobilization Mobilisation et démobilisation			

Sub Total of Indirect Costs Total partiel des coûts indirects

Amount Allowable (not greater than 20% of Direct Costs) Montant admissible (n'excédant pas 20 % des coûts directs)

Total Value of Assessment Credit (Total of Direct and Allowable Indirect costs) **Valeur totale du crédit d'évaluation (Total des coûts directs et indirects admissibles)**

Note: The recorded holder will be required to verify expenditures claimed in this statement of costs within 30 days of a request for verification. If verification is not made, the Minister may reject for assessment work all or part of the assessment work submitted.

Note : *Le titulaire enregistré sera tenu de vérifier les dépenses demandées dans le présent état des coûts dans les 30 jours suivant une demande à cet effet. Si la vérification n'est pas effectuée, le ministre peut rejeter tout ou une partie des travaux d'évaluation présentés.*

Filing Discounts

1. Work filed within two years of completion is claimed at 100% of the above Total Value of Assessment Credit.
2. Work filed three, four or five years after completion is claimed at 50% of the above Total Value of Assessment Credit. See calculations below:

Total Value of Assessment Credit × 0.50 = Total Assessment Claimed

Remises pour dépôt

1. Les travaux déposés dans les deux ans suivant leur achèvement sont remboursés à 100 % de la valeur totale susmentionnée du crédit d'évaluation.
2. Les travaux déposés trois, quatre ou cinq ans après leur achèvement sont remboursés à 50 % de la valeur totale du crédit d'évaluation susmentionné. Voir les calculs ci-dessous.

Valeur totale du crédit d'évaluation × 0,50 = Évaluation totale demandée

Certification Verifying Statement of Costs

I hereby certify:
that the amounts shown are as accurate as possible and these costs were incurred while conducting assessment work on the lands shown on the accompanying Report of Work form.

that as SENIOR FIELD GEOLOGIST I am authorized
(Recorded Holder, Agent, Position in Company)

to make this certification

Attestation de l'état des coûts

J'atteste par la présente :
que les montants indiqués sont le plus exact possible et que ces dépenses ont été engagées pour effectuer les travaux d'évaluation sur les terrains indiqués dans la formule de rapport de travail ci-joint.

Et qu'à titre de ____________ je suis autorisé
(titulaire enregistré, représentant, poste occupé dans la compagnie)

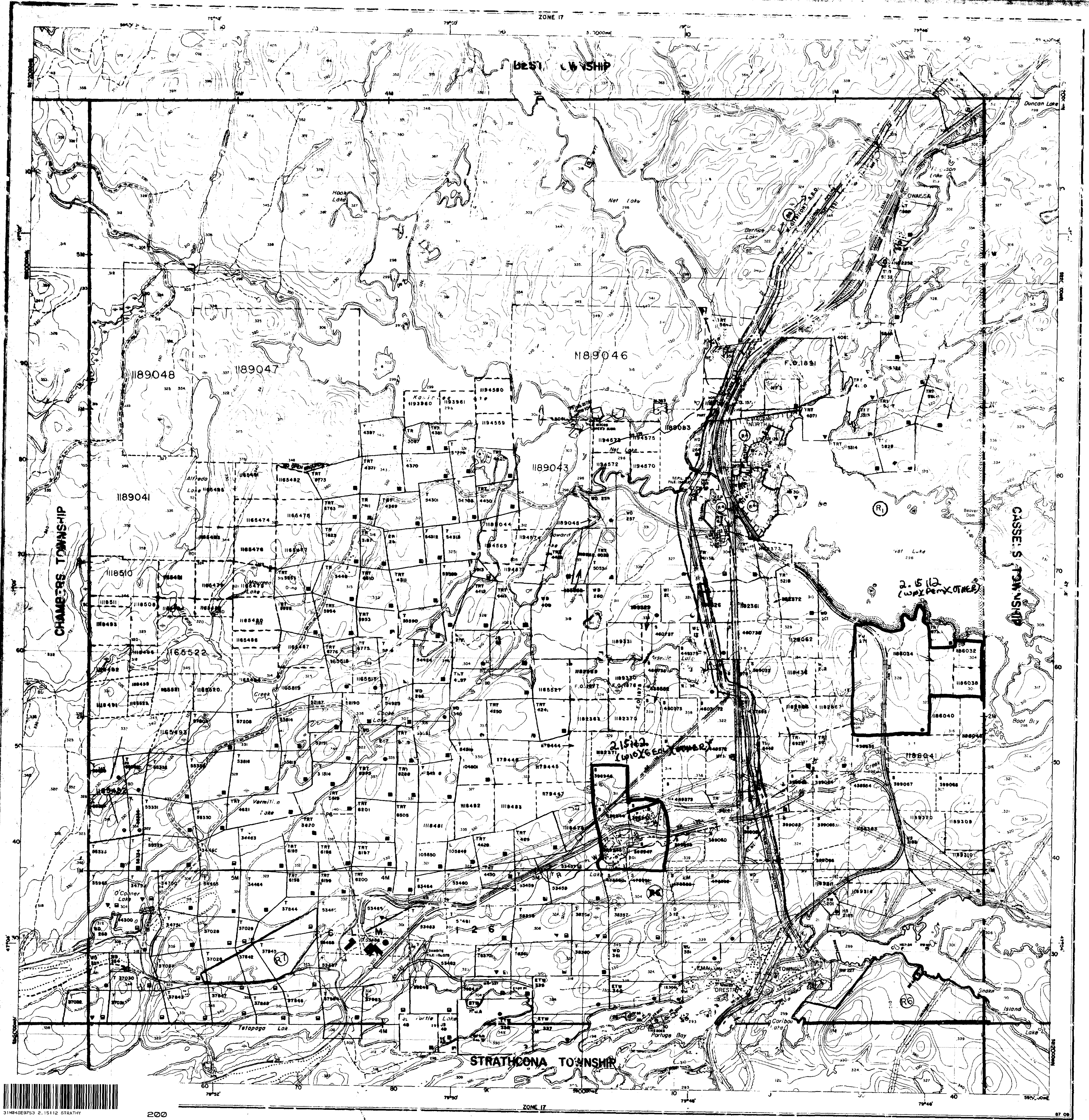
à faire cette attestation.

