CR#28184

CR 8699

Exploration Data Centre

EDC037537CA

EPMs 7650, 7649 & 10128
DAJARRA JV

CONFIDENTIAL

ANNUAL REPORT FOR THE PERIOD ENDING 16 FEBRUARY 1996

A JOHNSTONE
SEPTEMBER 1996

Exploration - BHP Minerals
BHP Minerals Pty. Ltd., A.C.N. 008 694 782

CR#28184

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SUMMARY

A program of exploration was undertaken to investigate the potential for Mt Isa styled copper mineralisation and Sedex styled mineralisation in the Dajarra area.

An airborne EM survey was completed over the entire joint venture area and identified a number of significant conductors within prospective Mt Isa Group sediments and Eastern Creek Volcanics adjacent to the Wonomo and Mount Annable Faults. Several conductors were selected for ground EM surveying and geochemical soil sampling. Assessment of the results has commenced.

1. INTRODUCTION

BHP Minerals Ltd has entered into a joint venture with Aberfoyle Resources Ltd covering EPMs 7650, 7649 and 10128 to explore for Mt Isa-styled Cu and Sedex Pb/Zn styled mineralisation. The tenements are located between 30 to 110km south of Mount Isa and are accessible via the Diamantina Development road (Figure 1).

This report documents the exploration activities undertaken by BHP Minerals Ltd since the inception of the joint venture on 3 July 1995. This work consists of an airborne EM survey; processing and interpretation of EM data; ground inspection of selected anomalies; moving loop EM surveying and geochemical soil sampling on selected grids.

2. TENEMENT INFORMATION

EPMs 7650 and 7649 were granted to Aberfoyle Resources Ltd on 13 February 1991 and 15 February 1991 respectively.

EPM 10128 was granted to Aberfoyle Resources Ltd on 24 June 1994.

3. PREVIOUS EXPLORATION

Past exploration activities undertaken within the area of the tenement have been summarised in Appendix A. Prior to the inception of the joint venture, Aberfoyle Resources Ltd completed the following work:

- a compilation of all previous geochemical data
- Flying of 75Hz 1ms GEOTEM airborne EM survey
- ground based EM follow-up of two anomalies identified from the GEOTEM survey
- ground based EM follow-up of a 3750nT magnetic anomaly
- drilling of a ground EM defined GEOTEM anomaly
- two east-west reconnaissance gravity traverses

Drilling by Aberfoyle Resources Ltd failed to intersect any significant mineralisation.

4. EXPLORATION RATIONALE

4.1 Regional Geology

EPMs 7650, 7649 and 10128 are underlain by a sequence of Early to Middle Proterozoic sediments and volcanics referred to as the Leichhardt River Fault Trough bounded to the west by the Palaeozoic Georgina Basin and to the east by the Kalkadoon-Leichhardt Block. The Kalkadoon-Leichhardt Block is in faulted contact with the Leichhardt River Fault Trough around Mt Isa and to the north but in the Dajarra area their relationship is not clear. The Georgina Basin is clearly on-lapping the Leichhardt River Fault Trough in the Dajarra area.

138°30' 139°00' 139°30' 140°00'

MT ISA

TEMPLETON | MT ISA 1:100,000 SHEET | MARY KATHLEEN

21°00'

GOA CREEK | OBAN | DUCHESS

10873
ANNABLE

Duchess

7650
DAJARRA JV (2)

21°30'

CARANDOTTA | ARDMORE | DAJARRA

10128
DAJARRA JV (3)

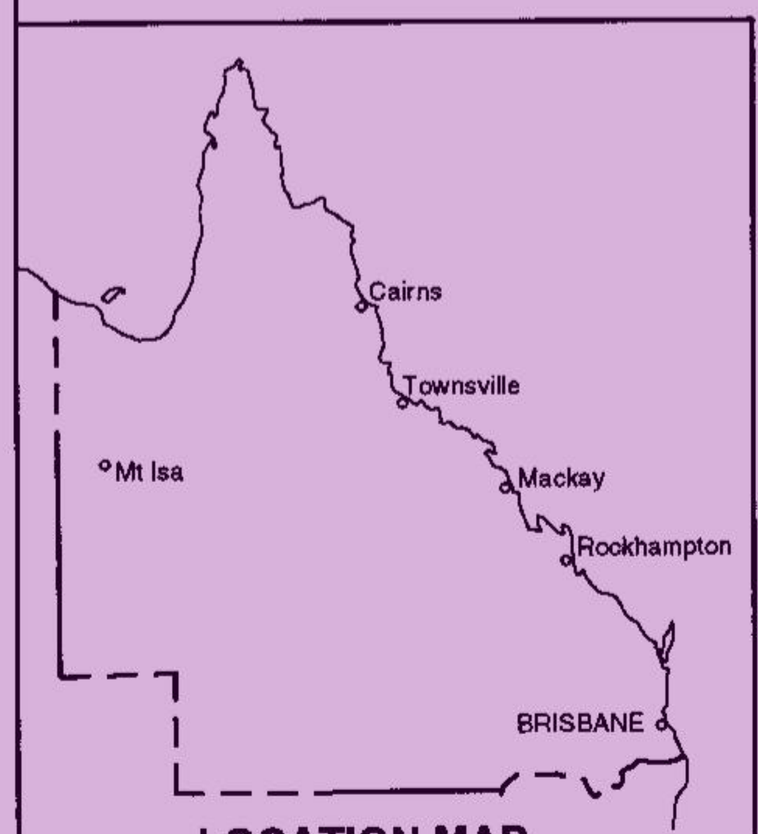
Dajarra

DAJARRA GEOTEM SURVEY

7649
DAJARRA JV (1)

22°00'

LAKE KATHERINE | LESLIE PEAK | BUCKINGHAM DOWNS



LOCATION MAP

Scale 1 : 1,000,000

0 10 20 30 40 50 km

Lambert Conformal Conic Projection
Standard Parallels 20°40' and 23°20'

CR 2 8 184

Prepared : A Johnstone	BHP	Exploration - BHP Minerals BHP Minerals Pty. Ltd., A.C.N. 008 694 782	Centre : Brisbane
Drawn : W Mead	DAJARRA JOINT VENTURE PROJECT NORTH WEST QUEENSLAND	A4-1852
Date : July 1996	LOCATION MAP	FIGURE 1
Revised :		

The Proterozoic stratigraphy of the Leichhardt River Fault Trough in the Ardmore/Dajarra region south of Mt Isa consists of basement and cover sequences two and three (see Figure 2). In this area the Leichhardt River Fault Trough is divided into eastern, central and western zones. This report is only concerned with the central and eastern belts separated by the Wonomo Fault which extends into the Mount Annable Fault to the North.

The basement consists of the Sulieman Gneiss west of the Wonomo Fault and the younger Bottle Tree Formation to the east. The Bottle Tree Formation is conformably overlain by the Haslingden group, while the Sulieman Gneiss is overlain by the Kallala Quartzite and the Jayah Creek Metabasalt including the Timothy Creek Sandstone Member. The Jayah Creek Metabasalt is possibly equivalent to the Eastern Creek Volcanics which forms the lower part of the Haslingden Group with the Mount Guide Quartzite. The Haslingden Group and Jayah Creek Metabasalt form Cover sequence 2.

Cover sequence 3 consists of the Carters Bore Rhyolite and Mt Isa Group. The Carters Bore Rhyolite is found in the south of the tenement area where it is inferred to be faulted against the Mount Guide Quartzite to the east and overlain disconformably by possible Mt Isa Group stratigraphy to the west.

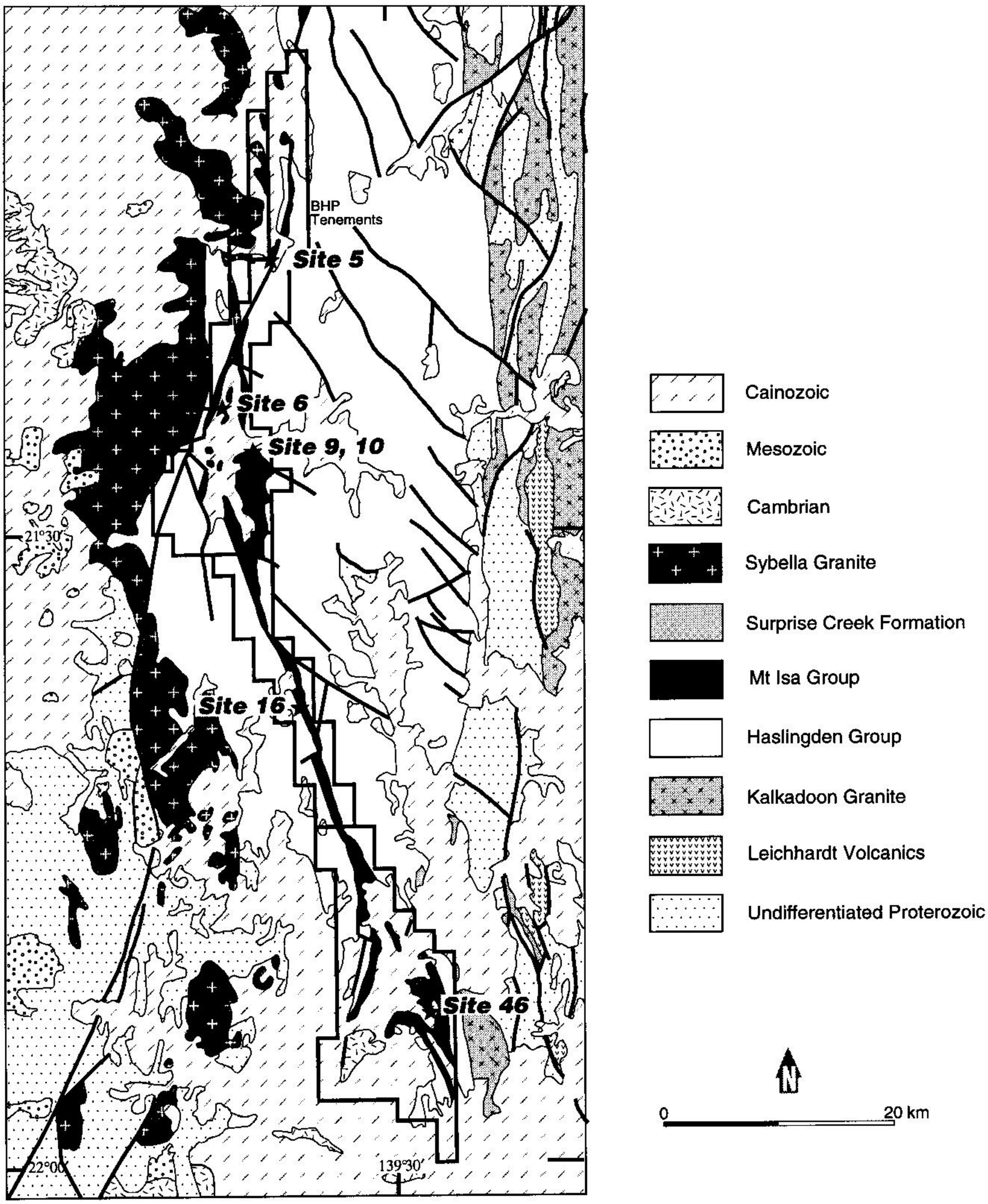
The Mount Isa Group stratigraphy is found in narrow partly fault bounded blocks to the east of the Mount Annable and Wonomo Faults extending south from Mt Isa. Thicker stratigraphic piles are found in the Wavely basin and the Carbine Creek Basin to the south. The Mt Isa formation in this area consists of the Warrina Park Quartzite, Moondarra Siltstone, Breakaway Shale and possibly Native Bee Siltstone in the thicker packages. Unfortunately the Urquhart shale host to the Ag-Pb-Zn and Cu ore bodies at Mt Isa has not been discovered to date.

4.2 Mineralisation

Several copper prospects and indications of copper mineralisation are known in the area. Sporadic mining activity has been carried out at Mt Annable and Blue Hills workings which lie in the Wavely Basin, and at the Bald Hills mine west of the Wavely Basin.

Copper mineralisation in the Wavely basin is hosted within the Moondarra Siltstone of the Mt Isa Formation; a unit consisting of laminated shales and siltstones, often carbonaceous and graphitic, dolomitic silty sandstone, in places stromatolitic, and quartzites with interbedded argillite and sandstone. Regionally this unit is preferentially weathered and outcrops poorly and is often covered in quartzite scree from the overlying Warrina Park Quartzite. Minor occurrences of copper mineralisation are also reported from the Warrina Park Quartzite usually in the form of turquoise.

Although the tenement area has been subject to a number of exploration campaigns in the past, drill testing of copper prospects and anomalies has been sporadic and limited in extent.



CR#29184

Prepared : A Johnstone	BHP	Exploration - BHP Minerals BHP Minerals Pty. Ltd. A.C.N. 008 694 782	Centre : Brisbane
Drawn : W Mead	EPM 7649, 7650, 10128 AND 10873 DAJARRA JOINT VENTURE	Drawing No.: CDB812
Date : July 1996	**REGIONAL GEOLOGY LOCATION OF PROJECTS**	**FIGURE 2**
Revised :		

4.3 Exploration Target and Concept

The principal exploration target is Mt Isa-styled copper and Sedex Pb/Zn styled mineralisation, the possibility for high grade structurally controlled deposits also exists. The Mt Isa Formation and Eastern Creek Volcanics adjacent to the Wonomo and Annable Faults is the main focus for exploration but the possibility for other locations for mineralisation will not be ignored.

It is accepted that while the previous exploration activity succeeded in locating much of the outcropping mineralisation the full potential was far from realised because of the poorer exposure of the host units and the very limited follow-up drilling of detected anomalies.

The Moondara Siltstone is a complicated laminated carbonaceous/graphitic siltstone containing zones of dolomitic silty sandstone, sandstone, interbedded argillite, quartzite and stromatolites. The Moondara Siltstone is very graphitic (black) at depth, but at surface leaches to a soft light chalky coloured siltstone.

The Eastern Creek Volcanics consists of massive to strongly cleaved basalt lava flows interlayered with sandstones, conglomerates and other sedimentary rocks. Individual basalt flows do not generally exceed 40m in thickness. In some areas siltstones are found in the Eastern Creek Volcanics which are graphic.

The Moondarra Siltstone and some sediments in the Eastern creek Volcanics are the only regional conductors in the area. All other sedimentary units in the area have little or no electromagnetic response. The region exhibits a good magnetic contrast between the Eastern Creek Volcanics and other relatively non magnetic stratigraphic units (Figure 3). Mineralisation, however, may have a magnetic response and could also have a gravity response in this area. It is expected that copper mineralisation or sulphides in the Moondara Siltstone and eastern Creek Volcanics would have a higher conductive response than the host, and any mineralisation outside the Moondara Siltstone and Eastern Creek Volcanics would be a clearly defined conductor in a resistive host.

5. WORK COMPLETED BY BHP MINERALS

In summary the work undertaken by BHP since the inception of the joint venture has consisted of:

- an airborne EM survey utilising the GEOTEM system
- processing and interpretation of GEOTEM data
- ground inspection of 20 GEOTEM anomalies
- moving loop EM surveying of 7 GEOTEM anomalies
- soil sampling on 3 EM grids

6. GEOTEM SURVEY

From 23 August to 15 September 1995 Geoterrex Pty Ltd completed an airborne electromagnetic (GEOTEM) survey and magnetic survey over the Dajarra Joint Venture area to define and evaluate the potential of any conductors within the Moondarra Siltstone or Eastern Creek Volcanics or adjacent to the Mount Annable or Wonomo Faults.

Field processed GEOTEM data from the survey was assessed using TEMPER and images of gridded data to highlight the strongest GEOTEM responses. The base for all operations was Mt Isa, Queensland. The survey was conducted by collecting data along east west lines with a separation of 300m. In total, 4858 line kilometres of GEOTEM electromagnetic and magnetic data was collected during this period. A plan of the survey boundary and location is shown in Figure 1.

A base frequency of 25Hz was used for the GEOTEM survey with a 4 ms pulse. Both X and Z component data were collected. The nominal terrain clearance for the plane was 105m and for the towed "bird" receiver 70m. The magnetic data was collected using a stinger magnetometer attached to be plane. Equipment and survey specifications are detailed in Appendix 2.

6.1 GEOTEM Interpretation and Results

All the GEOTEM lines were initially processed using TEMPER software to produce conductance and conductivity pseudo depth sections which were then displayed with line data and magnetic profiles. These combined sections defined many excellent conductors. The Dajarra area is known for units of conductive stratigraphy such as the Prd. Most of the GEOTEM responses in the Dajarra survey are associated with the conductive Moondara Siltstone. To better differentiate between the conductive stratigraphy and stronger conductors within it, images of gridded Z & X channel Amplitude data were produced (Figures 3 and 4). The images show areas with the strongest GEOTEM responses in the Moondara Siltstone. These images with the addition of vector geological information, were used to highlight interesting anomalies. Profiles over the anomalies were again examined so decay curve time constants could be calculated. The most interesting anomalies are listed below in Table 1. In conjunction with GEOTEM, magnetics were collected using a stinger magnetometer. An image of the magnetics can be seen in Figure 5.

6.2 Ground Inspection of GEOTEM Anomalies

Ground inspection of the anomalies listed in Table 1 highlighted a number requiring further investigation. Of the 18 anomalies examined in the field, seven were chosen to be covered with ground EM. The criteria for further work on each anomaly included the GEOTEM response and shape, stratigraphic position, structural position and other previous work, predominantly geochemistry. Anomalies 005, 009/010, 011/012 and 21/31 were all considered to have potential for further work. Temper profile sections showing the GEOTEM response for the 7 anomalies are shown in Figures 9 to 12.

7. GROUND EM FOLLOW-UP

Solo Geophysics collected SIROTEM ground EM data over anomaly DJ-005 from 23 to 21 October 1995. The surveys consisted of two 2 km lines of moving loop data and eight fixed loop surveys for 15.4km of data.

