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Geophysical Survey Logistics Report

Regarding the Quantec TITAN-24 Distributed Acquisition System TENSOR MT and DCIP Surveys over the Young Davidson Project, Matachewan, ON on behalf of Northgate Minerals Corporation, Toronto, ON

JM Legault
P Edwards
B Frantti
March - April 2007
Project CA486T

TABLE OF CONTENTS

LIST OF TABLES AND FIGURES

1. INTRODUCTION

- **Project No.:** CA00486T
- **Project Name:** **Young Davidson Project**
- **Grid Name:** Young Davidson
- **Survey Period:** March 18, 2007 to April 7, 2007
- **Survey Type:** Tensor Magnetotelluric (MT)
  DC Resistivity and Induced Polarization (DC/IP)
- **Client:** Northgate Minerals
- **Client Address:** 18 King Street East
  Suite 1602
  Toronto, ON
  Canada
  M5C 1C4
- **Representatives:** Katie Lucas
  Jim Janzen
- **Objectives:**

  The principle survey objectives were to detect chargeability and resistivity signatures associated with the known gold mineralized and syenite intrusive hosted mine horizon associated with the **Young Davidson** deposit, and to extend this information to other areas of the grid. A secondary objective was to assist with an understanding of the structural geology in the project area.

  The Titan 24[1] Distributed Acquisition System (DAS[2]) employs a combination of large array size, with a large multiplicity of sensors, as well as precise 24-bit digital sampling, with state of the art signal processing and 2D-3D computer-inversions, to help penetrate deeper than conventional mineral exploration surveys. It provides three independent datasets capable of accurately measuring subsurface resistivities (structure, alteration & lithology) to depths in excess of 1 kilometre, and chargeabilities (mineralization) to depths of 350-750m, in current array configuration.

  The Titan Distributed Acquisition System combines: a) Tensor Magnetotelluric Resistivity (MT) method, with its high resolution and deep penetration (>1-1.5km) and b) Galvanic DC Resistivity and Induced Polarization (DCIP) surveys, which benefits from superior shallow to mid-depth resolution and penetration (<500-750m), and sensitivity to metallic mineralization, from disseminated to massive. The survey was chosen based on its high resolution and deep drill targeting capabilities.
- **Report Type:** Survey logistics, describing the survey parameters and methodology, as well as presenting the survey results in digital/plot forms.

[1] *Ref., White, M. and Gordon, R. (2003). Deep Imaging: New technology lowers the cost of discovery. Canadian Mining Journal, April, p. 27,28.*
[2] *Ref., Sheard, N. (1998). MIMDAS: A new direction in geophysics. Proceedings of the ASEG 13th International Conference, Hobart, Tasmania.*

2. GENERAL SURVEY DETAILS

2.1 LOCATION

- **General Location:** Northern Ontario
- **District:** Kirkland Lake-Larder Lake District
- **Nearest Settlement:** Matachewan, ON
- **UTM Zone:** NAD83, 17U
- **Latitude/Longitude:** approx.: 47ø57'07.09"N, 80ø43'07.47"W
- **UTM position[3]:** approx.: 521000mE, 5311000mN

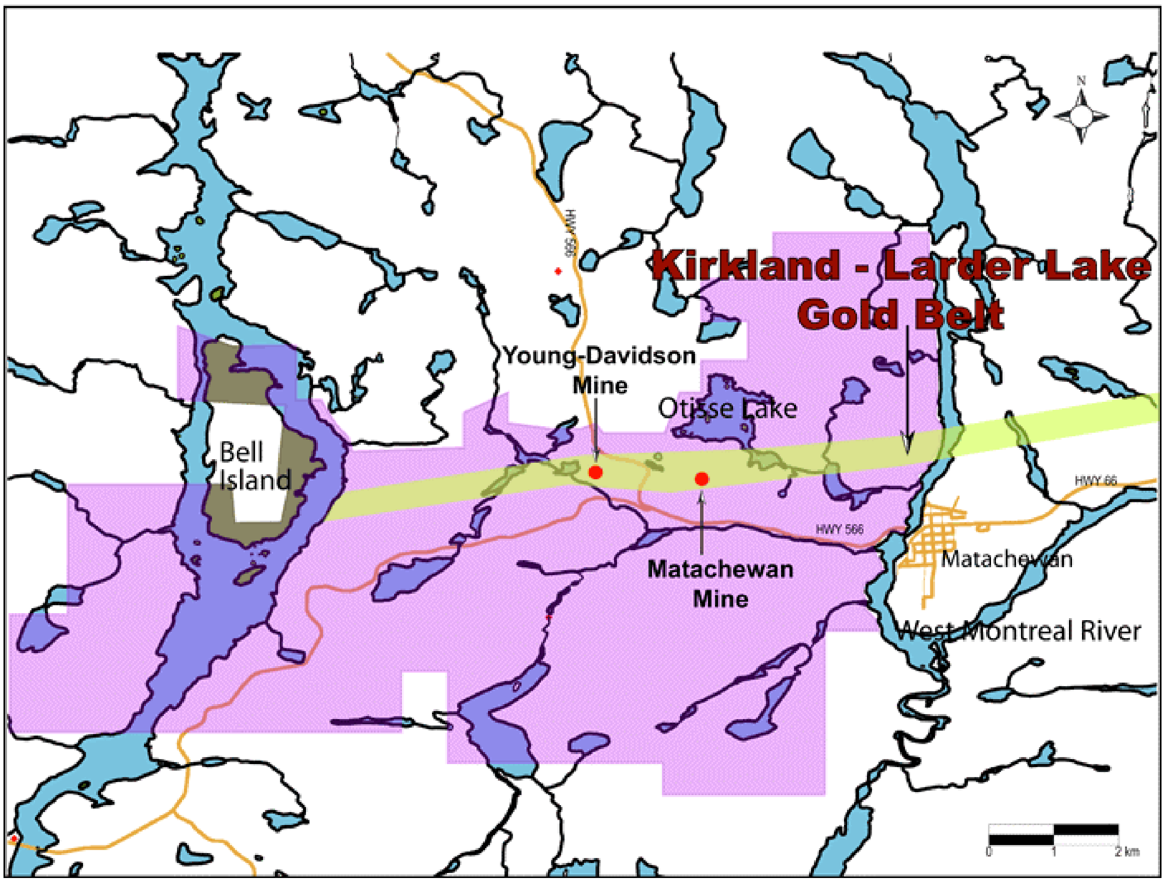


Figure 2.1: Young Davidson Project General Location Map[4]

[3] *UTM coordinates (NAD83) positioning (GPS) supplied by client.*
[4] *Young-Davidson Project General Location & Line Location maps obtained from www.northgateminerals.com.*

2.2 Access

- **Base of Operations:** Howard Johnson Motel
  50 Government Road East
  Kirkland Lake, ON
  P2N 1A5
  (705) 567-3241
- **Mode of Access to Grid:** Trucks
- **Mode of Access to Lines:** Snowmobiles and by foot

2.3 Survey Grid

- **Established by:** Northgate Minerals (Figure 2.2)
- **Coordinate Reference System:** Survey Grid Coordinates referenced to UTM Coordinates (See Figure 2.2 and Table I).
- **Datum:** NAD 83
- **Projection:** UTM zone 17U
- **Station Interval:** 100 meters
- **Method of Chaining:** Metric, secant distance, pickets

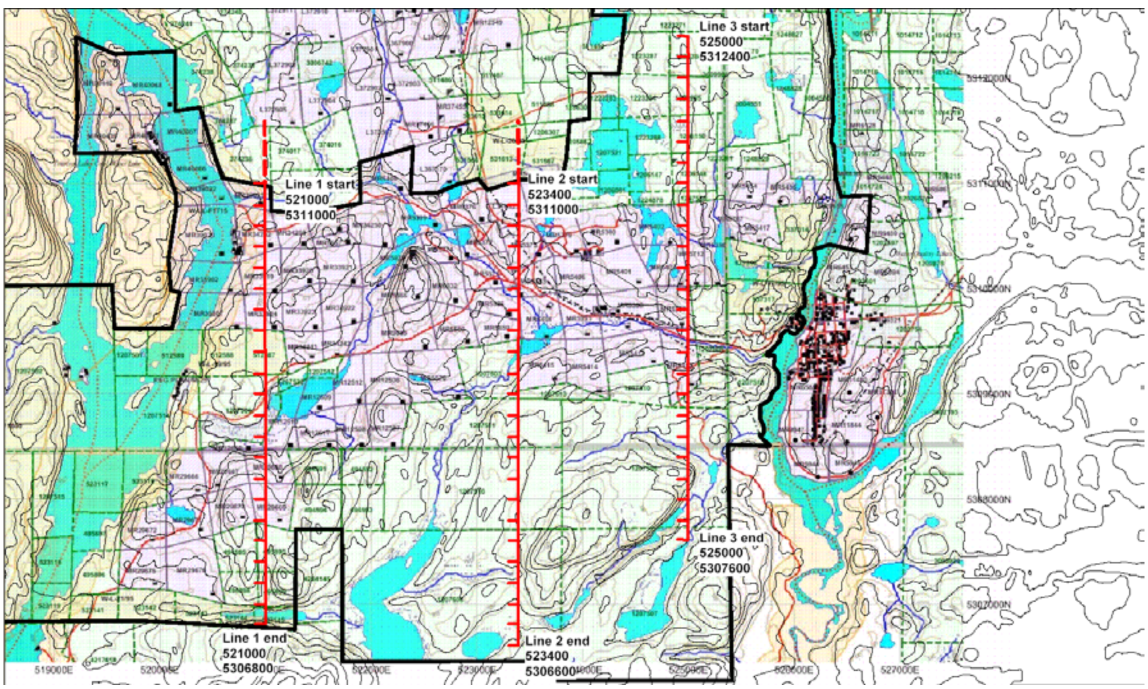


Figure 2.2: Young Davidson Project - Line Location Map

Line	Survey/Array Coord. Start	Survey/Array Coord. End	UTM Coord. Start		UTM Coord. End	
			Easting	Northing	Easting	Northing
1000E	200N	4200S	521000	5311200	521000	5306800
3400E	0N	4400S	523400	5311000	523400	5306600
5000E	1400N	3400S	525000	5312400	525000	5307600

Table I: Young Davidson Project Survey Lines UTM Reference

3. SURVEY WORK UNDERTAKEN

3.1 GENERALITIES

- **Survey Dates:** March 18 - April 7, 2007
- **Survey Period:** 21 days
- **Mob/demob:** 2 days
- **Survey Days (read time):** 19 days
- **Weather/Standby Days:** 0 day
- **Number of Lines Surveyed:** 3 lines/6 spreads (see Table I)
- **Survey Coverage:** DC/IP survey: 14.5 km. (21.3 km including overlaps) (Table II)
  MT survey: 13.5 km. (15 km including overlaps) (Table III)

3.2 PERSONNEL

- **Project Manager:** Kevin Blackshaw, Timmins, ON
- **Supervising Geophysicist:** Jean Legault, Toronto, ON
- **Data Processing:** Bruce Frantti, Reno, NV
- **Crew Chief & IP Operator:** Steve Wynn, Matachewan, ON
- **MT Operator:** Chris Hornby, Toronto, ON
  Shannon Guitard, Bathurst, NB
- **Remote Operator:** Kevin MacKenzie, Sydney, NS
- **Field Technicians:** Jesse Rondeau, Sturgeon Falls, ON
  Johnathon Hornby, Oakville, ON
  James Duivenvoorden, Bathurst, NB
  Robert Pratt, Bathurst, NB
  Robert Robey, Bathurst, NB
  Baden Leuszler, Sturgeon Falls, ON
  James Ward, Bathurst, NB
  Alex Drejas, Mississauga, ON
  Paul Luukkonen, Toronto, ON

3.3 SURVEY SPECIFICATIONS

3.3.1 DCIP Survey

- **Survey Array:** Pole – Dipole – Dipole Array (combines PDR & PDL see Figure 3.1 & Figure 3.2), using:
  a) Standard Current Injections[5]: L5000E (see Figure 3.3a)
  b) Extended Injections: L1000E & L3400E (Figure 3.3b)
- **Receiver Configuration:** 22-26 Ex = Continuous In-line voltages (Figure 3.4)

[5] *Note: Standard pldpdp array has current injections inside DAS receiver array at dipole-midpoints; Extended pldpdp array has current injections at 100m centers extending beyond each end of Rx array.*

11-13 Ey = Alternating (2-station) cross-line voltages[6]

- **Array Length:** 2200 - 2600 meters
- **Number of Arrays/line:** 2
- **Dipole spacing:** 100m
- **Rx-Tx Separation:** N-spacing (P_N-C_N min) = 0.5 to 26.5 max with maximum varying according to length of current extensions.
- **Sampling Interval:** Ex = 100meters
  Ey = 200meters
- **Infinite Pole Location:** UTM: 520154E, 5317103N (NAD83/Zone 17U)
  Grid coordinates: 154E, 6103N
- **Spectral Domain:** Tx = Frequency-domain square-wave current
  Rx = Full waveform time-series acquisition
  Data processing/output in frequency-domain

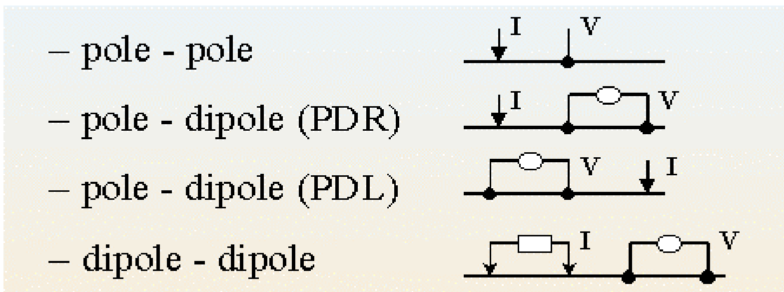


Figure 3.1: Common Electrode Arrays

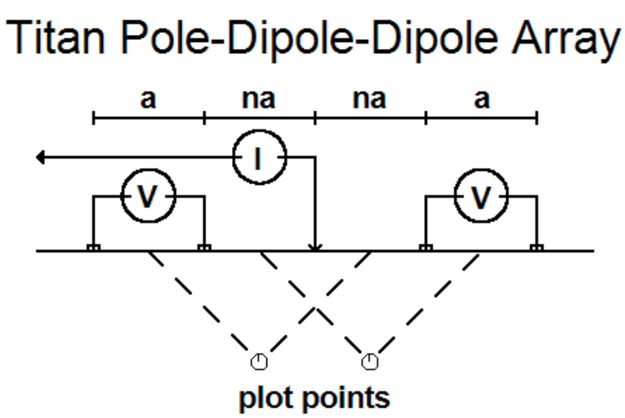


Figure 3.2: Titan Pole-dipole-dipole Array

[6] *Note: Cross-Line Ey voltages obtained for future reference purposes – not presented in cross-sectional plots.*

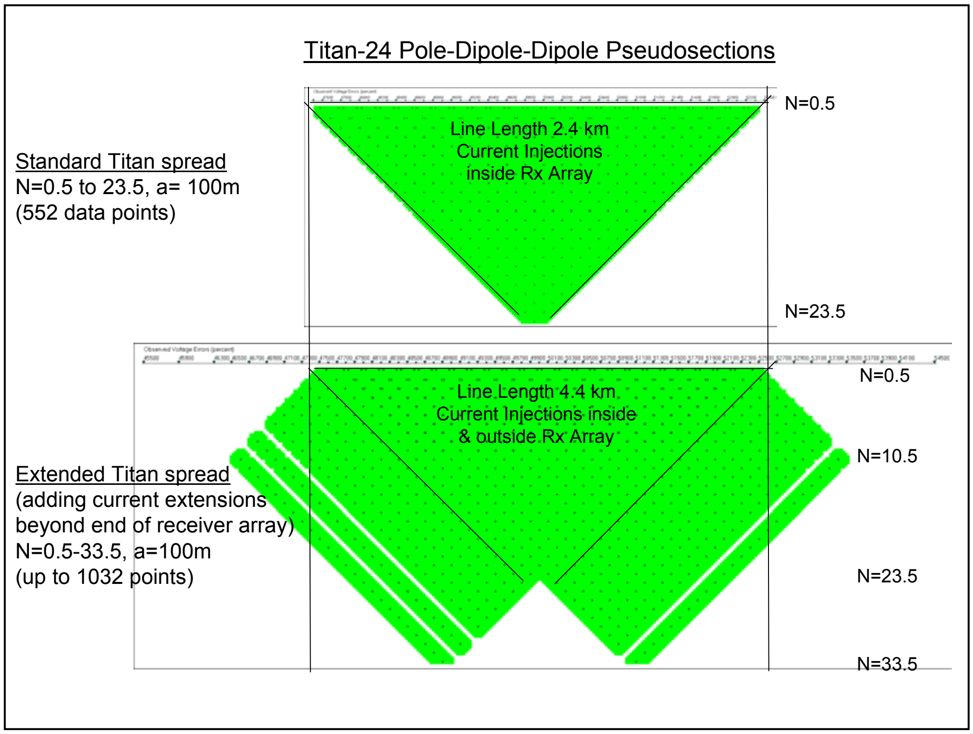


Figure 3.3: Titan Standard and Extended DCIP Arrays

3.3.2 MT Surveys

- **Technique:** Tensor soundings, remote-referenced
- **Base Configuration:** 22-26 Ex = Continuous In-line E-fields (Figure 3.4)
  11-13 Ey = Alternating (2-station) cross-line E-fields
  1 pair LF coils
  1 pair HF coils
- **Remote Configuration:** 1 Ex = in line E-fields
  1 Ey = cross-line E fields
  1 pair LF coils
  1 pair HF coils
- **Array Length:** 2400 - 2600 meters
- **Number of Arrays/line:** 2
- **Dipole Spacing:** 100m
- **Sampling Interval:** Ex = 100 meters
  Ey = 200 meters
- **Local Magnetic Field Measurements:** 1 Hx/Hy set per array
- **Ex/Ey Sampling Ratio:** 2:1 (see Figure 3.4)
- **E/H Sampling Ratio:** Ex = 22-26:1
  Ey = 11-13:1
- **Remote Reference Measurements:** 1 Hx/Hy set (1 Ey/Ex set for verification/monitoring)
- **Remote Reference Position:** 537010E, 5318633N (NAD 83 / Zone 17U)
- **Data Acquisition:** Full-waveform time-series acquisition

Data processing/output in frequency-domain

- **Frequency bandwidth:** 0.1 to 10000 Hz

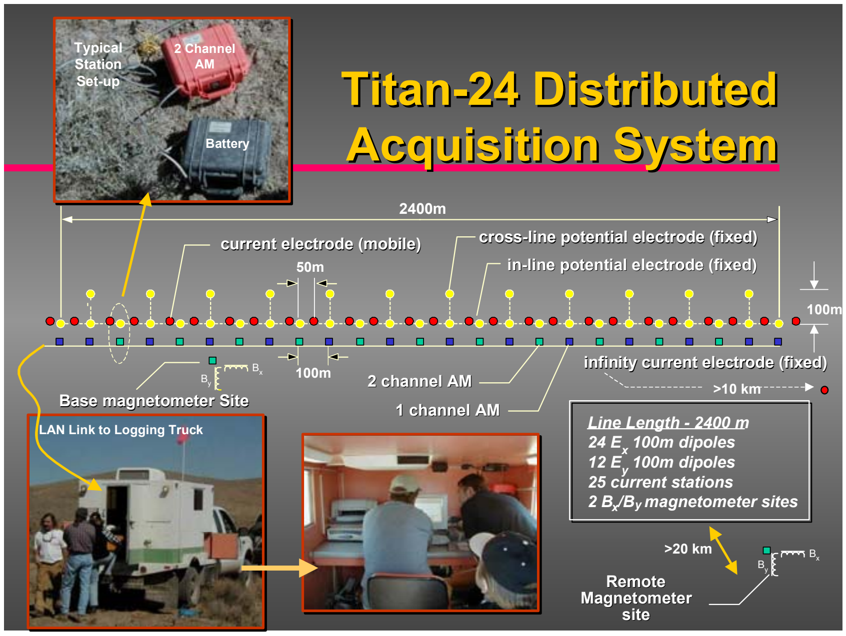


Figure 3.4: Titan-24 DCIP and MT Survey Layout

3.4 SURVEY COVERAGE

3.4.1 DCIP Surveys

LINE	Spread	Min Tx	Max Tx	Min P1	Max P2	Total (m)
1000E	1	2250S	650N	1900S	200N	2550 (2900)
	2	4050S	650S	4100S	1600S	2200 (3400)
3400E	1	4350S	850S	4400S	1800S	2600 (3500)
	2	3650S	550N	2600S	0	2350 (4200)
5000E	1	2250S	1350N	1200S	1400N	2600 (3600)
	2	3350S	350N	3400S	800S	2200 (3700)
					TOTAL	**14.5 km (21.3km including overlaps)**

Table II: DCIP Survey Coverage (Pot-to-Pot)

3.4.2 MT Surveys

LINE	Spread	Min Extent	Max Extent	Total (m)
1000E	1	1900S	200N	2100
	2	4100S	1600S	2200 (2500)
3400E	1	4400S	1800S	2600
	2	2600S	0	1800 (2600)
5000E	1	1200S	1400N	2600
	2	3400S	800S	2200 (2600)
			TOTAL	**13.5 km (15km including overlaps)**

Table III: MT Survey Coverage (Pot-to-Pot)

3.5 INSTRUMENTATION

- **Receiver System:** Quantec Distributed Array Acquisition System, comprising:
  - 61channels max. per system (55ch operationally – Figure 3.4)
    with internal A/D conversion (24bit @120db / dual speed @120-48kHz), and buffer memory (6Mb).
    22 x 2-channel Acquisition Modules (AMs)
    17 x 1-channel Acquisition Modules (AMs)
    AM data transmission using LAN cabling
  - 2 Central Recording Units (CRU), at base & remote (MT surveys) reference sites (140Gb data storage)
  - 2 GPS synchronization clocks (10nsec precision /12.3MHz clock-speed), at base & remote (MT surveys) CPU's
  - 2 PC-based Central Processing Units (base & remote)
- **Transmitter (DCIP Surveys):** GDD Tx II (3.6kW) with frequency/waveform control, using CPU and Current Monitor (CM)
- **Power Supply (DCIP Surveys):** Westinghouse Alternator (30 KVA @ 400 Hz / 220V / 3 phases) with Kolher Command 25 engine (25 HP / 2cyl) and Zonge VR-1 voltage regulator.
- **Receiver Electrodes:** Ground contacts using stainless steel rods
- **Receiver Coils (MT Surveys):** 4 Phoenix model P50 (100sec to 600Hz) magnetometers, 2 at base and 2 at remote
  4 EMI model BF-6 (10Hz to 20kHz) magnetometers 2 at base and 2 at remote

3.6 PARAMETERS

3.6.1 DCIP Surveys

- **Transmitter Waveform:** 30/256 Hz square waves at 100% duty cycle (~4sec Pos./Neg.)
- **Transmitter Output Current:** 0.18 amperes to 3.0 amperes
- **Receiver Sampling Speed:** 240 samples/second (24 bit A/D @ 120 db dynamic range)
- **Tx-Rx Synchronization:** using current monitor (10 μsec time-accuracy)
- **Time-Series Stacking:** 20 cycles (full-waveform)
- **Read Time:** 2.5 minutes per event
- **Post-Processing:** using QGL Quicklay™

  1) Time-series stacking
  2) Robust statistics
  3) Current waveform deconvolution
  4) Digital filtering (50Hz + harmonics)
  5) Spectral model decay-curve fitting (see Figure 3.5)

- **Spectral Chargeability Model[7]:** Halverson-Wait (see Fig. 3.5)
- **Time-Domain Decay Window:** T_O to T_F= 1000 to 1900 milliseconds
- **Final Data Output:**
  1) Normalized voltage (volts/ampere)
  2) Voltage error (volts/ampere)
  3) Output current (ampere)
  4) Current error (ampere)
  5) Phase (milliradians)
  6) Phase error (milliradians)
  7) Apparent Resistivity[8] (ohm-meters)

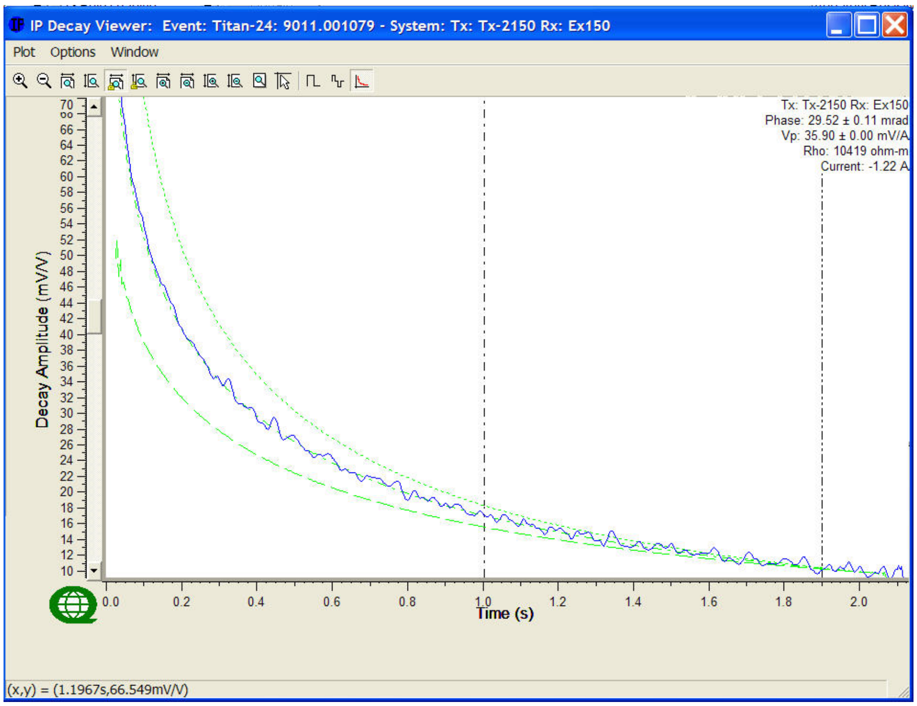


Figure 3.5: Titan Full-waveform IP Decay Curve and Best Fit Halverson-Wait Spectral Parameters[9]

