



Zonge Engineering and Research Organization (Australia) Pty Ltd

**Ngalia  
Gradient Array and Pole-dipole  
Induced Polarisation Survey**

**Logistics Summary**

**August-September 2017**

**For**

**Energy Metals Limited**

Compiled by:

S. Mann

Report No: 170308

Date : November 2017

**Zonge Engineering & Research Organization (Australia) Pty Ltd**

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2D Inversion model of the Yuendumu Thrust pole-dipole line

## **1. SUMMARY**

During August and September 2017, Zonge Engineering and Research Organization (Zonge) mobilised a three-person geophysical field crew to the Ngalia project near Vaughan Station in NT to conduct an Induced Polarisation (IP) survey for Energy Metals Limited. Information specific to this survey as provided to Zonge by Energy may be found within the "Survey\_Info" folder on the accompanying disc. Pre-survey information provided by Energy is presented in Appendix II.

A gradient IP survey with 25 metre dipoles and 50 metre line spacing was used and provided 912 data points over 39 lines and approximately 22.8 line kilometres on two grids. A single line of Pole-dipole IP was surveyed which provided 1.5 line kilometres of data at 50m station spacing.

Data quality and repeatability were monitored throughout the course of the survey which ensured that the best possible data was acquired given local conditions and time constraints. Throughout the survey data was provided to consulting geophysicist Nigel Cantwell from Resource Potentials.

## **2. IP INSTRUMENTATION**

A GDD GRX-32 IP receiver was used to take all of the data for this project. For gradient IP surveying data was recorded using single conductor wires. For pole-dipole surveying data was collected using multiconductor receiver cables. Receiver electrodes were porous ceramic pots filled with copper sulphate.

IP transmitted fields were generated using a Zonge GGT-30 Geophysical Transmitter. Signal frequency was controlled directly by a Zonge XMT controller; synchronisation with transmitted waveform is achieved automatically by the receiver.

The raw data from each day was downloaded every evening from the receiver to a laptop computer and emailed to Zonge's Adelaide office. Data quality control and editing were completed in Zonge Engineering's Adelaide office.

### 3. IP SURVEY PARAMETERS

All data recorded during this survey was taken using the GDD GRX-32 Time Domain IP receiver using a frequency of 0.125 Hertz. Chargeability (Mx) is recorded on the receiver using a calculation over 13 logarithmically spaced windows, decay magnitudes are also recorded so that Mx can be redefined in processing.

Gradient array lines were all of the same length within each grid but grids varied in size as shown in Table 1. Station numbers reflect distance along line in metres. The Dingo's Rest grid was oriented at 081°T with local grid system defined by Resource Potentials. The Walbiri grid was orientated true north-south with line and station numbers reflecting truncated UTM coordinates. The pole-dipole line at Yuendumu Thrust was oriented true north-south and used 50m station and receiver dipole size. Pole-dipole data was recorded to n=24 with coverage tapering to n=1 at ends of line. All line specifications are listed below in Table 1, all UTM coordinates provided are in GDA94 z52.