From 6 to 22 November 1995 Geoterrex Pty Ltd collected additional ground electromagnetic EM data using a PROTEM system in the Wavely and North Carbine basins in the Dajarra area. Anomalies DJ-009. DJ-010, DJ-011, DJ-012, DJ-021 and DJ-031 were investigated. A total of 16.2 km of moving loop PROTEM was collected.

Table 1 - Stage 1 Anomalies from the Dajarra GEOTEM survey

Anomaly	East	North	Line	to Line	X Tau	Z Tau	XC	ZC	Mag	Rank	Depth	Note	Setting/Unit	Stage	Follow up
DJ - 001	332657	7660804	4371	4381	1.47	1.27	15	10	no	3	surface	may dip slightly to the east, maybe stratigraphy	Qtz Arkose/Red Rock alt	2	Profiles/Setting
DJ - 002	335284	7658714	4281	4311	1.71	1.87	15	8	low	3	surface	flat body in Z, dips to east in X			
DJ - 004	336562	7649704	4011	4031	1.6	2.69	10	8	low	3	0-200	X dips to east, Z interesting 400m solution horse shoe anomaly			
DJ - 005	334222	7646205	3911	3901	1.88	2.25	20	20	low	2	50-150	X solution horse shoe anomaly, Z M shaped in Ch18 indicates vertical	Pim/Piw/ECVs	1	Ground EM Follow-up completed
DJ - 006	330079	7682009	3421	3451	2.43	2.94	20	25	low	4	25-50	folded conductor both limbs have same tau			
DJ - 007	326400	7626500												3	Check Profiles/Setting
DJ - 008	328958	7627207	3261	3271	2.11	2.32	20		slight	3	150-200	X, two conductors have same tau that make up anomaly Z, picking up	on track	3	Check Profiles/Setting
DJ - 009	330285	7627198	3261		2.95	2.25	8	7	low	2	0-100	X, is close to surface, Z shows may dip to east		1	Ground EM Followup
DJ - 010	331341	7627206	3261		3.15	1.58	15	7	low	2	0-200	Related to DJ - 9 dips to west		1	Ground EM Followup
DJ - 011	328820	7625408	3201		2.25	2.53	30	15	no	2	100	Vertical or sips slightly to the west		1	Ground EM Followup
DJ - 012	330079	7624181	3163	3182	2.51	3.82	25	40	high	1	180-200	Good coincident mag and cond anomaly south of current grid, Pib		1	Ground EM Followup
DJ - 014	331944	7624979	3182		3.13	2.85	30	25	slight	2	200	Individual Anomaly but sits in Pib, X may dip slightly to E,			
DJ - 015	330995	7619080	2991	2981	2.55	2.94	30	20	slight	3	350	deeper anomaly may sit on eastern dipping arm of fold? X, 100m!	Dyke	3	Check Profiles/Setting
DJ - 016	335963	7607092	2592	2601	null	1.16	5	3.5	slight	3	200-300	little response on X better Z in fault zone Important to check with MMI			
DJ - 017	333044	7601401	2402		1.2	1.24	10	8	low	3	0-50	High Amp in late channels but plots shallow			
DJ - 019	338295	7588214	1961		1.23	1.75	13	8	high	3	0-50	Ass. with flat toped mag high probably ECV's at surface			
DJ - 020	342689	7587310	1931		1.43	2.16	14	12	no	3	150-200	wide X response, wide Z response		3	Check Profiles/setting Braded chn
DJ - 021	344095	7585802	1891		3.29	3.12	25	20	slope	1	280-320	Good anomaly		1	EM Followup
DJ - 022	340665	7582192	1761	1771	1.68	1.56	17	13	low	3	0-60	High amplitude fast decay		3	Check Profiles/Setting
DJ - 023	345242	7582190	1761		2.54	1.75	9	7	no	3	50-110	wide Z response matches big mag response, stratigraphy ?		4	Check Profiles/Setting
DJ - 024	344250	7581000													
DJ - 025	343750	7579750													
DJ - 028	340634	7571113	1391		2.04	1.79	7	5	slope	3	80-100	This looks like stratigraphy - better coupling		3	Check Profiles/Setting
DJ - 029	344022	7572295	1431		null	1.88	7	6	low	4	0-250	Same as 28 but closer to fault(wonomo)			
DJ - 030	350117	7568103	1291	1331	4.31	2.52	20	8	slope	2	200-220	This has an excellent X Tau, vertical body, becomes more tabular to S	Hematite Qz Gossan	2	Check Profiles/Setting
DJ - 031	344790	7585500	1871		1.65	2.05	10	5	low	3	100-150	May be related to 42, M shaped in Z,			
DJ - 032	332929	7643098	3791	3811	1.89	1.28	6	3	high	3	150-200	Not a good response, But correlates with huge mag anomaly, ECV's in Fault			
DJ - 033	332151	7641305	3731	3741	2.23	null	5	4	high	3	100-300	Not a good response in X or Z, probably fault response			
DJ - 034	330990	7638611	3642	3652	2.79	2.94	20	20	slope	3	100-200	Z, decay is Mshaped slower on E peak, solution is also deeper -400m.			
DJ - 035	334192	7598619	3231	3241	null	6.94	3	2	slope	3	280-300	This anomaly has a decay below noise but good decay			
DJ - 036	334705	7620613	3041		null	null	1	1	high	5	0-10	ADI gives response but this looks like noise			
DJ - 037	330318	7622677	3111		2.93	3.51	40	30	slight	3	150-180	Same unit as 11 12 and 15, Z M shaped eastern ass. with mag high,			
DJ - 038	340071	7609512	2671	2681	null	null	2	1	slight	5	0-400	Surface response			
DJ - 039	334730	7603795	2481	2471	4.45	1.2	15	3.5	slope	3	250-300	the excellent X tau is in noise, but this is in an interesting structural position			
DJ - 040	344753	7600806	2381		3.95	1.59	6	7	low	4	0-30	possible wide surface response, Z shows high amp in last few channels			
DJ - 041	340762	7594487	2171		2.39	1.42	20	10	low	3	200-250	fault related X single peak Z M shaped may dip slightly to east			
DJ - 042	343721	7588759	1981	2071	2.91	2.59	18	4	slope	2	180-220	complex faulting, X & Z both single peak			
DJ - 043	348655	7584903	1851		1.48	1.21	10	8	slope	4	0-50	Interesting surface anomaly			

Anomaly	East	North	Line	to Line	X Tau	Z Tau	XC	ZC	Mag	Rank	Depth	Note	Setting/Unit	Stage	Follow up
DJ - 044	338915	7584899	1851		1.47	2	8	7	high	4	50-80	Interesting surface anomaly coincident with mag peak			
DJ - 045	338283	7583694	1811		1.59	1.51	15	8	low	3	10-110	X, shows nice anomaly dipping to E			
DJ - 046	347912	7578287	1631	1661	2.57	2.43	30	13	slope	2	150-210	Better X response, sub-vertical may dip to west			
DJ - 047	343660	7578009	1631		1.83	4.20*	13	10	no	3	50-100	Z shows excellent decay but this is noise, X real anomaly worth a look			
DJ - 048	335319	7664109	4491	4501	null	2.18	5	2	slight	4	0-100	Looks shallow maybe stratigraphy			
DJ - 049	333949	7653901	4151	4212	null	null	2	2	no	5	0-100	High Amp Early Ch no decay—shallow source, Salty Brine type response			
DJ - 050	330881	7632010	3421		2	4.71	20	20	yes	4	220	sits on edge of Pim			

GR2078 4

Both surveys were designed to assess anomalies from the Dajarra GEOTEM survey. The results have been used to refine electromagnetic responses and enable more accurate assessment of each anomaly for drill target selection. Four contractors and two vehicles were used to collect the data during each survey. Production was slowed due to the extreme temperatures +40 deg C, high humidity +80% and thick vegetation. The topography in the area around the quartzites is dominated by steep ranges which also slowed progress on some grid lines. Grids were positioned using GPS and pegged every 100m with lines spaced 200m apart. Figure 6 shows the positions of the grids.

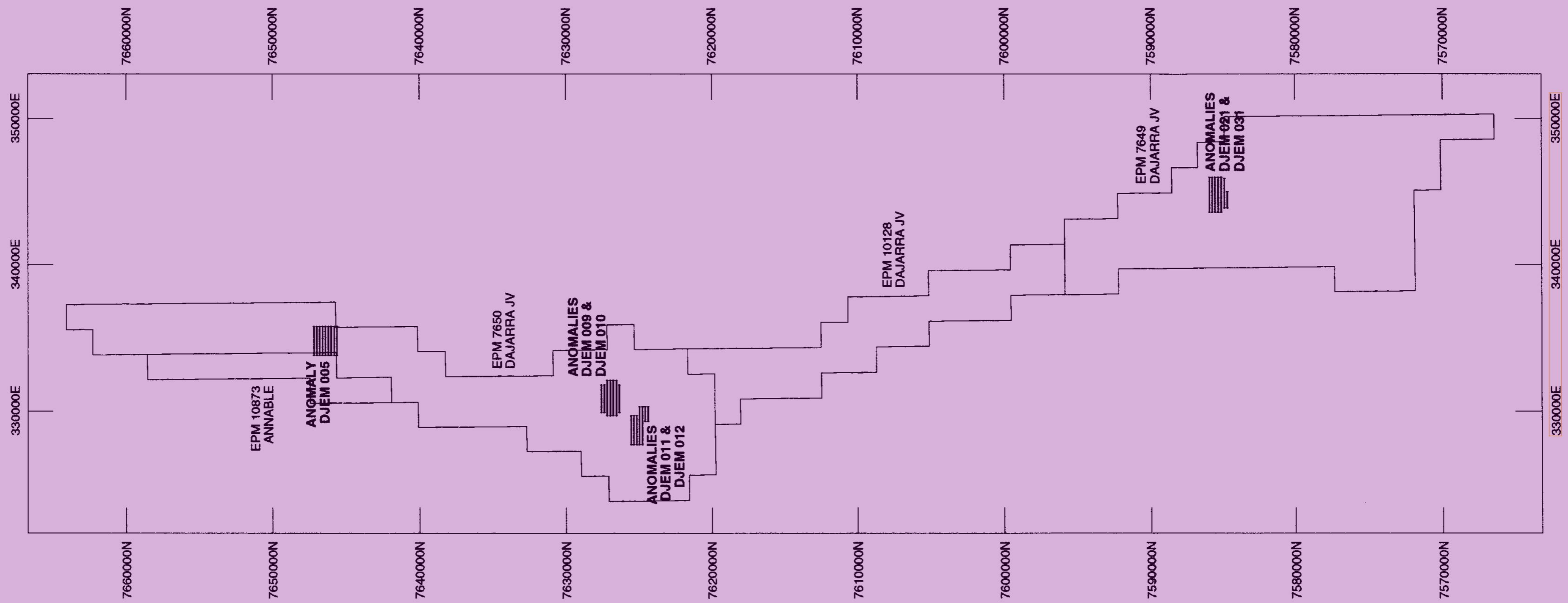
The PROTEM data was collected using 200 by 200m loops. PROTEM readings were made at both the centre of each loop and 50m from the centre of the loop, before loops were moved (Figure 7). Both 6.25 and 25 Hz PROTEM data were collected giving both good shallow and deep ground penetration.

The moving loop SIROTEM data was collected using the same survey specifications as for the PROTEM. Gain 1 and 10 data was collected to enable both shallow and deep ground penetration in a similar way to the PROTEM. The fixed loop SIROTEM survey required a static 600m x 300m loop with lines of data collected of the long side of the loop (Figure 8).

7.1 Ground EM Processing and Results

The PROTEM and SIROTEM data was delivered to BHP, as AMIRA format .tem files. All lines were first plotted using AVGBHP2 and PLOTBHP5. A representative linear profile for each line is displayed in set of EM figures. It is clear that at most sites the GEOTEM anomalies have been successfully targeted with either the SIROTEM or PROTEM systems.

Each line of moving loop data was processed using Imgcond to produce conductance and conductivity pseudo depth sections. The Imgcond sections clearly define all GEOTEM targets.



CR#29184

Scale 1 : 250,000

0 5 10 15 20 km

Transverse Mercator Projection. AMG Zone 54

BHP

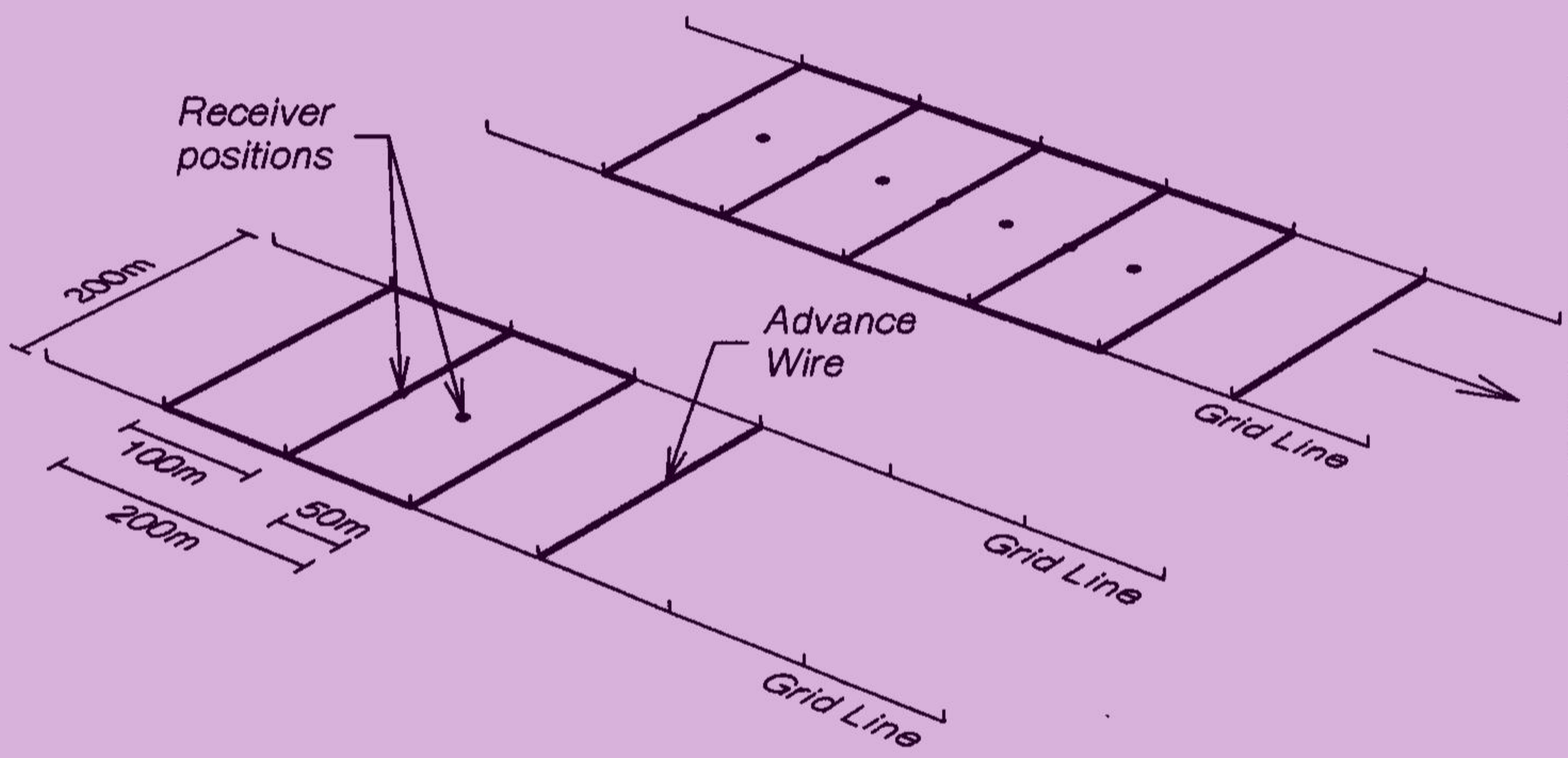
Exploration - BHP Minerals

BHP Minerals Pty. Ltd., A.C.N. 008 694 782

DAJARRA JV
NORTH WEST QUEENSLAND

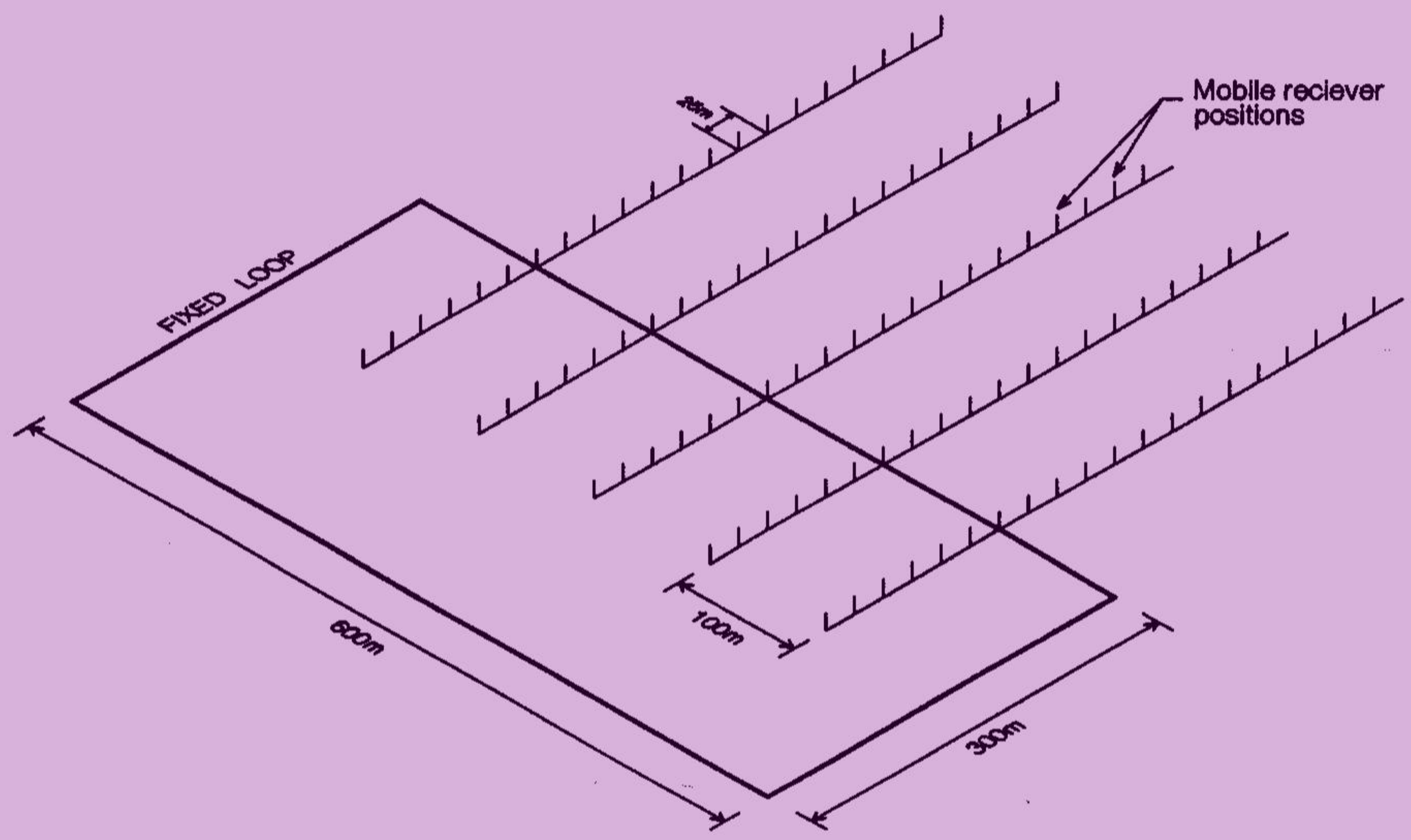
GROUND EM

Prepared : A Johnstone	Date : July 1996	**FIGURE 6**
Drawn : W Mead	Revised:	
Centre : Brisbane	Drg. No.: A3-1154	