3.6.2 MT Surveys

- **Frequency Bandwidth:** Operating: 0.01 to 48000 Hz; Effective: 10s to 20000 Hz
- **Time-series Sampling:** High Range: 48000 samples/sec; Mid-Range: 9600 samples/sec; Low Range: 120 samples/sec
- **Remote-Base Synchronization:** GPS clocks (10μsec time-accuracy)

[7] *Note: The Halverson-Wait model chargeability (Halverson et al., 1981) is similar to and improves upon the frequency-domain Cole-Cole model (Pelton et el., 1978) described in the time-domain by Johnson (1984).*

[8] *Note: Apparent Resistivities calculated in 2d space using4-electrode general array configuration (as per XY electrode positioning in columns4-11 of csv file) not based on pole-dipole calculations (K. Nurse, QGL, pers. Comm.., 07-2004).*

[9] *Note: HW model parameters calculated in frequency domain, with hatched green lines corresponding to theoretical HW decay with spectral r-factors of 0.1, 1.0 (default) & 10, k-factor of 0.2 (default) for 1000 to 1900msec decay interval, at 30/256Hz.*

- **Samples/Event:**
  High Range: 1,500,000 samples
  Mid-Range: 1,500,000 samples
  Low Range: 500,000 samples
- **Recording Time:**
  High Range: min. 4 events @ 30 seconds per event
  Mid Range: min. 2 events @ 2.5 minutes per event
  Low Range: 1.5 events @ 80 minutes for a full event
  (total recording and retrieving time approx. 5 to 7 hours)
- **Post-Processing:**
  using QGL QuickLay v.2.30.14
  1) Coherent noise rejection using remote-reference
  2) Proprietary digital filtering (scrubbing)
  3) Coherency sorting
  4) Impedance estimate stacking
- **Final Data Output:**
  1) Auto and cross-power spectral estimates
  2) Unrotated (XY & YX) Tensor impedances + errors
  (apparent resistivities and E/H phase – see Figure 3.6)
- **Final Data Processing:**
  Edited and un-edited phase & resistivity sounding curves (0.1-10000 Hz @ 8 pts/decade) using Geotools™

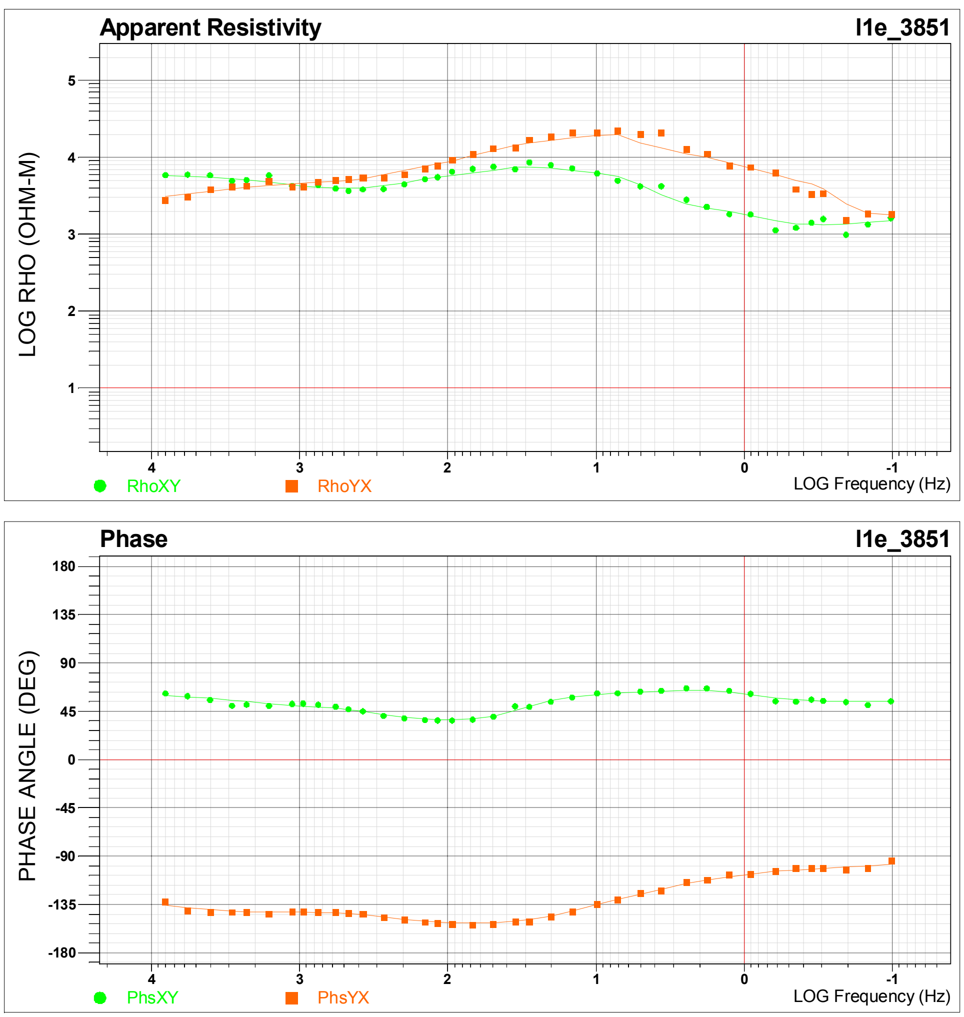


Figure 3.6: Example of Apparent Resistivity and Phase (XY and YX) Sounding Curves.

3.7 DATA ACCURACY AND REPEATABILITY

3.7.1 DCIP Surveys

ERROR TYPE	PHASE	VOLTAGE
Measured Data average error (csv files) using Halverson-Wait model calculation	85.7% of data < 1mrad error	99.5% of data < 1% error

Table IV: Minimum Errors for DCIP Measurements and Processing

3.7.2 MT Surveys

- **Parallel Sensor Test:** Test for P50 (Low Frequency Range) see Figure 3.87
  Test for BF-6 (High to Mid Frequency Range) see Figure 8. .
- **Data Error:** Apparent Resistivity = <1/20TH decade avg.
  Phase = <3 degrees avg.

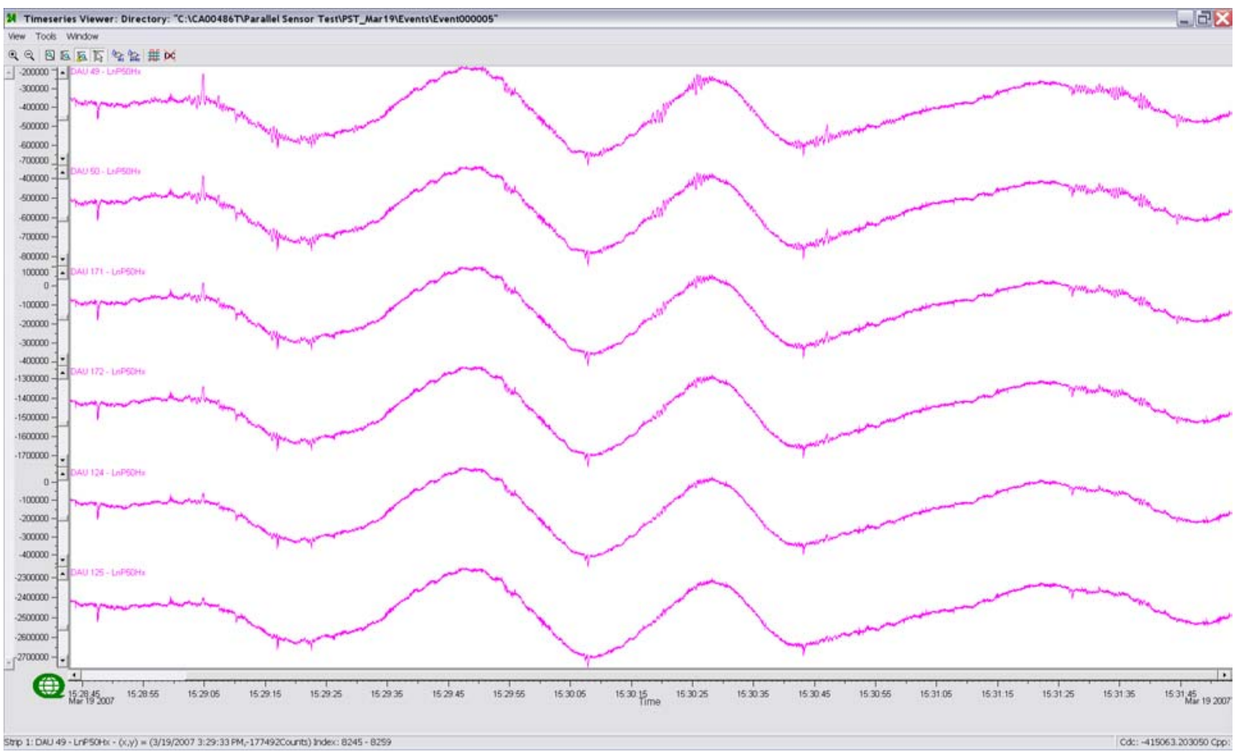
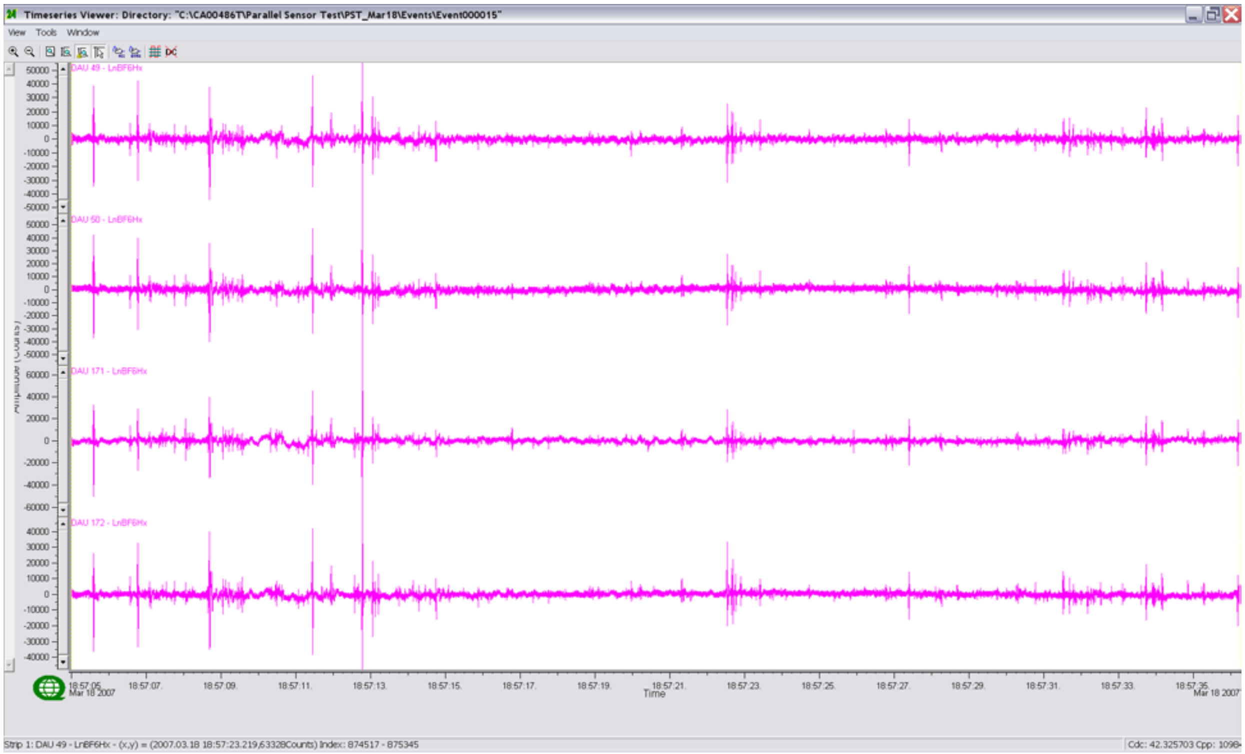


Figure 3.7: Example of Time Series taken from Parallel Sensor Test (P50)



<u>Figure 3.8: Example of Time Series taken from Parallel Sensor Test (BF-6)</u>

3.8 DATA PRESENTATION

3.8.1 <u>DCIP Surveys</u>

- **Maps:**

<u>Pseudosections Plots:</u> In-line[10] DC/IP Resistivity and Chargeability Pseudosections, posted, contoured (equal area zoning) and plotted in ground units using QuickLay viewer (Appendix C).

- **Digital:**

<u>Raw data:</u> Raw Event Log File Folders (i.e. Event10001 – 0012.dat). Also contains AU.txt and Event.log files, which contain information on the location and time of the event in QuickLay propriety digital format (output to Matlab format upon request).

<u>Processed data:</u>

DCIP ASCII DATA, in .CSV (comma spaced variables) file format, from QuickLay, containing final processed voltage and phase data (Ex)

Line 1:	Column headings
Column 1:	Event name/number (e.g., Event100020)
Column 2:	Transmitter site ID (e.g., Tx150)
Column 3:	Receiver site ID (e.g., Rx150)
Column 4-11:	C1-C2/P1-P2 positions in X and Y (meters)
Column 12:	Current (amperes)
Column 13:	Current error (amperes)

[10] Note: Cross-line (YX) values not shown for presentation purposes.

Column 14:	Normalized voltage (volts/ampere)
Column 15:	Voltage error (volts/ampere)
Column 16:	Phase (milliradians)
Column 17:	Phase error (milliradians)
Column 18:	Apparent resistivity (ohm-metres)[11]

3.8.2 MT Surveys

- **Maps:**

Sounding Curves: MT Apparent Resistivity and Phase (xy and yx) (Appendix D) in log frequency format, using Geotools™ viewer

Pseudosections Plots: MT Apparent Resistivity and Phase Pseudosections (XY, and YX), posted, contoured (equal area zoning) and plotted, in ground units using Geotools™ viewer (Appendix E)

- **Digital:**

Raw data: Base and Remote Raw Event Log File Folders (i.e. Base - Event10001 – 0012.dat; Remote Event 0012 – 0034.dat). Also contains AU.txt and Event.log files, which contain information on the location and time of the event in QuickLay propriety digital format.

Processed data: MT DATA, in .EDI (electronic data interchange) file, created in Geotools™ containing tensor sounding data (XY & YX)[12], for individual stations (sites) and profiles (site-sets), in a format conforming to SEG standard for the storage MT data.

[11] *Note: Apparent resistivities calculated in 2d space using 4-electrode general array configuration (as per XY electrode positioning in columns 4-11 of csv file) – not based on pole-dipole calculations (K. Nurse, QGL, pers. comm., 07-2004).*

[12] *XY denotes in-line electrical (E) field and orthogonal magnetic (H) field (Ex/Hy). YX denotes in-line H field and orthogonal E-field (Ey/Hx).*

4. REFERENCES

1. Halverson, M.O., Zinn, W.G., McAlister, E.O., Ellis, R., and Yates, W.C. (1981). Assessment of results of broad-band spectral IP field test. In: Advances in Induced Polarization and Complex Resistivity, pp.295-346, University of Arizona.
2. Johnson, I.M (1984). Spectral induced polarization parameters as determined through time-domain measurements. Geophysics, v. 49, pp. 1993-2003.
3. Pelton, W.H., Ward, S.H., Hallof, P.G., Sill, W.R. and Nelson, P.H. (1978). Mineral discrimination and removal of inductive coupling with multi-frequency IP. Geophysics, v.43, pp.588-609.

RESPECTFULLY SUBMITTED
QUANTEC GEOSCIENCE INC.

Bruce Frantti, B.Sc.
In-field Data Processor – QGL (US)

Jean M. Legault, M.Sc., P.Eng., P.Geo.
Senior Geophysicist – QGL (CAN)

Philippa Edwards, B.Sc.
Geophysicist Assistant - QGL (CAN)

May, 2007
Toronto, ON

APPENDIX A: STATEMENT OF QUALIFICATIONS

I, Jean M. Legault, declare that:

1. I am a consulting geophysicist with residence in Waterdown, Ontario and am presently employed in this capacity with Quantec Geoscience Ltd., Toronto, Ontario.

2. I obtained a Bachelor's Degree, with Honours, in Applied Science (B.A.Sc.), Geological Engineering (Geophysics Option), from Queen's University at Kingston, Ontario, in Spring of 1982. I also obtained a Master's of Applied Science (M.A.Sc.), in geophysics, at Ecole Polytechnique de Montreal, Quebec, in Spring, 2005.

3. I am a registered professional engineer (# 90531542), since 1985, and a registered professional geoscientist (#0948), since 2003, with license to practice in the Province of Ontario.

4. I have practiced my profession continuously since May, 1982, in North-America, Europe, South-America, North-Africa and Asia.

5. I am a member of the Association of Professional Geoscientists of Ontario, the Association of Professional Engineers of Ontario, the Association des Explorateurs du Quebec, the Prospectors and Developers Association of Canada, and the Canadian Exploration Geophysics Society (KEGS), and the Society of Exploration Geophysics (SEG).

6. I have no interest, nor do I expect to receive any interest in the properties or securities of **Northgate Minerals,** its subsidiaries or its joint-venture partners.

7. I am the project supervisor, in charge of data acquisition quality control and qualified person for this project. I have reviewed the logistics report and survey results and can attest that these accurately and faithfully reflect the data acquired on site. The statements made in this report represent my professional opinion based on my consideration of the information available to me at the time of writing this report.

Toronto, Ontario
May, 2007

Jean M. Legault, M.Sc.A., P.Eng., P.Geo. (ON)
Senior Geophysicist
Quantec Geoscience Ltd.

APPENDIX A: STATEMENT OF QUALIFICATIONS

I, Bruce Frantti, declare that:

1. I am a Geophysicist with residence in Reno, NV, USA, and am presently employed in this capacity with Quantec Geoscience USA, Inc.., Reno NV.

2. I obtained a Bachelor of Science degree in Applied Geophysics, with high honors, from Michigan Technological University in February of 1984.

1. I have practiced my profession continuously since March, 1984 in North America, South America, Europe, Africa and the middle east.

3. I have no interest, nor do I expect to receive any interest in the properties or securities of **Northgate Minerals,** its subsidiaries or its joint-venture partners.

4. I was the data processor on site, responsible for the quality control of data acquired for the survey. I compiled the logistics report. The statements made in this report represent my professional opinion based on my consideration of the information available to me at the time of writing this report.

Toronto, Ontario
April, 2007

Bruce Frantti, B.Sc.
Data Processor
Quantec Geoscience US.

APPENDIX F INSTRUMENT SPECIFICATIONS

REF TEK – 120 Data Acquisition System
Acquisition Module (AM)

SPECIFICATIONS

Physical	
Size:	♦ 267 x 248 x 184 mm ♦ 10.5 x 9.75 x 7.25 in.
Weight:	♦ 3.7kg ♦ 305 g ♦ 8 lbs (2-Channels maximum weight))
Temperature:	♦ -40°C to 60°C operating range.
Environmental:	♦ Operates in 1m of water without leaking for 48 hours. ♦ Airtight to 1.0 psi.
Shock:	♦ Remains operational after 1m drop (any corner) onto cement floor.
Connectors	
Line A & Line B:	♦ A pair of identical 10 pin U77/U style connectors. ♦ Each connector provides 3 pairs of lines (±): — A (+)/B (-) Receive telemetry data and/or commands — C (+)/D (-) Transmit telemetry data and/or commands — E (+)/F (-) Sync
Power:	♦ PTO7A12-8S style connector. ♦ Provides input +12 VDC supplied from battery.
Sensor:	♦ PU283/U style connector. ♦ Provides for a direct connection from the AM to the sensor.
Power Requirements	
Battery:	♦ Two 12 volt lead acid battery (7 Ah).
Signal Input	
Input Impedance:	♦ 10 megohms, 330pF, differential
Broadband Dynamic Range:	♦ 130dB (noise power ratio test @ 125 sample per second [sps])
ADC Type:	♦ Delta-sigma modulation
Sample Rage:	♦ Multiple 50 to 48,000
Gain Settings:	♦ Four – programmable for 1, 4, 16 and 64.

Sensor Input Signal Range:

Gain	***24-Bit High Speed A/D***		***24-Bit Low Speed A/D***	
	Actual	***Reported***	***Actual***	***Reported***
1	1.192µV	78.12mV	1.907µV	125.0mV
4	298.0nV	19.53mV	476.8nV	31.25mV
16	74.51nV	4.883mV	119.2nV	7.812mV
64	18.63nV	1.221mV	29.80nV	1.953mV

Data Storage	
Data Size:	♦ 32-bit two's compliment.
Base Memory:	♦ 128K EPROM ♦ 6.5Mb SRAM
Base Capacity:	♦ Better than 1.5 million samples or approximately 3 hours 10 minutes continuous data @ 125 sps.
AM Telemetry	
Protocol:	♦ Full duplex synchronous data link control (SDLC).
Error Correction:	♦ Packet acknowledge with modulo 8 sliding window.
Speed	♦ 3.072Mb/second
Encoding:	♦ Bi-phase pulse = 1, missing pulse = 0
Line Impedance:	♦ 100 Ohm
Synchronization	
Timing:	♦ Each AM on-line is timed and synchronized for simultaneous sampling within $\pm$ 1.50 μsecond.
Protection	
Electrical Protection:	♦ Line A and Line B signals circuits are protect by: — A surge arrestor located on the RT514 board (SS1-14). — A line isolation transformer located on the RT514 board (T1-6) with over-voltage diodes (D1-4) on both sides of each secondary windings.
State-of-Health	
Information Provided:	♦ The AM reports information on battery status, clock setting, gain setting, calibration mode and the communications link.

ACQUISITION PARAMETERS

Acquisition parameters include the sample rate, transmitter frequency and number of samples desired. The operator can also determine whether the AMs calibration signal is activated during data collection.
In typical use, the acquisition parameters are set according to the specific application configuration and event type. For each event type, several recording sessions are made, each at a different transmitter frequency and sample rate. The recording period is set based on event type and transmitter frequency.
The listing below shows several examples of event type, typical transmitter frequency (Hz), sample rates (with applicable ADC resolution) and the corresponding number of samples (record period).

Event Type	Transmit Frequency	Sample Rate	ADC Resolution	Number of Sample
Geophysical Response	375 Hz	48,000	24	124,032
Gain Test	375	48,000	24	65,536
Geophysical Response	75	9,600	24	130,176
Gain Test	75	9,600	24	65,536
Geophysical Response	25/8	3,200	24	139,264
Gain Test	25/8	3,200	24	32,768
Sensor Impedance	N/A	1,600	24	8,704
Ambient Noise	N/A	1,600	24	8,192
Geophysical Response	25/128	800	24	147,456
Gain Test	25/128	800	24	16,384
Geophysical Response	25/2048	100	24	212,992
Gain Test	25/256	100	24	4,096
Gain Test	N/A	50	24	4,096
Geophysical Response	N/A	50	24	65,536

SENSOR CALIBRATION

The AM can source a 12.5Hz, 50µA signal to the sensor input for measuring the source impedance of the attached sensor. The user can also specify frequency in amplitude of calibration signal.

TELEMETRY CABLE

The telemetry cable is a *Category V* specification cable and is supplied by the customer.

SAMPLE RATES

The following table shows all available sample rates, based on a 12.288 Mhz oscillator. A 24-bit resolution ADC is used for sample rates 48000 through 4800 and a 24-bit resolution ADC is used for sample rates 3200 and below. The correct ADC is selected automatically by the AM, based on the sample rate.

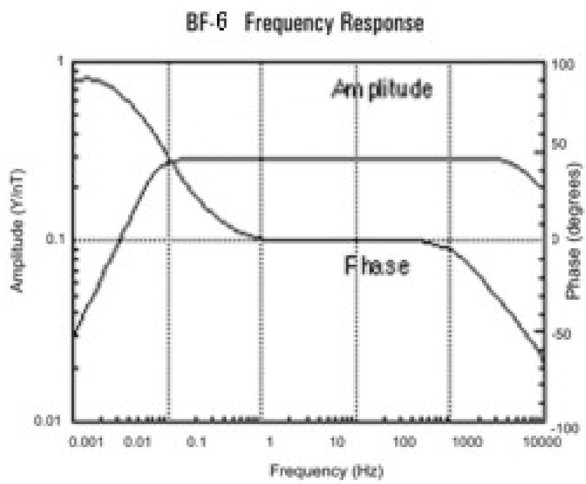
Typically, different sample rates and transmitter frequencies are used in 50 Hz and 60 Hz power environments to minimize AC power effects on the data. In the table, the shaded areas indicate the sample rates typically used in a 60 Hz power environment. A few rates are typically used in both environments.