**Table 1 Survey line specifications**

Grid	Line	Start Station *			End Station *			Rx Dipole	Number of Stations	Line length (m) *	Array Type
		Local	UTM mE/mN		Local	UTM mE/mN					
		m	mE	mN	m	mE	mN	m			
Dingo's Rest	0	0	730800	7525341	600	731393	7525436	25	24	600	Gradient
Dingo's Rest	50	0	730793	7525391	600	731385	7525485	25	24	600	Gradient
Dingo's Rest	100	0	730785	7525441	600	731378	7525535	25	24	600	Gradient
Dingo's Rest	150	0	730777	7525490	600	731370	7525584	25	24	600	Gradient
Dingo's Rest	200	0	730769	7525539	600	731362	7525633	25	24	600	Gradient
Dingo's Rest	250	0	730761	7525589	600	731354	7525683	25	24	600	Gradient
Dingo's Rest	300	0	730754	7525638	600	731346	7525732	25	24	600	Gradient
Dingo's Rest	350	0	730746	7525688	600	731338	7525781	25	24	600	Gradient
Dingo's Rest	400	0	730738	7525737	600	731331	7525831	25	24	600	Gradient
Dingo's Rest	450	0	730730	7525786	600	731323	7525880	25	24	600	Gradient
Dingo's Rest	500	0	730722	7525836	600	731315	7525930	25	24	600	Gradient
Dingo's Rest	550	0	730715	7525885	600	731307	7525979	25	24	600	Gradient
Dingo's Rest	600	0	730707	7525934	600	731299	7526028	25	24	600	Gradient
Dingo's Rest	650	0	730699	7525984	600	731291	7526078	25	24	600	Gradient
Dingo's Rest	700	0	730691	7526033	600	731284	7526127	25	24	600	Gradient
Dingo's Rest	750	0	730683	7526083	600	731276	7526177	25	24	600	Gradient
Dingo's Rest	800	0	730675	7526132	600	731268	7526226	25	24	600	Gradient
Dingo's Rest	850	0	730668	7526181	600	731260	7526275	25	24	600	Gradient
Dingo's Rest	900	0	730660	7526231	600	731252	7526325	25	24	600	Gradient
Dingo's Rest	950	0	730652	7526280	600	731245	7526374	25	24	600	Gradient
Dingo's Rest	1000	0	730644	7526330	600	731237	7526423	25	24	600	Gradient
Dingo's Rest	1050	0	730636	7526379	600	731229	7526473	25	24	600	Gradient
Dingo's Rest	1100	0	730628	7526428	600	731221	7526522	25	24	600	Gradient
Dingo's Rest	1150	0	730621	7526478	600	731213	7526572	25	24	600	Gradient
Dingo's Rest	1200	0	730613	7526527	600	731205	7526621	25	24	600	Gradient
Dingo's Rest	600	-500 (Tx West)	730213	7525856	1100 (Tx East)	731793	7526107	N/A	N/A	N/A	Gradient
Walbiri	300	6725	765300	7526725	7325	765300	7527325	25	24	600	Gradient
Walbiri	350	6725	765350	7526725	7325	765350	7527325	25	24	600	Gradient
Walbiri	400	6725	765400	7526725	7325	765400	7527325	25	24	600	Gradient
Walbiri	450	6725	765450	7526725	7325	765450	7527325	25	24	600	Gradient
Walbiri	500	6725	765500	7526725	7325	765500	7527325	25	24	600	Gradient
Walbiri	550	6725	765550	7526725	7325	765550	7527325	25	24	600	Gradient
Walbiri	600	6725	765600	7526725	7325	765600	7527325	25	24	600	Gradient
Walbiri	650	6725	765650	7526725	7325	765650	7527325	25	24	600	Gradient
Walbiri	700	6725	765700	7526725	7325	765700	7527325	25	24	600	Gradient
Walbiri	750	6725	765750	7526725	7325	765750	7527325	25	24	600	Gradient
Walbiri	800	6725	765800	7526725	7325	765800	7527325	25	24	600	Gradient
Walbiri	850	6725	765850	7526725	7325	765850	7527325	25	24	600	Gradient
Walbiri	900	6725	765900	7526725	7325	765900	7527325	25	24	600	Gradient
Walbiri	600	6225 (Tx South)	765600	7526225	7825 (Tx North)	765600	7527825	N/A	N/A	N/A	Gradient
Yuendumu	694000	2300	694000	7532300	3800	694000	7533850	50	31	1500	Pole-dipole

\* Start and End locations are taken from maximum extent of receiver electrodes.

#### **4. PRODUCTION ISSUES AND SUMMARY**

No safety related incidents were reported during the survey however some minor delays due to equipment failure were experienced. Travel into Alice Springs was required on two occasions to repair one of the crew's vehicles and to pick up equipment required for the pole-dipole surveying.

All safety information and other documentation produced by Zonge or provided to Zonge in execution of this survey, including the above incident reports can be found on accompanying disc under "*Safety\_Documentation*".

Appendix I provides a summary of the production of Job 170308. More detailed information on daily production may be found on the accompanying disc under "*Production Reports*".

#### **5. DATA PROCESSING**

The quality of each block of raw GradIP data was examined and edited using Scientific Computing Applications TQIP software before being averaged to create a single averaged record for each data point. Blocks or channels that were considered of poor quality were skipped before averaging each station's data. All raw data taken during this survey as well as TQIP database are included on the accompanying disc so that this data may be re-averaged if necessary. Data was provided to Nigel Cantwell of Resource Potentials during the survey for review and plotting.

No plotting, modelling or interpretation of the gradient data was performed by Zonge however inversion modelling of the pole-dipole data was provided and is presented in Appendix III.