Signature

Date MAY-28-93

0212 (04/91)

Nota : Dans cette formule, lorsqu'il désigne des personnes, le masculin est utilisé au sens neutre.



31M04SE9753 2.15112 STRATHY

200

Ministry of Natural Resources
Ministry of Northern Development and Mines
Ontario

INDEX TO LAND DISPOSITION

PLAN
G-3451
TOWNSHIP
STRATHY

M.N.R. ADMINISTRATIVE DISTRICT
TEMAGAMI
MINING DIVISION
SUDBURY
LAND TITLES/REGISTRY DIVISION
NIPISSING

DATE OF ISSUE
JUN 4 1993
SUDBURY
MINING RECORDER'S OFFICE

Scale 1:20 000

Contour Interval 10 Metres

IN SERVICE JANUARY 10, 1990

AREAS WITHDRAWN FROM DISPOSITION

MRO - Mining Rights Only
SRO - Surface Rights Only
M + S - Mining and Surface Rights

	Description	Order No.	Date	Disposition	File
R1	36(a)R.S.O.1960	W. 2022/66		SRO.	3996
~~R2~~	~~SEC.36/80~~	~~W-.../84~~	~~16/03/84~~	~~S~~	~~195540~~
R3	W-01/91/ONT	S.R.O.	SEP.20/91	L.R. FILE	
R4	SEC.36/80	W-S-02/91 NER		M & S	195150
~~R5~~	~~SEC. 35 /80~~	~~W-S-01/93 CR~~		~~M & S~~	~~195150~~

R6 PENDING DISPOSITION UNDER THE PUBLIC LANDS ACT LAND NOT OPEN FOR STAKING SUB-SECTION 30(B) of the Mining Act R.S.O. 1990
Notice received 92/JAN/06

R7 PENDING DISPOSITION UNDER THE PUBLIC LANDS ACT LAND NOT OPEN FOR STAKING SUB-SECTION 30(B) of the Mining Act R.S.O. 1990
Notice received 92/JAN/06

R5 O-ONT-06/92 NER/CR MAR.16/92 M & S 195150

R5 O-ONT-07/92 NER/CR JUNE.1/92 M & S 195150

~~Note: PART OF R5 STILL WITHDRAWN BY ORDER W-S-01/93 CR~~

R5 O-S-16/93 JUNE 1/93 M & S 195150

SYMBOLS

Boundary
- Township, Meridian, Baseline
- Road allowance; surveyed
  - shoreline
- Lot/Concession; surveyed
  - unsurveyed
- Parcel; surveyed
  - unsurveyed
- Right-of-way; road
  - railway
  - utility
- Reservation
- Cliff, Pit, Pile
- Contour
  - Interpolated
  - Approximate
  - Depression
- Control point (horizontal) △
- Flooded land
- Mine head frame
- Pipeline (above ground)
- Railway; single track
  - double track
  - abandoned
- Road; highway, county, township
  - access
  - trail, bush
- Shoreline (original)
- Transmission line
- Wooded area

DISPOSITION OF CROWN LANDS

Patent	
Surface & Mining Rights	●
Surface Rights Only	⊖
Mining Rights Only	⊖
Lease	
Surface & Mining Rights	■
Surface Rights Only	⊟
Mining Rights Only	⊟
Licence of Occupation	▼
Order-in-Council	OC
Cancelled	⊗
Reservation	Ⓡ
Sand & Gravel	ⓢ

