

CONTENTS

| | PAGE NO |
|---------------------------------|---------|
| 1. SUMMARY | 1 |
| 2. INTRODUCTION | 2 |
| 3. RESEARCH | 3 |
| 3.1 Geology | 3 |
| 4. SOUTH QUE RIVER | 4 |
| 4.1 DDH MAC28 | 4 |
| 4.1.1 Introduction | 4 |
| 4.1.2 Geophysics | 4 |
| 4.2 DDH MAC29 | 5 |
| 4.2.1 Introduction | 5 |
| 4.2.2 Geology | 5 |
| 4.2.3 Geochemistry | 8 |
| 4.2.4 Geophysics | 9 |
| 4.3 DDH MAC28 - Additional DHEM | 9 |
| 4.3.1 Geophysics | 9 |
| 4.4 DDH MAC30 | 10 |
| 4.4.1 Introduction | 10 |
| 4.4.2 Geology | 10 |
| 4.4.3 Geochemistry | 11 |
| 4.4.4 Geophysics | 12 |
| 4.5 Conclusions | 13 |

PLATES (VOL. 2)

| <u>Plate</u> | <u>Scale</u> | <u>Title</u> |
|--------------|--------------|--|
| MAC161C / | 1:10,000 | Mackintosh Area - Interpretive Geology |
| MAC220 / | - | Mackintosh Stratigraphic Column |
| MAC306 / | 1:10,000 | Summary Plan - Structure, Que River Shale Marker Horizon and Geochemistry |
| MAC311 / | 1:10,000 | Selected Larger Lineaments and Linears Geochemical Highs in C Horizon |
| MAC319 / | 1:1,000 | DDH MAC28-MAC29, Section 6000N |
| MAC319B1 / | - | Geochemical Profiles - DDH MAC29 |
| MAC319B2 / | - | Geochemical Profiles - DDH MAC29 |
| MAC322 / | 1:10,000 | Summary Geological Overlay, south Que River |
| MAC323 / | 1:10,000 | Interpretive Cross Sections, South Que River |
| MAC340 / | 1:1,000 | DDH MAC30, Section 5850N |
| MAC341 / | - | Geochemical Profiles - DDH MAC30 |

FIGURES

1. Mackintosh District - Tenure Summary
2. Schematic Section 6000N
3. Schematic Section 6000N

APPENDICES

- I Research, Que-Hellyer Volcanics, volcanology project progress reports
- II Research, Southwell Sub-Group, volcanology project summary report
- III DDH MAC28, DHEM survey report
- IV South Que River Area, geological interpretation
- V DDH MAC29, detailed log, petrographic report
- VI DDH MAC29, core grind geochemistry
- VII DDH MAC29, DHEM survey results
- VIII DDH MAC28, additional DHEM results
- IX DDH MAC30, detailed log, petrographic report
- X DDH MAC30, core grind geochemistry

1. SUMMARY

Exploration on EL 106/87 during this reporting period focussed on the South Que River area. Two holes for 1546.4m were drilled to determine the source of a complicated downhole EM (DHEM) response detected in DDH MAC28. Neither hole intersected a conductive source or prospective ore horizon. Intersected pyritic footwall alteration is base metal poor and weakens to the south.

Research continues into aspects of the geology of the Mackintosh district.

2. INTRODUCTION

The Lake Mackintosh Exploration Licence (EL 106/87) was granted to Aberfoyle Resources Limited on 5 February, 1988 subject to the Hellyer Mine Agreement Ratification Act 1987. The licence comprised 135 sq. km. previously covered by EL's 2/70 (Mackintosh) and 15/73 (Hatfield) and encloses the 20.2 km² of CML's 68M/84 and 103M/87 (encompassing the Que River and Hellyer mines and facilities).

Under the terms of this Act, EL 106/87 was reduced to 95 sq. km. on 5 February, 1990. Current tenure is shown on Figure 1.

This report summarises exploration completed in the Mackintosh district on EL 106/87 for the period April 1991 to April 1992.