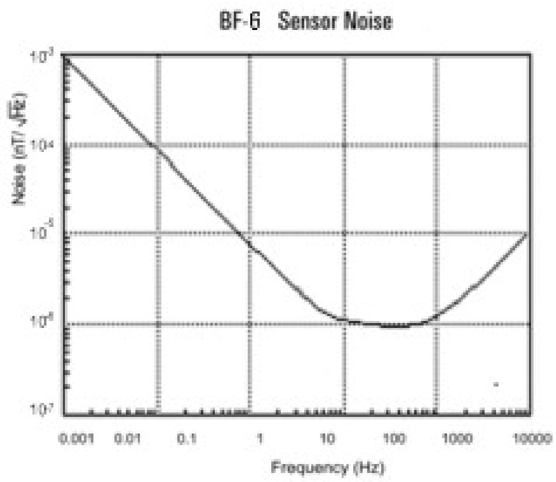
Sample Rate	***Power Line***
48000	50 & 60
24000	50 & 60
19200	60
16000	50
12000	50 & 60
9600	50 & 60
6400	50
4800	60
3200	50
1920	60
1600	50
960	60
800	50
480	60
400	50
240	60
200	50
120	60
100	50
60	60
50	50
60/2	60
50/2	50
60/4	60
50/4	50
60/8	60
50/8	50
60/16	60
50/16	50
60/32	60
50/32	50

EMI – ELECTROMAGNETIC INSTRUMENTS INC. – BERKELEY, CA

BF-6 Magnetic Field Induction Sensor

The BF-6 sensor utilizes a magnetic feedback design to provide a stable flat response over several decades of frequency. The sensors respond as a B field detector over the flat band regions. Both the amplitude and phase responses are highly stable with variations of less than 0.1dB in amplitude and +/- one degree in phase between sensors. For the frequencies below the flat response region, the sensor response is proportional to signal frequency so that the sensor acts as a dB/dt detector. The coil is potted with epoxy and housed inside a rugged impact-resistant ABS tube. A matched low noise preamplifier is connected to the coil in a waterproof case and powered by an external +/- 12V power supply.





Features

- High sensitivity
- Very low noise
- Magnetic feedback design
- Ruggedized and waterproof
- Light weight and compact
- Low power consumption (210 mW)
- Stable phase response

Applications

- Magnetotellurics
- Audiomagnetotellurics
- Controlled-source electromagnetics
- Magnetometric resistivity
- Time domain electromagnetics

Technical Specifications

Performance

- Frequency Range: 1 Hz to -100 kHz or 1 Hz to 25 kHz
- 3 dB frequency corners: 10 Hz, 25 kHz or 10 Hz, 100 kHz
- Sensitivity (flat region): 0.3 V/nT (standard)
- Power consumption: 9mA at +/-12V

Physical

- Housing: High Impact ABS Straight Tube
- Length: 73 cm (29 inches)
- Diameter: 5 cm (2 inches)
- Weight: 1.7 kg (3.7 lbs)
- Connector: 8-pin Tajimi

PHOENIX GEOPHYSICS LTD. TORONTO, CANADA.

GENERAL INFORMATIONS

Phoenix offers a range of electrical and magnetic sensors for MT and AMT data acquisition.

All Phoenix field sensors are highly reliable, lightweight, and manufactured to exacting standards. Designed for use in the most demanding environments, they have proven their reliability and quality on many thousands of MT and AMT sites around the world.

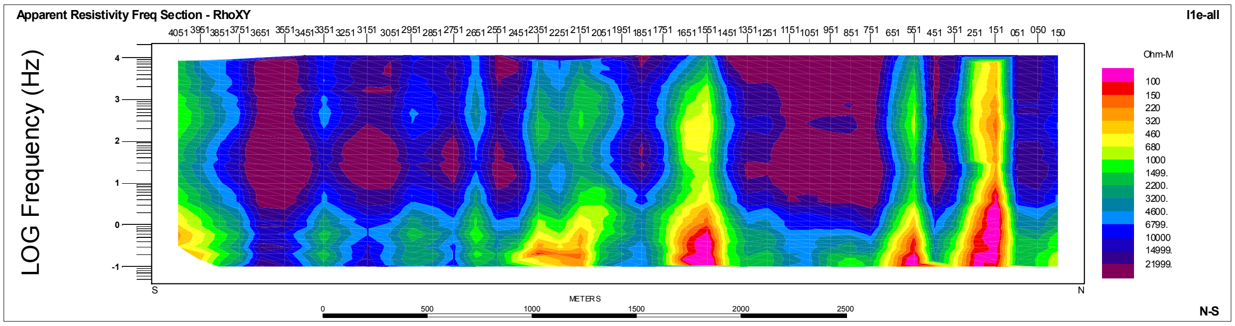
MT LOW FREQUENCY SENSORS

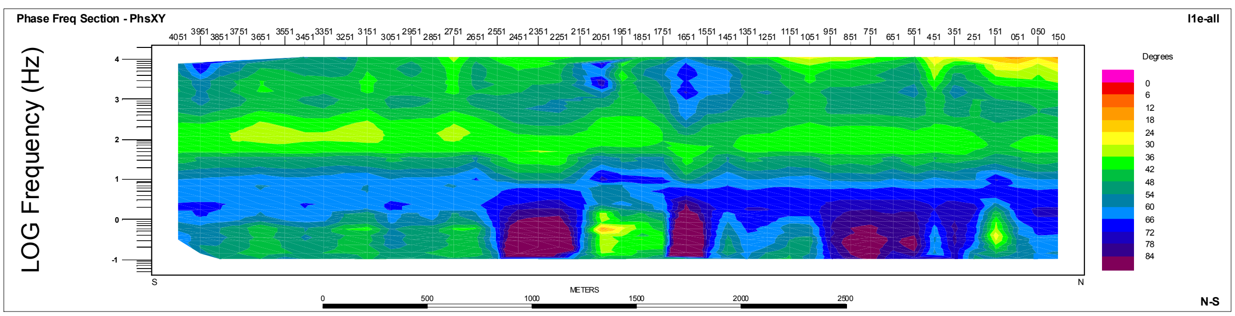
MTC-50 magnetic senor coils weigh just over 10 kg, and measure only 141 cm. They provide magnetotelluric data at frequencies between 400 Hz to 0.0002 Hz.

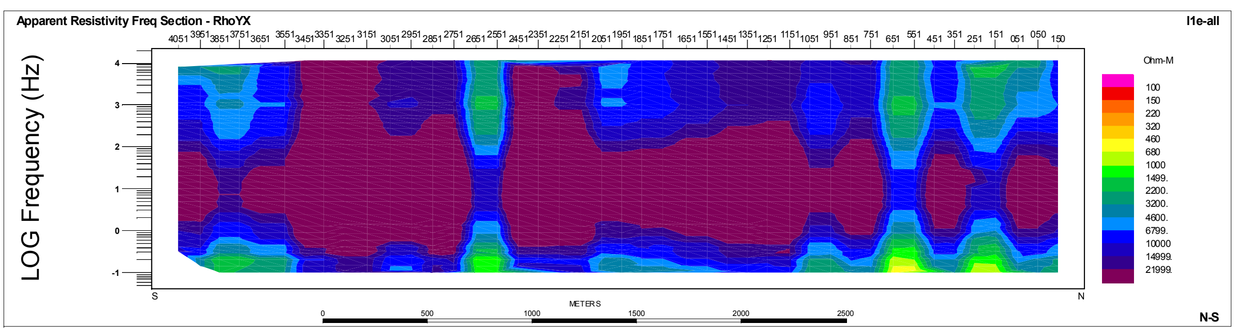
APPENDIX E: MT APPARENT RESISTIVITY AND PHASE PSEUDO-SECTIONS

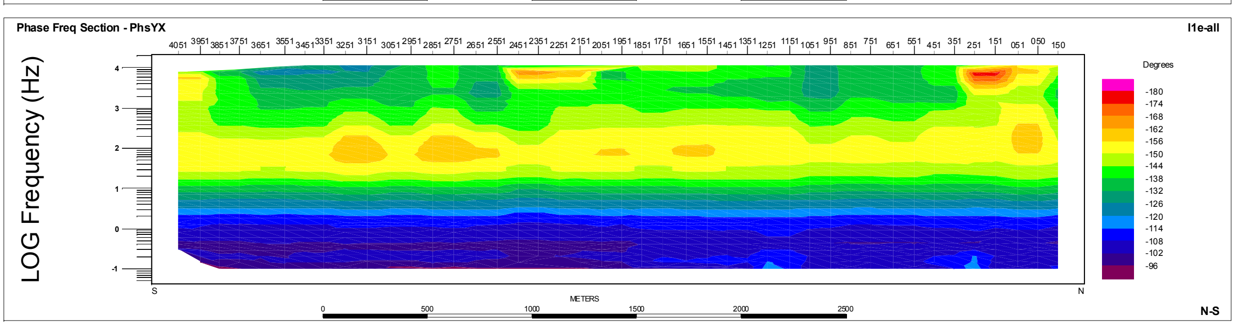
Note: XY denotes in-line electrical (E) field and orthogonal magnetic (H) field (Ex/Hy).
YX denotes in-line H field and orthogonal E-field (Ey/Hx).

LINE 1000E –APPARENT RESISTIVITY AND PHASE (XY & YX) PSEUDOSECTIONS

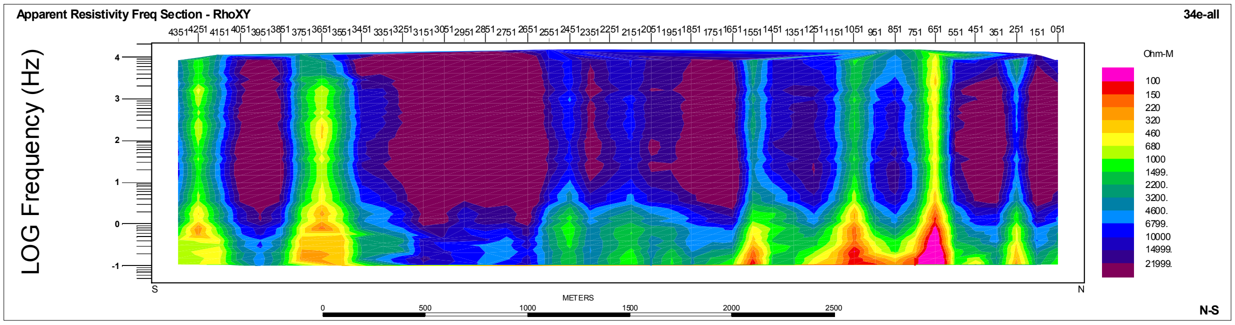


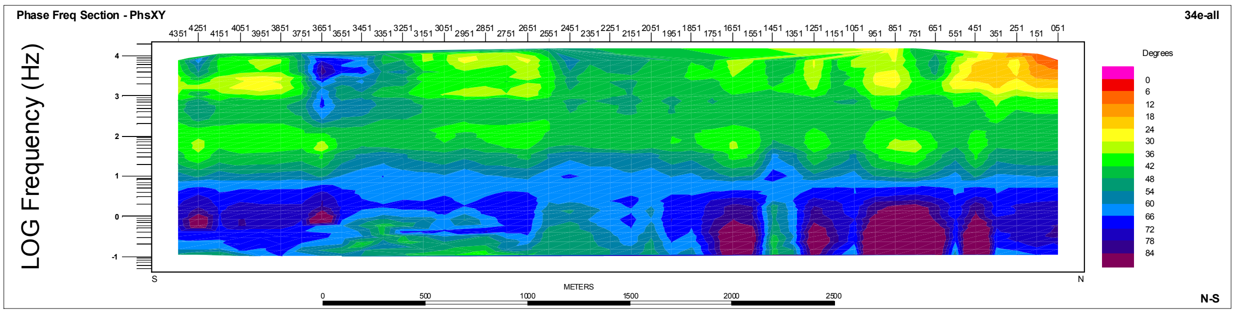


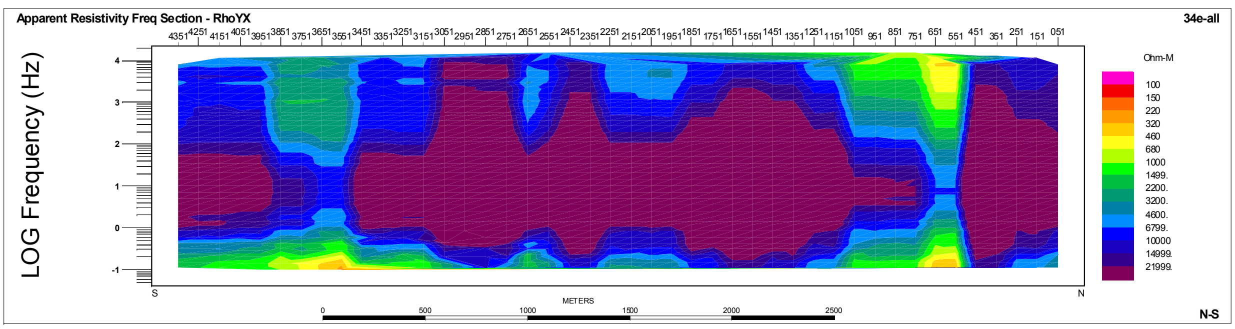


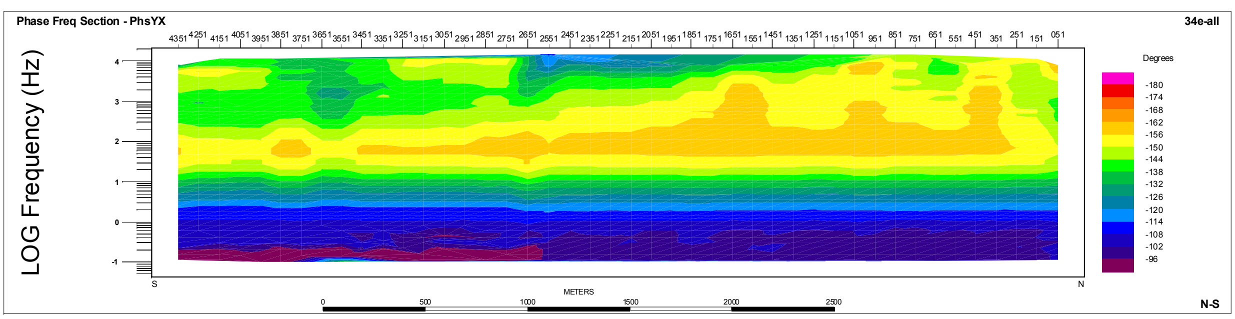


LINE 3400E –APPARENT RESISTIVITY AND PHASE (XY & YX) PSEUDOSECTIONS

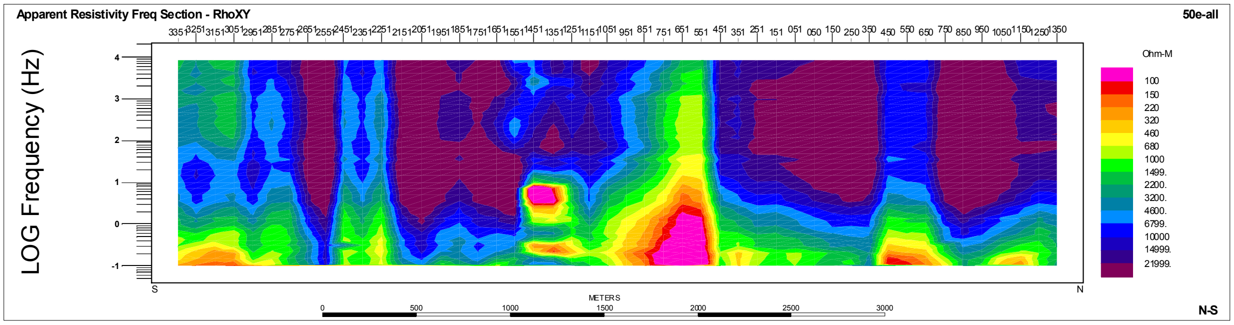


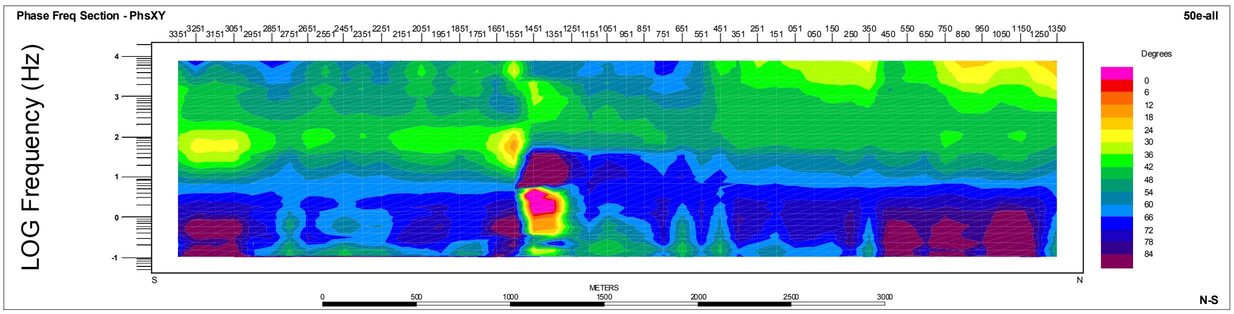


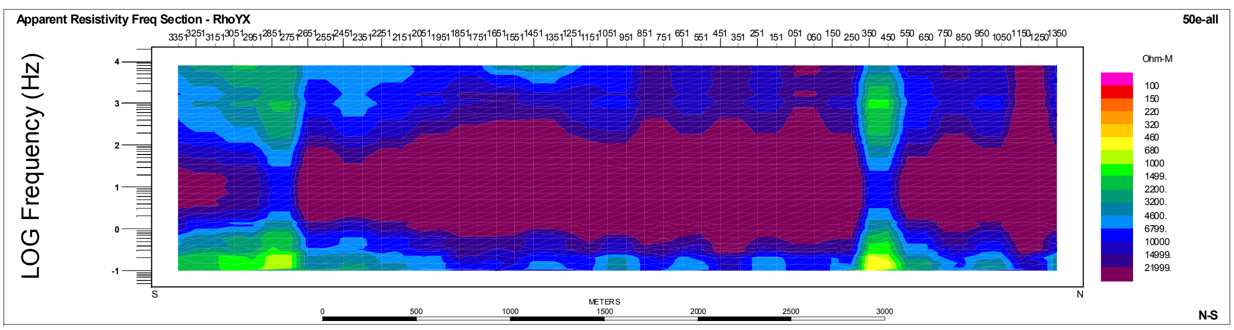


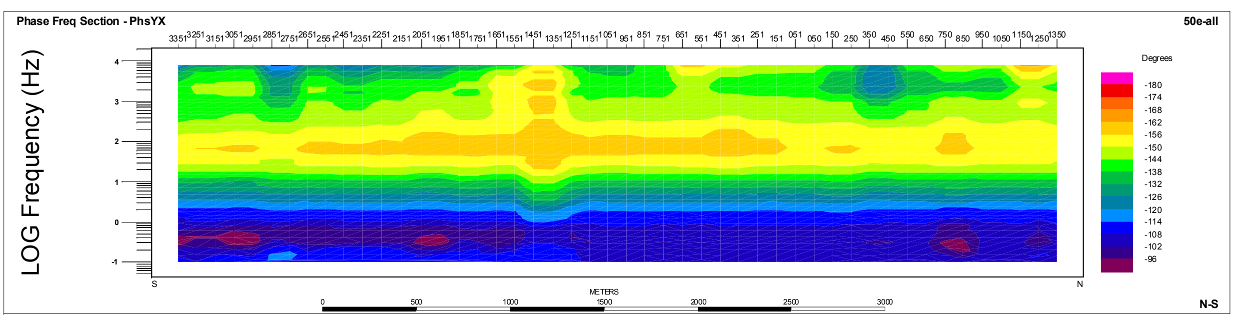


LINE 5000E –APPARENT RESISTIVITY AND PHASE (XY & YX) PSEUDOSECTIONS





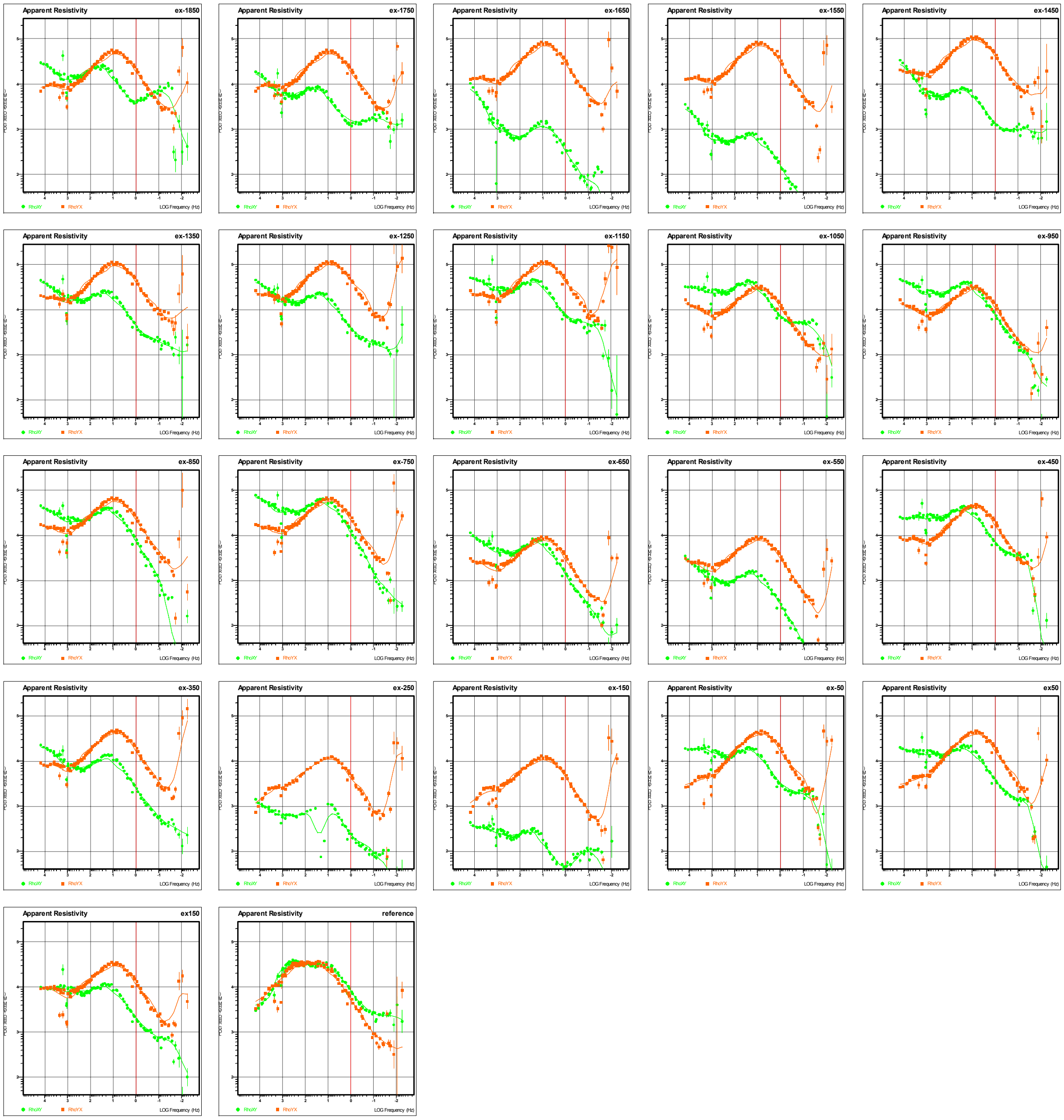




APPENDIX D: MT APPARENT RESISTIVITY AND PHASE SOUNDING CURVES

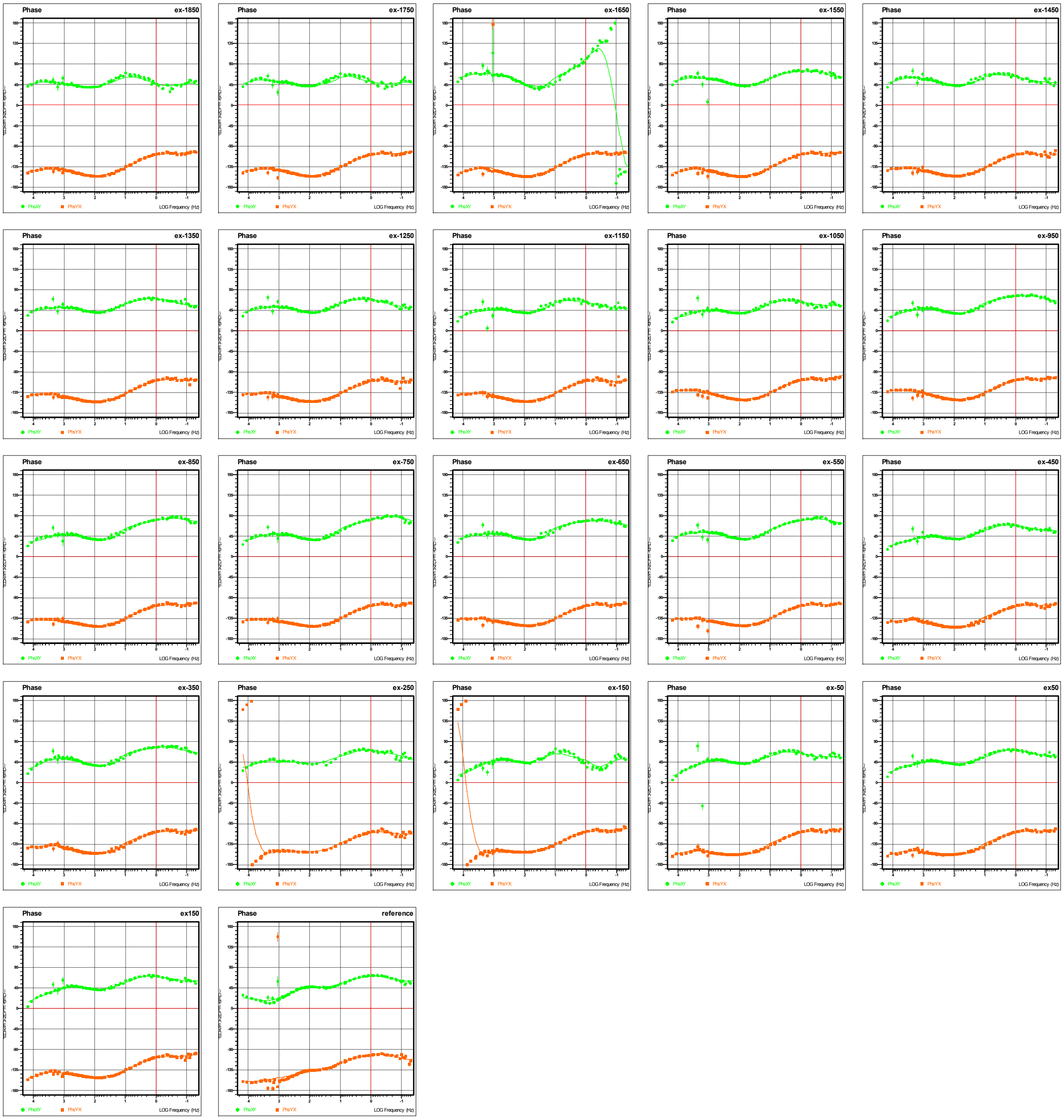
Note: XY denotes in-line electrical (E) field and orthogonal magnetic (H) field (Ex/Hy).
YX denotes in-line H field and orthogonal E-field (Ey/Hx).