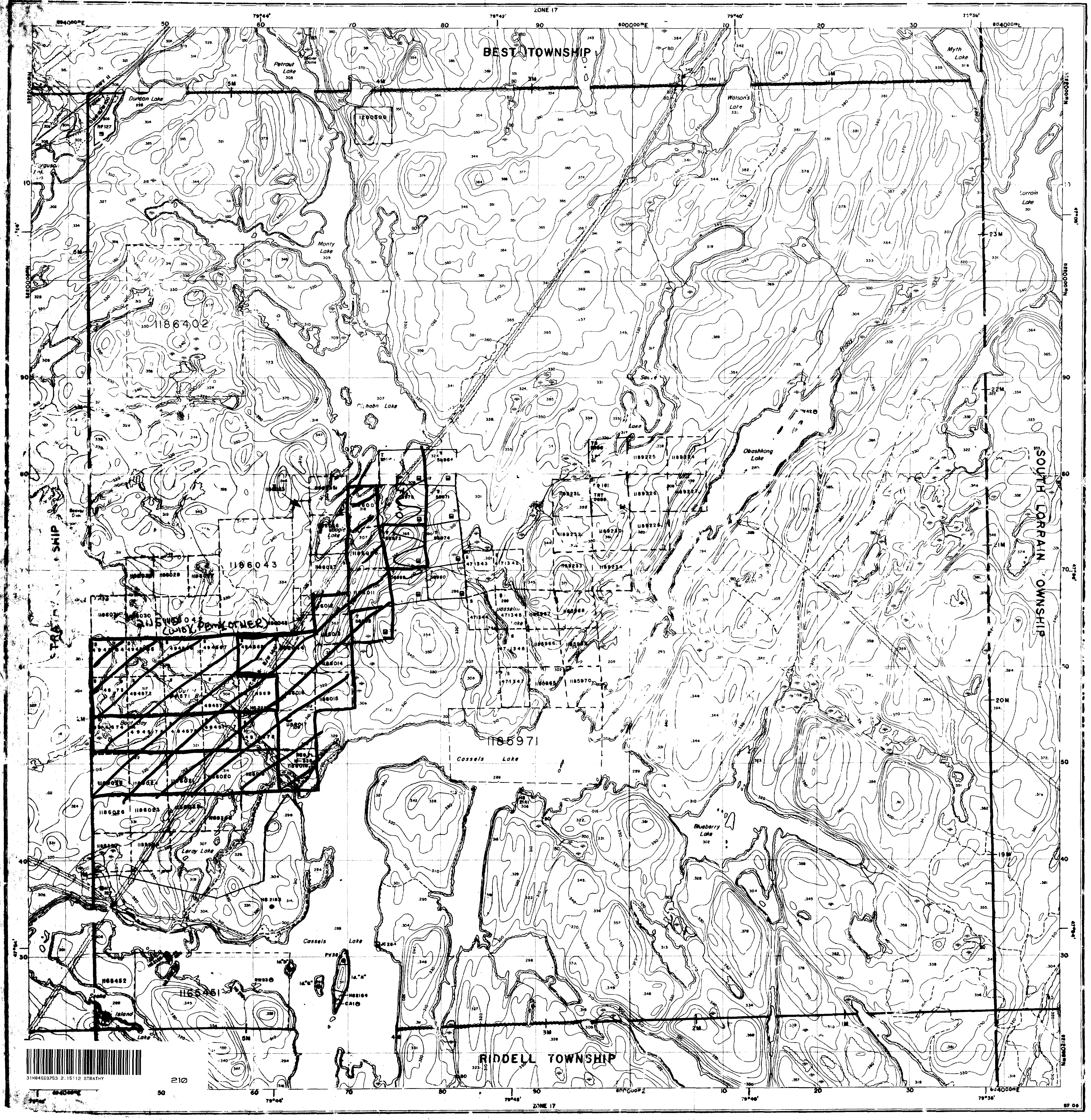
NOTES

ISLAND 27 BELONGS WITH STRATHCONA TWP.
ISLANDS IN LAKE TEMAGAMI - NOT OPEN FOR STAKING

THE INFORMATION THAT APPEARS ON THIS MAP HAS BEEN COMPILED FROM VARIOUS SOURCES, AND ACCURACY IS NOT GUARANTEED. THOSE WISHING TO STAKE MINING CLAIMS SHOULD CONSULT WITH THE MINING RECORDER, MINISTRY OF NORTHERN DEVELOPMENT AND MINES, FOR ADDITIONAL INFORMATION ON THE STATUS OF THE LANDS SHOWN HEREON.

Map base and land disposition drafting by Surveys and Mapping Branch, Ministry of Natural Resources.

The disposition of land, location of lot fabric and parcel boundaries on this index was compiled for administrative purposes only.



Ministry of Natural Resources
Ministry of Northern Development and Mines
Ontario

IN SERVICE FEBRUARY 10, 1989

INDEX TO LAND DISPOSITION

PLAN

G-3415

TOWNSHIP

CASSELS

M.N.R. ADMINISTRATIVE DISTRICT

TEMAGAMI

MINING DIVISION

SUDBURY

LAND TITLES/REGISTRY DIVISION

NIPISSING

Scale 1:20 000

Metres 1000 0 1000 2000 Metres

Feet 1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10,000 Feet

Contour Interval 10 Metres

DATE OF ISSUE
JUN 4 1993
SUDBURY
MINING RECORDER'S OFFICE

SYMBOLS

Boundary
- Township, Meridian, Baseline
- Road allowance; surveyed
  - shoreline
- Lot/Concession; surveyed
  - unsurveyed
- Parcel; surveyed
  - unsurveyed
- Right-of-way; road
  - railway
  - utility
- Reservation

Cliff, Pit, Pile
Contour — 20 —
- Interpolated
- Approximate
- Depression

Control point (horizontal) △
Flooded land
Mine head frame
Pipeline (above ground)
Railway; single track
- double track
- abandoned

Road; highway, county, township
- access
- trail, bush

Shoreline (original)
Transmission line
Wooded area

AREAS WITHDRAWN FROM DISPOSITION

MRO - Mining Rights Only
SRO - Surface Rights Only
M+S - Mining and Surface Rights

	Description	Order No.	Date	Disposition	File
~~R5~~	~~Sec.36/80~~	~~W.1/84~~	~~16/3/84~~	~~M.+S.~~	[illegible]
~~R5~~		~~W-S-01/92-CR~~	~~92/JAN/17~~	~~M+S~~	~~195150~~

R6 PENDING DISPOSITION UNDER THE PUBLIC LANDS ACT
LAND NOT OPEN FOR STAKING SUB-SECTION 30(B) of the Mining Act R.S.O. 1990
Notice received 92/JAN/06

R5 O-ONT-06/92 NER/CR MAR.16/92 M & S 195150

R5 O-ONT-07/92 NER/CR JUNE 1/92 M & S 195150

DISPOSITION OF CROWN LANDS

Patent
- Surface & Mining Rights ●
- Surface Rights Only ◒
- Mining Rights Only ◓

Lease
- Surface & Mining Rights ■
- Surface Rights Only ⬒
- Mining Rights Only ⬓

Licence of Occupation ▼
Order-in-Council OC
Cancelled ⊗
Reservation ®
Sand & Gravel ⓢ

