Interpretation of 2010 VTEM Survey Data

Hellyer Corridor Project Area

For

Bass Metals Limited

By

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(JSA Pty Ltd)

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SUMMARY

The VTEM survey over the Hellyer Corridor Project area did not identify any responses that could be reconciled with the EM effects from a bedrock VMS style conductor source.

Two culture style anomalies which appear to be in an area not known to contain culture are however recommended for a ground check.

1. INTRODUCTION

In April 2010 a 595 kilometre airborne VTEM 25 Hz TDEM data set was collected the over the Hellyer Corridor Project Area in North West Tasmania (Figure 1). Geotech Airborne Limited performed the survey on behalf of Bass Metals Limited. The purpose of the survey was to detect conductive volcanogenic massive sulphides (VMS) within the survey area containing previously mined zinc-lead-silver-gold mineralization. The purpose of this report is to present the analysis of the VTEM data and the identification of potential targets representing mineralisation.

2. SURVEY EQUIPMENT

Airborne EM data was collected using the VTEM electromagnetic and magnetic system, with a base operating frequency of 25 Hz. Real times differential GPS was used for navigation and the data was collected at nominal 100 meter line spacing .

Table 1: Airborne Equipment Specifications

System Parameters		**VTEM 25 hz** Specifications
Navigation		Real time Differential GPS
Nominal aircraft speed (m/s)		30
Geometry	Transmitter height Above ground level (m agl) (Nominal terrain clearance)	35
	Receiver Bird Height (agl, m)	35
	Tx-Rx horizontal separation (m)	0
Transmitter	Coil Axis	Vertical
	Signal	Square Trapezoidal
	Base frequency (Hz)	25
	Repetition rate (pulses per second)	35
	Pulse width (microseconds)	7340
	Loop area (square metres)	530
	Number of turns	4
	Peak Current (amps)	190
	Tx loop dipole moment (Am^2)	4.08×10^5
Receiver	Coil Axes	Z
	Sample Interval (seconds)	0.10
	Channel times	see Table 2

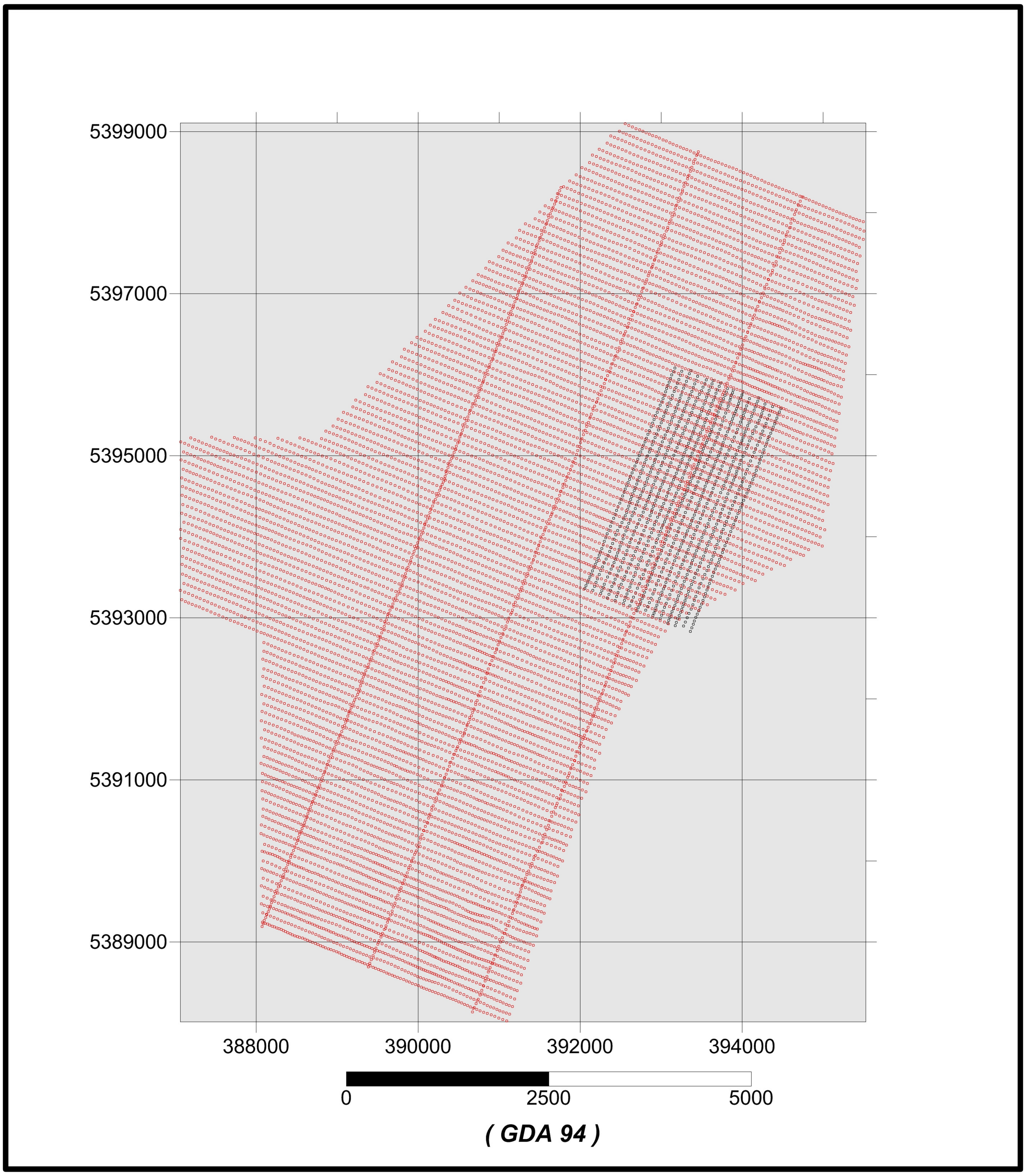

Figure 1: Outline of Hellyer Corridor Project Survey

Table 2: Receiver Channel Positions

B-field VTEM Decay Sampling scheme				
Channel	**Microseconds**			
Index	**Middle**	**Start**	**End**	**Width**
0	0	-3	3	6
1	5	3	8	5
2	10	8	13	5
3	16	13	18	5
4	21	18	23	5
5	26	23	29	5
6	31	29	34	5
7	36	34	39	5
8	42	39	45	6
9	48	45	51	7
10	55	51	59	8
11	63	59	68	9
12	73	68	78	10
13	83	78	90	12
14	96	90	103	13
15	110	103	118	15
16	126	118	136	18
17	145	136	156	20
18	167	156	179	23
19	192	179	206	27
20	220	206	236	30
21	253	236	271	35
22	290	271	312	40
23	333	312	358	46
24	383	358	411	53
25	440	411	472	61
26	505	472	543	70
27	580	543	623	81
28	667	623	716	93
29	766	716	823	107
30	880	823	945	122
31	1010	945	1086	141
32	1161	1086	1247	161
33	1333	1247	1432	185
34	1531	1432	1646	214
35	1760	1646	1891	245
36	2021	1891	2172	281
37	2323	2172	2495	323
38	2667	2495	2865	370
39	3063	2865	3292	427
40	3521	3292	3781	490
41	4042	3781	4341	560
42	4641	4341	4987	646
43	5333	4987	5729	742
44	6125	5729	6581	852
45	7036	6581	7560	979
46	8083	7560	8685	1125
47	9286	8685	9977	1292
48	10667	9977	11458	1482
49	12250	11458	13161	1703

3. DATA CHARACTERICS AND QUALITY

VTEM EM data over the Hellyer Corridor Project exploration area as illustrated by Figure 2 and 2a , covers a wide dynamic range with a number of conductive (high signal levels) areas set in amongst highly resistive blocks with virtually zero background response. The image of the power line monitor identifies power lines within the survey area (Figure 2b) with many of the conductive features closely following the power line trends. The extensive broad lithological conductors seem to be related to the conductive (poorly conductive) shales within the survey area.

