Geophysical Survey Report

covering

Surface Pulse EM Surveys
over the
Hutt Project
for
Falconbridge Ltd.
during
October 2000

by

CRONE GEOPHYSICS & EXPLORATION LTD.

Survey Area:	**Hutt Project near Timmins, Ontario**
Survey Type:	**Surface Pulse EM Survey**
Lines Surveyed:	**1700 E – 2200 E**
Survey Operators:	**Rene Morin**
Survey Period:	**October 26th – 31st, 2000**
Report By:	**K. Ralph**
Report Date:	**January, 2001**

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Appendices

1. INTRODUCTION

Crone Geophysics & Exploration Limited was contracted by Falconbridge Ltd. to conduct a Surface Pulse Electromagnetic survey on its **Huttt Project** near Timmins, Ont. This report summarizes the geophysical work carried out on the property during October of 2000 during which time six lines (1700 E – 2200E) were surveyed from one transmit loop. The appendices to this report contain page size plan profile maps, PEM data profiles (lin-log scale), linear profile plots and a description of the Crone Instrument Specifications.

2. PERSONNEL

The following personnel were involved in the collection of the data and production of this report:

Survey Operators: Rene Morin
Report: Kevin Ralph

3. SURVEY METHOD & EQUIPMENT

The Crone Pulse EM system is a time domain electromagnetic method 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 **120VDC, 4.5hp Motor Generator** powers the **PEM 2.4 kW 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 ("Ramp Time") , and finally, zero current for a selected length of time in milliseconds ("Time Base"). 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 receiver apparatus. These readings are across fixed time windows or "Channels" and are recorded with the **PEM Digital Receiver**. Synchronization between the receiver and transmitter is maintained by a direct cable, **Radio Link**, or crystal clock.

In surface line profiling methods, a **Receive Coil,** mounted on a tripod is used to measure the induced secondary field. The coil can be orientated to measure the vertical (dBz/dt), in-line horizontal (dBx/dt), and cross-line horizontal (dBy/dt) components.

There are numerous possible survey configurations for the Pulse EM system, but for this area the **DEEPEM** method was utilized. In this mode survey lines are read outside and perpendicular to the long side of a stationary transmit loop and this method provides good depth penetration and coupling for conductors with dips of 45° or more.

During this survey the vertical (dBz/dt) and the in-line horizontal (dBx/dt) components of the secondary EM field were recorded. The polarity convention for a standard **DEEPEM** survey is to have a positive Primary Pulse outside of the transmit loop. The horizontal component is positive in the direction of the transmit loop.

4. SURVEY PARAMETERS

Table I: Survey Parameters

Loop	Size	Location	Ramp Time	Current	Time Base	Channels
North	600m x 600m	1600 E - 2200 E 0 S - 600 S	1.5 ms	18 amps	16.66 ms	20

Table II: Survey Coverage

Line	Loop	Survey Date	Segment Read	Station Interval	Components
1700 E	North	October 28, 2000	680 S – 1500 S	20 m	X,Y,Z
1800 E	North	October 29, 2000	660 S – 1500 S	20 m	X,Y,Z
1900 E	North	October 29, 2000	660 S – 1500 S	20 m	X,Y,Z
2000 E	North	October 30, 2000	640 S – 1500 S	20 m	X,Y,Z
2100 E	North	October 30, 2000	640 S – 1500 S	20 m	X,Y,Z
2200 E	North	October 31, 2000	620 S – 1500 S	20 m	X,Y,Z

5. PRODUCTION SUMMARY

Table III: Production Summary

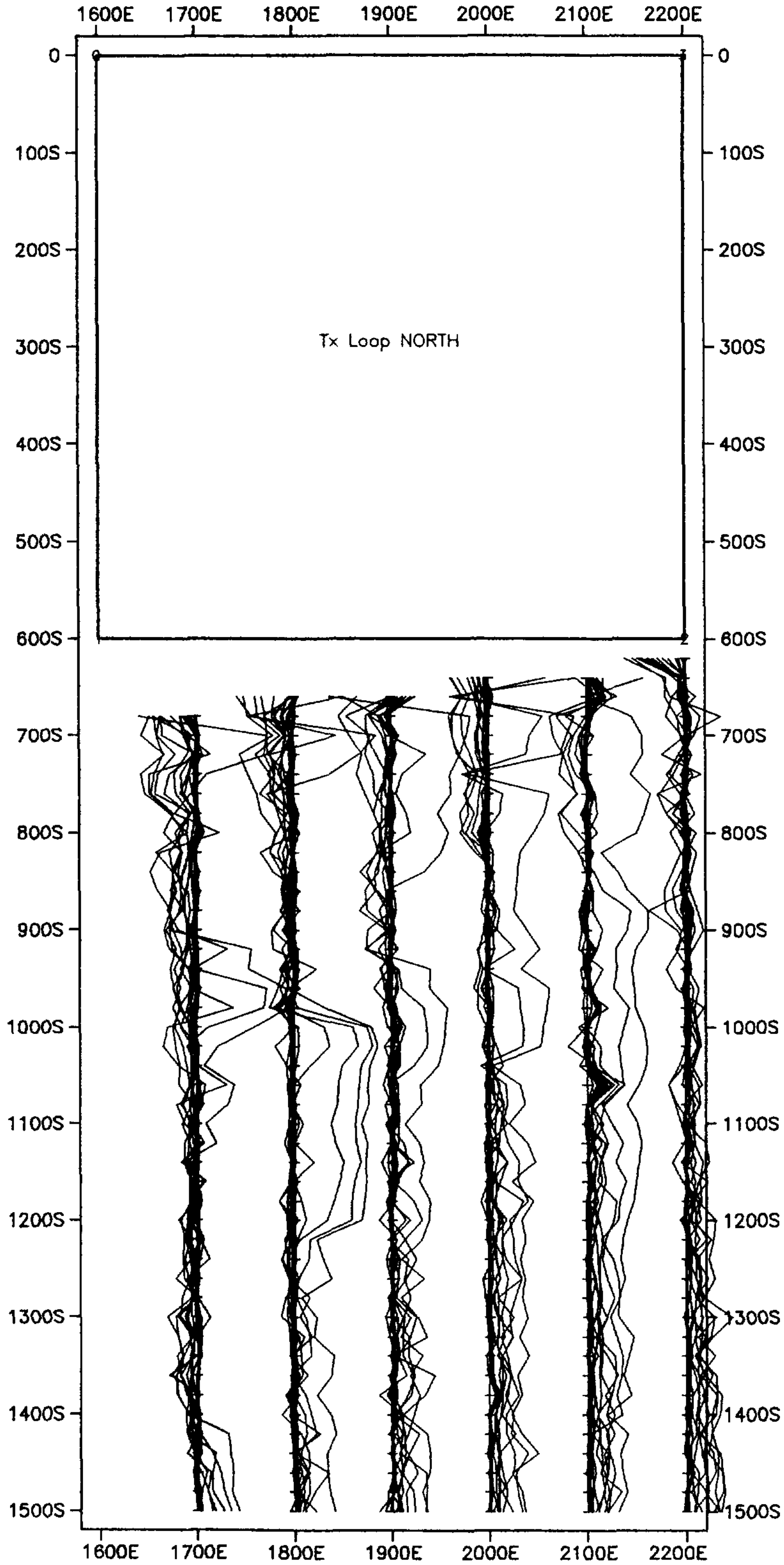
Oct.26th, 2000	Spent over 2 hours trying to find the grid and then spent more time finding access to the survey area. Laid part of north loop.
Oct.27th, 2000	Finished laying North loop. Attempting to start the survey but had problems with synchronization.
Oct. 28th, 2000	Surveyed 1.16 km on lines 1700 E and 1800E at a station interval of 20m.
Oct. 29th, 2000	Surveyed 1.34 km on lines 1800E and 1900E.
Oct. 30th, 2000	Surveyed 1.72 km on lines 2000 E and 2100 E.
Oct. 31st, 2000	Surveyed 880m on line 2200E. Picked up the transmit loop and carried all gear from grid area.

Respectfully Submitted,

Kevin Ralph
Geophysicist
Crone Geophysics & Exploration Ltd.

APPENDIX I

PAGE SIZE PROFILE PLAN MAPS

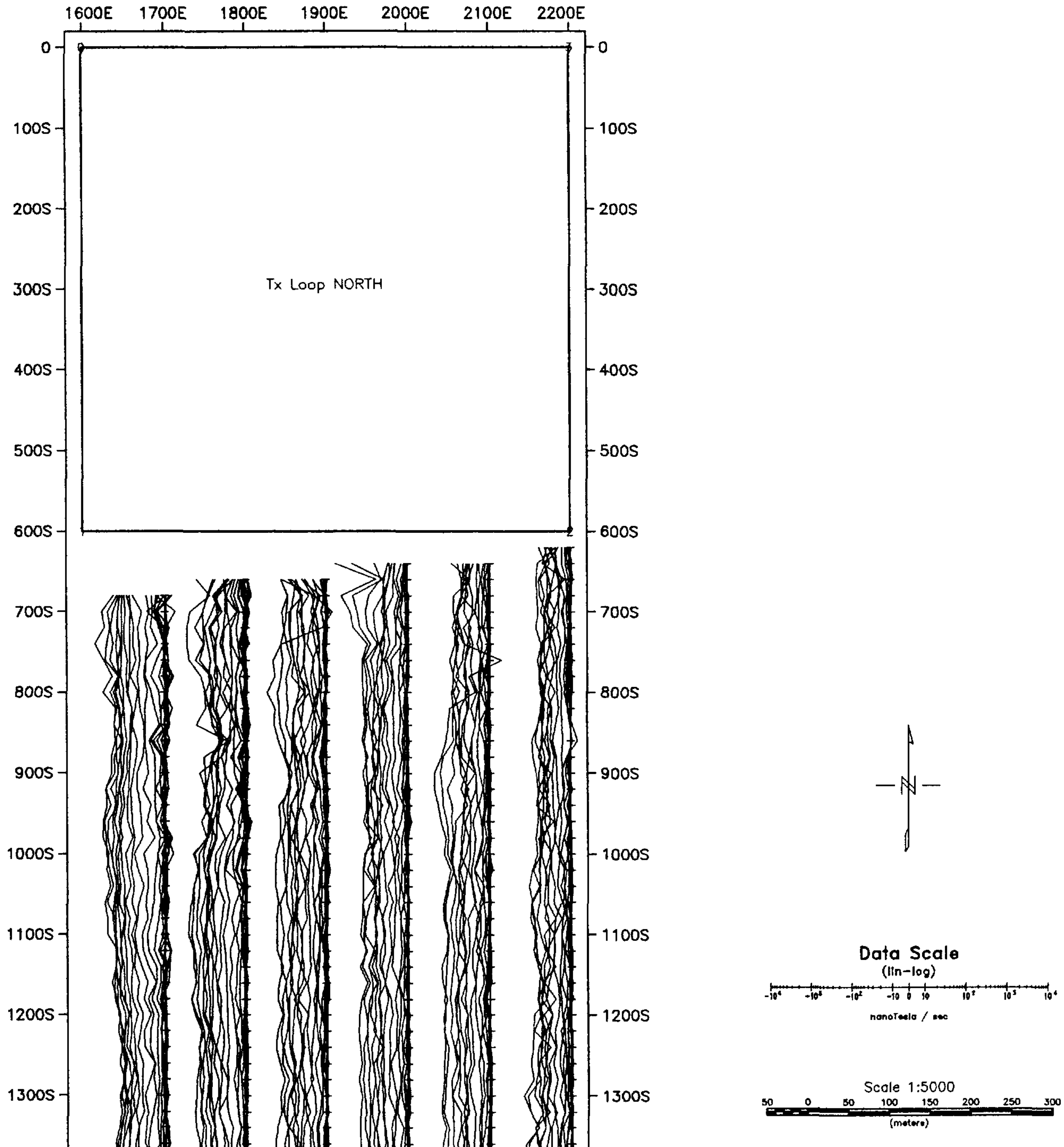


Data Scale
(lin-log)

nanoTesla / sec

Scale 1:5000
50 0 50 100 150 200 250 300
(meters)

Falconbridge Ltd. Hutt Grid (NORTH)
Surface Pulse EM Survey Loop Location Map
Horizontal X Component Survey Date: Oct 28, 2000
Crone Geophysics & Exploration Ltd.



Falconbridge Ltd.

Hutt Grid (NORTH)

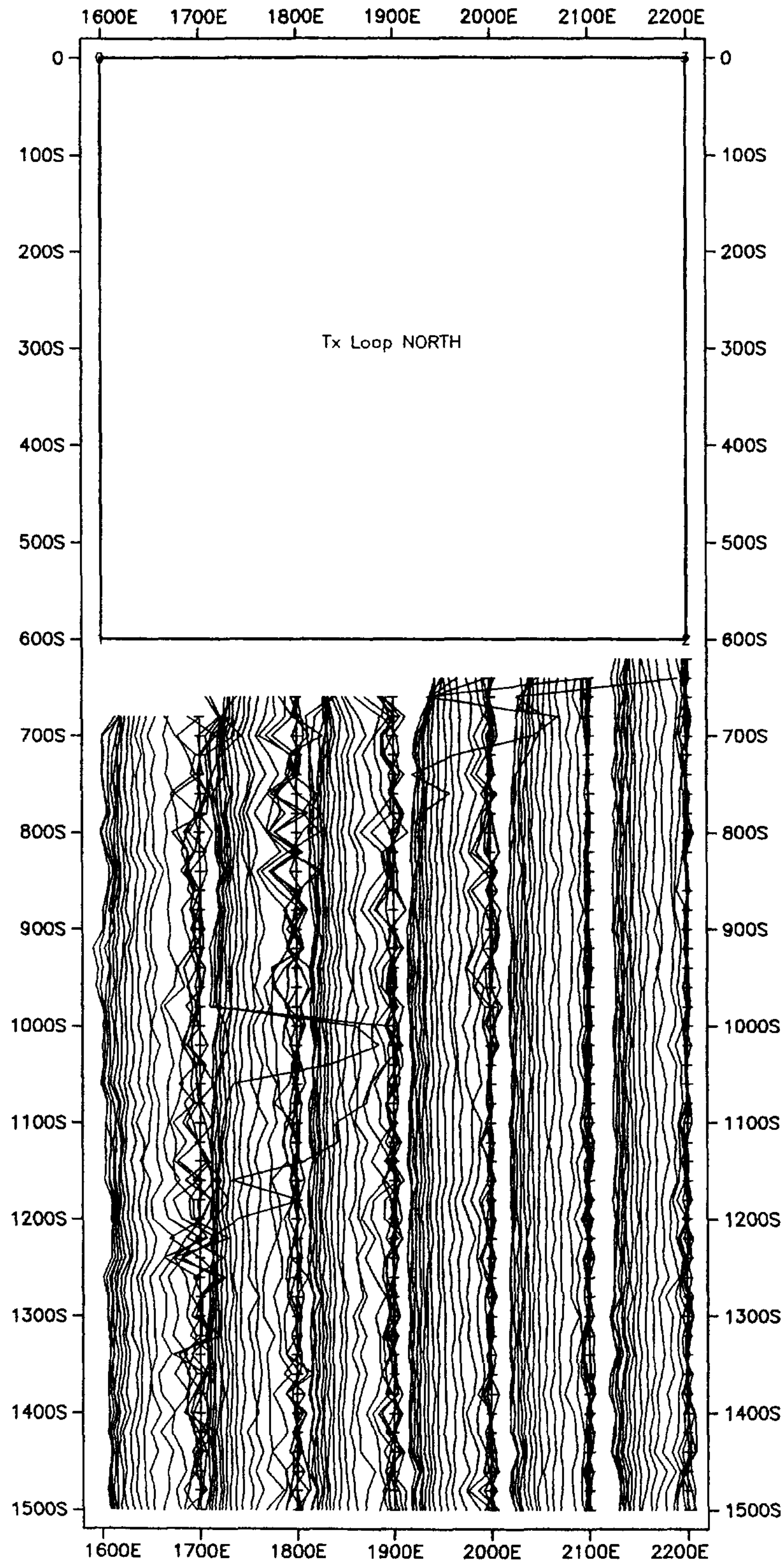
Surface Pulse EM Survey

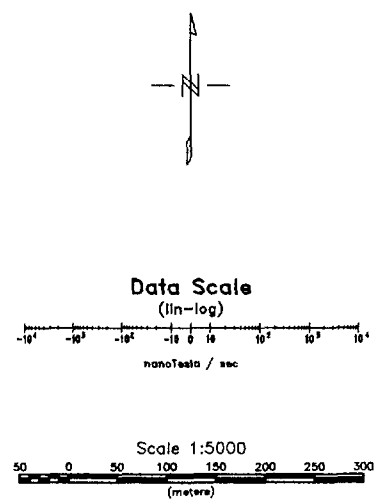
Loop Location Map

Horizontal Y Component

Survey Date: Oct 28, 2000

Crone Geophysics & Exploration Ltd.





Falconbridge Ltd.
Hutt Grid (NORTH)

Surface Pulse EM Survey
Loop Location Map

Vertical Z Component
Survey Date: Oct 28, 2000

Crone Geophysics & Exploration Ltd.

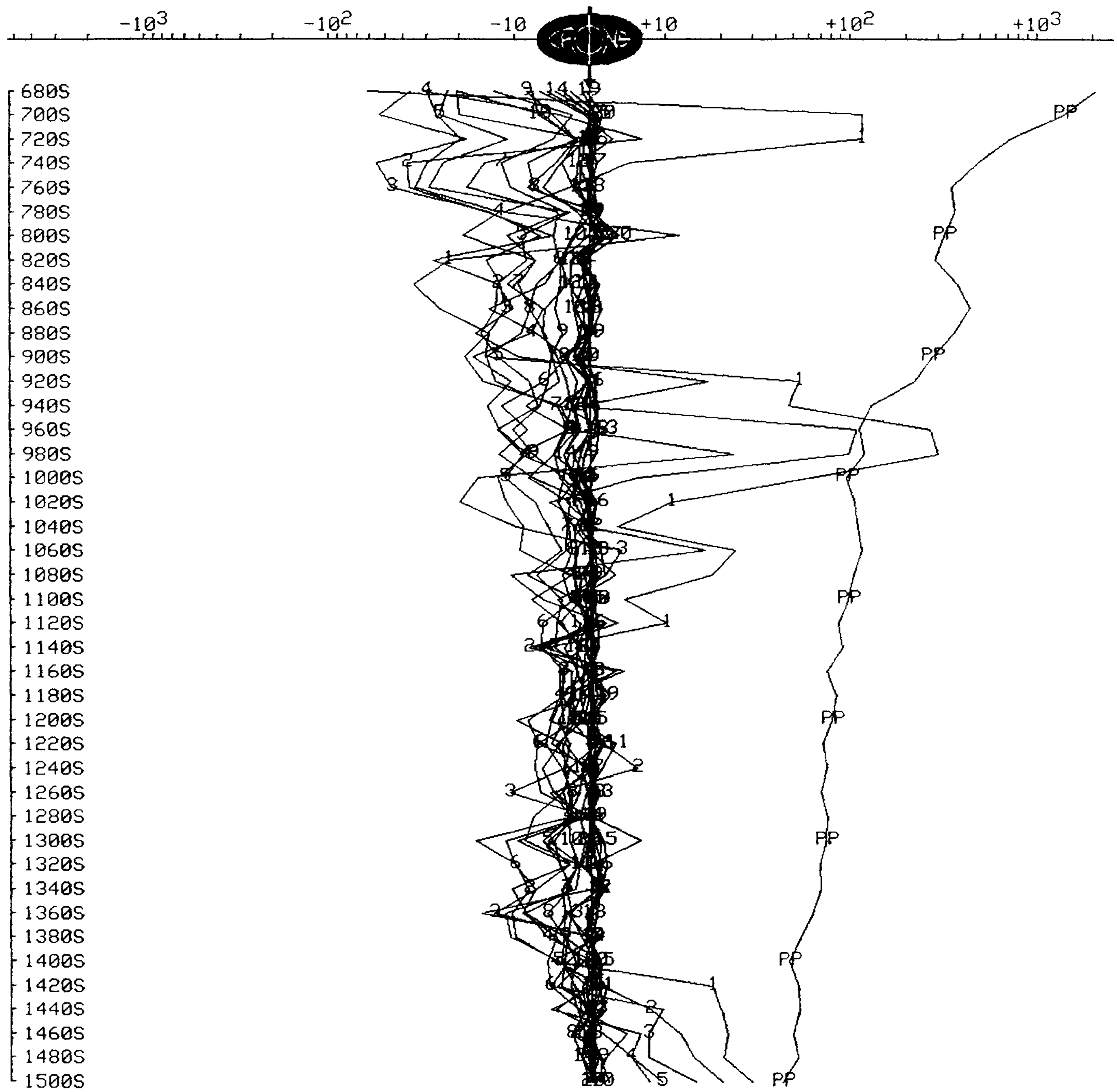
APPENDIX II

PULSE EM DATA PROFILES (LIN-LOG SCALE)

CRONE GEOPHYSICS & EXPLORATION LTD
Surface Pulse EM Survey

Client	: **Falconbridge Ltd.**	Line	: **1700E**
Grid	: **Hutt Grid**	Tx Loop	: **NORTH**
Date	: Oct 28, 2000	File name	: 1700EA.PEM

IN-LINE HORIZONTAL COMPONENT dBx/dt nanoTesla/sec - 20 of 20 channels and
Scale: 1:5000



CRONE GEOPHYSICS & EXPLORATION LTD
Surface Pulse EM Survey

Client : **Falconbridge Ltd.**
Grid : **Hutt Grid**
Date : Oct 28, 2000

Line : **1700E**
Tx Loop : **NORTH**
File name : 1700EA.PEM

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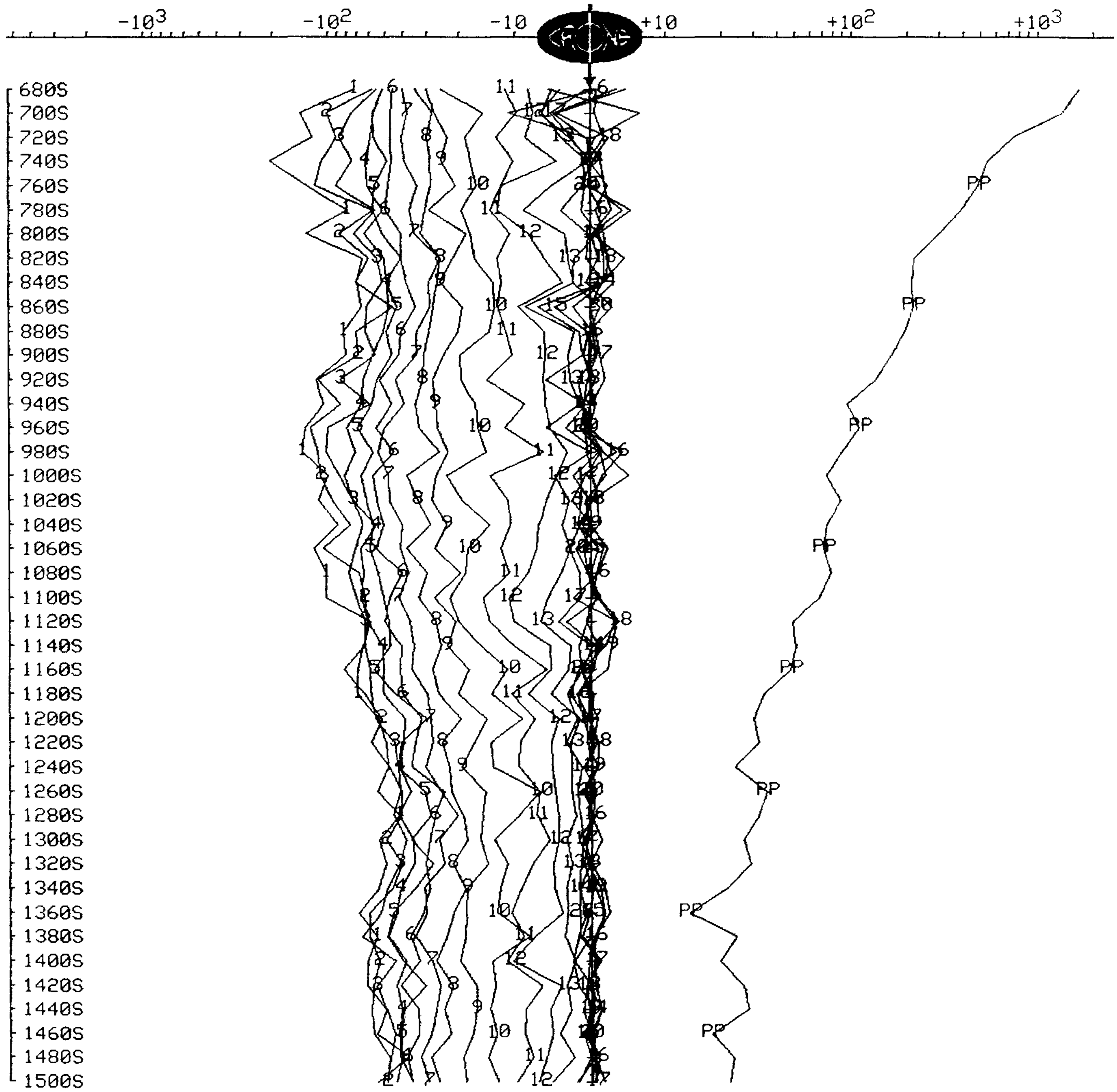

CRONE GEOPHYSICS & EXPLORATION LTD
Surface Pulse EM Survey

Client	:	**Falconbridge Ltd.**	Line	:	**1700E**
Grid	:	**Hutt Grid**	Tx Loop	:	**NORTH**
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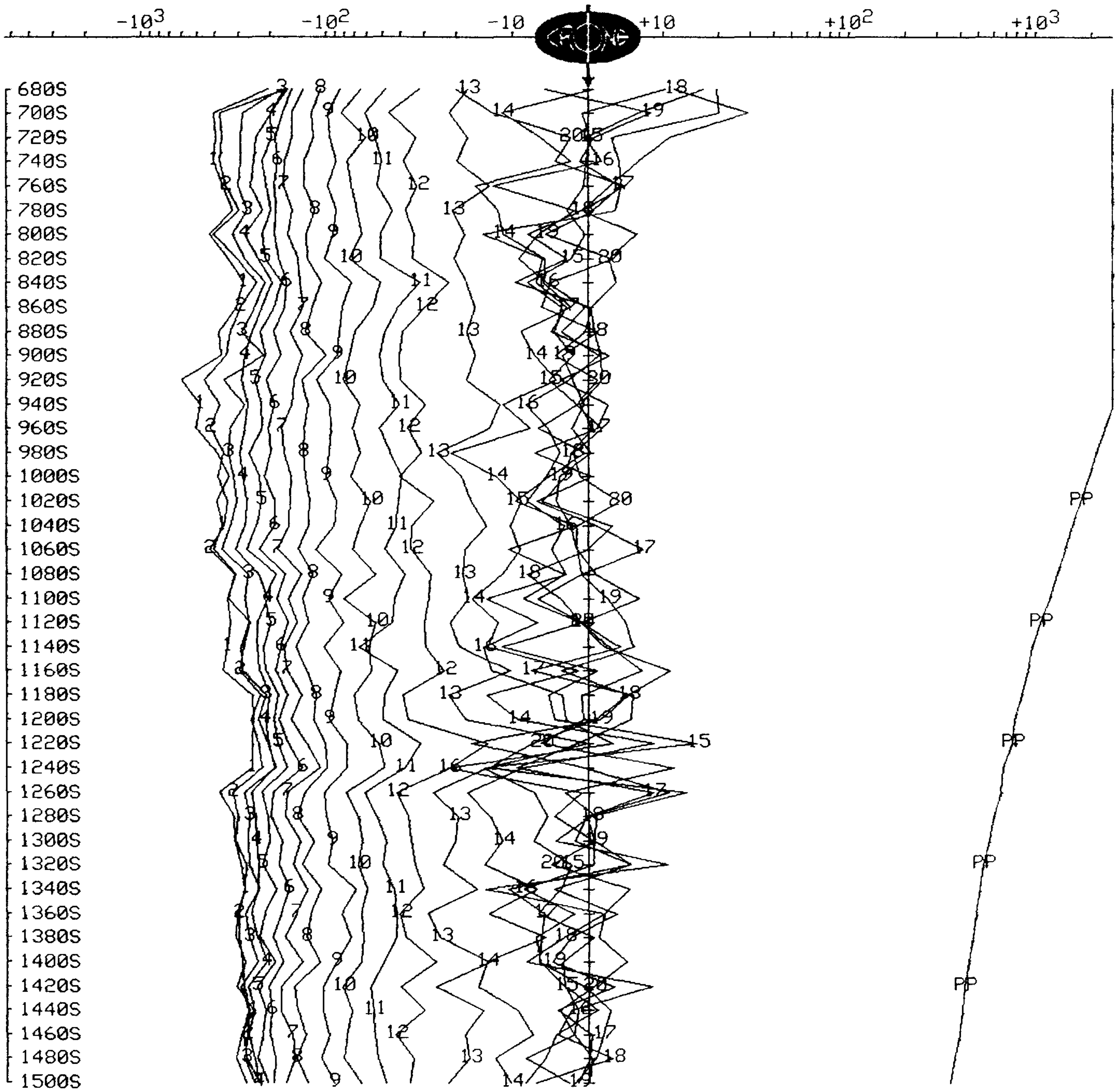

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Surface Pulse EM Survey

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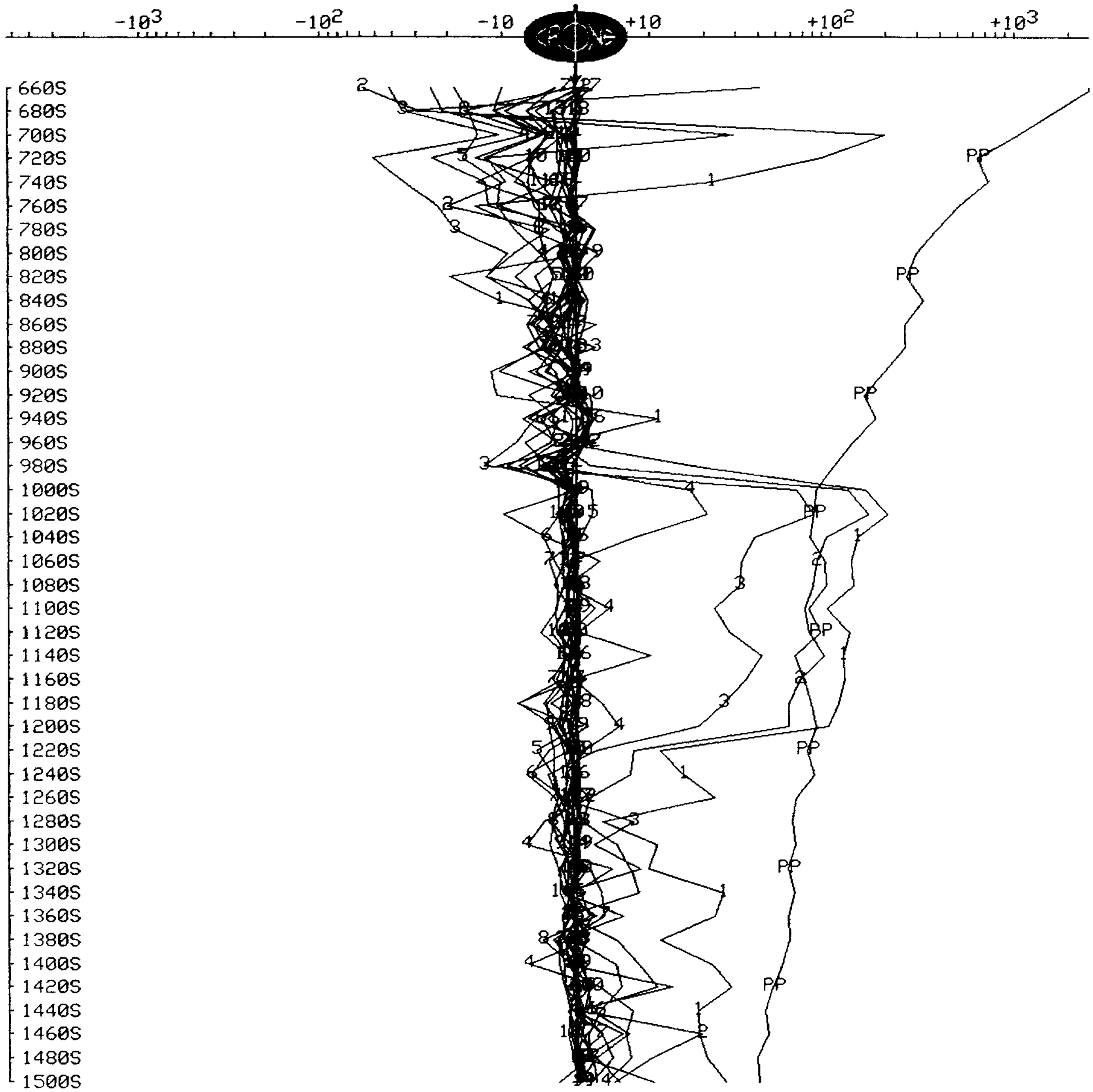

CRONE GEOPHYSICS & EXPLORATION LTD
Surface Pulse EM Survey

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Grid	: **Hutt Grid**	Tx Loop	: **NORTH**
Date	: Oct 28, 2000	File name	: 1800EA.PEM

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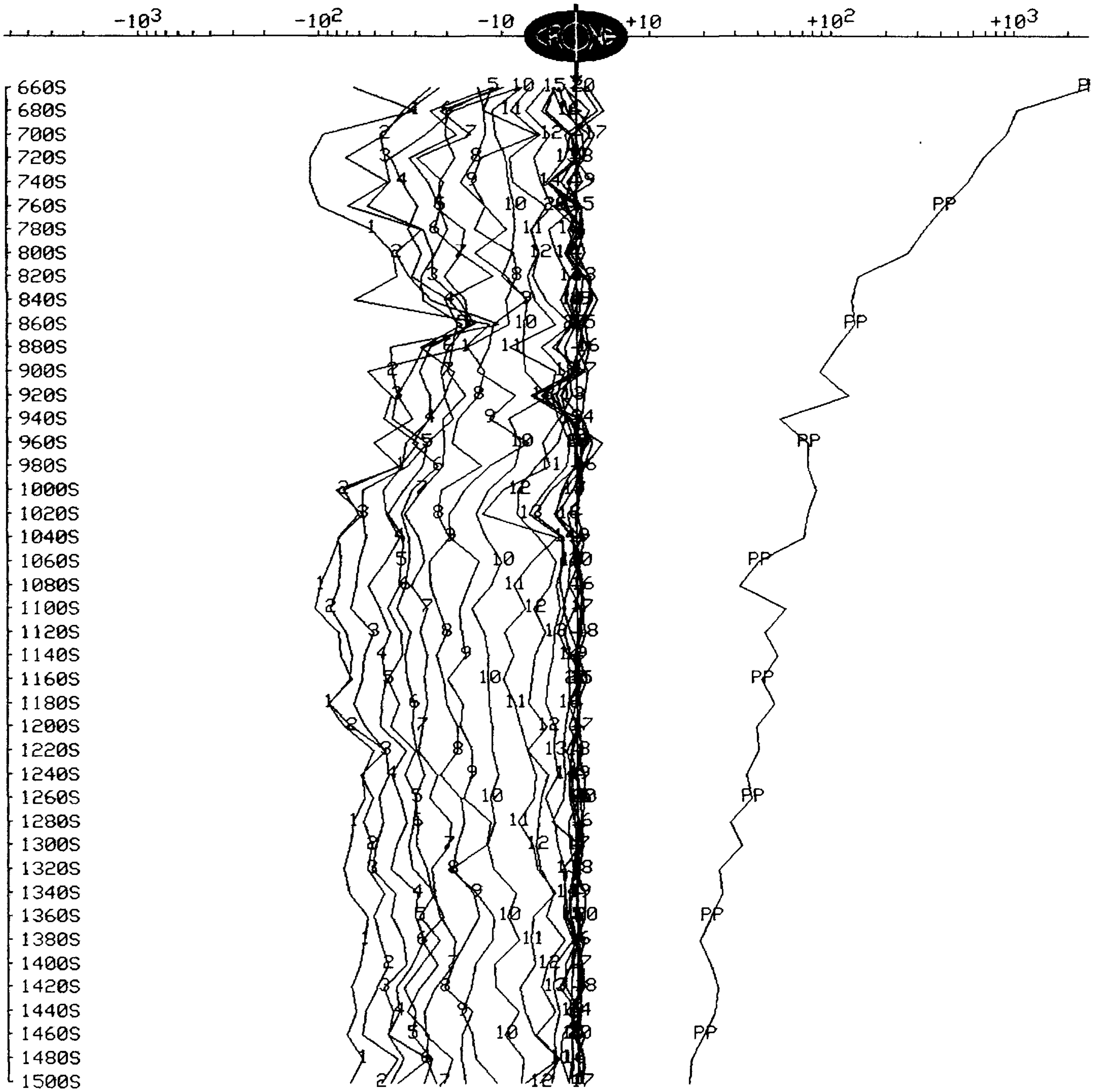

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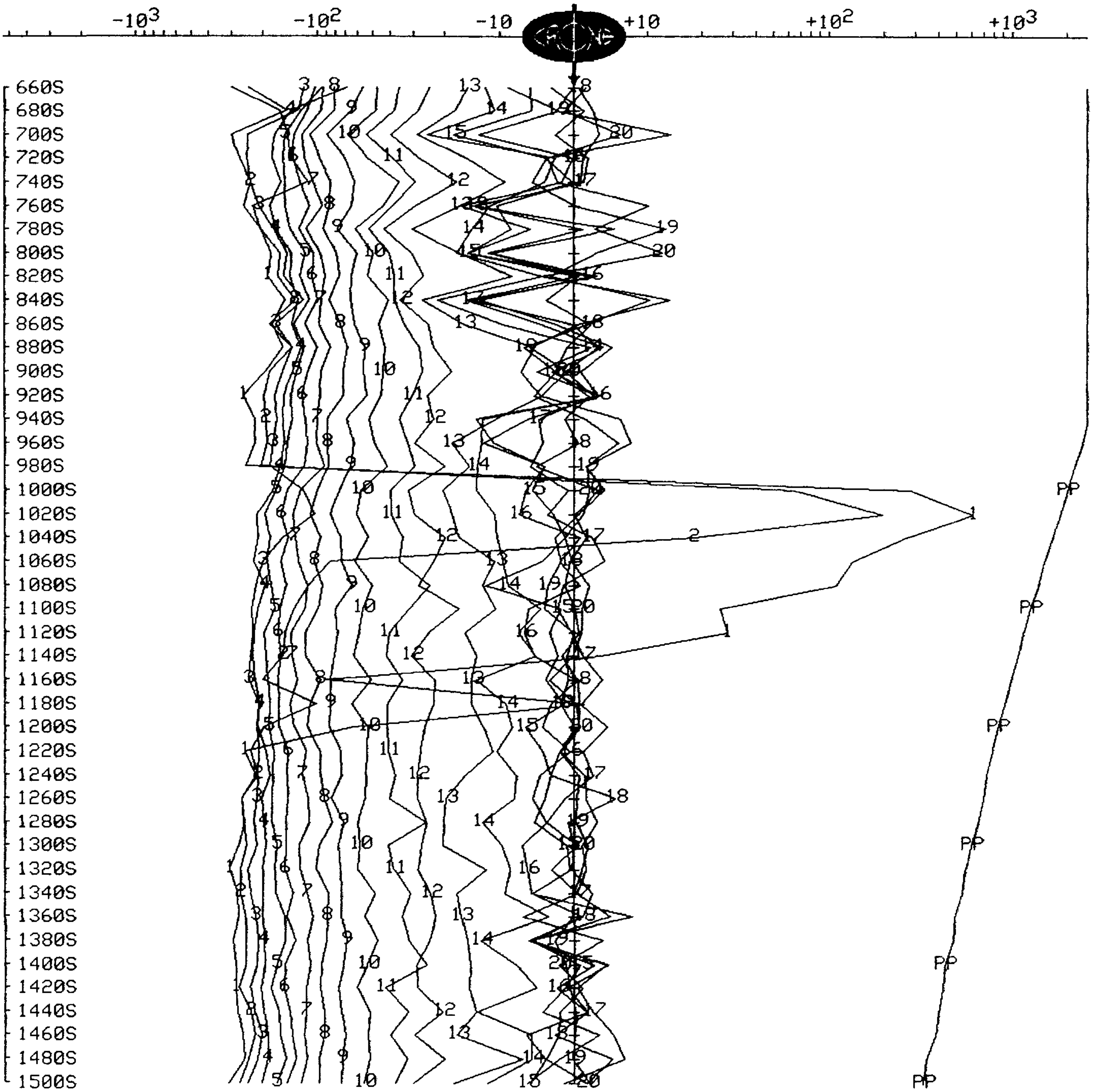
Surface Pulse EM Survey