## 6. EXPLANATION OF FILES

Digital data is provided on CD along with paper plots of the data. Data from each surveyed line are placed in the following directory structure on the accompanying CD:

*Processed\_Data\line#*. File formats are explained below:

<b>*.DAT</b>	AMIRA style text files containing averaged and edited resistivity and chargeability information produced by TQIP
<b>*.KML</b>	Google Earth file containing line and station positions and labels
<b>*.MDB</b>	TQIP database containing all survey data
<b>*.PDF</b>	Adobe Acrobat Portable Document File containing plot files, field reports and logistics report
<b>*.STN</b>	Text files containing station number, easting, northing and elevation information for each line
<b>*.DAT, *.GDD</b>	raw data as downloaded from the GDD receiver

## **APPENDIX I**

### **Job 170308 Production Summary**





# Zonge Engineering & Research Organization (Aust) Pty Ltd

## JOB HOURS SUMMARY

Job No.: 170308

Date: 26/08/2017

Client: Energy Metals Ltd

By: Trevor Shephard

Project Name: Ngalia Regional

Summary Sheet: 1 of 1

DATE	Production Hours			Misc Hours		Hire	Comments
	Mobe	3 man	2 man	Standby (3 man)	Weather (3 man)	ATV	
26-Aug-2017	13						Mobilisation from Adelaide to Marla Roadhouse - Overnight
27-Aug-2017	9.25						Continue Mobilisation from Marla to Tilmouth well - overnight
28-Aug-2017							Camp not setup - Drive back to Tilmouth Well - overnight
29-Aug-2017	4			6			Mobe from Tilmouth Well to Bigryi Camp - Assist with camp setup
30-Aug-2017		5.5		4.5			Inductions - Prestarts - unload and reload vehicles - Prep TX pit on grid
31-Aug-2017		12.25					Vehicle Prestarts + load - Prep TX grid + set up RX - Acquire Data on DRS grid
1-Sep-2017		12					Vehicle Prestarts + load - Drive to DRS grid - setup Rx - Acquire Data on DRS grid
2-Sep-2017		12.25					Vehicle Prestarts + load - Drive to DRS grid - setup Rx - Acquire Data on DRS grid
3-Sep-2017		12.75					Vehicle Prestarts + load - Drive to DRS grid - setup Rx - Acquire Data on DRS grid
4-Sep-2017		12					Vehicle Prestarts + load - Drive to DRS grid - setup Rx - Acquire Data on DRS grid
5-Sep-2017		12					Vehicle Prestarts + load - Drive to DRS grid - setup Rx - Acquire Data on DRS grid
6-Sep-2017		11.25	1				Load vehicles - Drive to DRS grid + Pack up - Start setup on Walbiri grid
7-Sep-2017		10.25					Prestarts + load - Drive to Walbiri grid + Set up - Acquire data
8-Sep-2017		11.5					Prestarts + load vehicles - Drive to Walbiri grid - Acquire data
9-Sep-2017		12.5					Prestarts + load vehicles - Drive to Walbiri grid - Acquire data - Pack up
10-Sep-2017		11.5					Prestarts + Load vehicles - Drive to DDIP Line 694000 - start Prep
11-Sep-2017							Prestarts + Drive to Alice Springs + Collect Troopie part, equipment + food supplies
12-Sep-2017		12.75					Prestarts - Prep Line 694000 at Yuendumu West - Acquire data on line 694000
13-Sep-2017		11.75	0.75				Prestarts - Acquire data - Pack up and reset line into Pole Dipole
14-Sep-2017		6					Prestarts - Drive to YuendumuWest DDIP line - Prep remote pit and TX wire
15-Sep-2017			6.5				Prestarts - Drive to YuendumuWest DDIP line - Rewater + prep pits
16-Sep-2017		12					Prestarts - Acquire data - Drive back to camp + Put equipment on charge
17-Sep-2017		10.25		2.25			Prestarts - Acquire data - Drive back to camp + Sort equipment and load vehicles
18-Sep-2017	7						Prestarts + load vehicles - De-mobe From camp to Alice Springs - overnight
19-Sep-2017	12.25						Prestarts continue De-mobe From Alice Springs to Glendambo
20-Sep-2017	8.25						Prestarts vehicles - Continue De-mobe from Glendambo to Adelaide
TOTALS	TOTAL HOURS						
	Mobe	3 man	2 man	Standby (3 man)	Weather (3 man)	ATV	
Sub Totals	53.75	188.5	8.25	12.75	0	0	
Totals	53.75	188.5	8.25	12.75	0	0	
Rate p/hr		315	275	157.5	0	0	
Billable Total	\$4,000.00	\$59,377.50	\$2,268.75	\$2,008.15	\$0.00	\$0.00	