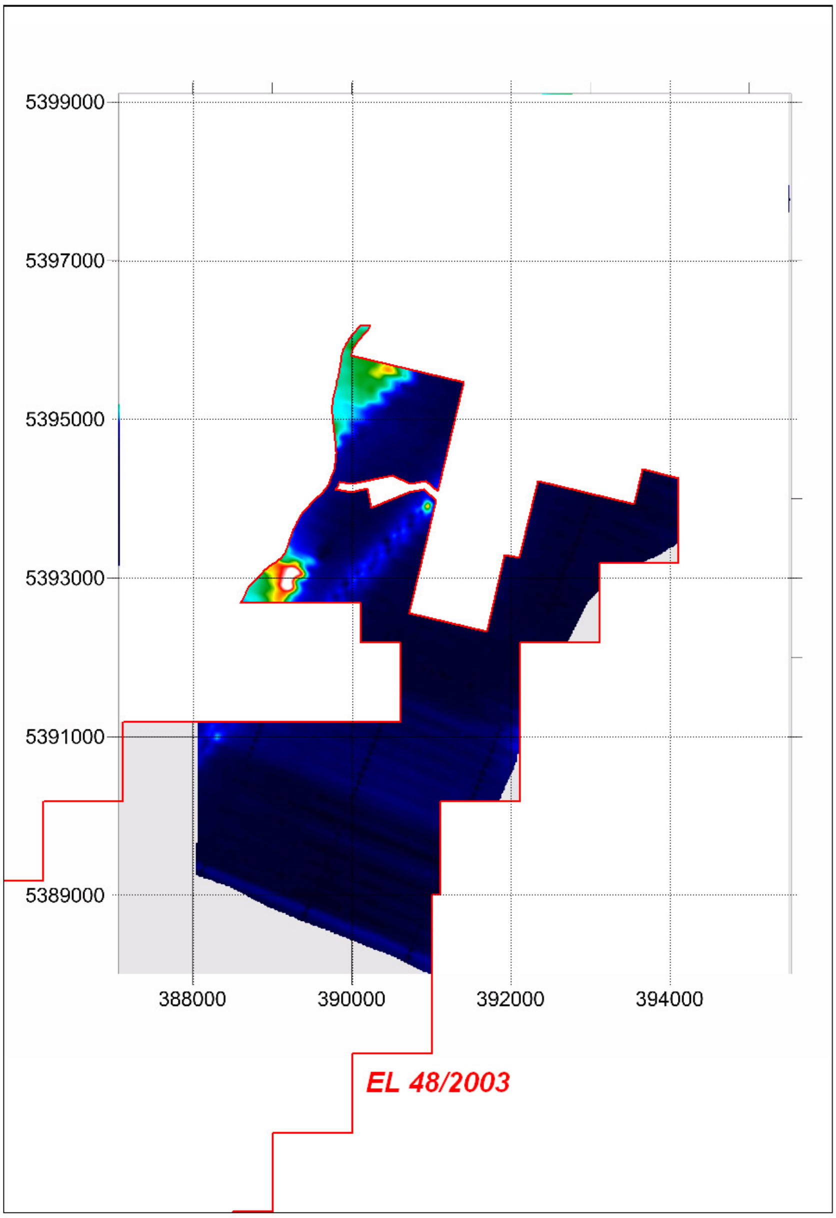

Figure 2. VTEM: Z component, Channel 15 (0.10 milliseconds)

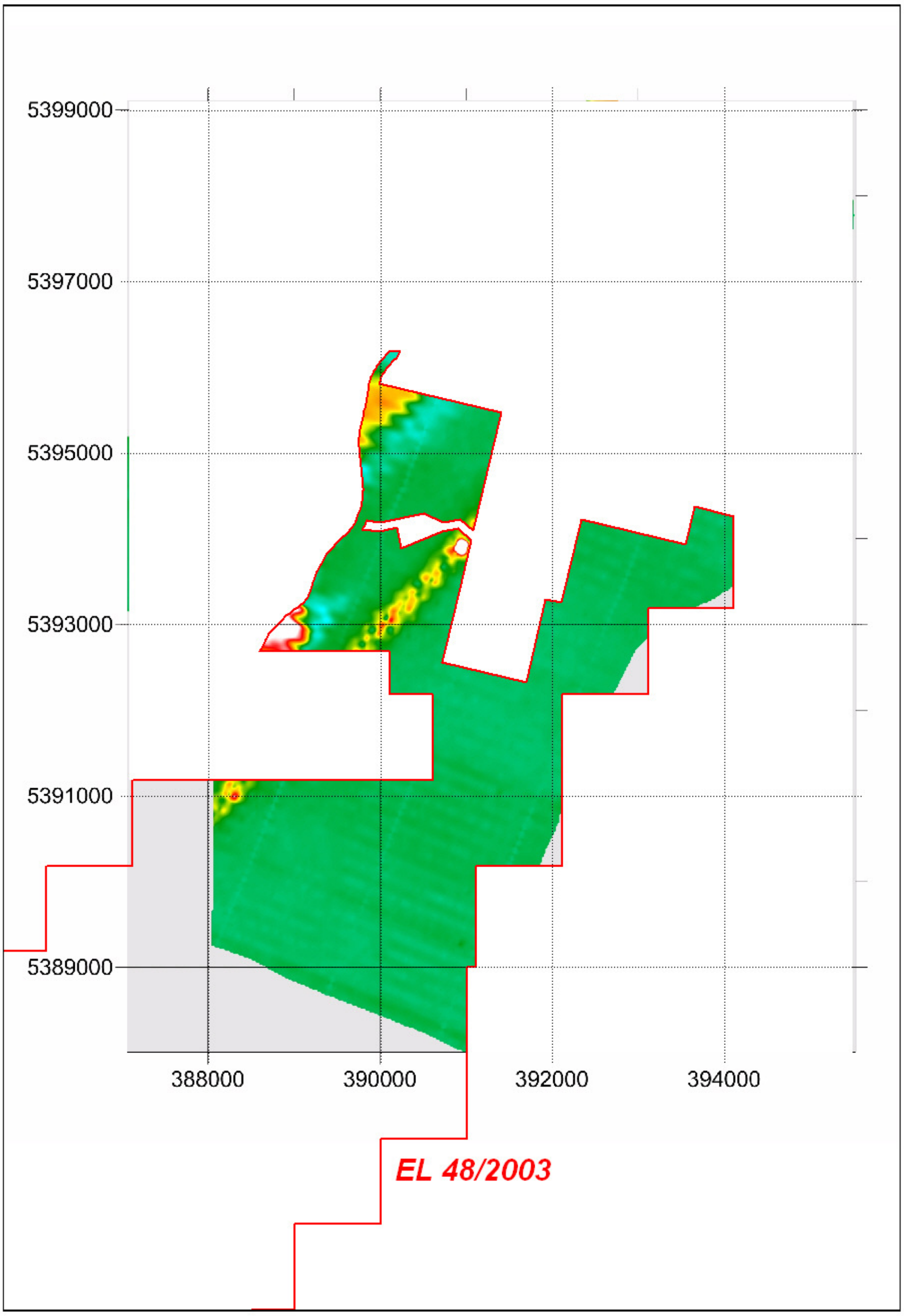

Figure 2a. VTEM : Z component channel 30 (0.88 millisecond)

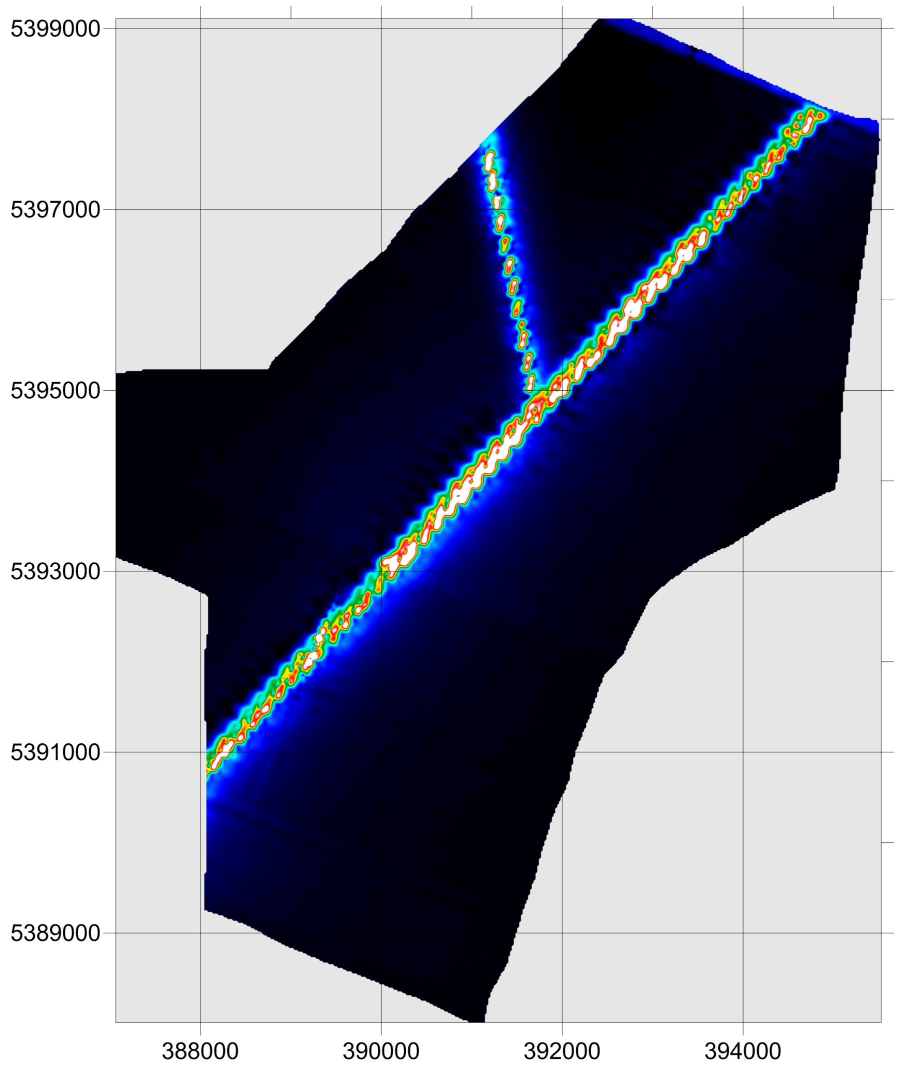

Figure 2b. VTEM: Powerline monitor

3.1 Data Noise Levels

By analysing the spatial characteristics of the data over areas with relatively flat background response estimates of standard deviation of the noise levels (envelopes) were for various time channels were derived .They are shown in Table 3 and quoted in units of picoTeslas/second (pT/s) . These data noise estimate values were then used in all subsequent data analysis, such as inversion processes, time constant calculations and estimates of the system's depth of penetration.