LINE 1000E SPREAD 1: APPARENT RESISTIVITY VS. FREQUENCY



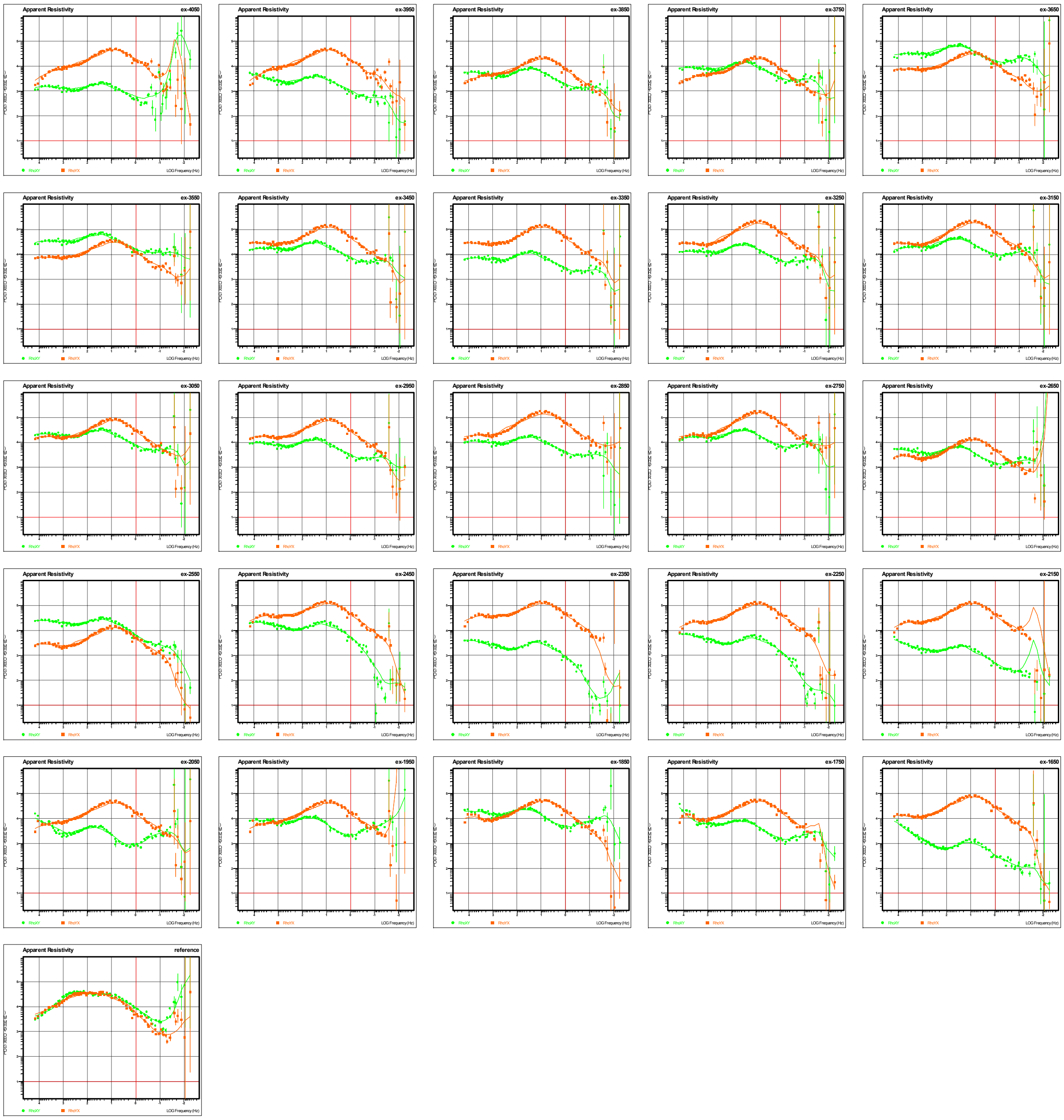
Rho xy ------- green
Rho yx ------- orange

LINE 1000E SPREAD 1: PHASE



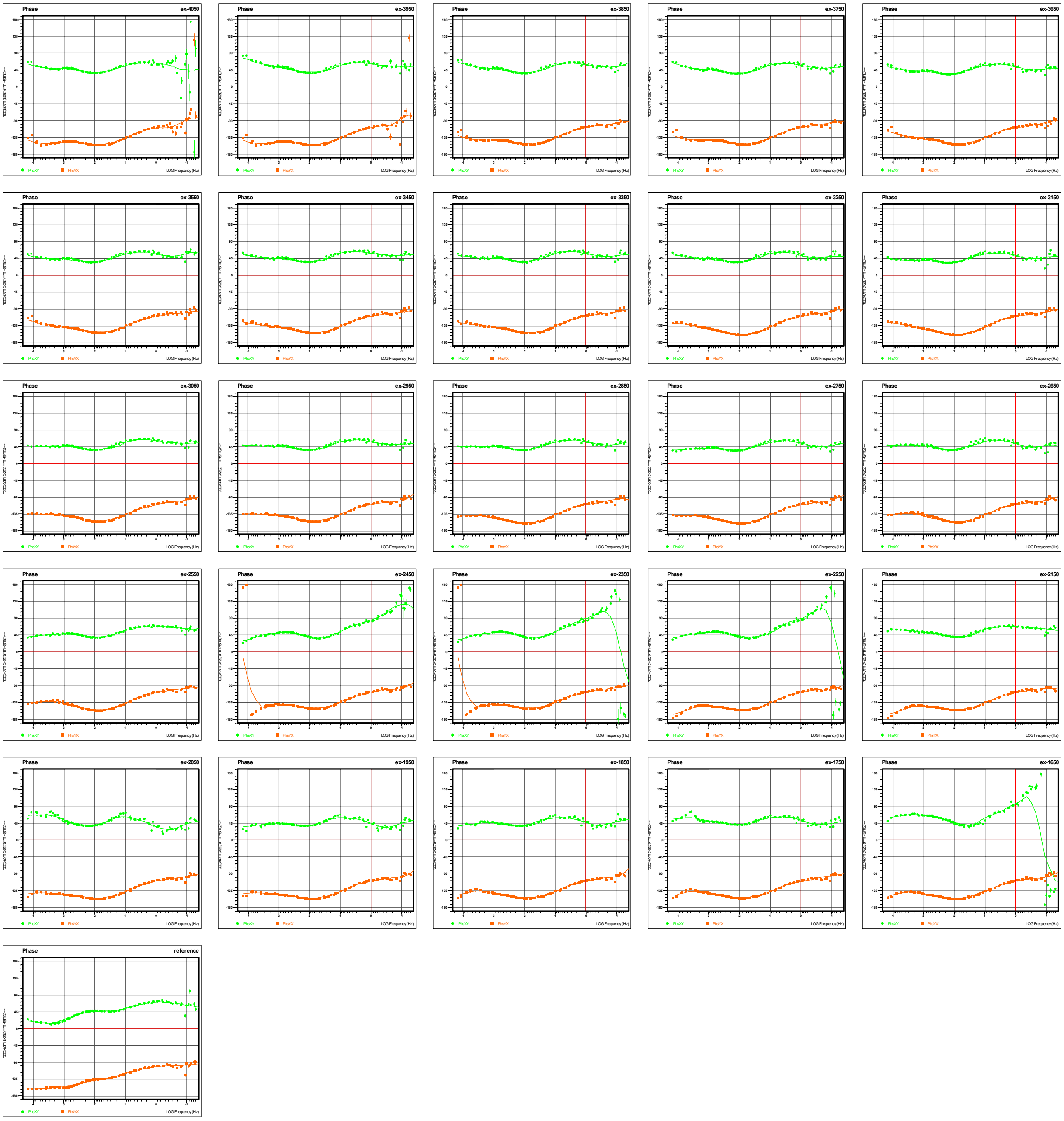
Phs xy ------ green
Phs yx ------ orange

LINE 1000E SPREAD 2: APPARENT RESISTIVITY VS. FREQUENCY



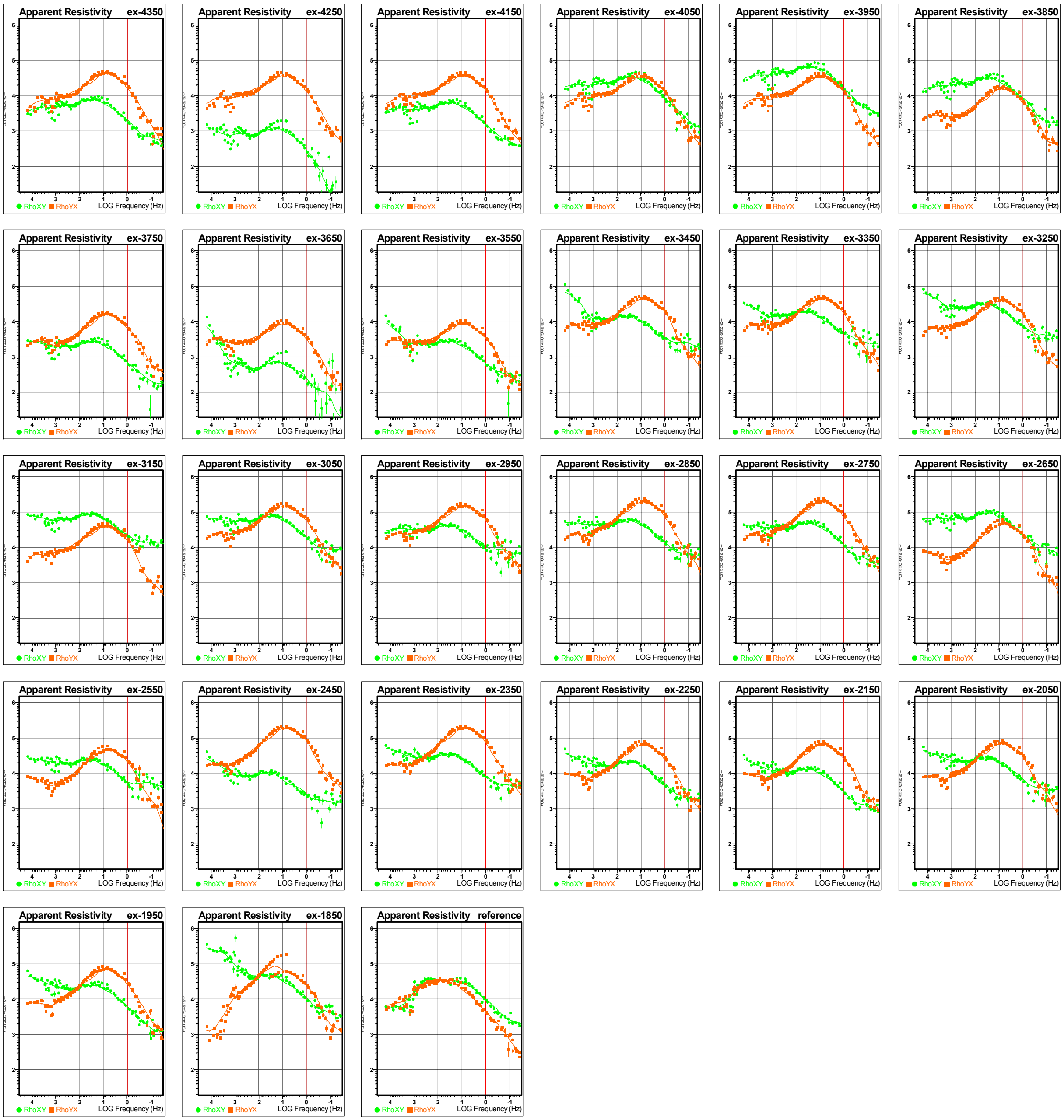
Rho xy ------ green
Rho yx ------ orange

LINE 1000E SPREAD 2: PHASE



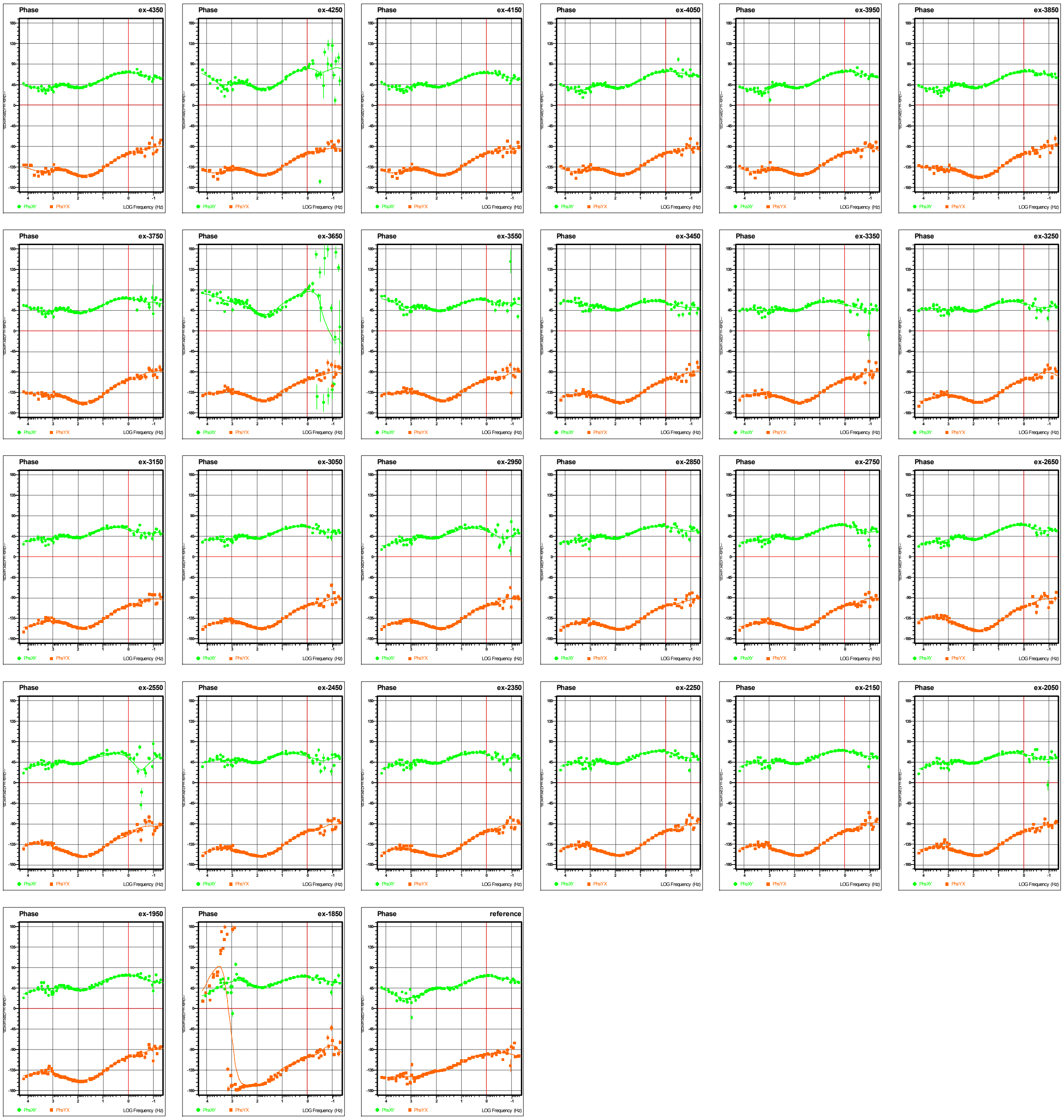
Phs xy ------ green
Phs yx ------ orange

LINE 3400E SPREAD 1: APPARENT RESISTIVITY VS. FREQUENCY



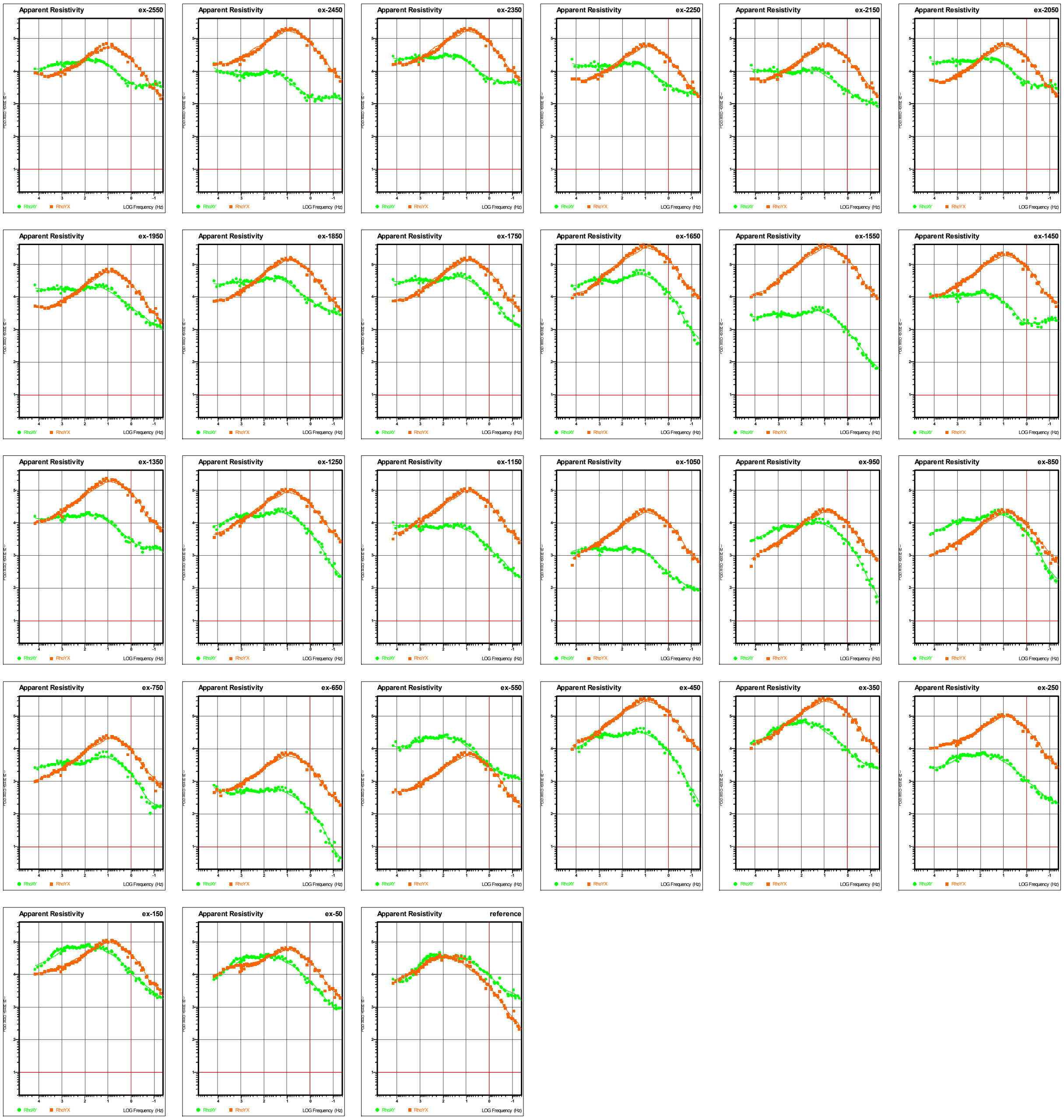
Rho xy ------ green
Rho yx ------ orange

Line 3400E Spread 1: Phase



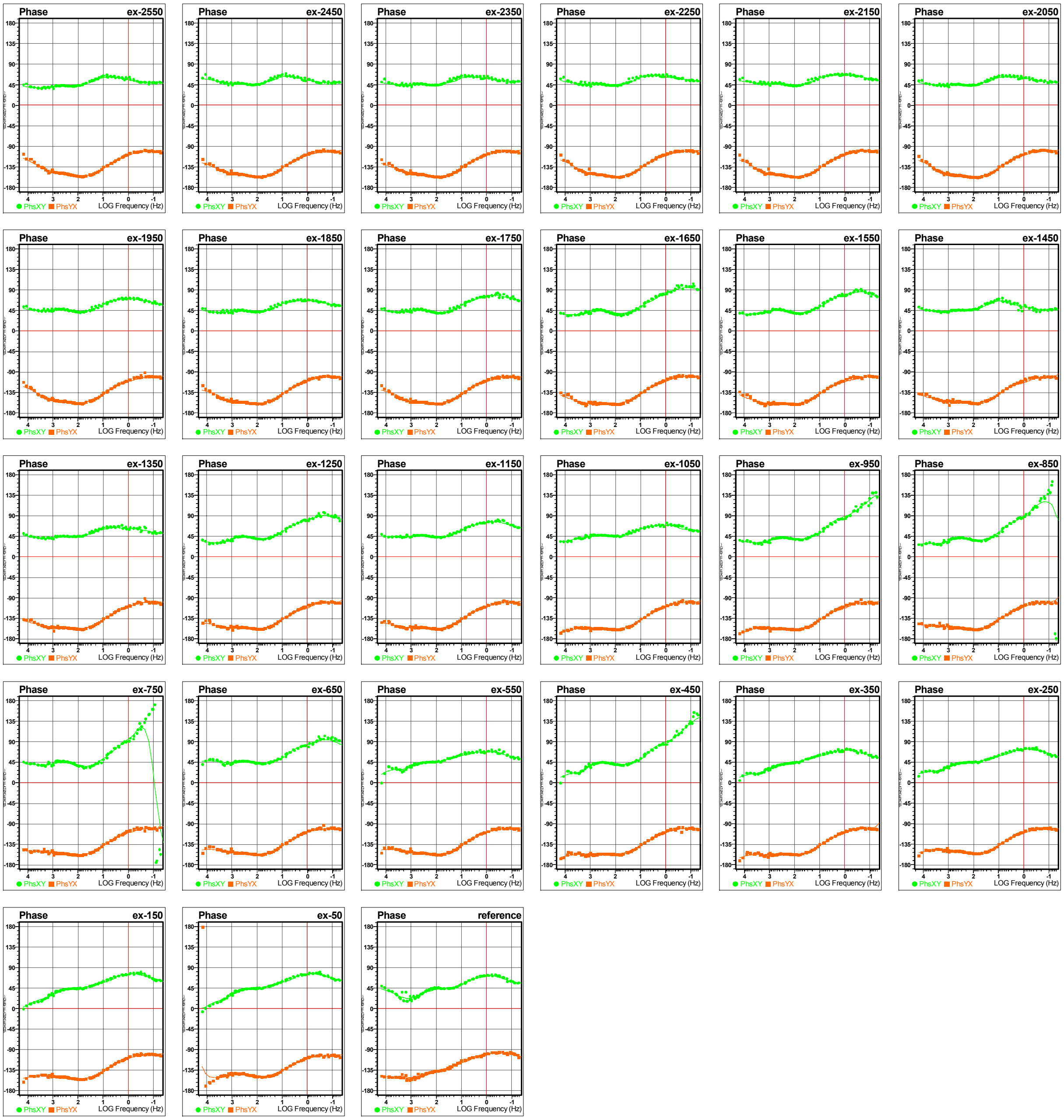
Phs xy ------ green
Phs yx ------ orange