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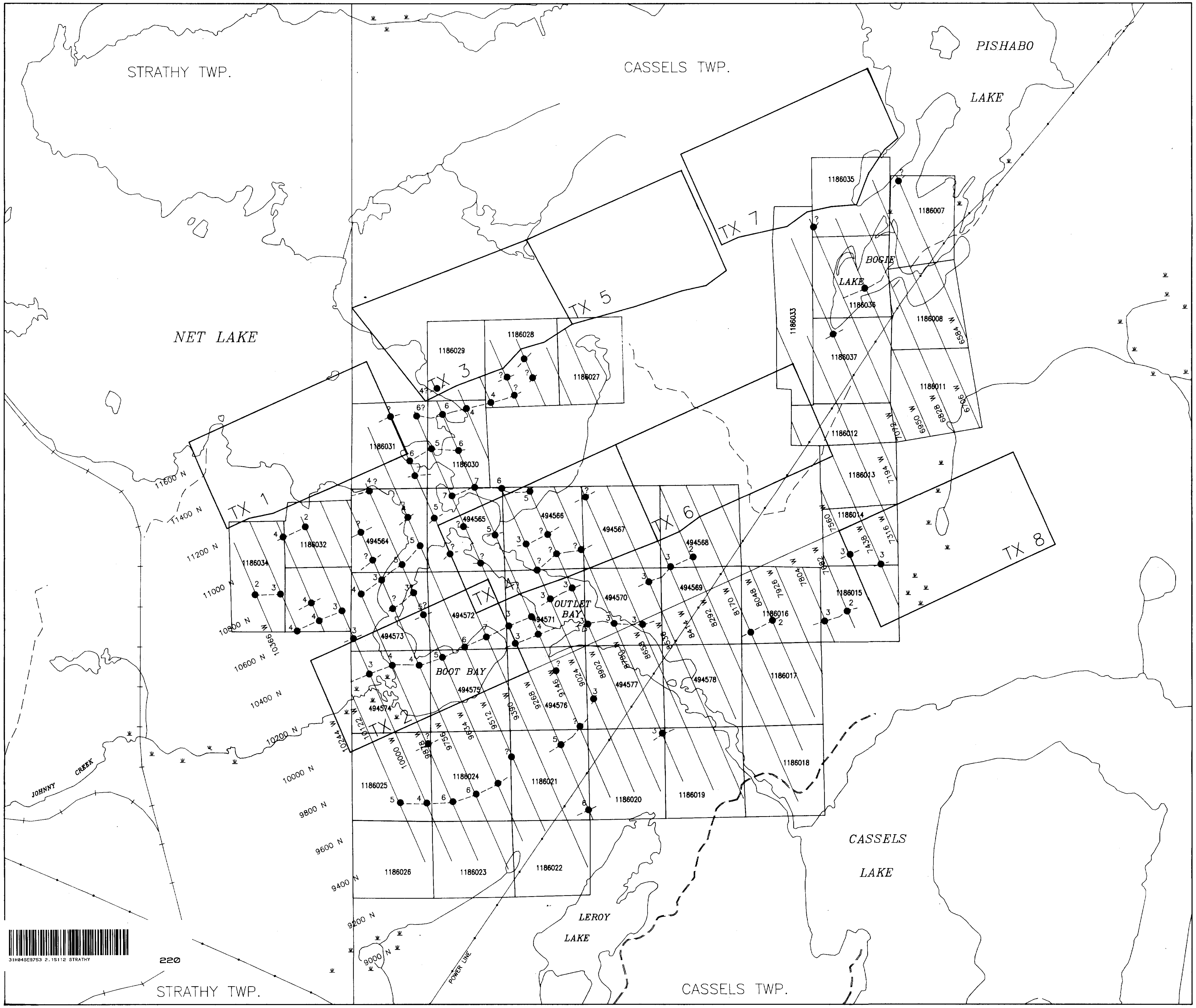
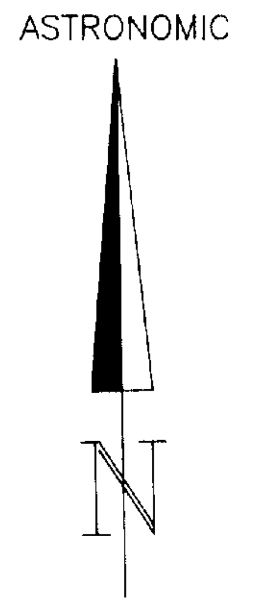




SHEET ORIENTED UTM NORTH
(AZIMUTH = 000° 55')

CULTURAL AND PHYSIOGRAPHIC FEATURES

═══	All weather road (paved, gravel)
═══	4 WD road
───	Track
— — —	Trail
▭	Buildings
▲	Campsite
─●─●─	Power Line (major line, regular line)
─●─●─	Telephone Line (usable, unusable)
─▬─	Pipeline
┼┼┼┼	Railroad Track
⊙	Tower
⌶	Bridge
≈	River (open, rapids)
∼	Intermittent Stream
○	Lake
⁂	Swamp
‹‹‹	Esker
⊡ □ □ ○	Claim Post (located, unlocated, witness, in water)
┼┼┼	Grids (current grid, old grid)
△ △	Survey Pin (located, unlocated)
⊡ □	Lot/Concession Corner Pin (located, government defined)
● 2	EM Anomaly, Number of Channels