Table 3: Estimates of systems noise levels

Channel	EM Data Noise Standard Deviation pT/s
11	7215
12	6716
13	5201
14	5094
15	4801
16	4901
17	4501
18	4578
19	4268
20	4110
21	3951
22	2844
23	1867
24	1477
25	1121
26	1004
27	968
28	840
29	865
30	738
31	719
32	798
33	652
34	605
35	596
36	476
37	447
38	424
39	331
40	330
41	309
42	300
43	298
44	290
45	299

Channel	EM Data Noise Standard Deviation pT/s
46	295
47	277
48	273

3.2 VTEM response over 3D conductive targets

To illustrate the characteristics of the VTEM system a number of theoretical model responses were generated for a 200 by 200 meter and 100 by 100 meter sheet (thin plate) conductor with a moderate conductivity-thickness product of 150 Siemens with variable depths to top and dips. The target was set in a typical resistivity environment for the survey area, a thin 100 ohm-meter layer over a relatively resistive basement of 1500 ohm-meters.

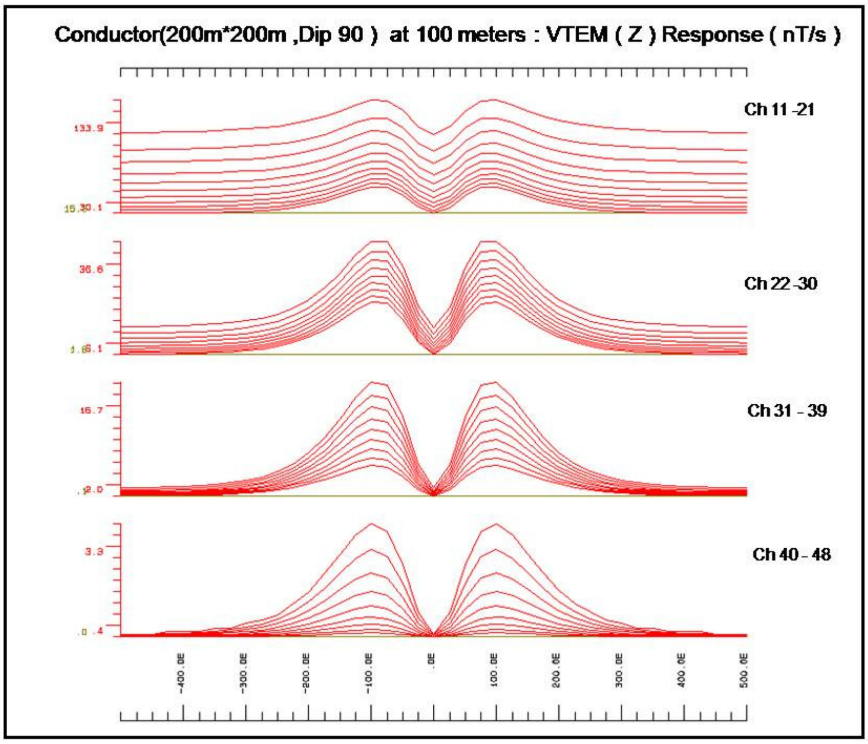

*Figure 3. Conductor (200m*200m, Dip 90) at 100 meters : VTEM (Z) Responses (nT/s)*

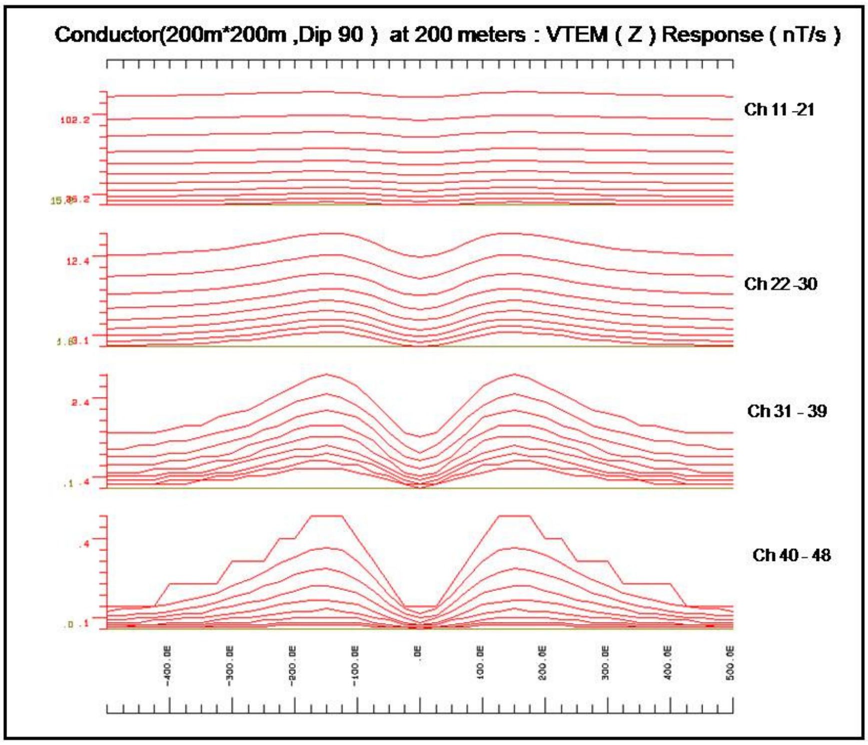

*Figure 3a. Conductor (200m*200m, Dip 90) at 200 meters : VTEM (Z) Responses (nT/s)*

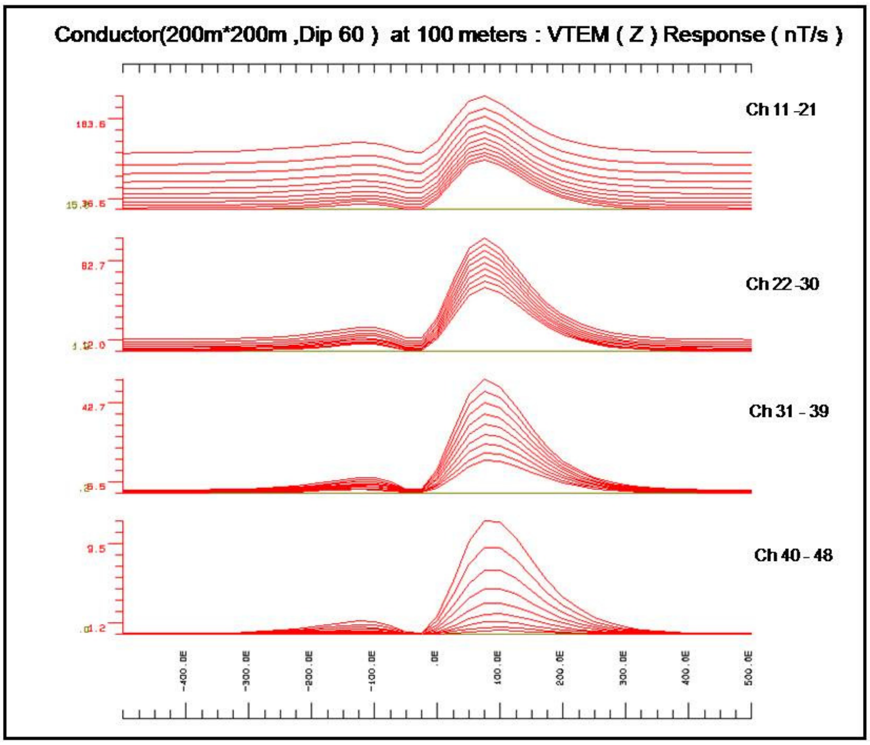

*Figure 3b. Conductor (200m*200m, Dip 60) at 100 meters : VTEM (Z) Responses (nT/s)*

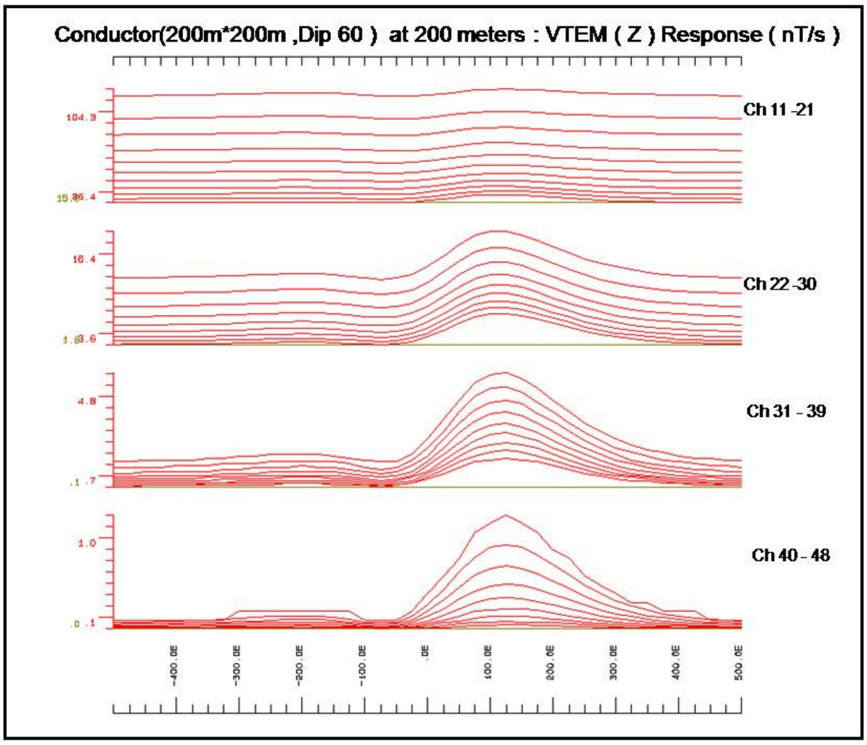

*Figure 3c. Conductor (200m*200m, Dip 60) at 200 meters : VTEM (Z) Responses (nT/s)*

