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DEPT. OF MINES				
REF. No. 6572/84				

THE SHELL COMPANY OF AUSTRALIA LIMITED

METALS DIVISION

E.L. 4/77 - HIGHCLERE

Report on "Old Park Road Geochemical Anomaly"

Author : D.C. Simpson  
Consulting Geologist

Report No : 08.2265

Date : 26/5/84

Copy No : 1

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  4. BXH/Devonport

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## 1.0 INTRODUCTION

### 1.1 General

The Old Park Road geochemical anomaly occurs within E.L. 4/77, Highclere, in a narrow east-west slice of ground to the south of ground held by Tasminex N.L.

The area is within partly logged rainforest, approximately 5 km east of St. Valentines Peak.

### 1.2 Tenement Status

The Highclere licence E.L. 4/77 is held in the name of Comalco Limited and is current to 1st June, 1984.

### 1.3 Present Investigations

This report is essentially a summary of work carried out over the past 18 months by various Shell personnel and the author.

The Supervising Geologist for Shell Metals, Devonport asked the author to collate and assess the available data, geologically map the area and make appropriate recommendations.

## 2.0 GEOLOGICAL SETTING

The area under review lies within an inlier of Cambro-Ordovician rocks obscured to the west, south and north by Tertiary basalt. The Cambrian rock represent the north-western flank of the Dundas Trough.

5 km to the northeast is the Housetop Granite while 5 km to the northwest is the Kara apophysis of the above granite.

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The prospect lies within a syncline occupied by Ordovician sediments including limestone, conglomerate, massive marine quartzwacke and siltstone. Tertiary basalt outcrops at the southern edge of the grid.

### 3.0 PRESENT INVESTIGATIONS & DISCUSSIONS

#### 3.1 Geology

Geological traverses were conducted along the cross lines and the baseline to provide information for a geological map at a scale of 1:2000 which is included as Fig. 1.

Due to dense nature of the forest and undergrowth in the mapped area it was generally not possible to map more than 20 metres from the lines and maintain accuracy. As a result mapping is restricted in its areal extent.

Outcrop is extremely rare within the grid with minor sub-outcrops and minor float. The geological interpretation therefore is tentative.

A sequence of siliceous siltstones and quartzose limestones is interpreted to dip to the southwest at about  $30^{\circ}$  in the northern-central part of the grid. Elsewhere there is insufficient outcrop to determine structure. The present investigations revealed the presence of calcareous rocks over a large part of the grid. The author therefore believes that the area may represent Ordovician Gordon Limestone rather than Devonian Bell Shale as suggested elsewhere.

At the south-western limit of the grid minor sub-outcrops of basalt occur which are related to the basalt seen to outcrop on the access road.

Fossils are relatively common across the grid and consist of fragments of bivalves (probably pelecypods), crinoid stems, corals and possible sponge spicules. No attempt was made to collect a fauna for stratigraphic studies as it was regarded as unwarranted at this stage.

### 3.2 Petrography

As part of the geological investigation of the area eleven rock samples were submitted to Central Mineralogical Services in Adelaide for study. Their report, CMS 84/4/3 is included at the back of this report.

The rocks selected for study were as representative as possible of the gridded area and revealed a consistency of rock type over the area. They were described as variably metasomatized impure, fossiliferous quartzose limestones.

On the geological fact plan the rocks are identified as siliceous hornfelses and the mineral assemblages identified in thin section generally confirm these observations.

CMS identified the assemblage as being metasomatic but in a subsequent conversation (17-5-84), W. Fander conceded that the minerals quartz-diopside-garnet-epidote may represent a metamorphic phase rather than a metasomatic one. While the mineral species present are not diagnostic of either metamorphic or metasomatic conditions some evidence suggests that the rocks were subjected to metasomatic effects, they are:

- a) Replacement of fossil fragments by diopside.
- b) Replacement of fossil fragments by pyrrhotite.
- c) The presence of prehnite.

Therefore it is possible that the rocks may have been subjected to contact metamorphism plus a metasomatic phase.

In view of the large Pb-Zn geochemical anomaly (500 x 500 metres) the area is of considerable interest.

Because of the small number of petrographic sample localities it is not possible to identify any area where metamorphism/metasomatism is more intense. One area, the eastern end of line 800N (i.e. 950 - 1000E) appears to have suffered little alteration and is essentially carbonate. (Samples 4140 and 4145).

### 3.3 Geochemistry

Geochemical soil sampling coverage is shown on plans numbered D/MQ 03/086, 102, 103, 104.

Analysis results are available for a variety of elements although the elements were not analysed for all locations.

Metals analysed were as follows:

<u>Metal</u>	<u>Method</u>
Sn, W, As	XRF 1
Cu, Pb, Zn, Co, Ni, Cd, Bi	AAS 1
Ag, Mo	AAS 3

All analyses were carried out by Comlabs Pty. Ltd., Mile End, South Australia.

The assay results for each of the metals is discussed below and should be read in conjunction with the appropriate plan.

Arsenic - Assay results available for all lines except 1400N.

Values are generally low and mostly in the range 20 - 40 ppm. A few higher values i.e. in 100 - 400 ppm range occur on line 2000N at the eastern and western end. These are

associated with Sn and W anomalies with the most likely cause being arsenopyrite associated with tin and tungsten in veins.

Bismuth - Assay results are uniformly low at <4 ppm and are of no significance.

Cadmium - Only available on 1400N. Results uniformly low at <1 or occasionally 1 ppm and hence of no significance.

Cobalt - Values generally less than 30 ppm with a few scattered higher values up to 110 ppm but not forming any defined anomaly.

Copper - Values are mostly in the range 10 - 80 ppm with isolated locations higher. No defined anomalies. Values are consistent with unaltered rock types in the area.