Client	: **Falconbridge Ltd.**	Line	: **1800E**
Grid	: **Hutt Grid**	Tx Loop	: **NORTH**
Date	: Oct 28, 2000	File name	: 1800EA.PEM

VERTICAL COMPONENT dBz/dt nanoTesla/sec - 20 of 20 channels and PP
Scale: 1:5000



CRONE GEOPHYSICS & EXPLORATION LTD
Surface Pulse EM Survey

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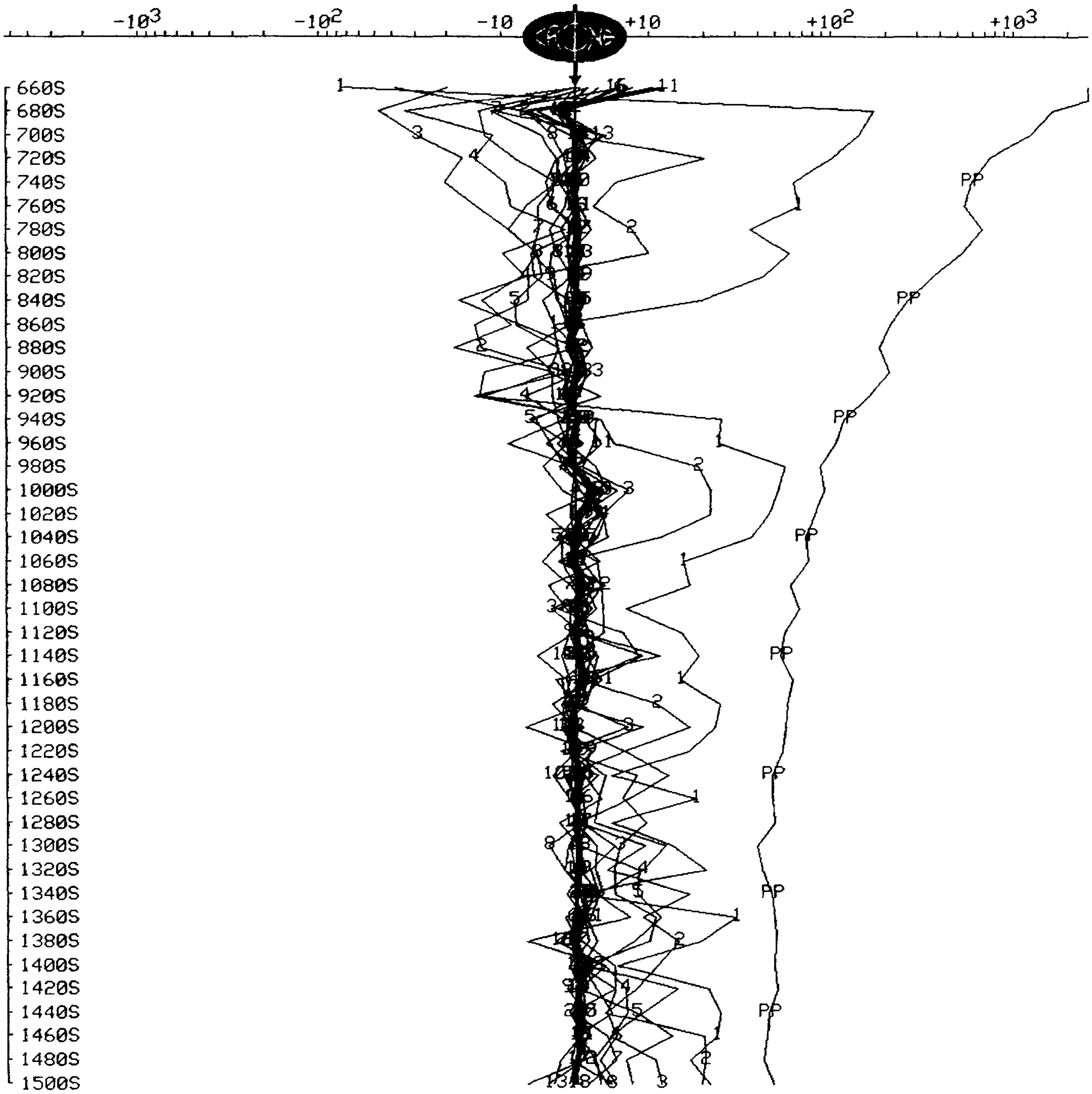
Grid	: **Hutt**	Tx Loop	: **NORTH**
Date	: Oct 29, 2000	File name	: 1900EA.PEM

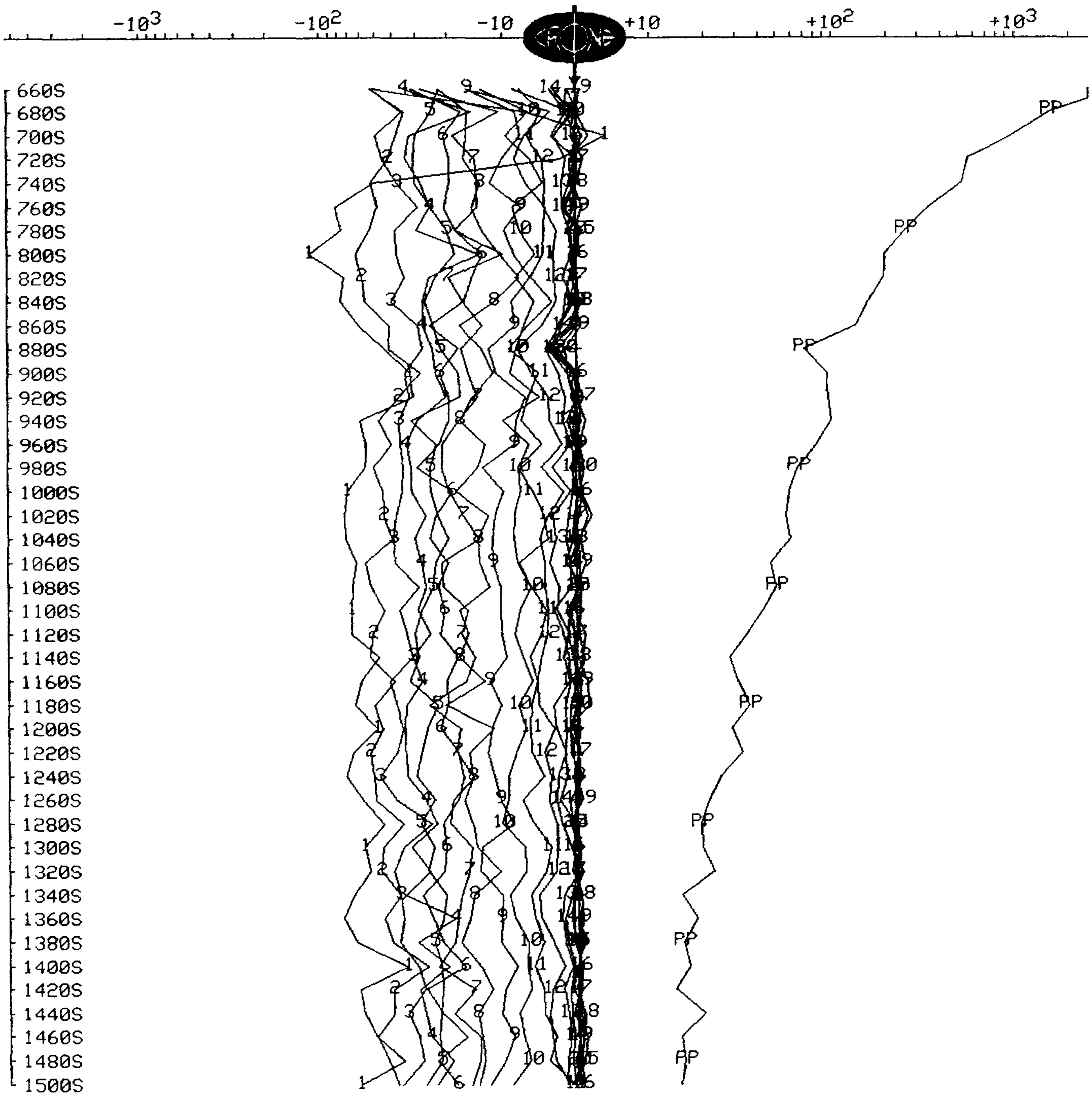
IN-LINE HORIZONTAL COMPONENT dBx/dt nanoTesla/sec - 20 of 20 channels and
Scale: 1:5000



CRONE GEOPHYSICS & EXPLORATION LTD
Surface Pulse EM Survey

Client	: **Falconbridge Ltd.**	Line	: **1900E**
Grid	: **Hutt**	Tx Loop	: **NORTH**
Date	: Oct 29, 2000	File name	: 1900EA.PEM

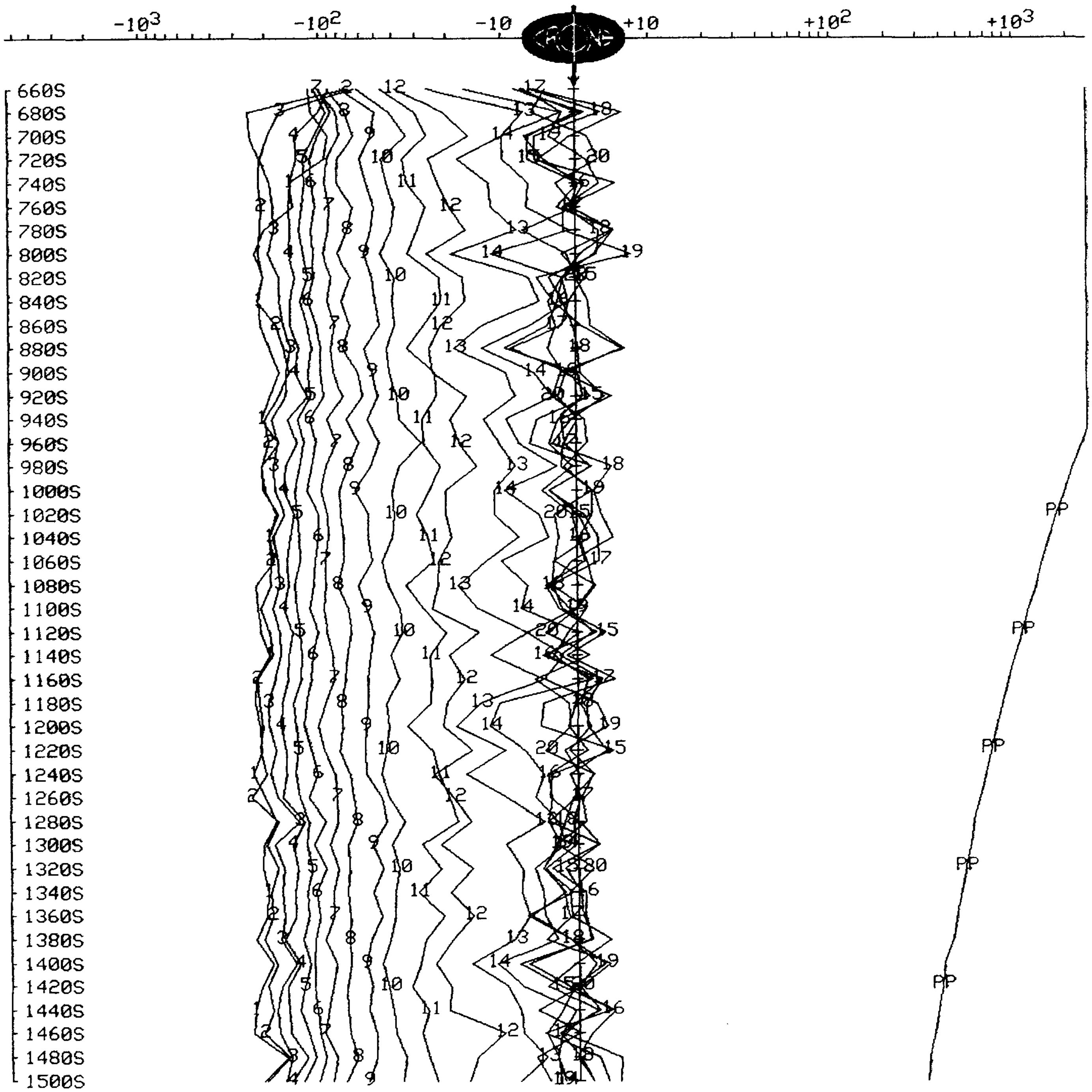
CROSS-LINE HORIZONTAL COMPONENT dBy/dt nanoTesla/sec - 20 of 20 channels a
Scale: 1:5000



CRONE GEOPHYSICS & EXPLORATION LTD
Surface Pulse EM Survey

Client	:	**Falconbridge Ltd.**	Line	:	**1900E**
Grid	:	**Hutt**	Tx Loop	:	**NORTH**
Date	:	Oct 29, 2000	File name	:	1900EA.PEM

VERTICAL COMPONENT dBz/dt nanoTesla/sec - 20 of 20 channels and PP
Scale: 1:5000



CRONE GEOPHYSICS & EXPLORATION LTD
Surface Pulse EM Survey

Client	: **Falconbridge Ltd.**	Line	: **2000E**
Grid	: **Hutt Grid**	Tx Loop	: **NORTH**
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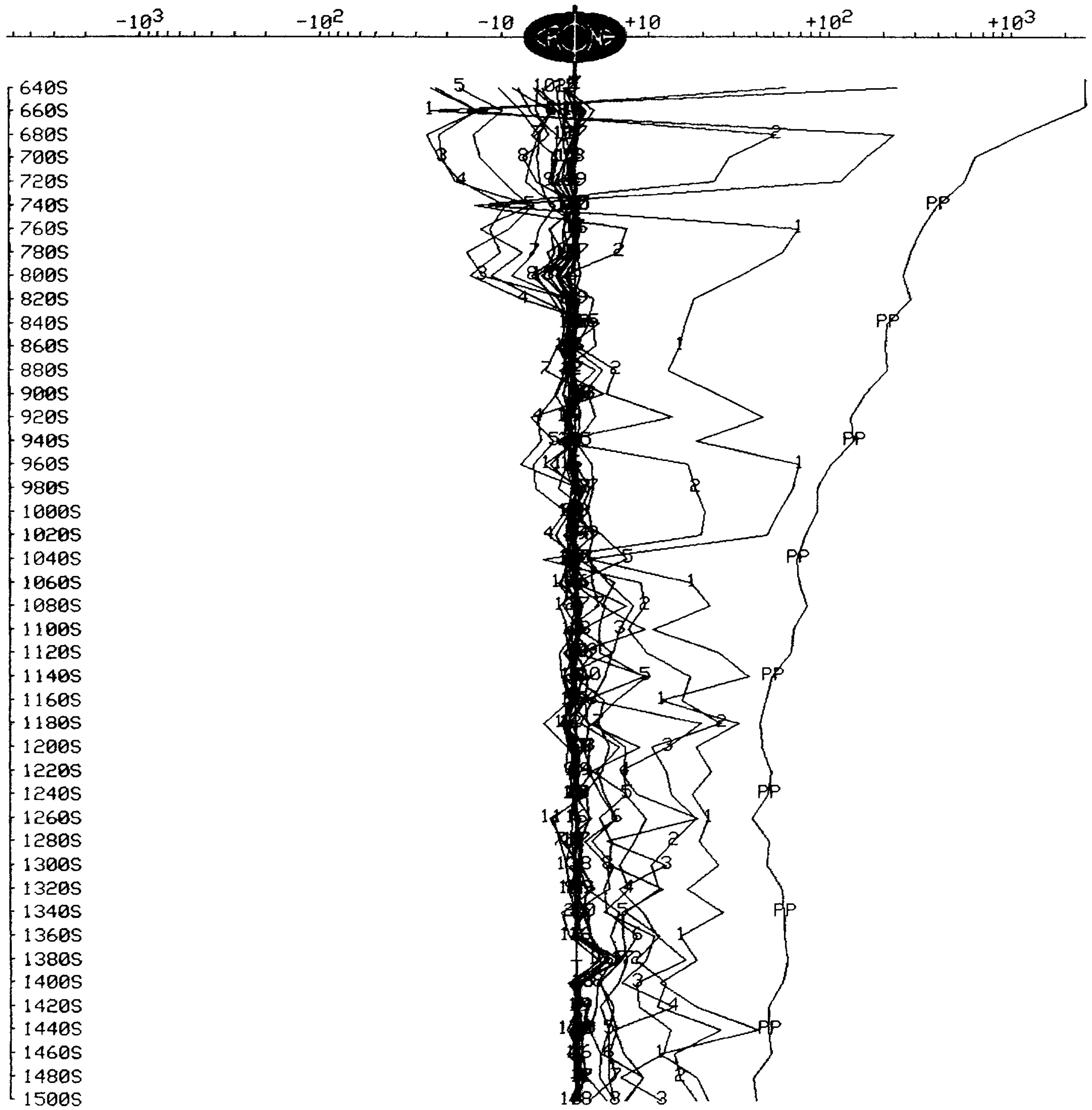

CRONE GEOPHYSICS & EXPLORATION LTD
Surface Pulse EM Survey

Client	: **Falconbridge Ltd.**	Line	: **2000E**
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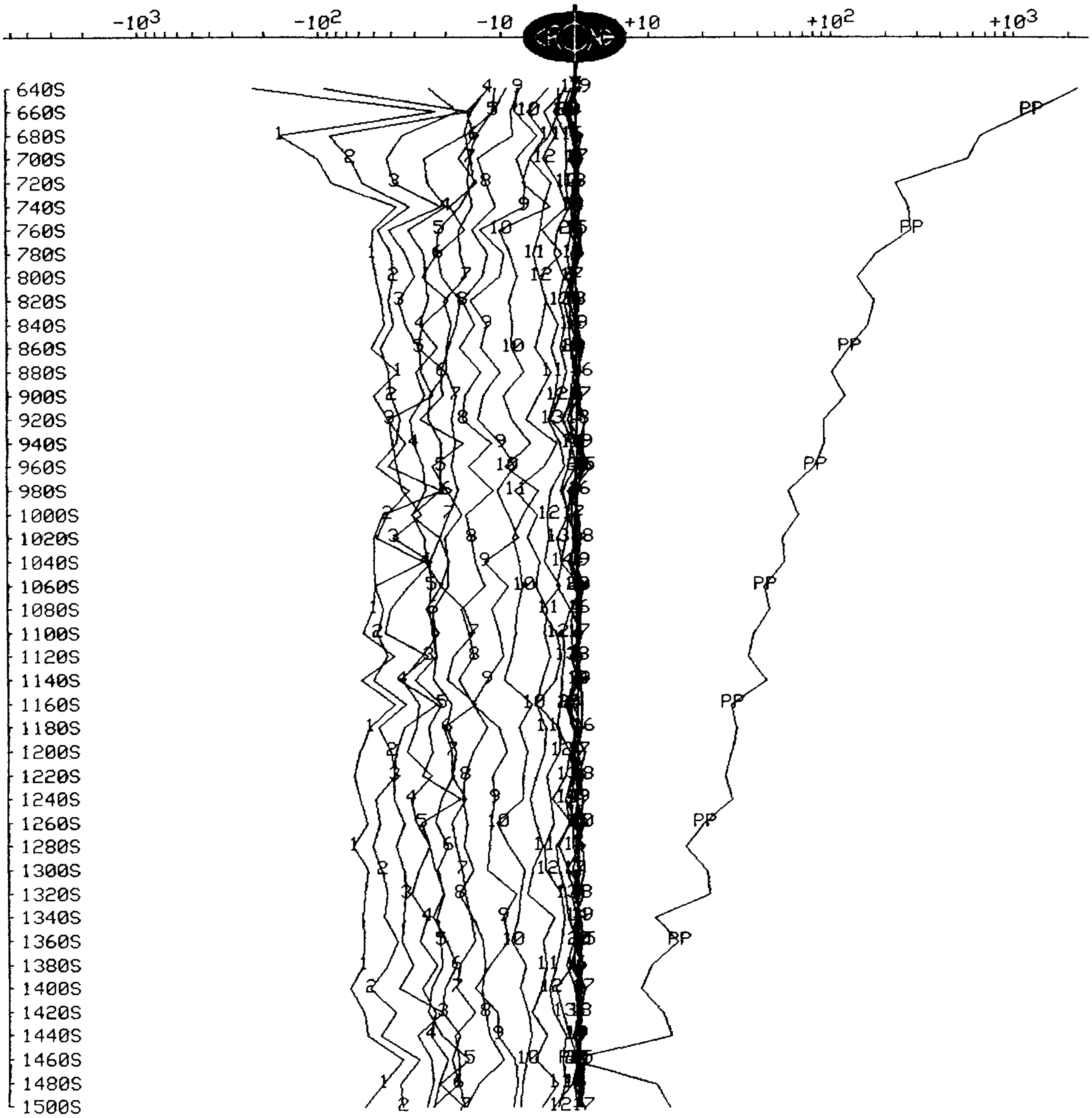
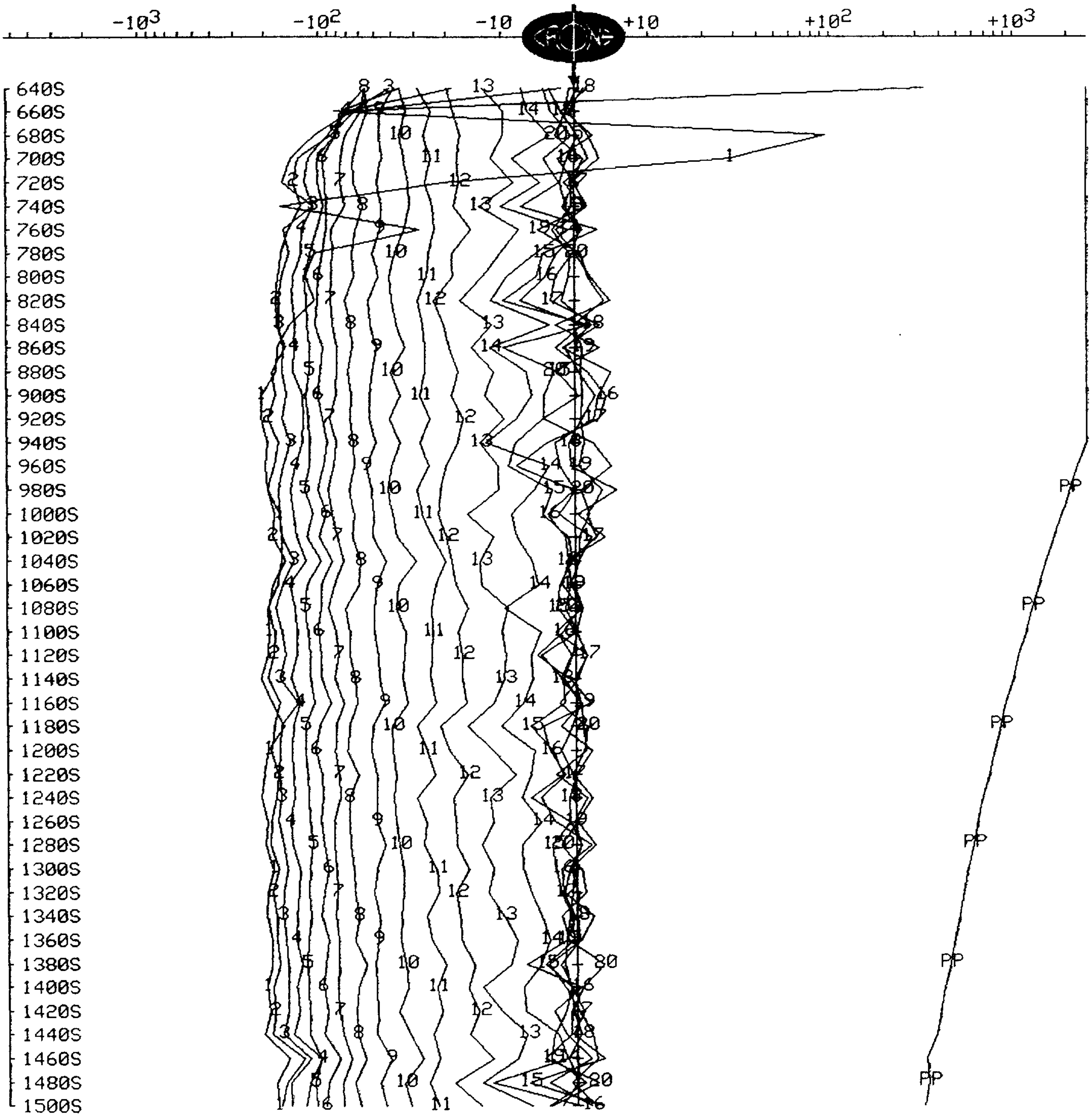
Scale: 1:5000



CRONE GEOPHYSICS & EXPLORATION LTD
Surface Pulse EM Survey

Client	: **Falconbridge Ltd.**	Line	: **2000E**
Grid	: **Hutt Grid**	Tx Loop	: **NORTH**
Date	: Oct 30, 2000	File name	: 2000EA.PEM

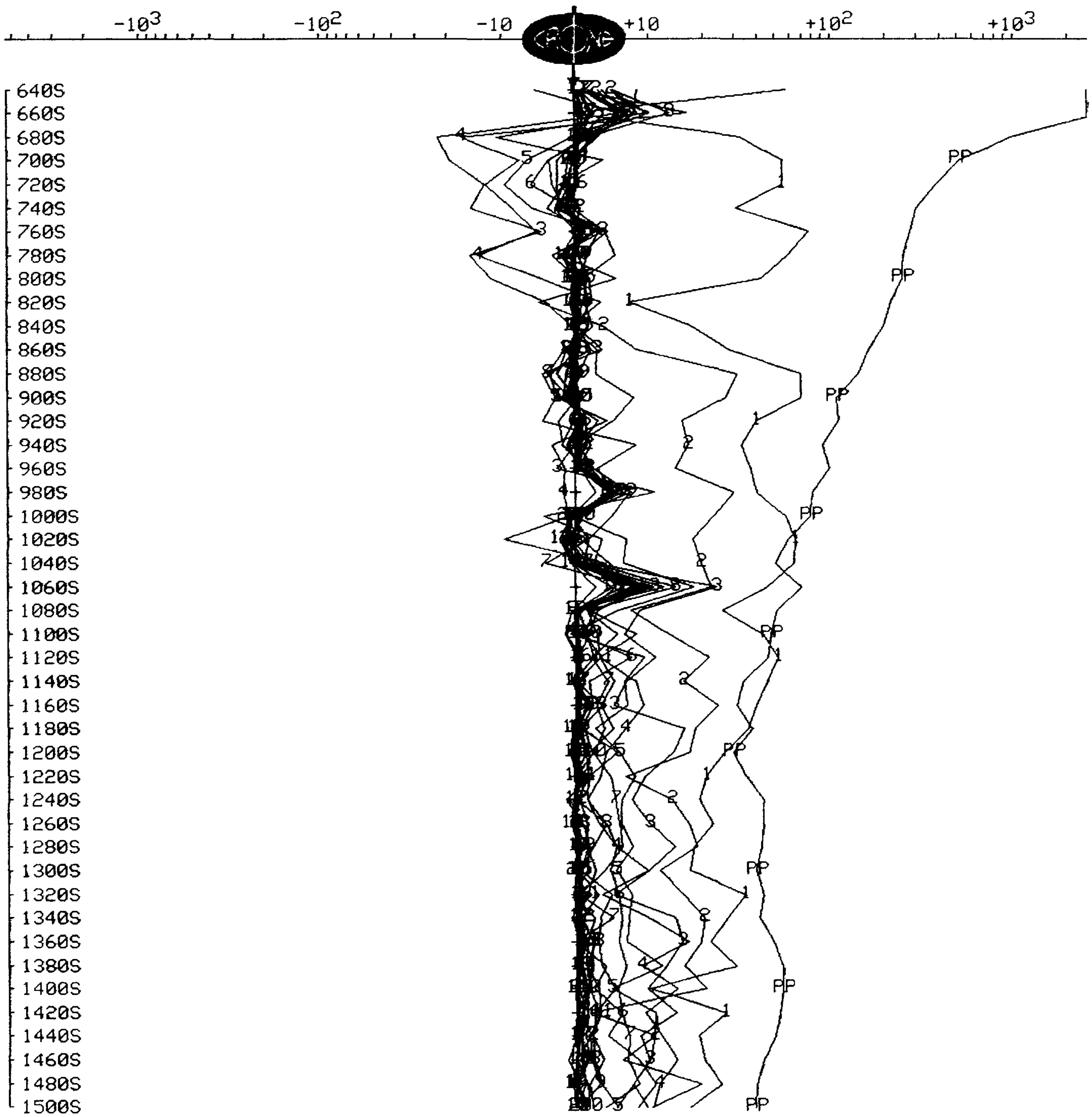
VERTICAL COMPONENT dBz/dt nanoTesla/sec - 20 of 20 channels and PP
Scale: 1:5000



CRONE GEOPHYSICS & EXPLORATION LTD
Surface Pulse EM Survey

Client	: **Falconbridge Ltd.**	Line	: **2100E**
Grid	: **Hutt Grid**	Tx Loop	: **NORTH**
Date	: Oct 30, 2000	File name	: 2100EA.PEM

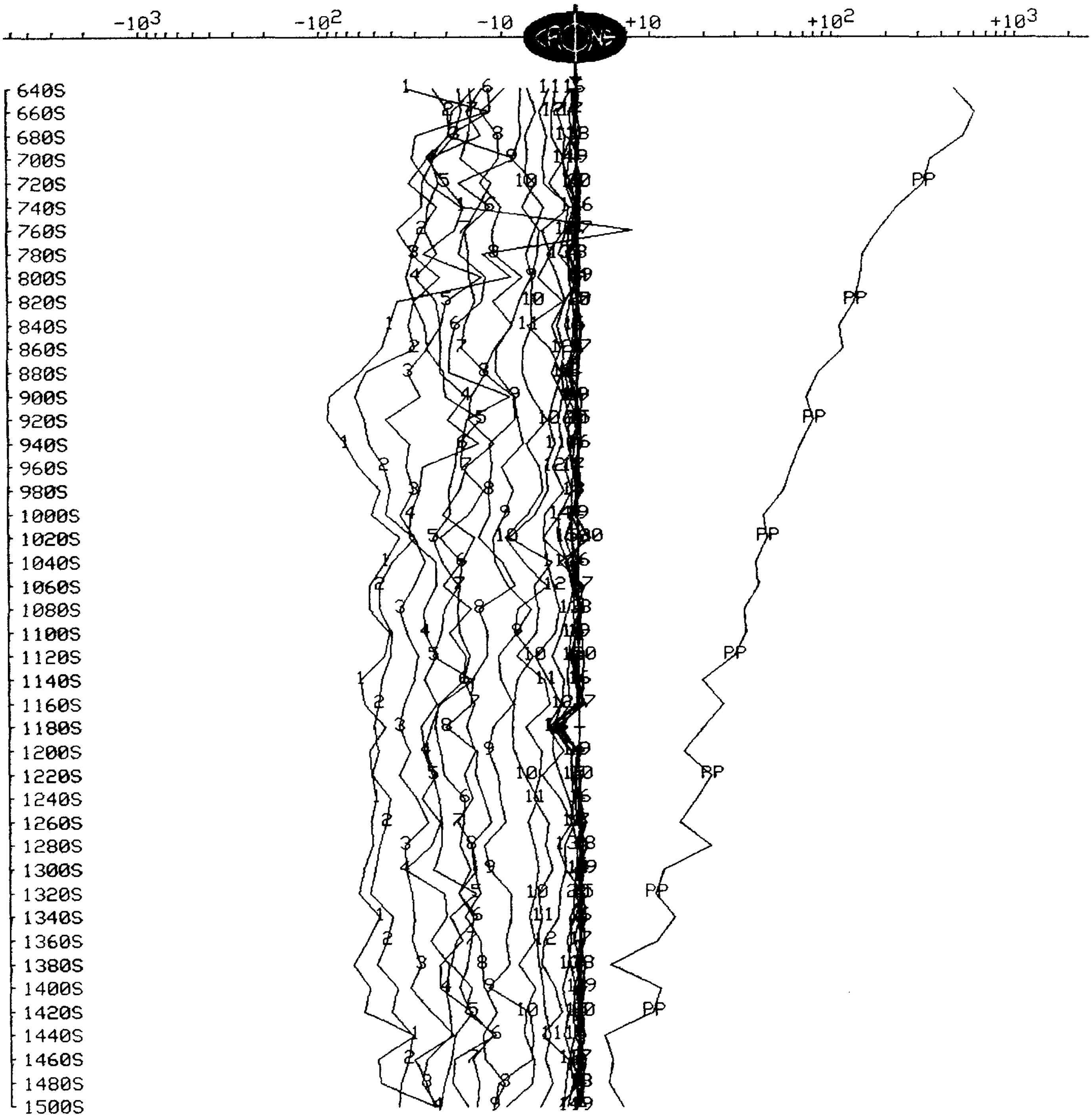
IN-LINE HORIZONTAL COMPONENT dBx/dt nanoTesla/sec - 20 of 20 channels and
Scale: 1:5000



CRONE GEOPHYSICS & EXPLORATION LTD
Surface Pulse EM Survey

Client	: **Falconbridge Ltd.**	Line	: **2100E**
Grid	: **Hutt Grid**	Tx Loop	: **NORTH**
Date	: Oct 30, 2000	File name	: 2100EA.PEM

CROSS-LINE HORIZONTAL COMPONENT dBy/dt nanoTesla/sec - 20 of 20 channels a
Scale: 1:5000



CRONE GEOPHYSICS & EXPLORATION LTD
Surface Pulse EM Survey

Client	: **Falconbridge Ltd.**	Line	: **2100E**
Grid	: **Hutt Grid**	Tx Loop	: **NORTH**
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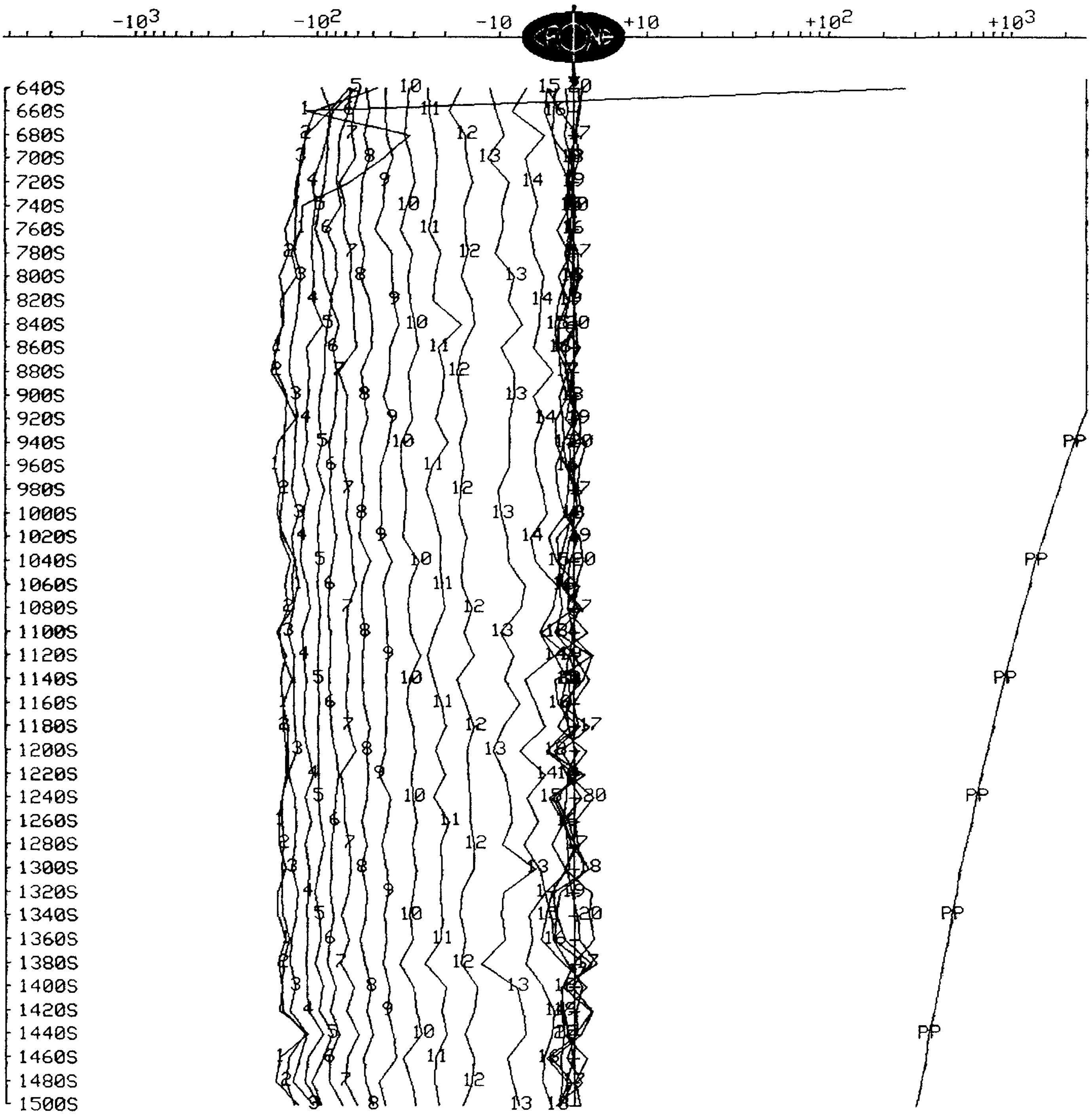
VERTICAL COMPONENT dBz/dt nanoTesla/sec - 20 of 20 channels and PP
Scale: 1:5000

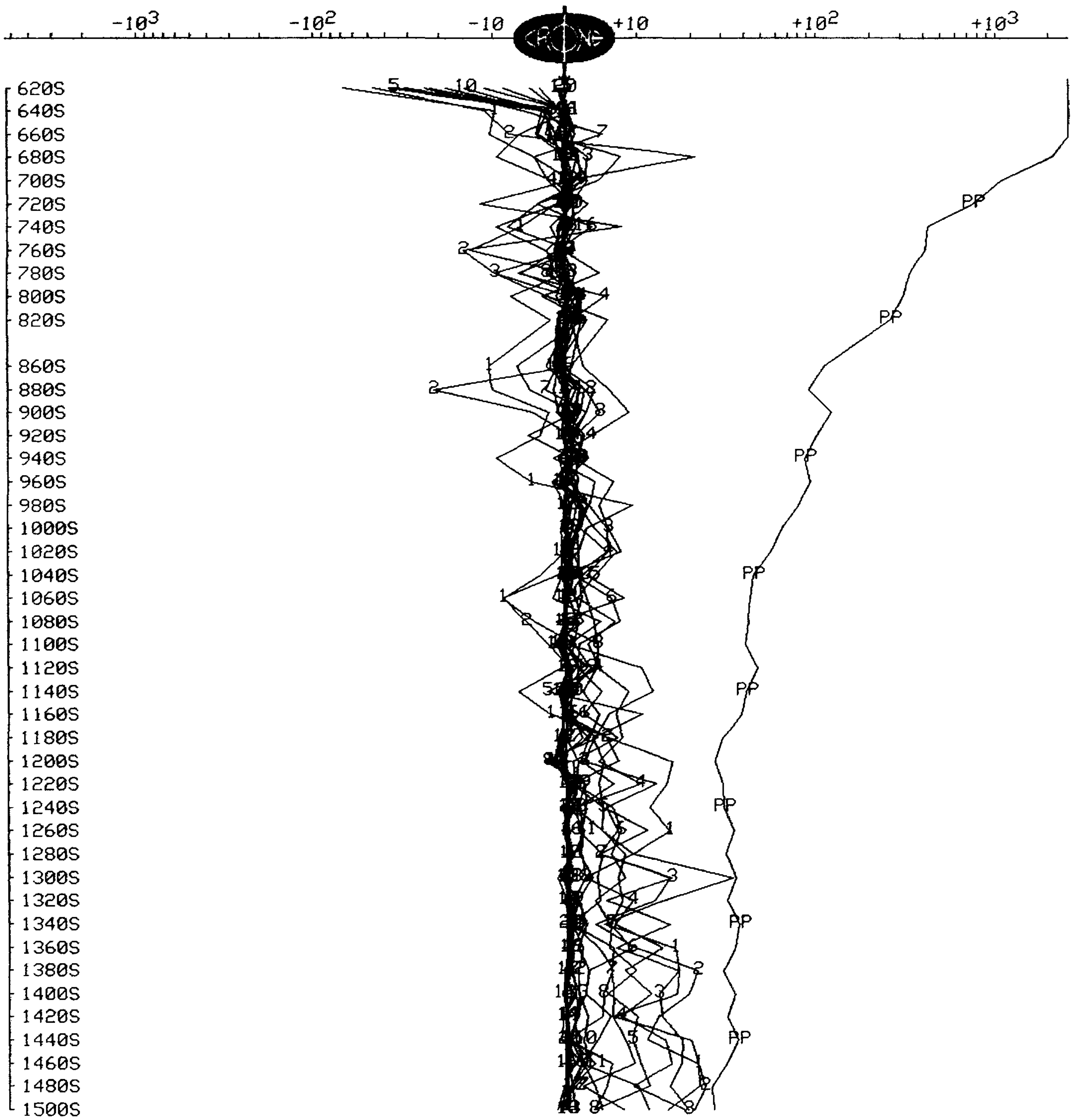


CRONE GEOPHYSICS & EXPLORATION LTD
Surface Pulse EM Survey

Client	: **FALCONBRIDGE**	Line	: **2200E**
Grid	: **HUTT**	Tx Loop	: **NORTH**
Date	: Oct 31, 2000	File name	: 2200EA.PEM