2.15112

FALCONBRIDGE LIMITED

Exploration Division Chelmsford ONTARIO

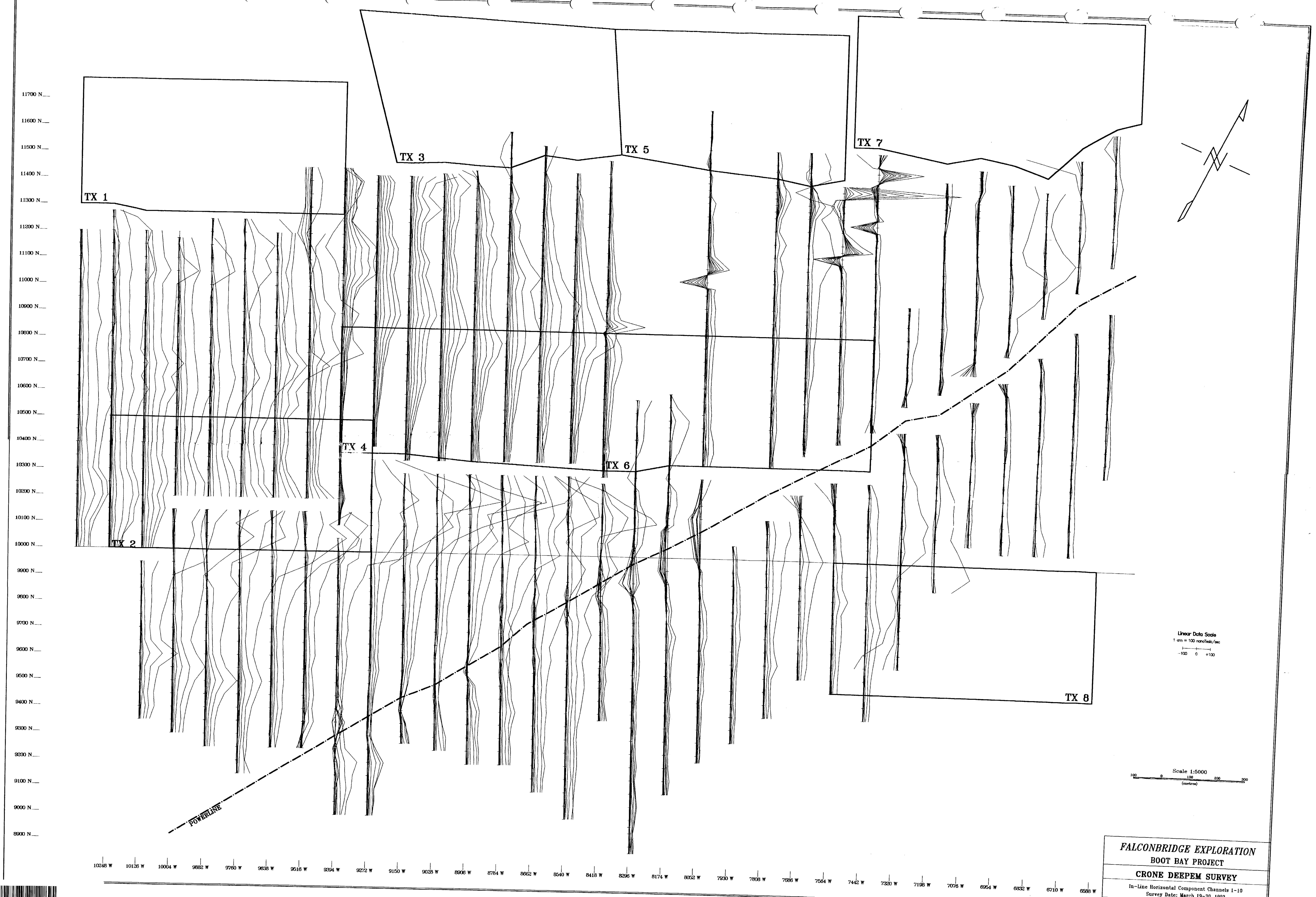
31M/4
(STRATHY / CASSELS TWPS.)

EM ANOMALY INTERPRETATION MAP

FIGURE 3

TRACED: D.F.	DATE: 04/93	NTS: 31L13	PROJECT:
DRAWN:	DATE:	MAP No:	FILE: CRSURVEY
SUPERVISED: S.K.	DATE: 04/93	SCALE 1:10 000 0 100 200 300 400m	
REVISED:	DATE:		

220



FALCONBRIDGE EXPLORATION

BOOT BAY PROJECT

CRONE DEEPEM SURVEY

In-Line Horizontal Component Channels 1-10
Survey Date: March 19-30, 1992

Crone Geophysics & Exploration Ltd.

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FALCONBRIDGE EXPLORATION
BOOT BAY PROJECT

CRONE DEEPEM SURVEY

In-Line Horizontal Component Channels 1-10
Survey Date: March 19-30, 1992

Crone Geophysics & Exploration Ltd.

FALCONBRIDGE EXPLORATION

BOOT BAY PROJECT

CRONE DEEPEM SURVEY

Vertical Component Channels 1-10
Survey Date: March 19-30, 1992

Crone Geophysics & Exploration Ltd.