Lead - A substantial anomaly >200 ppm centred approximately at 1300N 500E is of considerable interest and contains a core with dimensions 300m x 200m greater than 300 ppm. Several locations with values greater 500 ppm occur within this zone.

Values are well in excess of those expected in a siliceous limestone sequence. Unfortunately there are few exposures in the area of anomaly so it is not possible to attribute the anomalous values to definite sources.

The anomaly may be explained in several ways:

- a) A metasomatic aureole in a reactive carbonate horizon above a granitoid intrusive.
- b) Elevated Pb values caused by a primary depositional environment high in base metal. i.e. syngenetic Pb.
- c) A transposed geochemical anomaly unrelated to the underlying rocks.

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Molybdenum - Results available for all lines except 1400N, 1950N and 2050N.

Assay values are usually very low with isolated locations greater than 10 ppm which do not form any defined anomaly.

Nickel - Results available only for line 1400N and parts of 1950N, 2000N and 2050N. Values are mostly in the range 10 - 80 ppm and are thought to be insignificant. Insufficient sample points are available to show anomalous zones.

Silver - Assay results available for lines 800N, 1200N, 1600N, 2000N and 500E and values are mostly less than 1 ppm however there are a few locations of 1 ppm and 2 ppm most of which are associated with the >200 ppm Pb anomaly. Because of the association the silver results are significant.

Tin - Results available for most lines, exceptions being parts of 1950N and 2050N.

Values are usually below 10 ppm with three small zones exceeding 20 ppm. These are located at 1400N 750E, 2000N 50E and 2000N 900E and probably reflect small scale veining in the sediments.

Tungsten - Results available for most lines, exceptions being parts of 1950N and 2050N.

One anomalous area is apparent coinciding with the tin anomaly at approximately 2000N 900E with several values >20 ppm and a high of 65 ppm. This is probably associated with veining.

An isolated high value of 180 ppm occurs with elevated tin at 1400N 760E.

Zinc - Values are available for all lines except 1950N and 2050N.

A strongly developed zinc anomaly of >200 ppm occurs approximately coincident with that for lead. Several sample results exceeding 400 ppm occur within the above anomaly.

Comments made on the lead results also apply to those for zinc.

### 3.4 Geophysics

#### (a) Magnetics

An airborne magnetic survey conducted for Shell in 1980 by Geometrics failed to reveal any significant anomaly in the vicinity of the geochemical anomaly. However a ground magnetic survey was carried out over the lines 800N, 1200N, 1600N, 2000N and 500E with 1400N being carried out at a later date. Results were reviewed by N. Hungerford and presented in a memo to BXH/Devonport dated 16th March, 1984.

In considering the significance of the ground magnetic results I believe that some of the anomalies are of sufficient magnetitude to be judged interesting in terms of the possible source. The only magnetic material identified to date in the area is pyrrhotite (from petrographic studies) which would suggest a possible pyrrhotite source for the anomalies.

Shell personnel pointed out that if pyrrhotite was the source of these anomalies then it was unlikely that a pyrrhotite body of Renison characteristics existed at depth - because of the lack of an anomaly of broad dimensions. In view of the altered pyrrhotite reported

by Central Mineralogical Services it would be possible to explain the source as a body with characteristics akin to "Queen Hill". i.e. a pyrite body with a small pyrrhotite core.

N.B. There is some doubt about the results for line 1400N as the values do not compare with the other lines. e.g. 1400N 500E value is 61765 and (B.L.) 500E 1400N value is 62140.

This may be due to the fact that the cross line values were not adjusted to the corresponding value on the tie line. However the reason for the discrepancy was not available to the author at the time of writing.

(b) Sirotem

With this method being carried out on one line comparison with areas off the geochemical anomaly are not possible. Field inspection in the vicinity of the anomaly at 1250N 750E failed to reveal a source for the strong response. A clay pug identified in the bed of a small creek confirmed that weathering of the original rocks is intense in the area. No fresh outcrop occurs in the area.

Three surface resistance tests were carried out on 1200N near the Sirotem anomaly and the following results were obtained.

1200N	750 - 775E	160 $\Omega$ /m
	725 - 750E	320 $\Omega$ /m
	595 - 620E	320 $\Omega$ /m

These indicate that the surface is not particularly conductive but probably is relevant only to the top few metres. Sirotem results are shown in Figs. 6 and 7.

4.0 CONCLUSIONS

- 4.1 A 500 x 500m soil geochemical anomaly exceeding 200 ppm Pb exists on the Old Park Road grid.
- 4.2 A similar sized anomaly exceeding 200 ppm Zn covers the same location.
- 4.3 Local intense metamorphism and metasomatic activity has taken place indicating the presence of nearby igneous intrusive activity.
- 4.4 Ground magnetic results show that only minor anomalies exist on the grid.
- 4.5 A Sirotem survey on one line produced an unexplained anomaly within the Pb - Zn anomaly.
- 4.6 Little outcrop exists in the grid area. As a consequence geological structure remains unresolved.
- 4.7 Petrographic studies indicate the major rock type on the grid is impure quartzose limestone.
- 4.8 The metasomatic activity identified in a limestone environment represents a prime exploration target.

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5.0 RECOMMENDATIONS

Following from the conclusions above it is recommended that further work be undertaken to identify the source of the Pb - Zn geochemical anomaly as follows:

- 5.1 The anomaly should be located accurately by sampling along intermediate cross lines preferably at 100m spacing.
- 5.2 An induced polarization survey should be carried out to identify sulphide concentrations within the disseminated pyrrhotite.
- 5.3 Deep auger sampling be undertaken over the anomaly to obtain rock chips for petrographic identification and subsequent location of the metasomatic halo.
- 5.4 Consideration be given to drilling several short percussion holes to test the anomaly and obtain fresh rock to compare Pb and Zn values with that in the soils.
- 5.5 Chips from soil samples should be logged to assist with geological interpretation.