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

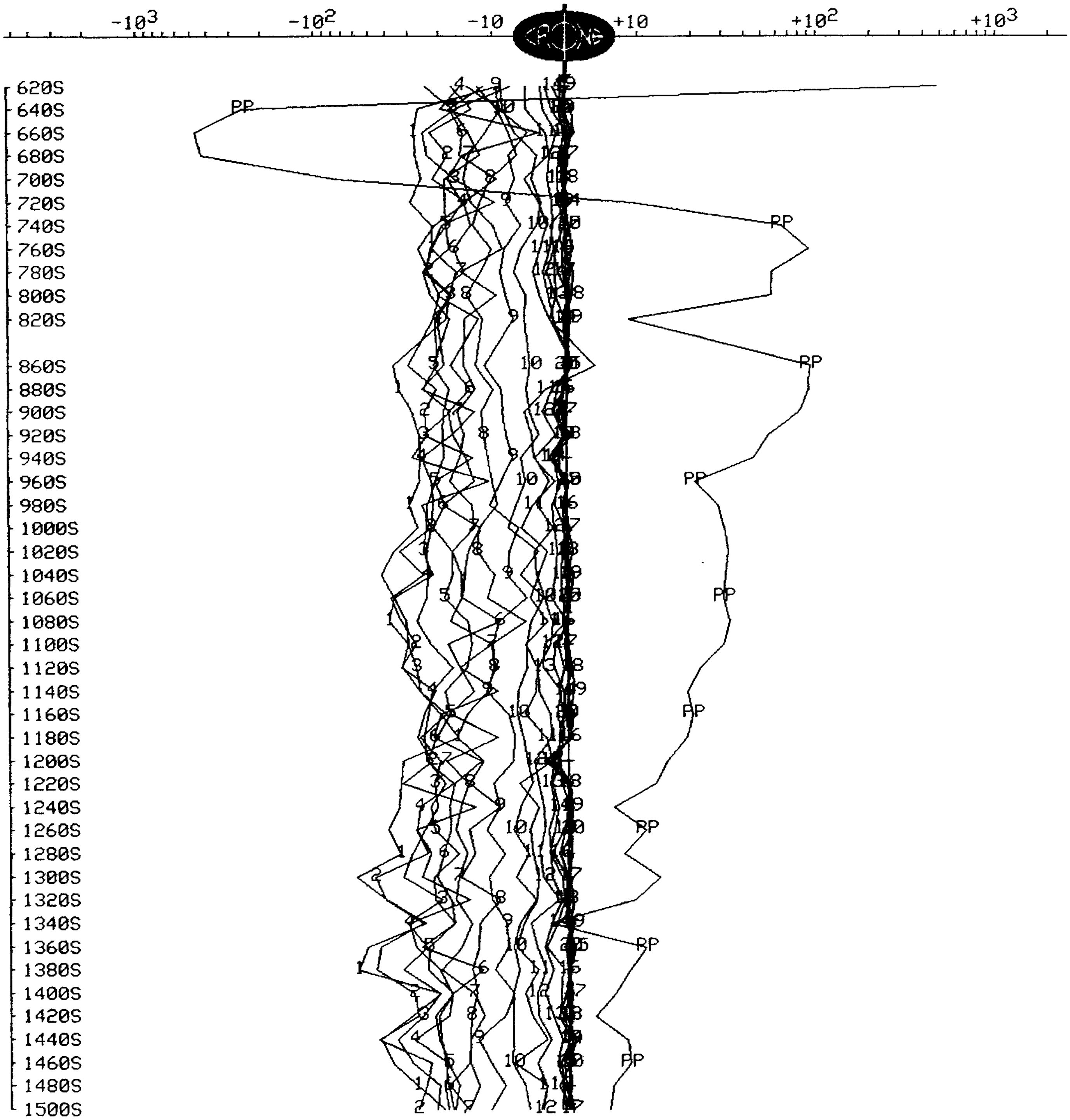
Scale: 1:5000



CRONE GEOPHYSICS & EXPLORATION LTD
Surface Pulse EM Survey

Client	: **FALCONBRIDGE**	Line	: **2200E**
Grid	: **HUTT**	Tx Loop	: **NORTH**
Date	: Oct 31, 2000	File name	: 2200EA.PEM

CROSS-LINE HORIZONTAL COMPONENT dBy/dt nanoTesla/sec - 20 of 20 channels a
Scale: 1:5000



CRONE GEOPHYSICS & EXPLORATION LTD
Surface Pulse EM Survey

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Grid	:	**HUTT**	Tx Loop	:	**NORTH**
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VERTICAL COMPONENT dBz/dt nanoTesla/sec - 20 of 20 channels and PP
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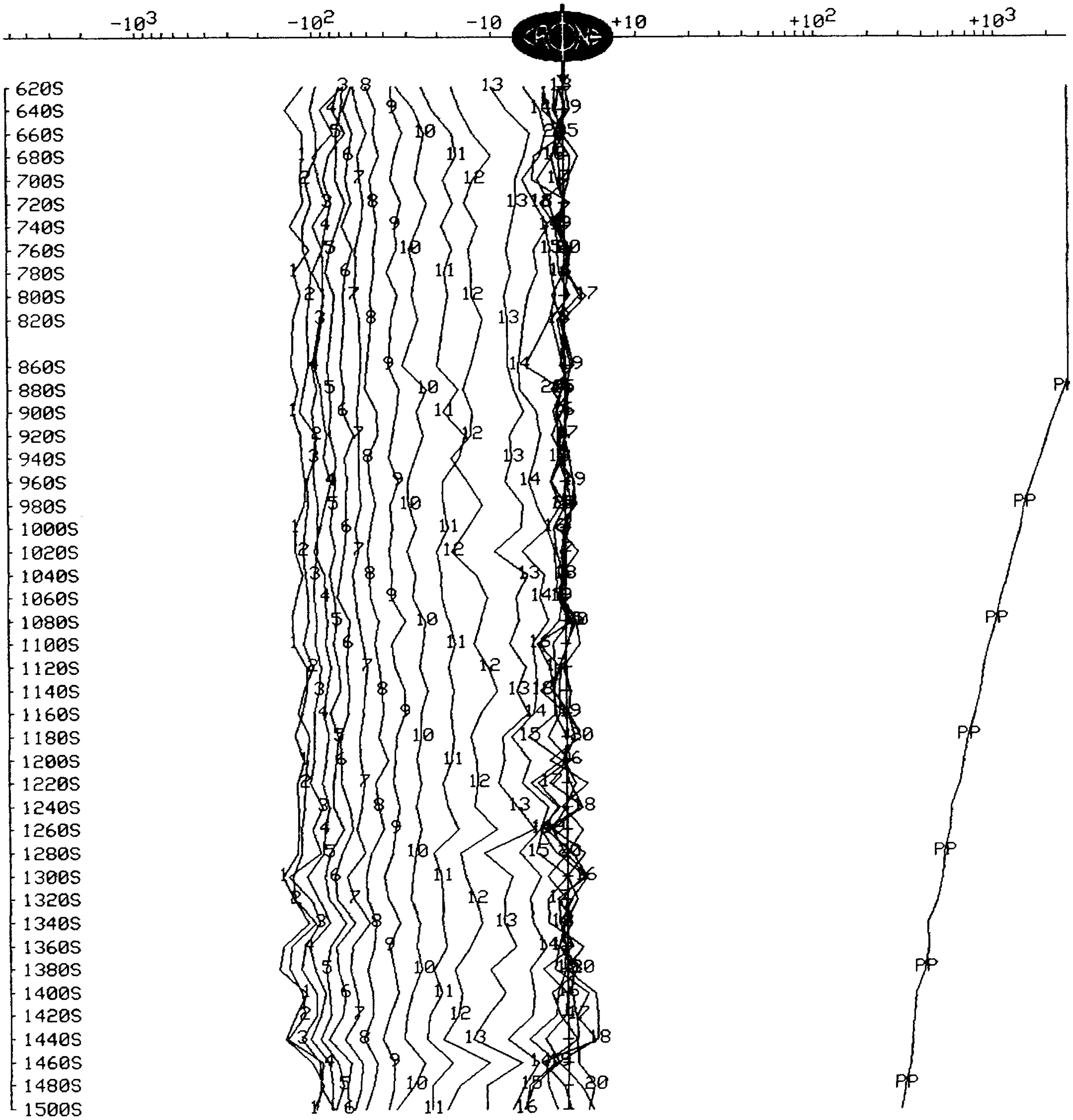

APPENDIX III

PULSE EM DATA PROFILES (SMOOTH)

CRONE GEOPHYSICS & EXPLORATION LTD
Surface Pulse EM Survey

Client	: **Falconbridge Ltd.**	Line	: **1700E**
Grid	: **Hutt Grid**	Tx Loop	: **NORTH**
Date	: Oct 28, 2000	File name	: 17SM.PEM

Data Smoothed along Profile and Down Decay Curve
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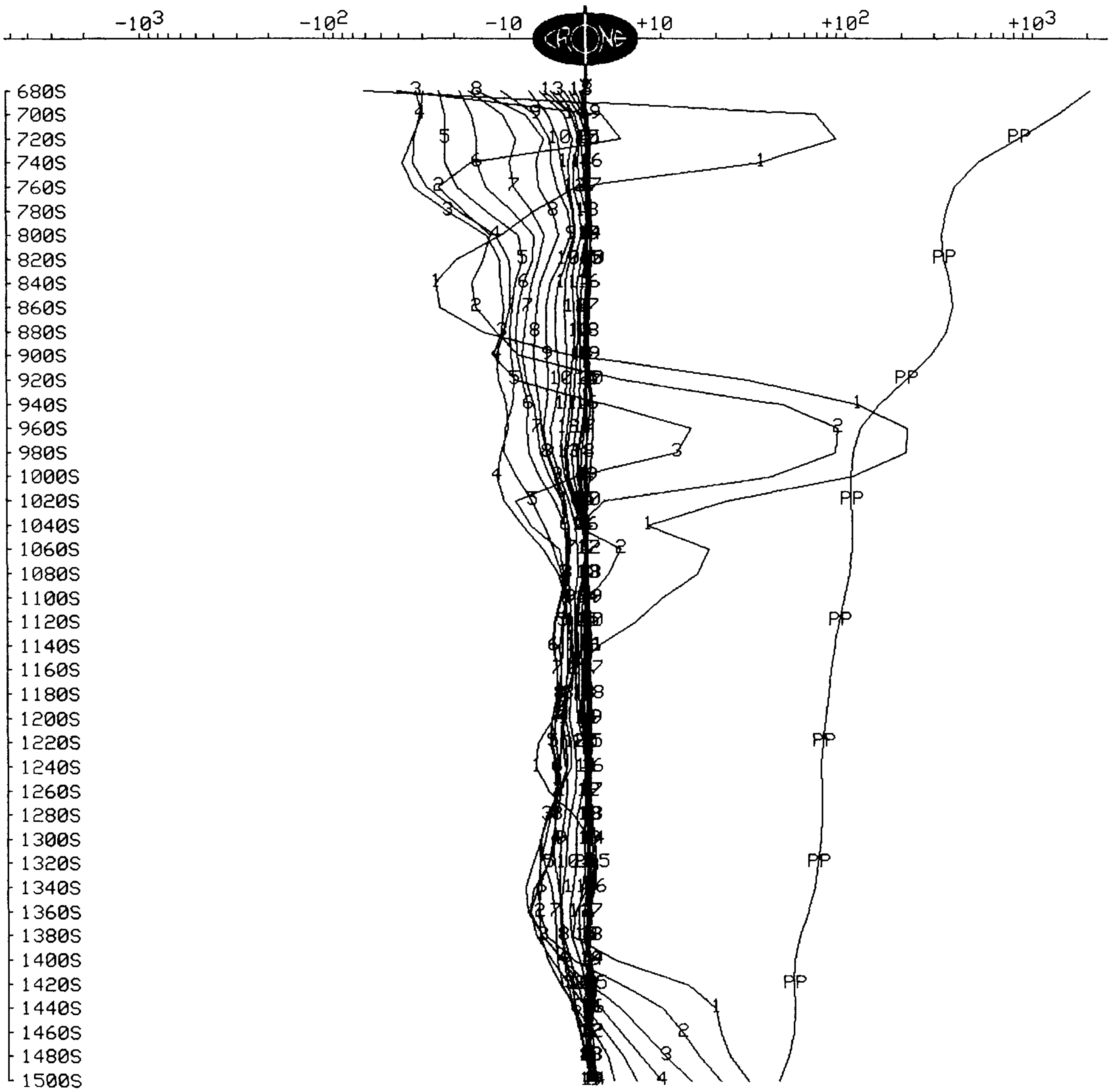
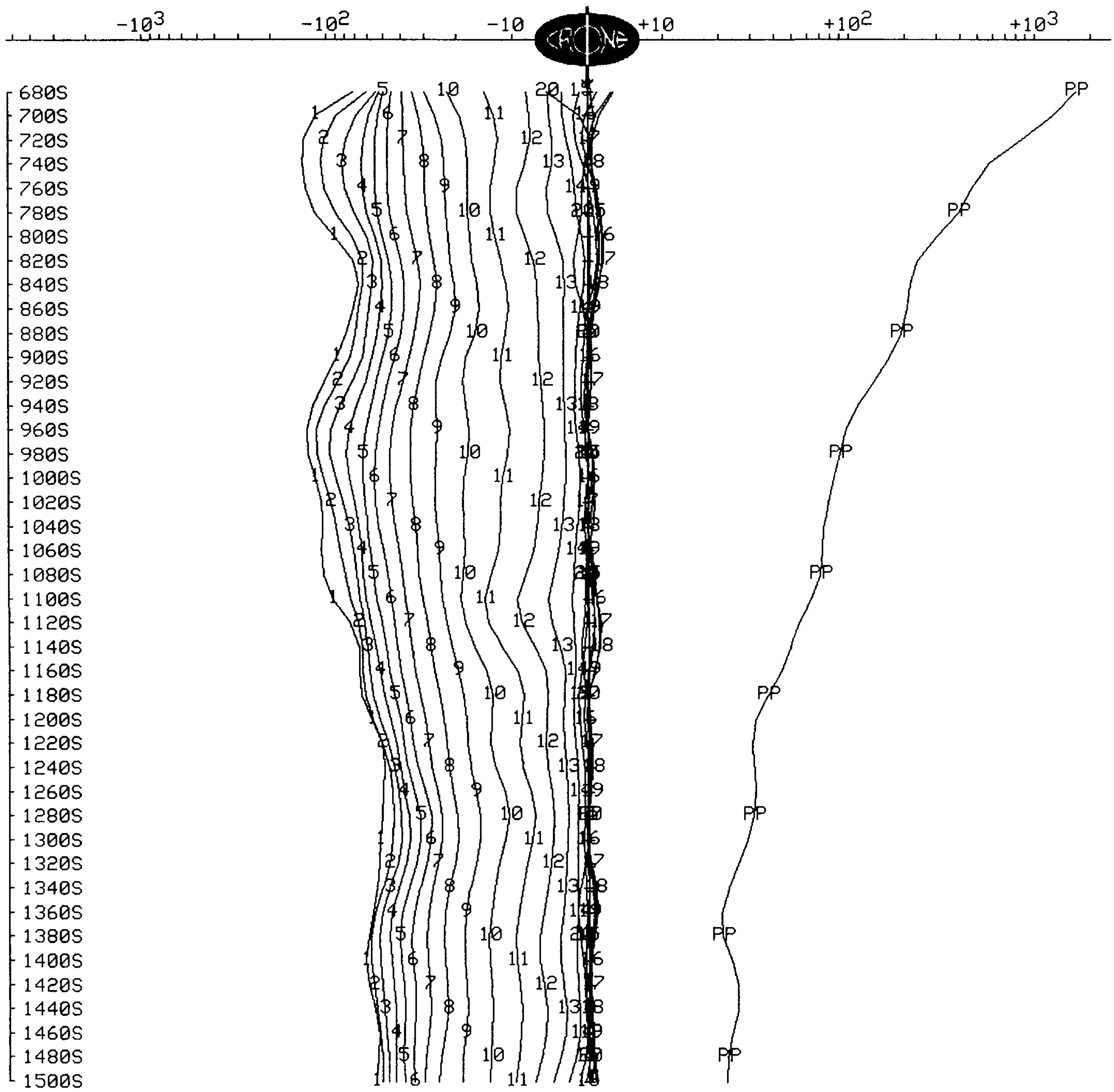
Scale: 1:5000



CRONE GEOPHYSICS & EXPLORATION LTD
Surface Pulse EM Survey

Client	: **Falconbridge Ltd.**	Line	: **1700E**
Grid	: **Hutt Grid**	Tx Loop	: **NORTH**
Date	: Oct 28, 2000	File name	: 17SM.PEM

Data Smoothed along Profile and Down Decay Curve
CROSS-LINE HORIZONTAL COMPONENT dBy/dt nanoTesla/sec - 20 of 20 channels a
Scale: 1:5000

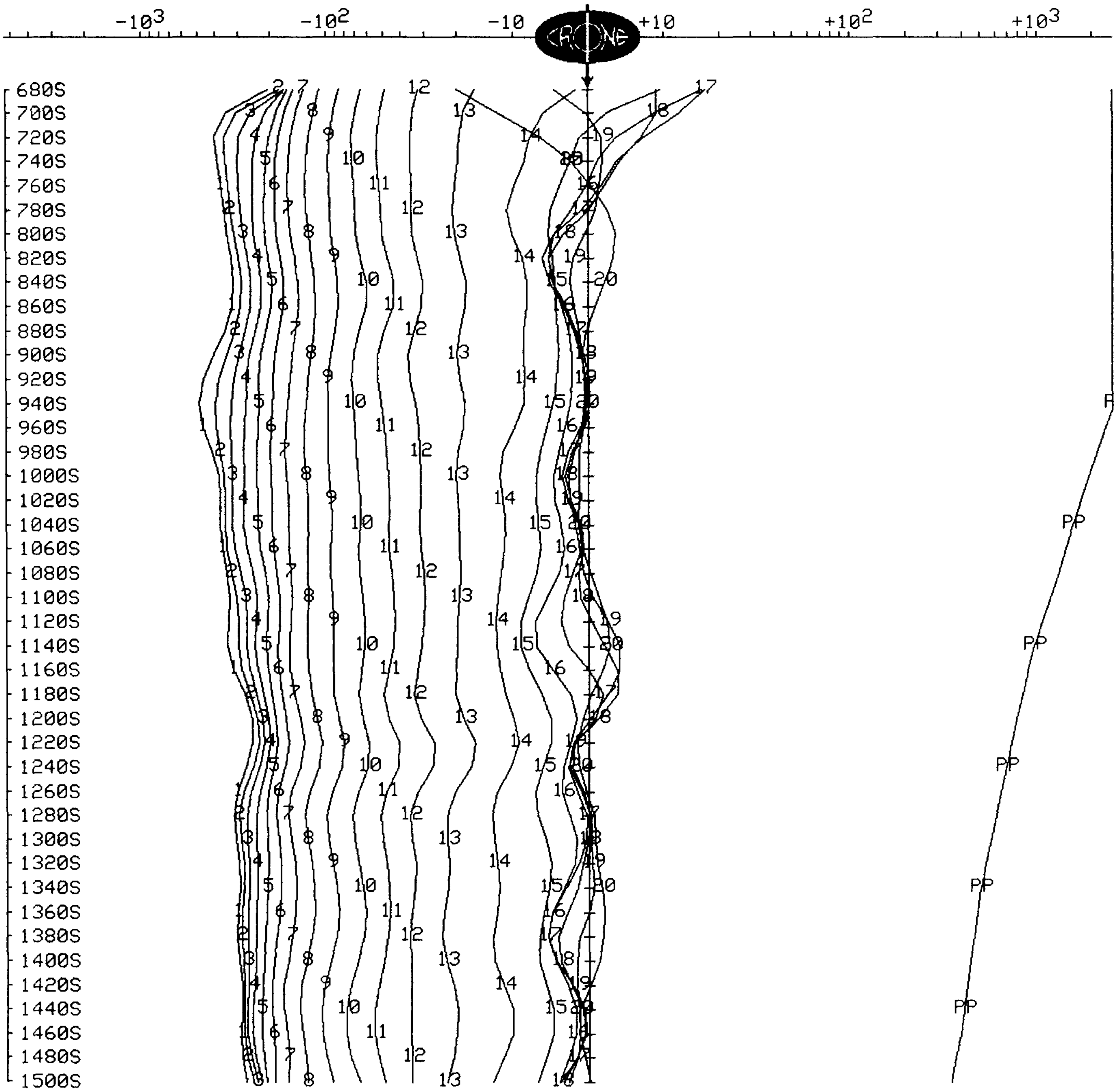


CRONE GEOPHYSICS & EXPLORATION LTD
Surface Pulse EM Survey

Client	: **Falconbridge Ltd.**	Line	: **1700E**
Grid	: **Hutt Grid**	Tx Loop	: **NORTH**
Date	: Oct 28, 2000	File name	: 17SM.PEM

Data Smoothed along Profile and Down Decay Curve
VERTICAL COMPONENT dBz/dt nanoTesla/sec - 20 of 20 channels and PP

Scale: 1:5000



CRONE GEOPHYSICS & EXPLORATION LTD
Surface Pulse EM Survey

Client	: **Falconbridge Ltd.**	Line	: **1800E**
Grid	: **Hutt Grid**	Tx Loop	: **NORTH**
Date	: Oct 28, 2000	File name	: 18SM.PEM

Data Smoothed along Profile and Down Decay Curve
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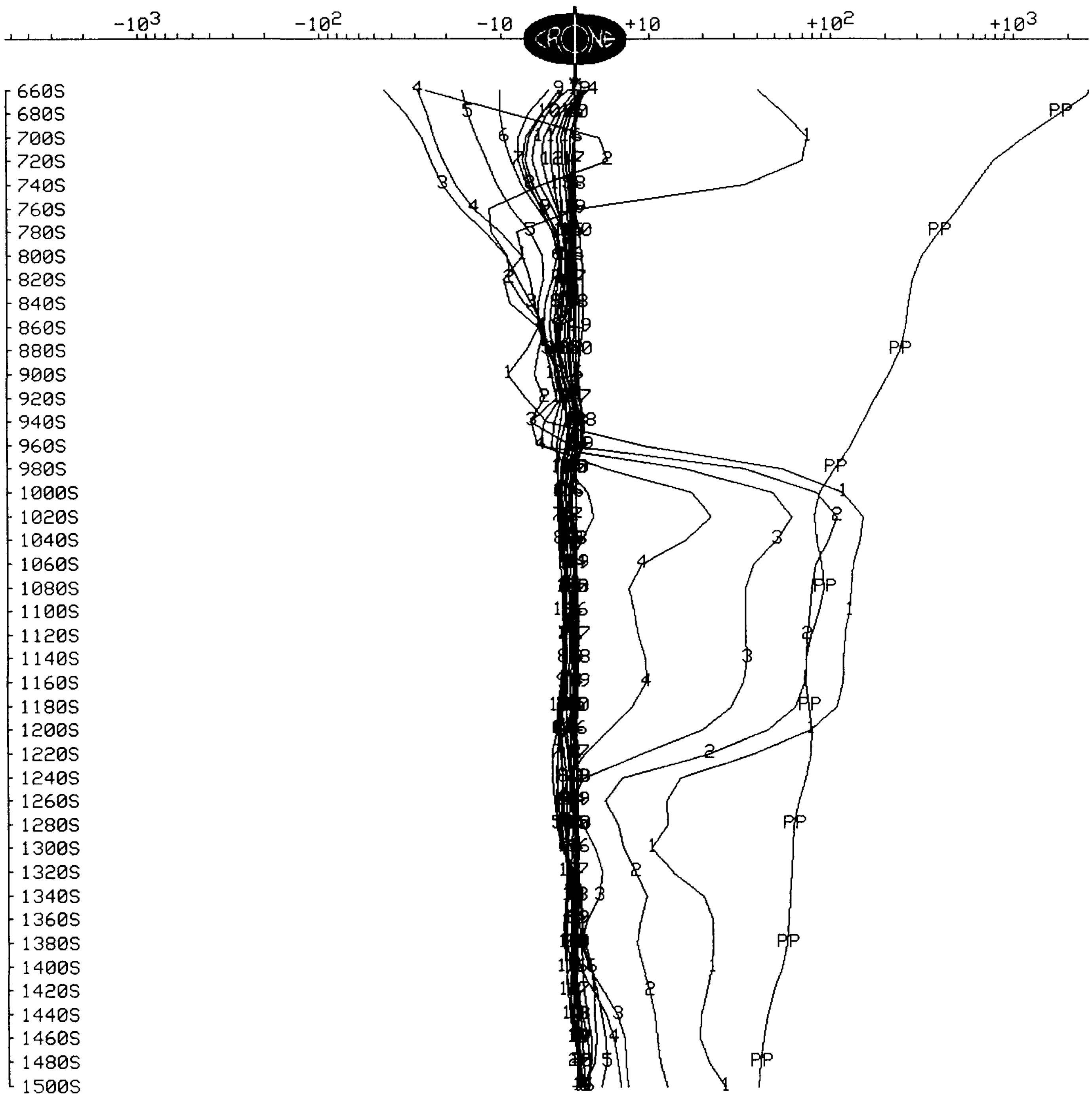
Scale: 1:5000



CRONE GEOPHYSICS & EXPLORATION LTD
Surface Pulse EM Survey

Client	: **Falconbridge Ltd.**	Line	: **1800E**
Grid	: **Hutt Grid**	Tx Loop	: **NORTH**
Date	: Oct 28, 2000	File name	: 18SM.PEM

Data Smoothed along Profile and Down Decay Curve
CROSS-LINE HORIZONTAL COMPONENT dBy/dt nanoTesla/sec - 20 of 20 channels a
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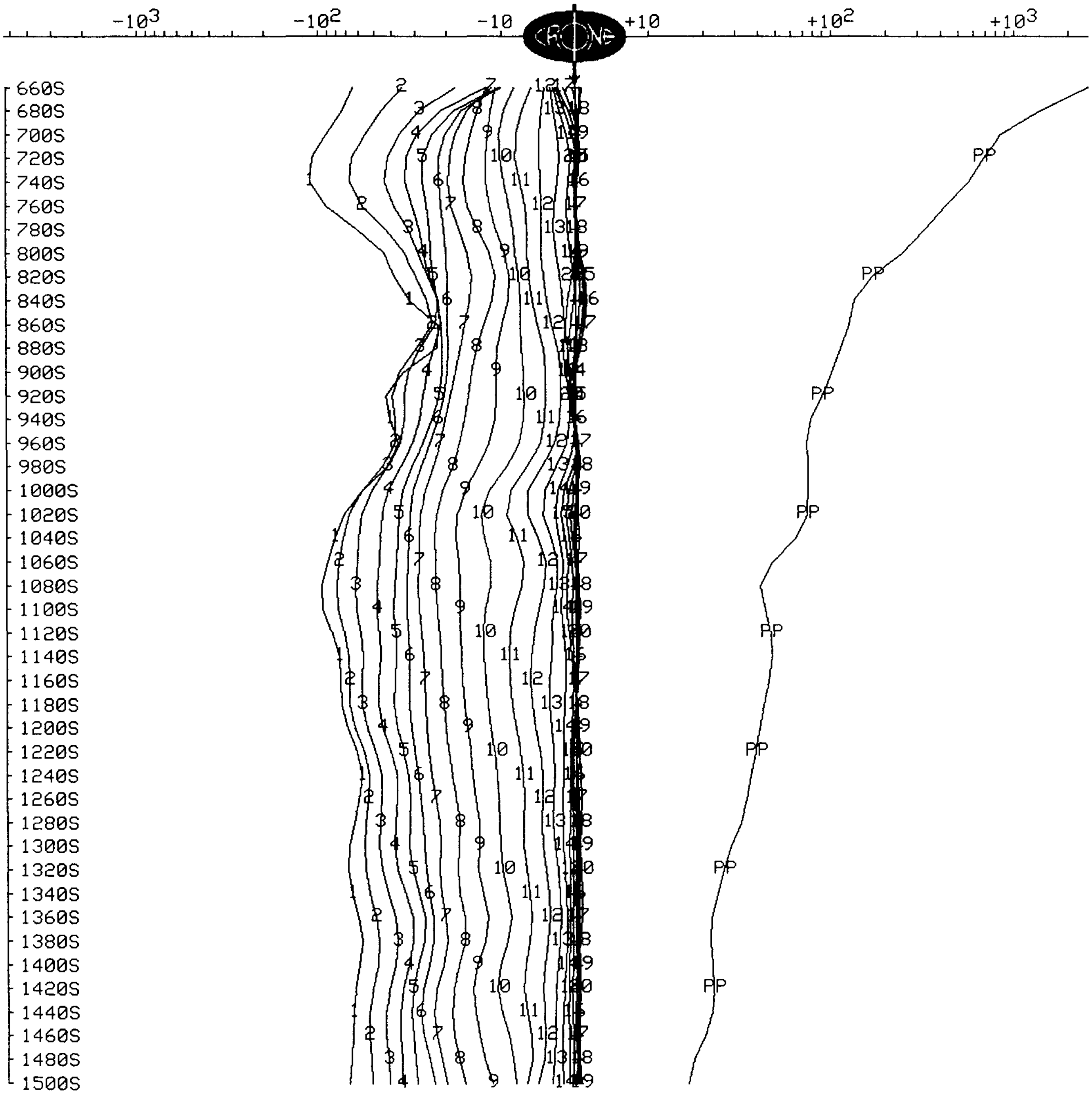
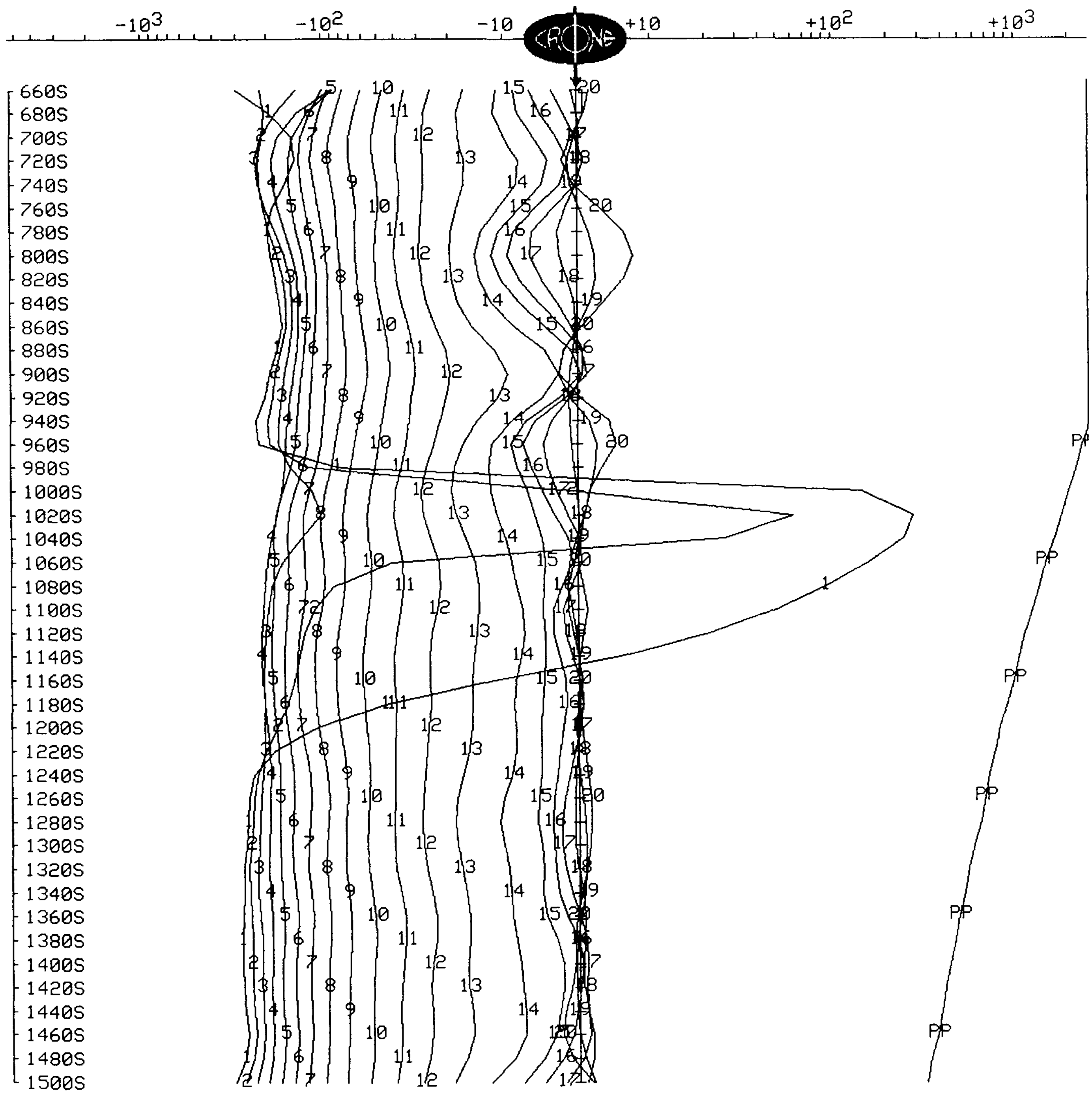


CRONE GEOPHYSICS & EXPLORATION LTD
Surface Pulse EM Survey

Client	: **Falconbridge Ltd.**	Line	: **1800E**
Grid	: **Hutt Grid**	Tx Loop	: **NORTH**
Date	: Oct 28, 2000	File name	: 18SM.PEM

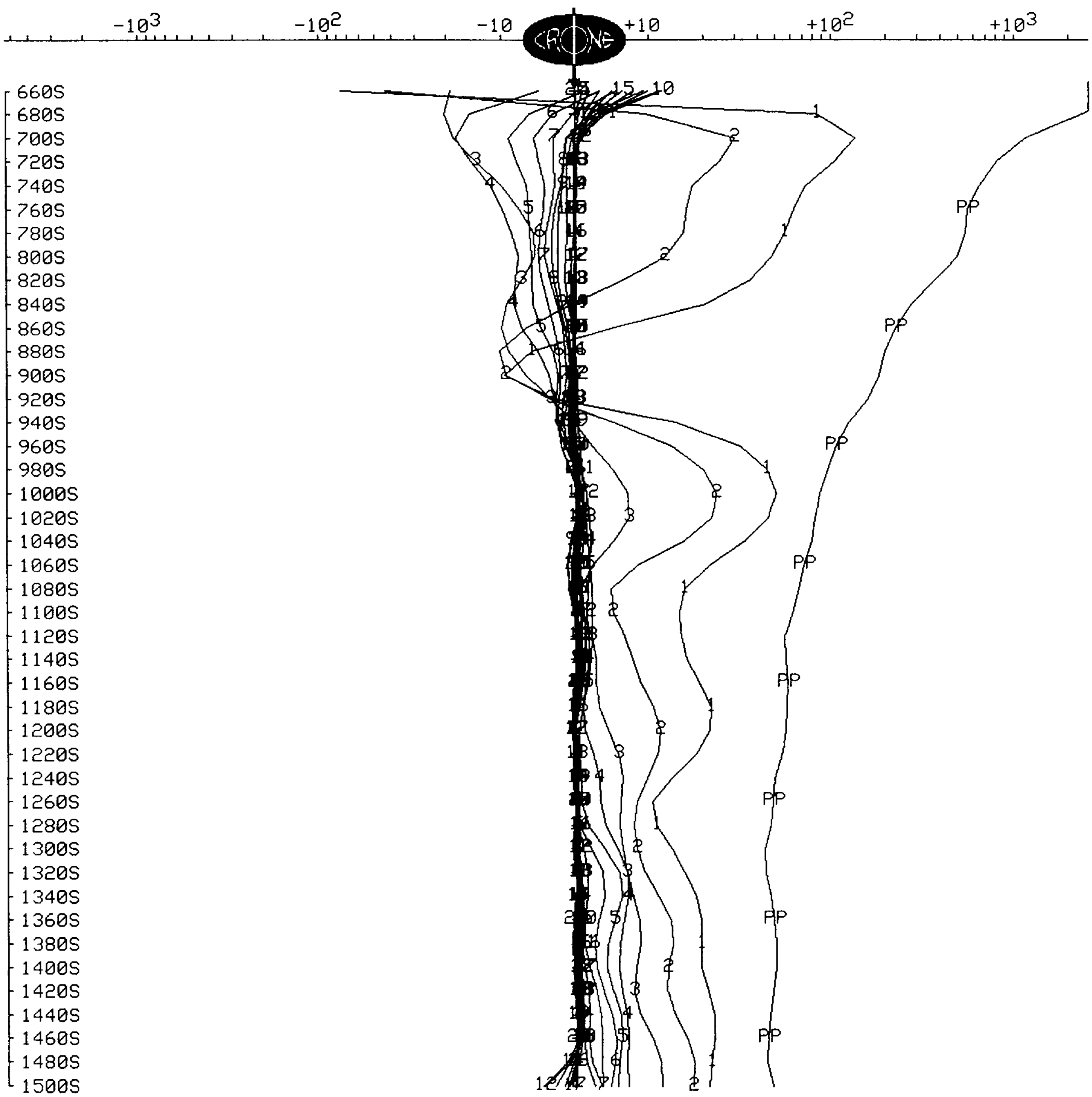
Data Smoothed along Profile and Down Decay Curve
VERTICAL COMPONENT dBz/dt nanoTesla/sec - 20 of 20 channels and PP
Scale: 1:5000



CRONE GEOPHYSICS & EXPLORATION LTD
Surface Pulse EM Survey

Client	: **Falconbridge Ltd.**	Line	: **1900E**
Grid	: **Hutt**	Tx Loop	: **NORTH**
Date	: Oct 29, 2000	File name	: 19SM.PEM

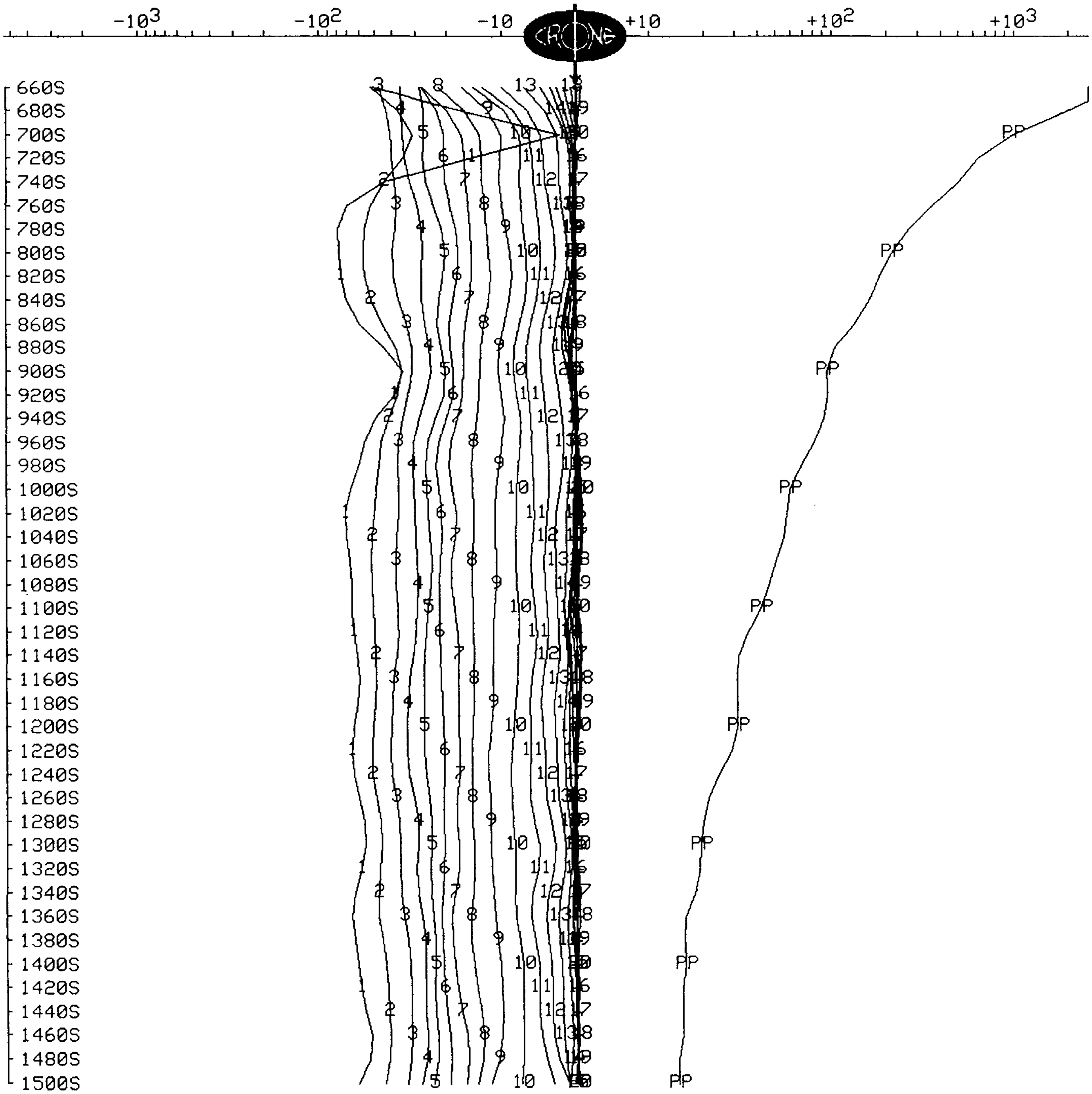
Data Smoothed along Profile and Down Decay Curve
IN-LINE HORIZONTAL COMPONENT dBx/dt nanoTesla/sec - 20 of 20 channels and
Scale: 1:5000