LINE 3400E SPREAD 2: APPARENT RESISTIVITY VS. FREQUENCY



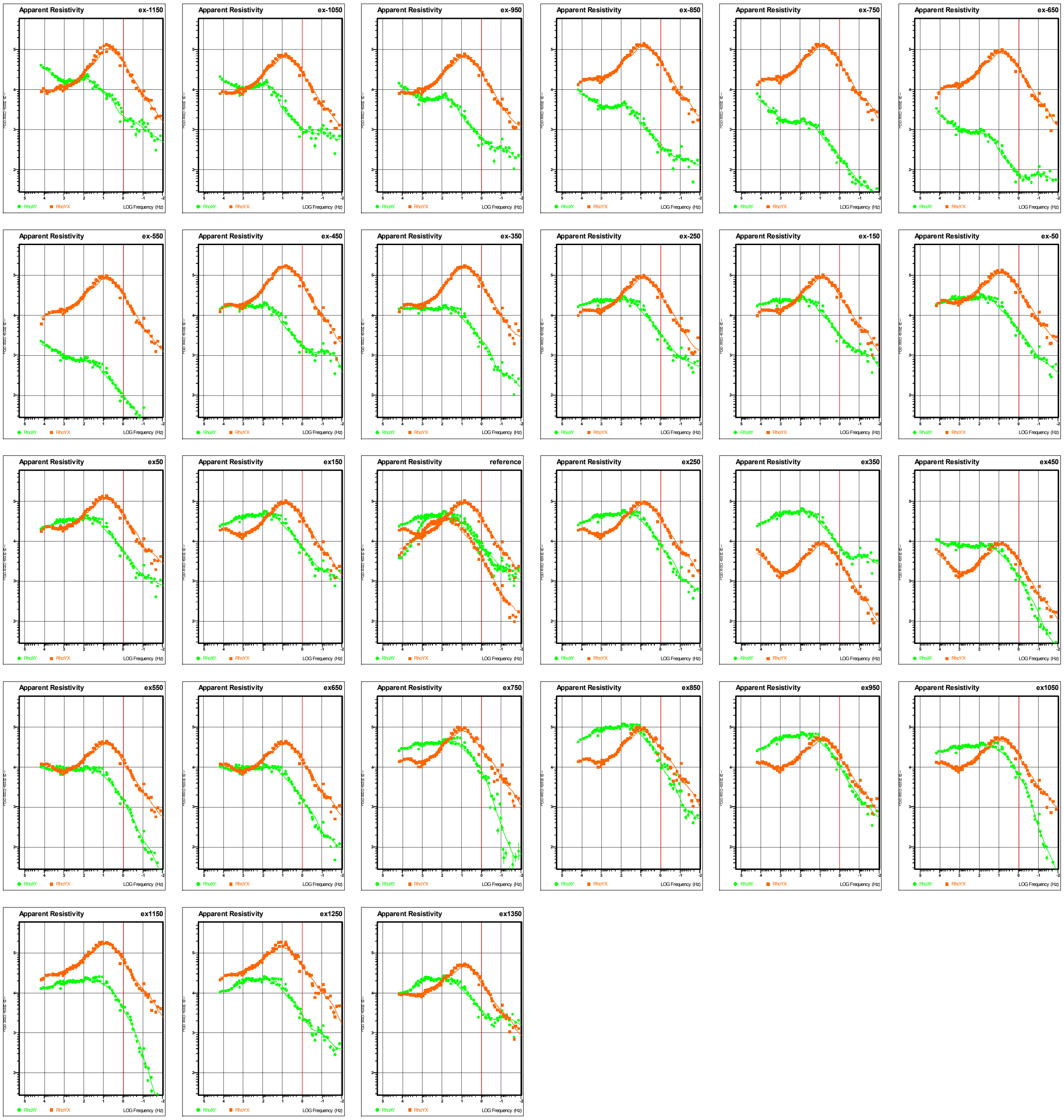
Rho xy ------ green
Rho yx ------ orange

LINE 3400E SPREAD 2: PHASE



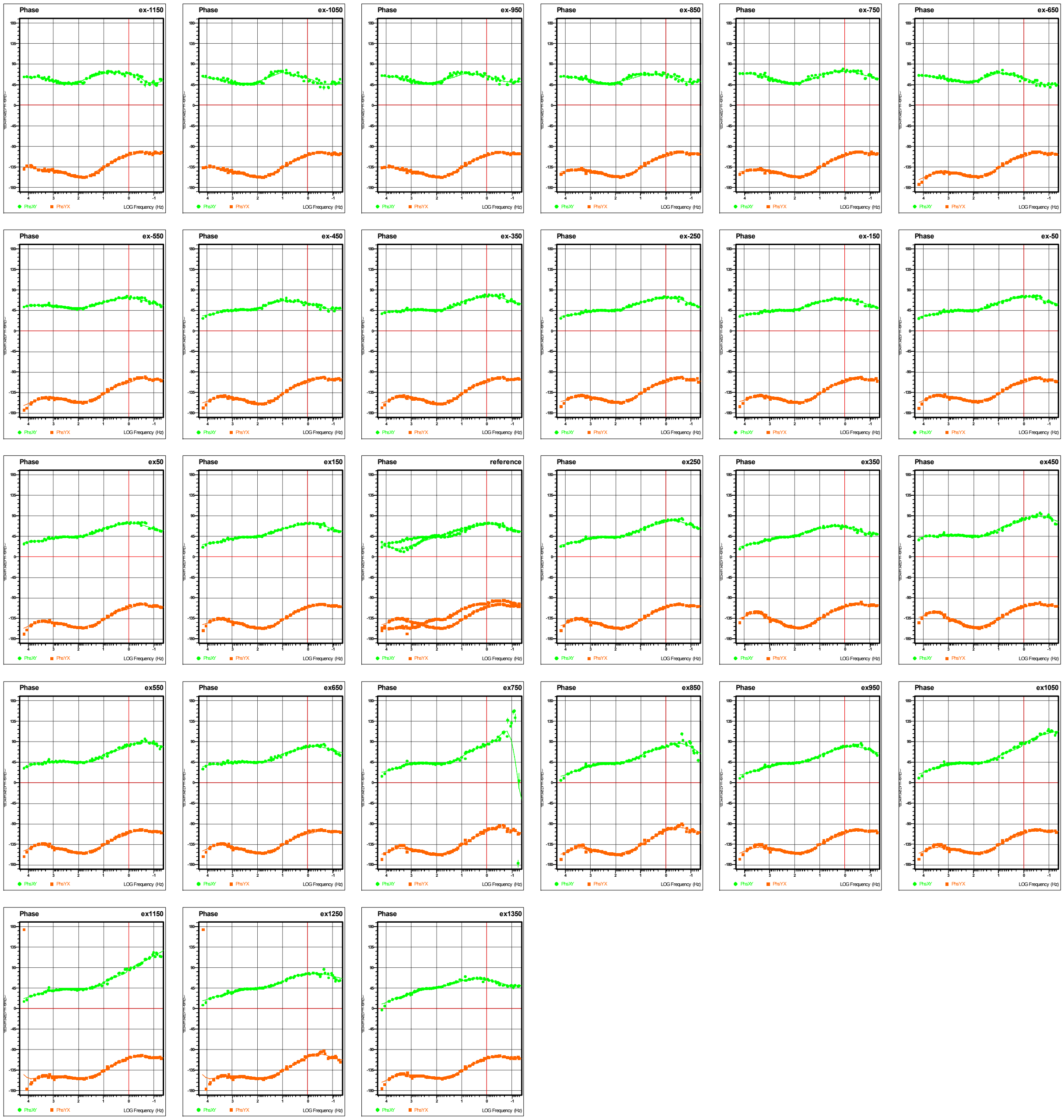
Phs xy ------- green
Phs yx ------- orange

LINE 5000E SPREAD 1: APPARENT RESISTIVITY VS. FREQUENCY



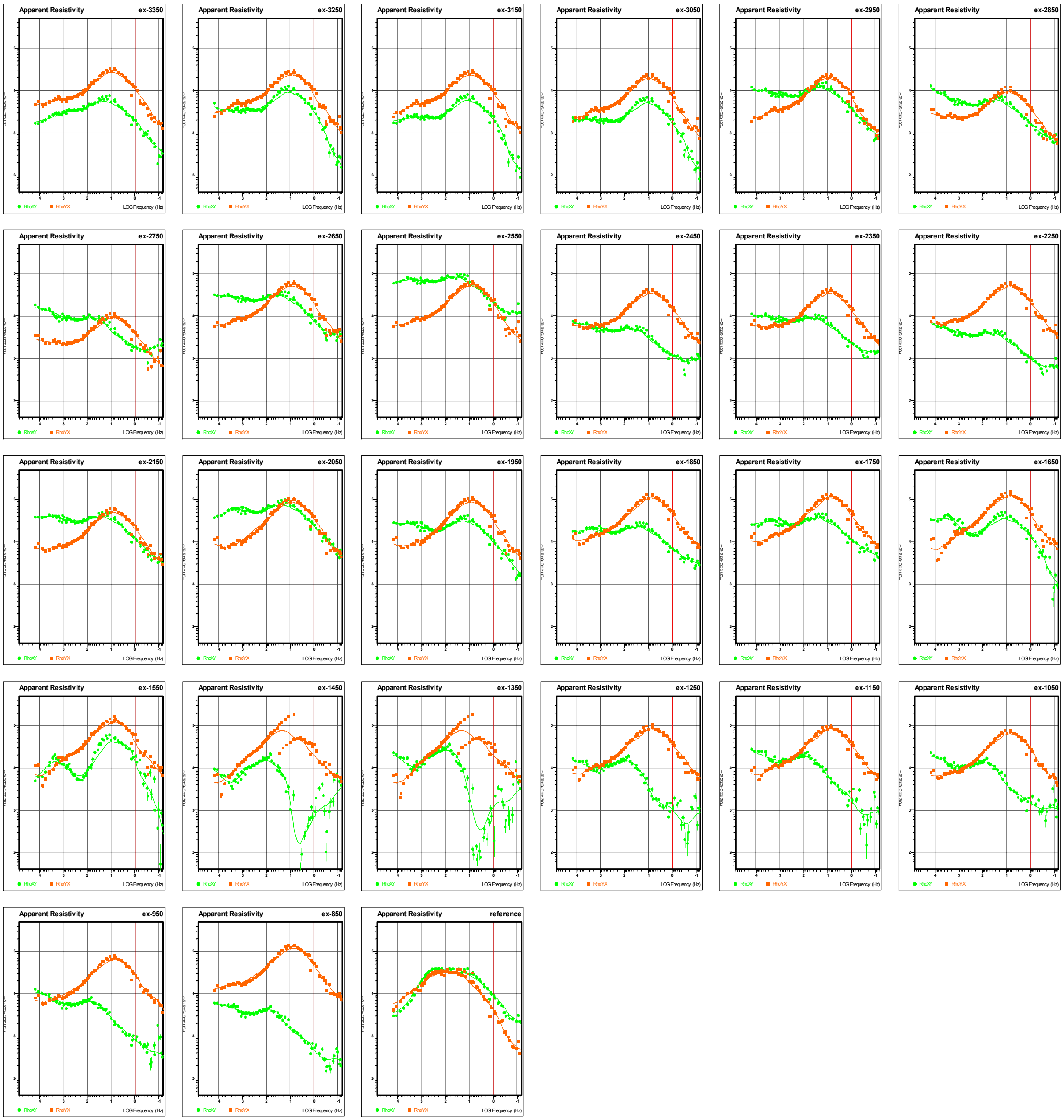
Rho xy ------ green
Rho yx ------ orange

LINE 5000E SPREAD 1: PHASE



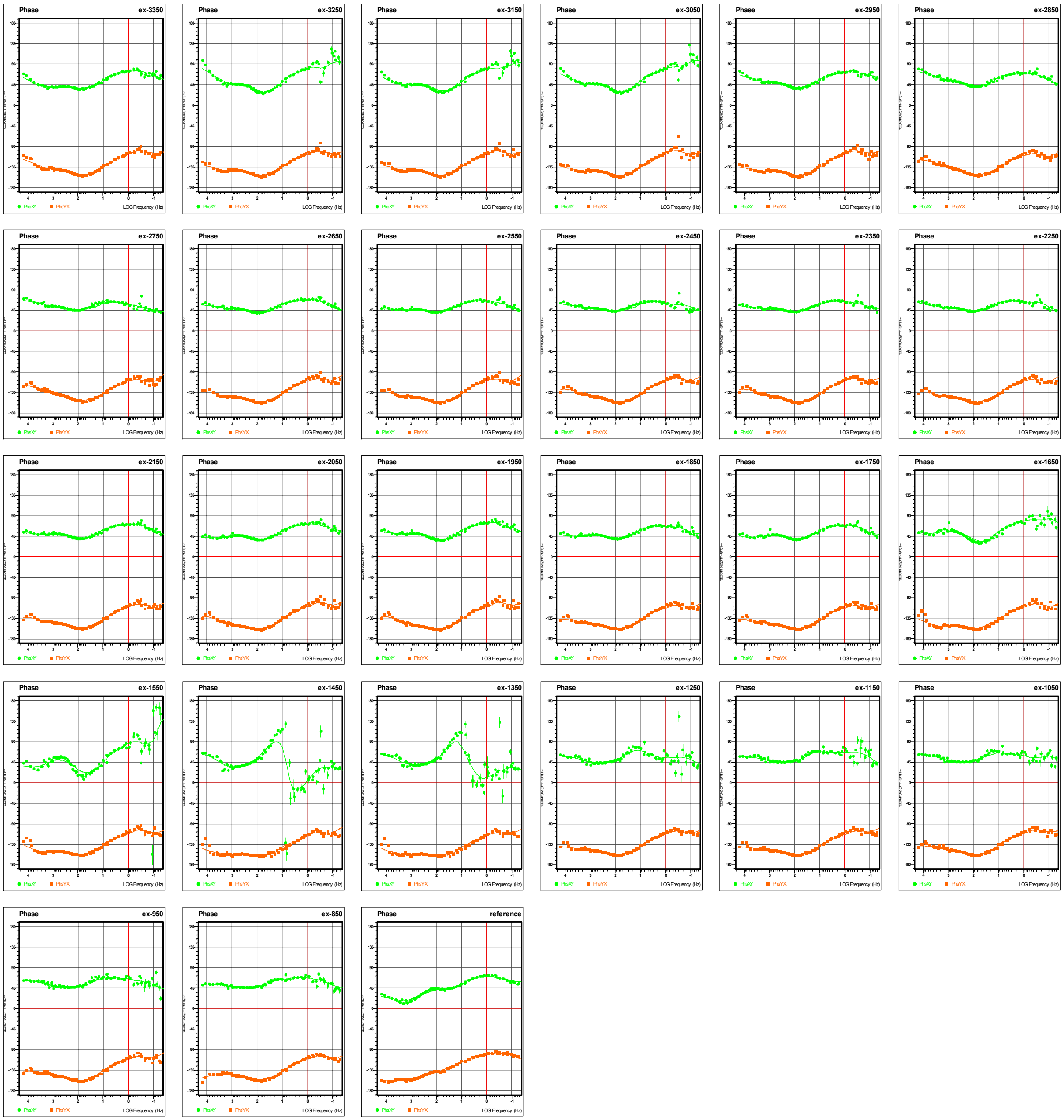
Phs xy ------- green
Phs yx ------- orange

LINE 5000E SPREAD 2: APPARENT RESISTIVITY VS. FREQUENCY



Rho xy ------ green
Rho yx ------ orange

LINE 5000E SPREAD 2: PHASE

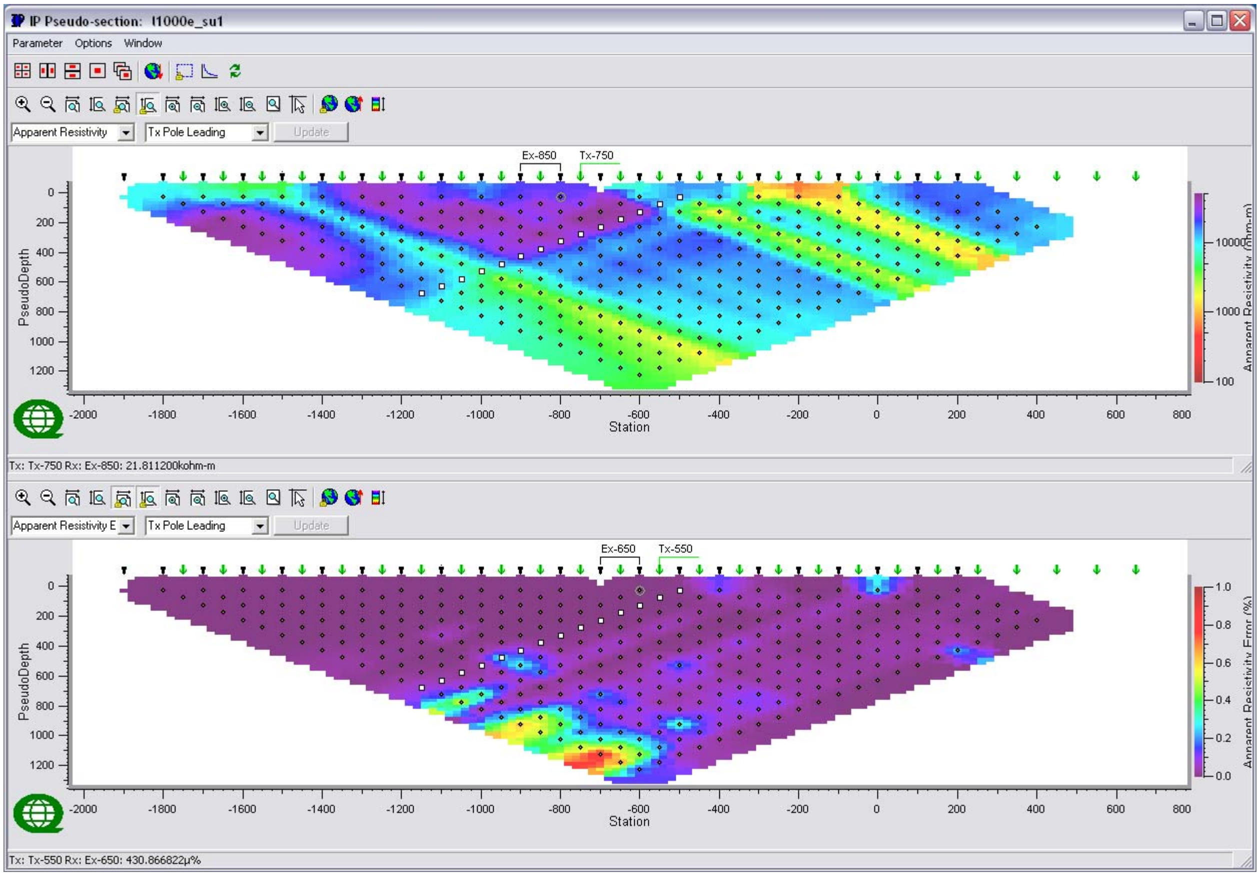


Phs xy ------ green
Phs yx ------ orange

APPENDIX C: IP APPARENT RESISTIVITY AND PHASE PSEUDOSECTIONS

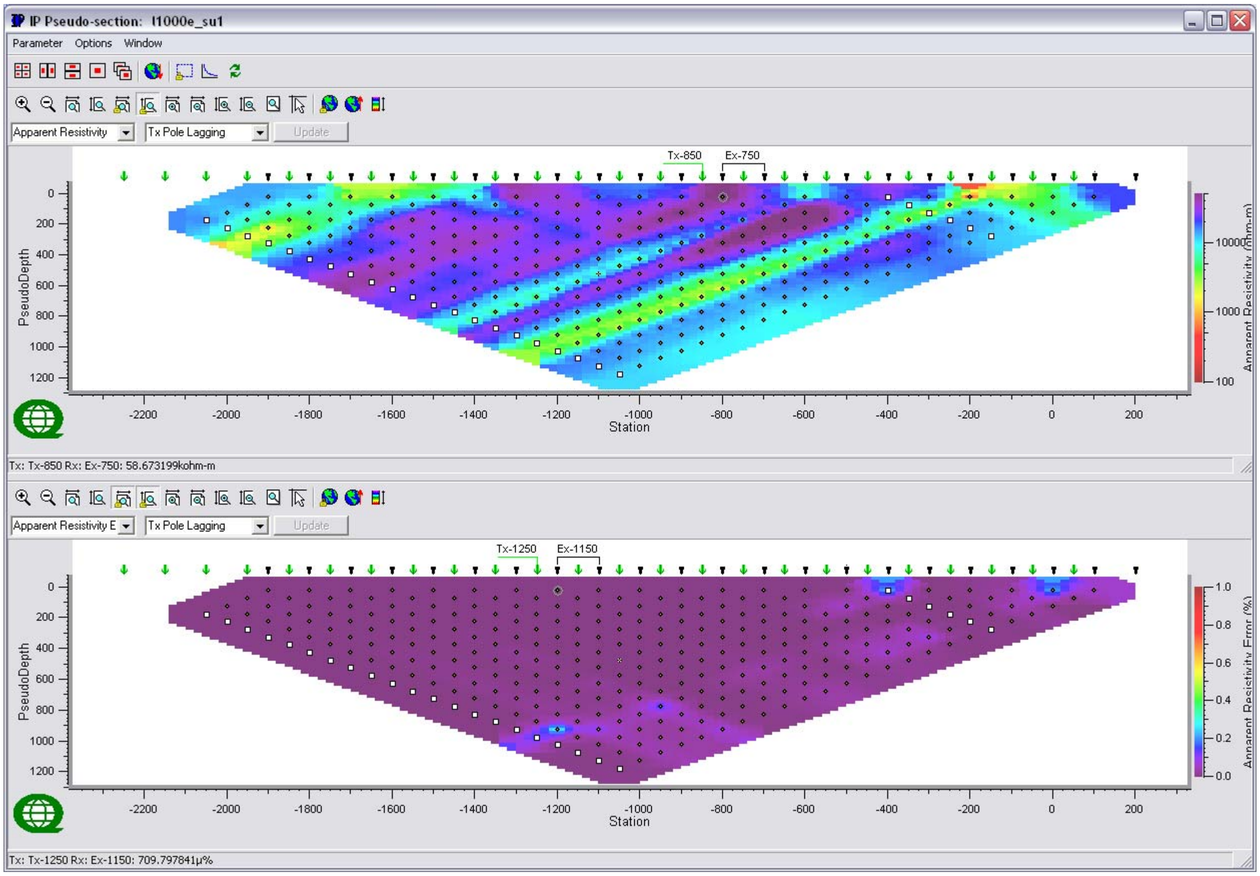
LINE 1000E SPREAD 1 – APPARENT RESISTIVITY

TRANSMITTER TO THE NORTH



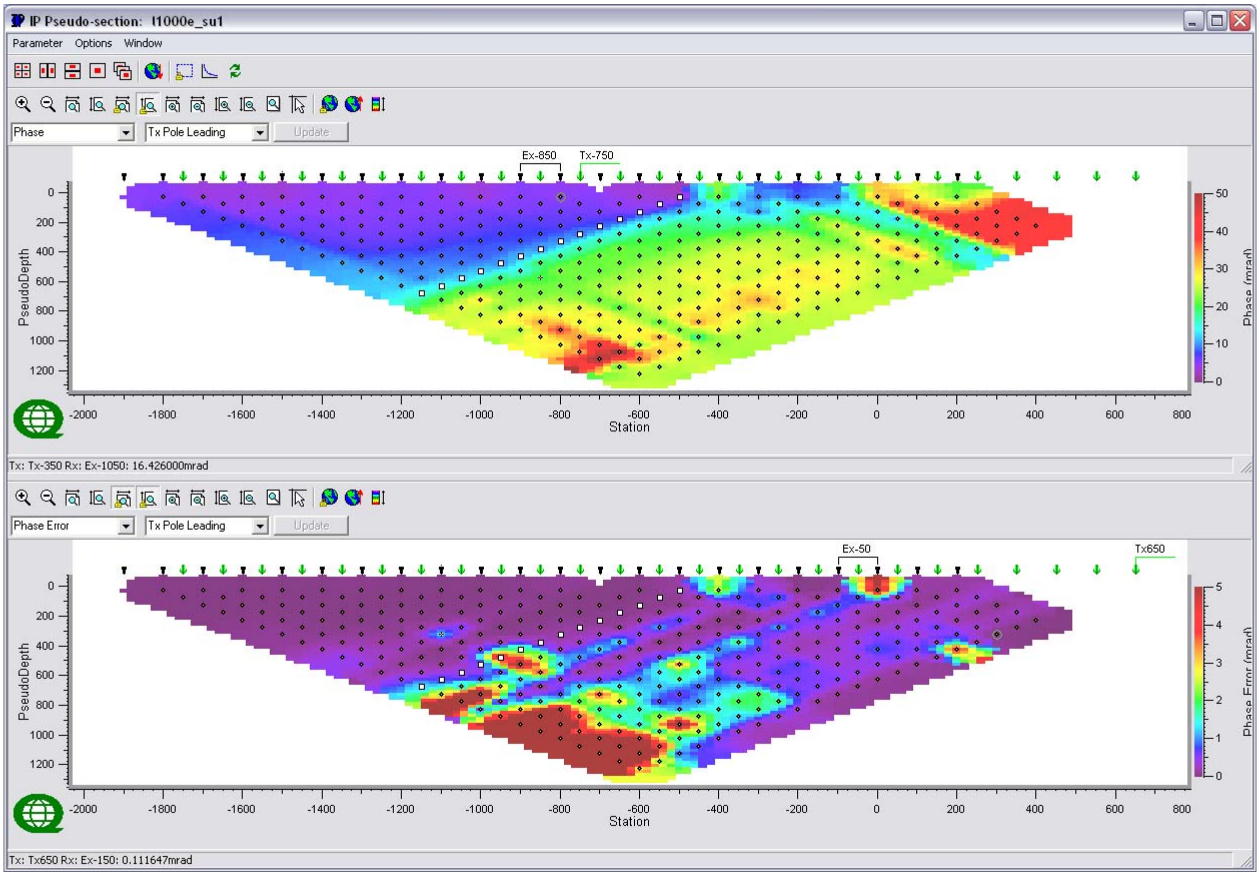
LINE 1000E SPREAD 1 – APPARENT RESISTIVITY