D.C. SIMPSON  
Consulting Geologist

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APPENDIX 1

Petrological Report CMS 84/4/3

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# Central Mineralogical Services



39 Beulah Road  
Norwood, S.A. 5067  
Telephone 42 5659

The Resident Geologist  
The Shell Co. of Aust. Ltd.  
Metals Division  
P.O. Box 860  
DEVONPORT / TAS. 7310

19th April, 1984

OLD PARK  
RD GEORGE  
ADAMSON

## REPORT CMS 84/4/3

YOUR REFERENCE:	Sample Despatch No. 4487/MQ03/DS/001
DATE RECEIVED:	2nd April, 1984
SAMPLE NOS.:	4135 - 4145
SUBMITTED BY:	D.C. Simpson
WORK REQUESTED:	Petrology

Copy to:  
Mr. D.C. Simpson  
Consulting Geologist  
55, Jackson Street  
WYNYARD / TAS. 7325

*H.W. Fander*  
H.W. Fander, M. Sc.

REPORT CMS 84/4/3Rock Samples 4135 - 4145

Eleven rock samples were received for petrographic study; thin-sections were prepared, and offcuts were subjected to potash stain tests. The rocks are all closely similar, with only minor variations, and thus for reasons of common sense and economy, are described here as a group.

Petrography

The rocks may be described as variably metasomatised impure, fossiliferous quartzose limestones.

The fresh, unmetasomatised rocks consisted of small (silt to fine-sand grade) angular quartz grains embedded in fine-grained carbonate, most probably calcite or dolomite, with scattered fossil fragments such as bivalves, possible sponge spicules and corals; some of the rocks were faintly bedded. This lithology was fairly constant throughout, with variations in quantity/grainsize of quartz, presence or absence of fossils.

Metasomatism was intense and only two or three of the rocks still contain relict carbonate, though quartz has survived, but is corroded. The main mineral to form was diopside, which pseudomorphs the fossil fragments in particular, but also occurs as finer-grained interstitial material. Other calc-silicates include zoisite-epidote, prehnite (especially in 4143) and isolated grossularite. Fine sulphides are widespread, but never abundant, and comprise pyrrhotite and pyrite; they are part of the metasomatic assemblage.

The rock least affected by metasomatism is 4140, which contains the most carbonate, as fossil fragments and as abundant matrix; the whole rock has a semi-schistose fabric.

In sample 4137, there are dark streaks of calc-silicates pigmented by unidentified submicroscopic material. This rock also contains pyrrhotite pseudomorphs after fossil fragments.

Sample 4138 contains dendritic  $MnO_2$  and diffuse patches of goethite which give a brown appearance to some areas.

Mineral grains which appear black, as in 4140, are generally altered pyrrhotite.

Very little relict carbonate occurs in 4145; it is very fine-grained and is calcite or dolomite.

Almost all the rocks show a positive, weak to moderate K-stain reaction which is believed to be due to ultrafine, metasomatic K-feldspar, but no definite mineral phase was identified; this would require more detailed mineralogical investigation, which may not be warranted at this stage.

H.W. Fander, M. Sc.

APPENDIX 2

Memorandum on Old Park Road

by

N. Hungerford

## MEMORANDUM

DATE : 16 March, 1984  
 FROM : BXN:NH:AJD  
 TO : BXH/Devonport

OLD PARK GEOCHEM ANOMALY 4042/15

Herewith some comments on the geophysical data over this anomaly.

Sirotem (Figs. 1 & 2). Fig. 1 indicates the data plotted as recorded (i.e. with negatives). The anomaly form is most unusual from a 100 metre coincident loop survey, especially over resistive ground. The usual explanation is a dipping contact or shallow conductive zone (e.g., due to preferential weathering). Is there any evidence of either here? If the negatives are ignored then Fig. 2 results and indicates a more normal anomaly type, with a conductor beneath 750E. The negative voltages can only be ignored if our Sirotem equipment is faulty, but this seems unlikely from our calibration tests. Hence Fig. 1 is thought to be a true profile despite its odd shape.

Magnetics. The aeromagnetics over this area show nothing of immediate interest, and the ground magnetics confirm this. Figs. 3 & 4 indicate the ground mag and Pb, Zn soil geochem profiles. Line 1200N (Fig. 3) does not indicate a very convincing correlation of geochemistry with the Sirotem anomaly at 750E, although there is some correlation of the latter with a 100 nT mag anomaly. This mag anomaly may correlate with that at 600E on Line 1400N (Fig. 4) although the wide line spacing causes uncertainty. (The sharp magnetic anomaly at 450E on Line 1200N appears to be caused by noise of some sort and can probably be ignored). <sup>1200N</sup>

Conclusions. Although the geophysical and geochemical anomalies can hardly be classed as 'good' ones, and despite the unprospective surface geology (Devonian Bell shale?) a (percussion?) drill hole designed to intercept a target 50 to 100 metres below 750E on 1250N can be supported.

Neither the magnetics nor the Sirotem give any clear indication of dip (but probably steep), so the drill hole inclination must be decided on geological grounds.

I have asked Bob Beeson for his comments on the geochemical results, but he is reluctant to say much since he knows nothing of the geology (nor do I!), or the soil sampling techniques used. However, he has drawn a cumulative frequency plot (Fig. 5) which he assures me indicates populations of anomalous results, especially above 300 ppm and 460 ppm for Pb. Anomalous populations for Pb+Zn occur in two main areas, namely 1) around and east of intersection of lines 1200N and 500E (immediately west of the Sirotem anomaly) and 2) east of intersection of lines 1600N and 500E. I have not plotted these areas on a geochem base plan since I do not have one here.