## **APPENDIX II**

Pre Survey Information provided by Energy Metals



# PRE SURVEY CLIENT CHECKLIST

**Date last modified:** 1-8-17

**Survey Details (Please attach maps or relevant documents)**

1.	Zonge Job Number:	<b>170308</b>				
2.	Zonge Representative Managing Survey:	<b>Simon Mann</b>				
3.	Client Company:	<b>Energy Metals Ltd</b>				
4.	Client Representative Planning Survey: Crew Chief:	<b>Matt Owers (ResPot)</b> <a href="mailto:MattO@respot.com.au">MattO@respot.com.au</a> <b>Wayne Taylor (EME)</b> <a href="mailto:wayne@energymetals.net">wayne@energymetals.net</a> <b>Rajab Lokiri</b>				
5.	Survey / Project Name:	<b>Ngalia Regional</b>				
6.	Exploration License Number:	<b>EL24453, EL24463, EL30144 (GAIP), EL24451 (DD)</b>				
7.	Coordinate Datum / Zone to be used:	<b>GAIP Surveys: 52; Dipole-Dipole Survey: 53</b>				
8.	Survey Type:	<b>Gradient IP/Dipole Dipole IP and Pole Dipole IP</b>				
9.	Survey area or line priority:	DRS (Dingo's Rest South)	GAIP	1200 x 600m	50 m	25 m
		Penrynth	GAIP	600 x 600m	50 m	25 m
		Walbiri	GAIP	600 x 600m	50 m	25 m
		Malawiri	DDIP / PDIP	1	1000 m	50 or 100 m
10.	Station / Dipole Spacing:	<b>As above</b>				



## PRE SURVEY CLIENT CHECKLIST

11.	Frequency:	0.125 Hz (time-domain)
12.	Data coverage required for IP:	GAIP: 50m line separation, 600m or 1200m lines
13.	Can the crew contact the client representative out of hours ( <b>weekends</b> ) if necessary?	<b>Matt Owers (ResPot) Mob. 0434 039 405</b> <b>Wayne Taylor (EME) Mob. 0415 863 871</b>
14.	Will Zonge be required to perform specific processing or inversion modeling on the data acquired?	<b>Yes, no charge for single line</b>
15.	Will the client require a hardcopy of the logistics report as well as digital?	<b>Yes</b>
16.	Will the client require a hard copy of safety documents and or MSDS?	<b>No</b>

### Site Details (please provide information where possible)

17.	Crew Accommodation:	<b>Bigirlyi Camp (GAIP Surveys) – food, accommodation and diesel provided (no alcohol permitted)</b> <b>Tilmouth Roadhouse (DD Survey) – Zonge to book directly (08) 8956 8777 <a href="mailto:tilmouthwell@ngur.com.au">tilmouthwell@ngur.com.au</a></b>
18.	Client contact for crew ( <i>name, phone and email</i> ):	<b>Wayne Taylor</b> <b>(08) 8956 4944 – Bigirlyi Camp landline</b> <b>(08) 9322 6904 – Perth office</b>
19.	Relevant site liaison contacts ( <i>name, phone and email</i> ):	<b>Wayne Taylor, Daniel Jordan, David Millward</b> <b>(08) 8956 4944 – Bigirlyi Camp landline</b> <b>(08) 9322 6904 – Perth office</b>
20.	Will Zonge crew be required to contact landowners or other external interested parties?	<b>No</b>
21.	Have all stakeholders been made aware of hazards relating to our operations? ( <i>please distribute Form 82 as required</i> )	<b>Advice will go out to stakeholders 3 weeks prior to start of the survey once we have a start date</b>
22.	Level of mobile phone coverage at accommodation or survey area:	<b>None</b>
23.	Please describe level of vehicle access along survey lines and expected topography ( <i>attach photos or maps if possible</i> ):	<b>Walbiri South – good access along Sandstone Bore track which passes through the grid, grid is flat grassy shrubland with minor mulga thickets in the south. Penrynth – access from west or east on old tracks, grid mostly flat grassy shrubland one low hill in north. DRS – access via Camel Flat</b>