TRANSMITTER TO THE SOUTH



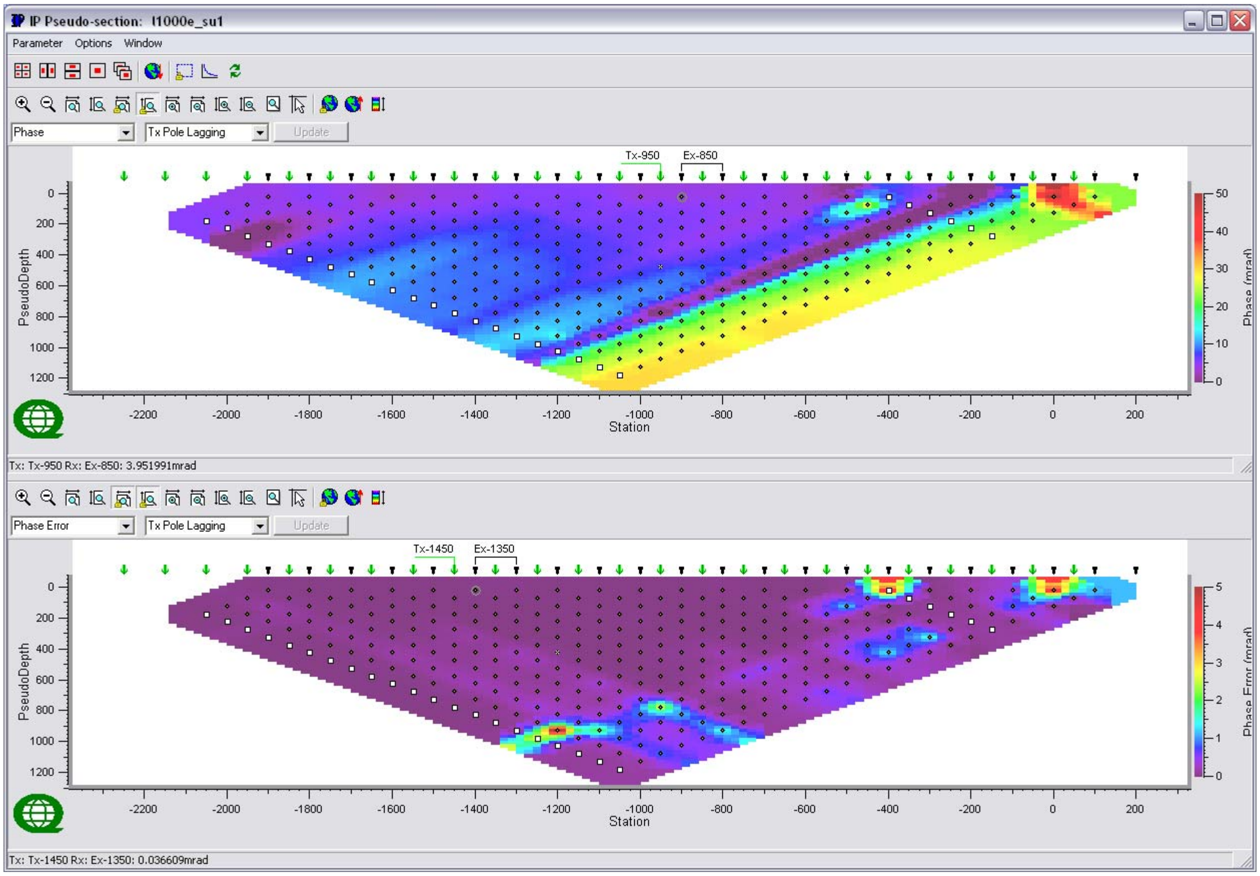
LINE 1000E SPREAD 1 – PHASE

TRANSMITTER TO THE NORTH



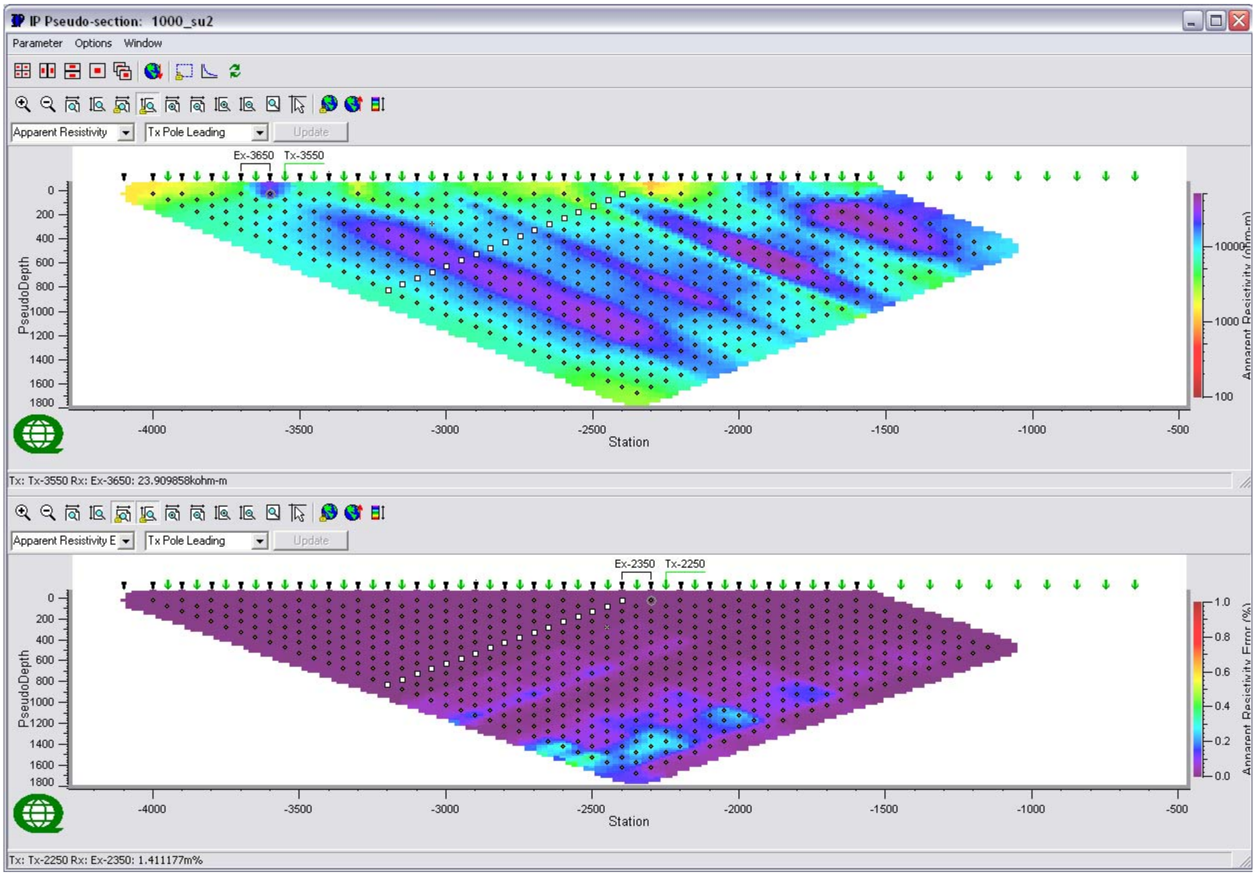
LINE 1000E SPREAD 1 – PHASE

TRANSMITTER TO THE SOUTH



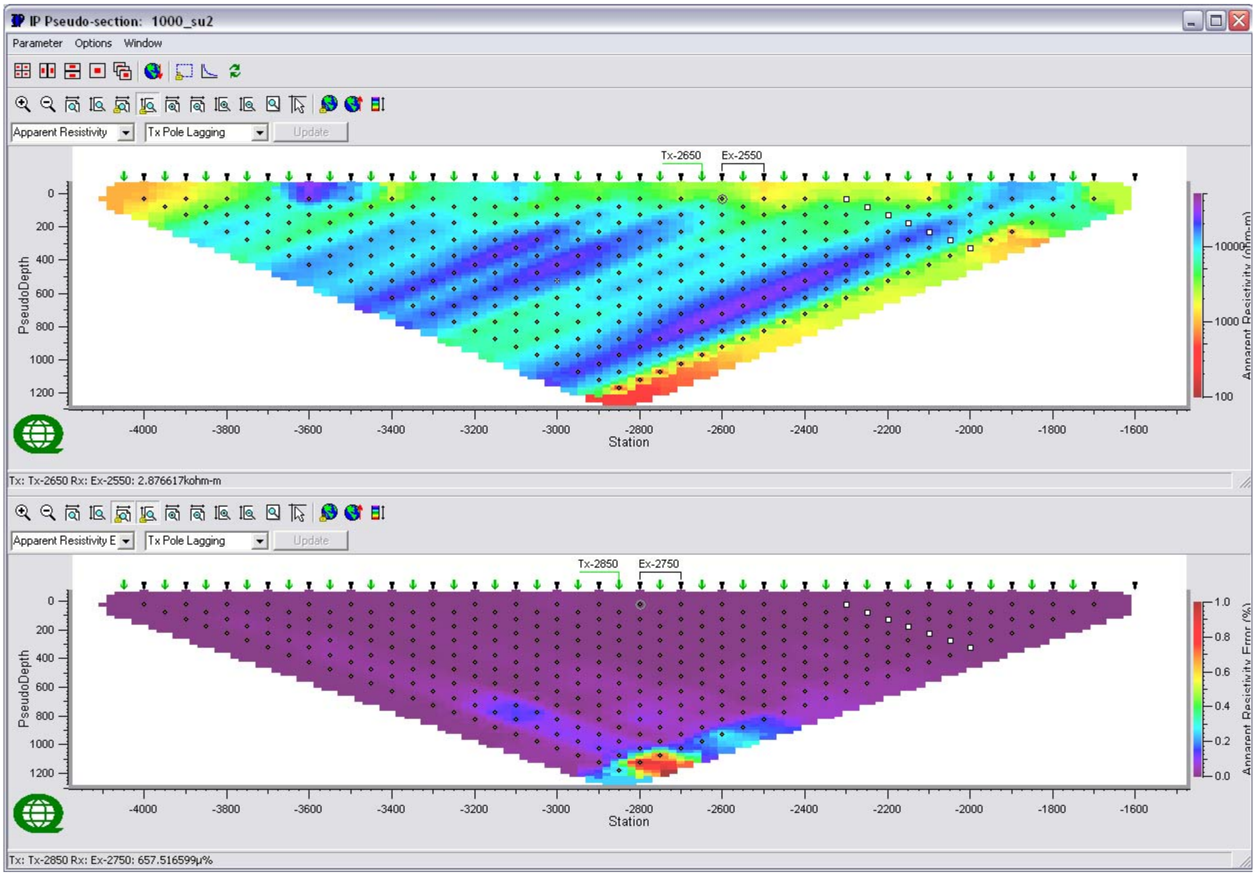
LINE 1000E SPREAD 2 – APPARENT RESISTIVITY

TRANSMITTER TO THE NORTH



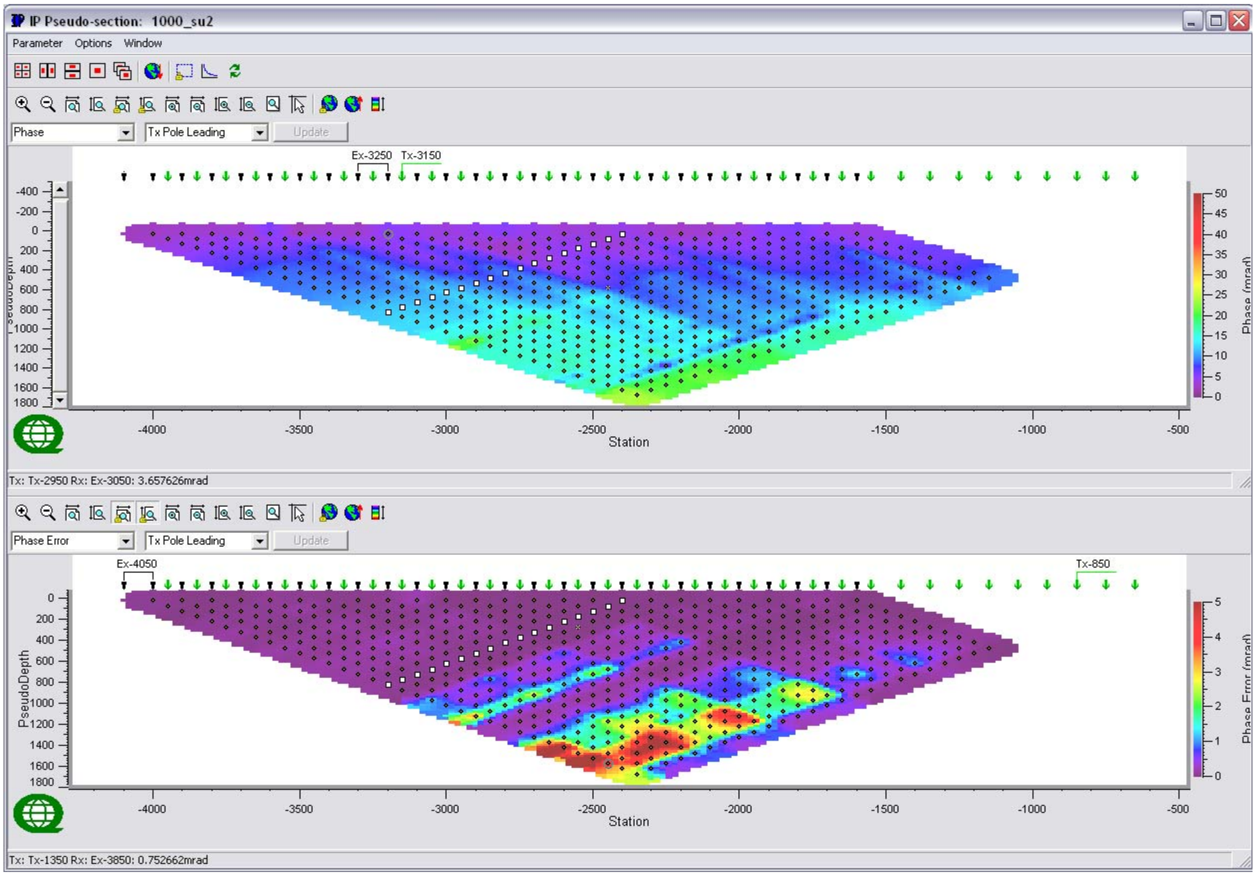
LINE 1000E SPREAD 2 – APPARENT RESISTIVITY

TRANSMITTER TO THE SOUTH



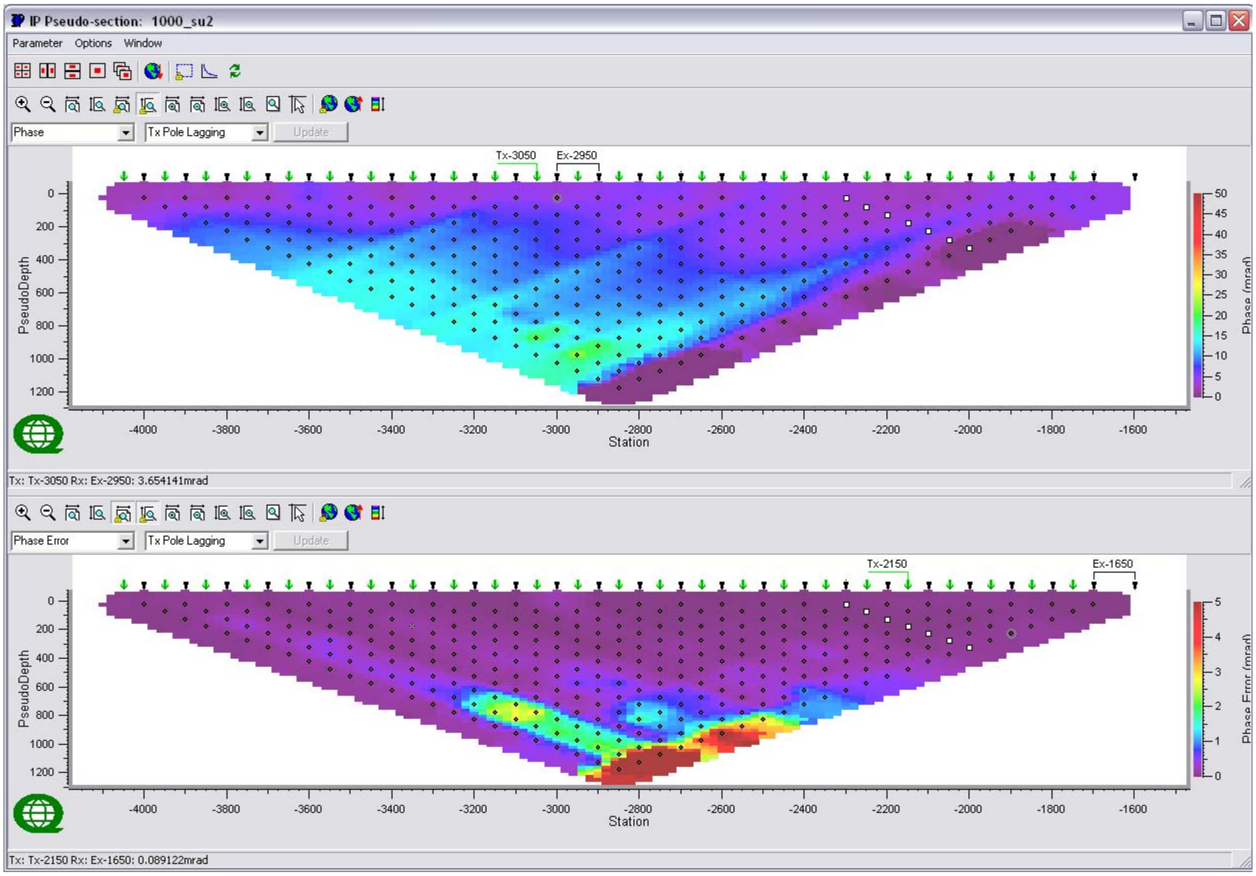
LINE 1000E SPREAD 2 – PHASE

TRANSMITTER TO THE NORTH



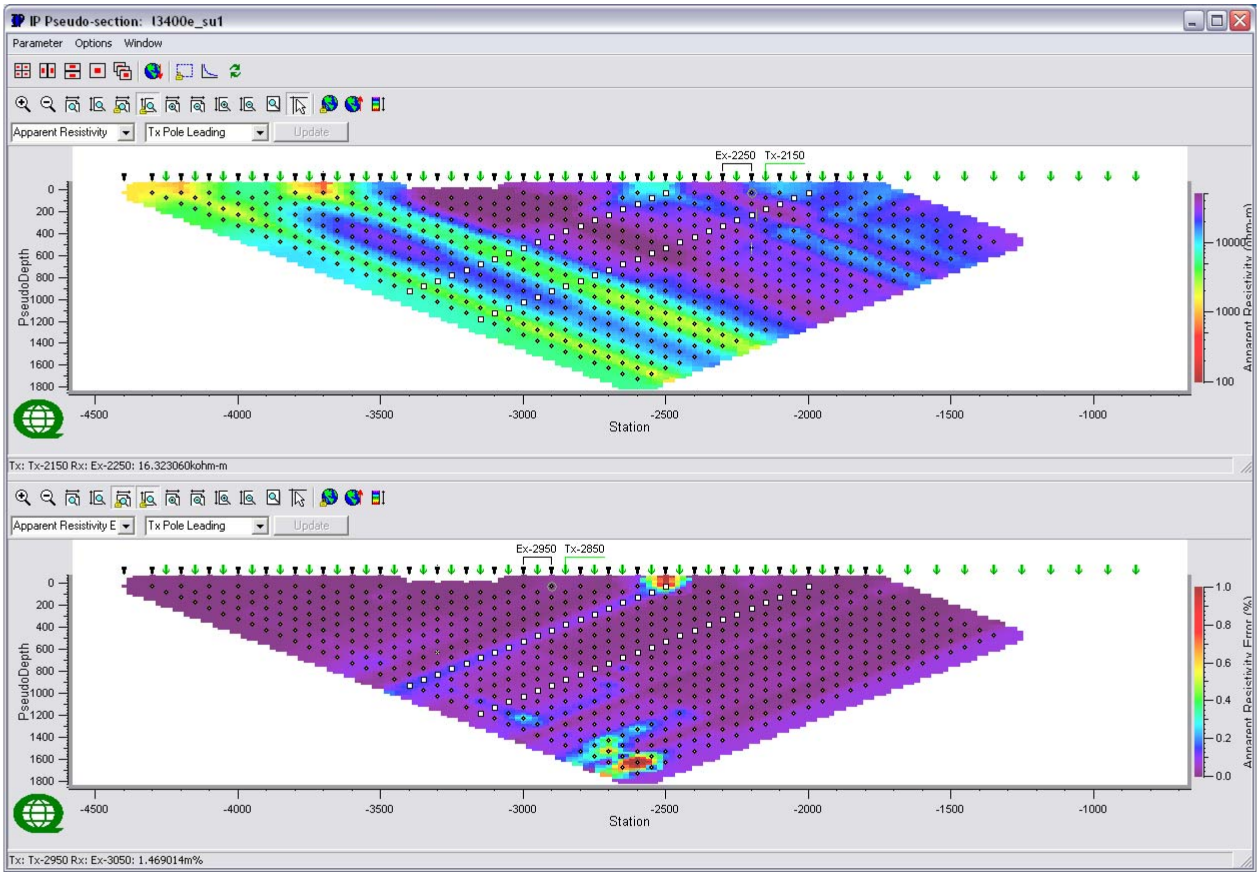
LINE 1000E SPREAD 2 – PHASE

TRANSMITTER TO THE SOUTH



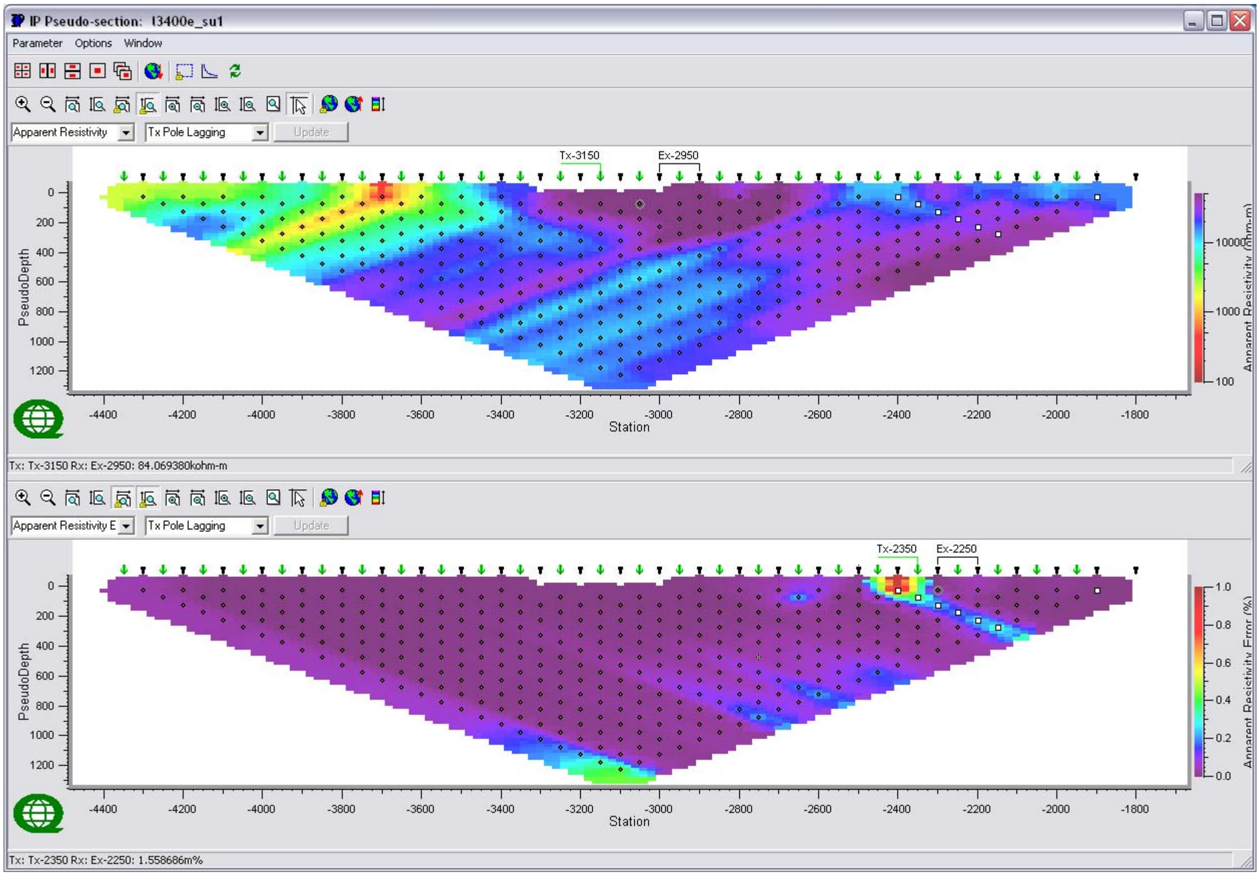
LINE 3400E SPREAD 1 – APPARENT RESISTIVITY

TRANSMITTER TO THE NORTH



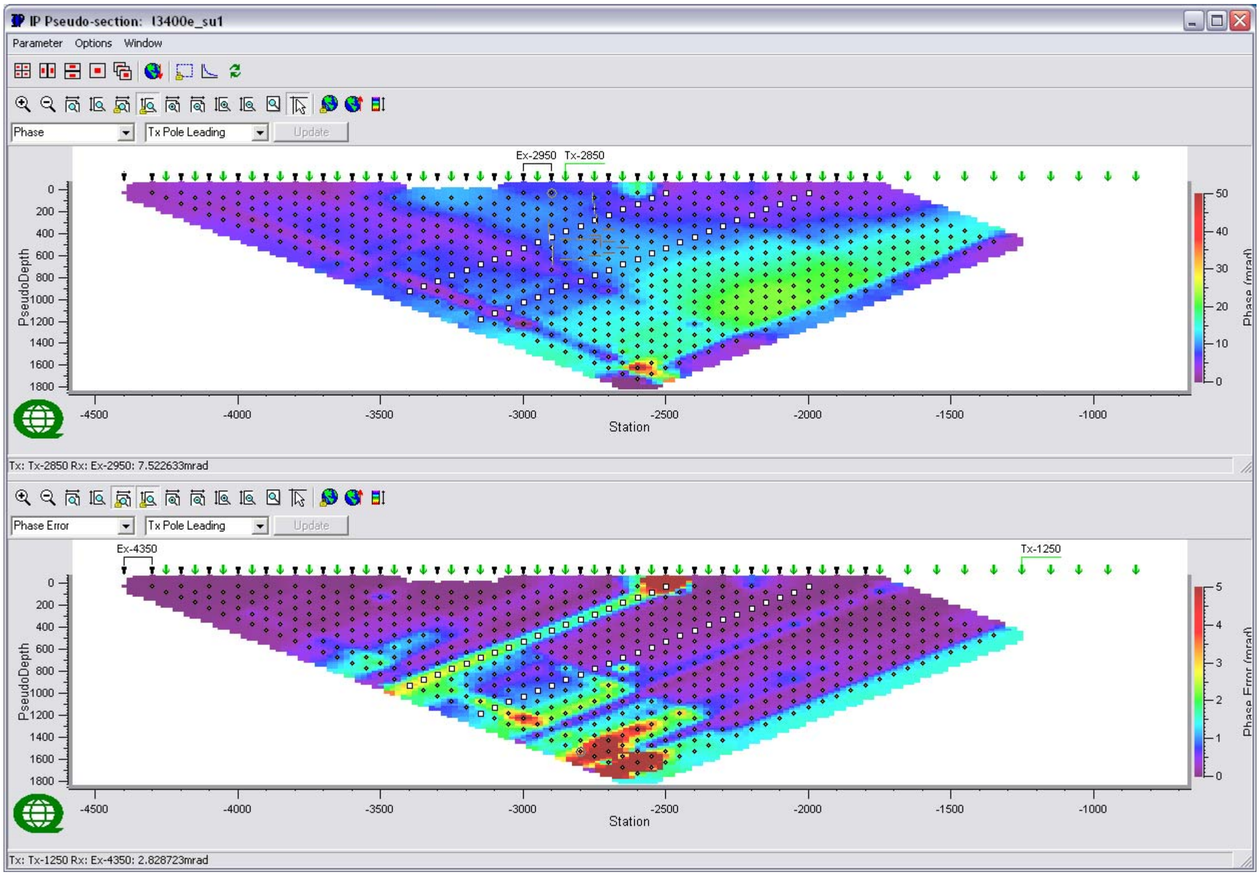
LINE 3400E SPREAD 1 – APPARENT RESISTIVITY