FALCONBRIDGE EXPLORATION

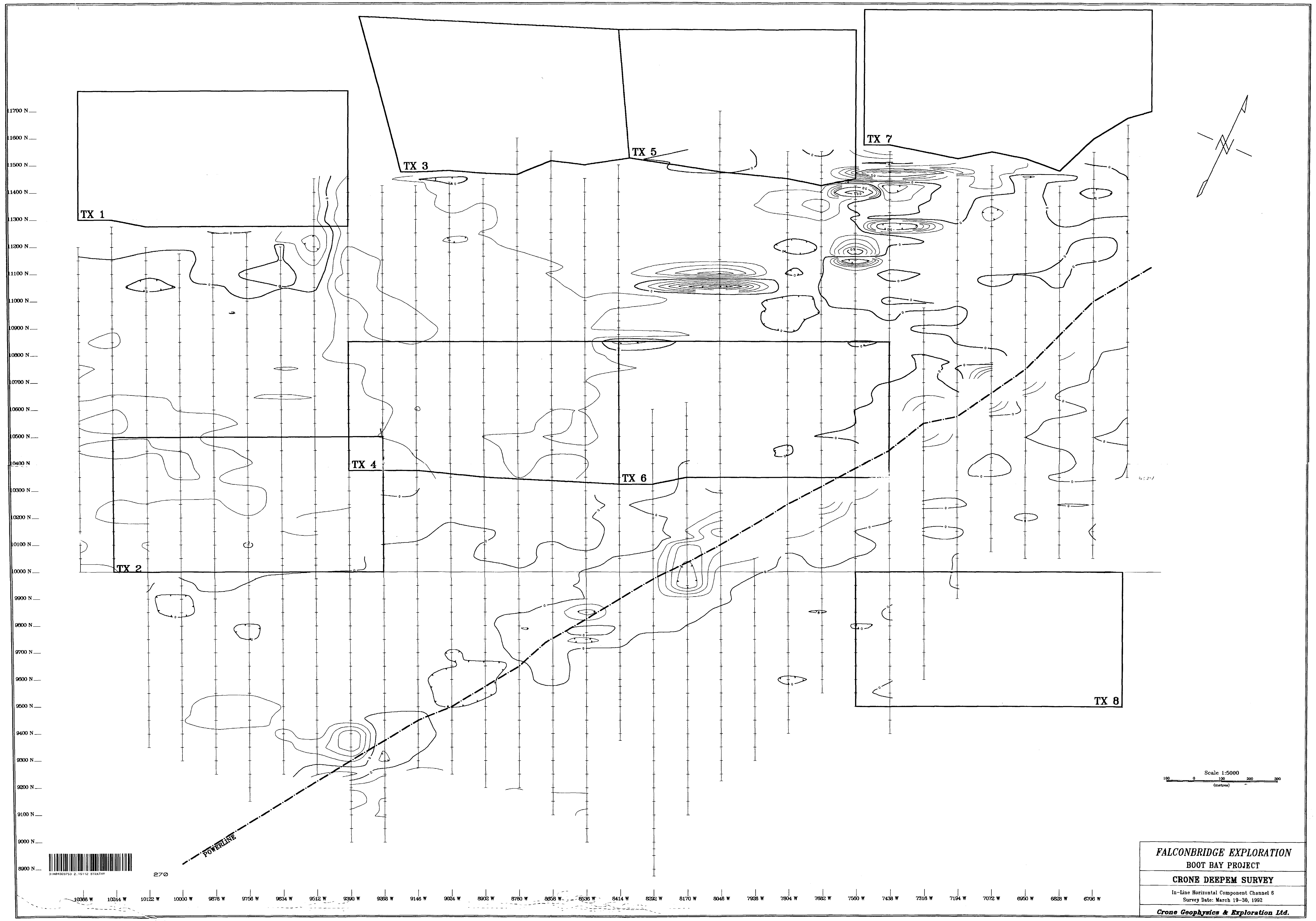
BOOT BAY PROJECT

CRONE DEEPEM SURVEY

In-Line Horizontal Component Channel 1

Survey Date: March 19-30, 1992

Crone Geophysics & Exploration Ltd.



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FALCONBRIDGE EXPLORATION

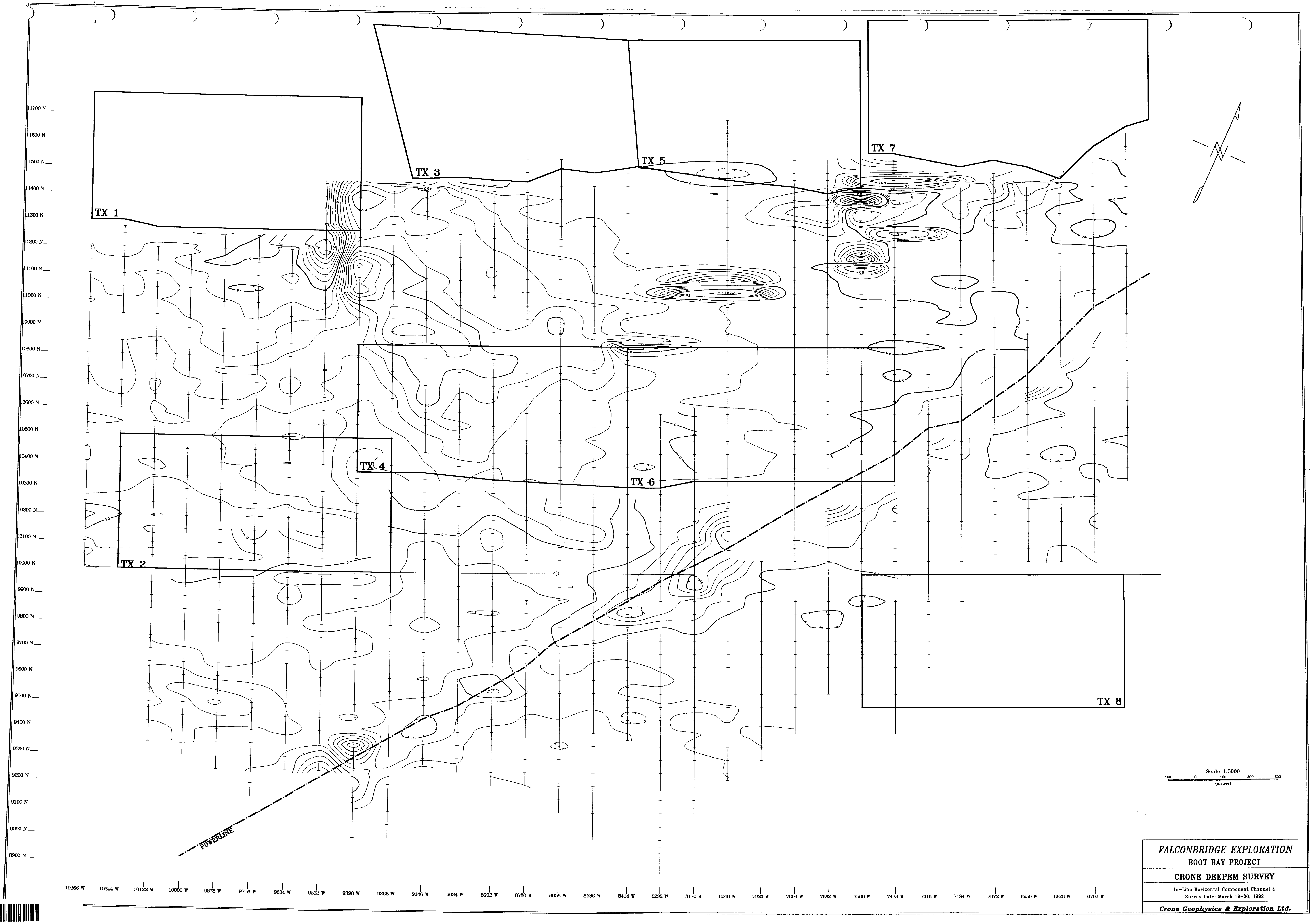
BOOT BAY PROJECT

CRONE DEEPEM SURVEY

In-Line Horizontal Component Channel 6

Survey Date: March 19-30, 1992

Crone Geophysics & Exploration Ltd.