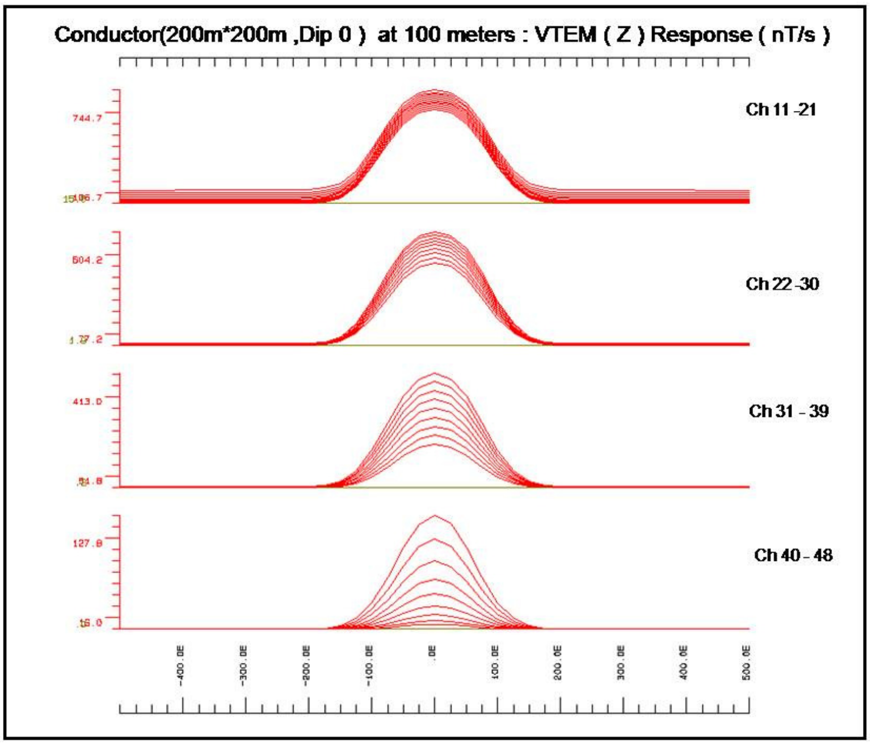

*Figure 3d. Conductor (200m*200m, Dip 0) at 100 meters : VTEM (Z) Responses (nT/s)*

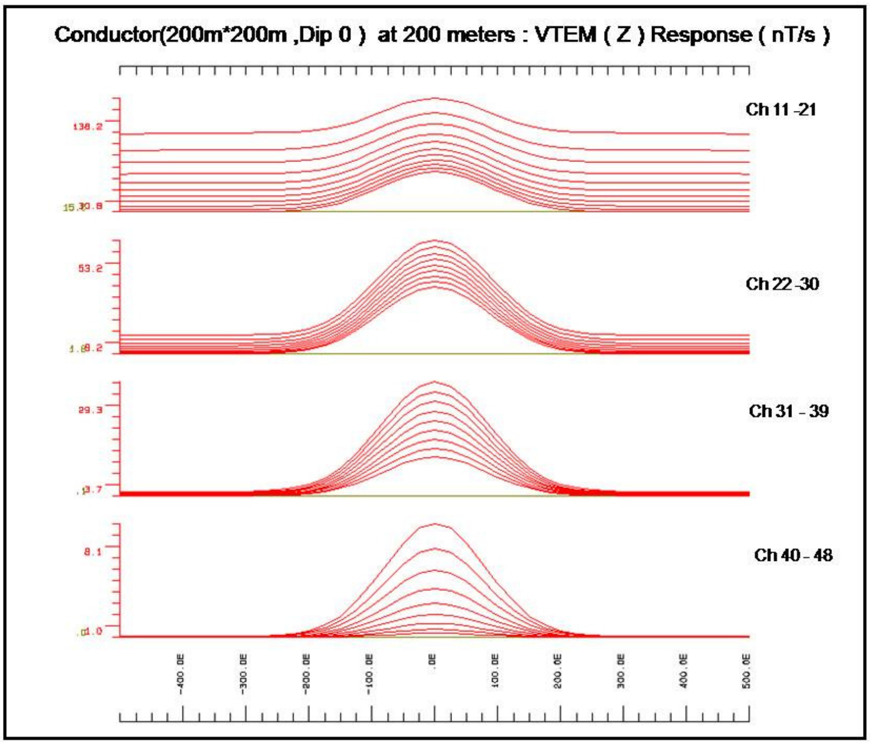

*Figure 3e.   Conductor (200m*200m, Dip 0) at 200 meters : VTEM (Z) Responses (nT/s)*

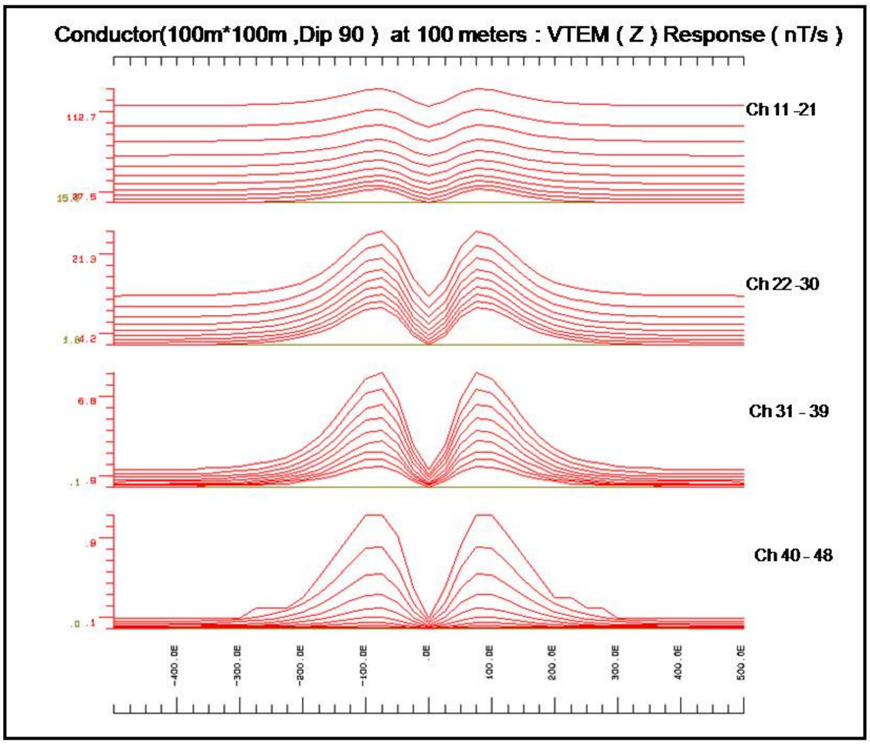

*Figure 3f.   Conductor (100m*100m, Dip 90) at 100 meters : VTEM (Z) Responses (nT/s)*

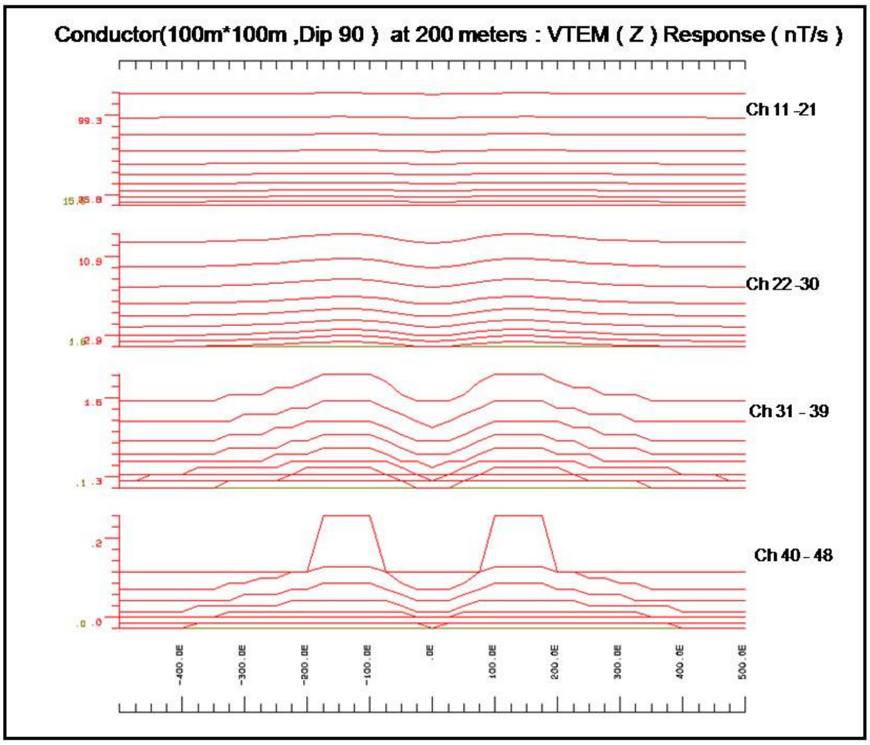

*Figure 3g. Conductor (100m*100m, Dip 90) at 200 meters : VTEM (Z) Responses (nT/s)*