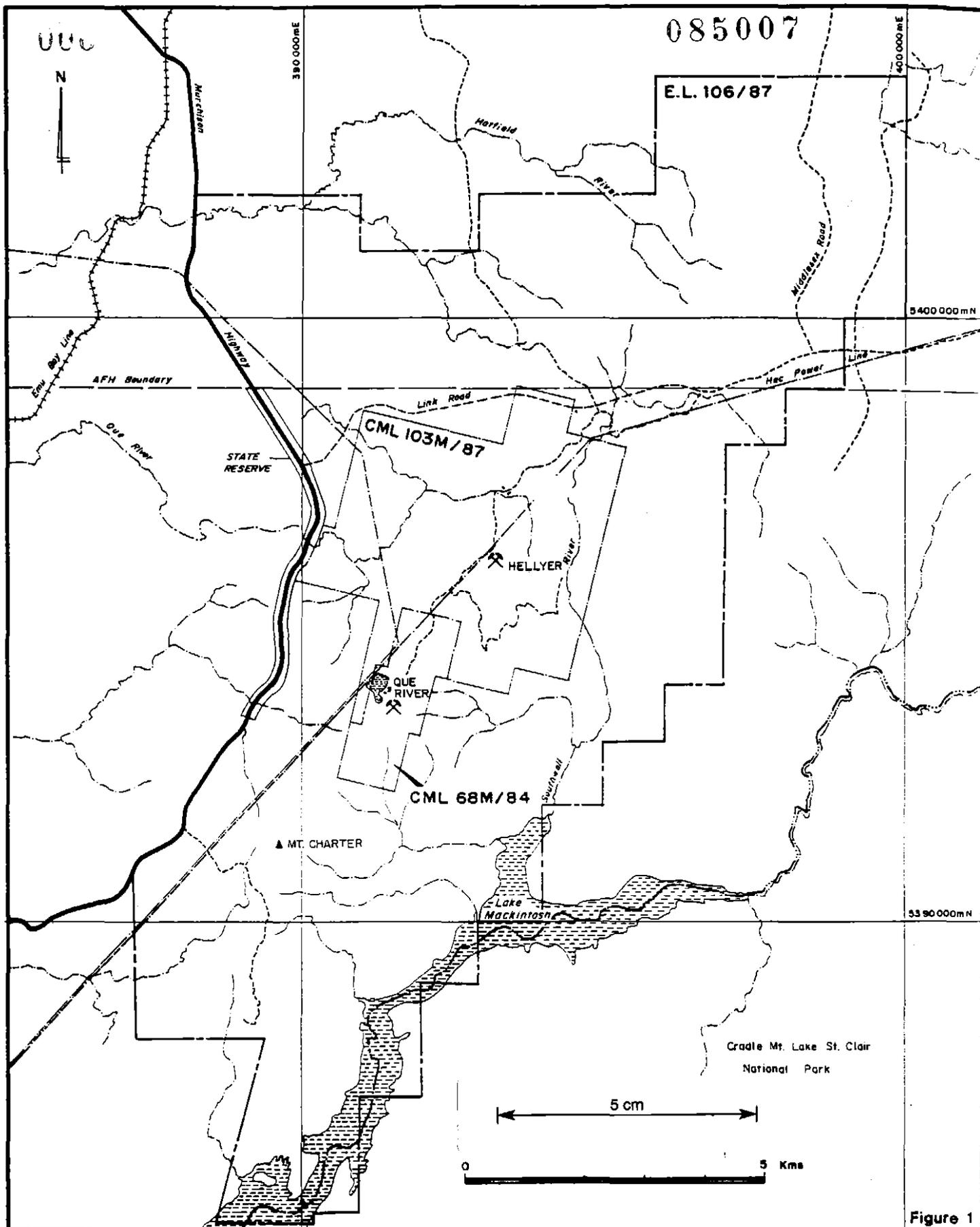


Figure 1

Aberfoyle Resources Limited

EXPLORATION DIVISION

NORTH WEST TASMANIA
MACKINTOSH DISTRICT
TENURE SUMMARY

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 Plate No. : MAC 1B1

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Date : May, 1990

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3. RESEARCH

3.1 Geology

Two research projects into aspects of the geology of the Mackintosh district are currently being supported. These are:

- 1) A PhD project on the volcanology and sedimentology of the Que-Hellyer volcanics. Initiated in 1988, this project is undertaken by J. Waters under the supervision of Dr. R. Cas, Monash University. Two progress reports were issued during this reporting period (Appendix I). Work concentrated on the relationship of the Que-Hellyer volcanics to Mount Read Volcanics to the north and south and on Mixed Sequence rocks in the Que River mine area.
- 2) The style and palaeoenvironment of the Southwell Sub-Group is being studied as an M.Sc. project by G. Lees also under the supervision of Dr. R. Cas. A report summarising work to date is included as Appendix II.

In addition Dr. M. Etheridge of Epithermex International is currently contracted to develop a new structural-stratigraphic interpretation of the Que-Hellyer Volcanics. This project is in progress and the results will be presented in the next annual report.

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4. SOUTH QUE RIVER

4.1 DDH MAC28

4.1.1 Introduction

The South Que River area lies between Que River Mine and Mount Charter. Diamond drilling on the southern-most section at Que River Mine (6700N) failed to close off the Que River alteration zone. This zone was interpreted on the basis of IP data and mapping to daylight around 6200N and plunge to the north. However, lineament studies and a review of the geophysical data suggested it to be equally plausible that the alteration zone plunged south.

A diamond drill hole, MAC28, was proposed to test for the southern extension of this alteration zone. The geology and geochemistry of MAC28 were discussed in the last annual report. As a DHEM survey was not complete at that time, these results are presented below.

4.1.2 Geophysics

A four loop DHEM survey of MAC28 was completed in June 1991. Appendix III contains a comprehensive report on the results of this survey.

A complex off-hole EM response is observed centred at around 650m downhole. The source was interpreted to be a flat lying conductor 150-200m above MAC28, probably extending east of the end of the hole. A key feature of the interpretation is that the conductor is probably faulted (?) into eastern and western parts, either side of about 4950E.

Higher conductivities are inferred for the eastern conductor but its location is less well constrained as MAC28 extends only to 4900E.

4.2 DDH MAC29

4.2.1 Introduction

DDH MAC28 intersected an interpreted Hellyer ore position at 149.5m where a five metre polymict epiclastic unit is overlain by basalt and underlain by feldspar phyric andesite. Re-interpretation of the structural/stratigraphic relationships in the South Que River area suggested this horizon could be synclinally folded to the east. An interpreted Hellyer ore position could occur in the MAC28 conductive target position overlying the MAC28 footwall alteration zone.

This interpretation is detailed in a report included as Appendix IV.

DDH MAC29 was drilled to test this highly prospective target above MAC28 on section 6000N.