TRANSMITTER TO THE SOUTH



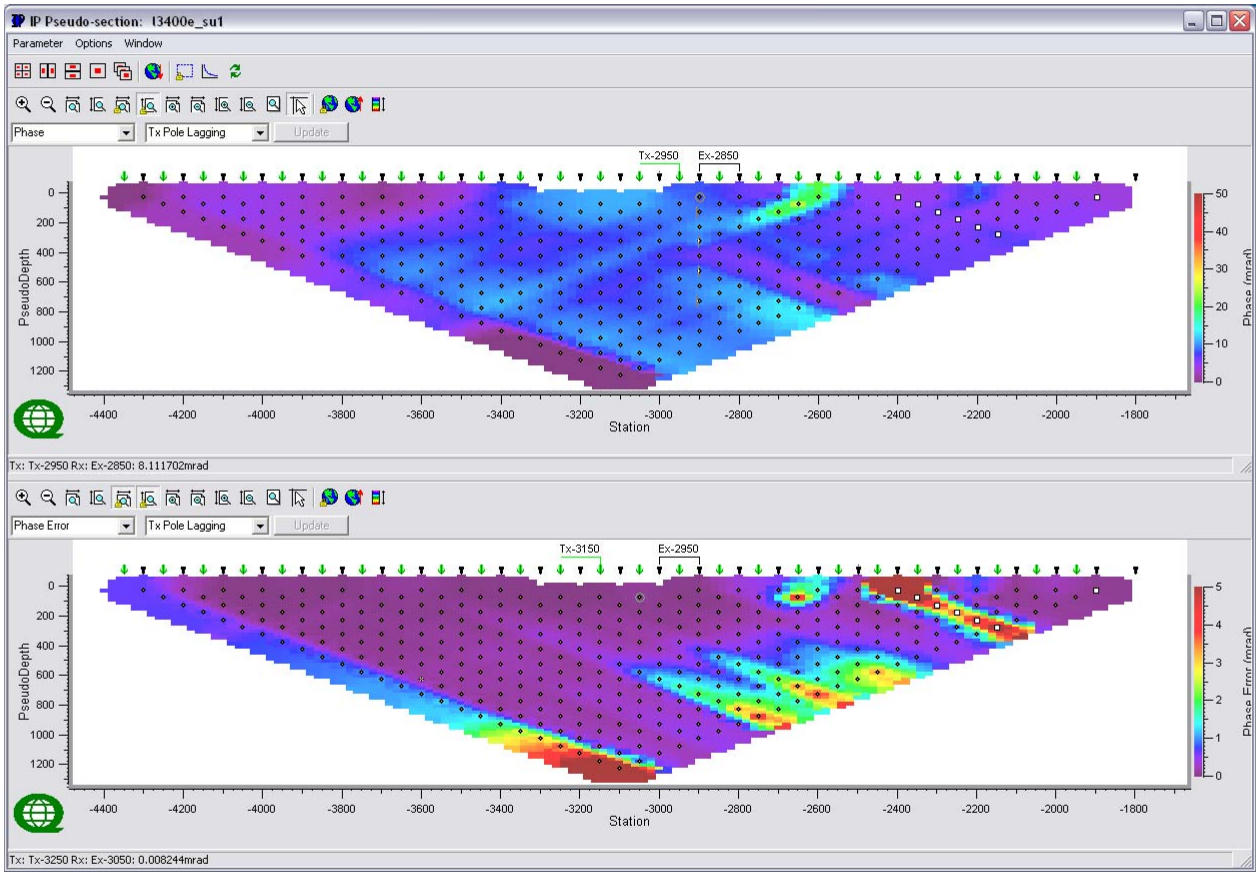
LINE 3400E SPREAD 1 – PHASE

TRANSMITTER TO THE NORTH



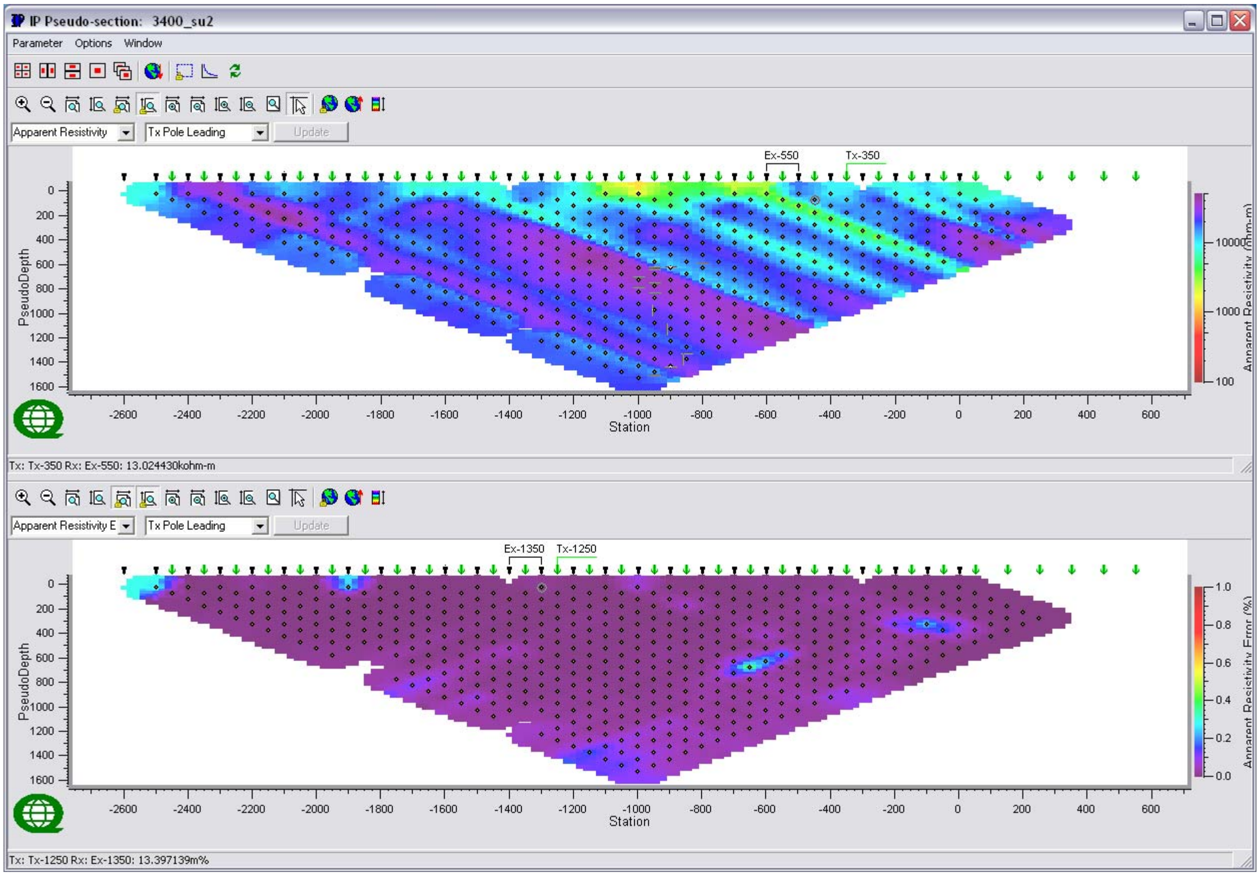
LINE 3400E SPREAD 1 – PHASE

TRANSMITTER TO THE SOUTH



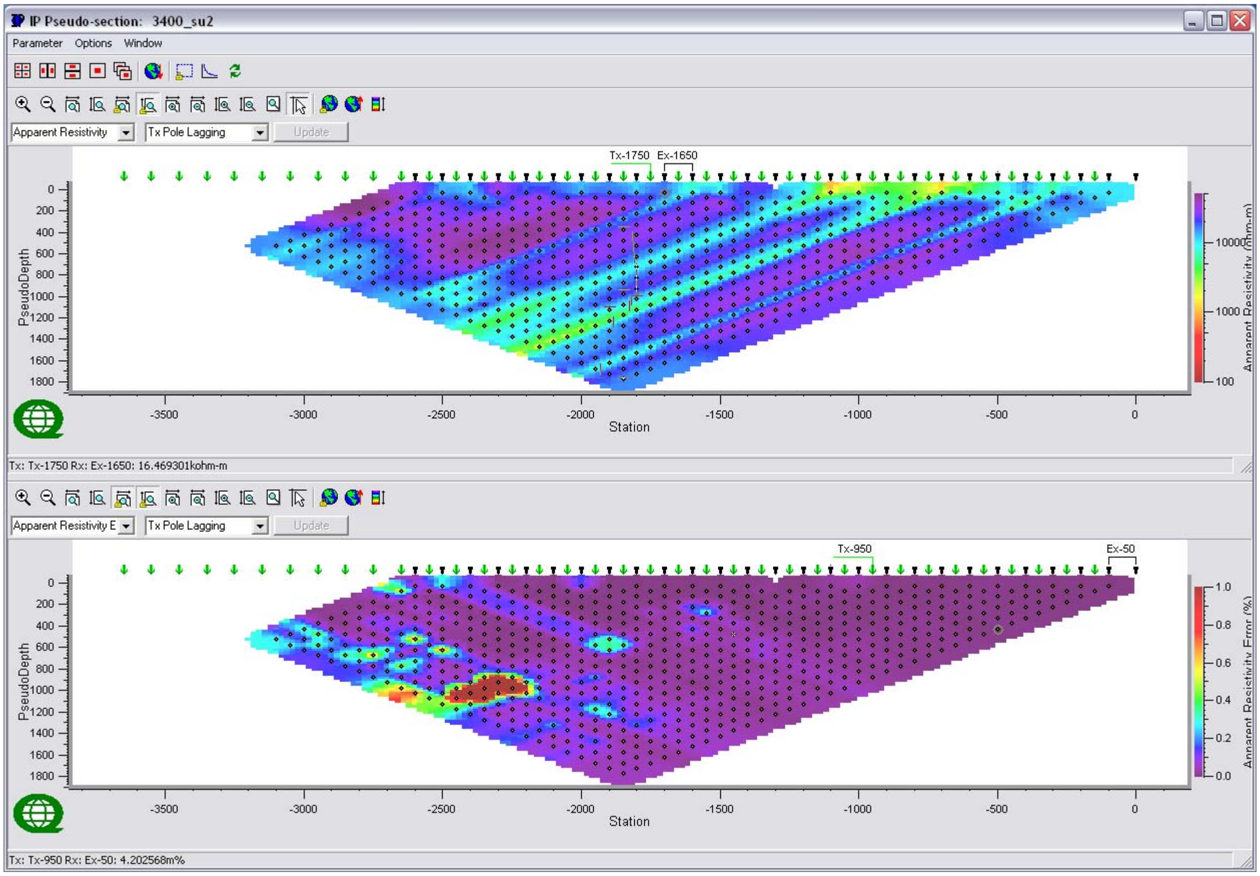
LINE 3400E SPREAD 2 – APPARENT RESISTIVITY

TRANSMITTER TO THE NORTH



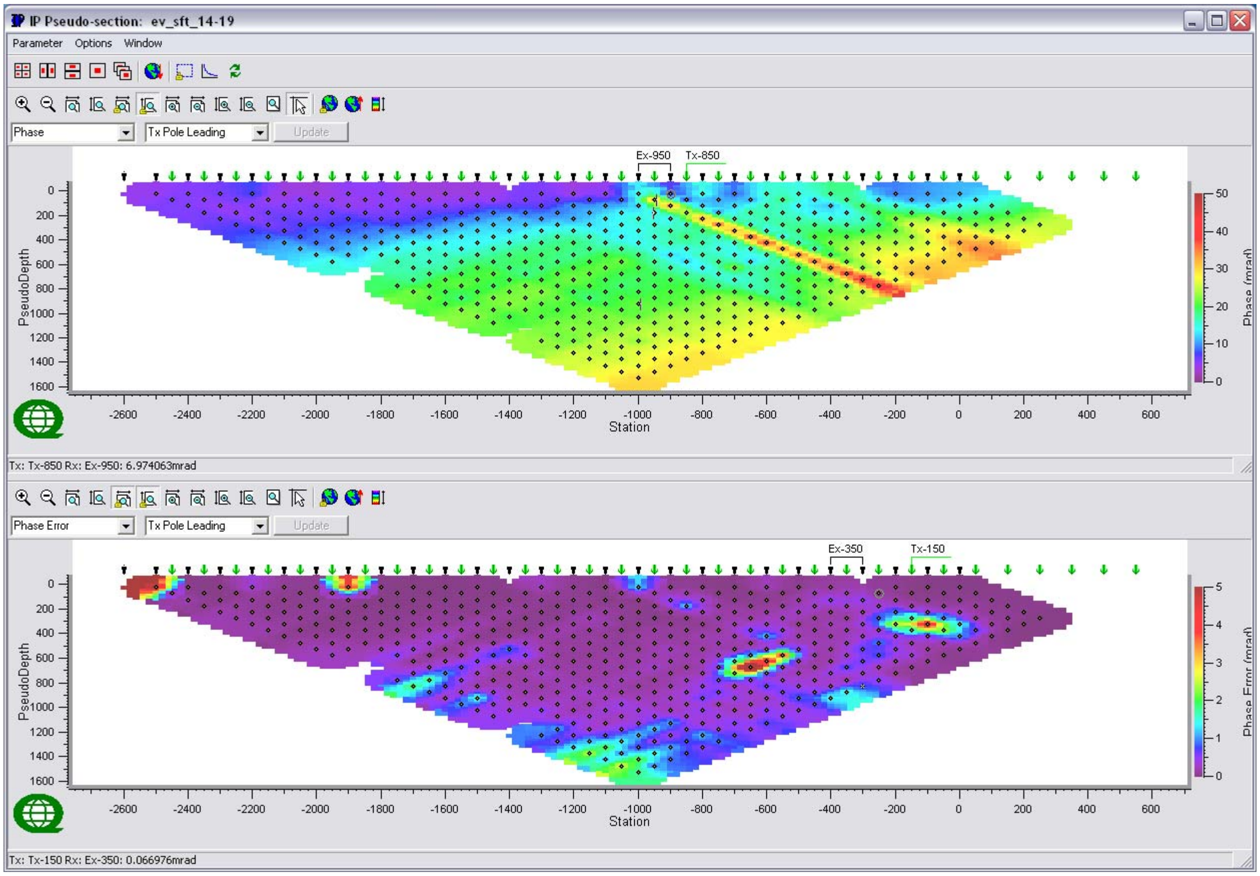
LINE 3400E SPREAD 2 – APPARENT RESISTIVITY

TRANSMITTER TO THE SOUTH



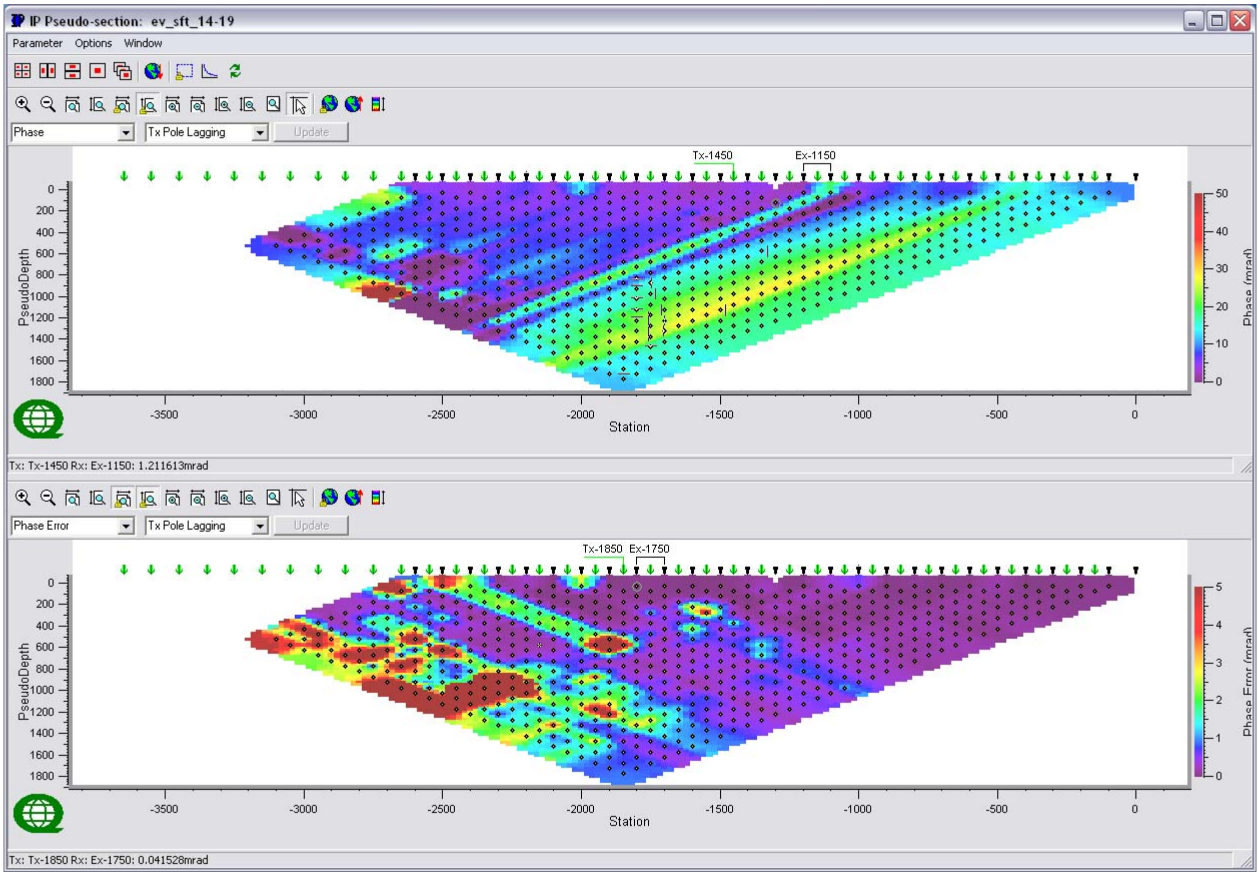
LINE 3400E SPREAD 2 – PHASE

TRANSMITTER TO THE NORTH



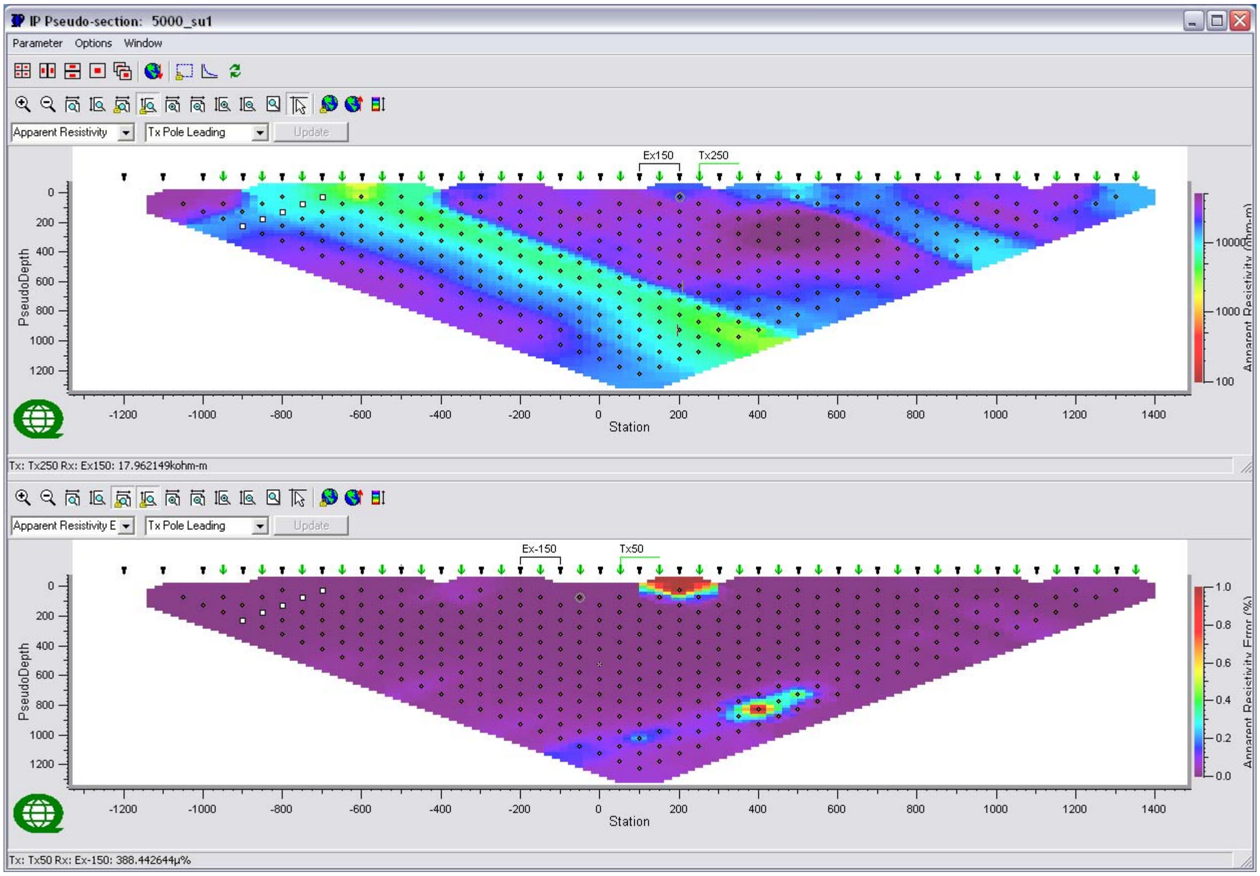
LINE 3400E SPREAD 2 – PHASE

TRANSMITTER TO THE SOUTH



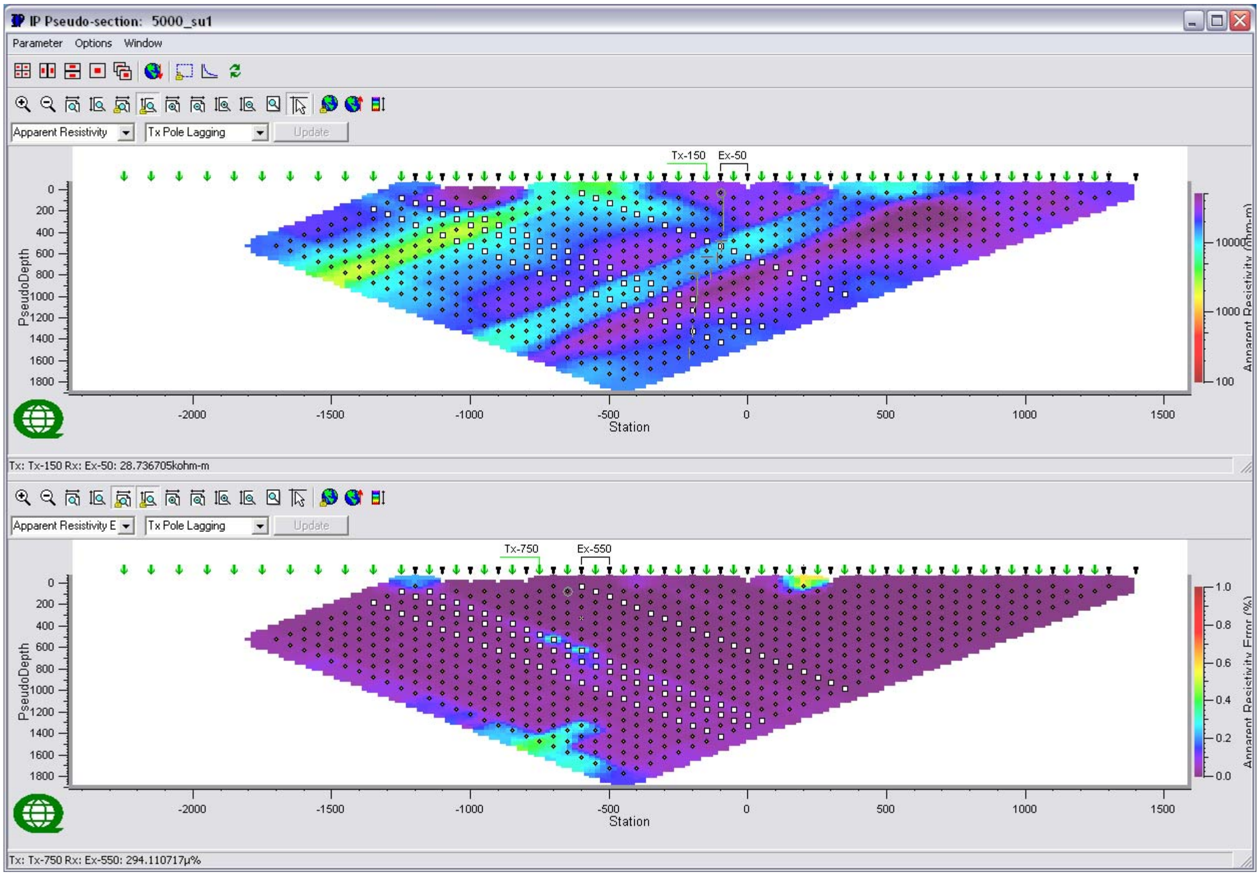
LINE 5000E SPREAD 1 – APPARENT RESISTIVITY