Both the geochem and geophysical interpretations suffer from 1) a lack of geological input, and 2) the widely spaced lines (minimum of 200 metres). I have also found the duplication of anomaly names very annoying since there is another Old Park Road anomaly in Loongana. I have therefore called this 'Old

019  
Park Geochem' anomaly (4042/15) to avoid future confusion especially in reports.

Regards.

*NH*

N HUNGERFORD

Attach.

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APPENDIX 3

Geochemical Sampling Procedure

APPENDIX 3Geochemical Sampling Procedure

Geochemical sampling was undertaken over the grid using hand augers to obtain 'B' horizon soil samples.

Some sample                    observed contained weathered rock and may have penetrated into the 'C' horizon. Existing records show that sample depth varied from 0.4 to 1.5 metres.

No geochemical orientation programme was conducted but limited sampling at 800N 550E showed that values for most metals tested (except tin) were enriched in the 'B' horizon. This comment excludes Bi, Ag, W and Mo which were all below limit of detection.

Samples were dried and the -80# fraction was sent for analysis. Some samples were sieved to -20# duplicating -80# samples and these are shown separately on the relevant plans.

ADDENDUM

## Observations on Selected Geochemical Samples

Seventeen geochemical samples from the Old Park Road grid were examined to determine:

- 1) If a relationship could be seen between high geochemical values and any rock characteristics.
- 2) Any alteration features not seen in outcrop.

Samples were selected to give a broad coverage of the grid both inside and outside the Pb-Zn anomaly. The freshest rock chips in the sample were examined under hand lens, checked with a magnet and some tested for carbonate presence.

Conclusions

Due to the weathered nature of the chips no fresh sulphide was seen nor any box works which may indicate prior presence of sulphides. However, there is a possible correlation between the high Pb-Zn values and the presence of manganese staining i.e. pyrolusite. The implication here is that the manganese may have acted as a 'scavenger' of metal ions. This concept would have to be tested by microscopic observation of a larger number of samples than carried out on this occasion.

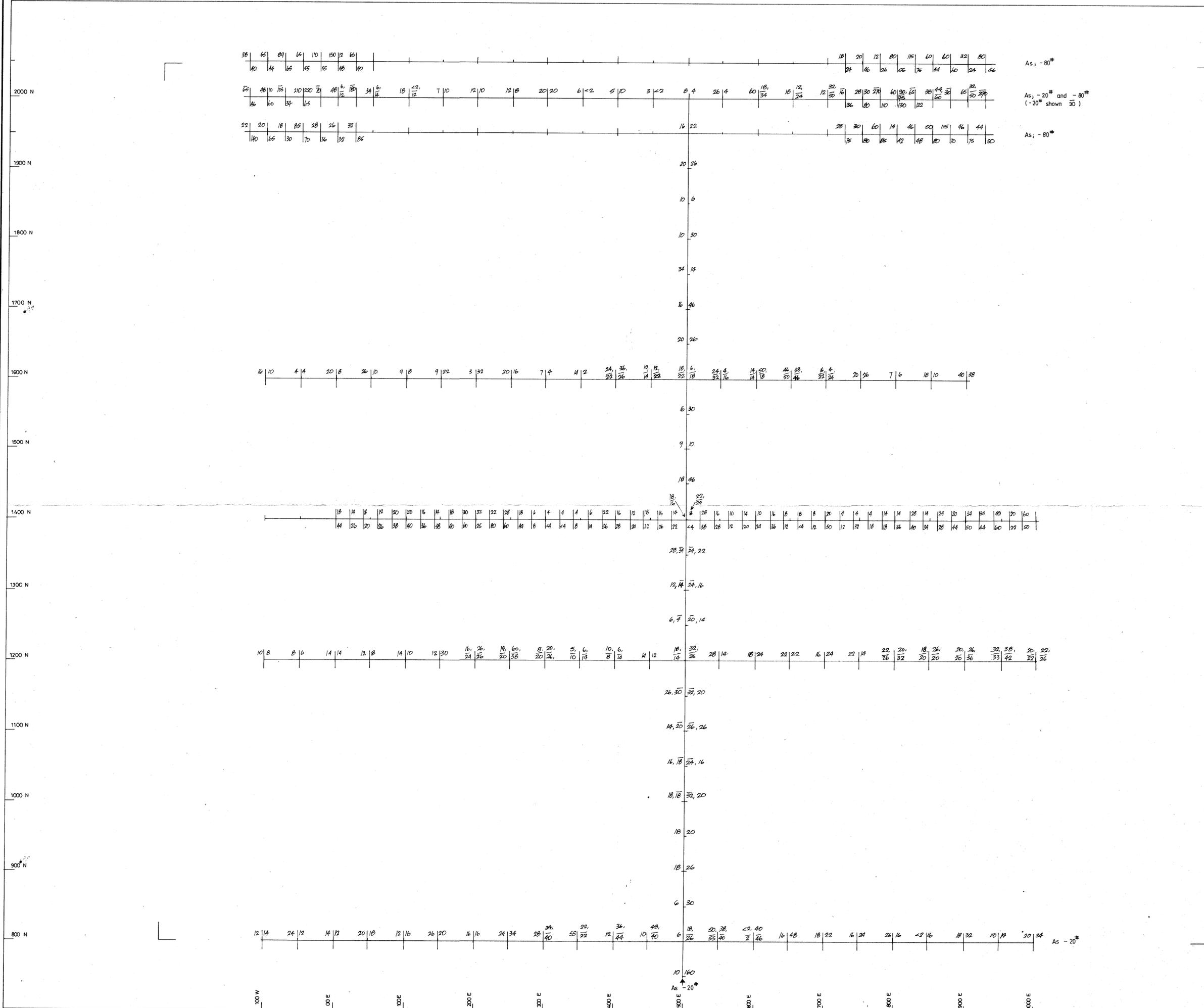
Other than this observation no relationship between higher geochemical values and mineralogy was determined.