4.2.2 Geology

A detailed log and petrographic descriptions are attached as Appendix V, whilst a cross section is included as Plate MAC319. A summary log is as follows:

| | | |
|--------|--------|---|
| 0- | 8.7m | Feldspar phyric andesitic volcaniclastics |
| 8.7- | 20.7m | Aphyric andesite lava - intrusive? |
| 20.7- | 157.5m | Feldspar phyric andesite lava and volcaniclastic |
| 157.5- | 162.2m | Polymict lapilli volcaniclastic |

162.2-219.2m Locally polymict andesitic lapilli
volcaniclastic
219.2-430.4m Basalt lava and volcaniclastic
430.4-436.3m Aphyric andesite lava - intrusive
436.3-461.7m Basaltic volcaniclastics
461.7-478.2m Aphyric andesite lava - intrusive
478.2-485.2m Basaltic volcanics
485.2-580.1m Strong Si+Se+Co+Cl+Py altered basalt
lava. Py 5-10% disseminations and
veins.
580.1-743.6m Basalt lava and volcaniclastics
743.6-762.0m Interbedded basalt lava and aphyric
andesite

MAC29 was collared in feldspar phyrlic andesite which locally became polymict towards its base. Dacite, basalt and silica+sericite+pyrite altered fragments occur within andesitic volcaniclastics whilst epiclastic units to a few metres thick contain andesite, dacite, basalt and altered volcanic clasts. Disseminated sphalerite and galena is associated with these rocks. A sharp contact at 219.2m marks the top of a sequence of basalt lava and volcaniclastic with minor intrusive aphyric andesite that extends to hole bottom.

A fault bounded pyritic footwall alteration zone was intersected over 100m in the target position. Alteration is strong silica+sericite+carbonate± chlorite+pyrite and hosted by basalt lava. Pyrite is the only sulphide observed (5-10%), present as disseminations and thin veins.

The hole failed to intersect any conductive source for the MAC28 DHEM response, with no potential ore horizon evident in the target area.

Two geological interpretations of the MAC28-29 results are possible. The feldspar phyric andesite sequences could be correlated between holes giving a steep westerly dip, placing the underlying units in the Lower Basalt Sequence, Fig. 2. This is conceptually consistent with the original interpretation of stratigraphy but would require rapid and major compositional changes within the Lower Basalt Sequence to explain petrological and geochemical differences between rocks in MAC28 and MAC29.

For example MAC28 comprises aphyric andesite with only minor basalt whilst MAC29 contains an almost entirely basaltic sequence.

A second interpretation could correlate the Upper Basalt Sequence in MAC28 with a much thickened basalt sequence in MAC29, Fig. 3. The western part of the conductive target horizon would lie between the two holes, whilst the eastern portion may occur east of a (growth?) fault, possibly beneath both holes. This model implies a much thickened Upper Basalt (>500m) but is largely consistent with the model on which MAC29 was drilled. Downhole orientations of bedding in MAC29 were variable and inconclusive.