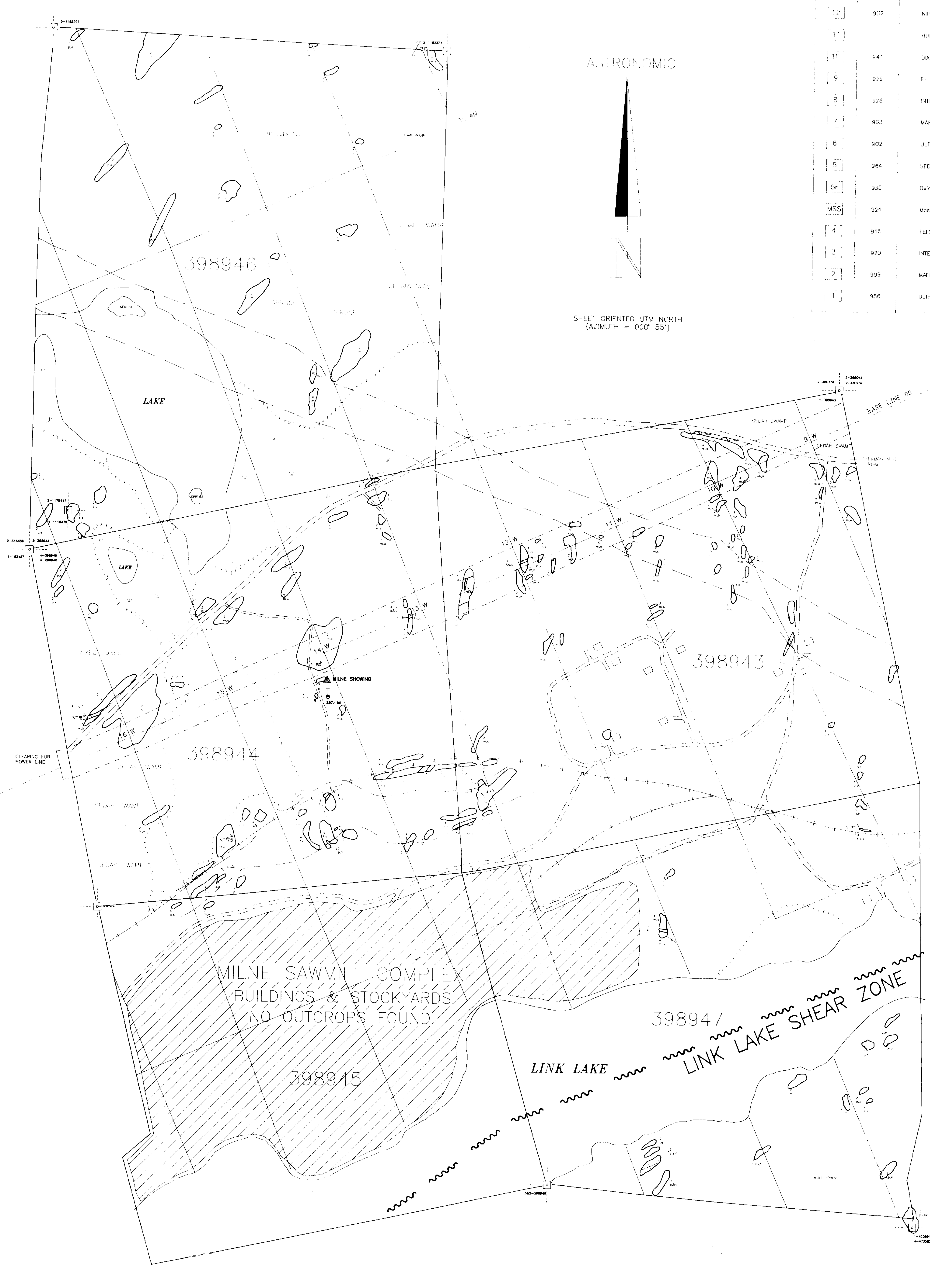
FALCONBRIDGE EXPLORATION

BOOT BAY PROJECT

CRONE DEEPEM SURVEY

In-Line Horizontal Component Channel 4
Survey Date: March 19-30, 1992

Crone Geophysics & Exploration Ltd.



LEGEND

Code	Prismacolor	MAJOR ROCK DIVISIONS
12	932	NIPISSING DIABASE
11		HURONIAN SUPER GROUP
10	941	DIABASE
9	929	FELSIC INTRUSIVE ROCKS
8	928	INTERMEDIATE INTRUSIVE ROCKS
7	903	MAFIC INTRUSIVE ROCKS
6	902	ULTRAMAFIC INTRUSIVE ROCKS
5	964	SEDIMENTARY ROCKS
5r	935	Oxide Iron Formation
MSS	924	Massive Sulphides
4	915	FELSIC VOLCANIC ROCKS
3	920	INTERMEDIATE VOLCANIC ROCKS
2	909	MAFIC VOLCANIC ROCKS
1	956	ULTRAMAFIC VOLCANIC ROCKS