## PRE SURVEY CLIENT CHECKLIST

		Road which passes through NE corner of grid, terrain is mostly flat spinifex-mallee sandplain with some mulga thickets in centre. North tx pit may need to be moved 30m off hillside.
24.	Known obstacles along lines ( <i>fences, roads etc</i> ):	DD Line is located 700m south of the Tanami Highway and 900m north of the Newhaven Road GAIP – roads as discussed above
25.	Are cultural noise sources present ( <i>power lines, fences, houses etc</i> )?	No
26.	Please describe access to nearest water source, both potable and non potable:	GAIP: Bigirlyi Camp or Turkey's Nest Bore, DD: Tilmouth Well or Witchetty Bore (spare submersible pump required for this bore). 1000 litre pods available at camp for water transport.
27.	Are large volumes of water available for grounded electrodes ( <i>up to ~2000L/day</i> )?	Yes
28.	Are there cultural or environmental restrictions the crew should be aware of?	Yes, no alcohol rule at Bigirlyi camp, but no restrictions at Tilmouth Well. A heritage sites map will be provided to the crew during induction.
29.	Please describe nearest refueling location ( <i>diesel and petrol</i> ):	Bigirlyi camp – diesel only Yuendumu & Tilmouth Well – diesel & petrol
30.	Do you require daily or scheduled contact with crew?	Yes – routine sked call
31.	Will the crew be required to work around other personnel?	No
32.	Please describe requirements (if any) for crew to work on site ( <i>restricted work hours, induction, drug test, PPE etc</i> ):	Site induction at Bigirlyi camp
33.	Have the lines been flagged prior to crew arrival?	No
34.	What level of rehabilitation of transmitter electrodes is required?	Please fully rehabilitate electrode locations
35.	Will a client based Emergency Response Plan be available? ( <i>If so please attach copy</i> )	Yes – copy provided during induction
36.	Will there be stock or animals in the survey area?	Yes – occasional cattle, kangaroos, dingos, emus



## PRE SURVEY CLIENT CHECKLIST

37.	Please describe vehicle requirements and site inspection checklist (where relevant): <i>e.g. no split rims, flashing lights etc.</i>	<b>No requirements – tune UHF radios to channel 38</b>
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Form reviewed by \_\_\_\_\_ **Wayne Taylor** \_\_\_\_\_ (if applicable)

Date: \_\_\_\_\_ **1/8/17** \_\_\_\_\_

Form reviewed by \_\_\_\_\_ (if applicable)