CRONE GEOPHYSICS & EXPLORATION LTD
Surface Pulse EM Survey

Client	: **Falconbridge Ltd.**	Line	: **1900E**
Grid	: **Hutt**	Tx Loop	: **NORTH**
Date	: Oct 29, 2000	File name	: 19SM.PEM

Data Smoothed along Profile and Down Decay Curve
CROSS-LINE HORIZONTAL COMPONENT dBy/dt nanoTesla/sec - 20 of 20 channels a
Scale: 1:5000

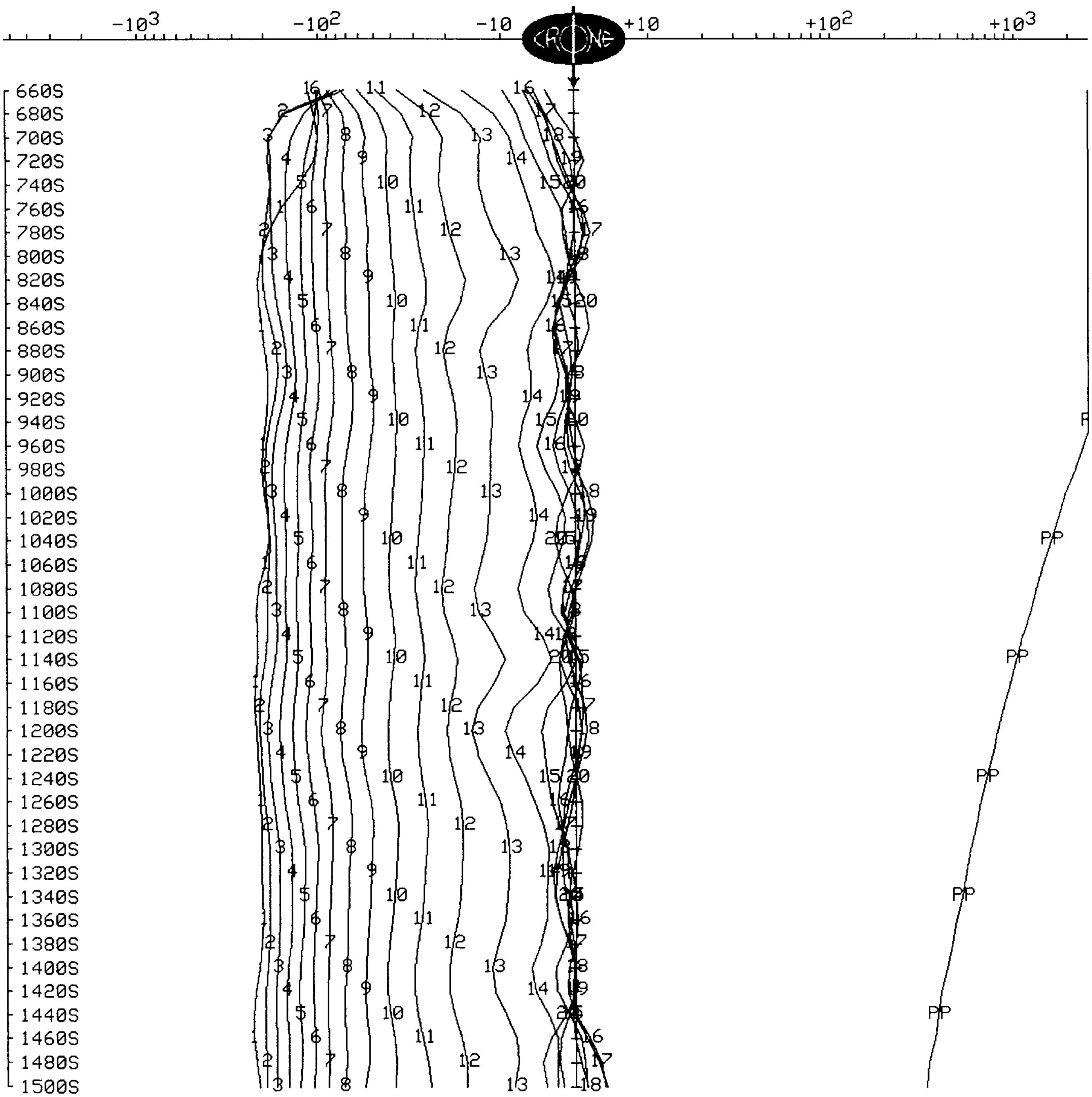


CRONE GEOPHYSICS & EXPLORATION LTD
Surface Pulse EM Survey

Client	: **Falconbridge Ltd.**	Line	: **1900E**
Grid	: **Hutt**	Tx Loop	: **NORTH**
Date	: Oct 29, 2000	File name	: 19SM.PEM

Data Smoothed along Profile and Down Decay Curve
VERTICAL COMPONENT dBz/dt nanoTesla/sec - 20 of 20 channels and PP

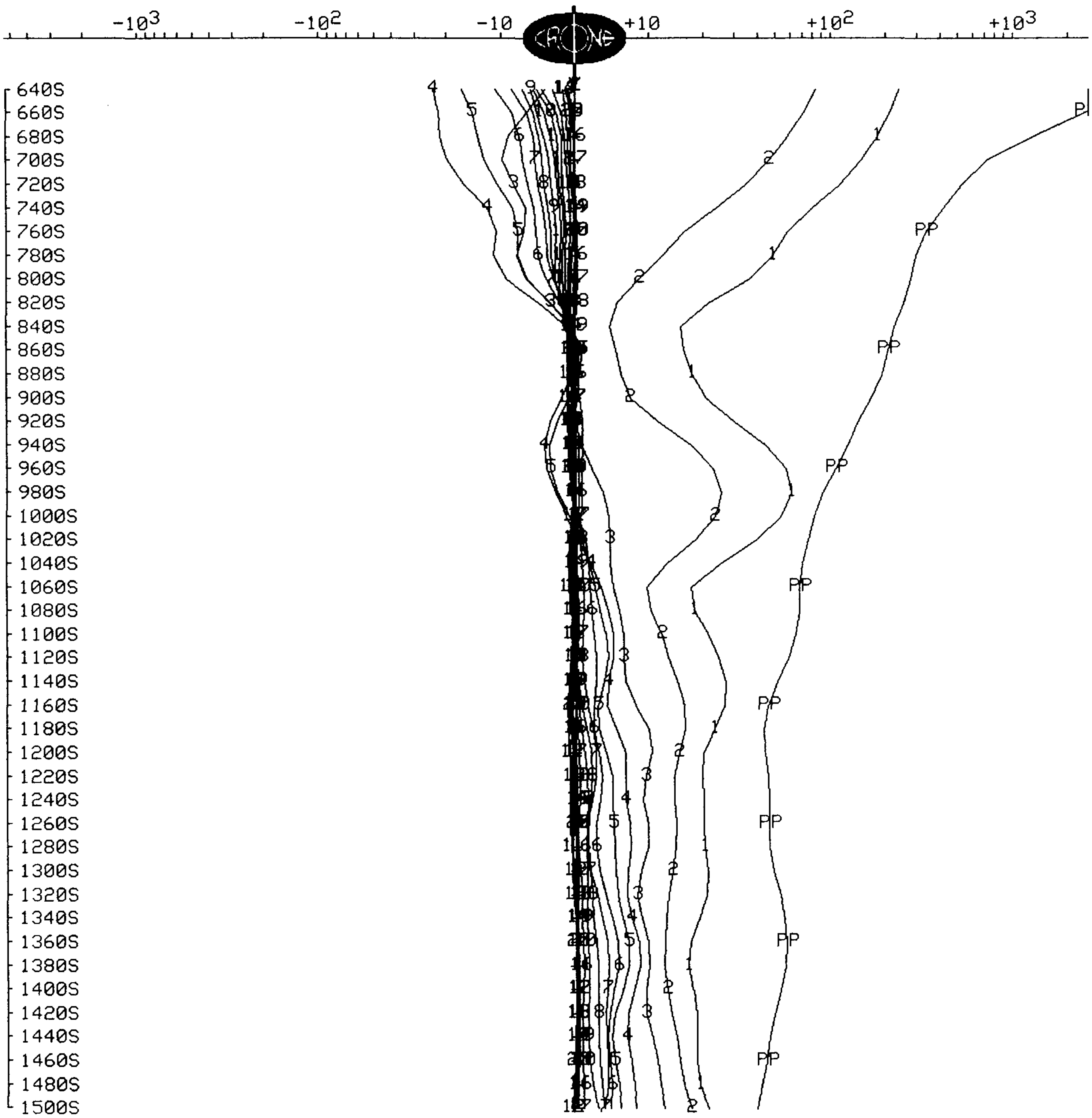
Scale: 1:5000



CRONE GEOPHYSICS & EXPLORATION LTD
Surface Pulse EM Survey

Client	:	**Falconbridge Ltd.**	Line	:	**2000E**
Grid	:	**Hutt Grid**	Tx Loop	:	**NORTH**
Date	:	Oct 30, 2000	File name	:	20SM.PEM

Data Smoothed along Profile and Down Decay Curve
IN-LINE HORIZONTAL COMPONENT dBx/dt nanoTesla/sec - 20 of 20 channels and
Scale: 1:5000



CRONE GEOPHYSICS & EXPLORATION LTD
Surface Pulse EM Survey

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Grid	: **Hutt Grid**	Tx Loop	: **NORTH**
Date	: Oct 30, 2000	File name	: 20SM.PEM

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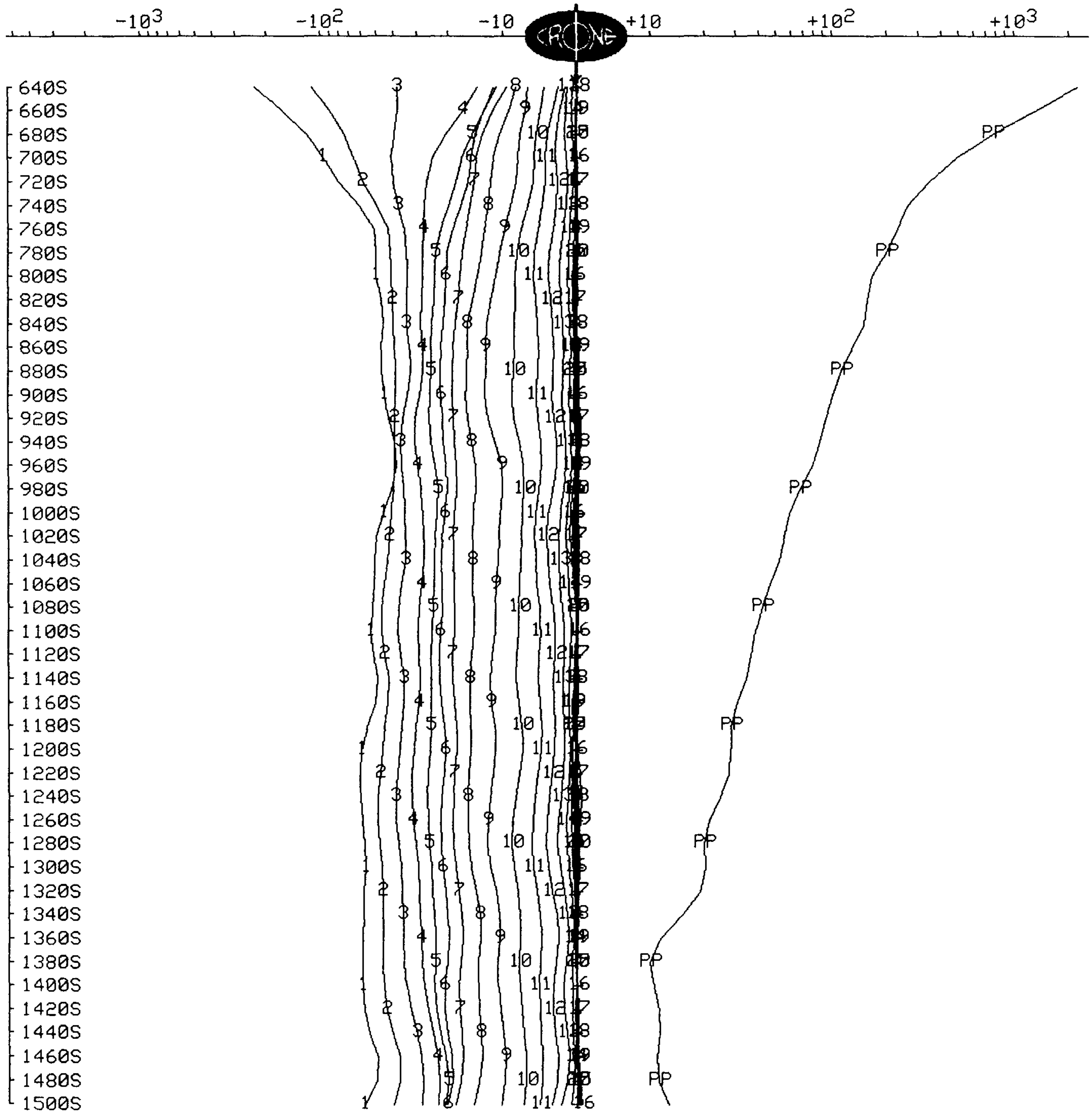

CRONE GEOPHYSICS & EXPLORATION LTD
Surface Pulse EM Survey

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Grid	: **Hutt Grid**	Tx Loop	: **NORTH**
Date	: Oct 30, 2000	File name	: 20SM.PEM

Data Smoothed along Profile and Down Decay Curve
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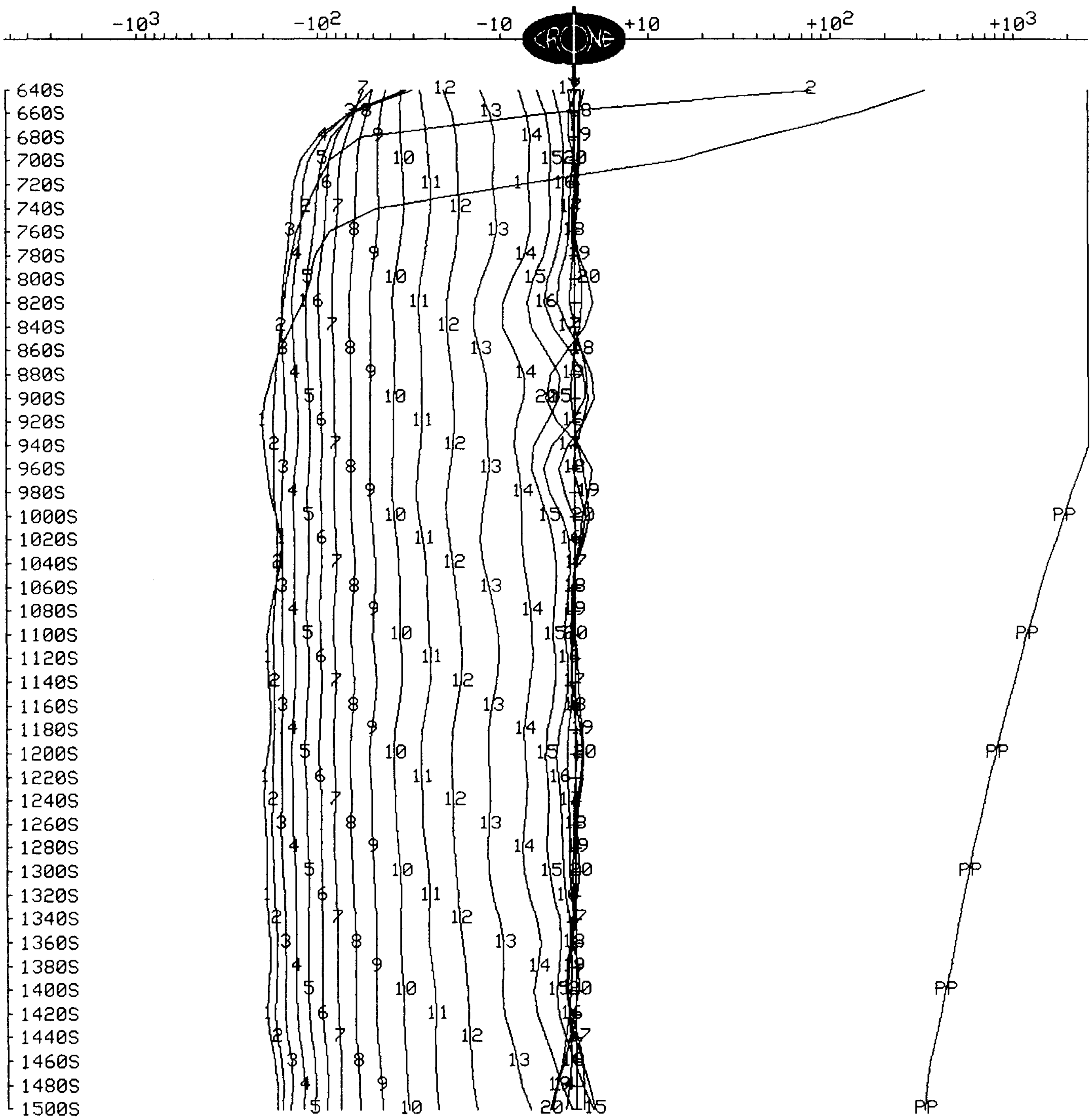

CRONE GEOPHYSICS & EXPLORATION LTD
Surface Pulse EM Survey

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Grid	: **Hutt Grid**	Tx Loop	: **NORTH**
Date	: Oct 30, 2000	File name	: 21SM.PEM

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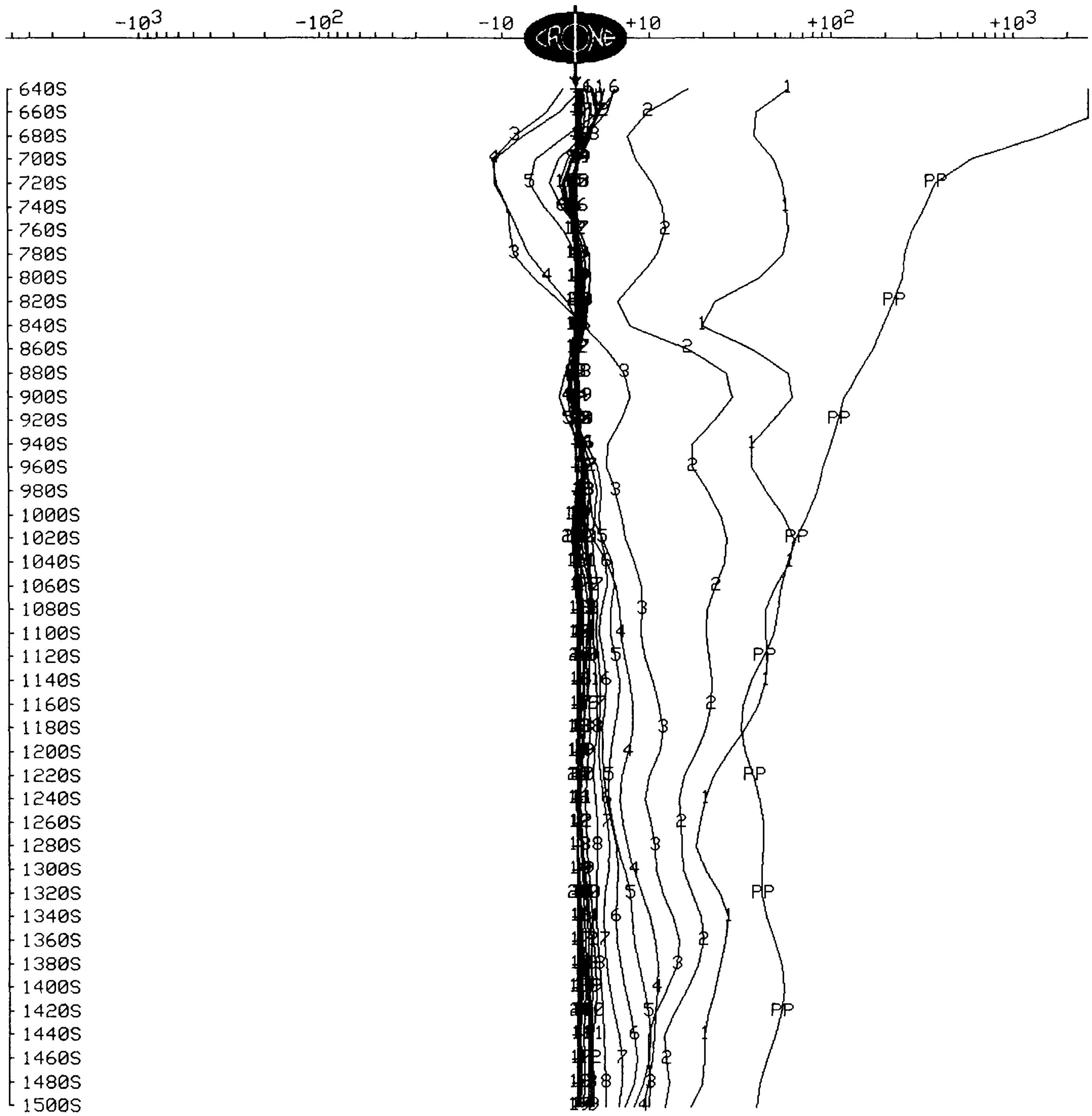

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Surface Pulse EM Survey

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Date	: Oct 30, 2000	File name	: 21SM.PEM

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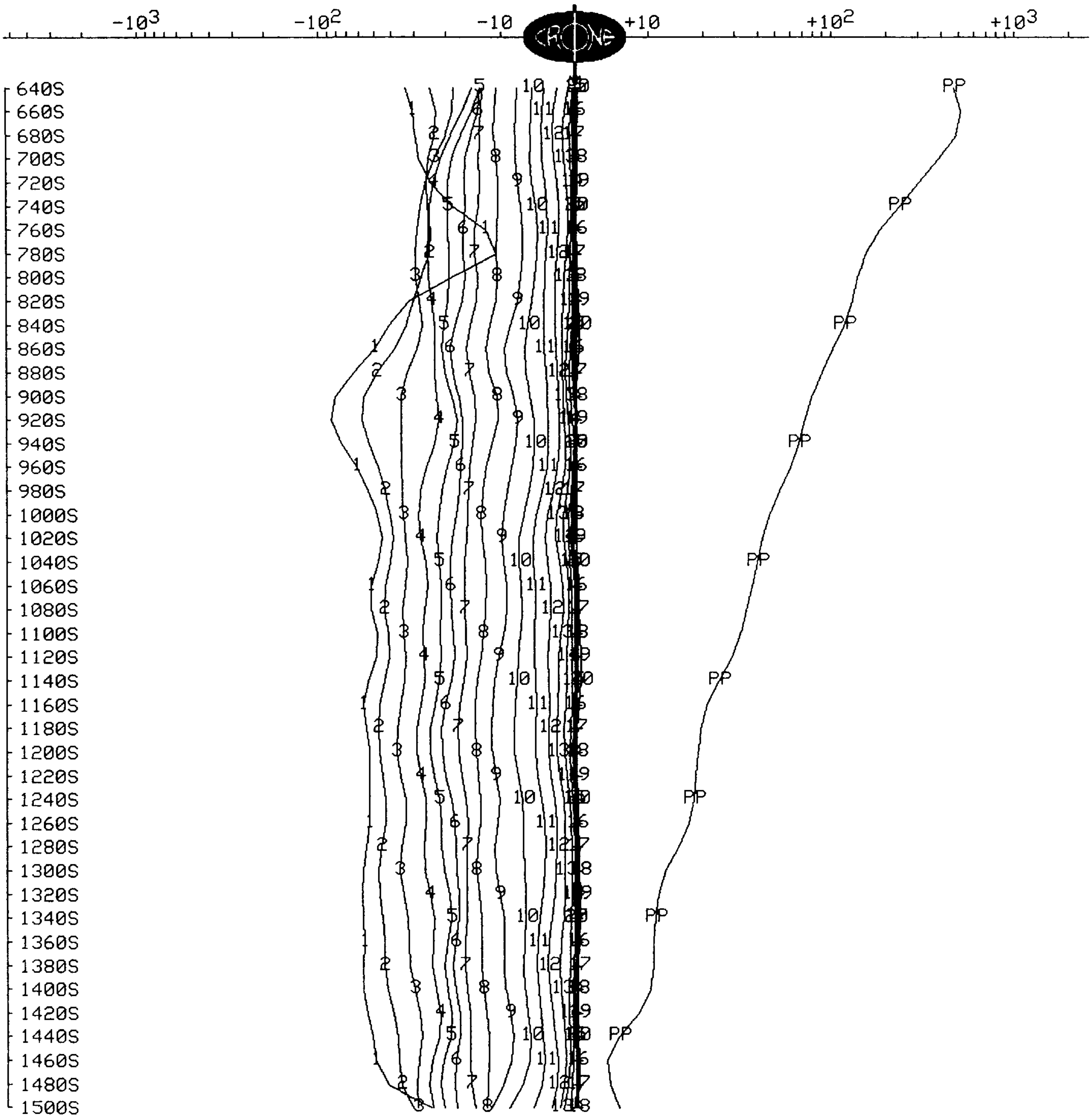

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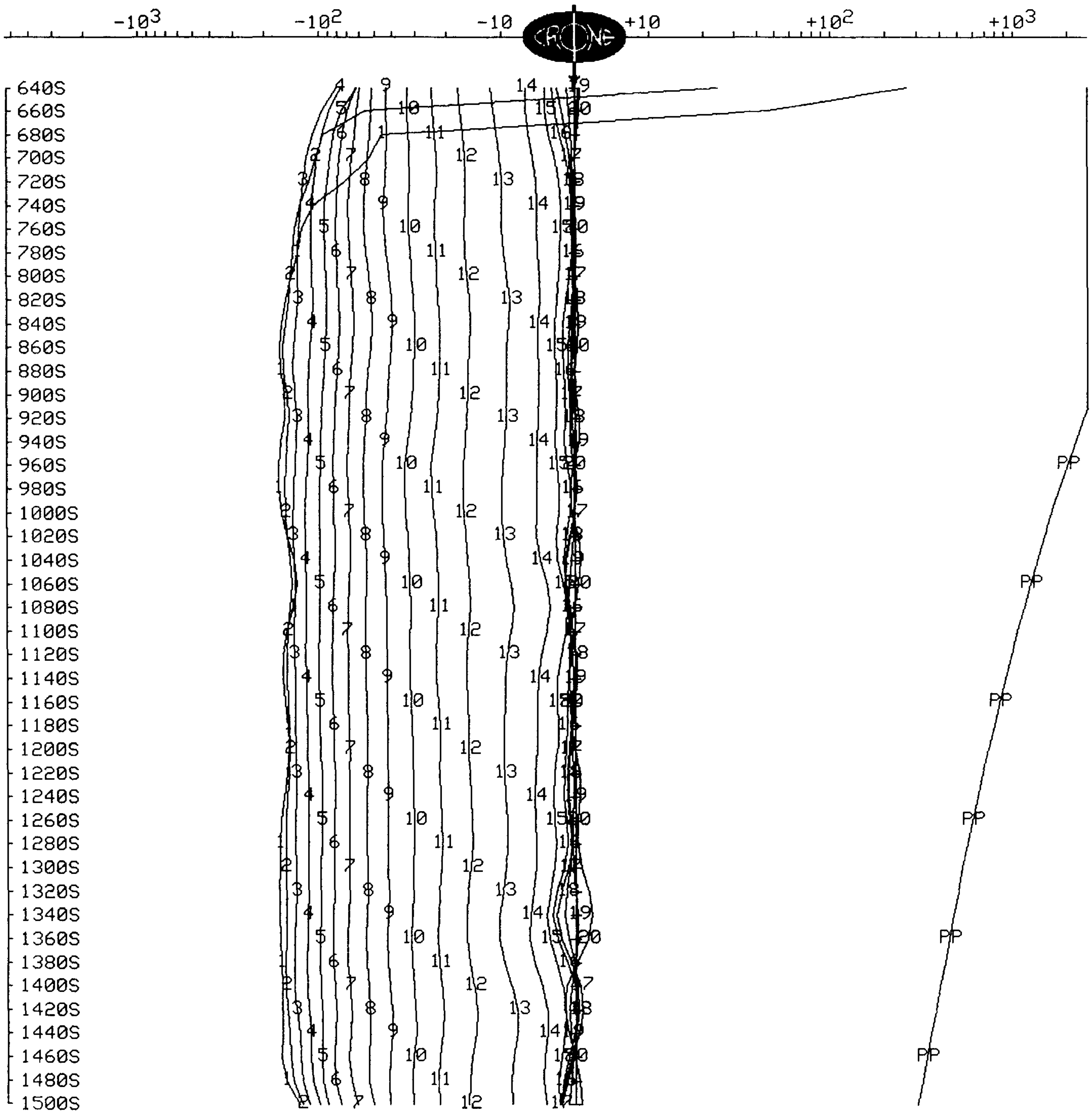

CRONE GEOPHYSICS & EXPLORATION LTD
Surface Pulse EM Survey

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Data Smoothed along Profile and Down Decay Curve
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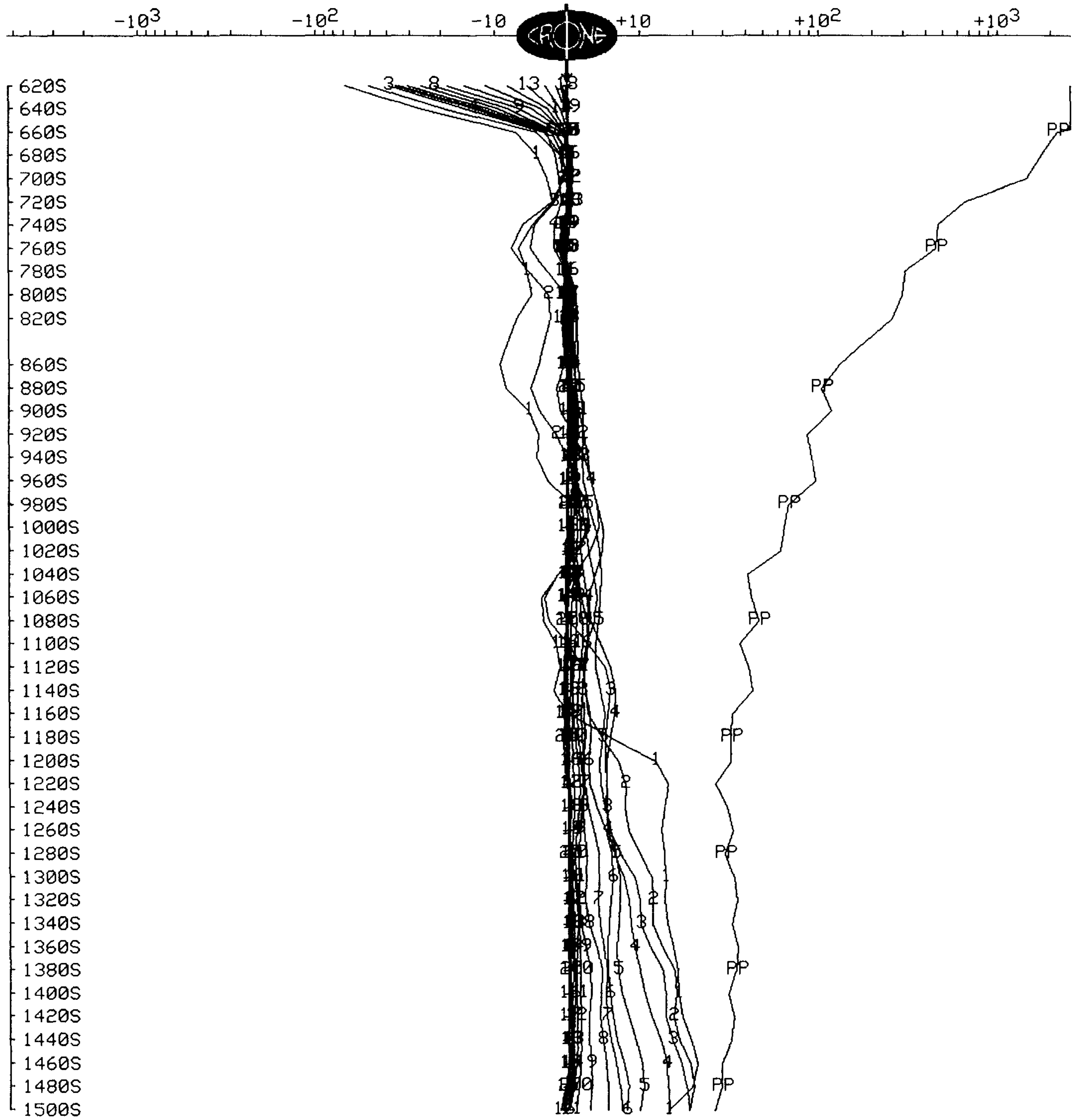
Scale: 1:5000



CRONE GEOPHYSICS & EXPLORATION LTD
Surface Pulse EM Survey

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Date	: Oct 31, 2000	File name	: 22SM.PEM

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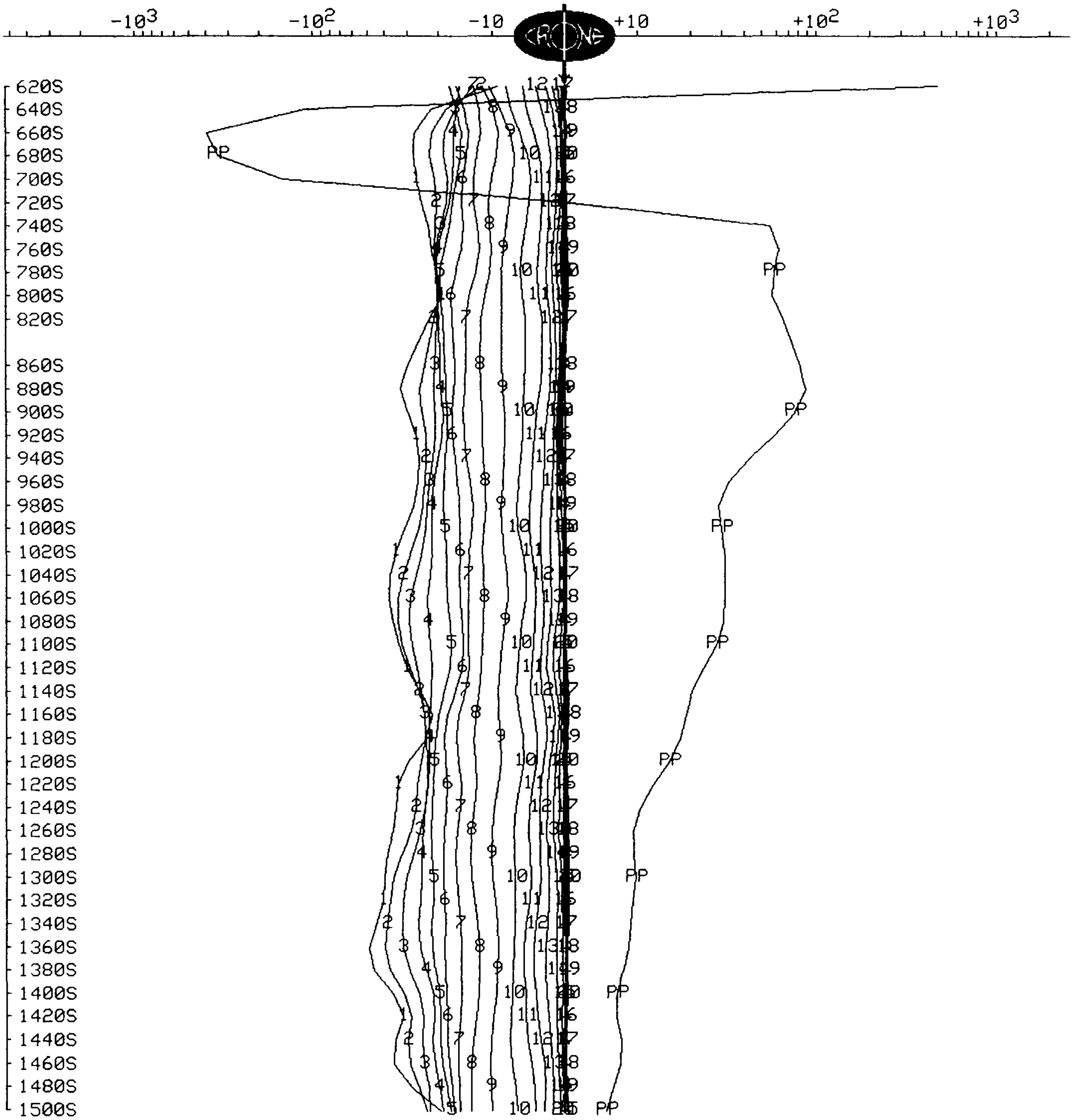

CRONE GEOPHYSICS & EXPLORATION LTD
Surface Pulse EM Survey

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Grid	: **HUTT**	Tx Loop	: **NORTH**
Date	: Oct 31, 2000	File name	: 22SM.PEM