CR 22184

Prepared : A.Johnstone	BHP	Exploration - BHP Minerals BHP Minerals Pty. Ltd., A.C.N. 009 694 792	Centre : Brisbane
Drawn : RRM			Drawing No.: A4-1681
Date : Jun 1995	**MOVING LOOP EM**		**FIGURE 7**
Revised :			



Prepared :A.Johnstone	BHP	Exploration - BHP Minerals BHP Minerals Pty. Ltd., A.C.N. 008 694 782	Centre : Brisbane
Drawn : C.J.W			Drawing No.: A4-1856
Date : July 1996	**FIXED LOOP EM**		**FIGURE 8**
Revised :			

ANOMALIES DJ-005

GEOTEM : DJ-005
Lines : 3901
Easting : 334222E
Northing : 7646205N
X-Tau : 2.26
Z-Tau : 3.29
Priority : 2

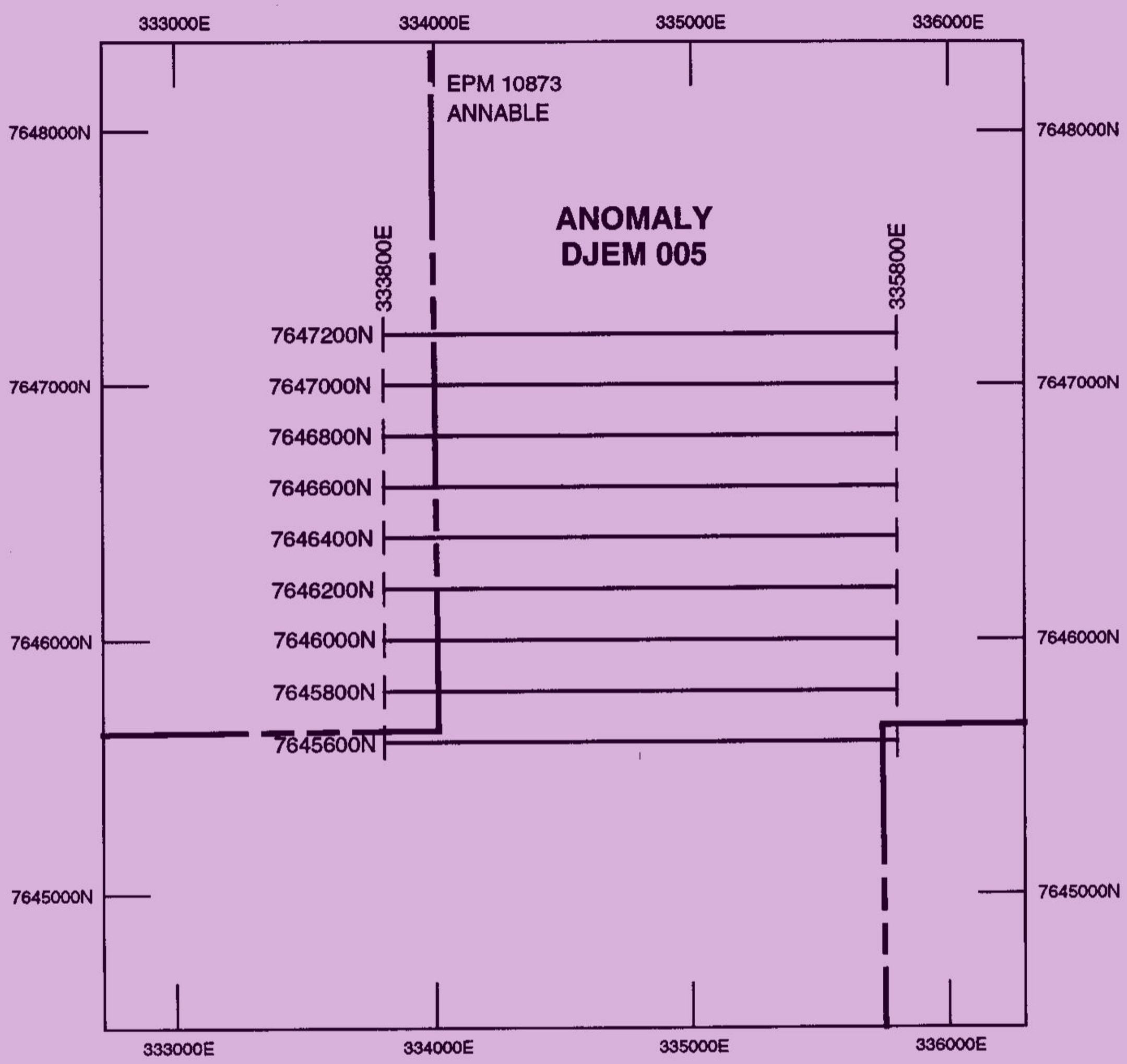
SIROTEM
Line : 8900N (local grid line northing)
Easting : 10700E
Northing : 8900N
Z-Tau : 11.6 (RMS Fit = 99.54%)

COMMENTS AND RECOMMENDATIONS

The GEOTEM response on line 3901 shows a strong conductor. The anomaly looks to be dipping to the west in the conductivity and conductance pseudo-sections, But the distemper 5 solution seems to indicate that the anomaly may be dipping to the east. The anomaly has a conductance around 20 (S) with a depth of less than 50m at its shallowest point. Tau calculations show the best decay as 2.29 for X component data (Figures 9a and 9b). The anomaly has good geophysical characteristics and sits in an interesting geological position. The amplitude images over this anomaly indicate that the conductor is offset by some structure into two parts.

Two lines of ground EM PROTEM were collected over each part of the anomaly to help refine its electromagnetic response. Figure 9e shows Z-amplitude moving loop profile data from line 9500N, and Figure 9d shows the same data for line 8900N. Conductance and conductivity sections (Figures 9f and 9i) from these two lines shows a conductor dipping away to the west. As seen in the profile data the conductor seems to be a classic M shaped anomaly. However at first we were not sure whether two separate conductors were detected by each moving loop line so fixed loop SIROTEM was collected over each potential conductor defined in the Moving Loop lines. Thus eight loops of data was collected over the 4 potential conductors. The results from the fixed Loop SIROTEM clearly showed only one conductor was present on each line with an offset between the moving loop lines. Modelling of both data sets shows the conductor has a depth of 150m and a dip of 15 degrees to the east.

Outcropping geology with a similar dip to the conductor and poor geochemistry, in addition to a shallow modelled depth and marginal time decay has downgraded the potential of this anomaly. The geophysical response is most likely due to un-weathered Moondarra siltstone at depth adjacent to the Mount Annable fault.

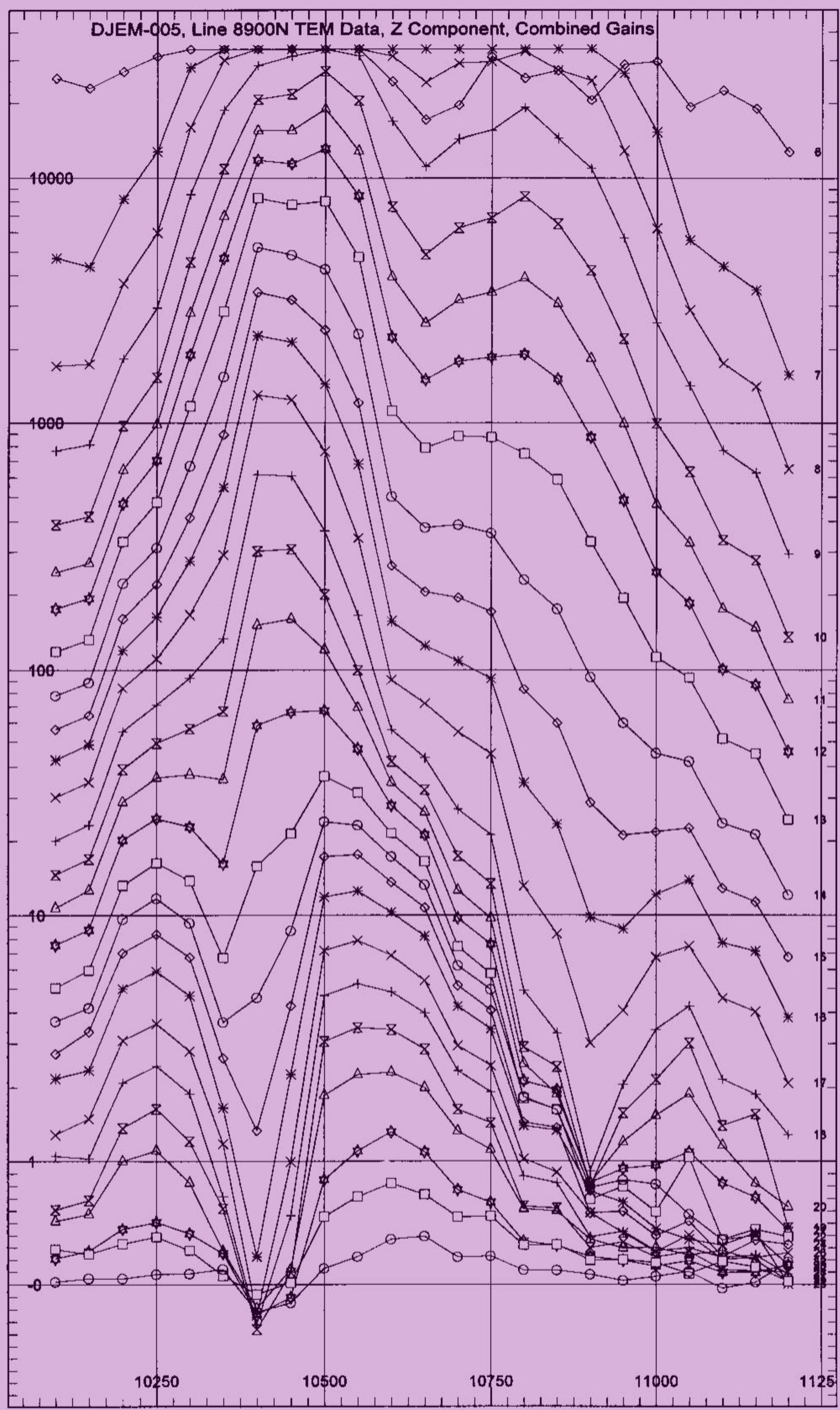


Scale 1 : 25,000

0 500 1000 1500 2000 metres

Transverse Mercator Projection. AMG Zone 54.

Prepared :	BHP	Exploration - BHP Minerals BHP Minerals Pty. Ltd., A.C.N. 006 694 782	Centre : Brisbane
Drawn :			Drawing No.: A4-9999
Date :	Anomaly DJEM 005		FIGURE 9c
Revised :			



CR#2 184

FIGURE 9d Moving Loop Sirotem Line 8900N

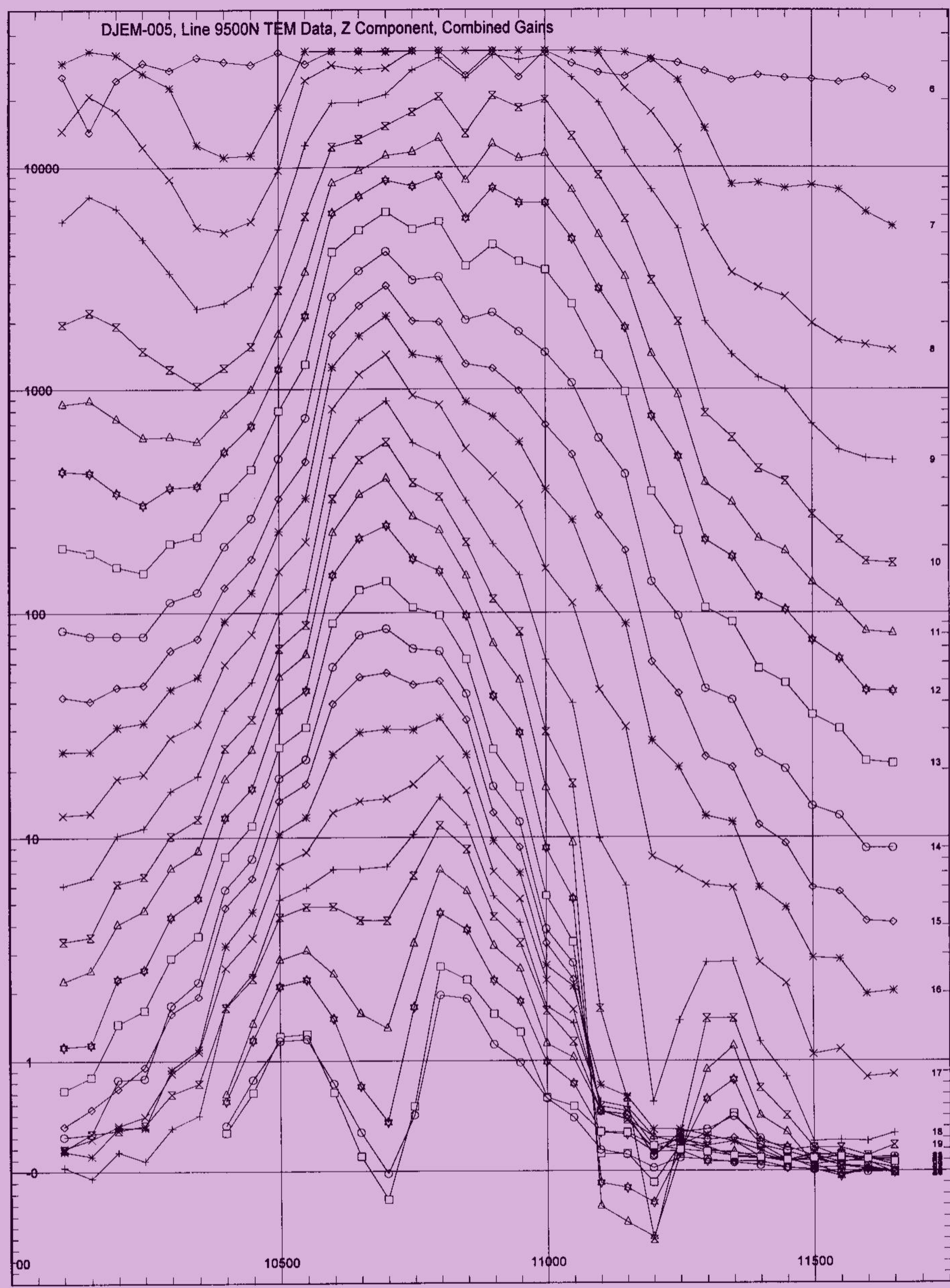


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FIGURE 9e Moving Loop Sirotem Line 9500N