Date: \_\_\_\_\_

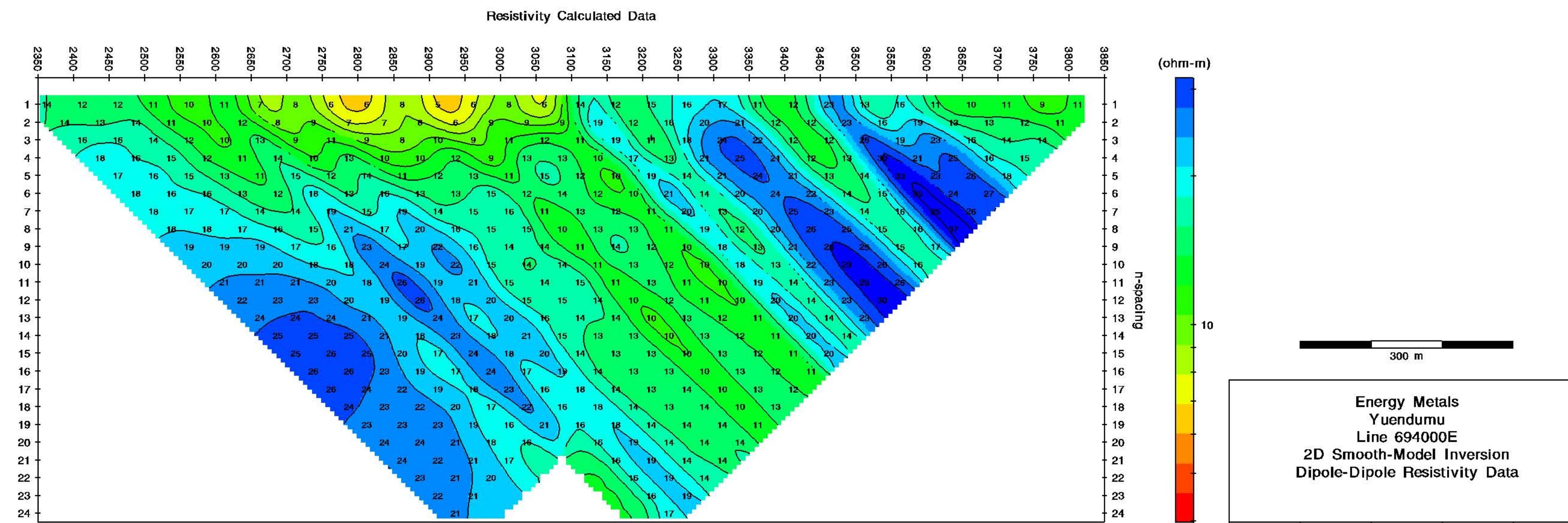
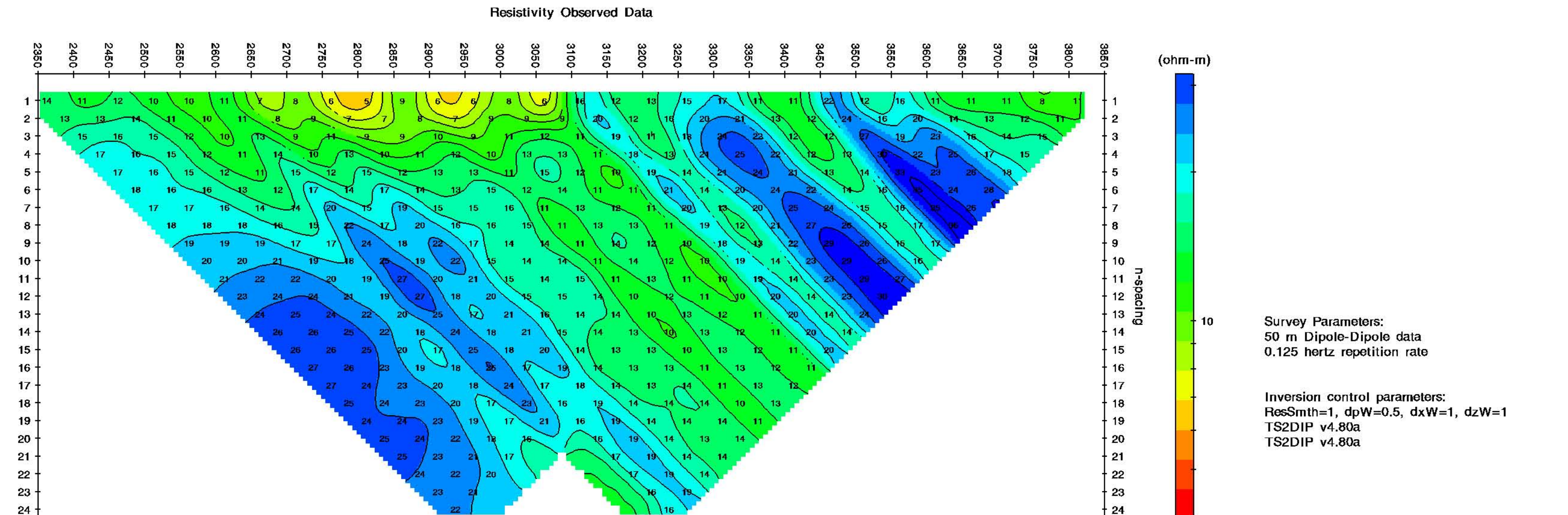
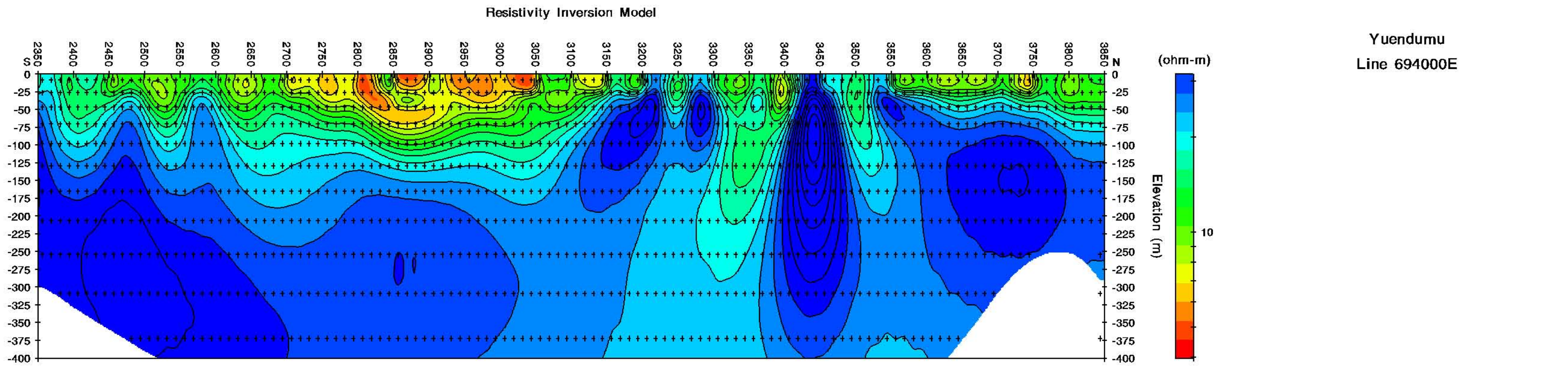
Form reviewed by \_\_\_\_\_ (if applicable)