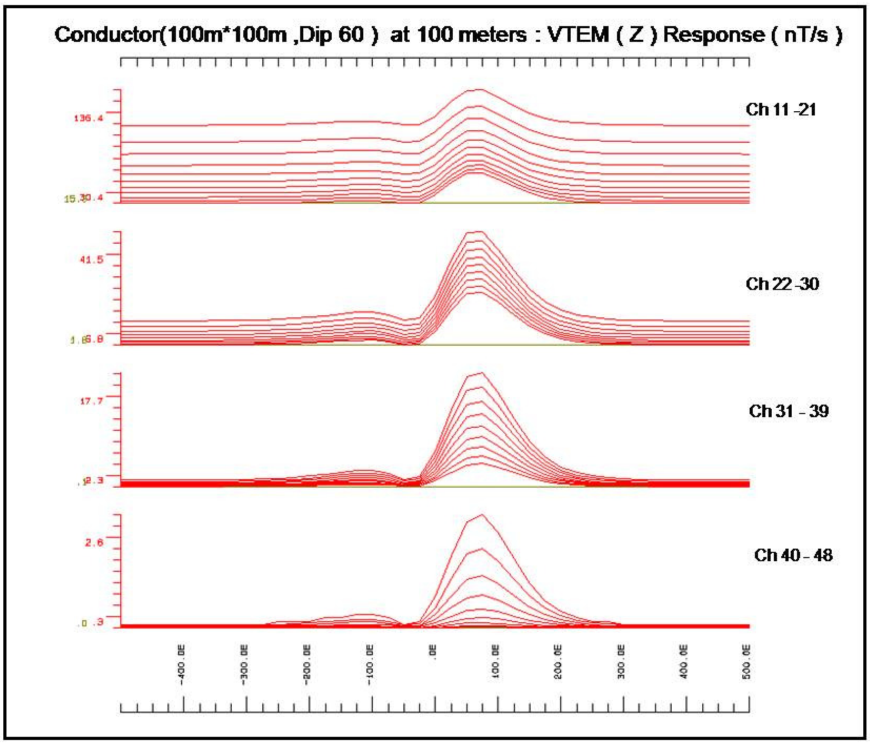

*Figure 3h. Conductor (100m*100m, Dip 60) at 100 meters : VTEM (Z) Responses (nT/s)*

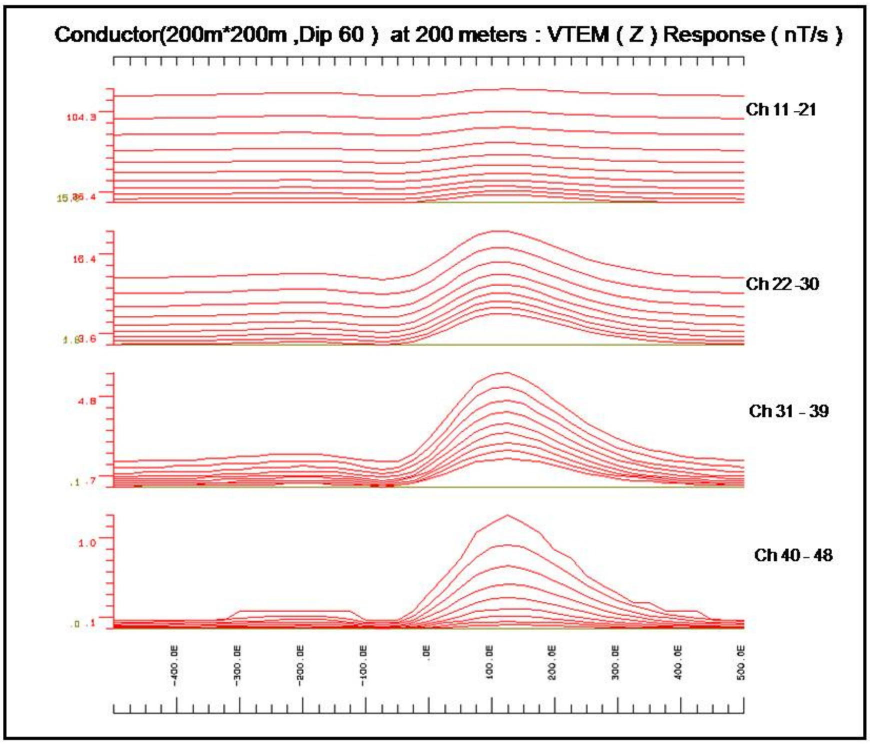

*Figure 3i. Conductor (200m*200m, Dip 60) at 200 meters : VTEM (Z) Responses (nT/s)*

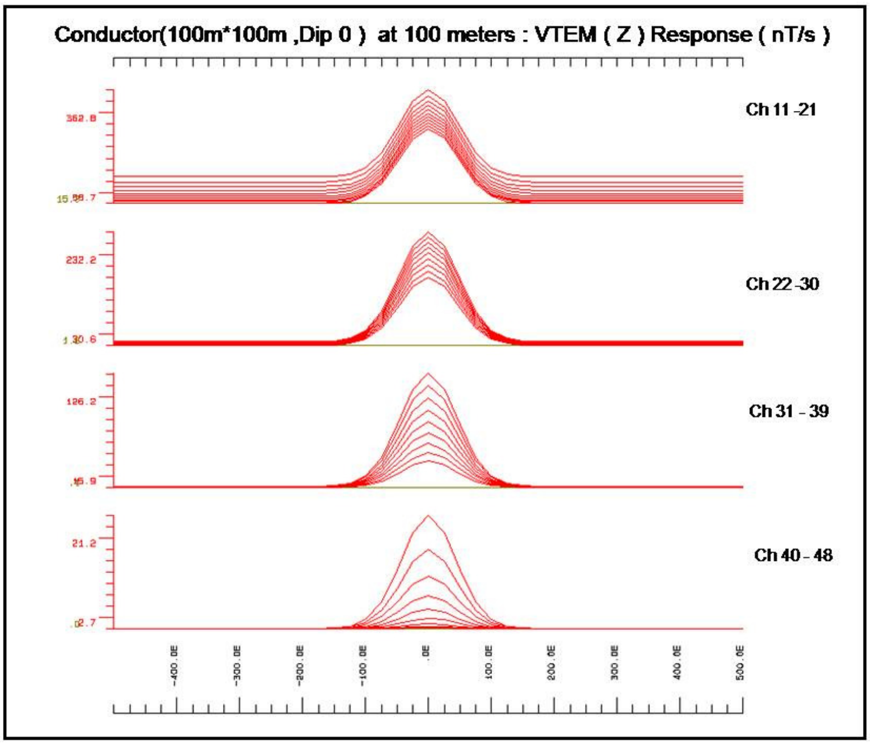

*Figure 3j. Conductor (100m*100m, Dip 0) at 100 meters : VTEM (Z) Responses (nT/s)*

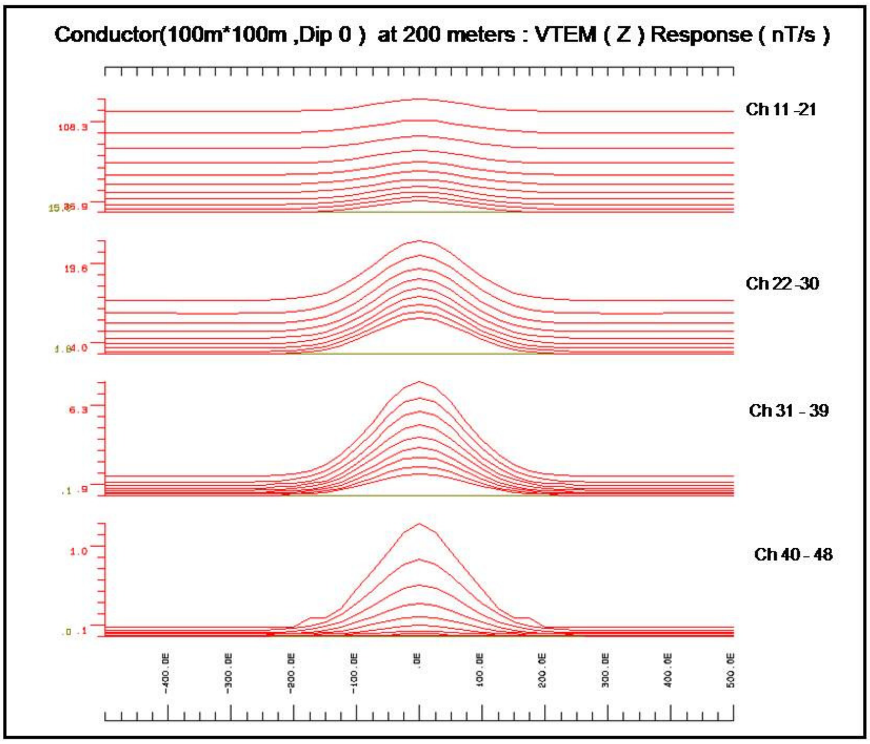

*Figure 3k. Conductor (100m*100m, Dip 0) at 200 meters : VTEM (Z) Responses (nT/s)*

As is evident from the profiles in Figures 3 – 3k, the secondary EM fields over plate like targets are invariably characterised by a localised minimum over the top of the target at location 0 E (Figures 3 – 3c) , for conductors with dips significantly greater than zero (flat) ,with relatively flat laying target (flat top) response peaking over the targets centre (Figures 3d and 3e) . The amplitude of the response and hence the targets detectability varies considerably with the target's dip and depth to top, the flat laying target or target with an extensive top area (e.g. Hellyer type target in the northern extremity of the deposit) generating a response of greatest amplitude .

The amplitude of the conductors response is also dependent on the ratio of targets size (strike length and depth extent) and its depth to top , with a dramatic fall off in the conductors response as the targets dimensions become smaller than its depth to top (Figures 3f – 3k) .

On the basis of the model data and the system noise estimates it is estimated that moderate size targets with a strike length of 200 meters and depth extent of 200 meters located at depths up to 200 (250) meters could be detected. Smaller 100

meter by 100 meter conductor could be detected at depths of approximately 100 meters plus.

4. VTEM DATA INTERPRETATION

4.1. Analysis of VTEM data

The analysis of VTEM data proceeded through decomposition of data into its anomalous components as described in Silic 2004 , and time constant estimates for the responses within the survey area and **detailed inspection of line profile data for every survey line**. As the images in Figures 4 – 4b illustrate a number of conductive features are within the survey area .