Data Smoothed along Profile and Down Decay Curve
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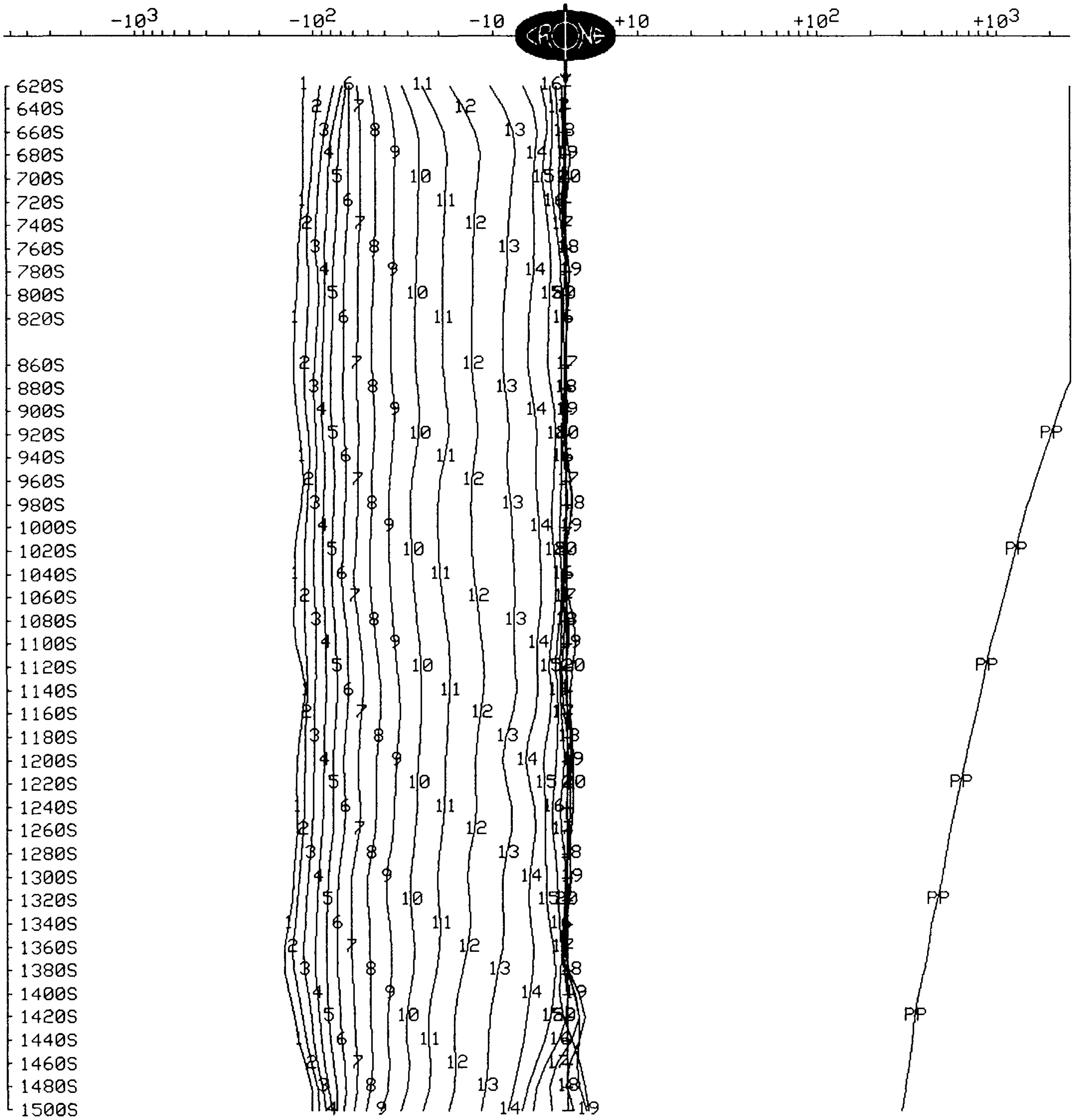
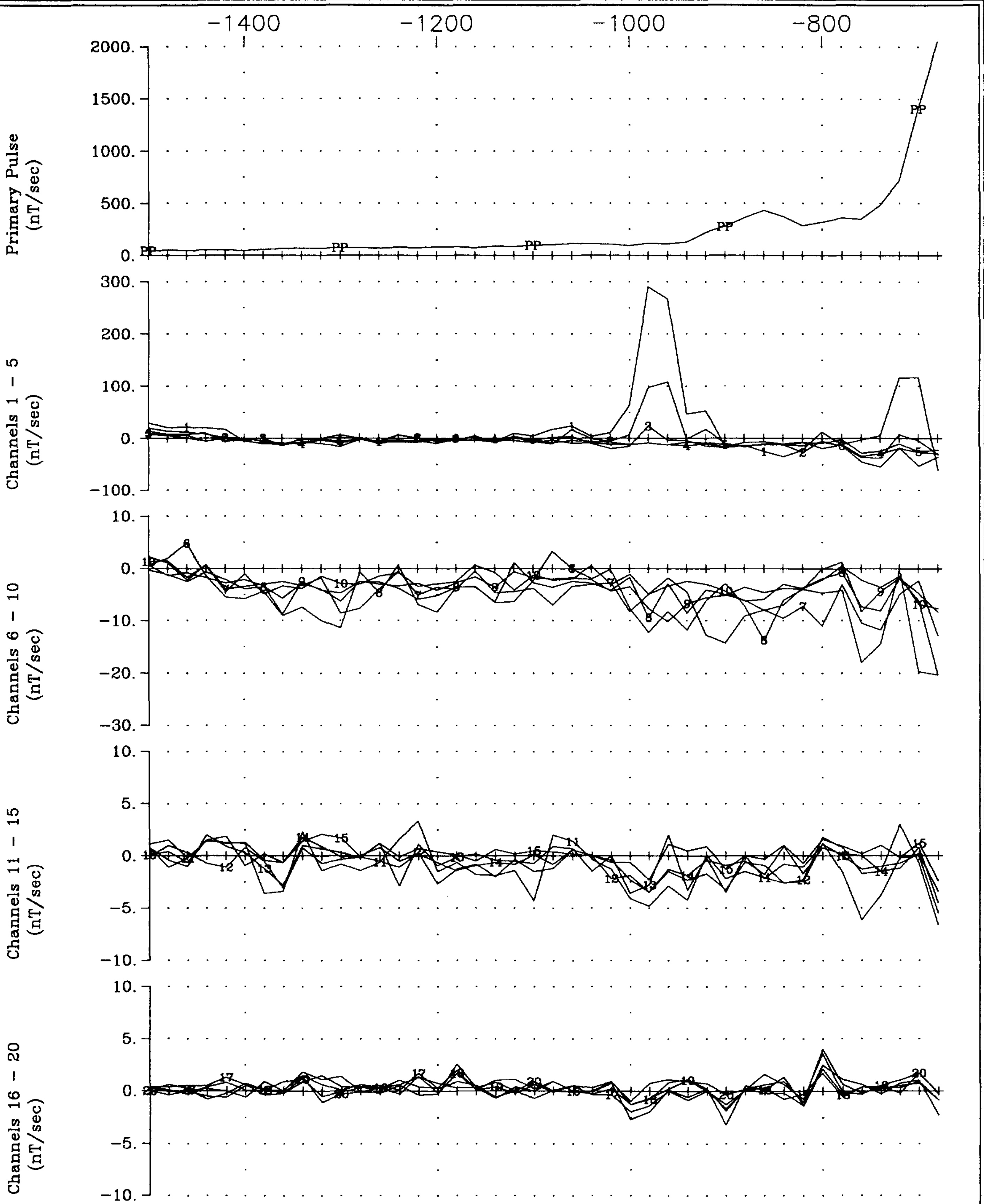


APPENDIX IV

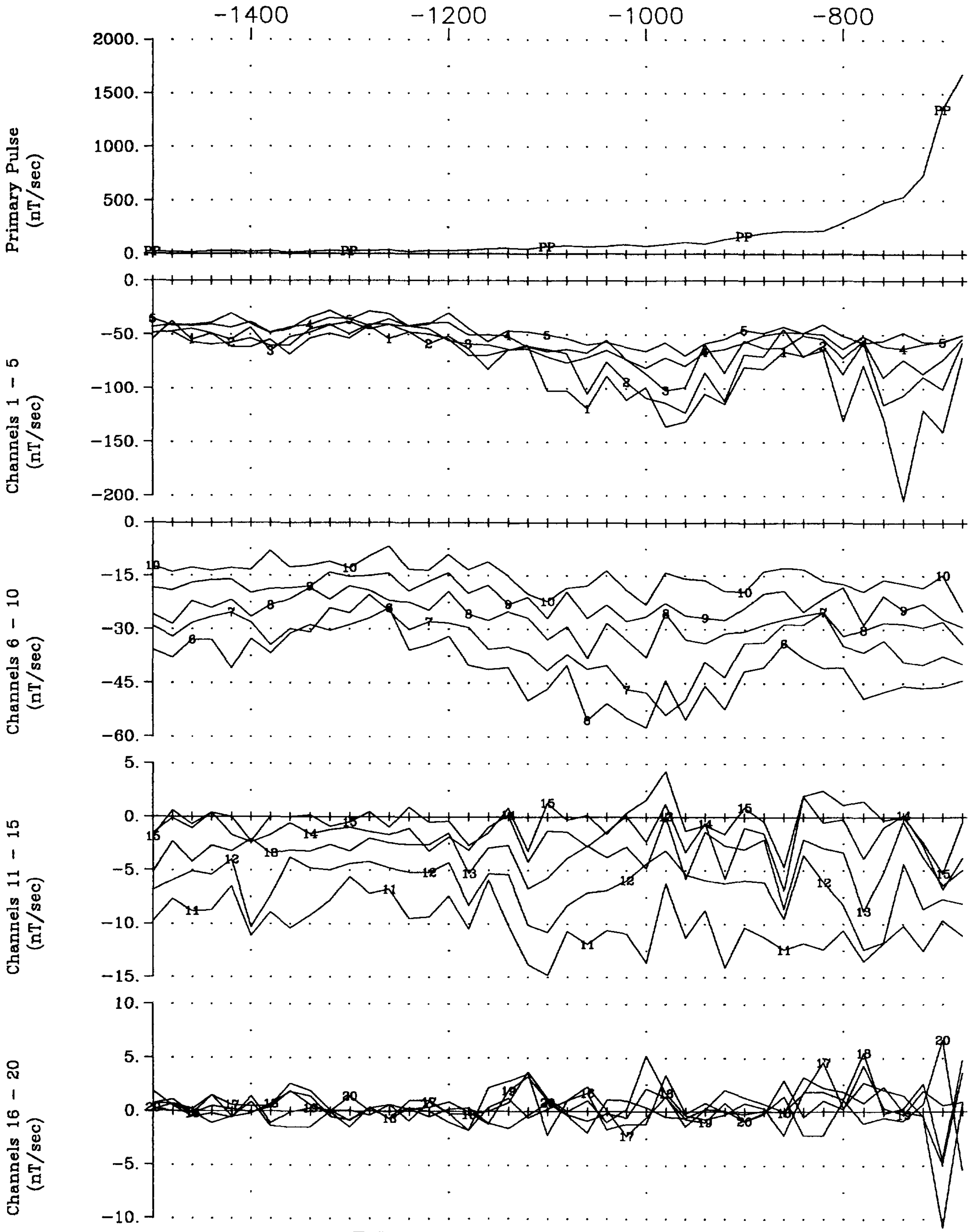
LINEAR PROFILE PLOTS



Falconbridge Ltd. Hutt Grid

Line 1700E X Component

Crone Geophysics & Exploration Ltd.



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Line 1700E Y Component

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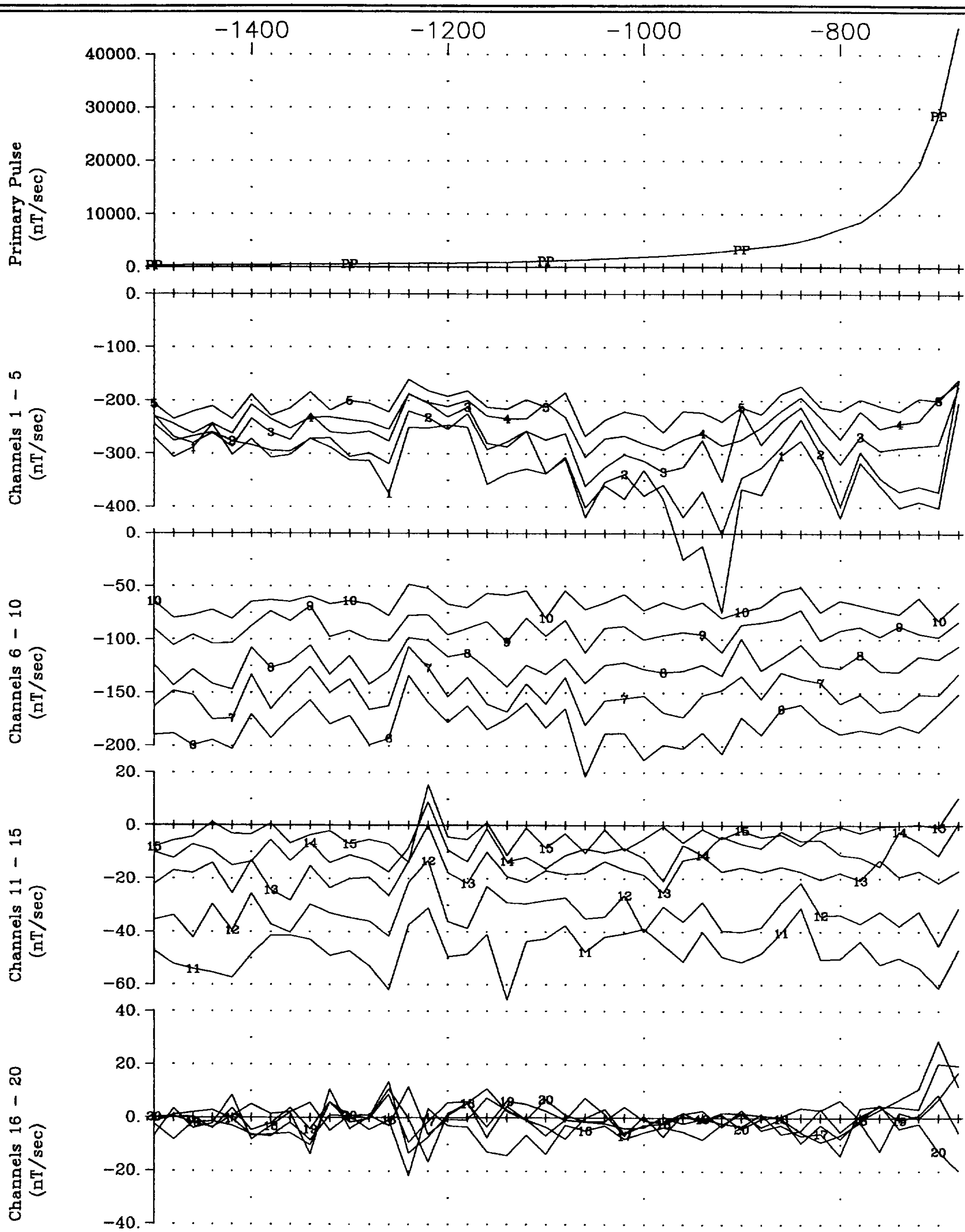

Falconbridge Ltd. Hutt Grid

Line 1700E Z Component

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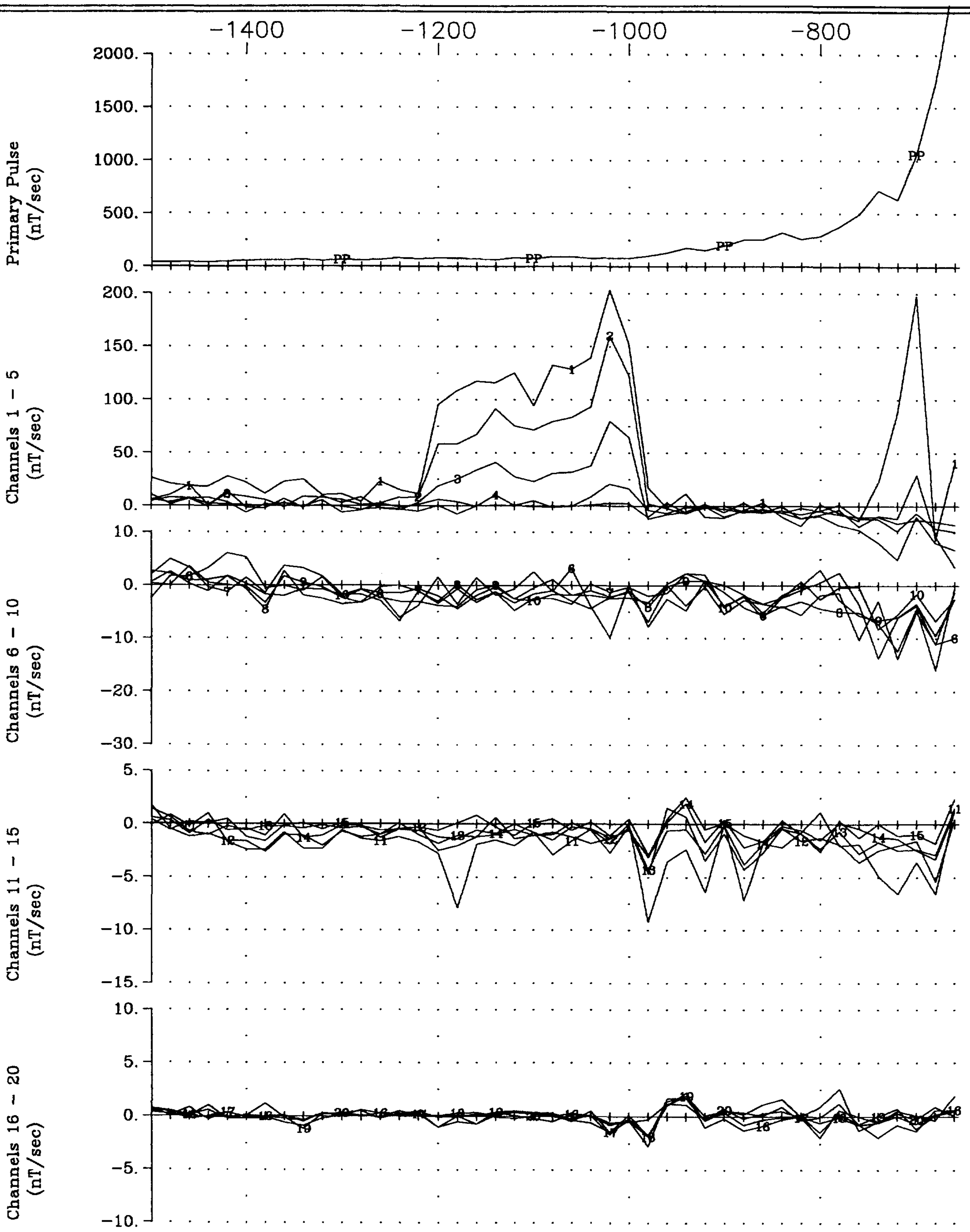
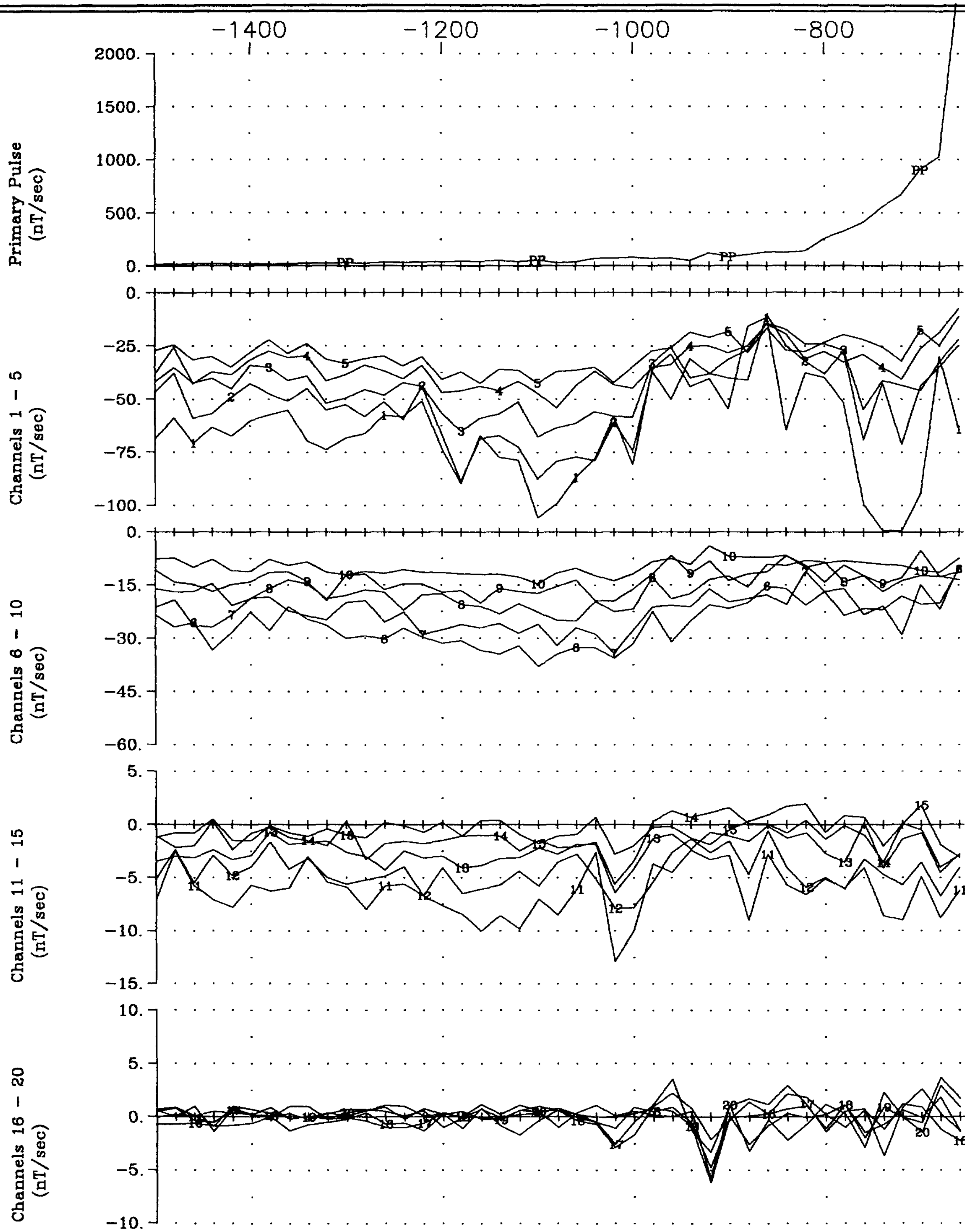


Falconbridge Ltd. Hutt Grid

Line 1800E X Component

Crone Geophysics & Exploration Ltd.



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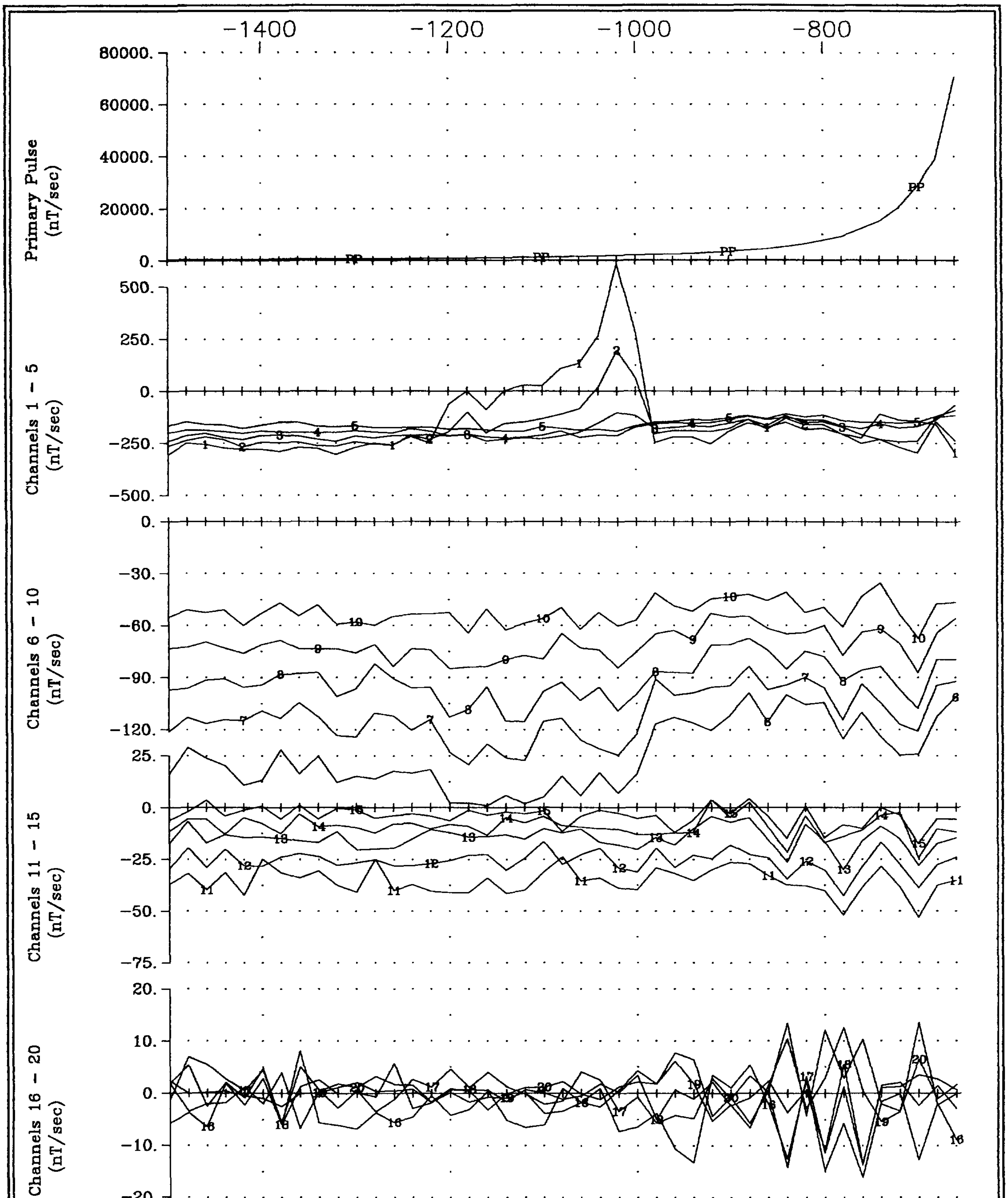

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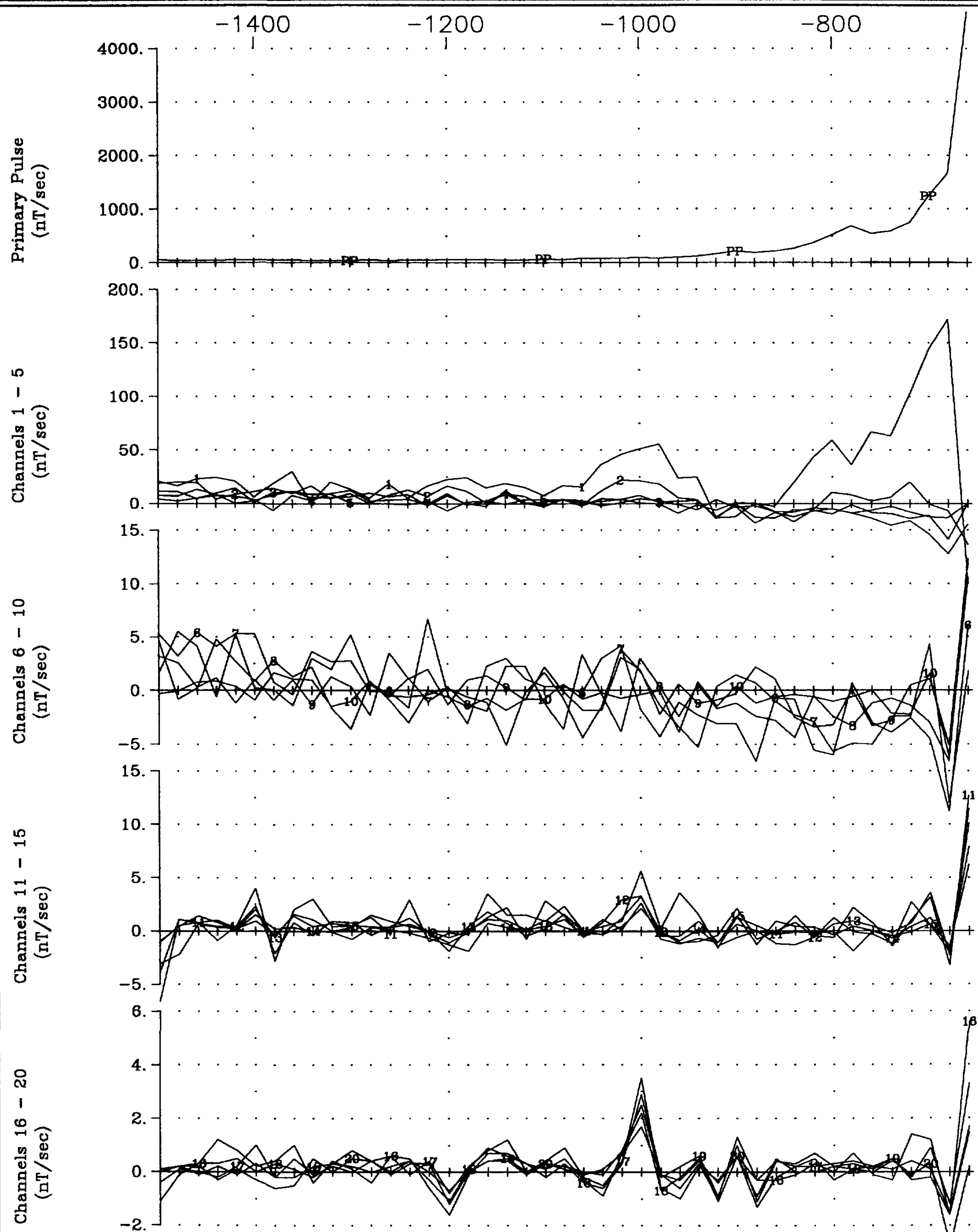
Line 1800E Z Component

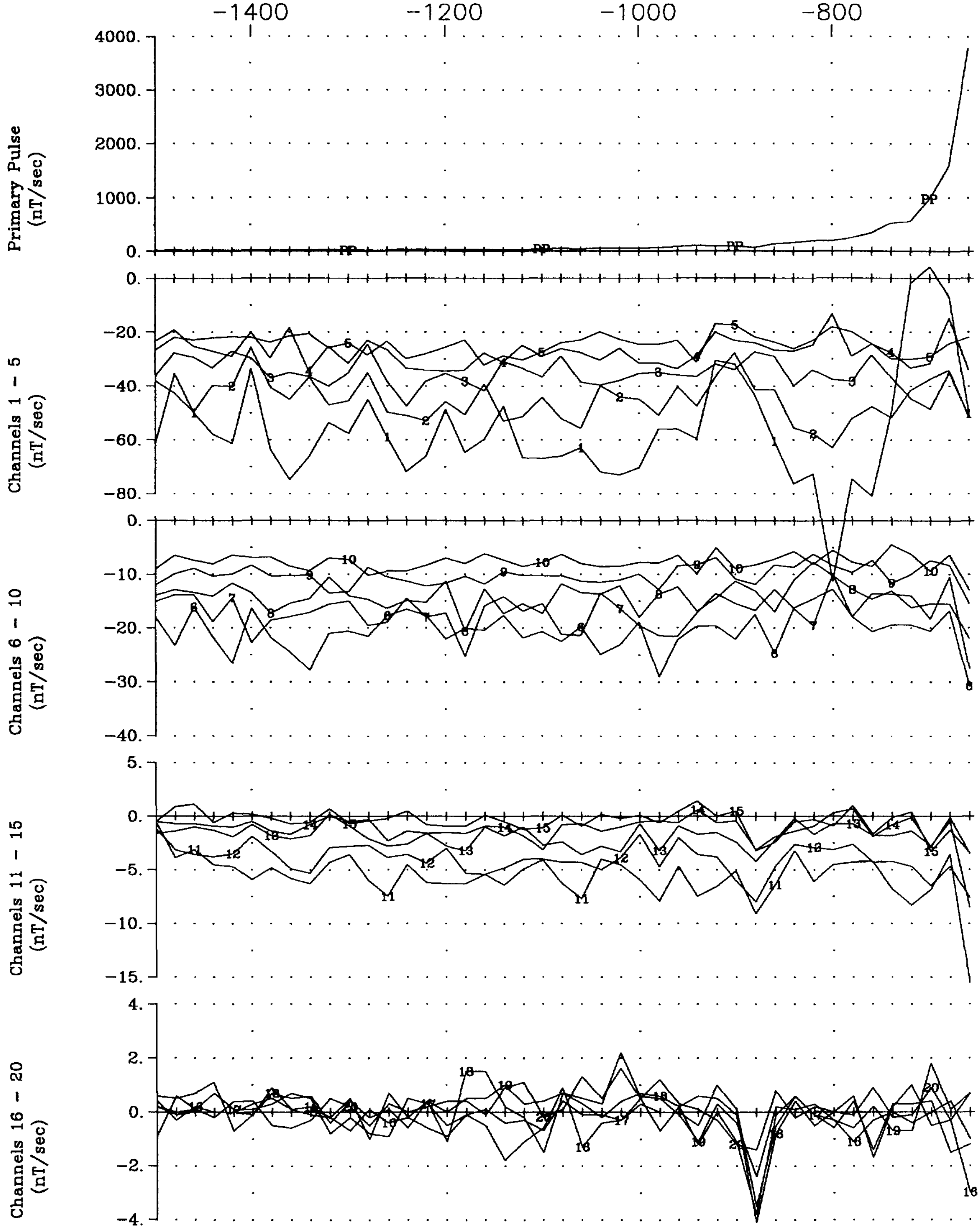
Crone Geophysics & Exploration Ltd.



Falconbridge Ltd. Hutt

Line 1900E X Component

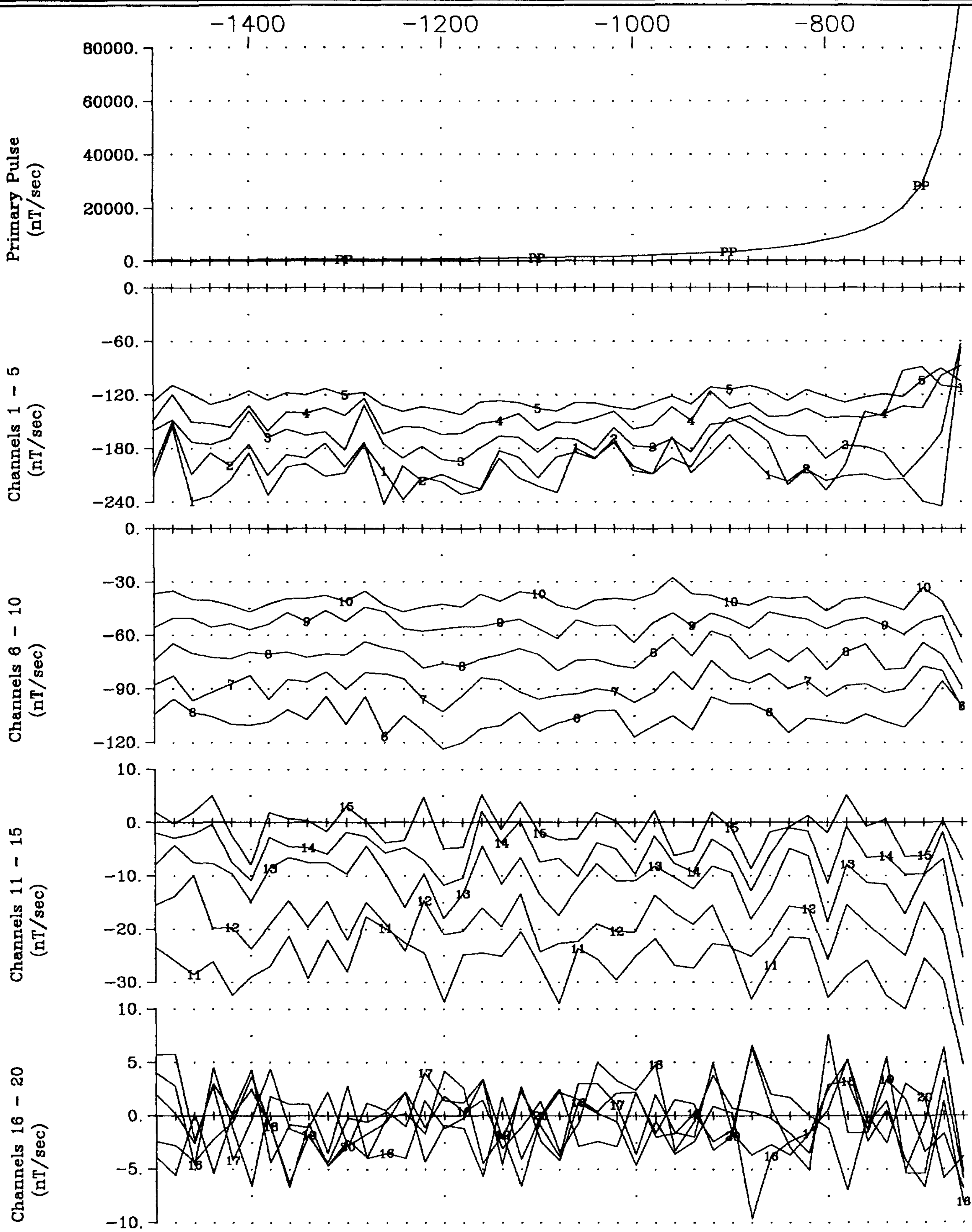
Crone Geophysics & Exploration Ltd.



Falconbridge Ltd. Hutt

Line 1900E Y Component

Crone Geophysics & Exploration Ltd.