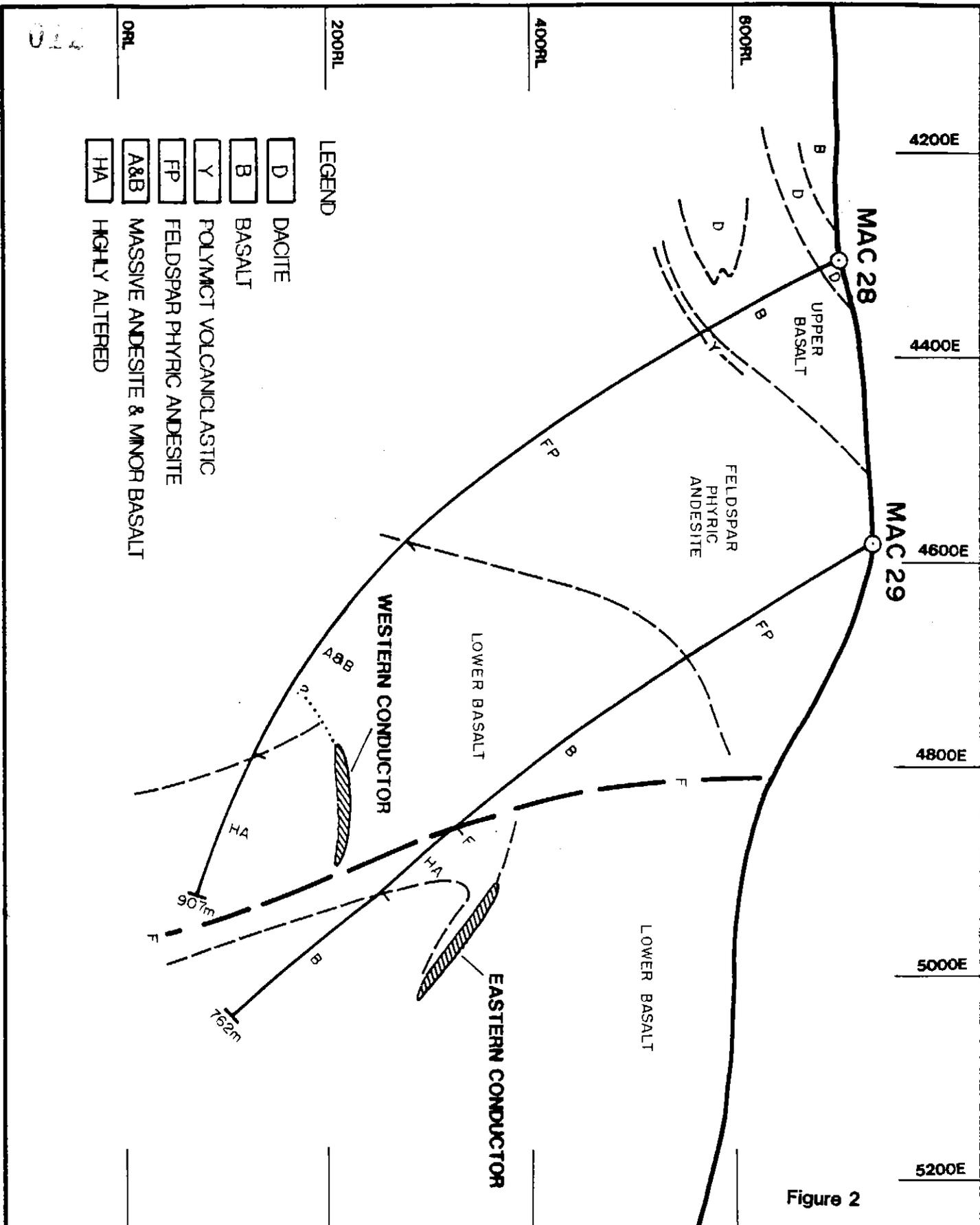


Figure 2

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EXPLORATION DIVISION

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NORTH WEST TASMANIA
EL 106/87 MACKINTOSH
SCHEMATIC SECTION 6000N
INTERPRETATION 1

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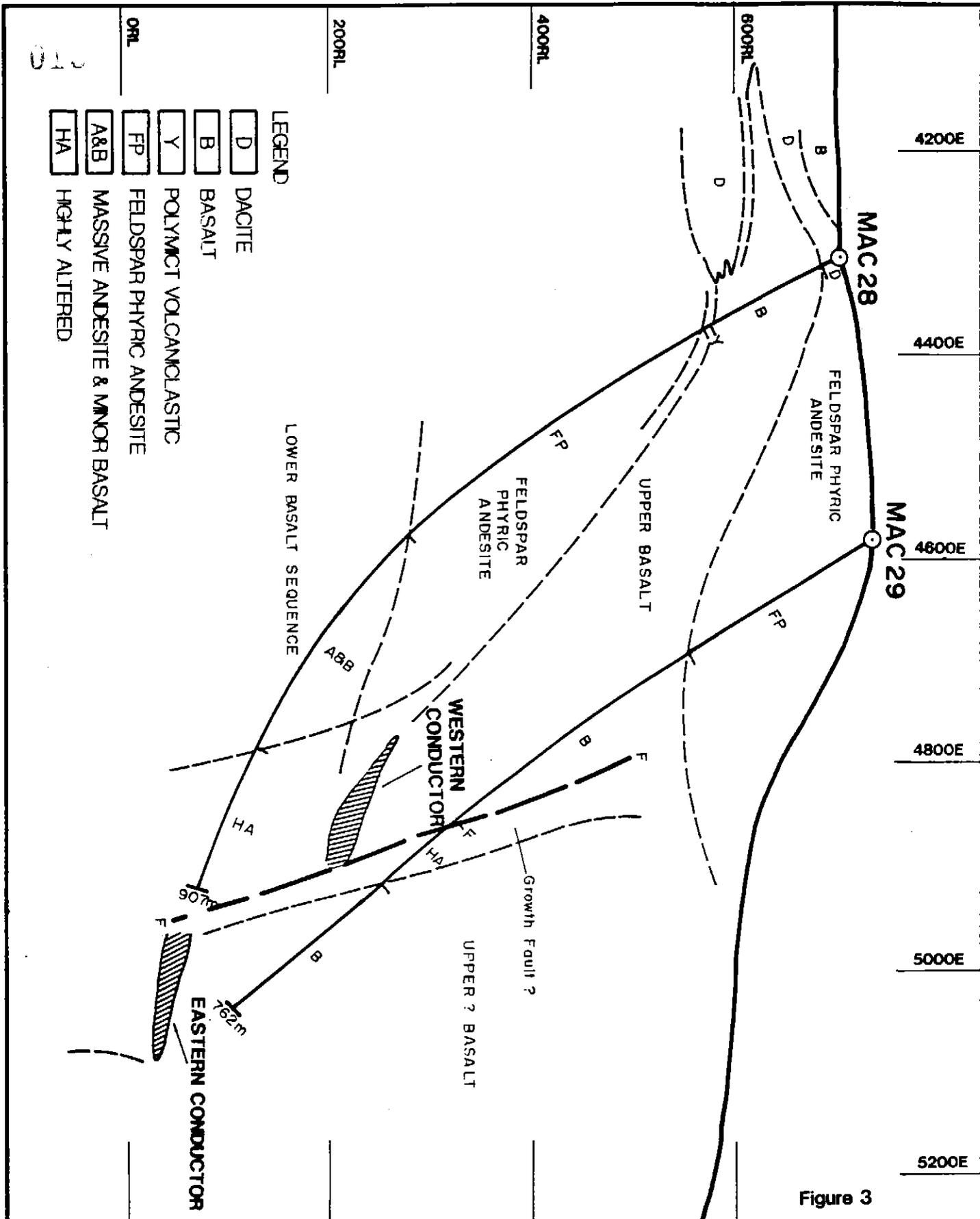


Figure 3

Aberfoyle Resources Limited
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NORTH WEST TASMANIA
EL. 106/87 MACKINTOSH
SCHEMATIC SECTION 6000N
INTERPRETATION 2

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4.2.3 Geochemistry

Seventy-seven core grind samples covering the length of MAC29 were submitted for whole rock and Zr, Cr, Ba, As, S, Rb, Sr, Cu, Pb, Zn, Ag and Au assay. Sample intervals were chosen coinciding with lithological boundaries or ten metres in areas of uniform lithology. Results are presented on Plates MAC319 B1 and B2 and in Appendix VI.