Nevertheless some thirty nine separate areas were analyzed in detail, by closely analyzing the data over an 1 kilometre by 1 kilometre area centred on a specified location as shown in Figures 4 – 4b. Some of these locations were close to or nearby prospective geological targets whereas others were related to possible anomalies evident in the images of the data.

Most of the “anomalous “responses were interpreted as being due to culture and broad conductive variations within the shale units.

Response characteristics of these features are discussed in the flowing sections .

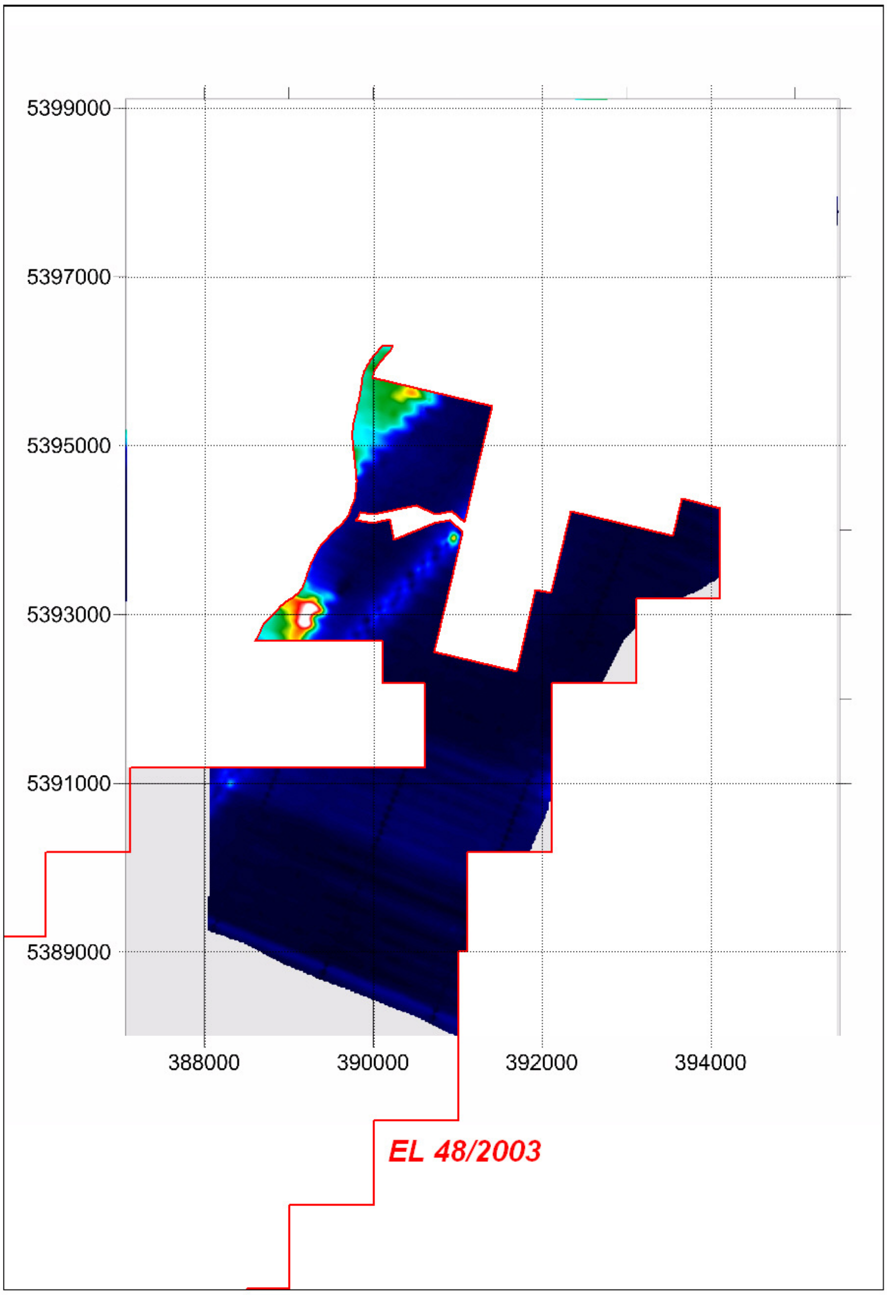

Figure 4. VTEM: Z Channel 15 (0.10 millisecond) and locations of areas analyzed in detail

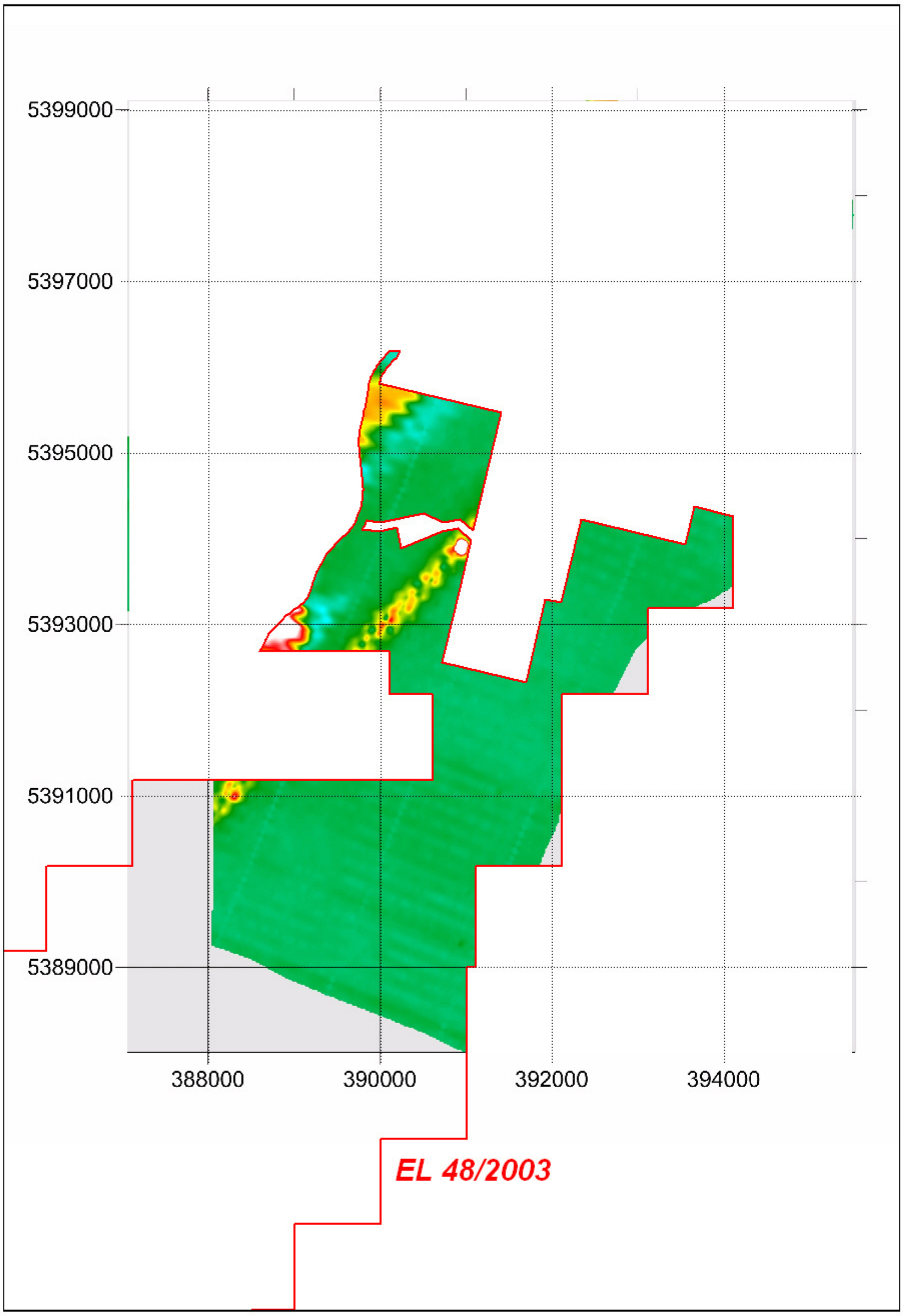

Figure 4a.   VTEM: Z Channel 30 (0.88 milliseconds) and locations of areas analyzed in detail