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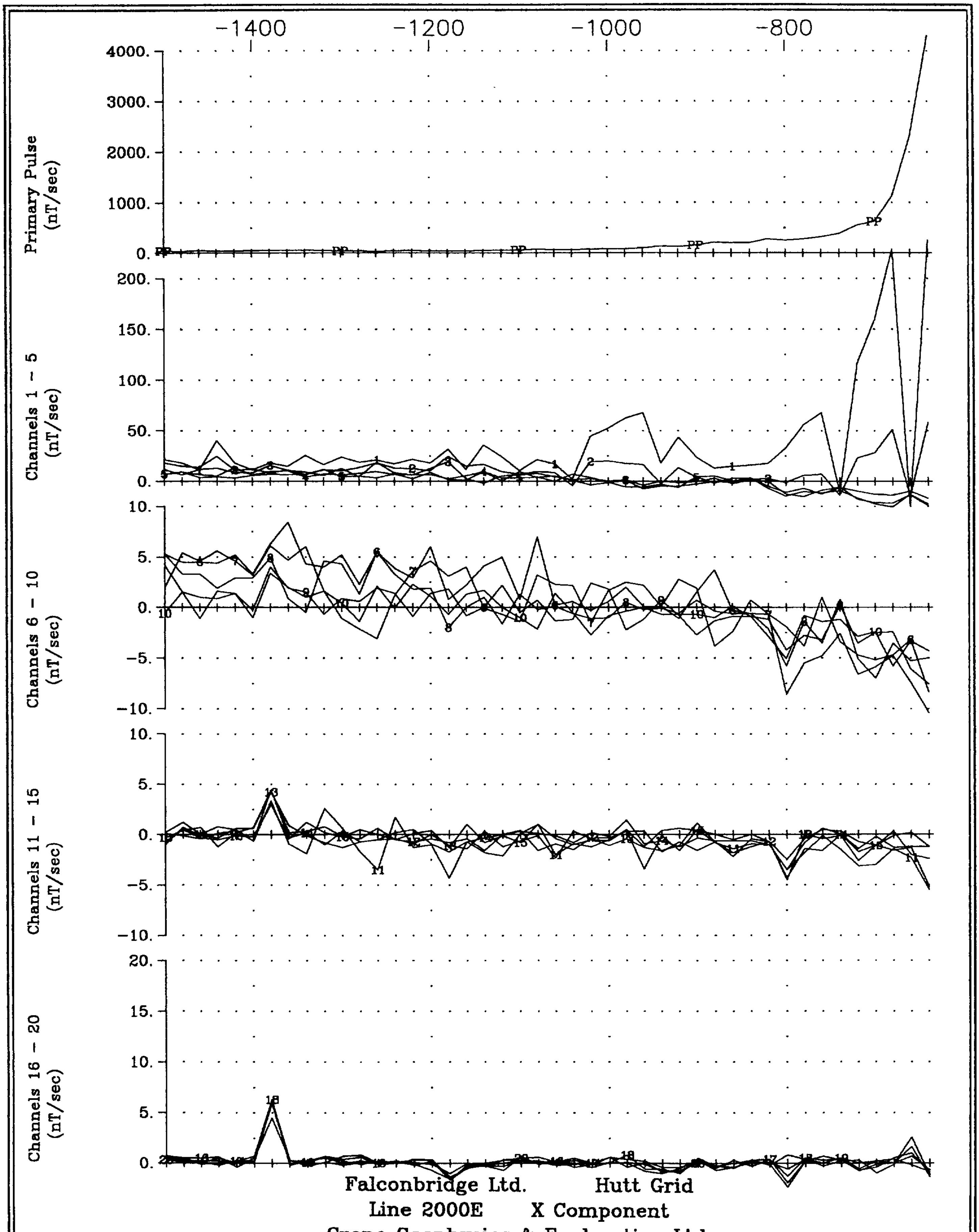

Falconbridge Ltd. Hutt Grid

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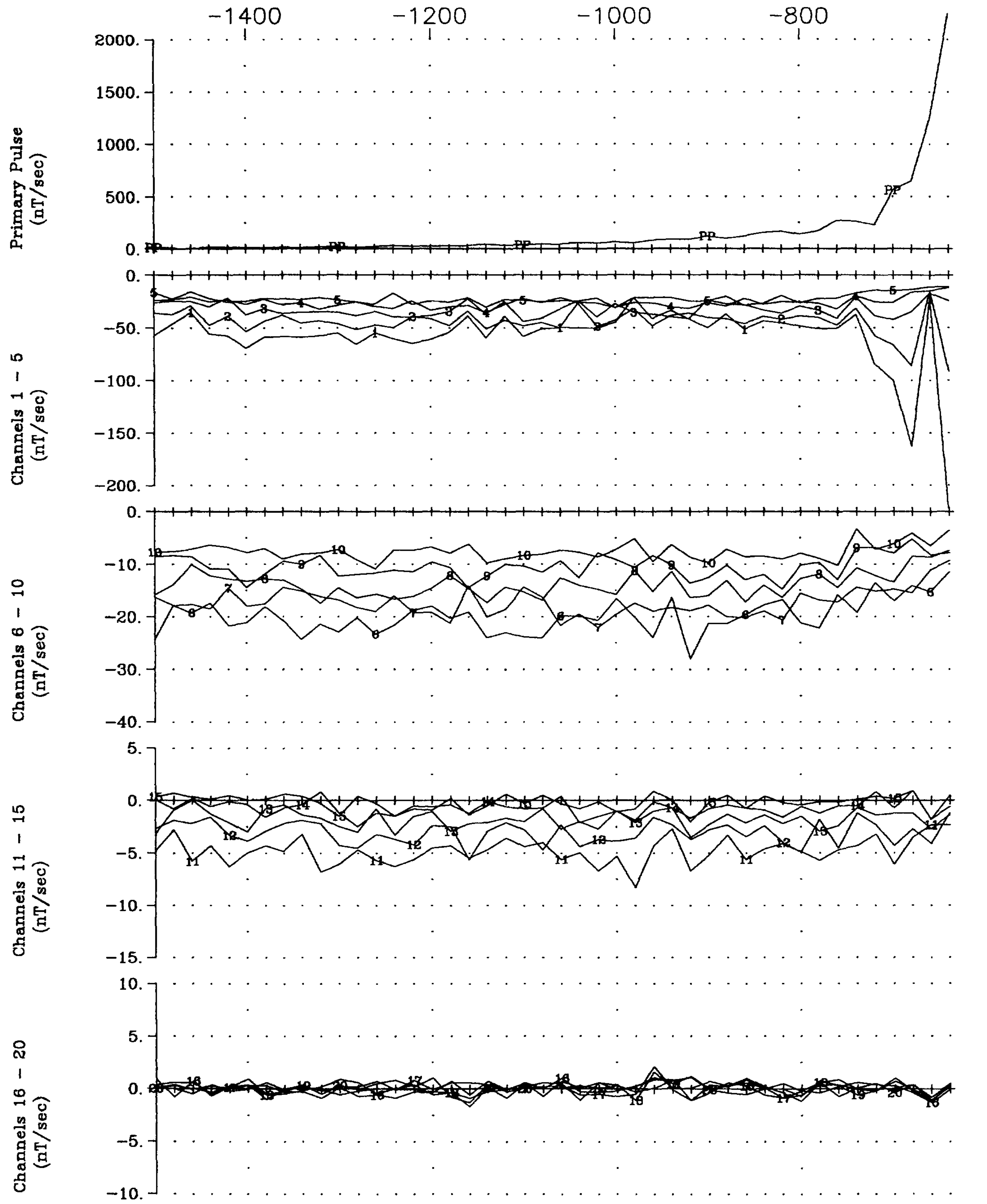
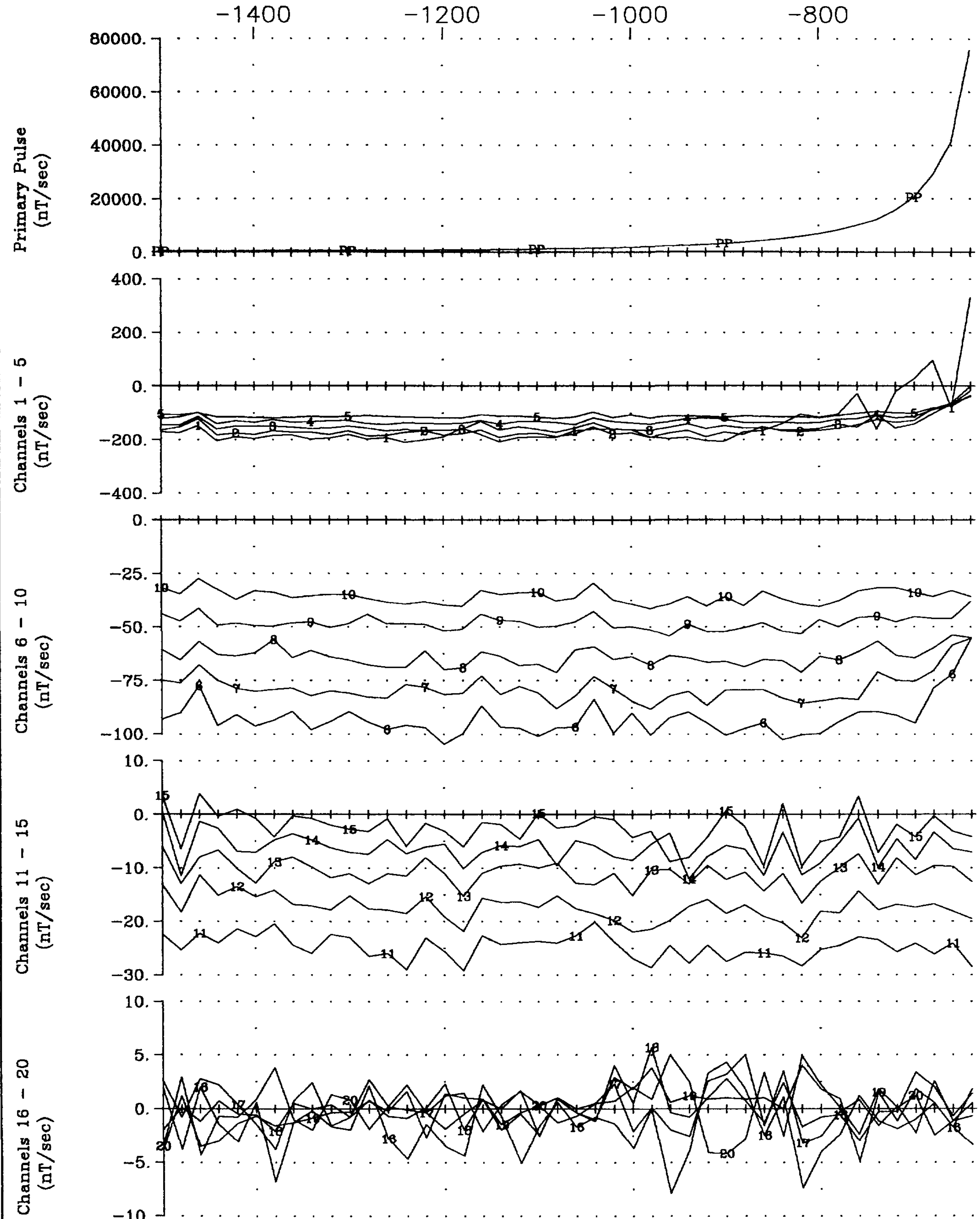


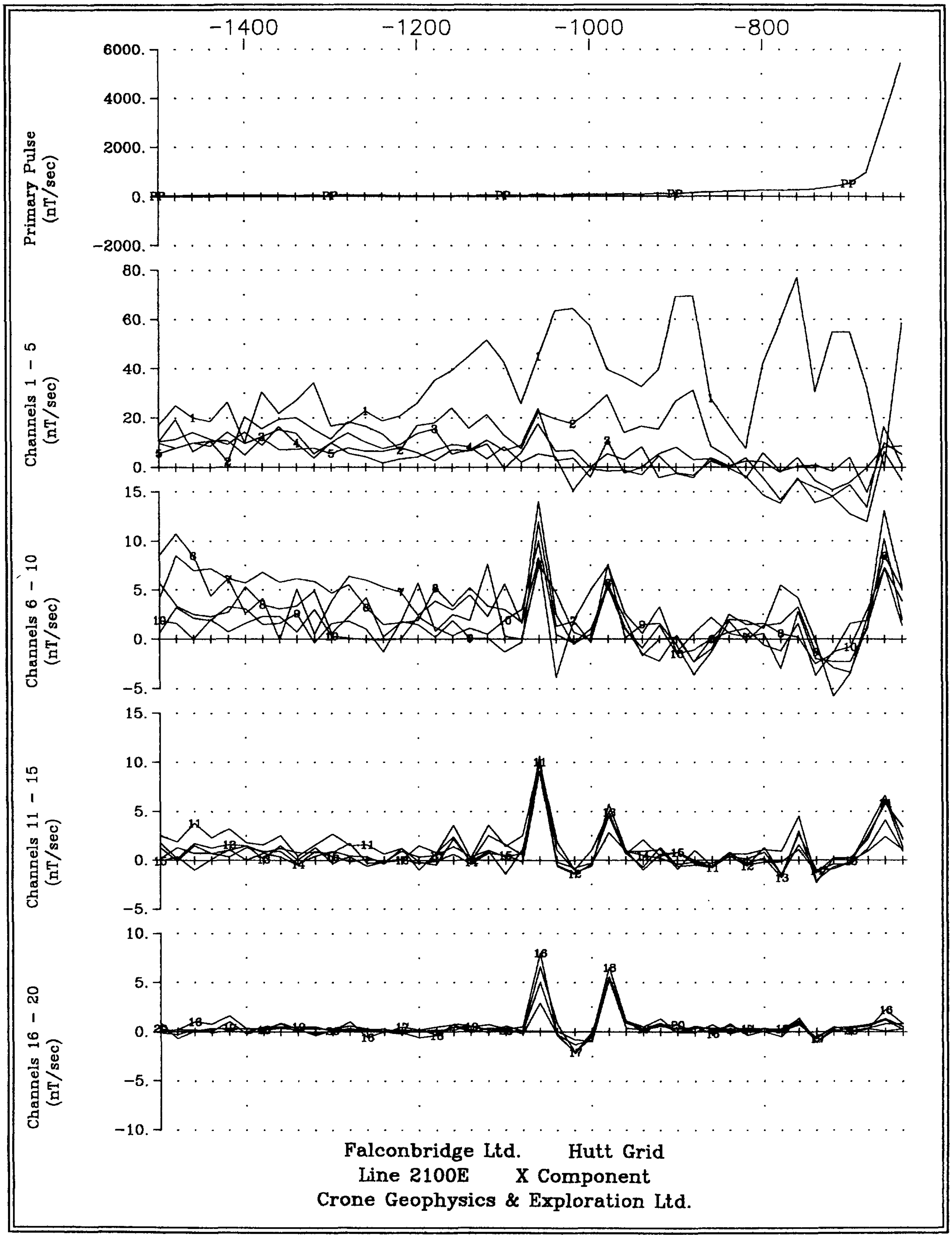
Falconbridge Ltd. Hutt Grid
Line 2000E Y Component
Crone Geophysics & Exploration Ltd.



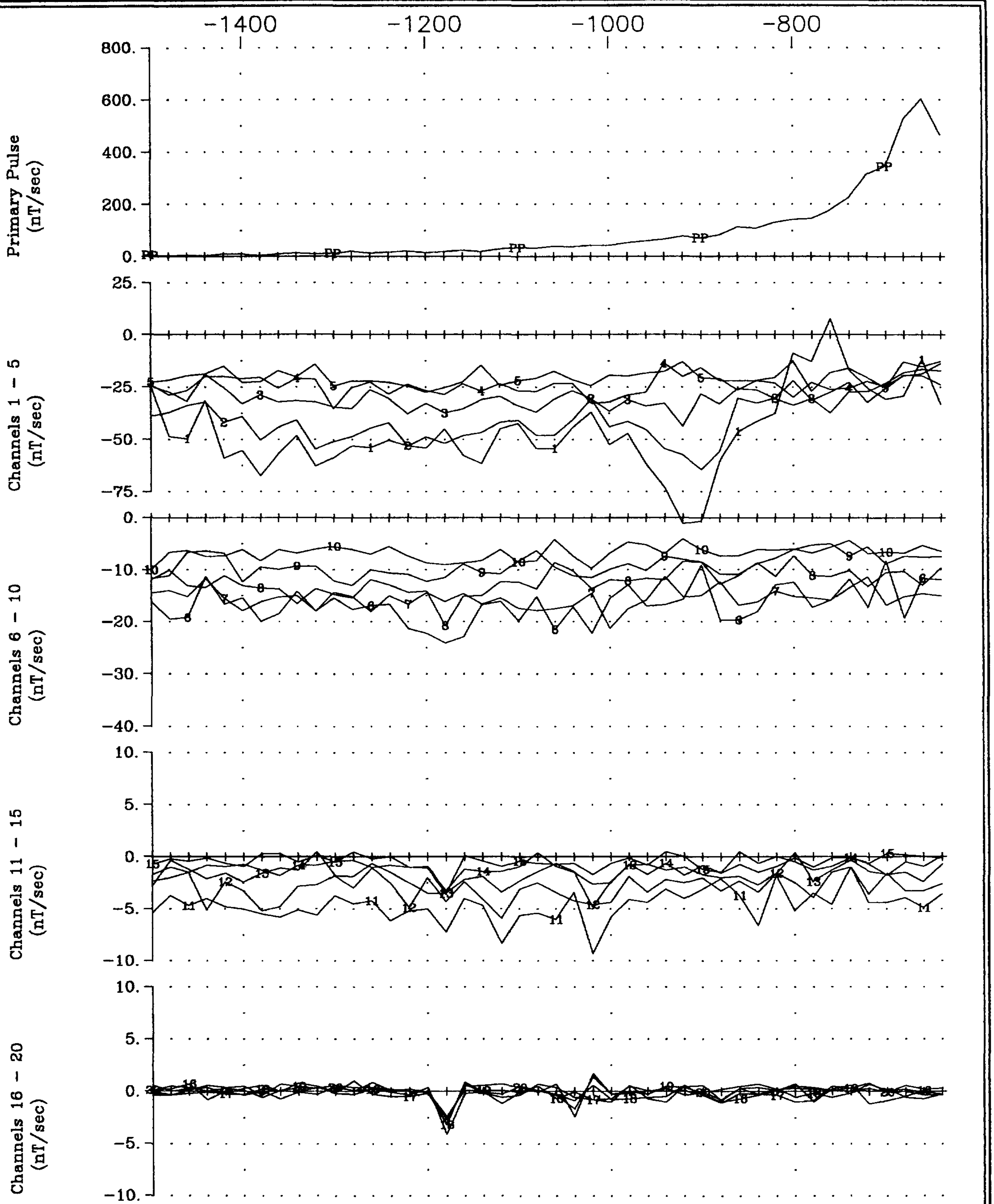
Falconbridge Ltd. **Hutt Grid**

Line 2000E **Z Component**

Crone Geophysics & Exploration Ltd.



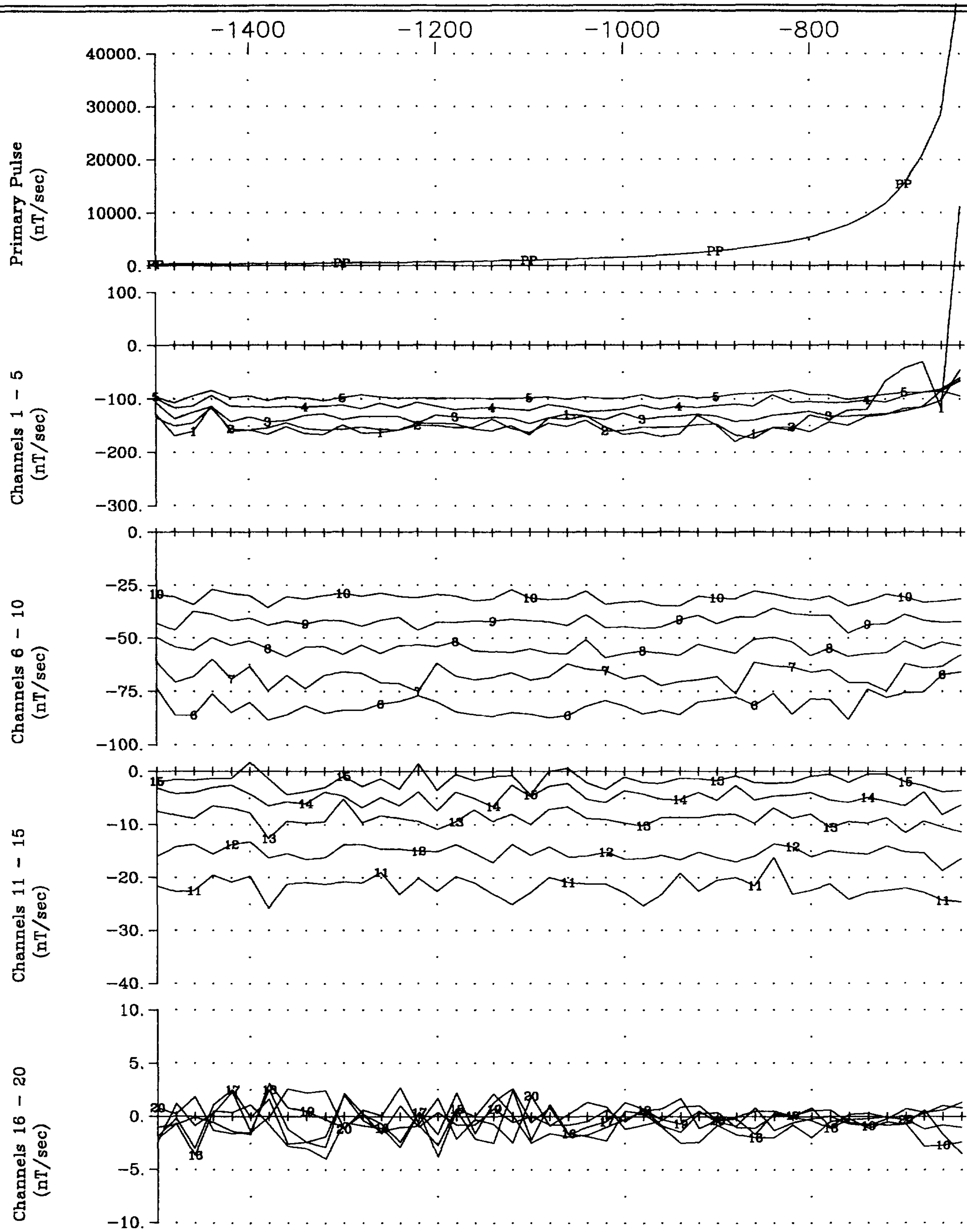
-1400
-1200
-1000
-800
Primary Pulse (nT/sec)
6000.
4000.
2000.
0.
-2000.
Channels 1 - 5 (nT/sec)
80.
60.
40.
20.
0.
Channels 6 - 10 (nT/sec)
15.
10.
5.
0.
-5.
Channels 11 - 15 (nT/sec)
15.
10.
5.
0.
-5.
Channels 16 - 20 (nT/sec)
10.
5.
0.
-5.
-10.
Falconbridge Ltd. Hutt Grid
Line 2100E X Component
Crone Geophysics & Exploration Ltd.



Falconbridge Ltd. Hutt Grid

Line 2100E Y Component

Crone Geophysics & Exploration Ltd.



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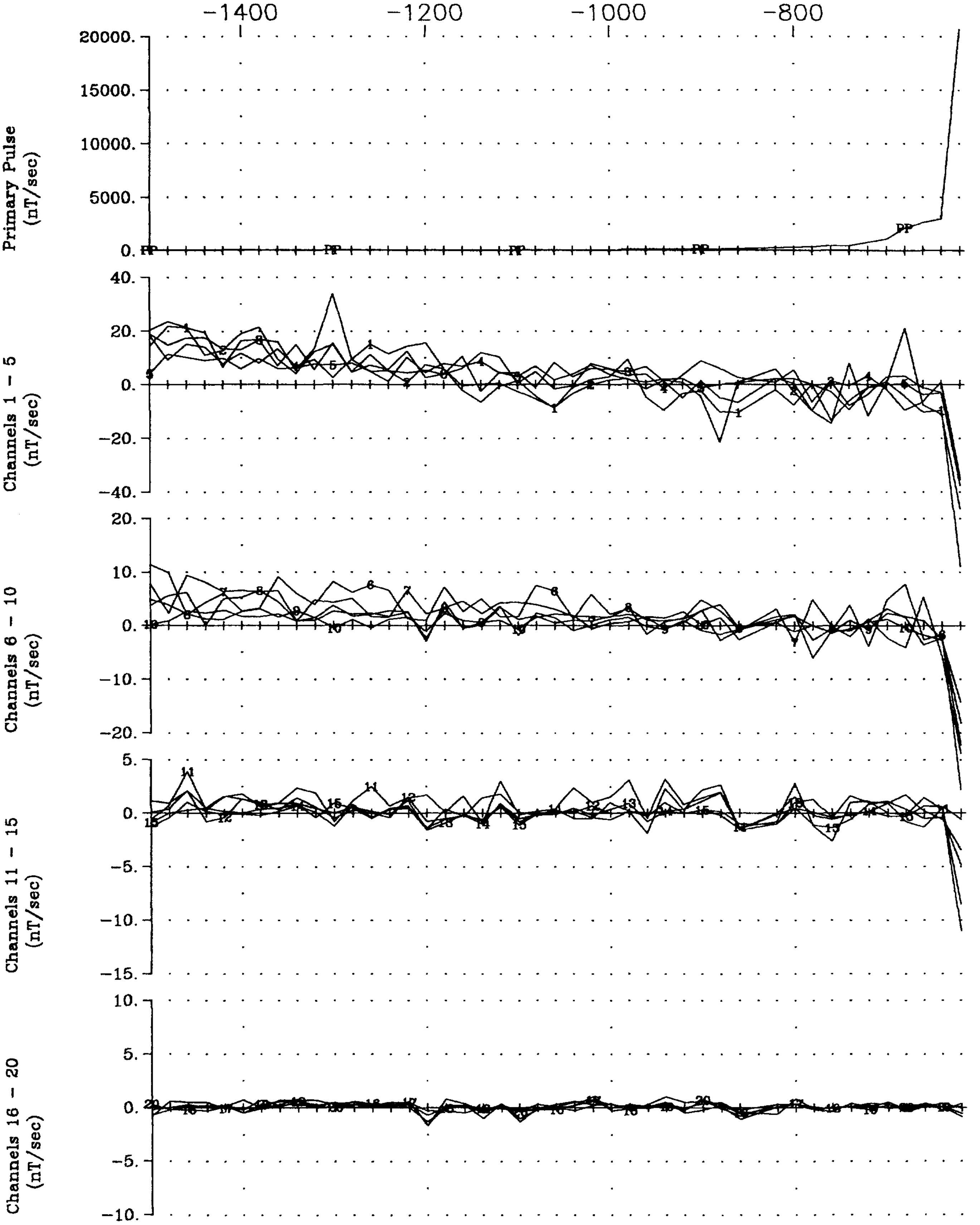
Line 2100E Z Component
Crone Geophysics & Exploration Ltd.



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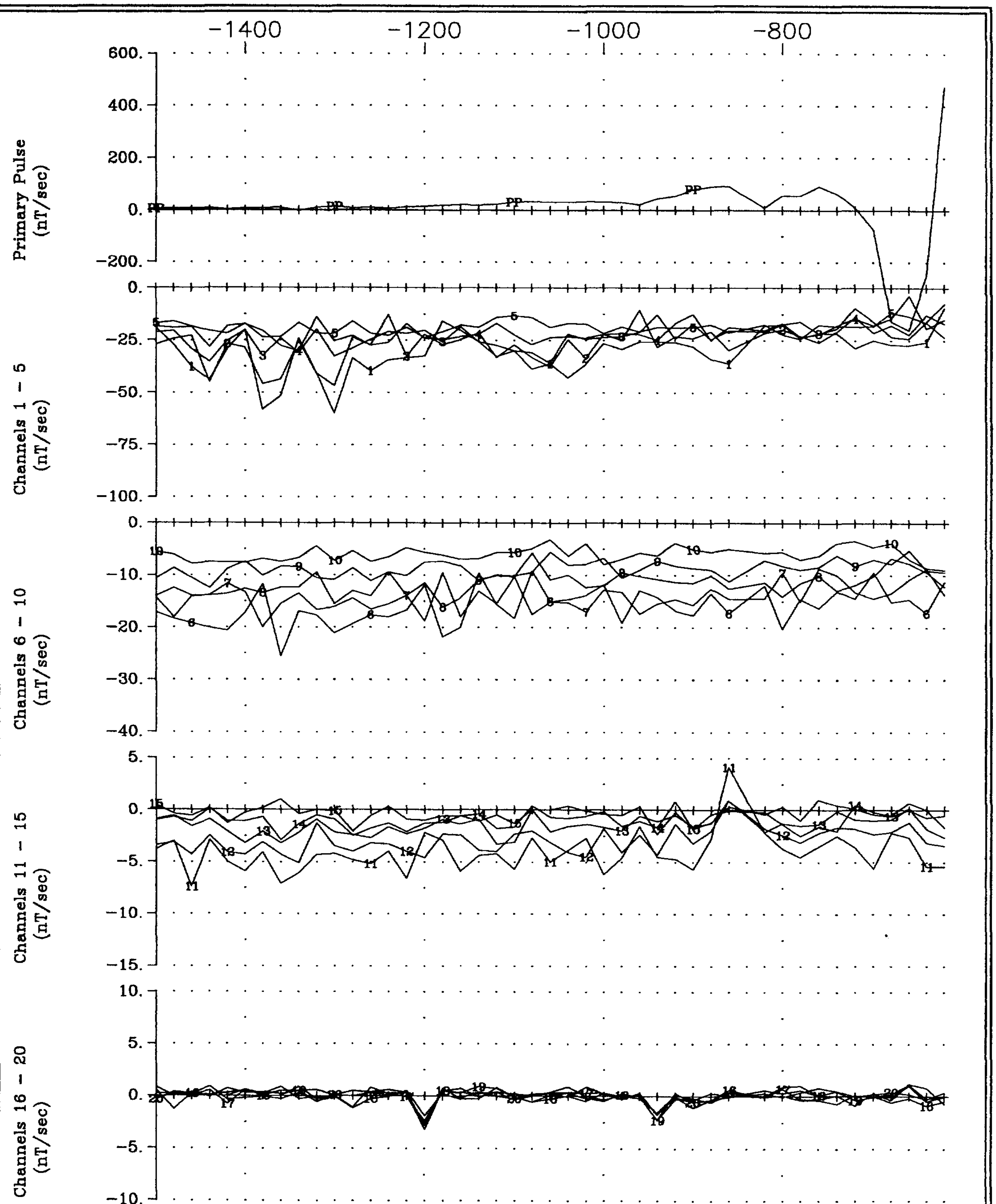

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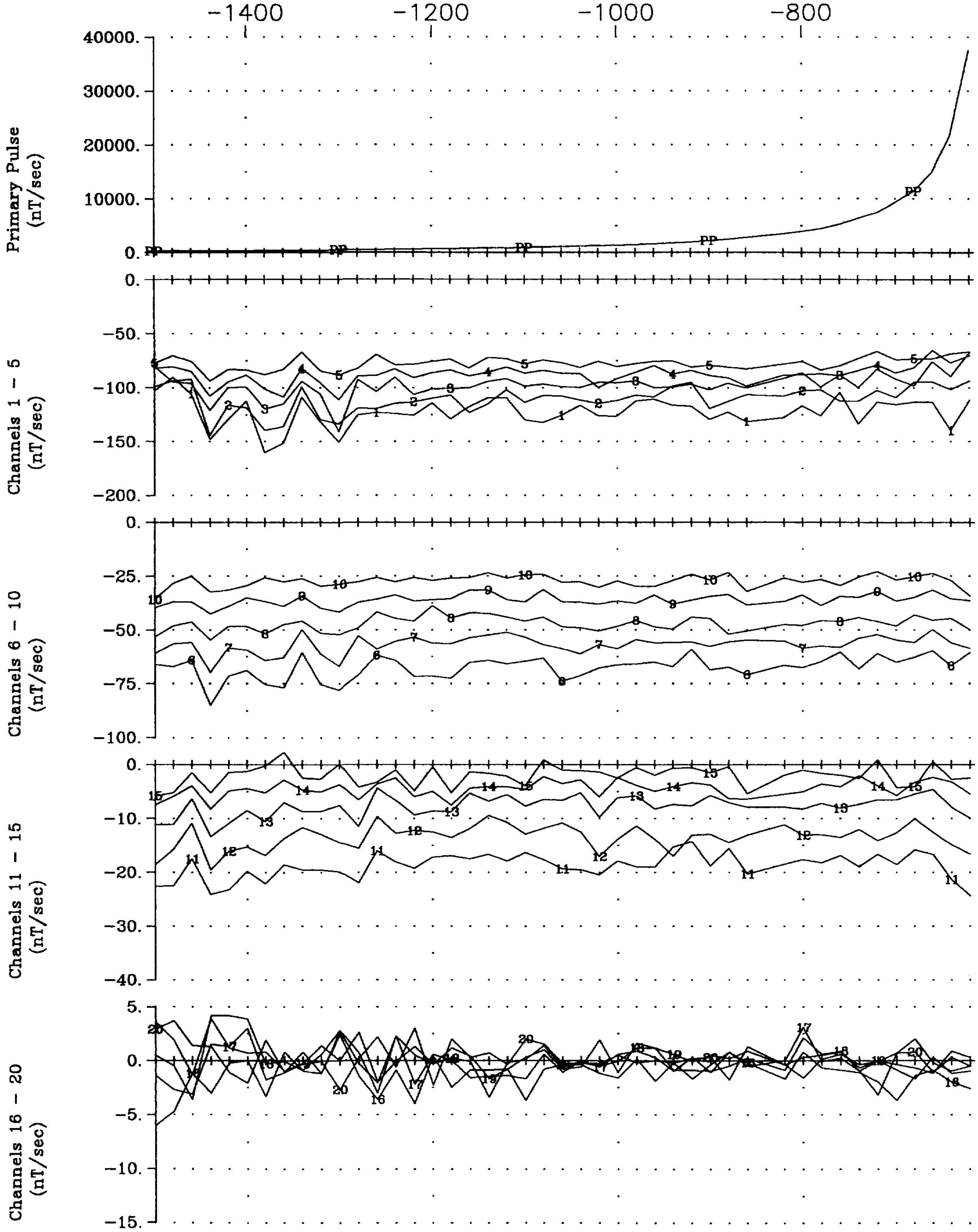
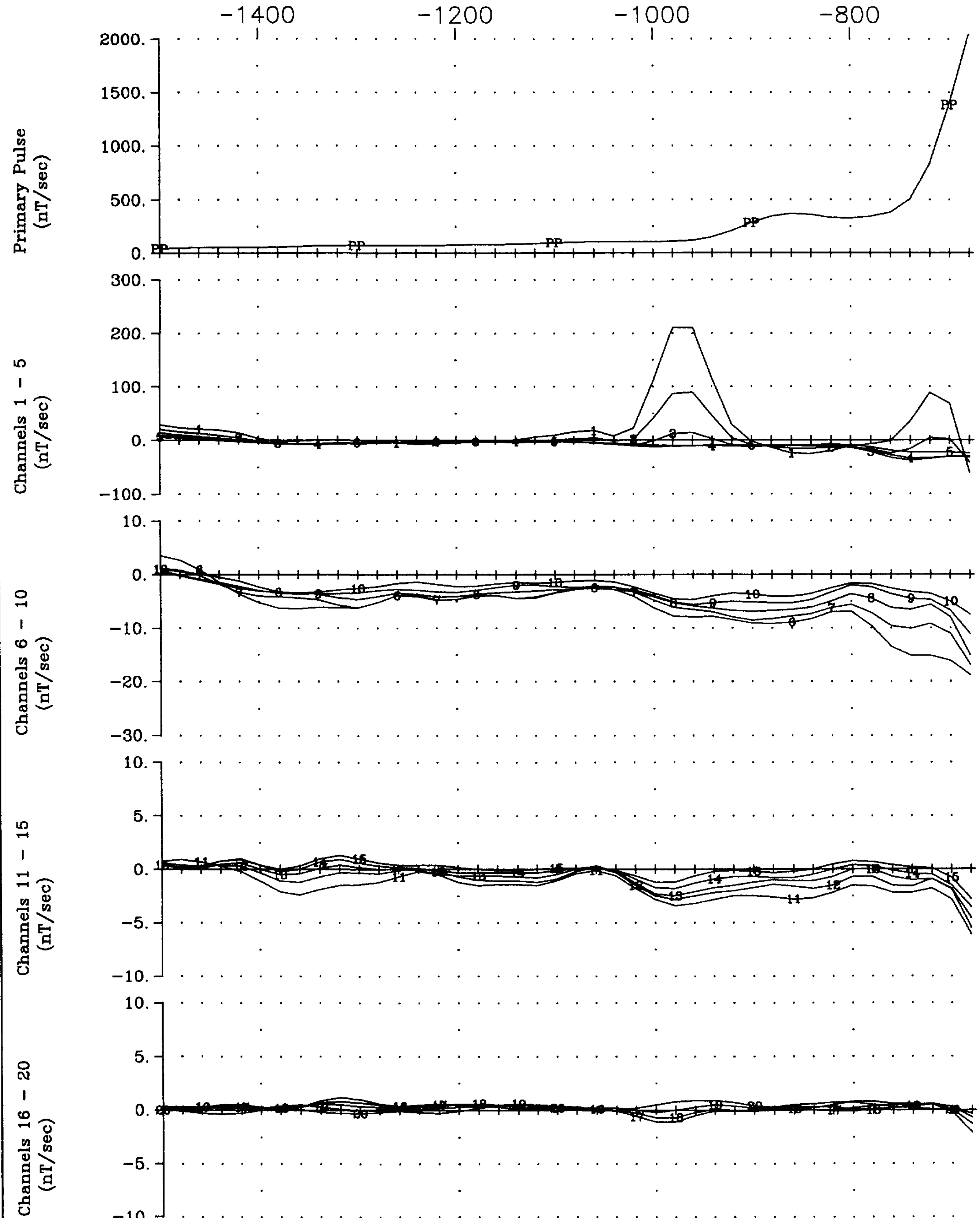


Falconbridge Ltd. Hutt Grid
Line 2200E Z Component
Crone Geophysics & Exploration Ltd.

APPENDIX V

LINEAR PROFILE (SMOOTH) PLOTS



Falconbridge Ltd. Hutt Grid

Line 1700E (Smooth Profile) X Component

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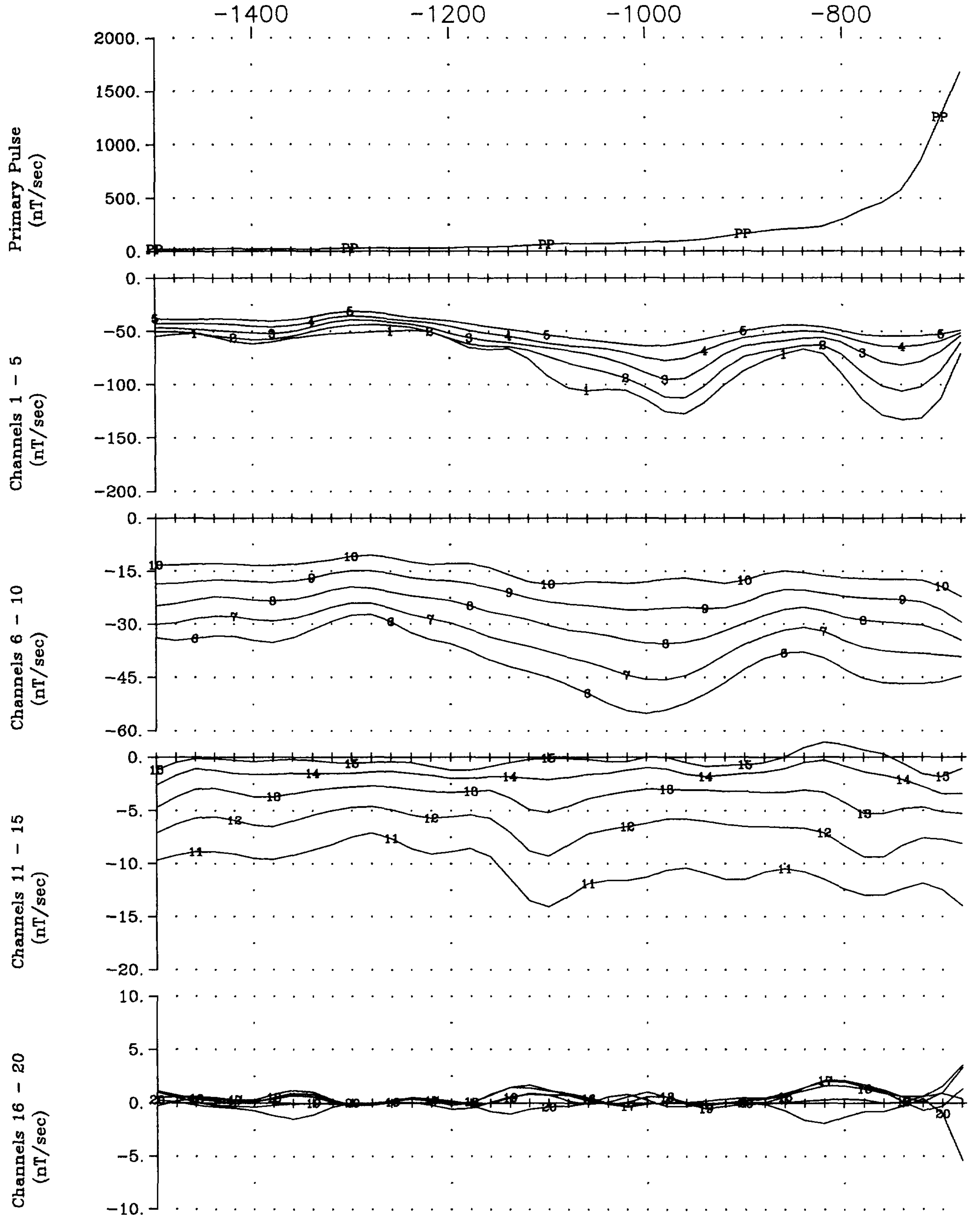

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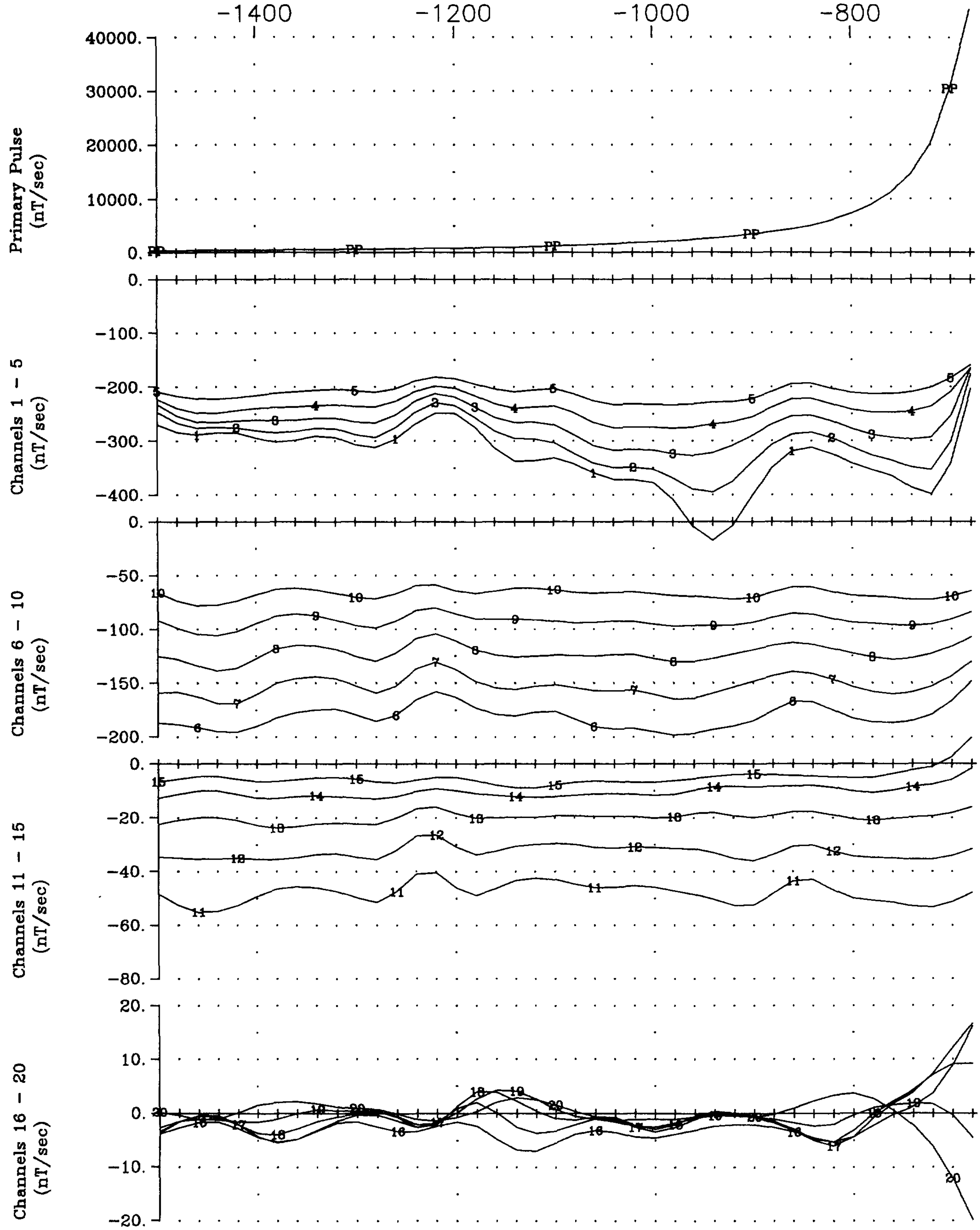