Date: \_\_\_\_\_

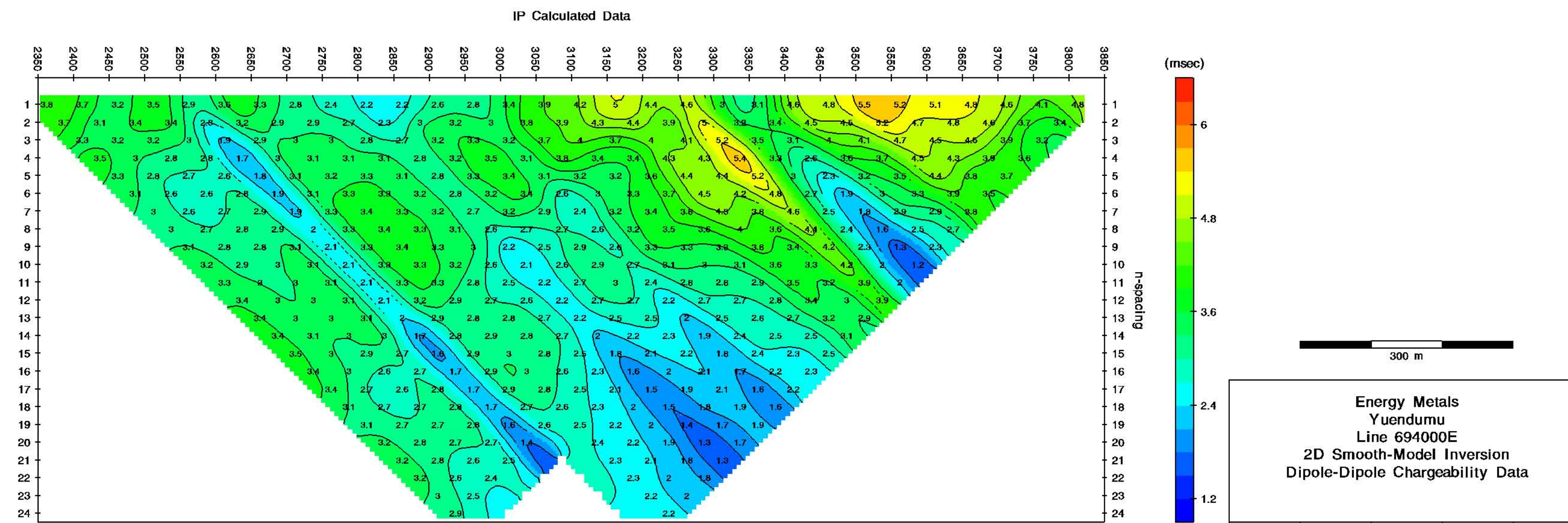
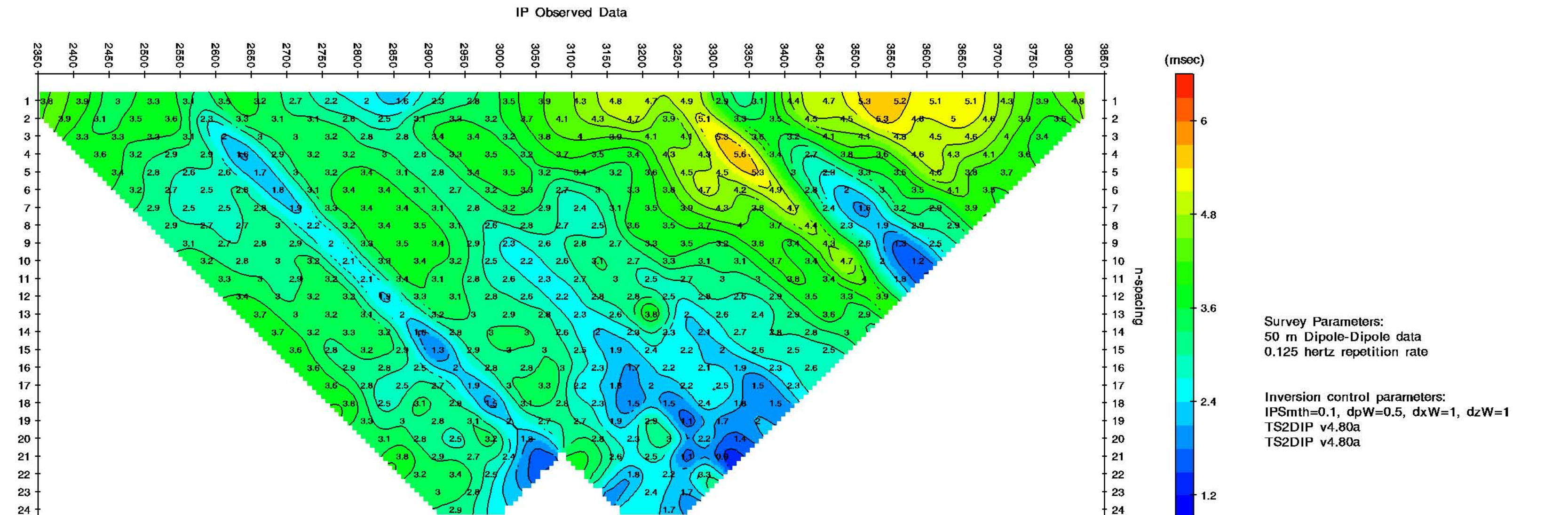
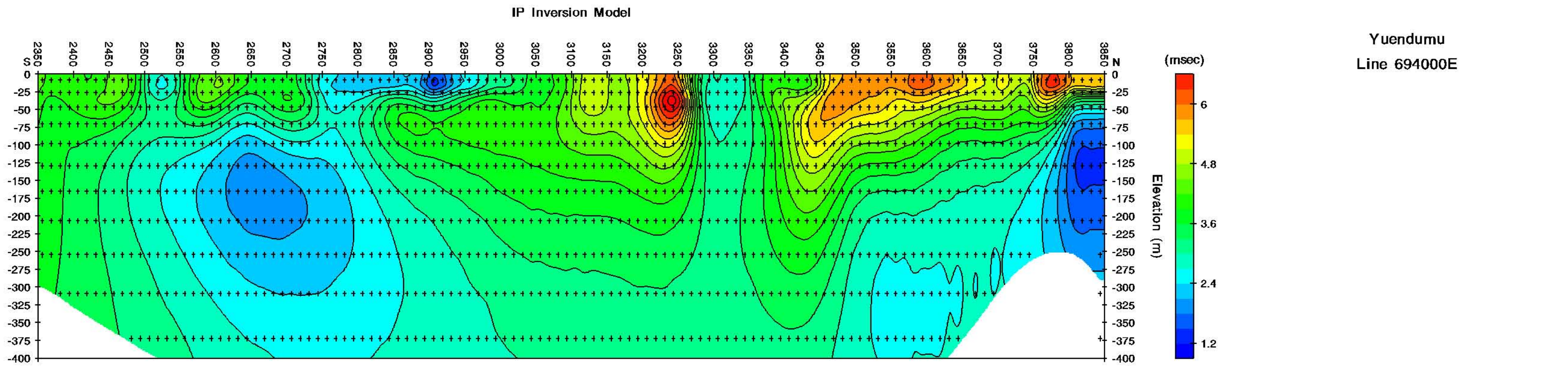
### **APPENDIX III**

2D Inversion model of the Yuendumu Thrust pole-dipole line









Energy Metals  
Yuendumu  
Line 694000E  
2D Smooth-Model Inversion  
Dipole-Dipole Chargeability Data

AUTHOR	DRAWN	DATE	SCALE	REPORT
Zonge	Zonge	17/09/17	1:5000	170308