The feldspar phyric andesite sequence is distinguished by its low Cr (<150 ppm) and moderate MgO (2-5%) content. The underlying basalt sequence is typified by increased MgO (5-9%) and Cr ranging between 150 and 900 ppm. Aphyric andesite intrusives are reflected in low MgO, Fe₂O₃, Cr, and increased SiO₂.

Despite apparent intensity the footwall alteration zone does not show Na or Ca depletion. Carbonate alteration would enhance CaO levels but the lack of significant sodium depletion is not understood.

Lead and zinc are anomalous in the basal part of the andesitic sequence between 142.8 and 200m. Lead peaks at 223 ppm whilst a maximum of 0.18% Zn occurs in the epiclastic unit between 157.5 and 162.2m. These values reflect the disseminated sphalerite and galena in this interval. Copper values are low although a slight increase occurs in the basalt sequence. The footwall alteration zone shows no increase in base metal content. Silver and gold values are uniformly low. Arsenic is anomalous within and adjacent to the alteration zone reaching a maximum of 86 ppm.

Barium shows a marked decrease below the western edge of the alteration zone, i.e. hydrothermally altered rocks appear to be depleted in Ba.

4.2.4 Geophysics

During an attempt to cement a major fault zone prior to PVC placement the NQ rod string became caught in the fault and was consequently cemented in. An attempt to free the rods resulted in abandoning the string below 463.5m leaving rods from this point to 709m.

A one loop DHEM survey of MAC29 was conducted above and below the abandoned rods. Loop location and survey results are included as Appendix VII.

The survey was largely inconclusive due to the loss of 260m of readings in a critical area. However, data collected to within 100m of the inferred conductor location indicated that MAC29 is still a significant distance from the source. This result may be consistent with the conductor occurring off section.

4.3 DDH MAC28 - Additional DHEM

4.3.1 Geophysics

During the prolonged attempt to free the MAC29 rod string, additional DHEM data was collected from MAC28 using six new loops. Loop locations, survey results and a report are attached as Appendix VIII.

Results confirmed the original interpretation but did not refine the targets location except to indicate the source appeared to extend to the south.

4.4 DDH MAC30

4.4.1 Introduction

MAC29 did not locate a source for the MAC28 DHEM response. The failure to successfully case MAC29 with PVC resulted in an inconclusive DHEM survey which did not provide the additional DHEM data required for a definitive test. It was therefore decided that a new hole would be drilled.

Given that the MAC29 DHEM data may indicate that the source is off section and the MAC28 data that the source extends to the south, it was proposed that the next test of the conductor be to the south of 6000N. MAC30 was planned to retest the interpreted conductor at 5850N (effective 100m south) 4850E, 250RL.

4.4.2 Geology

A detailed log and petrographic descriptions are attached as Appendix IX, whilst a cross section is included as Plate MAC340. A summary log is as follows:

| | |
|--------------|---|
| 0-118.6m | Feldspar phyric andesitic volcaniclastic |
| 118.6-142.6m | Feldspar - hornblende phyric andesite lava - intrusive |
| 142.6-152.1m | Feldspar phyric andesitic volcaniclastic |
| 152.1-162.7m | Feldspar-hornblende phyric andesite lava - intrusive |
| 162.7-255.7m | Locally polymict andesitic lapilli volcaniclastic |
| 255.7-589.7m | Basalt lava and volcaniclastic |

589.7-632.1m Andesite lava - intrusive
632.1-784.4m Basalt lava and volcanoclastic with
minor intrusive basalt

The MAC30 sequence is very similar to that of MAC29. Feldspar phyric andesite in the upper part of the hole again became polymict towards its base, with lapilli sized dacite, andesite, basalt and silica+sericite+pyrite altered volcanics as local exotics through to polymict epiclastic units to a few metres thick. Minor disseminated sphalerite was noted in this area. A sharp contact again marked the top of a major sequence of basalt lava and volcanoclastics which persisted to hole bottom.

Unlike MAC29, MAC30 did not intersect a well defined footwall alteration zone. Instead, fracture controlled silica+sericite+pyrite alteration is present over a broad interval from 300-589.7m. Strong but patchy silica+sericite+pyrite alteration is present from 473.7m to hole end. Best development is between 474.7m and 638.7m which is along strike from the MAC28-29 alteration and appears to represent the weakening of the system to the south.

Once again no conductive source for the MAC28 DHEM anomaly was intersected nor was any obvious ore horizon present.

4.4.3 Geochemistry

The total length of MAC30 was core ground and 69 samples submitted for Cu, Pb, Zn, Ag, Au, As, Ba, Cr, Ti and Zr assay. Sample intervals coinciding with lithological boundaries or up to 15 metres were used. Results are presented on Plate MAC341 and in Appendix X.

The feldspar phyric andesites are typified by low Cr (<150 ppm) with the basalts showing a broad range in Cr up to 976 ppm. Intrusive andesites show very low Cr.

Elevated zinc (up to 752 ppm) in the basal part of the feldspar phyric andesite sequence reflects disseminated sphalerite. Rocks affected by hydrothermal alteration show locally elevated lead and zinc with up to 270 ppm Pb and 995 ppm Zn where trace vein sphalerite and galena as thin veinlets are logged. Arsenic is weakly anomalous in this area with up to 61 ppm recorded. Copper, silver and gold values are uniformly low.

4.4.4 Geophysics

At the time of writing the planned DHEM survey of MAC30 is incomplete. Results of this survey will be presented in the next annual report.