D.C. SIMPSON  
26/6/84









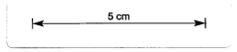
As; - 80\*

As; - 20\* and - 80\*  
(- 20\* shown 30)

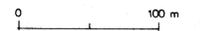
As; - 80\*

NOTE:  
As - 20\* and - 80\* AS SHOWN  
Ni ALL - 80\*

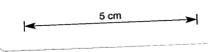
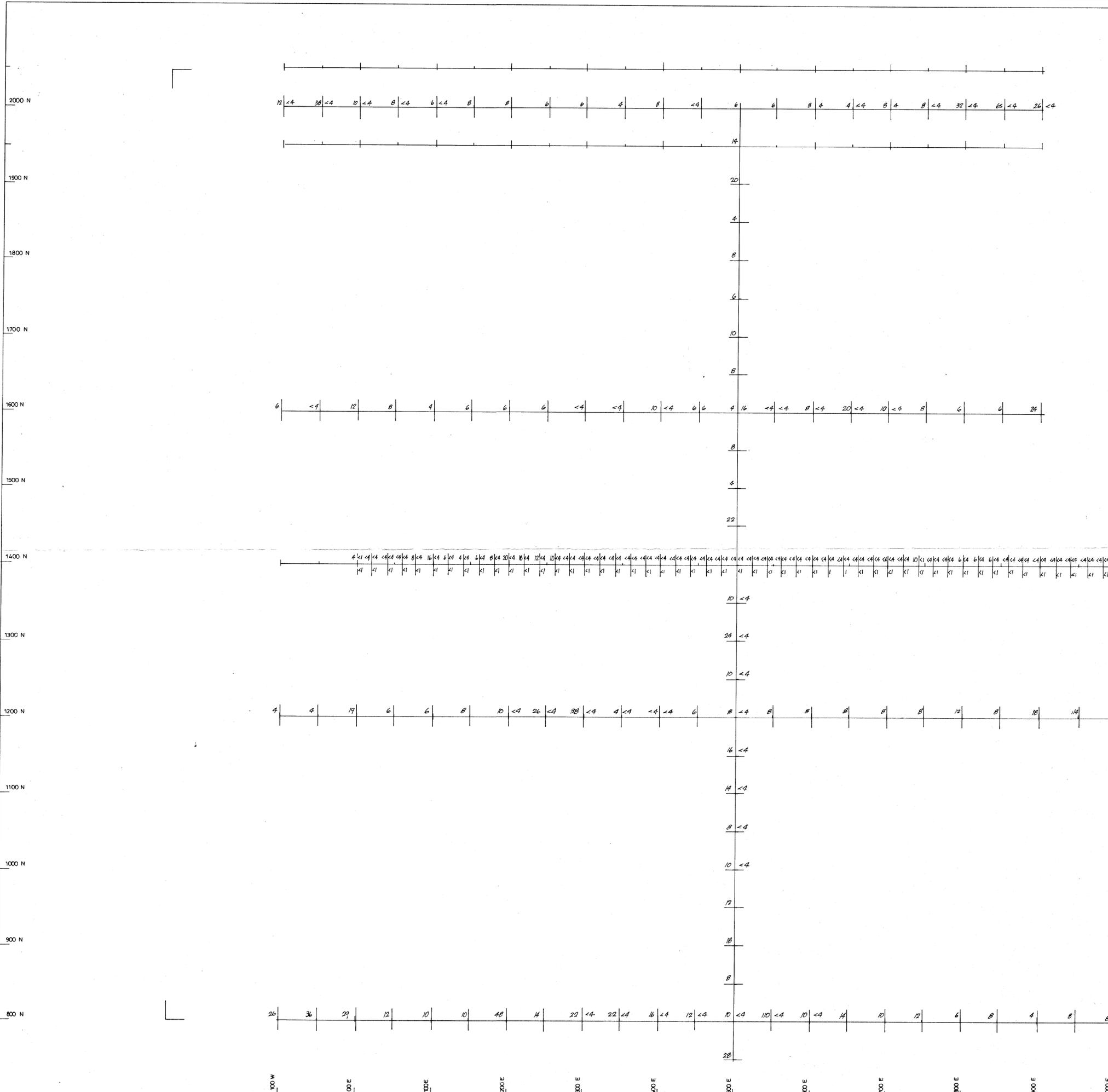
As | Cu  
| Ni



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The Shell Company of Australia Limited METALS DIVISION	
E.L. 4/77 HIGHCLERE OLD PARK ROAD SOIL GEOCHEMISTRY As, Ni, Cu, 1133	
84-2150	
SCALE 1:2500	DATE 14-6-84
AUTHOR D.C.S.	DRAWN J.L.L.
OFFICE DEVONPORT	REP No
ENCL No	DRG No D/MG 03/103