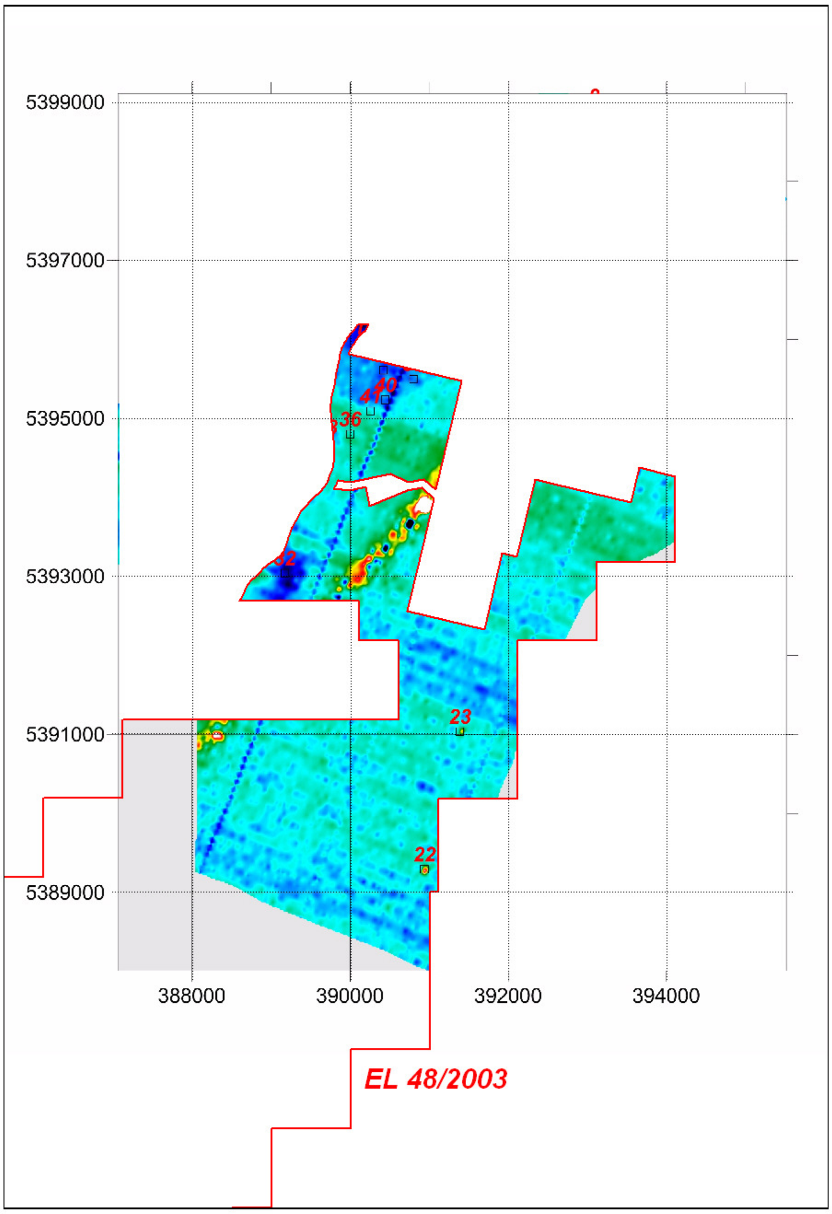

Figure 4b. VTEM: Z Channel 42 (4.64 milliseconds) and locations of areas analyzed in detail

4.1.1. Cultural Anomalies

Most cultural responses within the survey area are single line “small amplitude” late time as illustrated by profile data in Figure 5 to 5b. Some are associated with magnetic anomalies and as the data over anomaly HEL 03, 05 and 12 shows , they are also characterized by complicated or non uniform decay of the EM signal with time. Most of these cultural type anomalies are clustered around or are close to known cultural within the survey area.

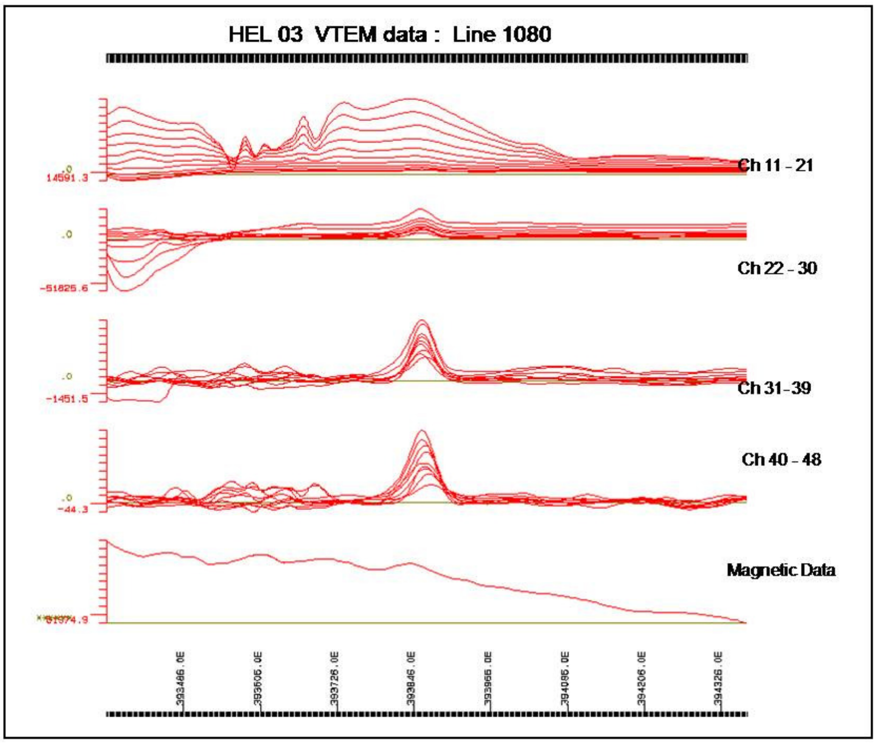

Figure 5. *HEL 03 VTEM data: Line 1080*

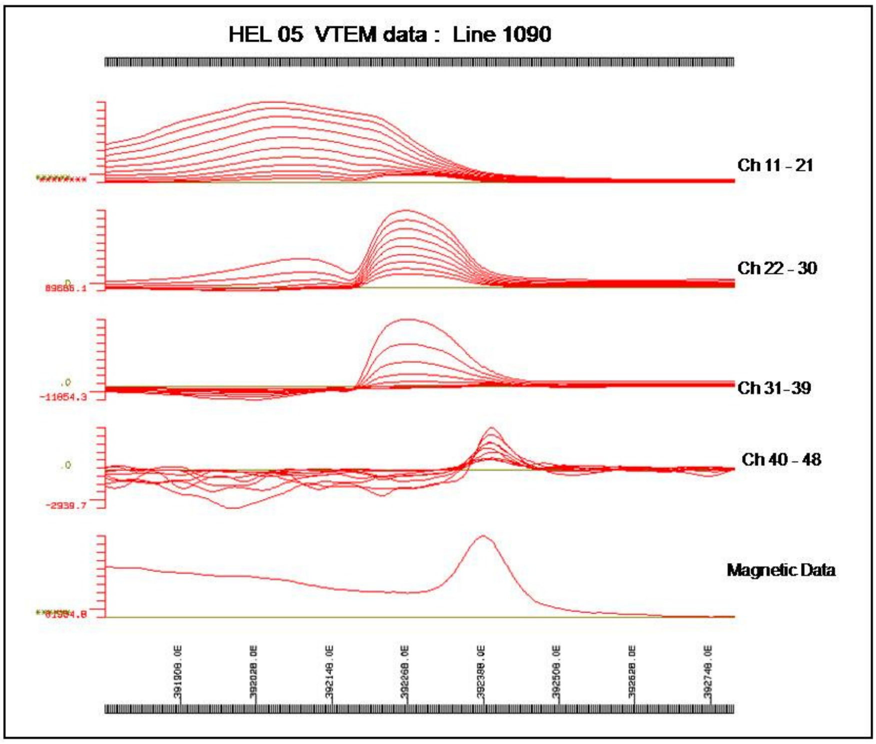

Figure 5a. *HEL 03 VTEM data Line 1090*

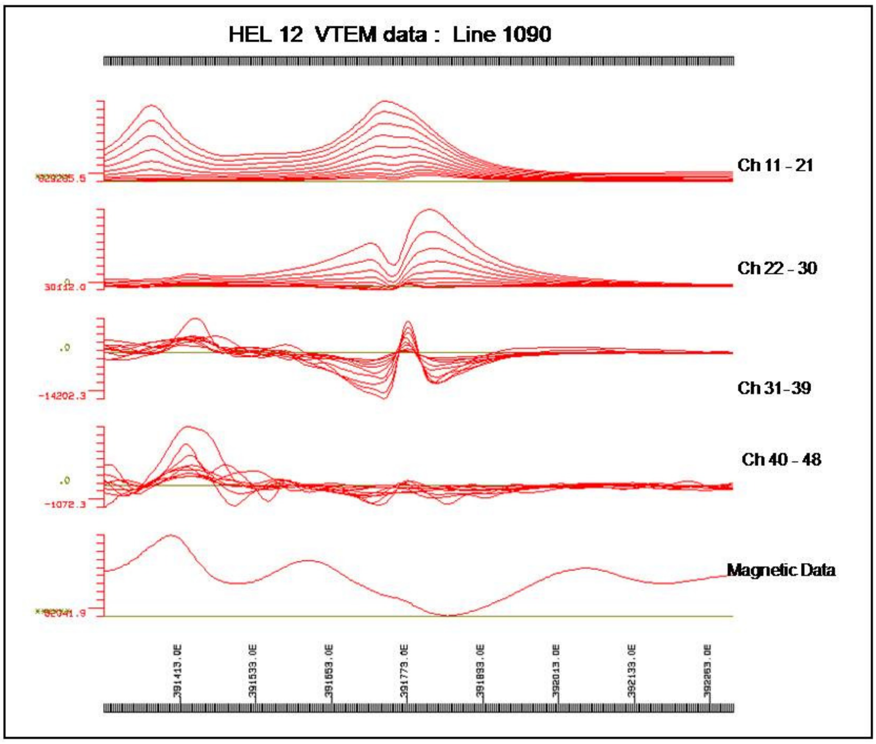

Figure 5b. HEL 12 VTEM data Line 1090

Two cultural type anomalies and which could not be reconciled with a response from a bedrock conductive target, HEL 21 and 23 appear to be removed from known culture within the survey area (Figure 5e and 5d).

These two anomalies have the characteristic of a cultural response and in particular, the anomalies are spatially “narrow” and the EM signal decay with time is not uniform nor predictable with number of channels grouped together (ie. no decay) and/or crossing over each other.