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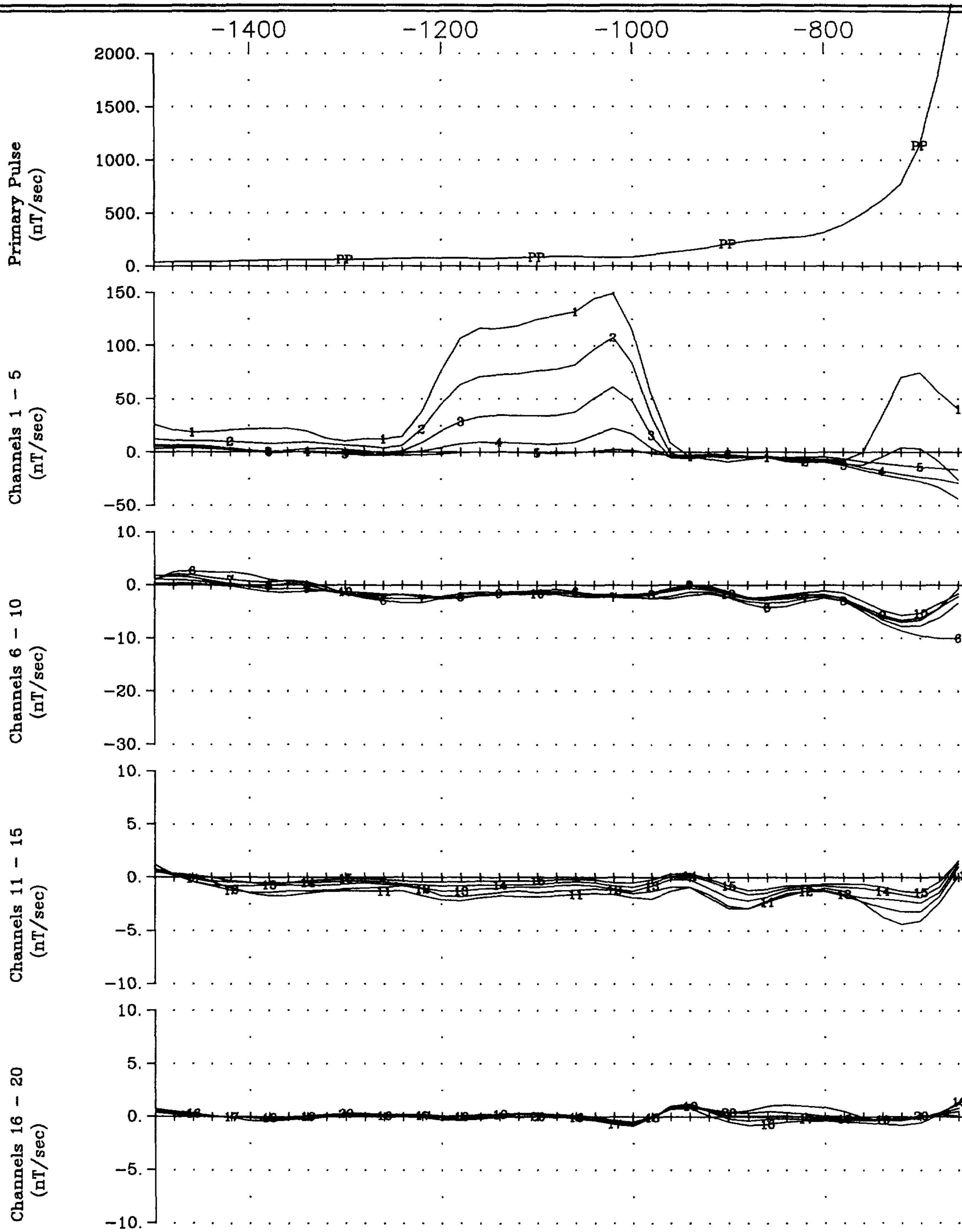

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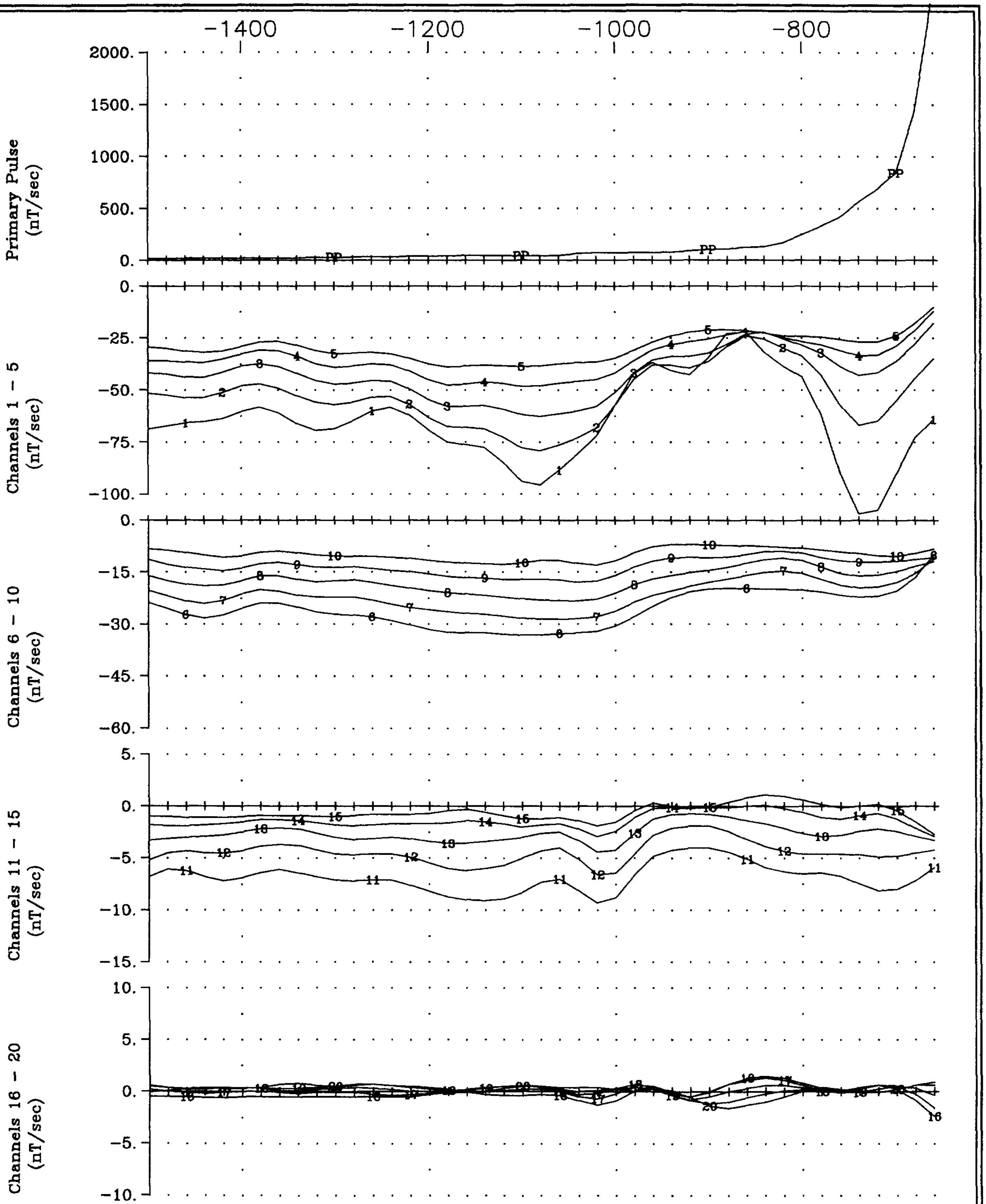

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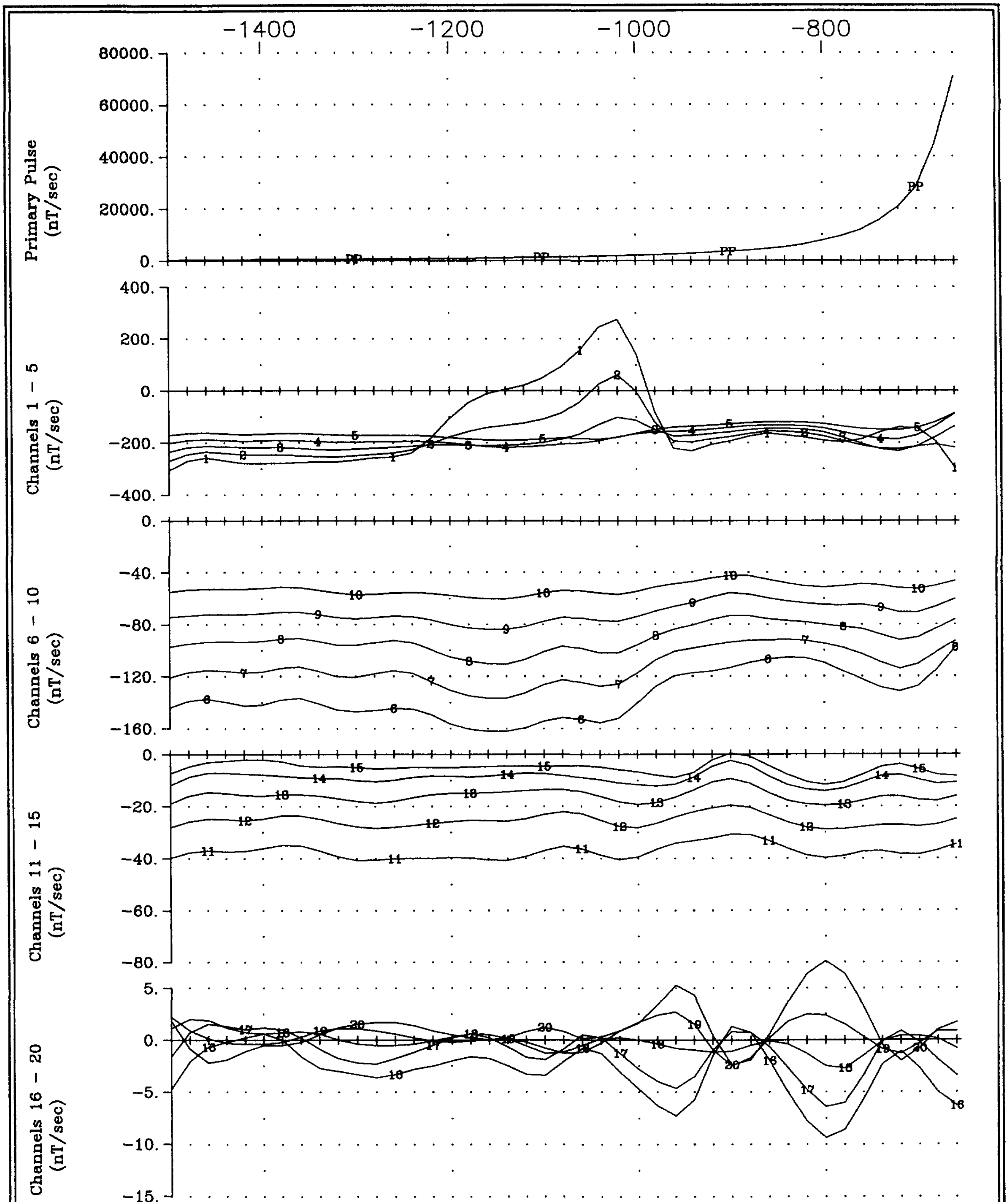

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Line 1800E (Smooth Profile) Z Component

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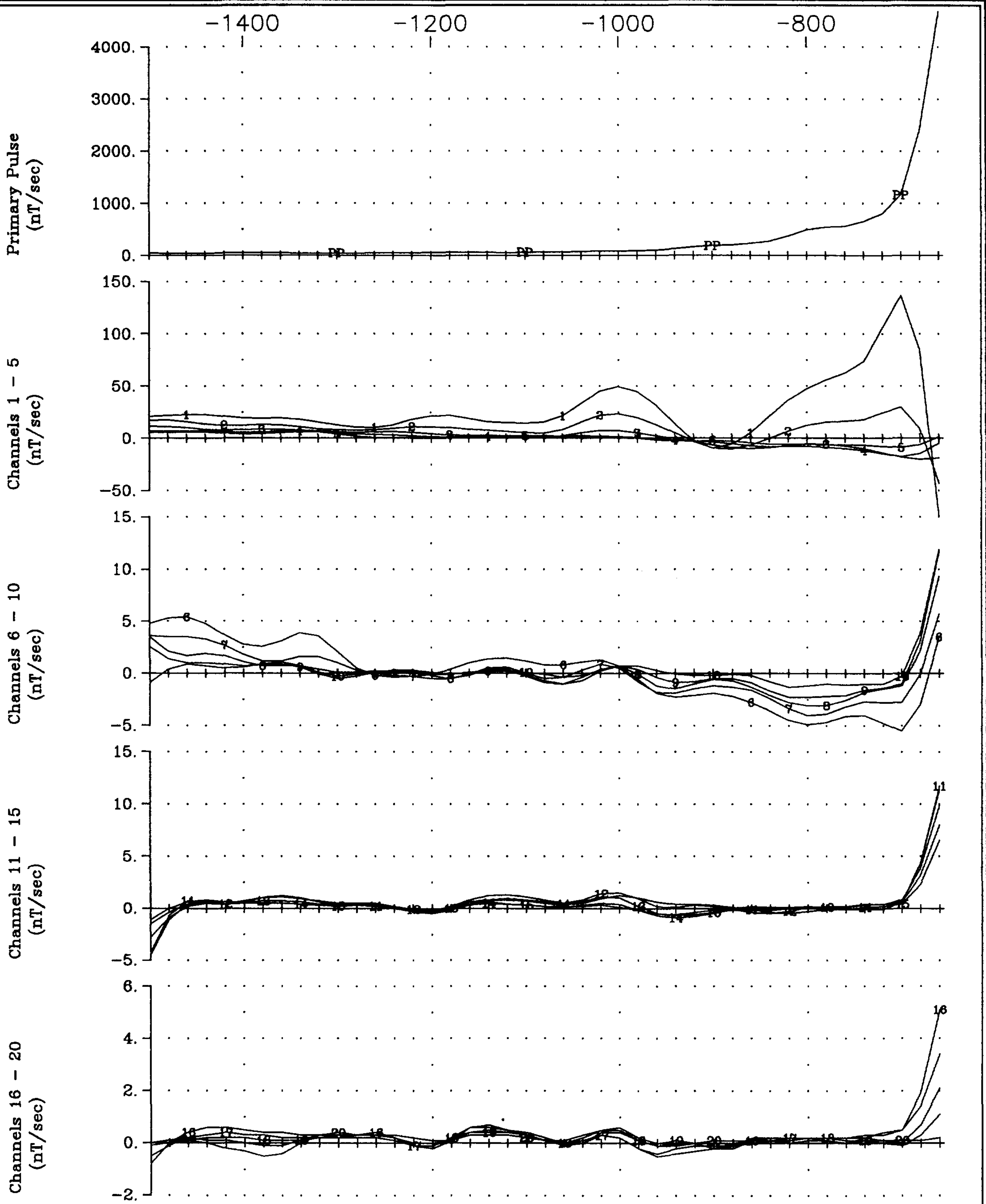

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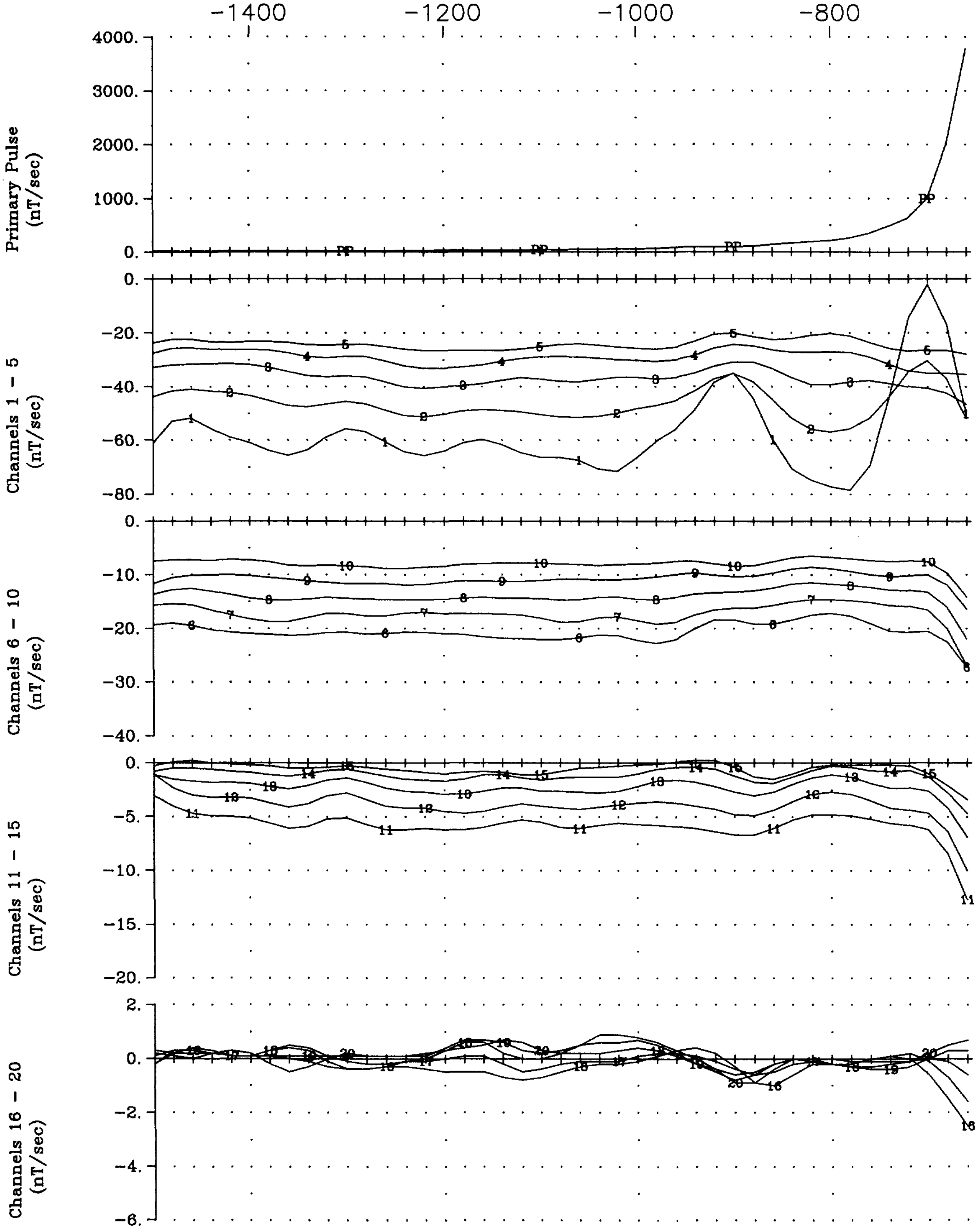
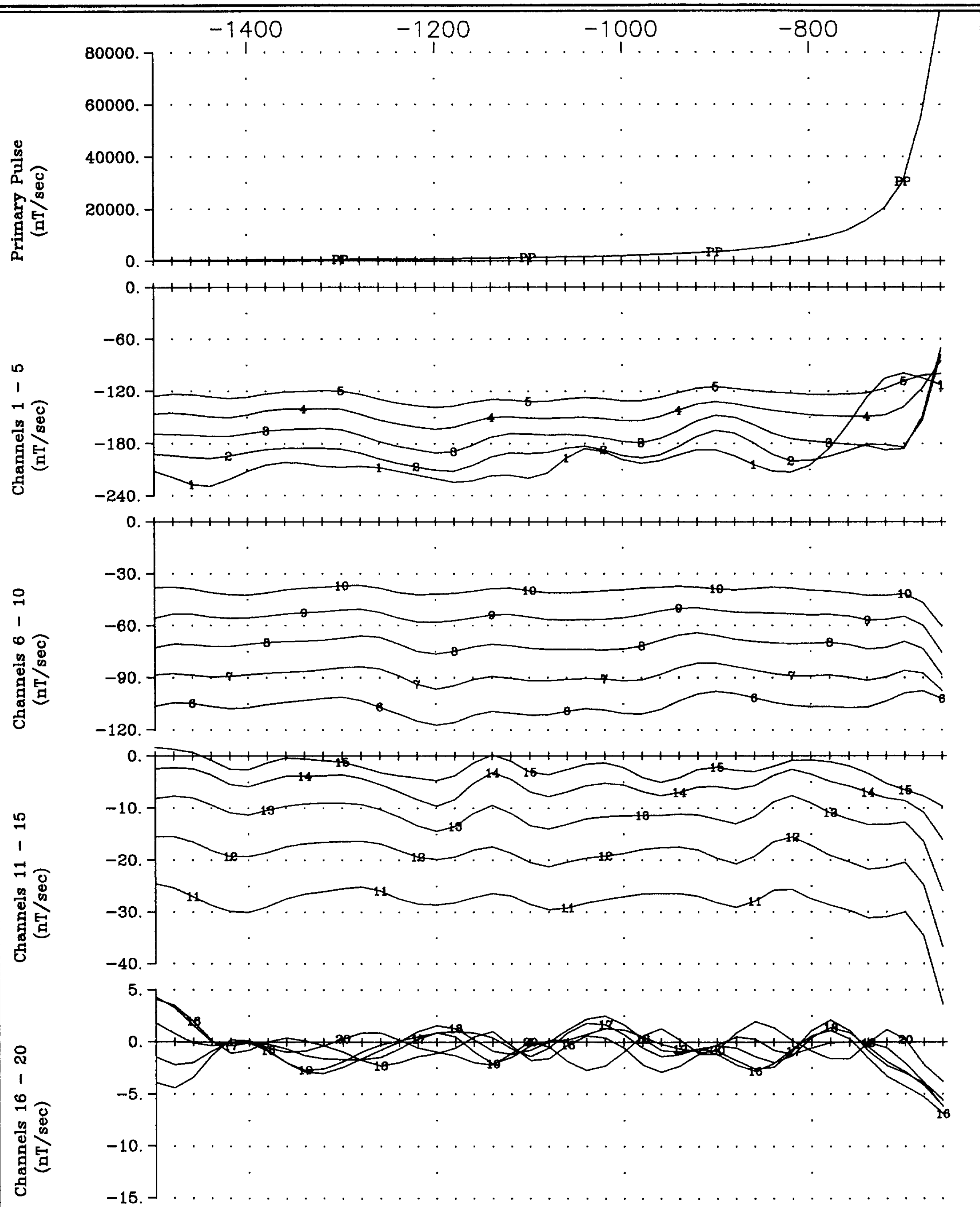


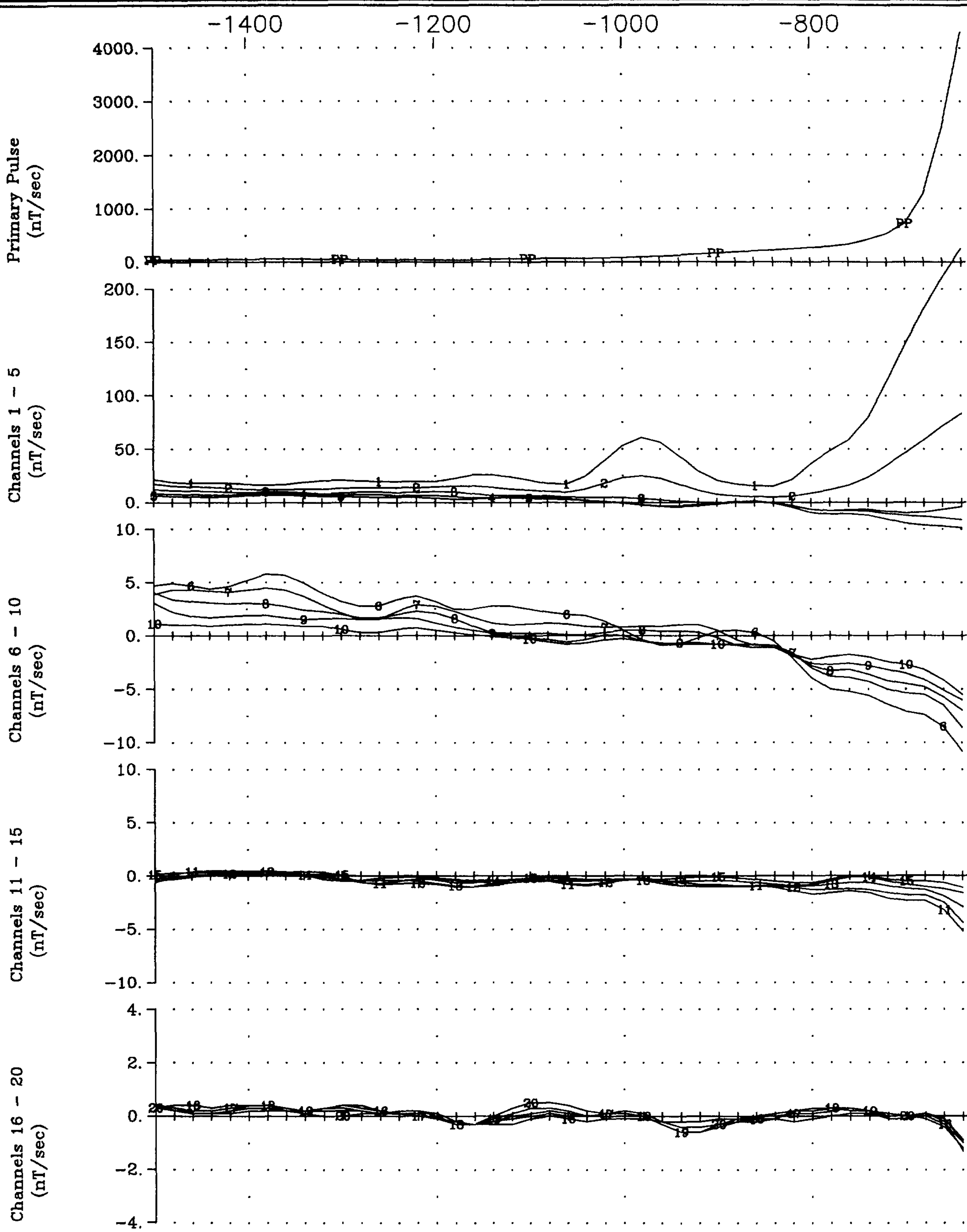
Falconbridge Ltd. Hutt Grid
Line 1900E (Smooth Profile) Y Component
Crone Geophysics & Exploration Ltd.



Falconbridge Ltd. Hutt Grid

Line 1900E (Smooth Profile) Z Component

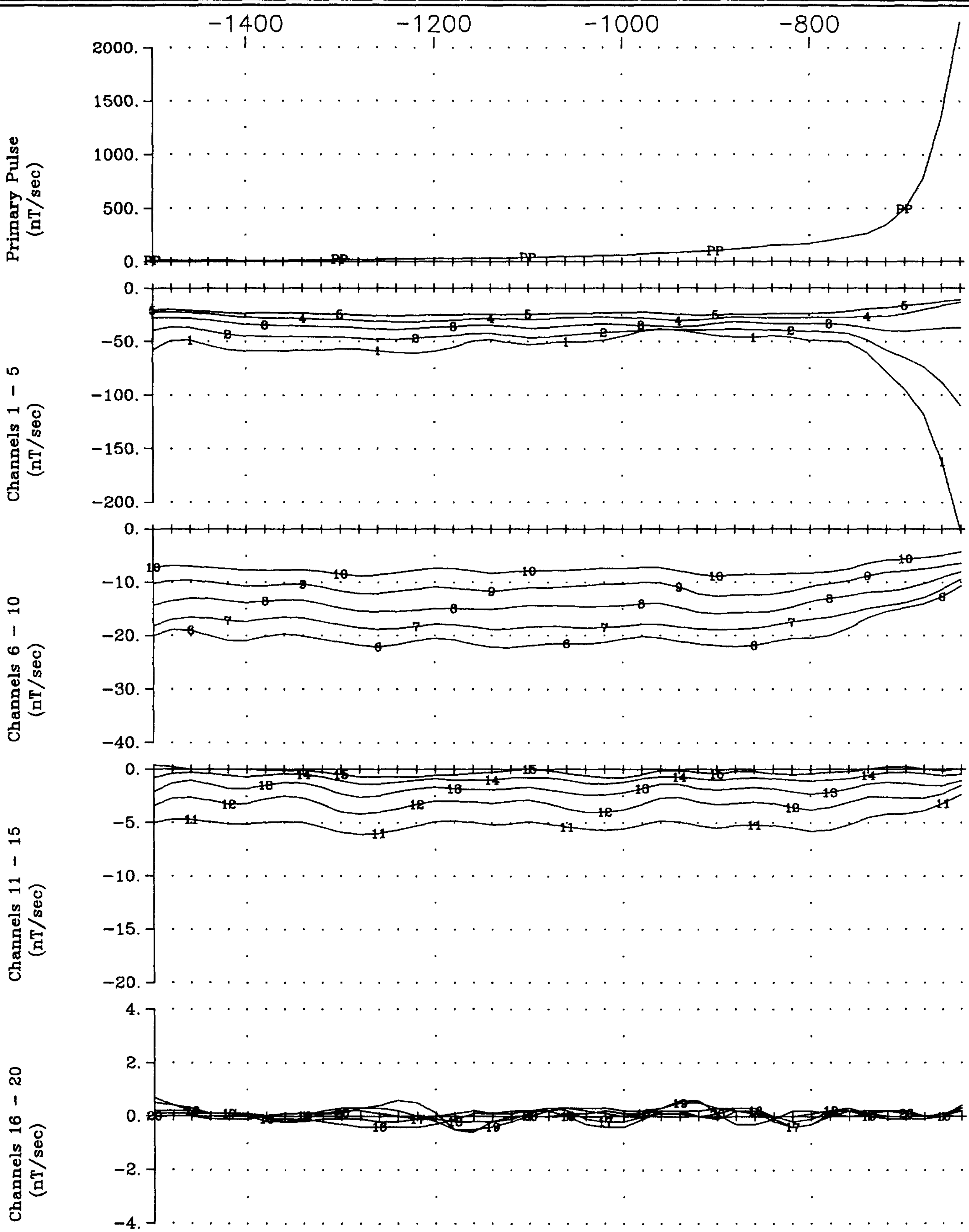
Crone Geophysics & Exploration Ltd.



Falconbridge Ltd. Hutt Grid

Line 2000E (Smooth Profile) X Component

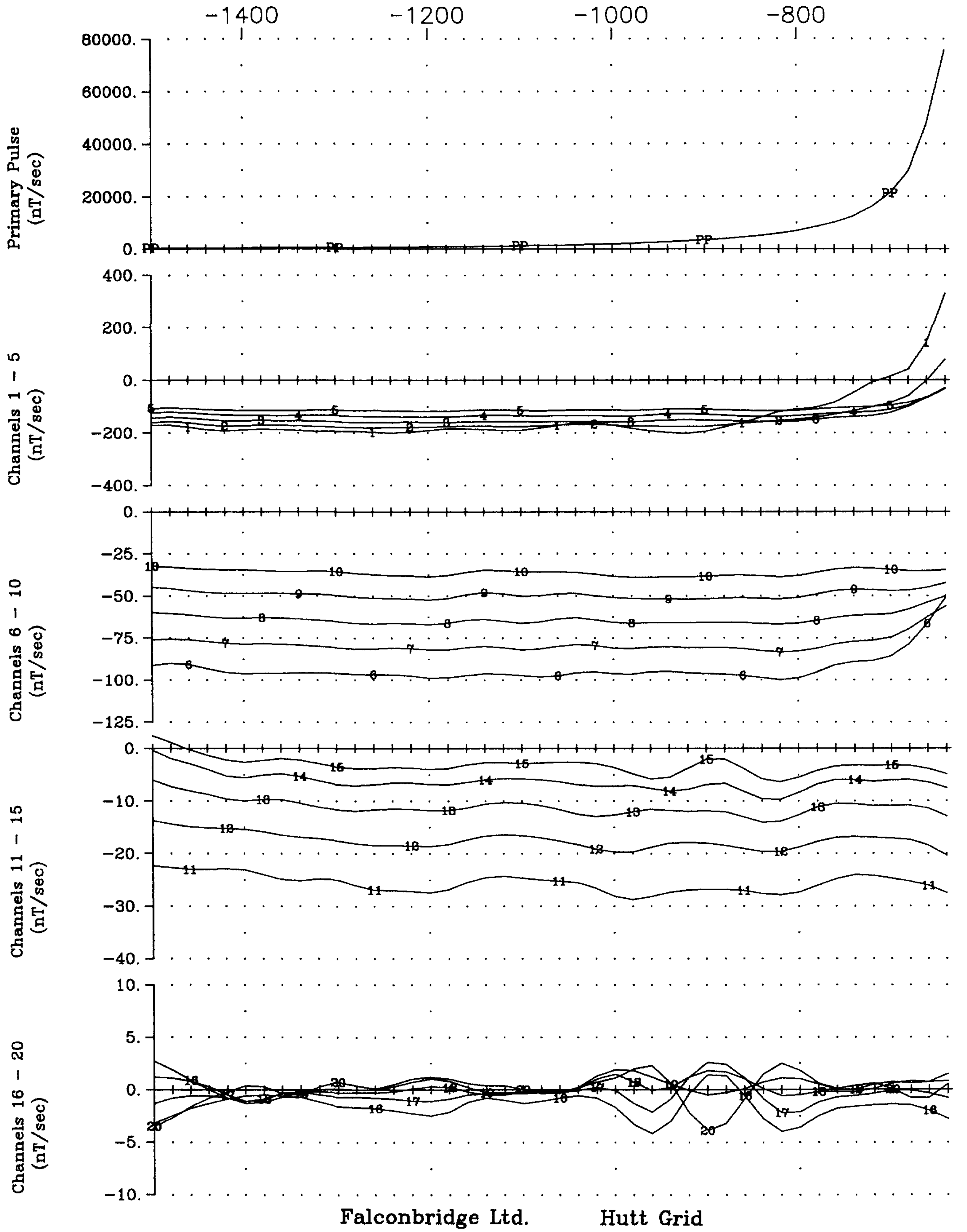
Crone Geophysics & Exploration Ltd.



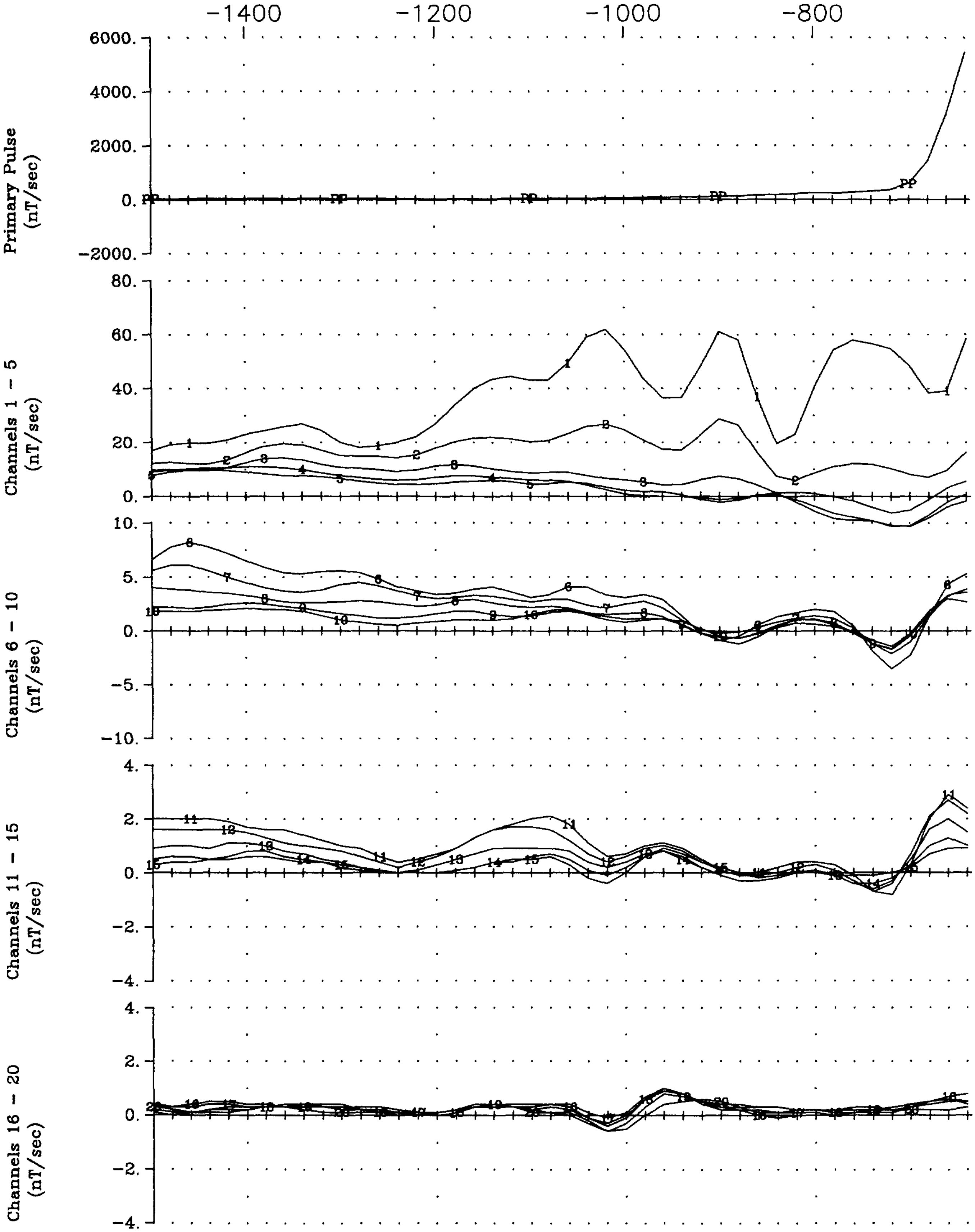
Falconbridge Ltd. Hutt Grid

Line 2000E (Smooth Profile) Y Component

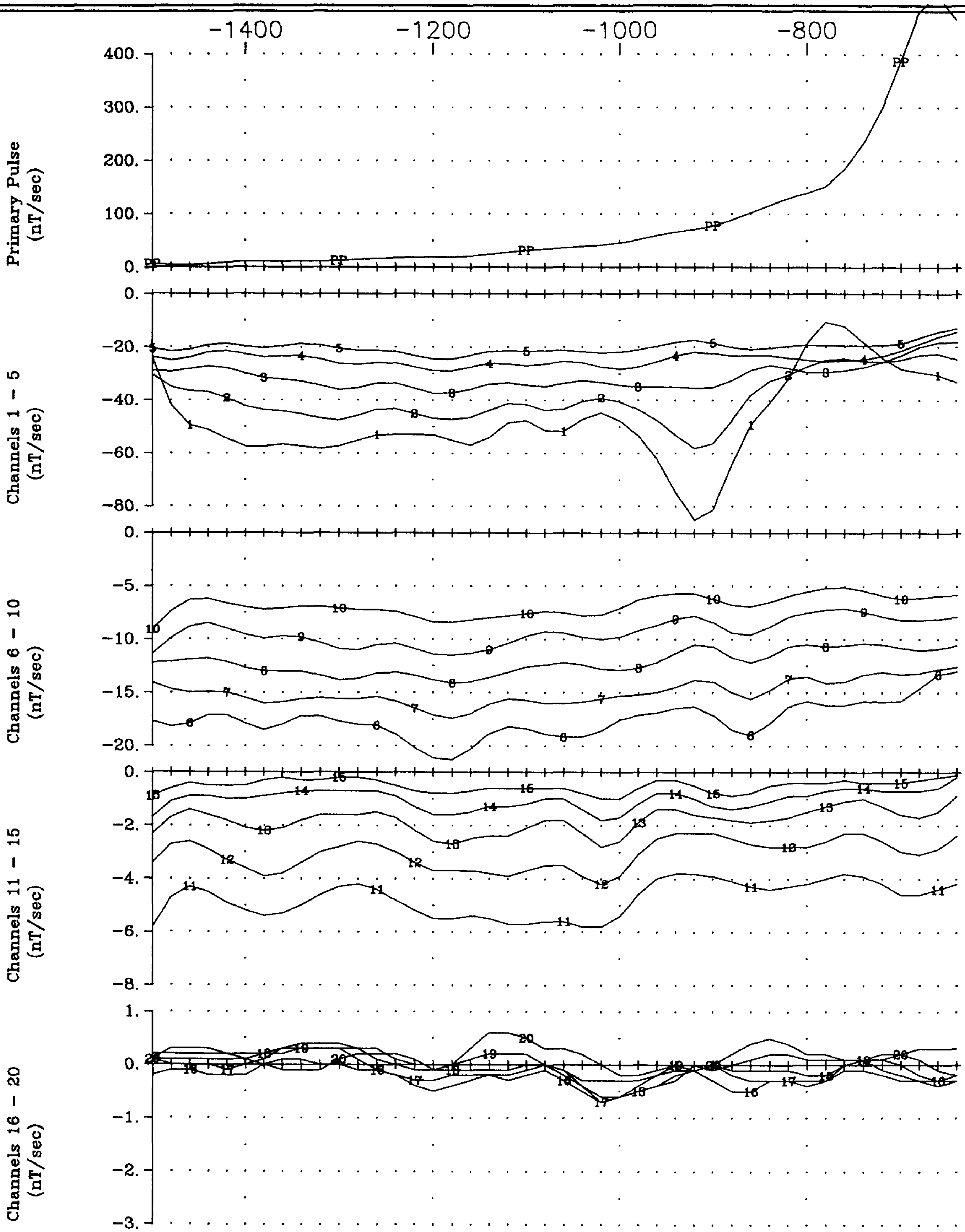
Crone Geophysics & Exploration Ltd.