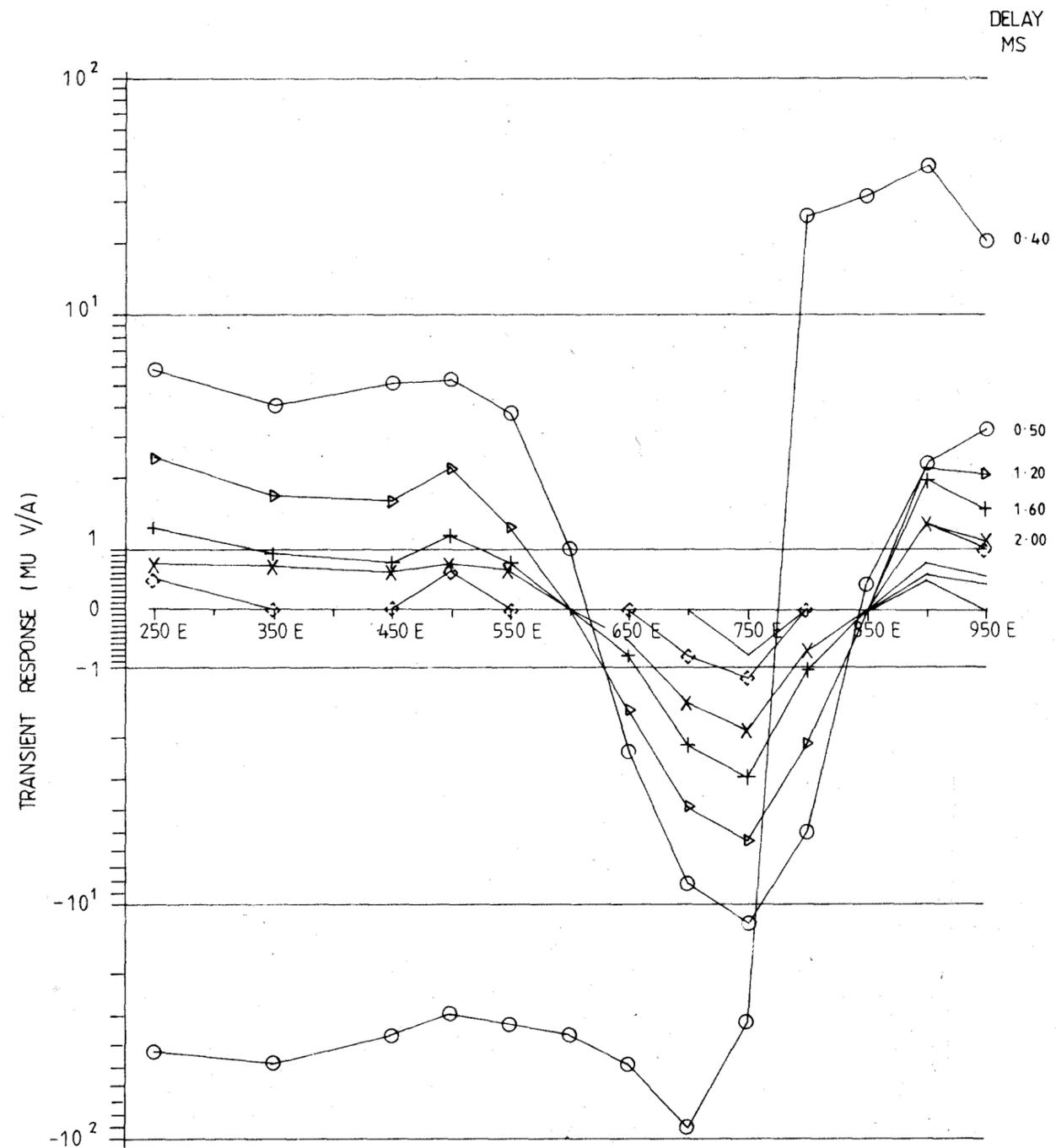
Co | Bi  
Cd  
Analyses in p.p.m.



406028



The Shell Company of Australia Limited METALS DIVISION	
E.L. 4/77 HIGHCLERE OLD PARK ROAD SOIL GEOCHEMISTRY Co, Bi, Cd,	
1134	
SCALE 1:2500	DATE 14-6-84
AUTHOR D.C.S.	DRAWN J.L.L.
OFFICE DEVONPORT	REP No.
ENCL No.	DRG No. D/MQ03/104