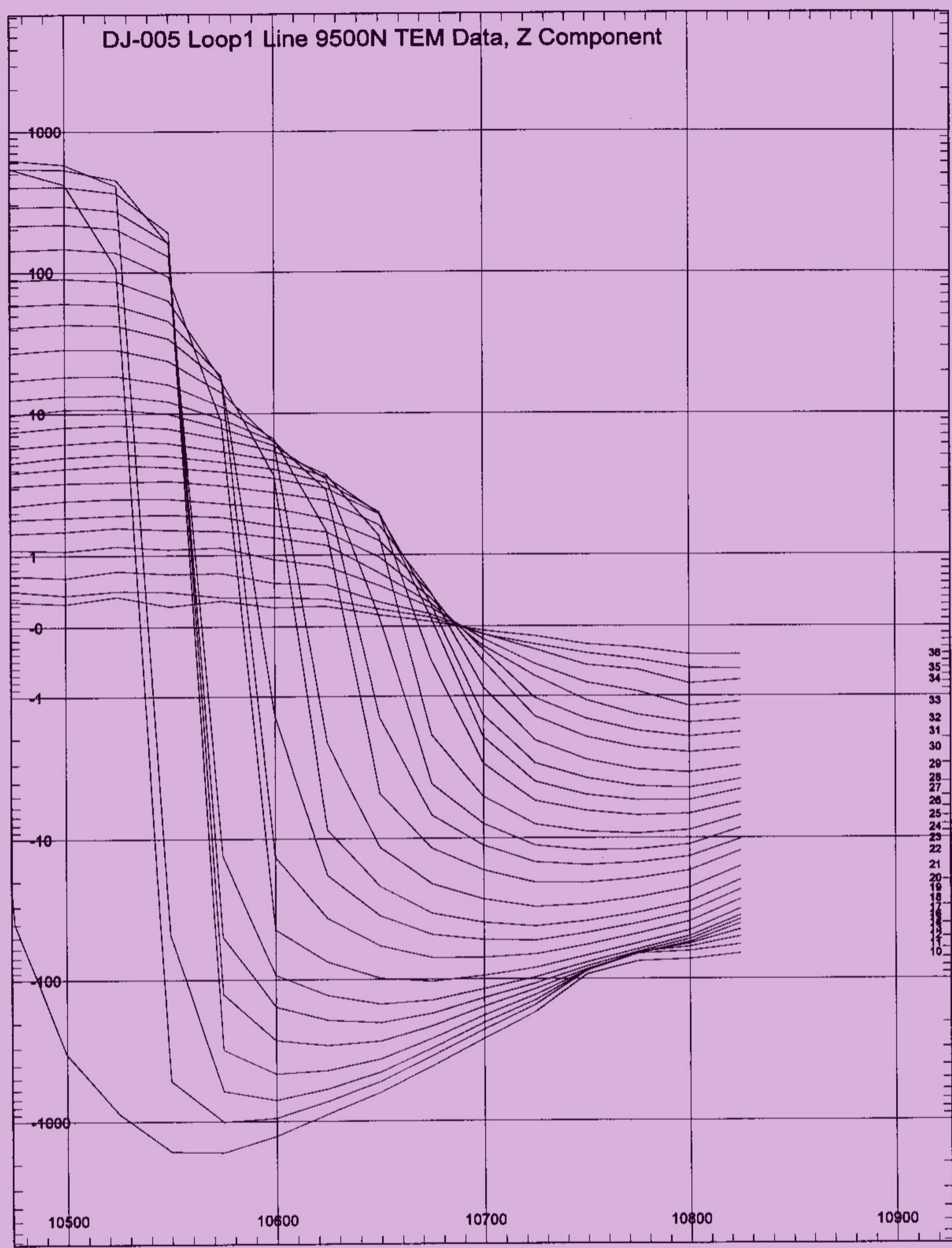


FIGURE 9I Fixed Loop Profile Loop 1 Line 9500N

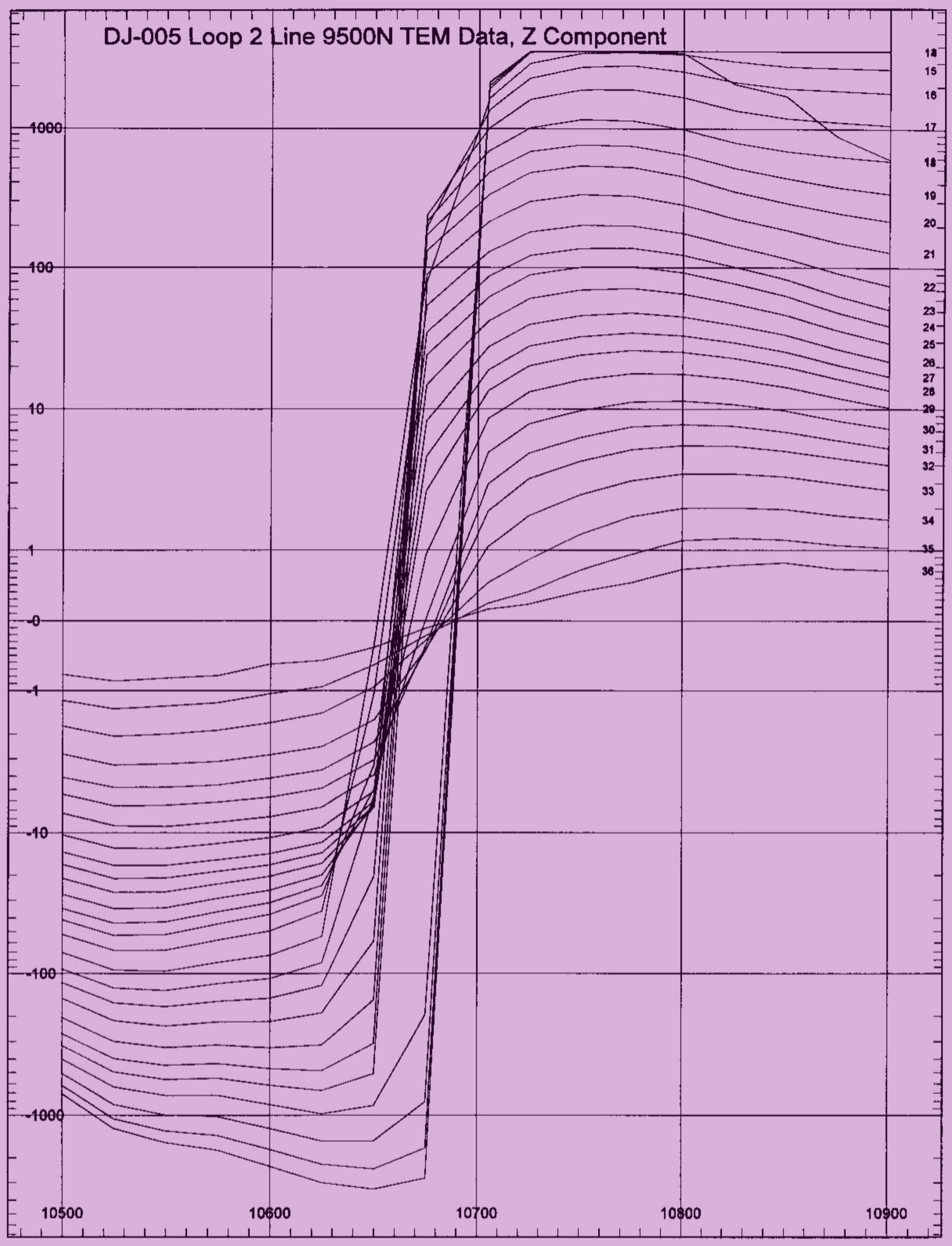


FIGURE 9m Fixed Loop Profile Loop 2 Line 9500N

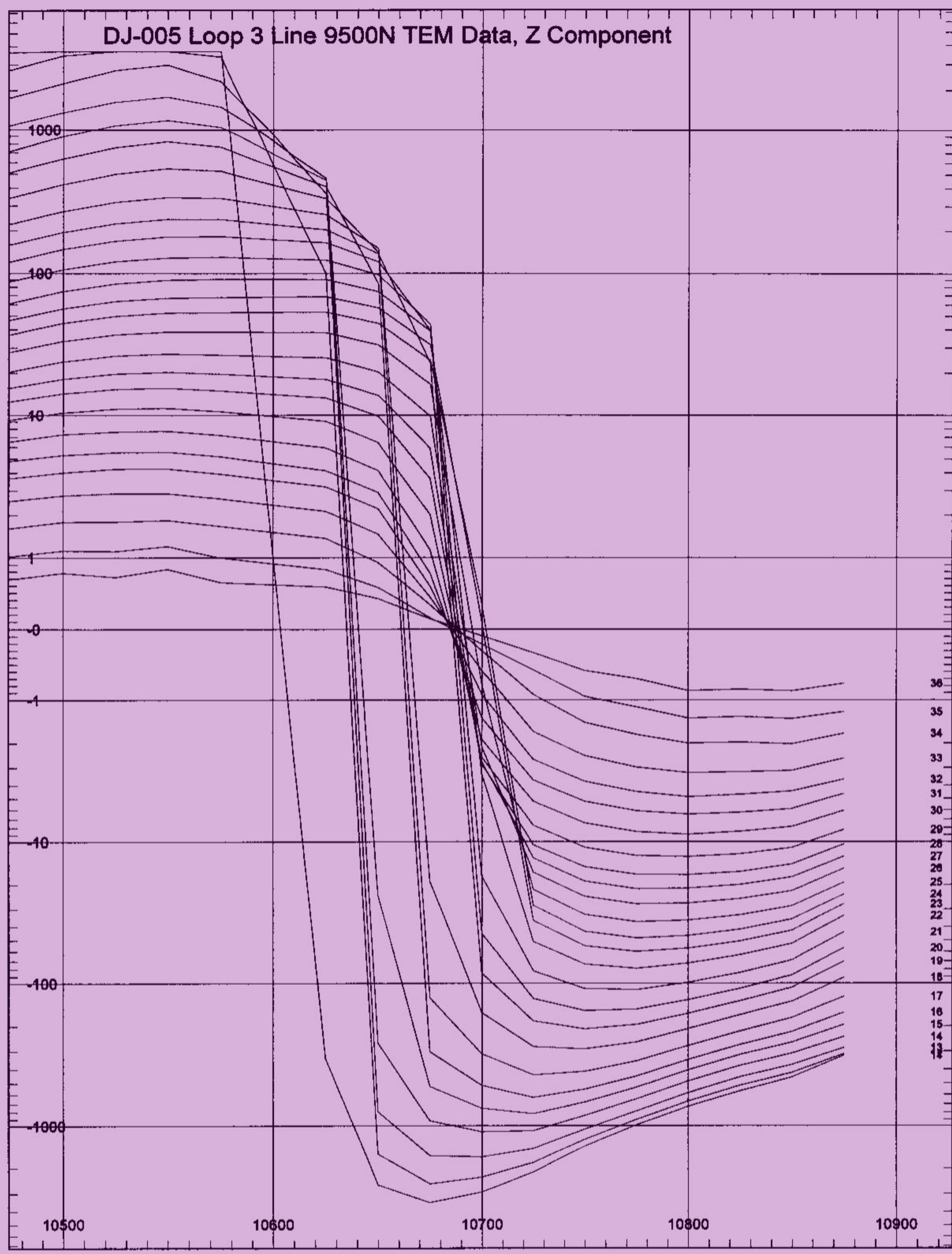


FIGURE 9n Fixed Loop Profile Loop 3 Line 9500N

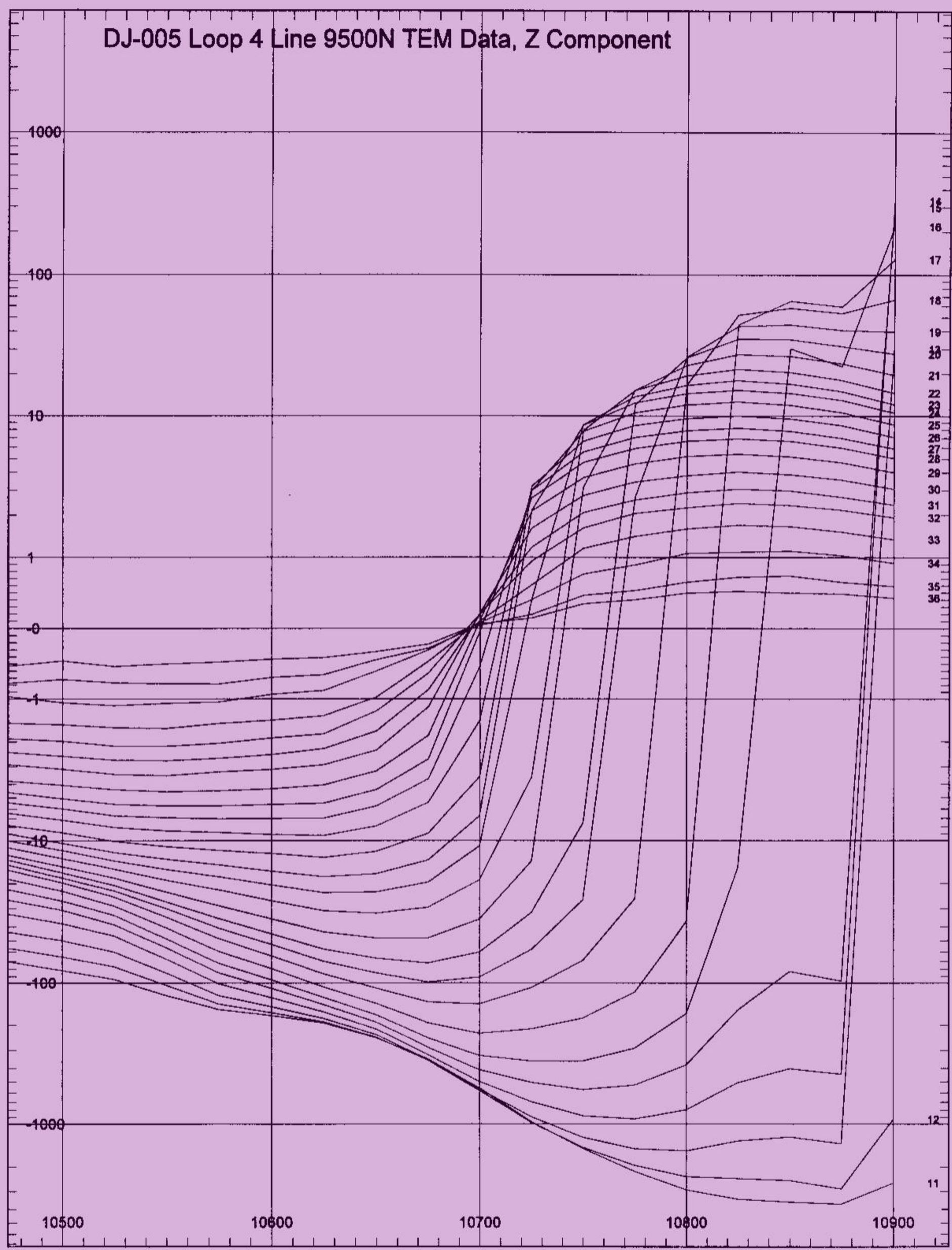


FIGURE 9o Fixed Loop Profile Loop 4 Line 9500N

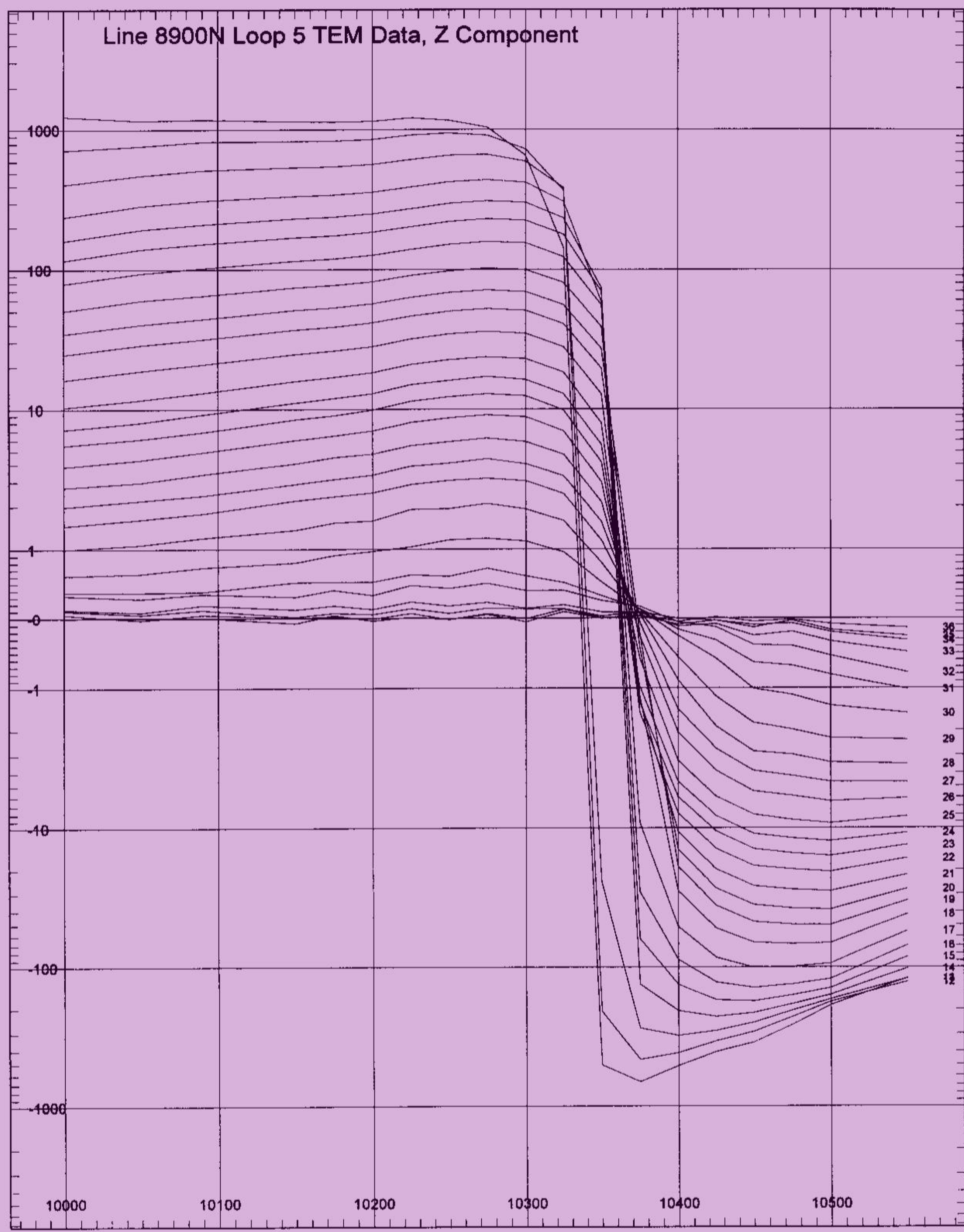


FIGURE 9p Fixed Loop Profile Loop 5 Line 8900N

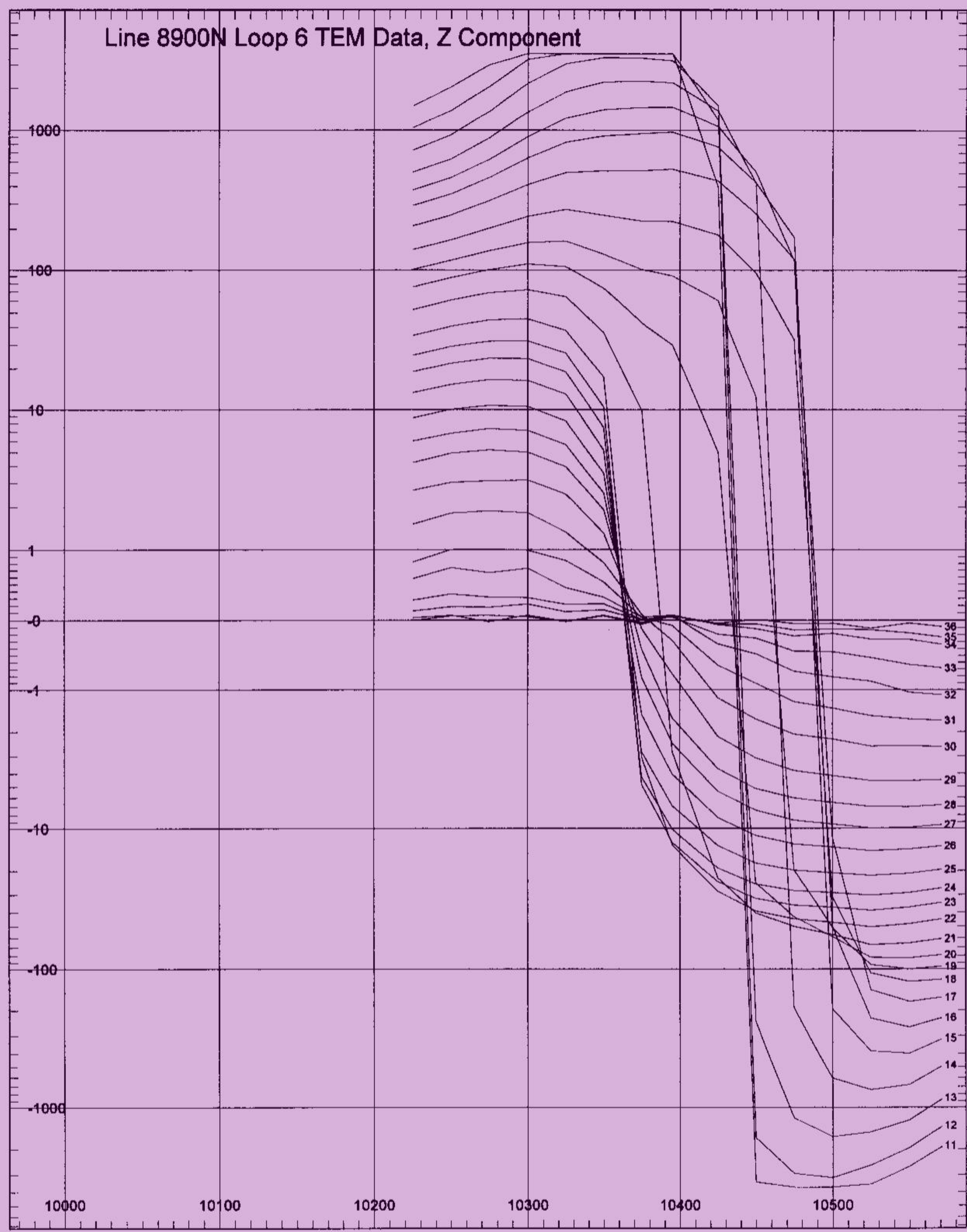


FIGURE 9q Fixed Loop Profile Loop 6 Line 8900N

CK# 164

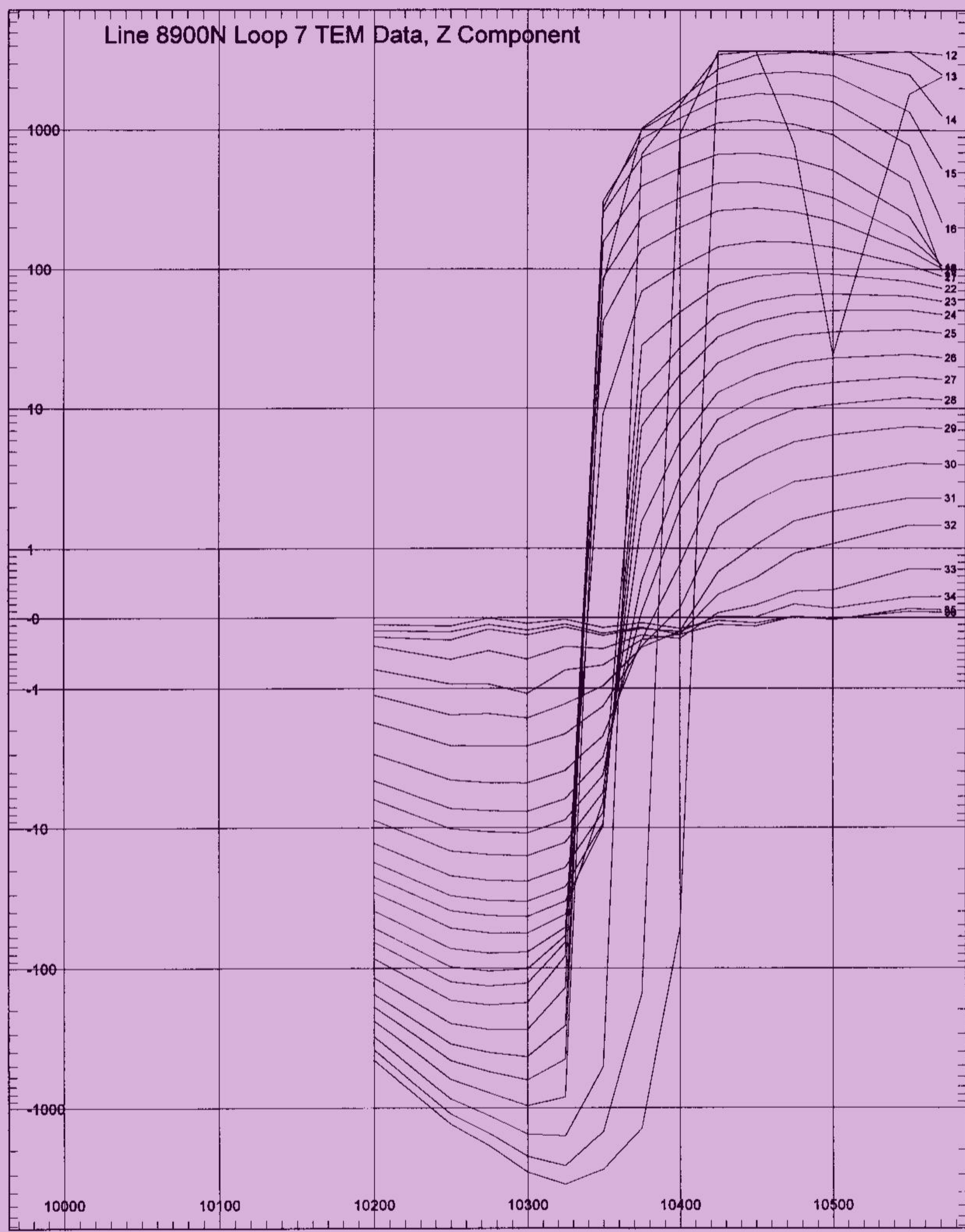


FIGURE 9r Fixed Loop Profile Loop 7 Line 8900N

CR 184

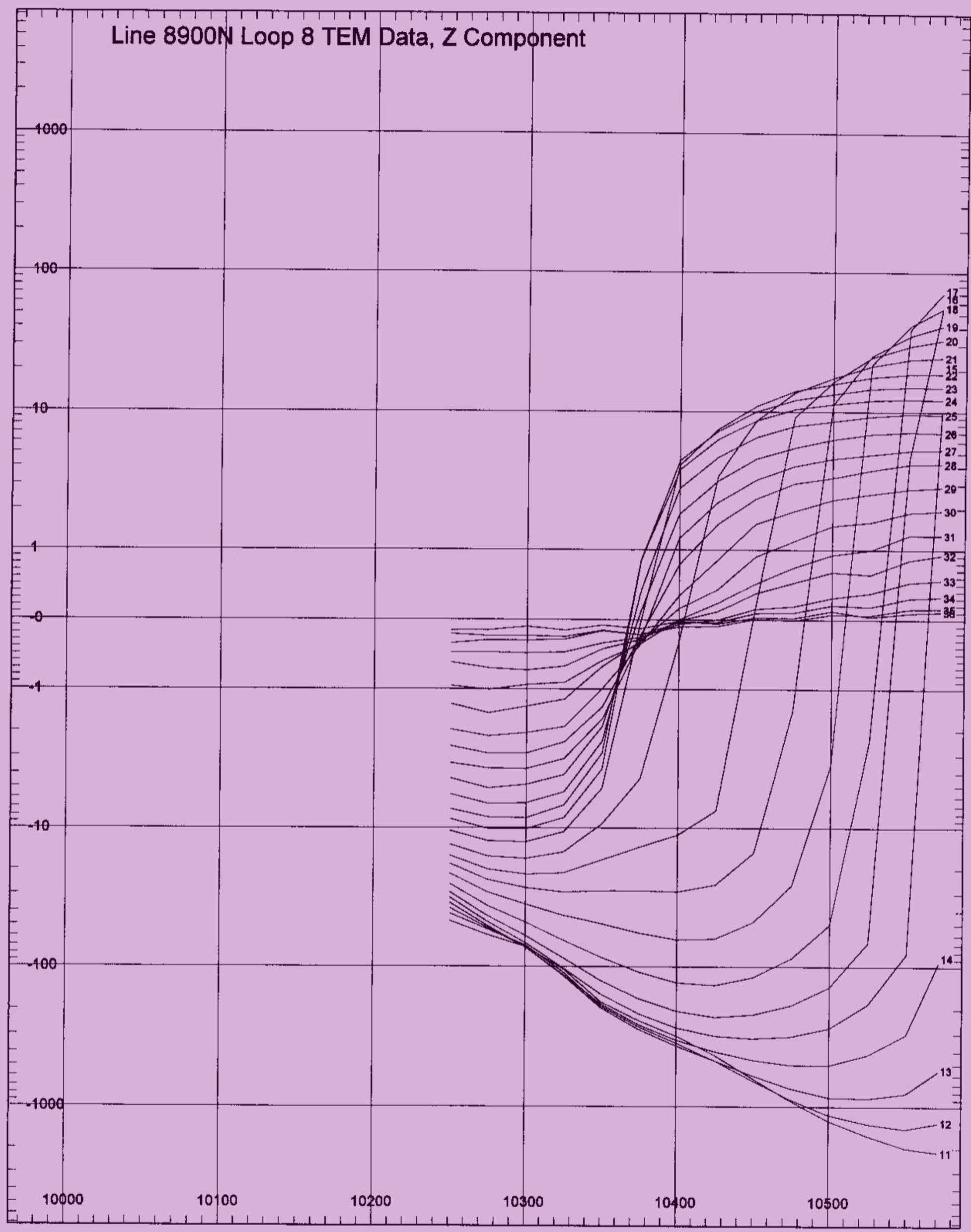


FIGURE 9s Fixed Loop Profile Loop 8 Line 8900N

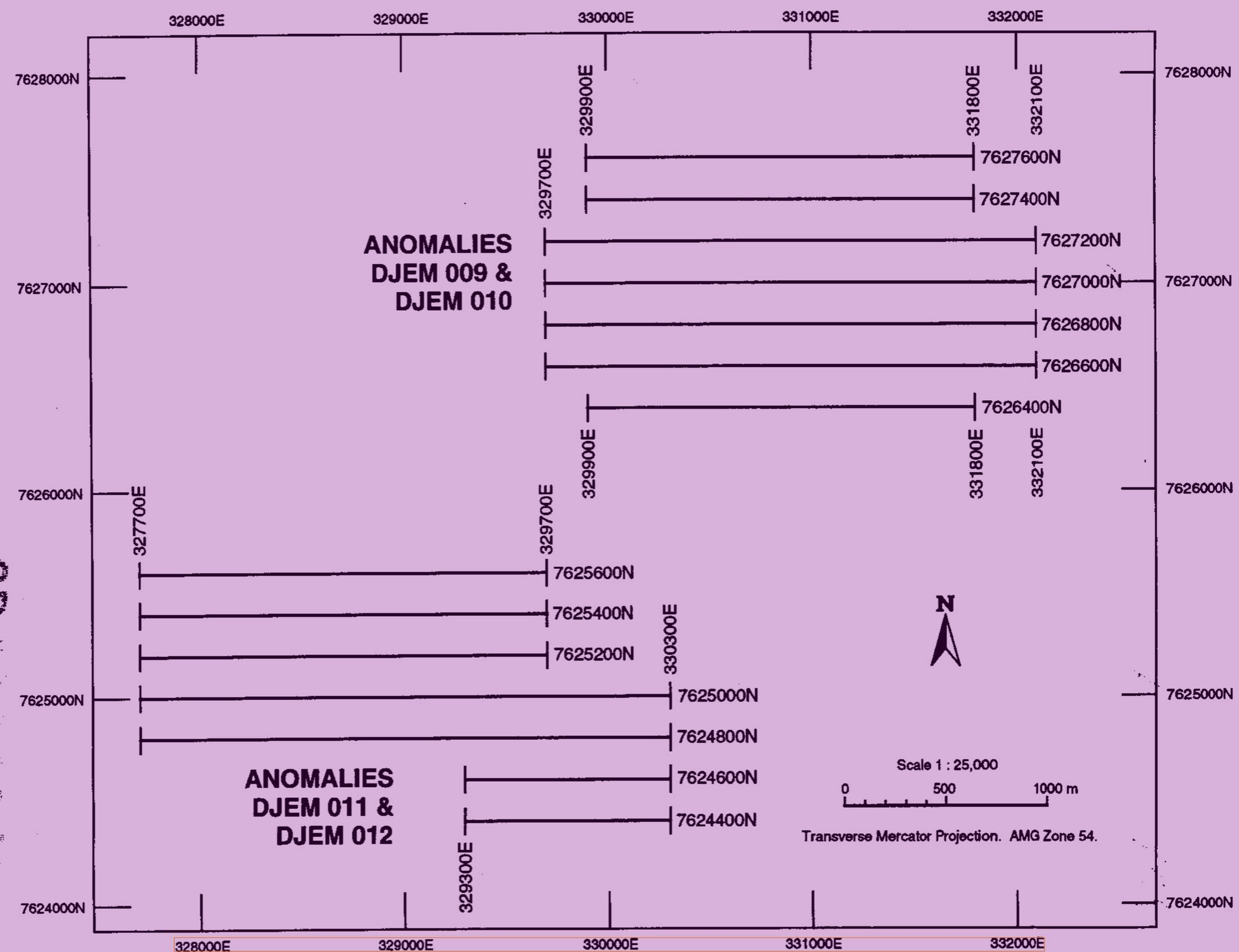
ANOMALY DJ-009 & DJ-010

GEOTEM	: DJ-009	DJ-010
Line	: 3261	3261
Easting	: 330447E	331505E
Northing	: 7627198N	7627206N
X-Tau	: 1.26	1.44
Z-Tau	: 1.45	1.28
Priority	: 2	2

COMMENTS AND RECOMMENDATIONS

The GEOTEM response over anomaly 10 indicates a conductor dipping to the east (Figures 10a & 10b). Its conductance is around 20 (S) with a depth between 80m and 250m. Anomaly 9 (Figures 10a & 10b) is not well defined in the conductance or conductivity pseudo-sections but has a high amplitude response in both the X and Z profile data. Decay calculations for both anomalies is around the 1.5 value which is quite low. It was decided that further work on anomalies 9 and 10 should proceed as both anomalies sit in the Wavely basin in Mt Isa formation not far from known mineralisation (Blue Hills Mine).

Three lines of ground electromagnetic PROTEM was collected over anomalies 9 and 10 to help refine their electromagnetic response. Figures 10e, 10f & 10g show the Z-amplitude moving loop data for lines 9100N, 9300N and 9500N respectively. The line profiles indicate 2 high amplitude responses in the early channels which are likely to represent the responses seen in the GEOTEM. In the late channels a wide conductor is defined on the western side of the lines, towards the western end of the lines the late channels become negative which may indicate an IP response. All inversions over the western section of each line give incorrect results. Conductance and conductivity inversion sections (Figures 10h and 10m) from these lines show a deep synformal conductor shallowing towards the centre of each line. This conductor seems quite deep, its shallowest point is on line 9300N at station 11300E with a depth of 300m. More analysis of these results is required before any further work on these anomalies is planned.