Falconbridge Ltd. Hutt Grid
Line 2000E (Smooth Profile) Z Component
Crone Geophysics & Exploration Ltd.



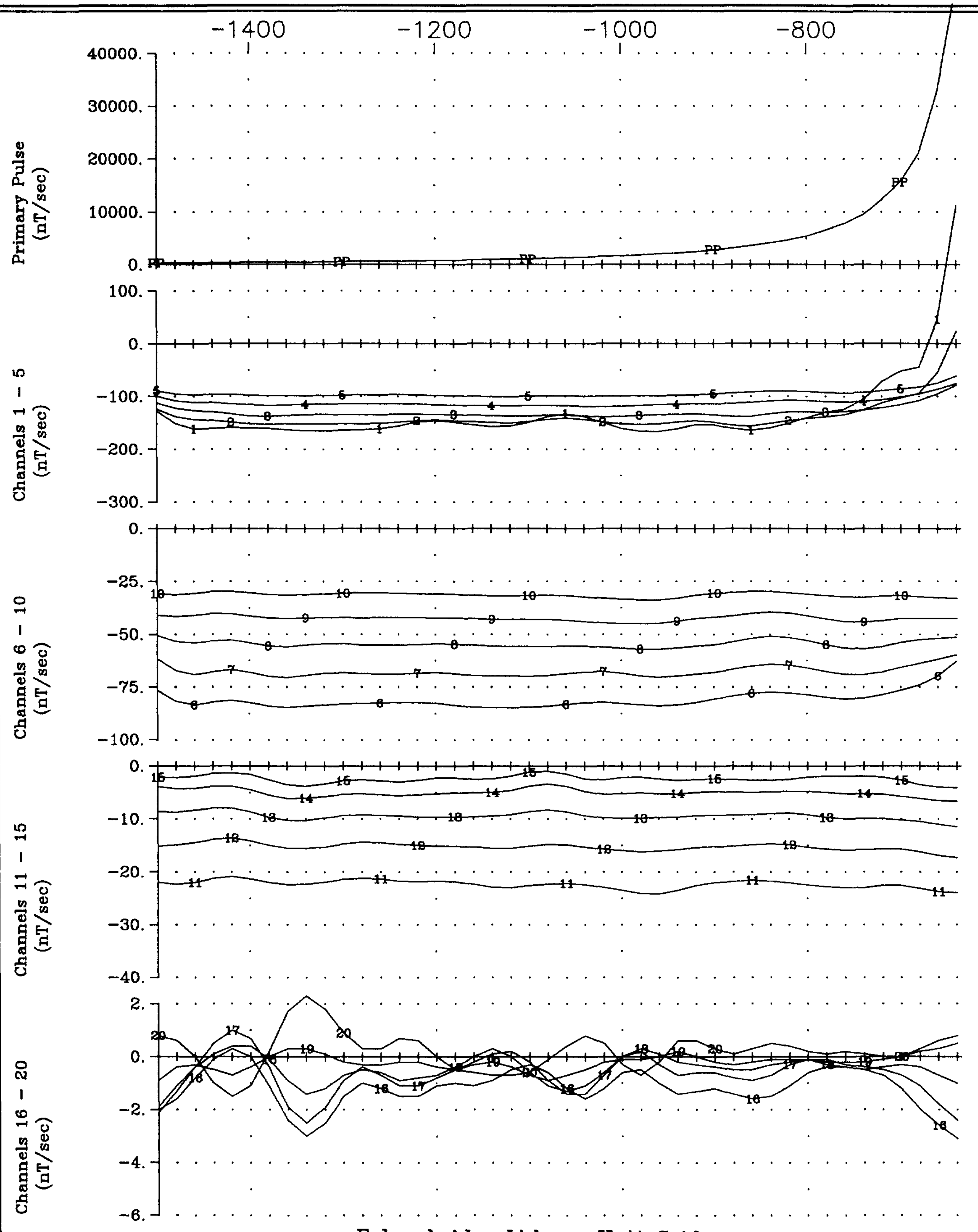
Falconbridge Ltd. Hutt Grid
Line 2100E (Smooth Profile) X Component
Crone Geophysics & Exploration Ltd.



Falconbridge Ltd. Hutt Grid

Line 2100E (Smooth Profile) Y Component

Crone Geophysics & Exploration Ltd.



Falconbridge Ltd. Hutt Grid

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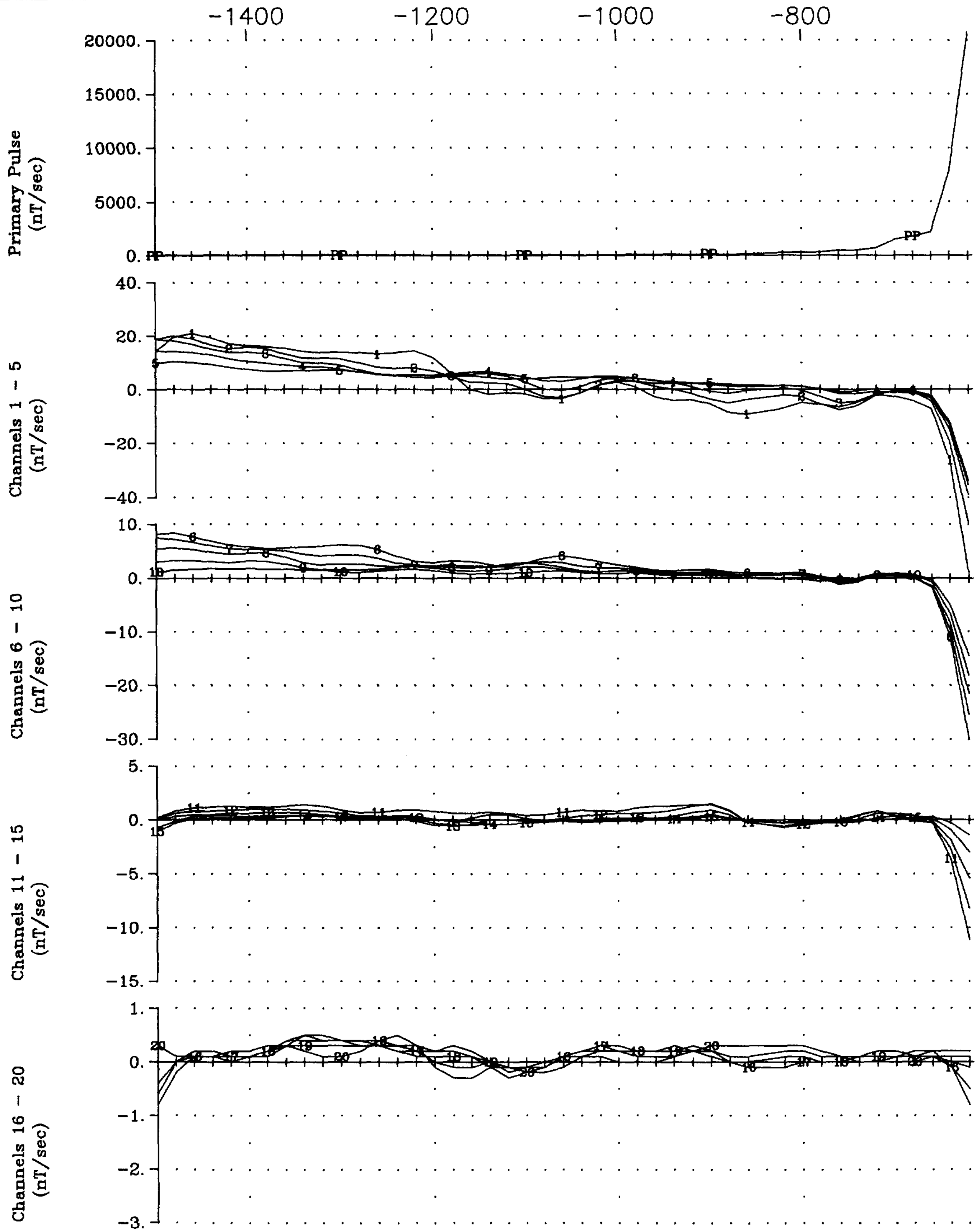

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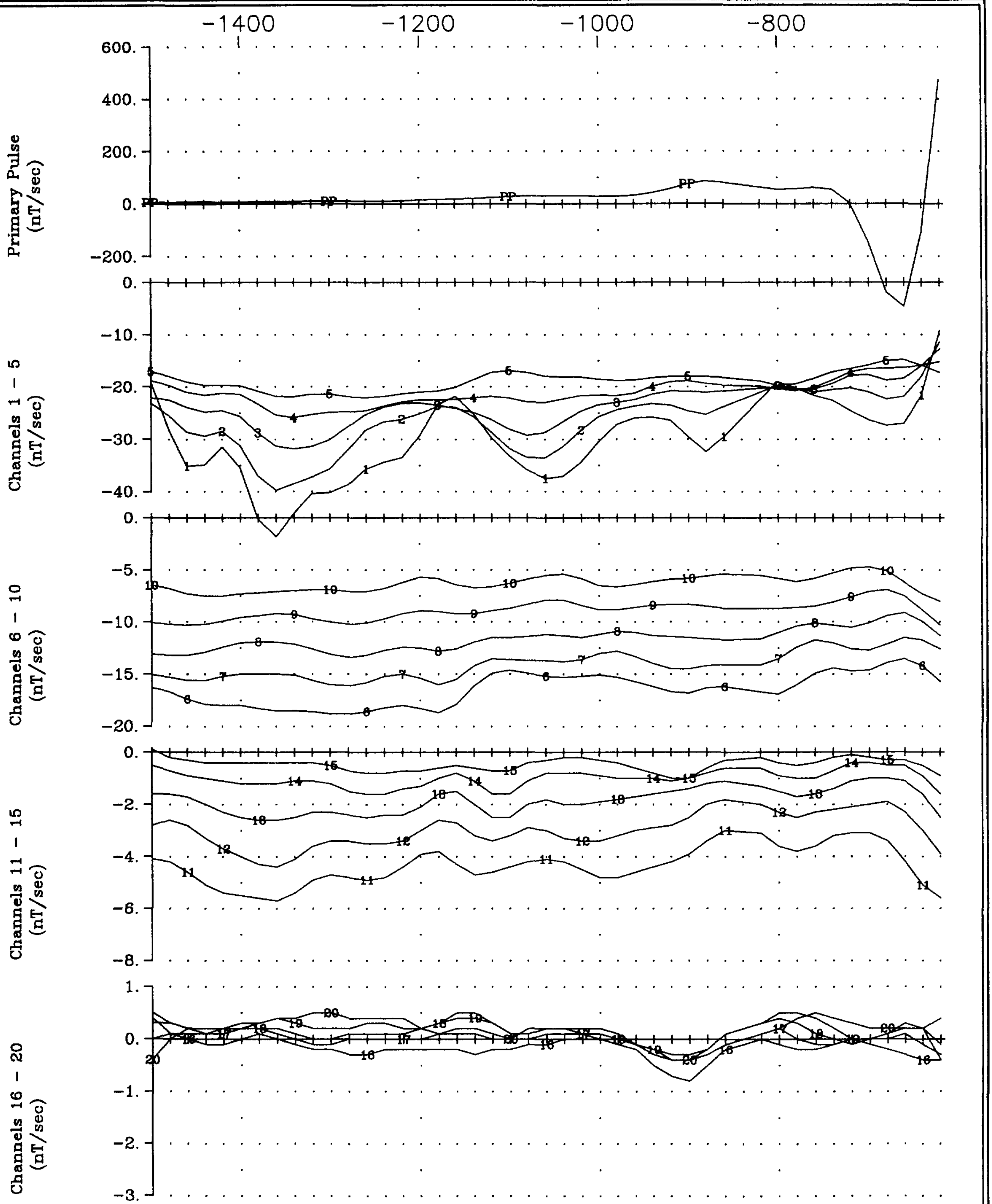
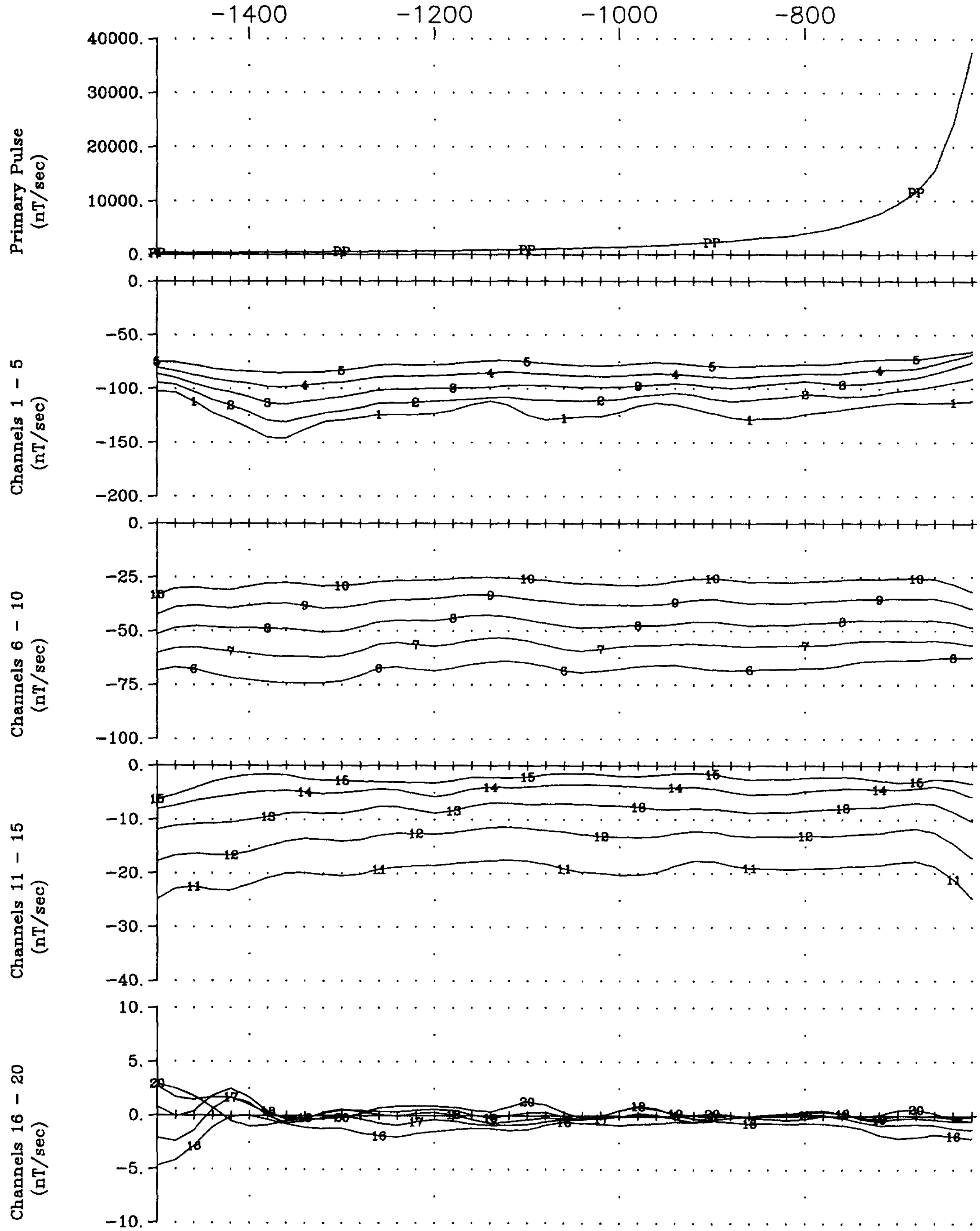
Crone Geophysics & Exploration Ltd.



Falconbridge Ltd. Hutt Grid

Line 2200E (Smooth Profile) Y Component

Crone Geophysics & Exploration Ltd.



Falconbridge Ltd. Hutt Grid
Line 2200E (Smooth Profile) Z Component
Crone Geophysics & Exploration Ltd.

APPENDIX VI

CRONE INSTRUMENT SPECIFICATIONS

CRONE PULSE EM SYSTEM

SYSTEM DESCRIPTION

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".

SYSTEM TERMINOLOGY

Ramp Time

"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.

Time Base

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, & 40.00ms

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.

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.

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.

Borehole (Z Component only)

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.

Multiple Boreholes: 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.

These methods have detected conductors to depths of 2500m from surface and up to 200m from the hole.

3-D Borehole

Drill holes are surveyed with both the Z and the XY borehole probes. The X and Y components provide accurate direction information using just one transmit loop.

Since the probe rotates as it moves down the hole a correction is required for the X-Y data. This is accomplished in one of two ways. The standard approach is to use the measurement of the primary field from the "PP" channel, apply a "cleaning" algorithm to remove most of the secondary field contamination, and compare this to theoretical values. The amount of probe rotation is then calculated, and the correction can be made. The second method involves the use of an optional orientation device for the X-Y probe which is produced in co-operation with IFG Corp. This attachment uses dipmeters to calculate the probe rotation.

Underground Borehole

Underground drill holes can be surveyed in any of the above mentioned borehole methods with one or more transmit loops on the surface. Near-horizontal holes can be surveyed using a push-rod system.

Resistivity Soundings

By reading a large number of channels in the centre of a transmit loop it is possible to perform a decay curve analysis giving a best-fit layer earth model using programs such as ARRTI or TEMIX.

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 normally operates with an input voltage from 24v to 120v. Modifications have recently been made to increase the power to 240 volts. The maximum current is still 20 amps. For low power surveys a 20amp/hr 24v battery can be used. The power supply requires a motor generator and a voltage regulator to control and filter the input voltage to the transmitter.

Specifications: PEM Motor Generator

- 4.5 hp Wisconsin, (2 kw) - 11 hp Honda (4 kw); 4 cycle engine
- belt drive to D.C. alternator
- cable output to regulator

- maximum output: 120v, 20amp (2 kw); 240v, 20amp (4 kw)
- fuse type overload protection
- steel frame
- external gas tank
- unit weight: 33kg (2 kw); 52kg (4 kw)
- optional packframe
- wooden shipping box
- shipping weight: 47kg (2 kw); 80kg (4 kw)

Specifications: PEM Variable Voltage Regulator

- selectable voltage between 24v and 120v or 48v and 240v
- 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: PEM Transmitter

- time bases: 10.89ms, 21.79ms, 8.88ms, 16.66ms, 33.33ms, 10ms, 20ms, 30ms
- ramp times: 0.5ms, 1.0ms, 1.5ms
- operating voltage: 24v to 120v (2 kw); 48v to 240v (4 kw)
- 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 the 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 25.5kg
- padded wooden shipping box

Menu driven operating software system offering the following functions:
- controls channel positions, channel widths, and number of channels
- time bases: 10.89ms, 21.79ms, 8.88ms, 16.66ms, 33.33ms, 10ms, 20ms, and 30ms
- ramp time selection
- 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, cable, and crystal clock. 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
- VLF filter
- 10khz bandwidth
- two 9v transistor battery supply
- tripod adjustable to all planes
- unit weight 4.5kg; shipping weight 13.5kg
- padded wooden shipping box

Borehole PEM Z Component Probe

The Z component probe measures the axial component of the EM field. The Z component data is not affected by probe rotation so no correction are required.

Specifications: Borehole PEM Z Component Probe

- ferrite core
- 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 PEM XY Component Probe

The XY probe measures two orthogonal components of the EM field perpendicular to the axis of the hole. Correction for probe rotation can be achieved by two methods. The standard approach is to use the measurement of the primary field from the "PP" channel, apply a "cleaning" algorithm to remove most of the secondary field contamination, and compare this to theoretical values. The amount of probe rotation is then calculated, and the correction can be made. The second method involves the use of an optional orientation device for the X-Y probe that uses dipmeters to calculate the probe rotation.

Specifications: Borehole PEM XY Component Probe

- ferrite core
- dimensions: length - 2.01m; dia - 3.02cm
- internal rechargeable ni-cad battery supply
- selection of X or Y coils by means of a switch box on surface or automatic switching with Digital receiver
- replaceable heat shrink tubing for abrasion protection
- pressure tested for depths to 2800m
- packaged in padded cover and aluminum tube
- shipped in padded wooden box; total shipping weight 20kg

Orientation Device

The orientation device is an optional attachment for the XY probe which measures the rotation of the probe using two dipmeters.

Specifications: Orientation Device

- 2 axis tilt sensors
- sensitivity +/- 0.1 deg.

- operating range -89.5 to -10 deg.
- dimensions: length - 0.94m; dia - 28.5cm
- packaged in padded cover and aluminum tube
- shipped in padded wooden box; total shipping weight 11kg

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.

Addendum to "Surface Pulse EM Surveys over Hutt Project – October, 2000"

GENERAL SURVEY DETAILS

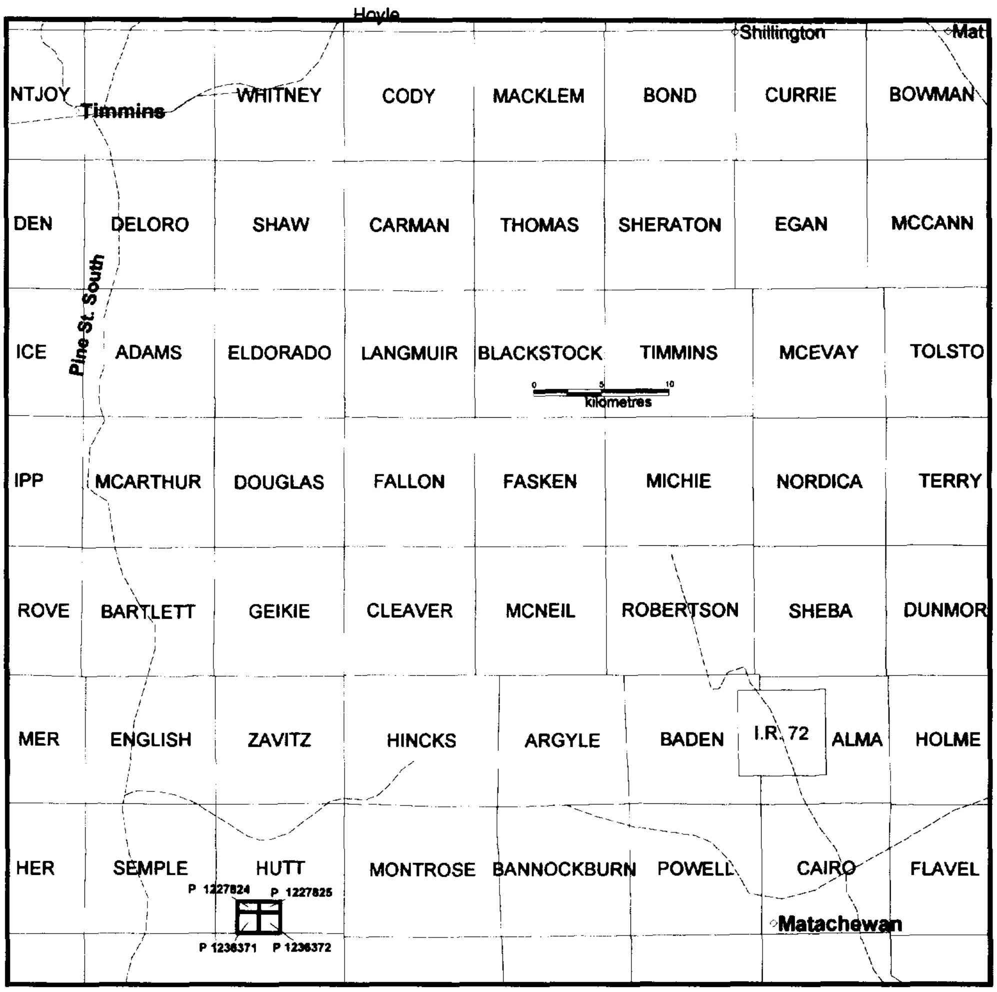
Location & Access

The property is located in southwestern Hutt Twp., Porcupine Mining Division, approximately 70km south of the City of Timmins, Ont. (NTS 42A/3). The property is accessible by truck via Pine Street South which branches eastward at southern English Twp. approximately 60km south of Timmins. The branched road intersects a high-voltage hydro line approximately 10km to the east. An ATV / 4x4 truck trail along the power-line intersects the western boundary of the grid area approximatly 7km to the south.*(see figure below)*

Mining Lands

The property consists of 4 contiguous unpatented mining claims all owned 100% by Falconbridge Limited; *(see figure below)*

P 1227824 – 8 units
P 1227825 – 8 units
P 1236371 – 16 units
P 1236372 – 16 units



FL Property Location – Hutt Twp.

PREVIOUS WORK

1951-1952	Dominion Gulf Co., trenched and sampled apparently barren disseminated pyrite, pyrrhotite and minor chalcopyrite in interflow units of intermediate to felsic tuff southwest of Foy Lake, west of the current property. This work was done as part of program on a large land package in Semple Township, underlain by a thick package of ultramafic intrusives, mafic to intermediate volcanics, and minor interflow units of intermediate to felsic pyroclastics,
1962-1963	Hollinger Consolidated Gold Mines Ltd. held ground immediately west of Canoeshed Lake. They reported the area was largely underlain by felsic pyroclastics, with subordinate mafic to intermediate pillow lavas and minor discontinuous interbeds of pyrite-bearing iron formation and graphitic tuff. 15 holes were drilled around the Semple-Hutt north township boundary (Bright, 1984). The drilling intersected quartz-feldspar porphyry dykes cutting felsic pyroclastics in this area.
1966-1967	Amax Exploration Inc. conducted an airborne geophysical survey over several townships in the Hutt area, staked five claim blocks in Hutt and Semple Townships, carried out ground magnetic and EM surveys over the claims, and subsequently drilled several holes in the area. Of interest is the Adele Group property, situated between Hutt12 and Hutt15, which is underlain by mafic to intermediate volcanics intercalated with minor felsic volcanics. Drill holes on this property intersected felsic breccia with 1-2% pyrite, graphitic tuff containing disseminated to massive pyrite, intercalated intermediate to felsic flows and breccias with an average of 6% pyrite, and chalcopyrite stringers (1.3 cm wide) in fractured and altered felsic volcanics (Bright, 1984).
1983-1986	Kidd Creek Mines Ltd. conducted airborne and ground geophysical surveys and goelogic mapping over claims held in in southeast Hutt and north central Halliday townships (Mullen, 1984; McIlvena, 1985). Six east-west trending anomalies representing lithological contacts were outlined, and no significant new geophysical anomalies were identified. Zones of strongly altered (Na_2O depleted) felsic rocks were geochemically identified. This ground included, in part, the present Hutt15 property.
1992-1996	Former Kidd Creek Mines Ltd. geologist D. Mullen restaked some former Kidd claims (including part of Hutt15), conducted a detailed geological mapping program, and ran three short IP survey lines. The geophysical survey revealed a weak conductor associated with altered felsic volcanic rocks, that was considered to have potential (Mullen 1993; 1994; 1995).
1997	Panterra Minerals Inc. drilled five holes in central Halliday Township, near Relic Lake, on IP anomalies associated with elevated base metal values at an ultramafic-felsic contact. Three out of five holes intersected 2 to 22 m of sulphide chert breccia, including sections of pyrite-rich massive sulphides with elevated base metal values, bounded by altered intermediate volcaniclastics (Panterra Minerals, 1997).
1998	Approximately 42km of line was cut on four separate grids covering prospective AEM conductors. Ground magnetic surveys and 21.7km of HLEM were completed on the grids. A geologic mapping and sampling program was conducted over three of the grids. Results of the reconnaissance mapping program were very encouraging with the identification of prospective, altered, FIII, massive and fragmental rhyolites located in the vicinity of all but one targeted AEM anomaly. HLEM work

identified three weak and one moderate strength conductors on the ground. Results from the magnetic surveys indicate that two of the grids may have been oriented in the wrong direction. New AEM targets generated by a review of geophysical data in 1999 where either unable to be located on the ground or deemed unworthy of drill follow-up.

CONCLUSIONS AND RECOMMENDATIONS

Data acquisition proved difficult during the Time Domain EM survey due to the interference and noise created by the nearby high voltage hydro transmission line. A distinct bedrock conductor was however identified on L18+00E at 9+80N, roughly co-incident with an isolated response from a previous airborne EM survey performed over the property. The conductor is difficult to interpret due to the interference however the response does appear to occur in all 20 channels making it a strongly conductive target, caused by either sulphide mineralization or graphite. The apparent depth to the top of the conductor is approximately 35m although the dip is not possible to determine.

It is recommended that the area around the anomaly be mapped to attempt to find any surface expression of the conductive body. If still unexplained the conductor should be drill tested on L18+00W at 9+80N at a vertical depth of approximately 40-45m.

Dean Rogers
Project Geologist
Falconbridge Limited

Warren Hughes
Associate Geophysicist
Falconbridge Limited

ONTARIO MINISTRY OF NORTHERN DEVELOPMENT AND MINES

Work Report Summary

Transaction No:	W0160.30132	**Status:**	APPROVED
Recording Date:	2001-MAY-18	**Work Done from:**	2000-OCT-26
Approval Date:	2001-SEP-08	**to:**	2000-OCT-31

Client(s):

130679 FALCONBRIDGE LIMITED

Survey Type(s):

EM

Work Report Details:

Claim#		Perform	Perform Approve	Applied	Applied Approve	Assign	Assign Approve	Reserve	Reserve Approve	Due Date
P	1227824	$1,890	$1,890	$1,556	$1,556	$0	0	$334	$334	2002-MAY-22
P	1227825	$0	$0	$3,200	$3,200	$0	0	$0	$0	2002-MAY-26
P	1236371	$10,080	$10,080	$0	$0	$8,547	8,547	$1,533	$1,533	2002-MAY-20
P	1236372	$630	$630	$5,977	$5,977	$0	0	$0	$0	2002-MAY-20
		$12,600	$12,600	$10,733	$10,733	$8,547	$8,547	$1,867	$1,867	

Status of claim is based on information currently on record.

41P14NE2008 2.21428 HUTT 900

Ministry of
Northern Development
and Mines

Ministère du
Développement du Nord
et des Mines

Ontario

GEOSCIENCE ASSESSMENT OFFICE
933 RAMSEY LAKE ROAD, 6th FLOOR
SUDBURY, ONTARIO
P3E 6B5

Tel: (888) 415-9845
Fax:(877) 670-1555

Date: 2001-SEP-13

FALCONBRIDGE LIMITED
SUITE 1200, 95 WELLINGTON STREET WEST
TORONTO, ONTARIO
M5J 2V4 CANADA

Submission Number: 2.21428
Transaction Number(s): W0160.30132

Dear Sir or Madam

Subject: Approval of Assessment Work

We have approved your Assessment Work Submission with the above noted Transaction Number(s). The attached Work Report Summary indicates the results of the approval.

At the discretion of the Ministry, the assessment work performed on the mining lands noted in this work report may be subject to inspection and/or investigation at any time.

The revisions outlined in the Notice dated July 25, 2001 have been corrected. Accordingly, assessment work credit has been approved as outlined on the Declaration of Assessment Work Form accompanying this submission.

NOTE: The requirement for "a summary of exploration and development work performed on the land" refers only to work performed on the present claim.

If you have any question regarding this correspondence, please contact BRUCE GATES by email at bruce.gates@ndm.gov.on.ca or by phone at (705) 670-5856.

Yours Sincerely,

Roy Spooner
Supervisor, Geoscience Assessment Office

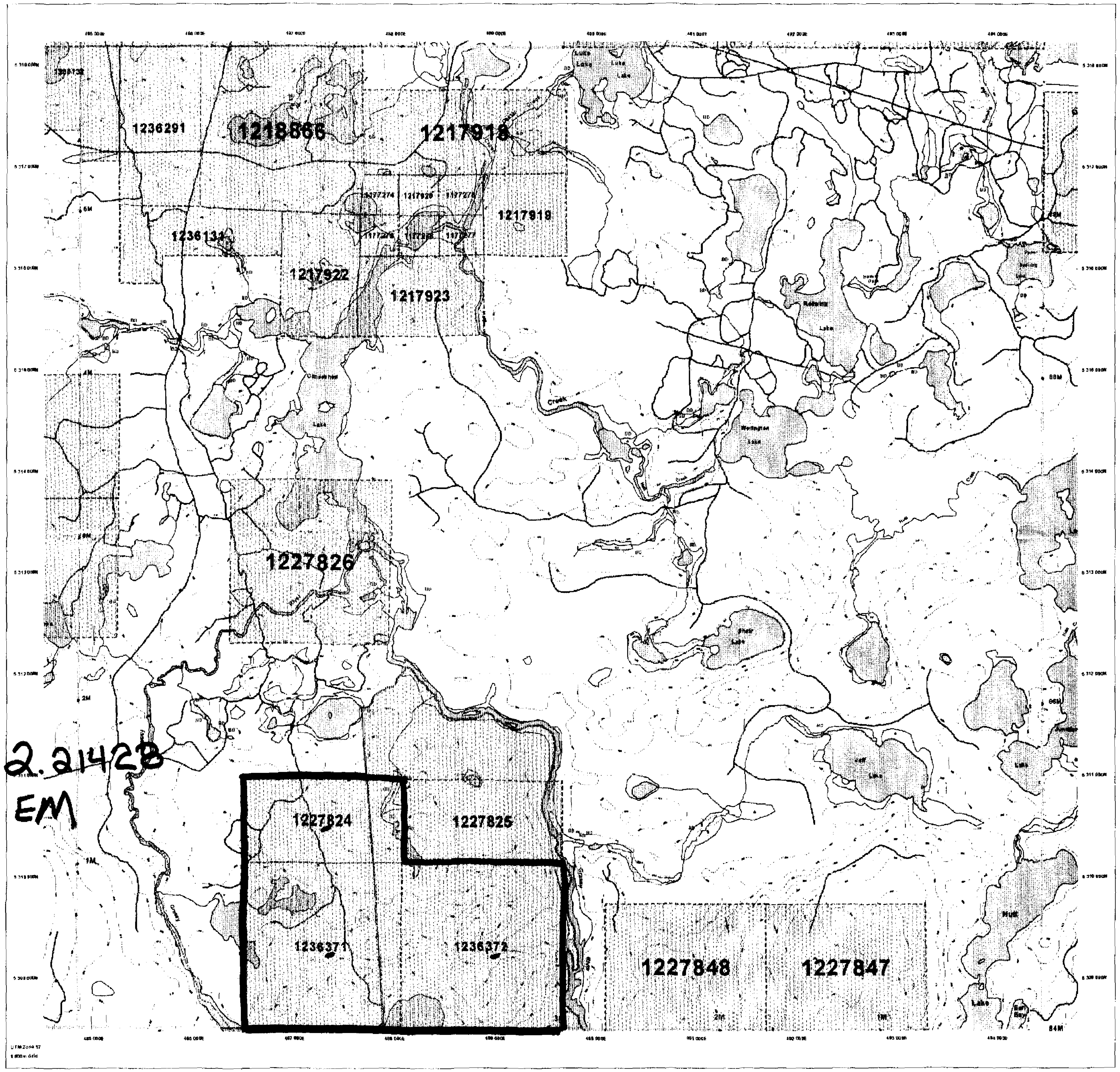
Cc: Resident Geologist

Falconbridge Limited
(Claim Holder)

Dean Rogers
(Agent)

Assessment File Library

Falconbridge Limited
(Assessment Office)



MINING LAND TENURE MAP

Date / Time of Issue May 18 2001 11:57h Eastern

TOWNSHIP / AREA: HUTT

PLAN: G-3948

ADMINISTRATIVE DISTRICTS / DIVISIONS

Mining Division	Porcupine
Land Titles/Registry Division	SUDBURY
Ministry of Natural Resources District	TIMMINS

TOPOGRAPHIC

LAND TENURE

LAND TENURE WITHDRAWALS

IMPORTANT NOTICES

LAND TENURE WITHDRAWAL DESCRIPTIONS

IMPORTANT NOTICES

General Information and Limitations

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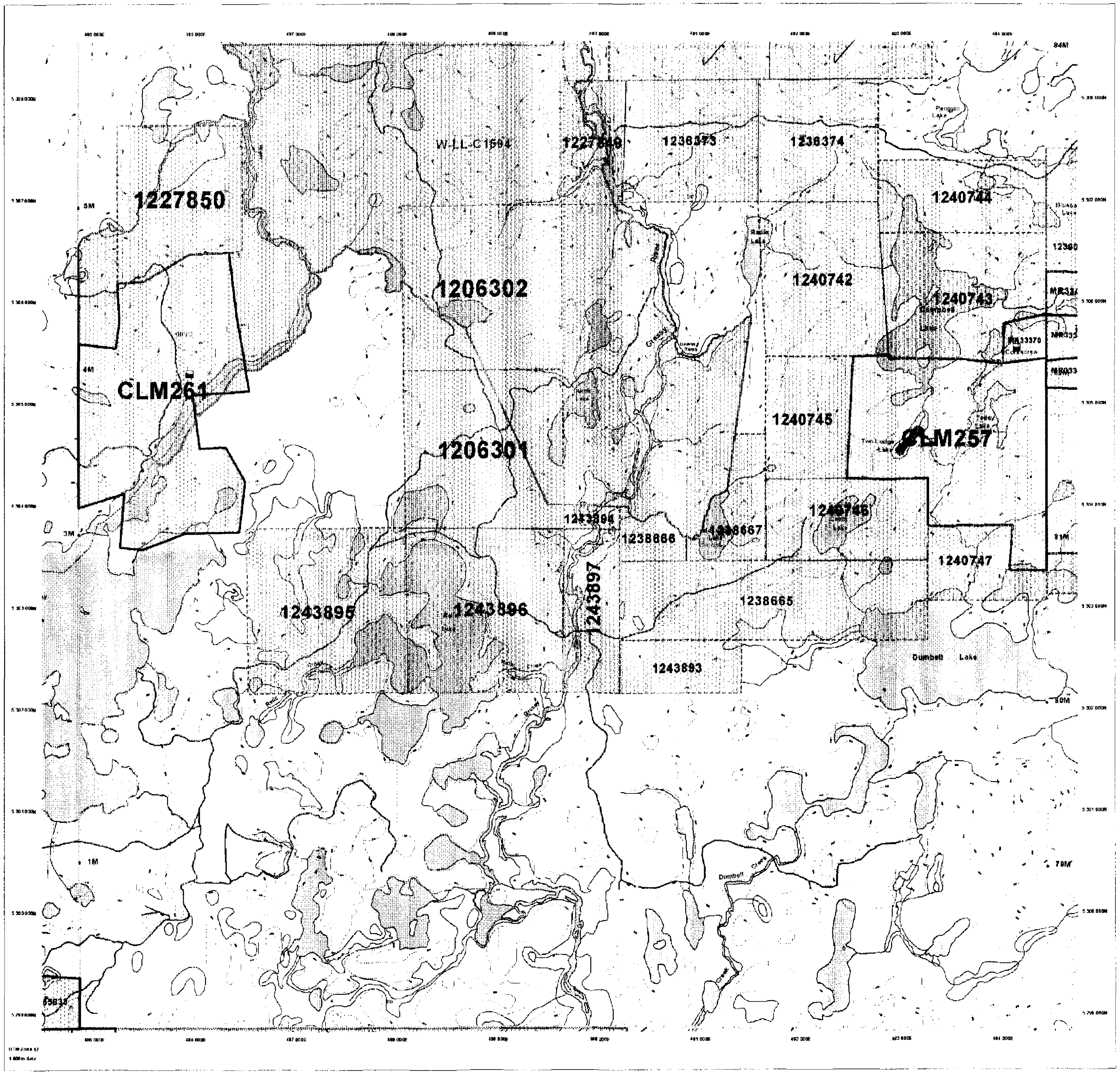
MINING LAND TENURE
MAP

Date / Time of Issue May 18 2001 12:00h Eastern

TOWNSHIP / AREA HALLIDAY
PLAN G-0976



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Exploration Division
Timmins, ONTARIO
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Halliday Twp.
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ASTRONOMIC
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