406029

5 cm

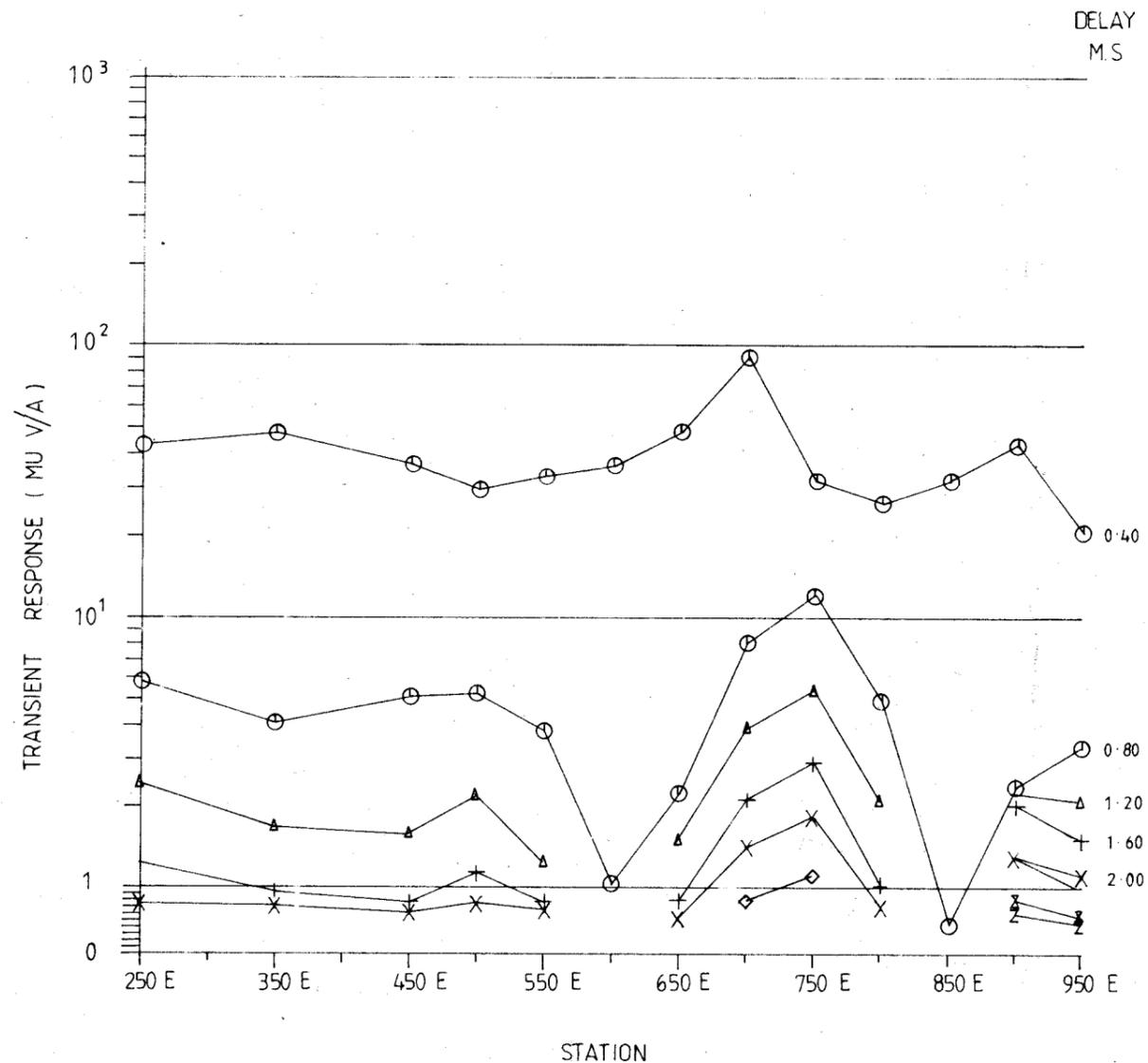
The Shell Company of Australia Limited  
METALS DIVISION

E.L. 4 77 HIGHCLERE 1135  
OLD PARK ROAD  
GEOCHEM ANOMALY 4042/15  
SIROTEM LINE 1250 N  
COINCIDENT LOOP 84-2150

SCALE	1:5000	DATE	13-6-84
AUTHOR	N.H.	DRAWN	J.L.L.
OFFICE	DEVONPORT	REP.No.	
DRG.No.	D/MQ 03/106	FIG.No.	1

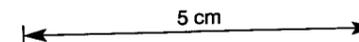
INSTRUMENT : SIROTEM  
 CONFIGURATION : COINCIDENT  
 LOOP SIZE (METRES) : 100  
 LOOP SEPARATION (METRES) : N/A  
 READING INTERVAL (METRES) : 50

SURVEYED BY : S.C.O.A.



SYMBOL	DELAY	TIMES	(M SEC)
○	0.4		19.0
○	0.8		22.0
△	1.2		25.4
+	1.6		28.6
x	2.0		33.4
◇	2.6		39.8
⊕	3.4		46.2
x	4.2		52.6
z	5.0		59.0
y	5.8		68.6
x	7.0		81.4
*	8.6		94.2
⊗	10.2		107.0
i	11.8		119.8
⊗	13.4		139.0