Prepared :

Drawn :

Date :

Revised :

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Anomalies DJEM 009, 010, 011, 012

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Centre : Brisbane

Drawing No.:

FIGURE 10c

9100n62.fem V2

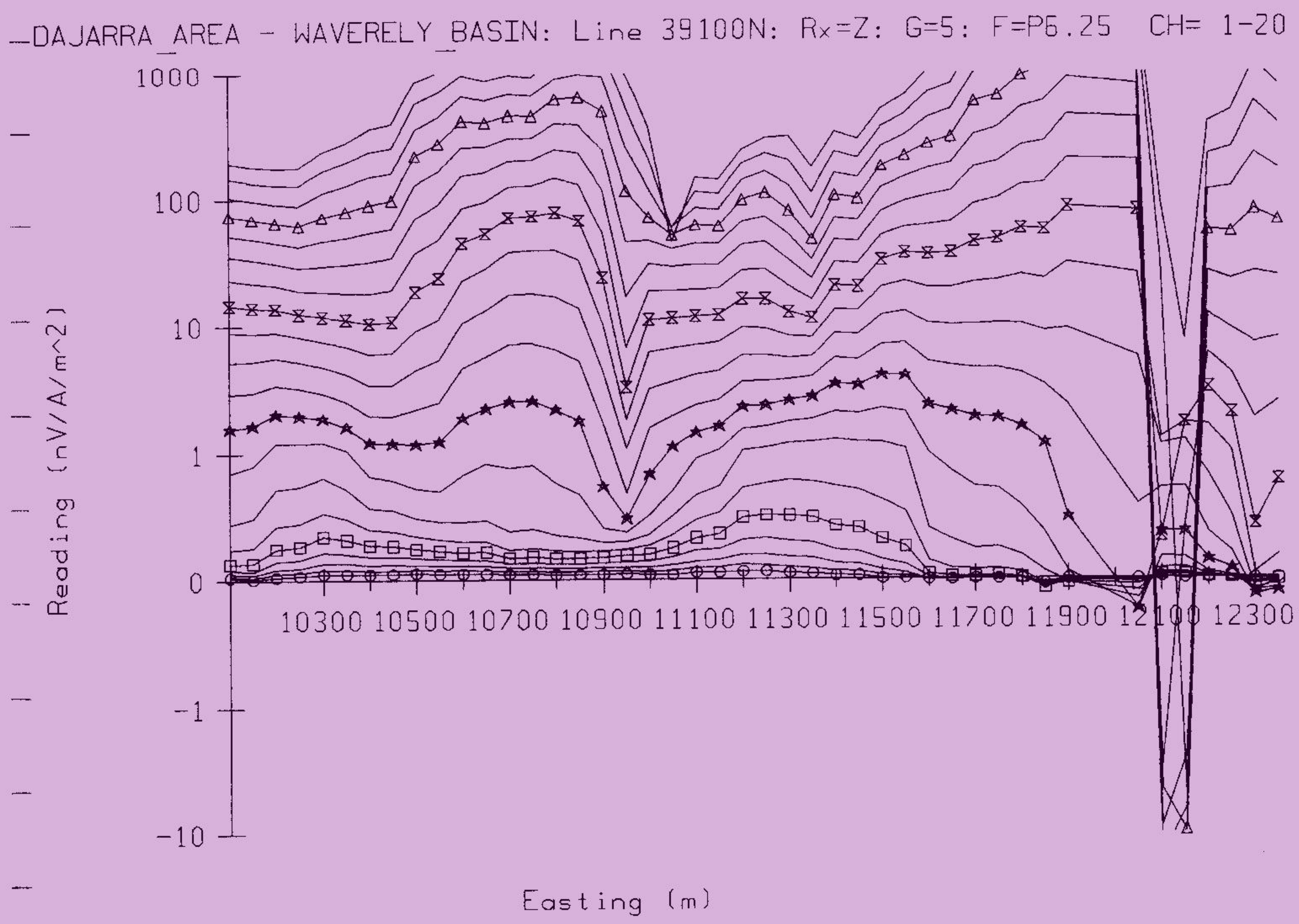


FIGURE 10e Moving Loop Profile Line 9100N

1300n62.tem.

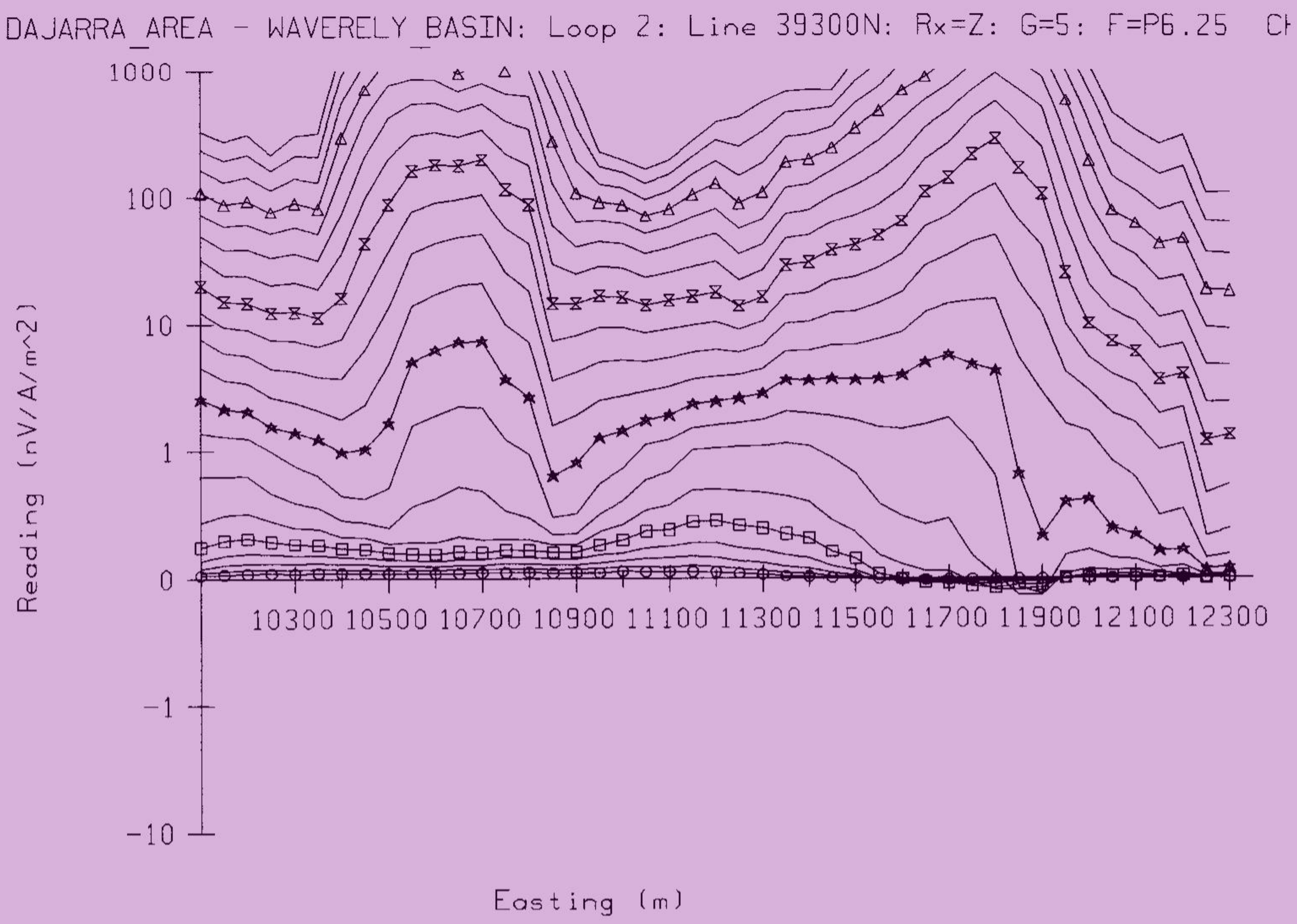


FIGURE 10f Moving Loop Profile Line 9300N

9500n62.fem.

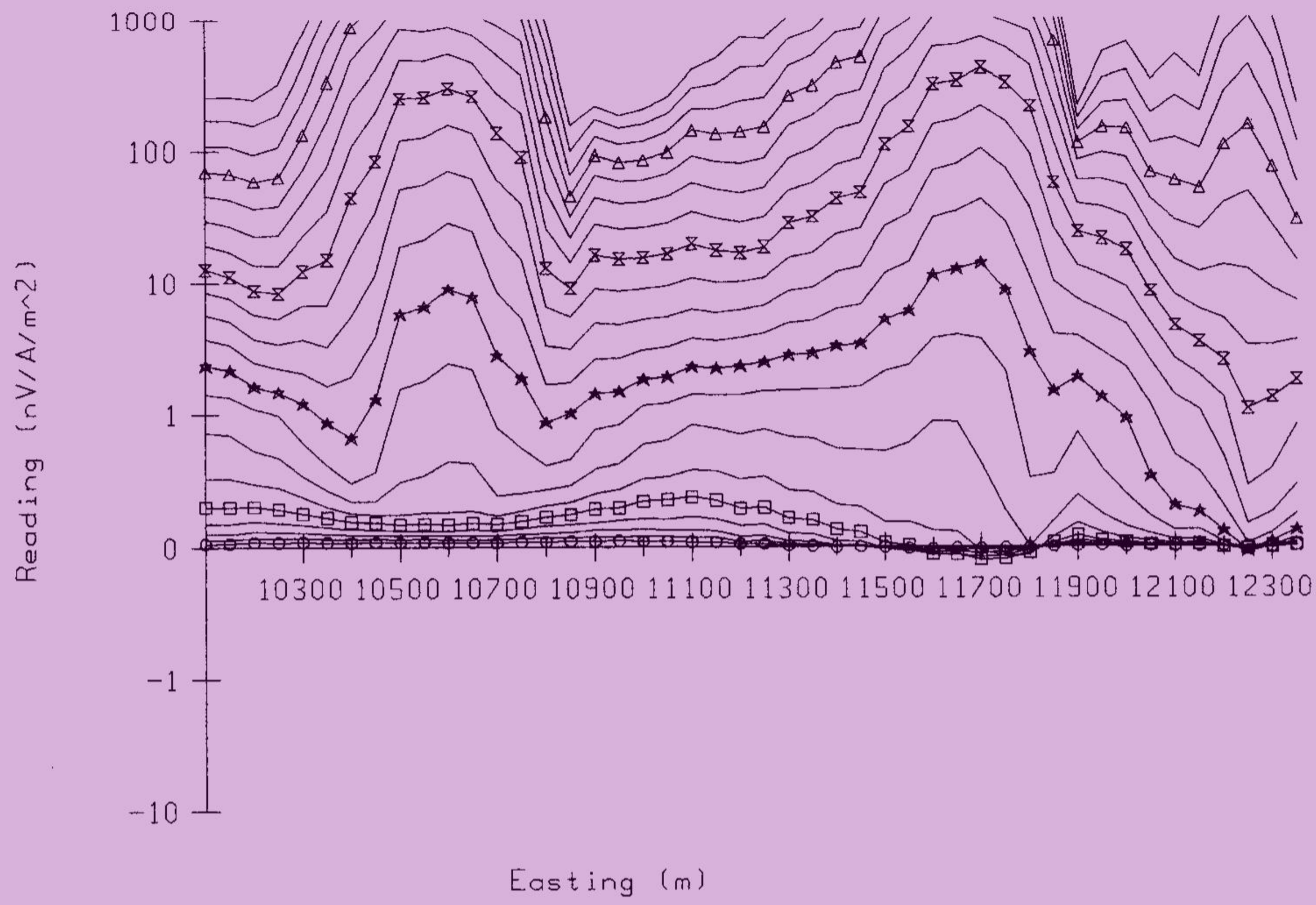


FIGURE 10g Moving Loop Profile Line 9500N

ANOMALY DJ-011 & DJ-012

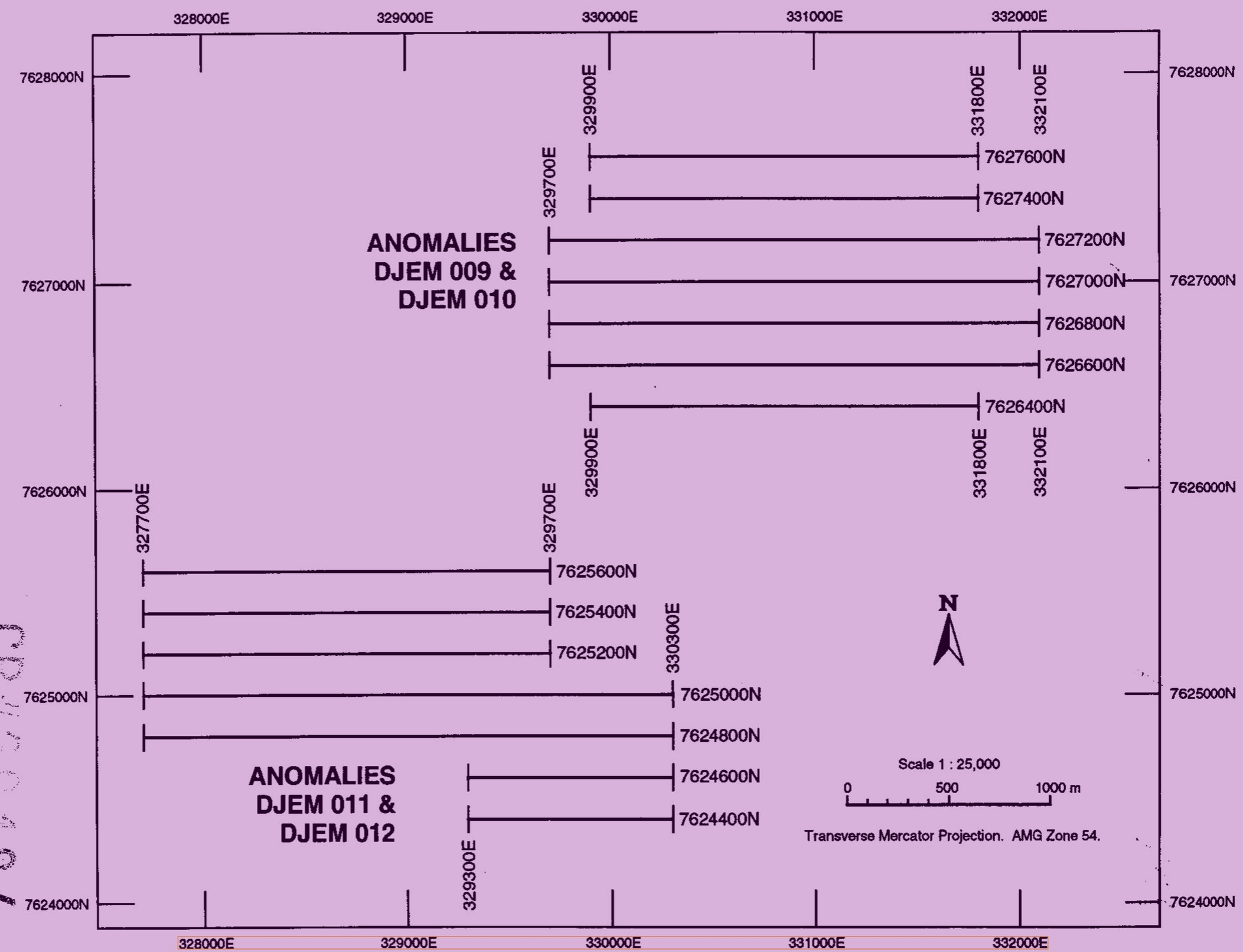
GEOTEM	: DJ-011	DJ-012
Line	: 3201	3163
Easting	: 328820E	330040E
Northing	: 7625408N	7624184N
X-Tau	: 1.92	1.93
Z-Tau	: 2.27	3.74
Priority	: 2	2

COMMENTS AND RECOMMENDATIONS

GEOTEM line 3201 shows two anomalies both anomalies are present in the Z &X data (Figures 11a and 11b). The western anomaly DJ-011 is wider than anomaly DJ-012 to the east. The GEOTEM line 3163 (figures 11c & 11d), which is further south, shows only anomaly DJ-012. The conductance of anomaly DJ-011 is around 20 (S) with a depth between 50m and 80m. Tau calculations give a better result in the Z component suggestion better coupling on this axis. Anomaly DJ-011 is quite discrete, sitting adjacent to the Wonomo fault. DJ-012 has a conductance of 25 (S) and a good decay in the Z component. Although this anomaly has a long strike length and could be conductive stratigraphy its Z component decay constant (Tau) is excellent.

Four lines of ground EM PROTEM were collected over these anomalies to help refine their electromagnetic response. Figure 9e shows a plan image of the lines and grided channel 11 response, Z-amplitude moving loop profiles for lines 9100N, 9500N, 9300N and 9700N are shown in figures 11g to 11j respectively. The earlier time/channels from profiles clearly define the two GEOTEM anomalies these responses can also bee seen in the conductance and conductivity sections (Figures 11k and 11r) calculated from the line data. The geology in this area is quite steep. This can be seen in some of the M shaped anomalies in the late times of the profile data. Unfortunately inversions do not adequately model such responses. Anomaly DJ-011 seems to be wide and shallow in the profiles and the inversions confirm this. Anomaly DJ-012 seems to become M shaped in the late channels on line 9500N indicating a steeper dip. Inversions suggest that the conductor is shallow with a complex structure.

An additional steeply dipping anomaly has been discovered to the east of DJ-011. This anomaly can be seen as M shaped responses in the profile data from lines 9300N and 9500N at eastings 11300E and 11250E respectively. This anomaly does not seem to be present in the additional lines to the north and south. I think this new anomaly is an interesting target which may require further investigation. Additional plate modelling and a review of geochemistry is required before any drilling is planned.