Code	Prismacolor	HURONIAN MODIFIERS
		COBALT GROUP
i	947	LORRAIN FORMATION
		GOWGANDA FORMATION
ii	945	Firstbrook Member
iii	947	Coleman Member
		QUIRKE LAKE GROUP
iv	934	SERPENT FORMATION
v	919	ESPANOLA FORMATION
vi	967	BRUCE FORMATION
		HOUGH LAKE GROUP
vii	936	MISSISSAGI FORMATION
viii		PECORS FORMATION
viiii		RAMSEY LAKE FORMATION
		ELLIOT LAKE GROUP
x		MCKIM FORMATION
xi		MATINENDA FORMATION

TEXTURAL/GEOCHEMICAL MODIFIERS

a	Fine Grained
b	Medium Grained
bx	Breccia
c	Coarse Grained
d	Quartz–Feldspar Phyric
e	Amygdaloidal/Vesicular
f	Primary Fragmentals
g	Graphitic/Argillaceous
h	Tholeiitic
i	Alkalic
j	Calc–Alkalic
k	Komatiitic
l	Flows
m	Massive
n	Variolitic/Spherilitic
p	Pillowed
q	Quartz Phyric
r	Oxide Iron Formation
s	Sulphides, Exhalites
t	Pyroclastic
u	Tuff
v	Lappilli
w	Aglomerate Lappilli Tuff
x	Andesite
y	Icelandite
z	
A	Primitive (Y<20)
B	Evolved (Y>20<60)
C	Heterolithic
D	Feldspar Phyric
E	Chert
F	Wacke
G	Conglomerate
H	Siltstone
I	Olivine
J	Pyroxenite
K	Net Textured
L	Peridotite
M	Dunite
N	Ophitic
P	Porphyritic
Q	Basaltic Komatiite
R	Polysutured
S	Fractured
T	Gabbroic Textured
U	Pyroxene Spinifex
V	Olivine Spinifex
W	Skeletal/Crescumulate
X	Adcumulate
Y	Mesocumulate
Z	Orthocumulate

ALTERATION MODIFIERS

<Ab>	Albitization
<Bl>	Bleached
<C>>	Carbonaceous
<Cb>	Carbonatization
<Ch>	Chloritization
<Ep>	Epidotization
<He>	Hematization
<K>>	Potassic Alteration
<Se>	Sericitization
<Si>	Silicification
<Sr>	Serpentinization
<Tc>	Talc–Carbonatized

MINERAL OCCURRENCES

asp	Arsenopyrite
ba	Barite
bn	Bornite
cp	Chalcopyrite
Co	Cobalt
Cu	Copper
gn	Galena
Au	Gold
gf	Graphite
Pb	Lead
mag	Magnetite
mc	Malachite
mar	Marcasite
Mo	Molybdenum
Ni	Nickel
pent	Pentlandite
Pt	Platinum
py	Pyrite
po	Pyrrhotite
Ag	Silver
sp	Sphalerite
stib	Stibnite
Zn	Zinc

Symbols

CONTACTS

- Outcrop (small, defined, inferred, boulder/float)
- Geological Boundary (defined, approximate, assumed)
- Geological Boundary (gradational, geophysically inferred)
- Flow Contact (defined, approximate)

MEASUREMENTS

- Bedding with tops known (horizontal, inclined, vertical, overturned, dip unknown)
- Bedding with tops unknown (Inclined, vertical, dip unknown)
- Pillow top (horizontal, inclined, vertical, overturned, dip unknown)
- Spinifex top
- Schistosity, gneissosity, cleavage or foliation (horizontal, inclined, vertical, dip unknown) (No. of ticks = generation – S1, S2, S3)
- Jointing (horizontal, inclined, vertical, dip unknown)
- Lineation (horizontal, inclined, vertical)
- Folding · defined folds S fold, Z fold, multiple S, multiple Z)
- Folding – undetermined type
- Fault (defined, approximate, assumed) (inclined, vertical, movement w/circle on downthrow side)
- Fault (Geophysically inferred, Lineament inferred)
- Thrust Fault (defined, approximate, assumed) (teeth indicate upthrust side)
- Shear zone
- Dyke, vein (defined, approximate, assumed)
- Anticline, Antiform (with or without plunge, overturned)
- Syncline, Synform (with or without plunge, overturned)
- Glacial striae (ice movement known, unknown) (numbers indicate relative age)
- Limit of Geological Mapping

PHYSICAL WORK

- Mineral Occurrence
- Trench (1:20,000 +, 1:5,000 –)
- Diamond Drill Hole (collar surveyed, collar located, collar unlocated)
- Overburden Drill Hole
- Mine, quarry or glory hole (active, abandoned)
- Shaft (vertical, inclined, raise, winze)
- Adit, Ramp
- Rock Dump, Tailings
- Gravel Pit (active, abandoned)

CULTURAL AND PHYSIOGRAPHIC FEATURES

- All weather road (paved, gravel)
- 4 WD road
- Track
- Trail
- Buildings
- Campsite
- Power Line (major line, regular line)
- Telephone Line (usable, unusable)
- Pipeline
- Railroad Track
- Tower
- Bridge
- River (open, rapids)
- Intermittent Stream
- Lake
- Swamp
- Esker
- Claim Post (located, unlocated, witness, in water)
- Grids (current grid, old grid)
- Survey Pin (located, unlocated)
- Lot/Concession Corner Pin (located, government defined)

2.15112

FALCONBRIDGE LIMITED

Exploration Division
Chelmsford ONTARIO

31M/4
(STRATHY TWP.)

GEOLOGY MAP

MANDERSTROM PROPERTY

TRACED: D.F.	DATE: 05/93	NTS: 31M/4	PROJECT:
DRAWN:	DATE:	MAP No:	FILE: GSLMDR93.DWG
SUPERVISED: J.D.F.	DATE: 05/93	SCALE 1:2000	
REVISED:	DATE:	0 50 100m	