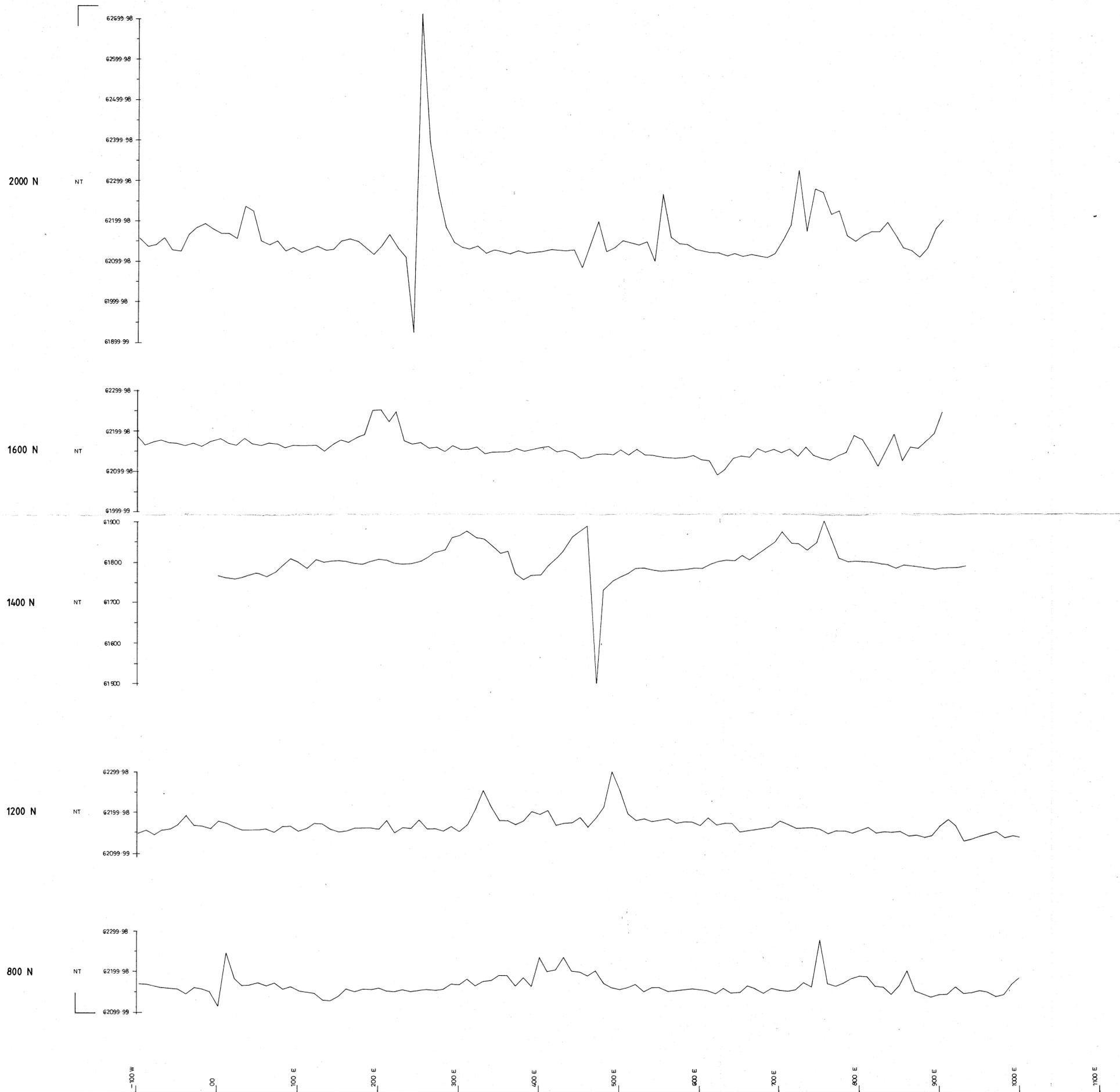
406030



The Shell Company of Australia Limited  
 METALS DIVISION

E.L. 4/77 HIGHCLERE 1136  
 OLD PARK ROAD  
 GEOCHEM ANOMALY 4042/15  
 SIROTEM - LINE 1250 N  
 84-2150

SCALE	1:5000	DATE	1-6-84
AUTHOR	N.H.	DRAWN	J.L.L.
OFFICE	DEVONPORT	REP.No.	
DRG.No.	D/MQ03/105	FIG.No.	2



READING SCALE = 50.00 NT/CM

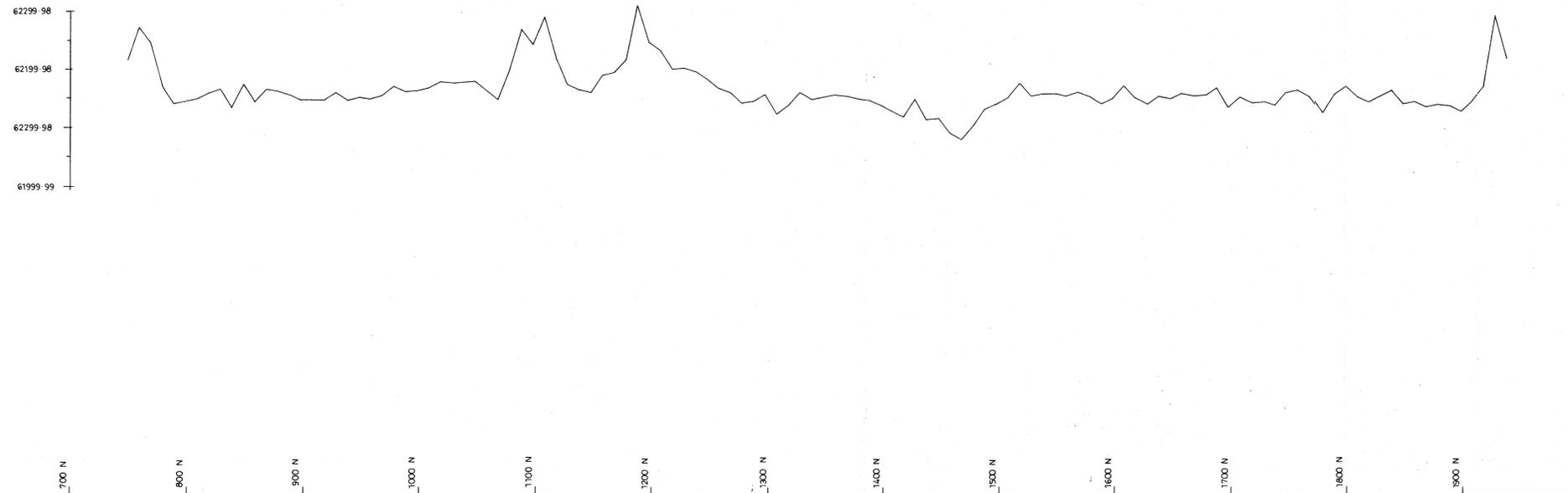


5 cm

The Shell Company of Australia Limited METALS DIVISION	
E.L. 4/77 HIGHCLERE OLD PARK RD. GEOCHEM. ANOMALY GROUND MAGNETICS PROFILES	
LINES 800 N	1200 N 1137
1400 N	1600 N
2000 N 84-2150	
SCALE 1:2500	DATE 1-6-84
AUTHOR P.A.R.	DRAWN J.L.L.
OFFICE DEVONPORT	REP No.
ENCL No.	DRG No. D/MG03/107

500 E NT

62299.98  
62199.98  
62299.98  
61999.99



406031

READING SCALE = 50.00 NT/CM



5 cm

The Shell Company of Australia Limited  
METALS DIVISION

E.L. 4/77 HIGHCLERE  
OLD PARK RD. GEOCHEM. ANOMALY  
GROUND MAGNETIC PROFILE  
LINE 500 E 1138

84-2150

SCALE 1:2500	DATE 1-6-84
AUTHOR P.A.R.	DRAWN J.L.L.
OFFICE DEVONPORT	REP No.
ENCL No.	DRG No. D/MQ03/108