4.5 Conclusions

No source for the MAC28 DHEM conductor has been located, nor has any obvious potential ore horizon been intersected in the target area.

The large thickness of basalt intersected in MAC29-30 suggests a basaltic volcanic centre located in the South Que River area. Although the Que River and Hellyer ore horizons are well defined by epiclastics, separating sequences of differing composition, this is not always a feature of Volcanogenic Massive Sulphide deposits. For example the Amulet A orebodies (Canada) occur within a basalt sequence with only the sulphide bodies themselves to mark a break in volcanism.

Given the poorly constrained nature of the MAC28 DHEM response potential remains for a massive sulphide accumulation within the basalt sequence, possibly adjacent to the footwall alteration zone.

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APPENDIX I

ERUPTIVE ACTIVITY, PRODUCTS AND DEPOSITIONAL
SETTING OF THE CAMBRIAN VOLCANIC-SEDIMENTARY
SUCCESSION HOSTING MASSIVE SULPHIDE
MINERALISATION (VMS) AT HELLYER AND QUE RIVER
MINES, MT. READ VOLCANIC BELT, WESTERN
TASMANIA.

PROGRESS REPORT NO.11

by
John Waters. Ph.D. Student,
Department of Earth Sciences, Monash University.

APRIL 1991 - JUNE 1991

085023

Introduction

This report is the eleventh in a series of progress reports to Aberfoyle Resources on the Ph.D study of the Hellyer - Que River Volcano - Sedimentary succession. It covers data collected over the three month period April through June 1991.

The report has been divided into three sections. The first section deals with the occurrence of Que - Hellyer Volcanics correlates in the Middlesex Road area to the north-east of the Cradle Mountain Link Road. Here volcanics petrographically and chemically similar to those in the Mt. Charter - Hellyer area have been recorded in five drill holes.

The second section looks at the Que - Hellyer Volcanics in DDH Mc-015 (MCH-1) in the Mt. Charter area. This drill hole completes the southern half of a regional north - south section from Mt. Charter through to the Middlesex Road area.

The final section will discuss the possible relationships between the Que - Hellyer sequence and the Mount Read Volcanics south of Mt. Charter. This discussion proposes that the Que - Hellyer Volcanics may occur as a lens within Central Volcanic Complex correlates, and therefore implies that mineralisation along the length of the Mt. Read belt is essentially the same age.

Field Work

No field work was carried out during the period covered by this report. Drill holes referred to in this report were logged toward the end of the last period.

Results:

Part 1: Middlesex - Beecroft Road Area.

Recent drilling by the Mines Department of Tasmania, in the Middlesex - Beecroft Road area, suggests that the Que - Hellyer Volcanics continue northward beneath younger cover sequences for at least 10 kilometres to the north-east of the Hellyer deposit (Pemberton et.al., 1991). Intersections of basaltic to andesitic volcanics, petrographically identical to those found in the Que - Hellyer area, have been located in five drill holes (MXRD-1, MCPD-1, MCPD-2, MCPD-3 and BTRD-1), in this area. Logs of these drill holes have been reconstructed using data from Pemberton et. al., (1991), and these are shown