Prepared :

Drawn :

Date :

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Anomalies DJEM 009, 010, 011, 012

Centre : Brisbane

Drawing No.:

FIGURE 11e

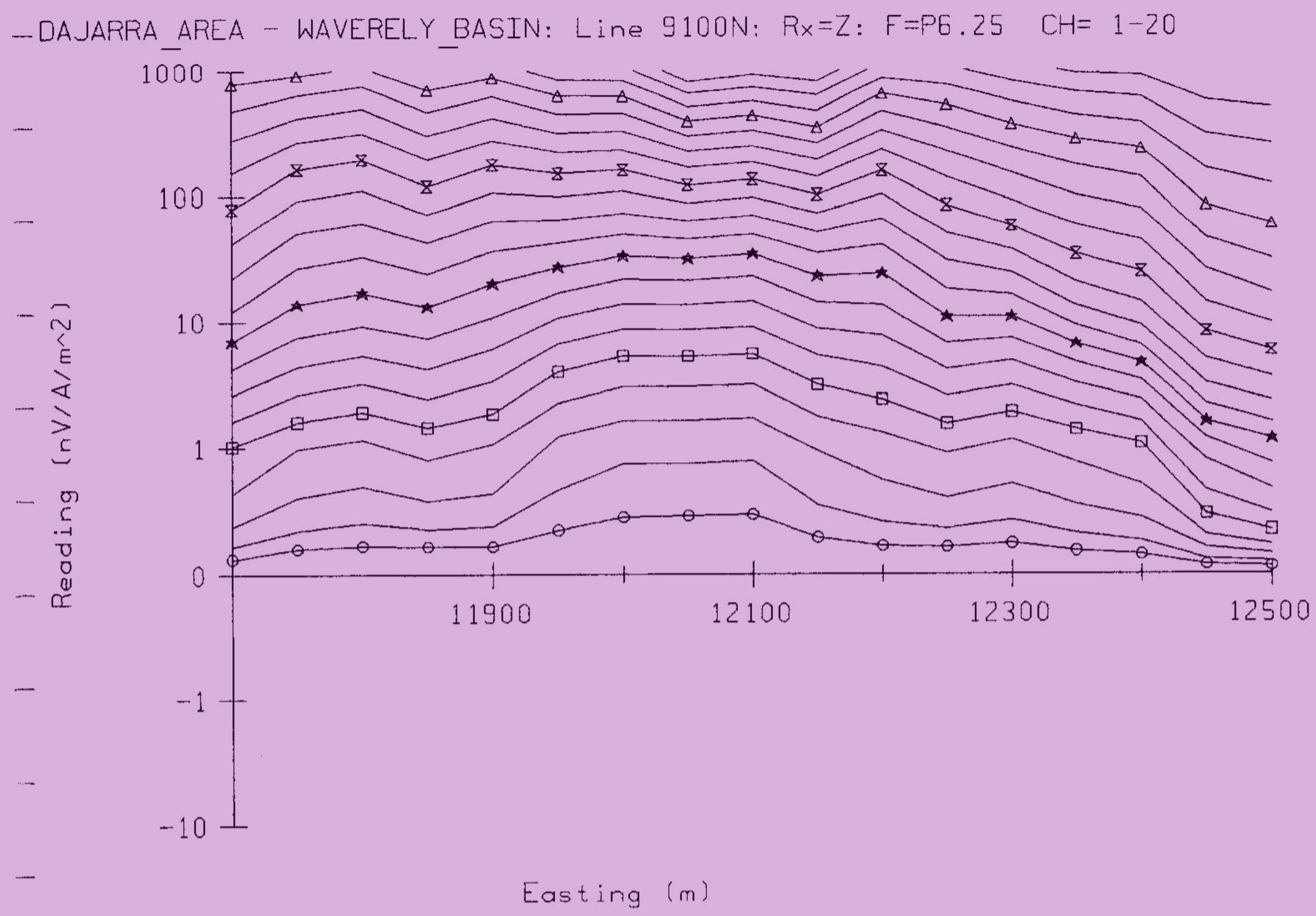


FIGURE 11g Moving Loop Profile Line 9100N

CR#28164

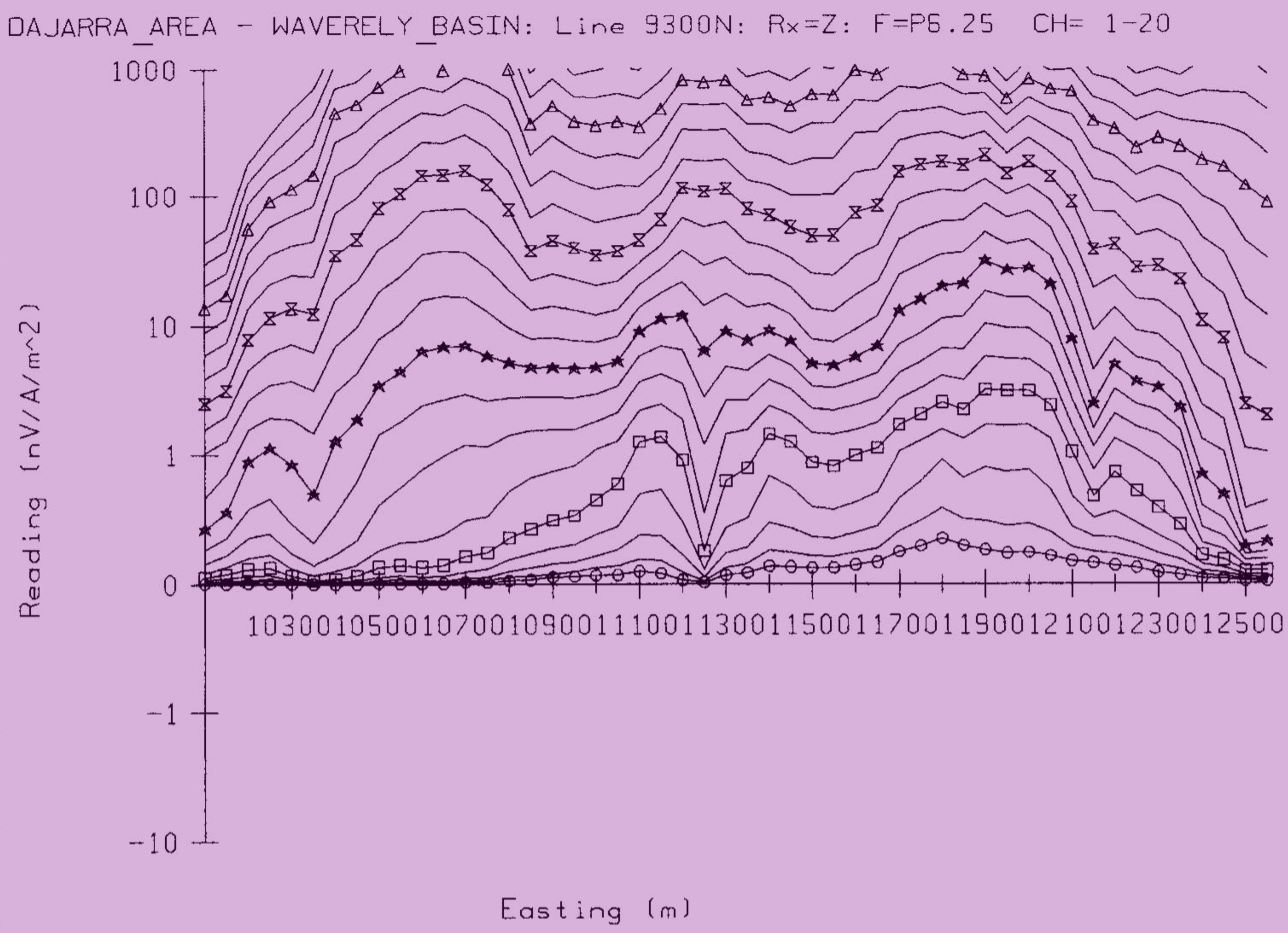


FIGURE 11h Moving Loop Profile Line 9300N

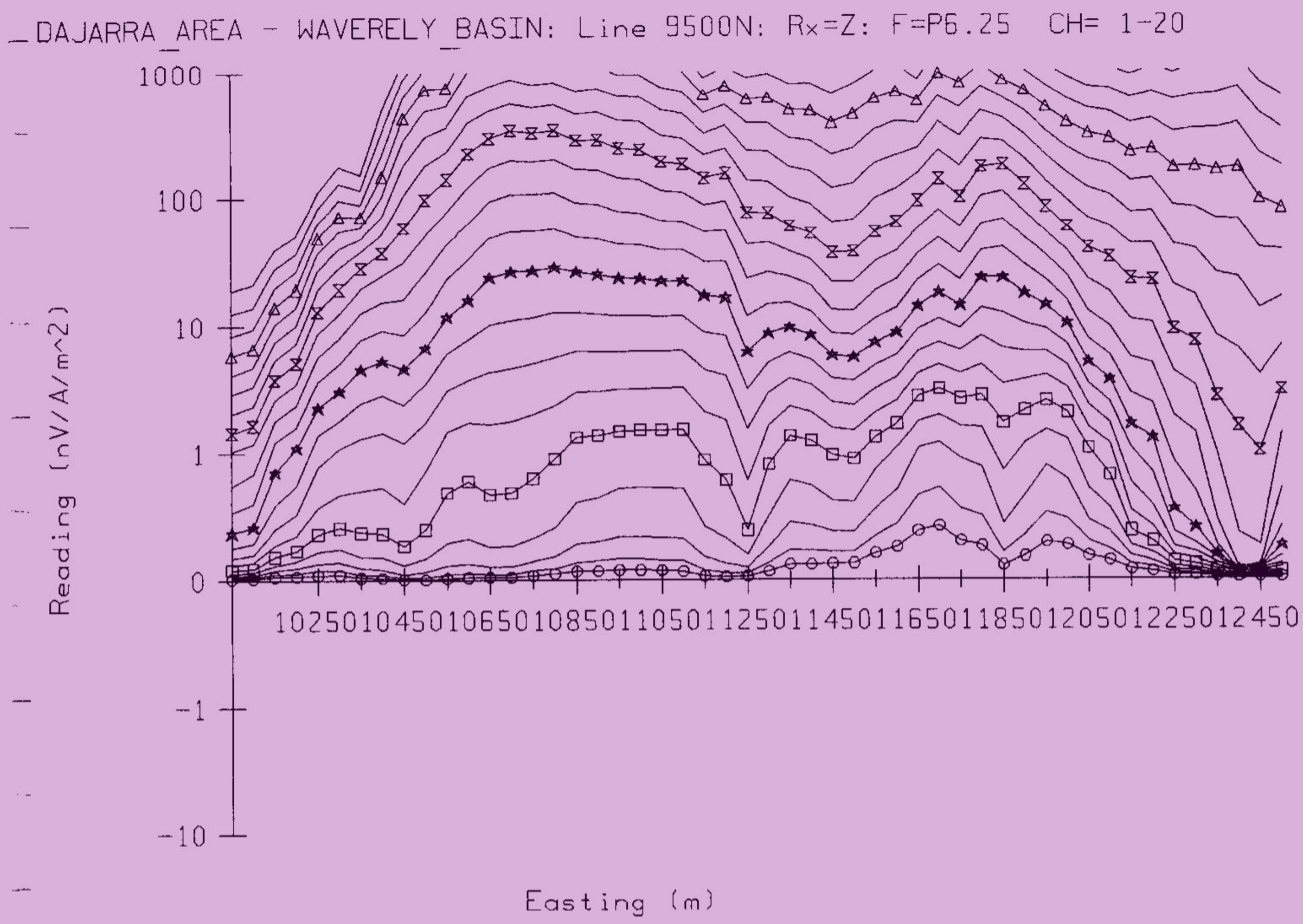


FIGURE 11i Moving Loop Profile Line 9500N

CR 34

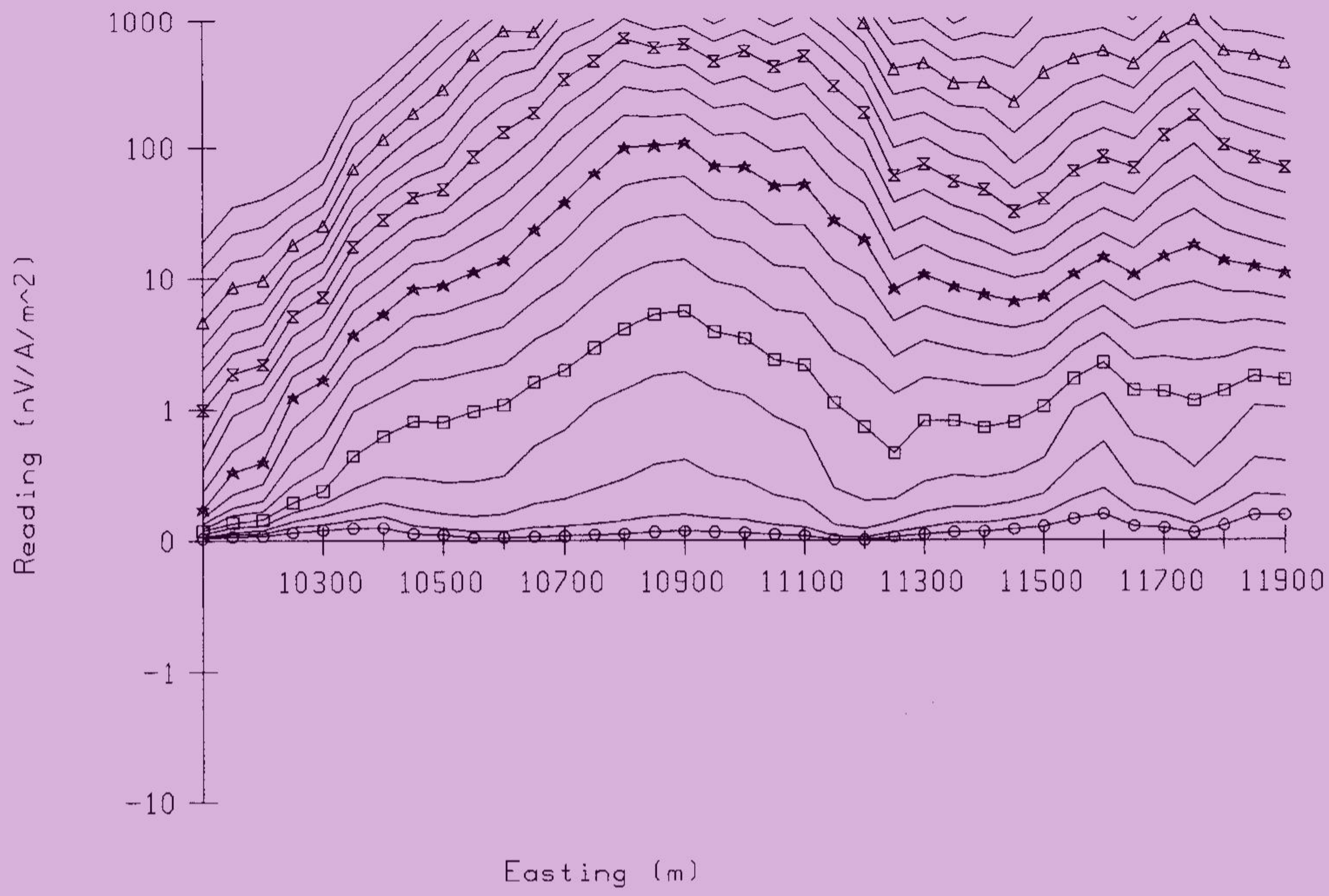


FIGURE 11j Moving Loop Profile Line 9700N

CR 4

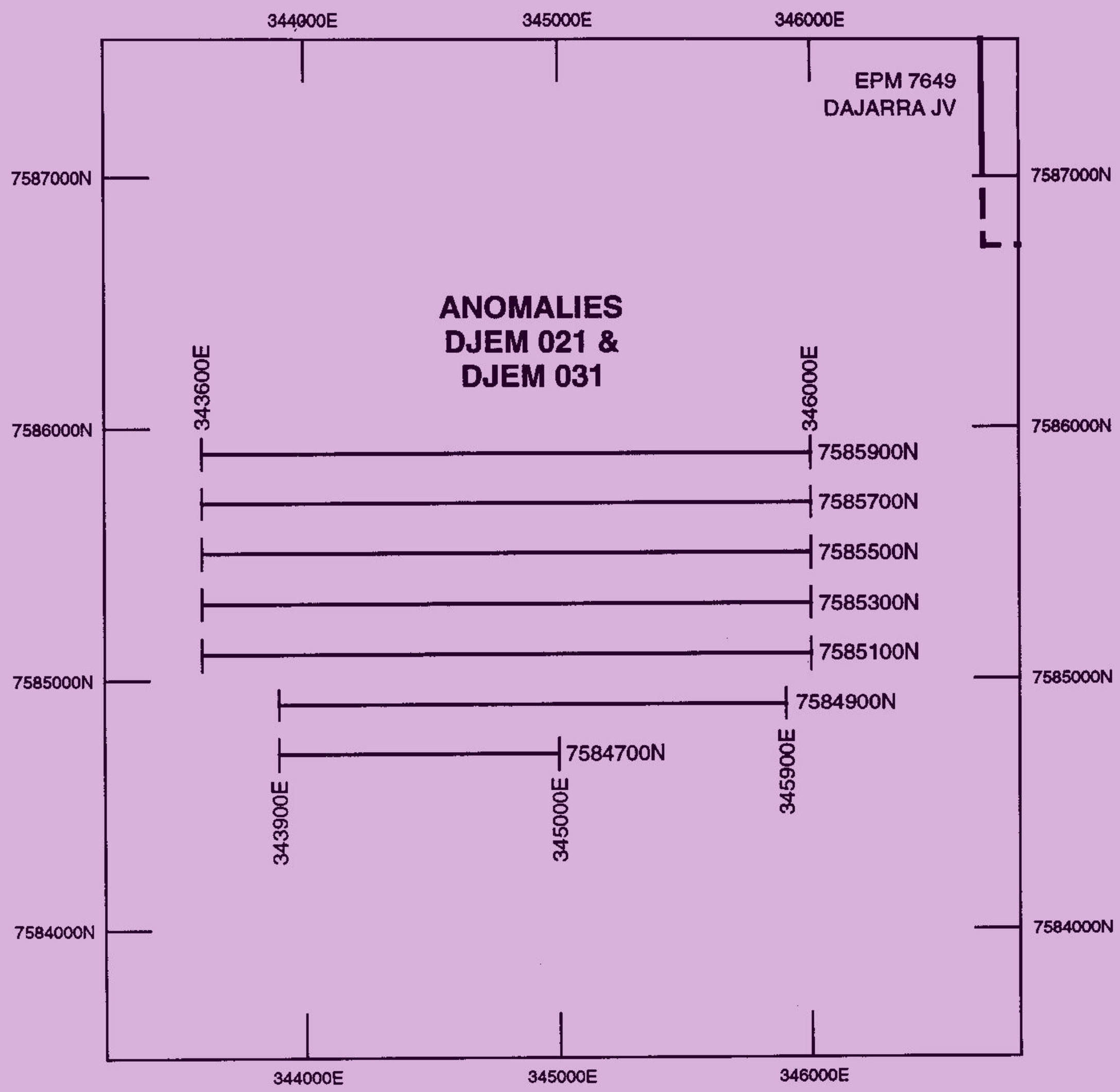
ANOMALY DJ-021 & DJ-031

GEOTEM	: DJ-021	DJ-031
Line	: 1891	1871
Easting	: 343500E	344750E
Northing	: 7586105N	7585500N
X-Tau	: 2.53	1.58
Z-Tau	: 2.96	1.87
Priority	: 2	2

COMMENTS AND RECOMMENDATIONS

The Temper sections from line 1891 (Figures 12a & 12b) show anomaly DJ-021 as a deep conductor with a depth around 200m and a conductance of 20 (S). Anomaly DJ-031 (Figures 12c & 12d) is not as well defined in the conductance or conductivity pseudo-sections but has a high amplitude response in both the X and Z profile data. Decay calculations for anomaly DJ-031 are around 1.7 which is quite low. While the decay constant for anomaly DJ-021 is better at approximately 2.7 . It was decided that a grid over DJ-021 should be extended to cover DJ-031 which represents a different style of GEOTEM response.