TRANSMITTER TO THE NORTH



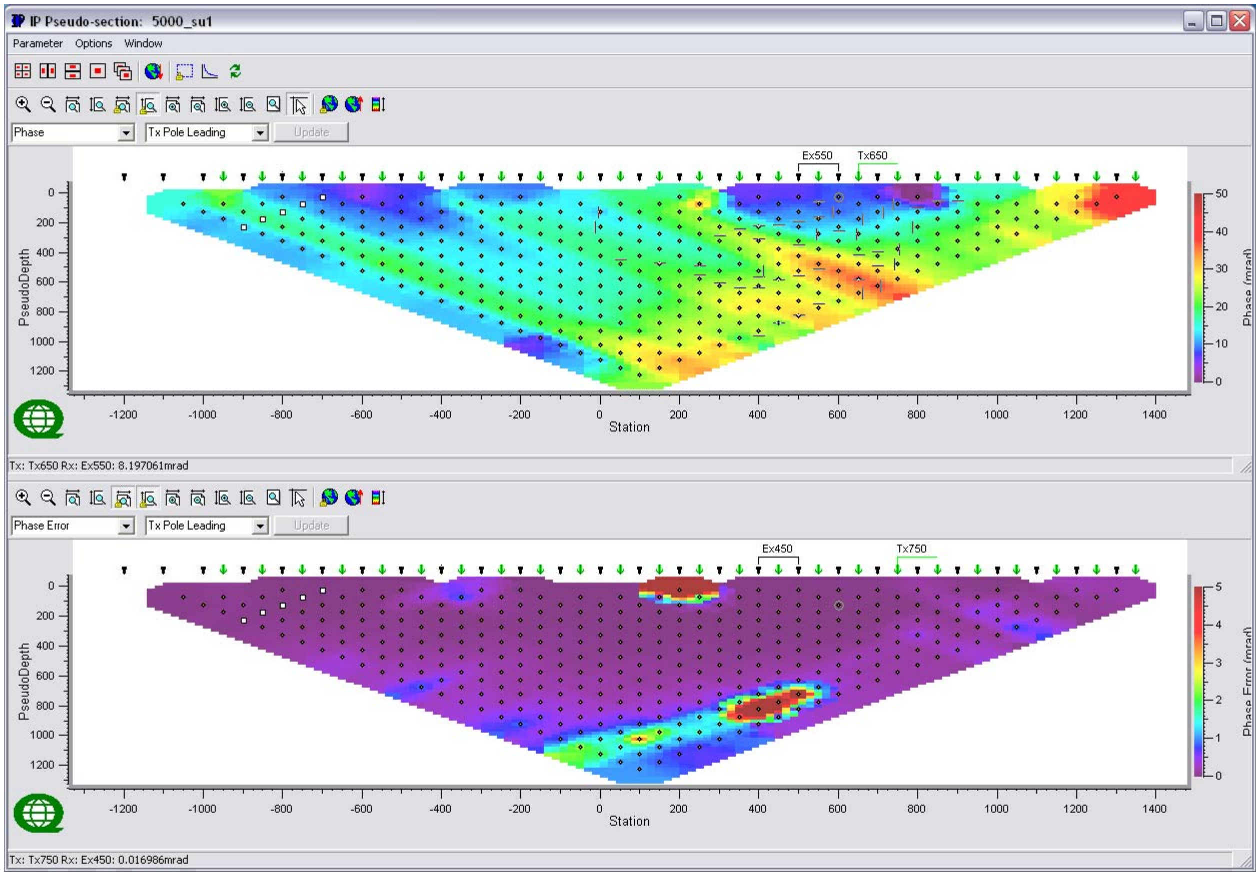
LINE 5000E SPREAD 1 – APPARENT RESISTIVITY

TRANSMITTER TO THE SOUTH



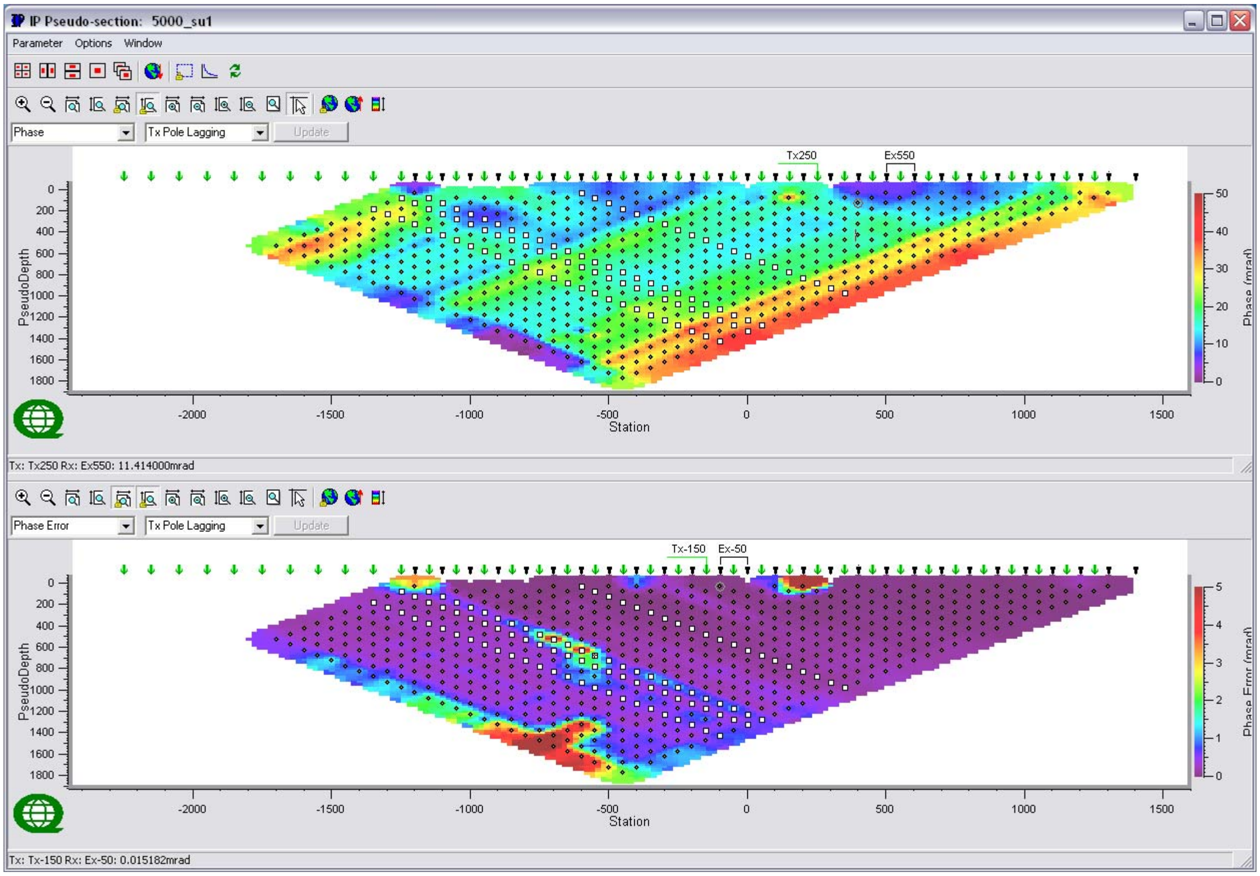
LINE 5000E SPREAD 1 – PHASE

TRANSMITTER TO THE NORTH



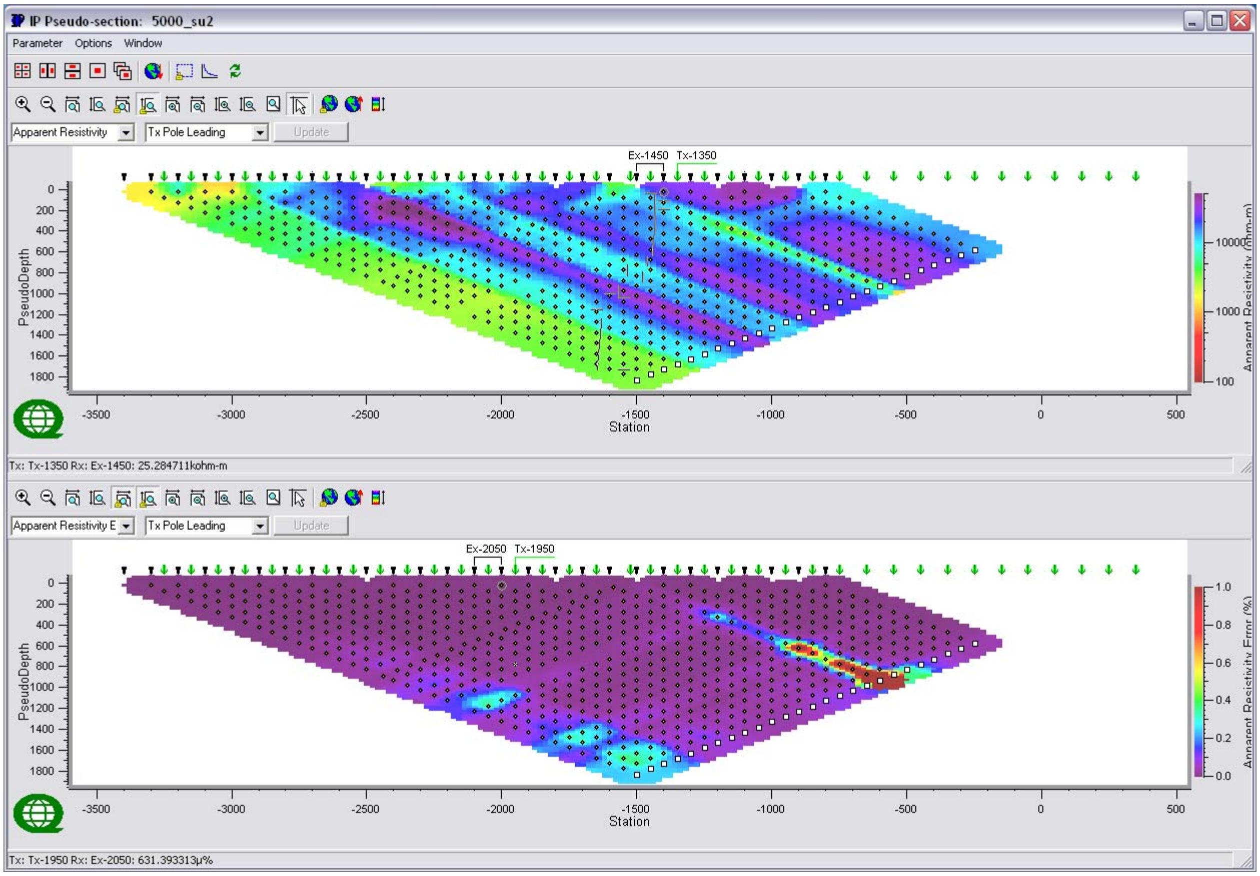
LINE 5000E SPREAD 1 – PHASE

TRANSMITTER TO THE SOUTH



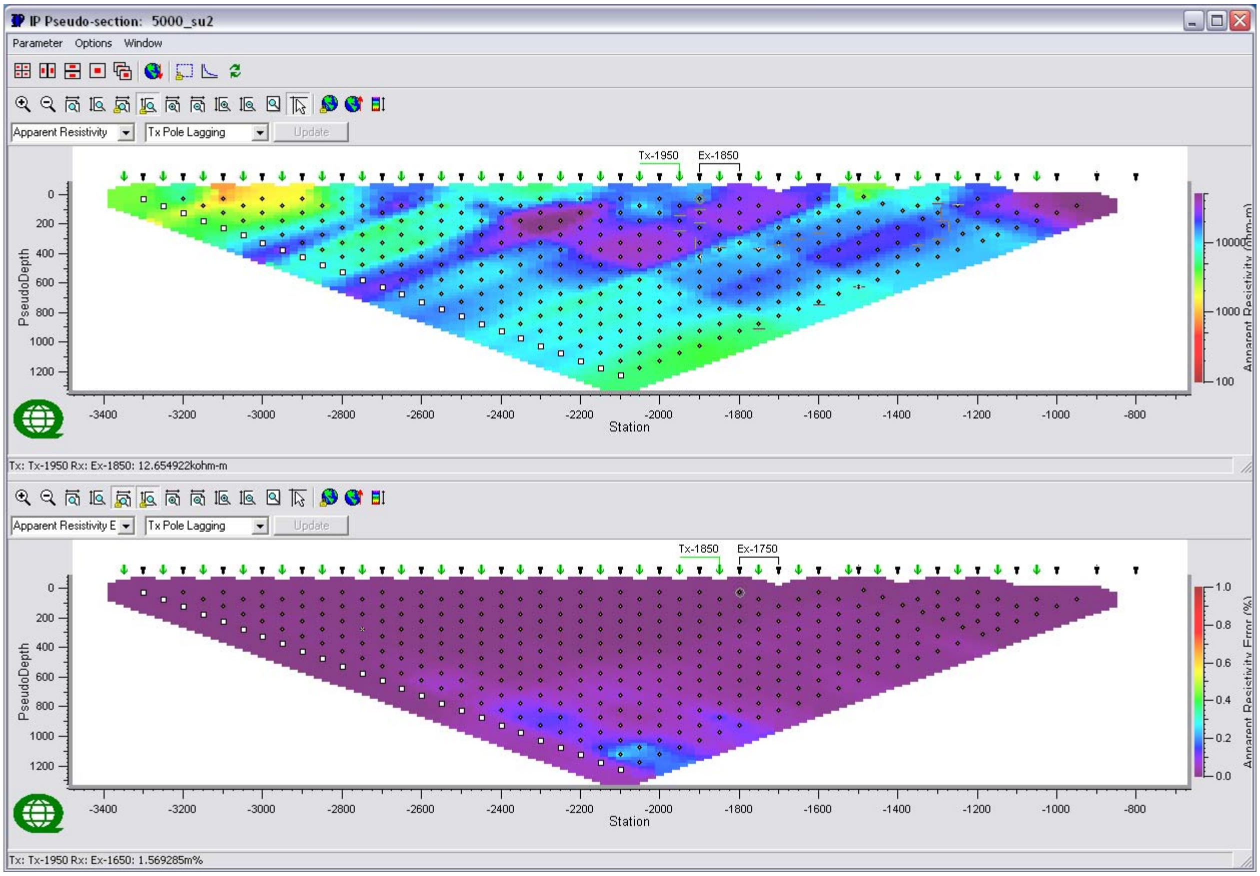
LINE 5000E SPREAD 2– APPARENT RESISTIVITY

TRANSMITTER TO THE NORTH



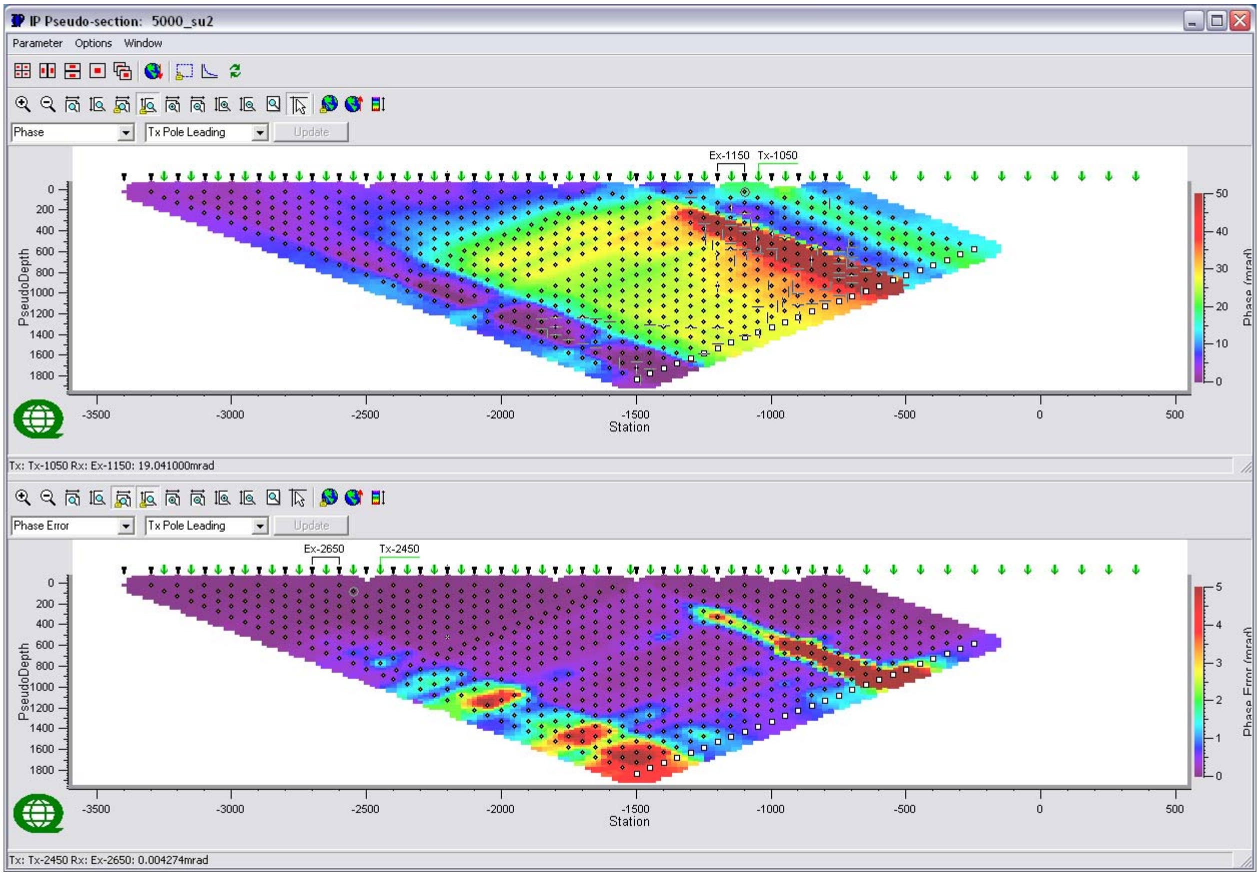
LINE 5000E SPREAD 2– APPARENT RESISTIVITY

TRANSMITTER TO THE SOUTH



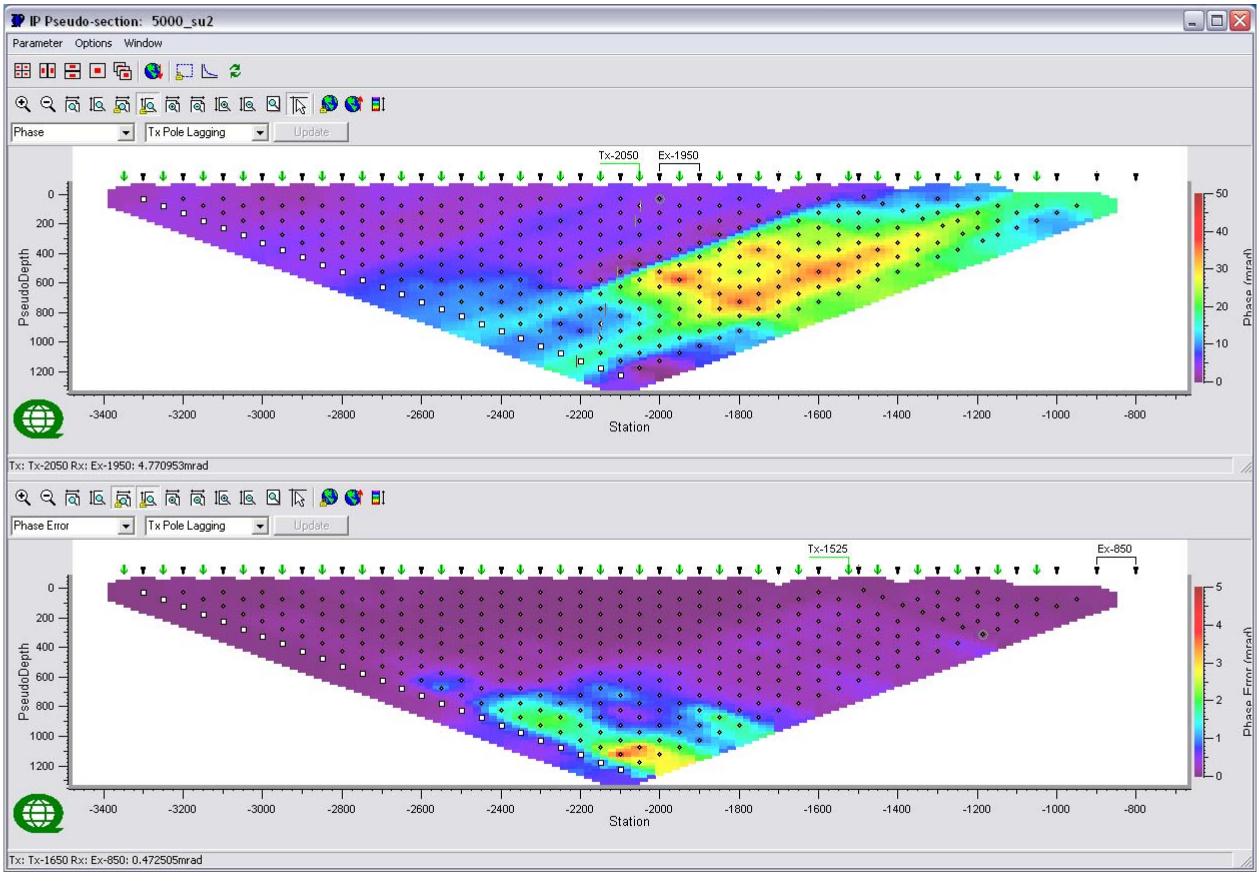
Line 5000E Spread 2 – Phase

Transmitter to the North



LINE 5000E SPREAD 2 – PHASE

TRANSMITTER TO THE SOUTH



APPENDIX B: PRODUCTION SUMMARY

DATE	DESCRIPTION	LINE	START	END	READ (m.)		TOTAL (Km.)	
					MT	IP	MT	IP
YOUNG DAVIDSON PROJECT								
Mar.18/07	**Mob to Kirkland Lake Set up Infinite High Frequency PST**							
Mar.19/07	**Start Line setup Low Frequency PST Set up remote Site**	L1000E	****	****	****	****	0.0	0.0
Mar.20/07	**Line setup**	L1000E	****	****	****	****	0.0	0.0
Mar.21/07	**Read IP Read MT- 120 only (d/t Lan problems)**	L1000E L1000E	2250S 200N	2050S 1900S	2100	200	2.1	.2
Mar. 22, 07	**No IP d/t xmtr cable Read MT**	L1000E	200N	1900S	2100	0	4.2	.2
Mar.23, 07	**Read IP – slow d/t Lan crashing**	L1000E	2250S	650N	0	2900	4.2	3.1
Mar. 24, 07	**Read MT**	L1000E	1600S	4100S	2500	0	6.7	3.1
Mar. 25, 07	**Read IP**	L1000E	650S	4050S	0	3400	6.7	6.5
Mar. 26.07	**No acquisition – moving to line 3400E (1800s – 4400s)**				0	0	6.7	6.5
Mar. 27, 07	**No acquisition – troubleshooting bad FAMs d/t lightning, Pick up remote to dry out equipment d/t excess water**				0	0	6.7	6.5
Mar. 28, 07	**Read IP Read MT Troubleshooting FAMs, infinite, xmtr problems Mt – no 120'S, 48'S poor**	L3400E L3400E	850s 4350s 1800s	1550s 3750s 4400s	2600	1300	9.3	7.8
Mar. 29, 07	**Read IP Read MT – 120's only d/t LAN problems**	L3400E L3400E	1650s 1800s	3650s 4400s	2600	2000	11.9	9.8
Mar. 30, 07	**Read MT – HF poor**	L3400E	1800S	4400S	2600	0	14.5	9.8
Mar. 31, 07	**Read MT**	L3400E	0	2600S	2600	0	17.1	9.8
Apr. 01, 07	**Read IP**	L3400E	550N	3650S	0	4200	17.1	14.0
Apr. 2, 07	**Read MT – poor hf, 3 bad dipoles**	L5000E	1400N	1200S	2600	0	19.7	14.0
Apr. 3, 07	**Read IP Read MT**	L5000E	1350N 1400N	2250S 1200S	2600	3600	22.3	17.6
Apr. 4, 07	**Read MT**	L5000E	800S	3400S	2600	0	24.9	17.6
Apr. 5, 07	**Read IP**	L5000E	350N	3350S	0	3700	24.9	21.3
Apr. 6, 07	**Pick up equipment**				0	0	24.9	21.3
Apr. 7, 07	**Demob**							

Survey days:	**19**			
Weather days:	**0**	**TOTAL PRODUCTION:**		
Mob-Demob days:	**2**		**MT:**	**24.9**
Days off:	**0**		**IP:**	**21.3**
Total Days:	**21**			