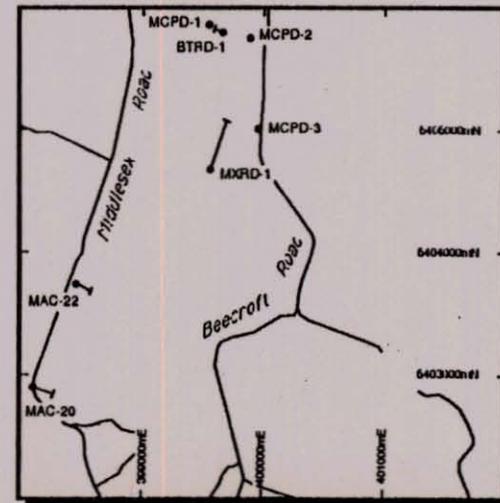
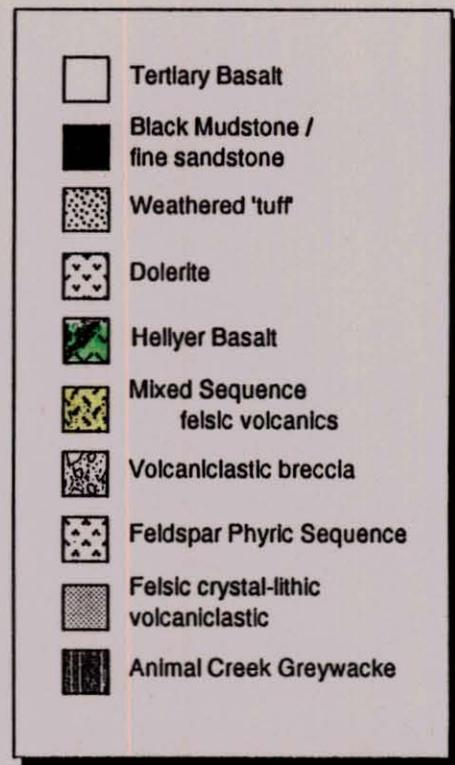
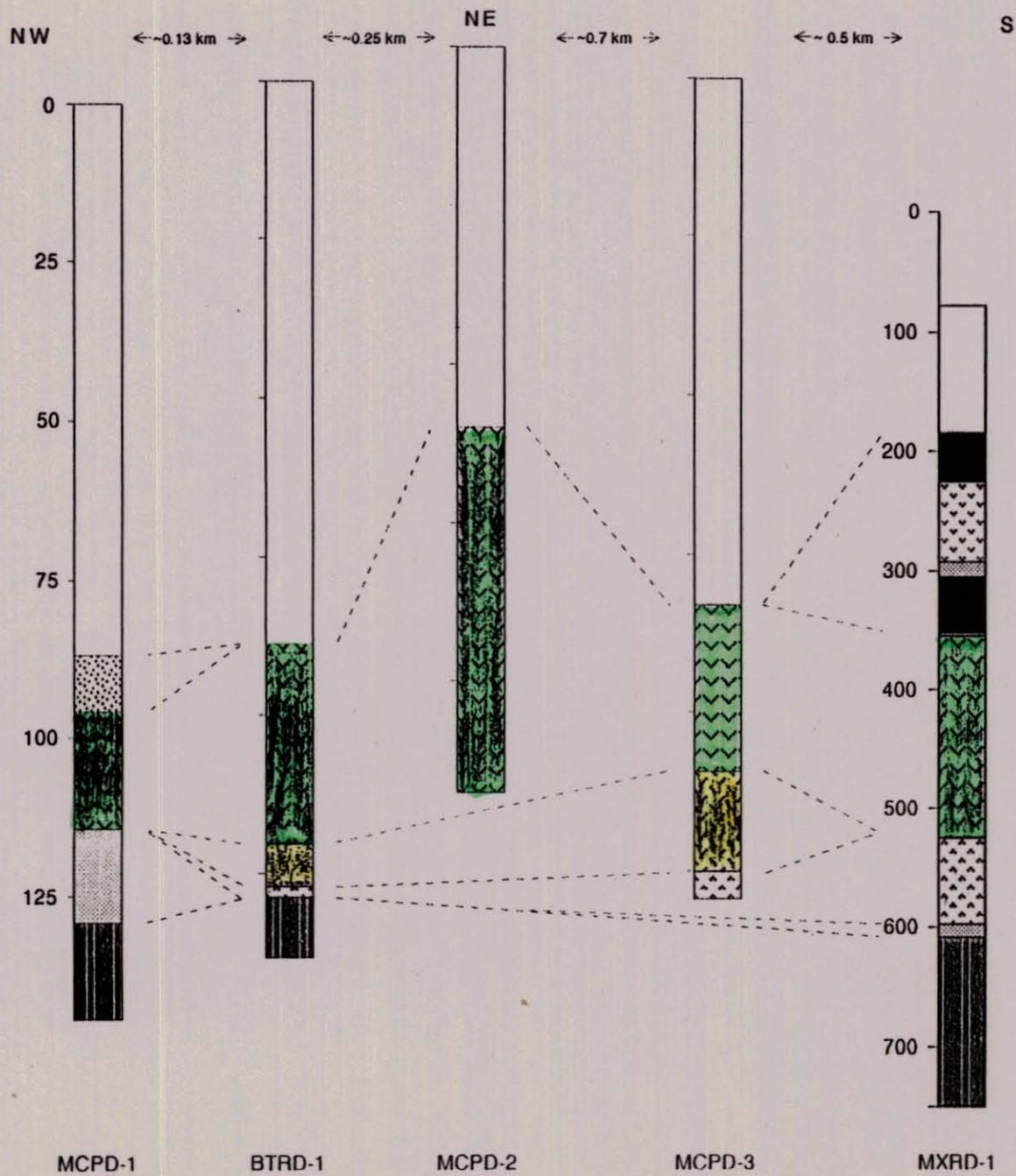
in Figure 1. Of these holes only MXRD-1 has been logged in detail and a simplified version of this log is shown in Figure 2.

The Que - Hellyer Volcanics in MXRD-1 consist of a 253 metre intersection of basaltic to andesitic volcanics and volcanoclastics. Four distinct units from within the volcanics can be identified in this drill hole, these being, in stratigraphic order, an upper unit of basalt-andesite (Hellyer Basalt equivalent), a crystal lithic volcanoclastic (Mixed Sequence? equivalent), a lower andesite-basalt unit (Feldspar Phyrlic Sequence equivalent), and a pumiceous, juvenile rich volcanoclastic (?). Another unit which overlies the upper most sequence of basalts-andesites, and itself conformably overlain by black mudstones and fine to medium sandstones interpreted as Que River Shale, may be part of the Que - Hellyer sequence. This unit consists of crystal rich (pumiceous?) muddy sandstones ranging in grain size from coarse to granule. These lithologies are more typical of some of the units found toward the base of the Southwell Sub-Group, although they do exhibit some similarities with volcanoclastics found in the Mixed Sequence.

Hellyer Basalt equivalent

The upper most unit of the Que - Hellyer Volcanics in the Middlesex Road area consists of a 170 metre intersection of basaltic to andesitic lavas and lava breccias (Fig. 2). This is most likely a stratigraphic equivalent to the Hellyer Basalt found in the Que - Hellyer area. This unit lies conformably below lithologies interpreted as Que River Shale and Southwell Sub-group equivalents.