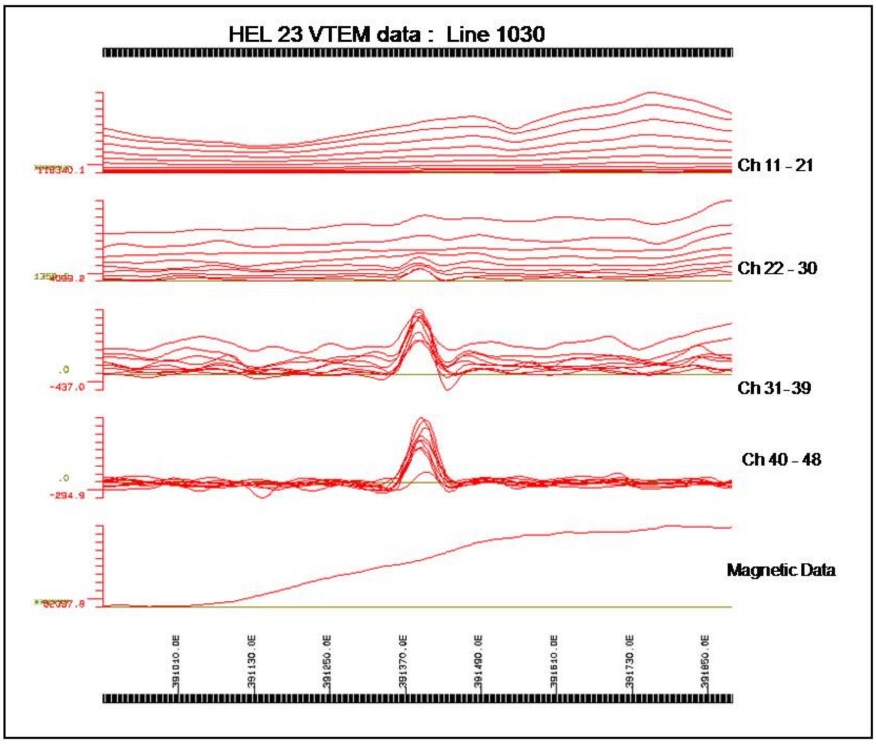

Figure 5c. HEL 23 VTEM data Line 1030

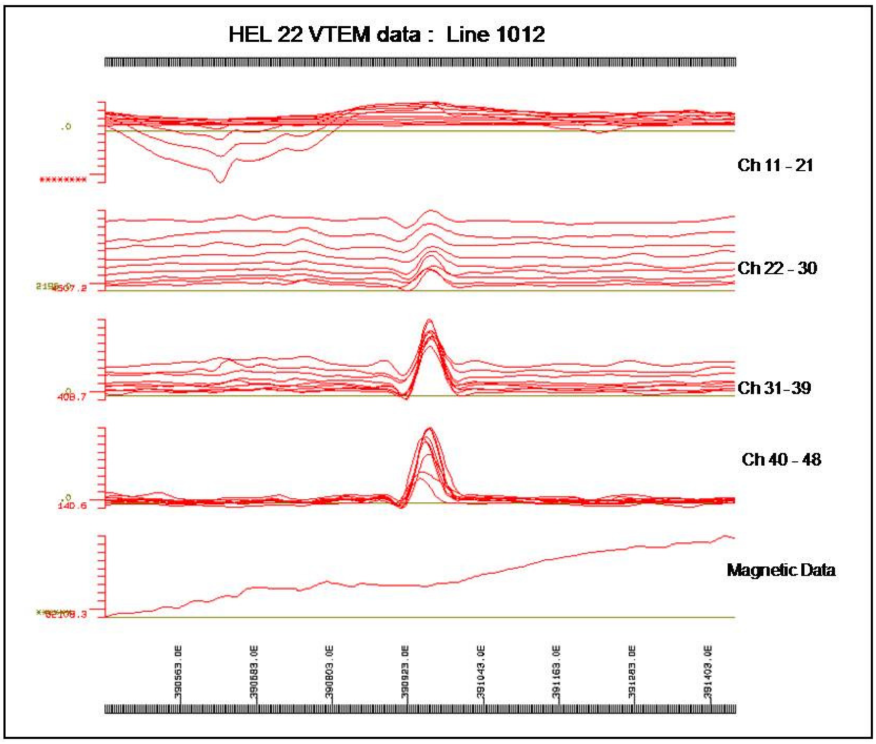

Figure 5d. HEL 22 VTEM data Line 1012

Nevertheless, considering that they are located in an area currently not known to contain cultural feature a ground check is recommended.

The two responses area located at in GDA 94 co-ordinates

HEL 22: 390940 E, 5389290 N
HEL 23: 391390 E, 5391040 N

4.1.2. Lithological (Shale) responses

All of the response confined to broad lithological units were either early time (hence due to outcropping source) poorly conductive target EM effects (HEL 15, Figure 6) or late time broad response indicative of thickening of the conductive unit with depth or the down faulting of the geological unit (Figure 6a HEL 21)

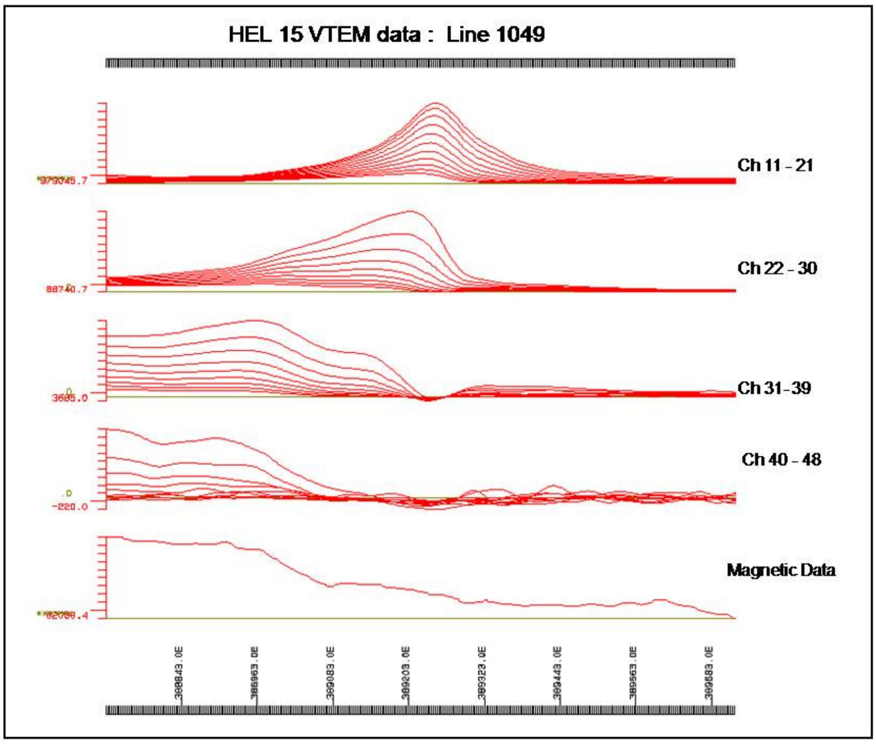

Figure 6. HEL 15 VTEM data Line 1049

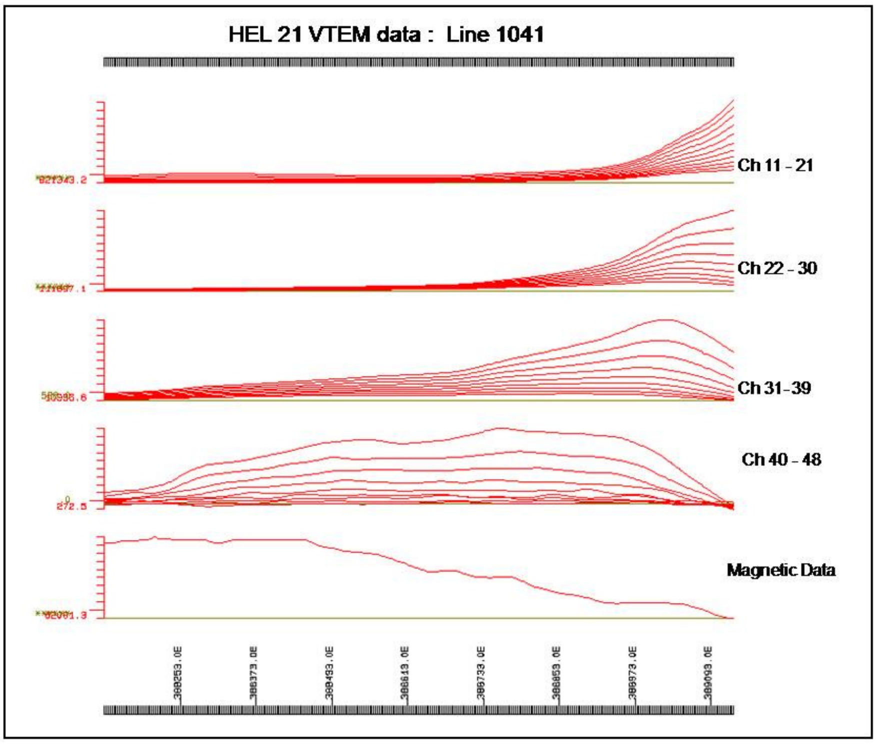

Figure 6a. HEL 21 VTEM data Line 1041

CONCLUSION

The VTEM survey over the Hellyer Corridor Project area did not identify any responses that could be reconciled with the EM effects from a bedrock VMS style conductor source.

Two culture style anomalies which appear to be in an area not known to contain culture are however recommended for a ground check.

REFERENCES:

Silic J. (2004) : Discoveries through innovation in application of airborne and ground TDEM methods in very conductive environment: Extended Abstracts, ASEG 17Th Geophysical Conference and Exhibition, Sydney Australia, 2004.