Two lines of ground electromagnetic PROTEM was collected over anomalies DJ-021 and DJ-031 to help refine their electromagnetic response. Figures 12e shows a plan of the two PROTEM lines. Figures 11g & 12h show the Z-amplitude moving loop data for lines 9700N and 9900N respectively. In the early channels the line profiles show two responses similar to those seen in the GEOTEM, but in the late channels the response over anomaly DJ-021 becomes M shaped and wide. In the late channels the response over anomaly DJ-031 becomes negative indicating an IP effect. Because of this IP effect the inversions on data over anomaly DJ-031 are incorrect. The inversions for the each profile over DJ-021 (Figures 12i to 12l) indicate a surface conductor and a deeper conductor probably dipping to the west. DJ-021 may be a stratigraphic response, geochemistry and geology are needed to confirm this. The IP effect from DJ-031 is interesting and represents a good target, the wavelength of the response on line profiles indicate the anomaly is fairly shallow. Geochemistry will be needed to confirm anomaly as a target. An additional response in the moving loop data with a lower amplitude early channel response and a good late channel decay is seen at 11200E on both lines. This anomaly represents an excellent target, with a depth around 200m, once again geochemistry is required to screen this target.



Scale 1 : 25,000

0 500 1000 1500 2000 metres

Transverse Mercator Projection. AMG Zone 54.

Prepared :	BHP Exploration - BHP Minerals BHP Minerals Pty. Ltd., A.C.N. 008 694 782	Centre : Brisbane
Drawn :		Drawing No.:
Date :	Anomalies DJEM 021 & 031	FIGURE 12e
Revised :		

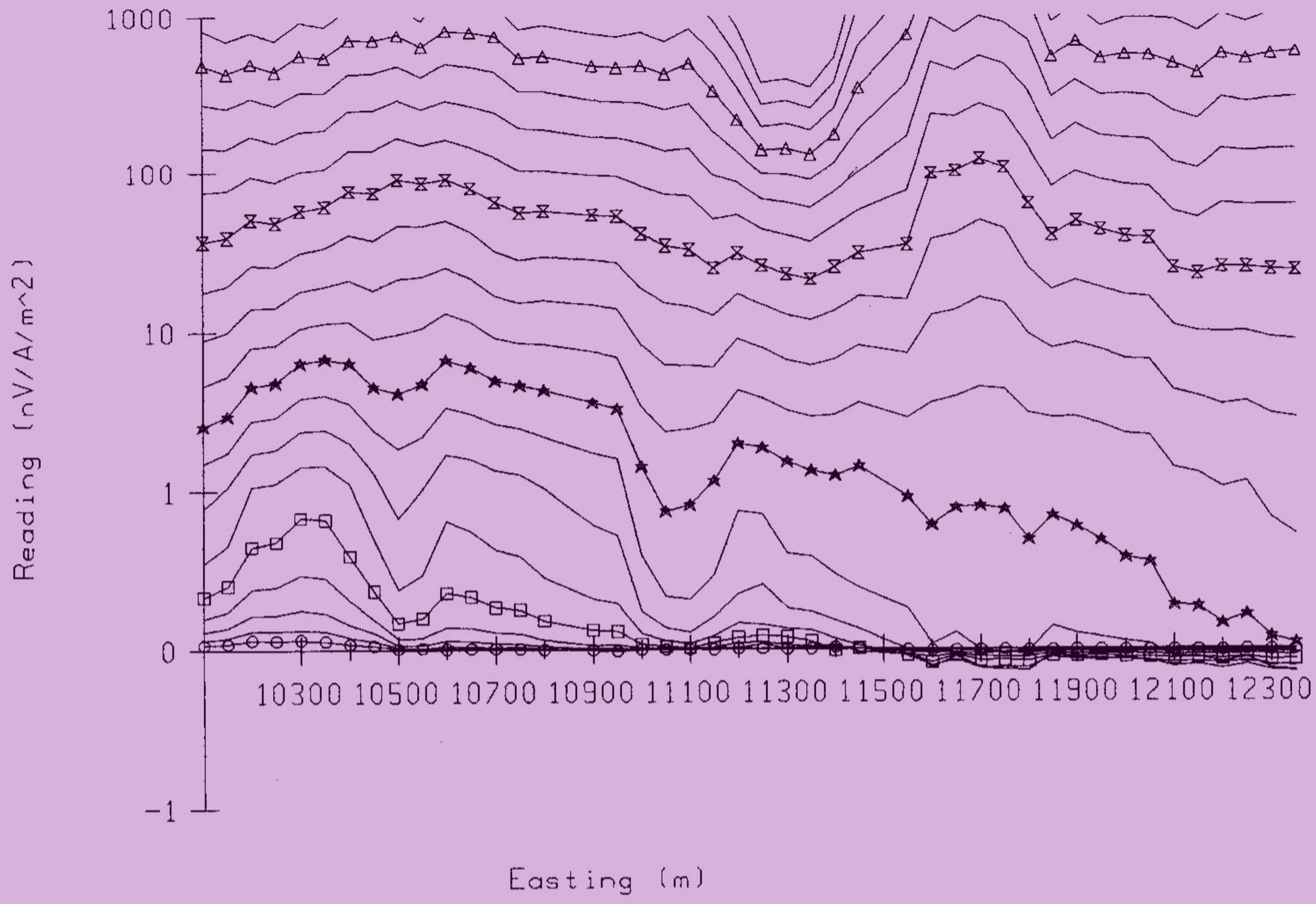


FIGURE 12g Moving Loop Profile Line 9700N

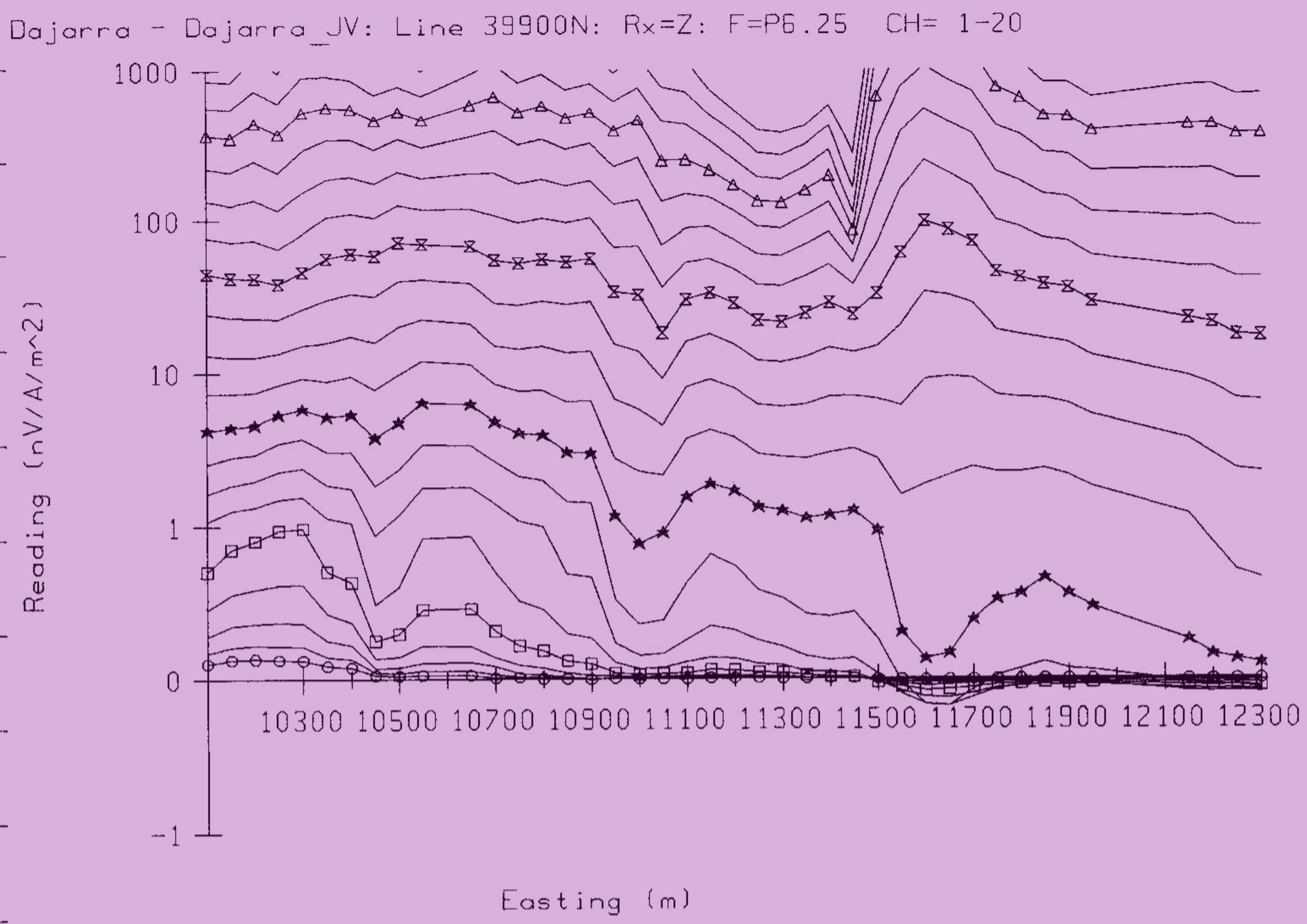


FIGURE 12h Moving Loop Profile Line 9900N

8. GEOCHEMICAL SAMPLING

Geochemical analysis of soils and rock chips was performed to test some of the areas highlighted by the GEOTEM data. Regular soil sampling, rock chips and orientation soil sampling took place at Site 5, while at Site 9 only orientation Soil sampling took place.

Geochemical soil sampling was undertaken at Site 5 to test the area of the airborne and ground EM conductor. The sampling was carried out on a 200m by 50m spacing. Samples were analysed for Cu, Pb, Zn, Fe and Mn by Australian Laboratory Services (ALS) using a perchloric acid digestion with an AAS finish. Results are tabled in Appendix 3.

Nine rock chip samples were collected from within the grid area at Site 5. Sampling of a ferruginous gossan after siltstone returned anomalous Zn values up to 2270 ppm and elevated Cu values up to 376 ppm. The high Zn values are attributed to scavenging by the iron in the gossan as associated Pb values are low. A set of geochemical results for the nine rock chips is contained in Appendix 4.

8.1 Orientation Soil Sampling

A total of 87 soil samples, of which 3 were field duplicates, were collected on two lines over the DJ5 EM anomaly. A total of 92 soil samples, of which 4 were field duplicates, were collected on two lines over the DJ9 EM anomaly. The samples were collected on both lines at a spacing of 50m. The lines cross the EM conductors perpendicular and extend each side. Sample location for each anomaly are shown in Appendix 5 and 6.

Except in the case of field duplicates only one sample was collected at each site and sieved in the field to -2mm. The samples were then sent to ANALABS in Townsville where a split was pulverised to -75mm and assayed by Aqua Regia Perchloric Acid/ICPOES (ARP), see Table 2. A separate split was analysed directly by MMI methods A and B, see Table 3.

Table 2 - Acid Digest/AAS Analytical Details

Method Code	Digestion Method	Detection Method	Element	Units	Detection Limits	Precision
GI142	Aqua regia/ Perchloric Acid	ICPOES	Ag	ppm	0.2	±10%
GI142	Aqua regia/ Perchloric Acid	ICPOES	As	ppm	2	±10%
GI142	Aqua regia/ Perchloric Acid	ICPOES	Cu	ppm	2	±10%
GI142	Aqua regia/ Perchloric Acid	ICPOES	Fe	%	0.1	±10%
GI142	Aqua regia/ Perchloric Acid	ICPOES	Mn	ppm	2	±10%
GI142	Aqua regia/ Perchloric Acid	ICPOES	Pb	ppm	5	±10%
GI142	Aqua regia/ Perchloric Acid	ICPOES	Zn	ppm	2	±10%

Table 3 - MMI Analytical Details

Method Codes	Digestion Method	Detection Method	Element	Units	Detection Limits	Precision
MT801	MMI-B	ICPMS	Ag	ppb	0.25	±10%
MT801	MMI-B	ICPMS	Au	ppb	0.25	±10%
MS800	MMI-A	ICPMS	Cd	ppb	2	±10%
MT801	MMI-B	ICPMS	Co	ppb	1	±10%
MS800	MMI-A	ICPMS	Cu	ppb	20	±10%
MT801	MMI-B	ICPMS	Ni	ppb	5	±10%
MS800	MMI-A	ICPMS	Pb	ppb	20	±10%
MT801	MMI-B	ICPMS	Pd	ppb	0.25	±10%
MS800	MMI-A	ICPMS	Zn	ppb	40	±10%

RESULTS

Merge results for each site are attached in Appendices 7 and 8. Original laboratory reports are attached Appendices 9 and 10. Basic statistics for results from both sites are shown in Tables 3 and 4. For orientation purposes the results have been normalised against an arbitrary background based on their respective 25th quartile. This will enable comparisons despite the different methods, detection limits and analytical units. Line profiles, for each site, using the response ratios are shown in Appendices 11 and 12.

Table 4 - Basic Statistics for soil results from Site DJ5

Elements	Unit	No.	Mean	Median	Min	Max	25th%	75th%	Std
CU_ARP	ppm	83	28.04	23	6	114	18	33	16.70
PB_ARP	ppm	83	19.33	11	5	374	8	17	40.99
ZN_ARP	ppm	83	31.70	29	8	84	19	40	16.74
MN_ARP	ppm	83	326.49	317	118	581	246	411	111.72
FE_ARP	%	83	3.60	3.25	1.13	7.6	2.74	4.45	1.26
AS_ARP	ppm	79	14.95	16	2	36	9	19	6.98
AG_ARP	ppm	0	--	--	--	--	--	--	--
ZN_MMI	ppb	82	484.39	440	120	1360	300	580	255.06
CD_MMI	ppb	83	15.08	14	2	30	10	18	6.19
PB_MMI	ppb	83	172.05	--	20	3660	60	140	409.81
CU_MMI	ppb	83	182.89	140	40	1040	--	220	144.16
NI_MMI	ppb	83	366.08	315	45	1115	195	520	233.36
AU_MMI	ppb	28	0.54	0.41	0.29	1.5	0.34	0.67	0.29
AG_MMI	ppb	83	5.52	3.84	1.71	31.68	3.31	6.45	4.68
CO_MMI	ppb	83	281.41	263	35	793	161	379	162.45
PD_MMI	ppb	23	0.70	0.59	0.26	1.65	0.49	0.83	0.32

Table 5 - Basic Statistics for soil results from Site DJ9

Element	Units	No.	Mean	Median	Min	Max	25th%	75th%	Std
CU_ARP	ppm	88	27.51	25	13	66	22	30	9.86
PB_ARP	ppm	86	13.14	12	6	36	9	14	5.82
ZN_ARP	ppm	88	36.90	34	23	87	30	38	11.51
MN_ARP	ppm	88	399.75	366	196	952	313	463	132.41
FE_ARP	%	88	3.26	3.215	2.34	4.85	2.99	3.465	0.45
AS_ARP	ppm	85	13.48	13	2	26	9	17	5.73
AG_ARP	ppm	0	--	--	--	--	--	--	--
ZN_MMI	ppb	88	377.05	300	60	1140	200	460	255.43
CD_MMI	ppb	87	10.34	10	2	26	8	12	4.73
PB_MMI	ppb	87	80.23	80	20	460	40	--	57.91
CU_MMI	ppb	88	203.64	160	40	660	120	280	122.94
NI_MMI	ppb	88	438.81	367.5	65	1505	240	610	268.66
AU_MMI	ppb	50	0.45	0.36	0.25	1.19	0.3	0.54	0.21
AG_MMI	ppb	88	6.35	5.29	1.88	19.49	3.62	7.67	3.71
CO_MMI	ppb	88	281.44	261	83	711	179	363	137.55
PD_MMI	ppb	16	0.47	0.325	0.25	1.43	0.28	0.56	0.33

Site DJ5

One large Pb response occurs at the sample site 11250E on the 39400N line. The response occurs in both the ARP and MMI results, 374ppm and 3640ppb respectively. The sample site corresponds to in-situ soils overlie the contact between the Mt Guide Quartzite and the Eastern Creek Volcanics. Given the in-situ nature of the soils, the magnitude of this single point anomaly, in both ARP and MMI results, is not indicative of large scale mineralisation. Normally MMI response ratios in in-situ soils over mineralisation, even low grade, are normally in the order of several 100's to 1000's. In this situation the response ratio is only 75. The anomaly is also only seen in the lead and not supported by other elements such as Zn or Ag. The result most likely corresponds to weak Pb mineralisation in a small quartz vein.

The rest of the response ratios on both line are weak for all elements by both methods. This is confirmed by the raw data, see Appendix 7 and Table 4. Variations in the profiles along the lines most likely represent differences in the soil types and underlying geology. At this site the variations are more obvious than those at DJ9 due to the in-situ nature of the soils at the DJ5 site. Once again the response ratio profiles for each methods almost mirroring each other with the MMI results showing an order of magnitude almost twice that of the ARP results. Follow-up work at this stage should involve ground truthing of the high lead site.

Site DJ9

The response ratios on both line are weak for all elements by both methods. This is confirmed by the raw data with values below what would be considered anomalous in an ARP digest, high 100's ppm, and an MMI digest, high 1000's ppb. See Appendix 8 and Table 5. The small variations in the profiles along the lines most likely represents differences in the soil types. The low magnitude of these variations compared to those seen at site DJ5 reflects the more exotic nature of the soils at site DJ9.

Despite the exotic nature of the soils the response ratio profiles for both methods almost mirroring each other. The MMI results however show an order of magnitude almost twice that of the ARP results. This reflects the more subtle detection limits of the MMI method. No further work is recommended in this area.

Quality Assurance

No standards were submitted with the sample batches. Field duplicate samples taken at both sites returned values with in 10% confidence limits, for both methods, of their corresponding original samples.