The upper most 5 metres of this interval is more andesitic in composition than the rest of the Hellyer Basalt, and is noticeably different in appearance, looking more typical of the footwall lavas. Chemically this small interval is similar to those andesites and basalts interpreted as Feldspar Phyrlic Sequence equivalents found lower in the hole, and appears very similar to andesitic lithologies found in the hangingwall in the Mount Charter area to the south (Figs. 3a, 3b and 3c). This unit consists of a peperitic andesitic breccia with a dark grey to black mud matrix. Fragments within the breccia range up to 40 centimetres in diameter and are generally irregular in shape with straight to slightly cusped margins. Minor jigsaw fit fragmentation of the larger fragments indicates some degree of insitu quench fragmentation. The top contact with the overlying juvenile and crystal rich volcanoclastics is



(modified after Pemberton et al., 91)

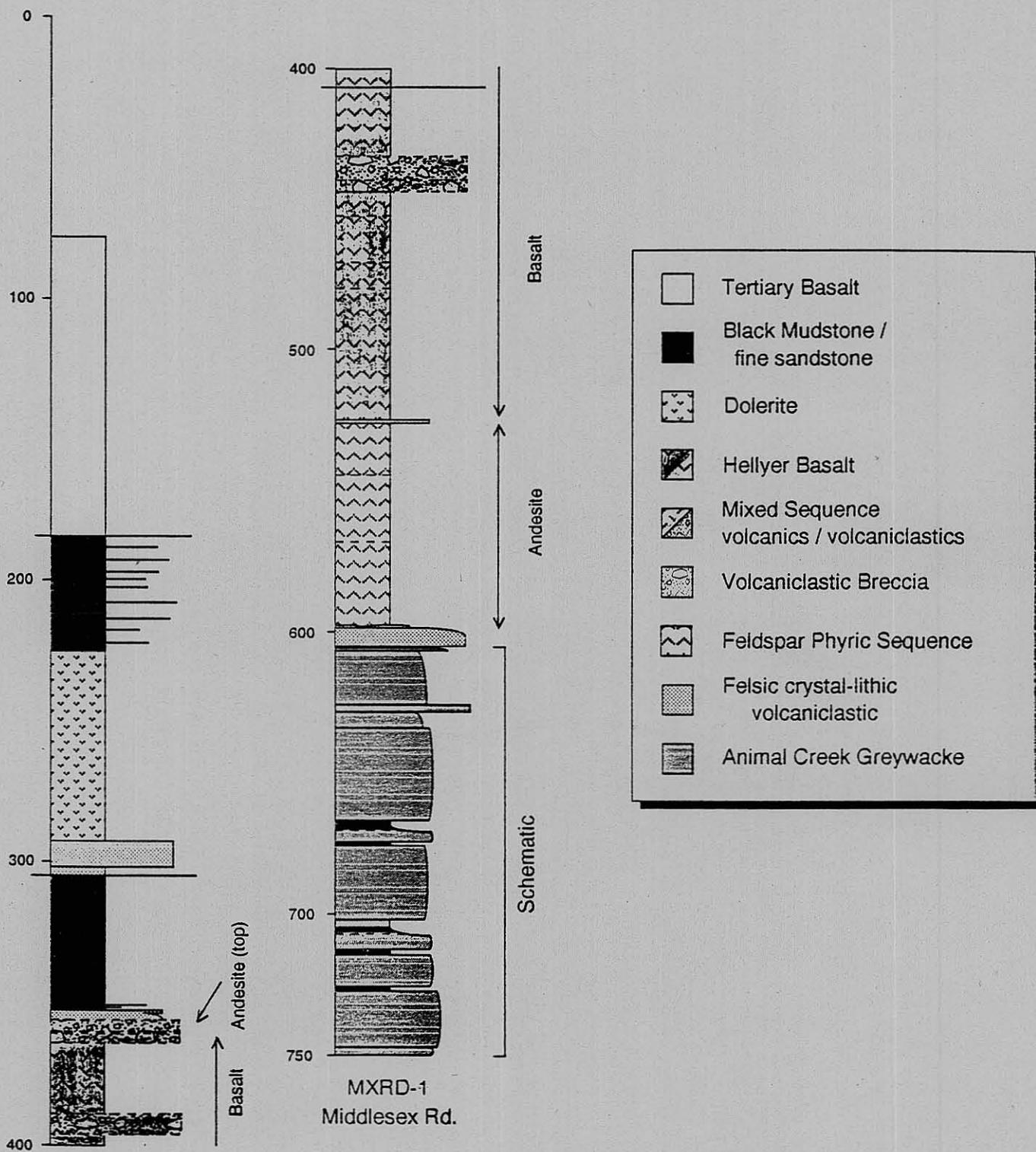


FIGURE 2: Simplified drill hole log for MXRD-1

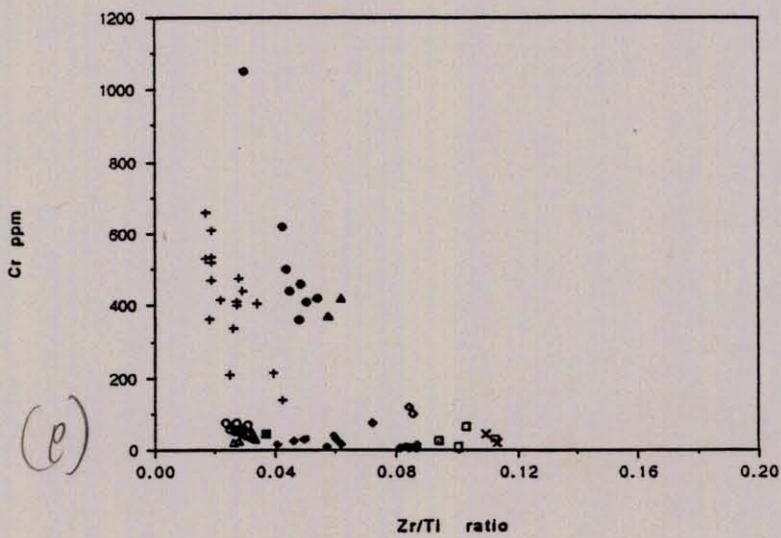
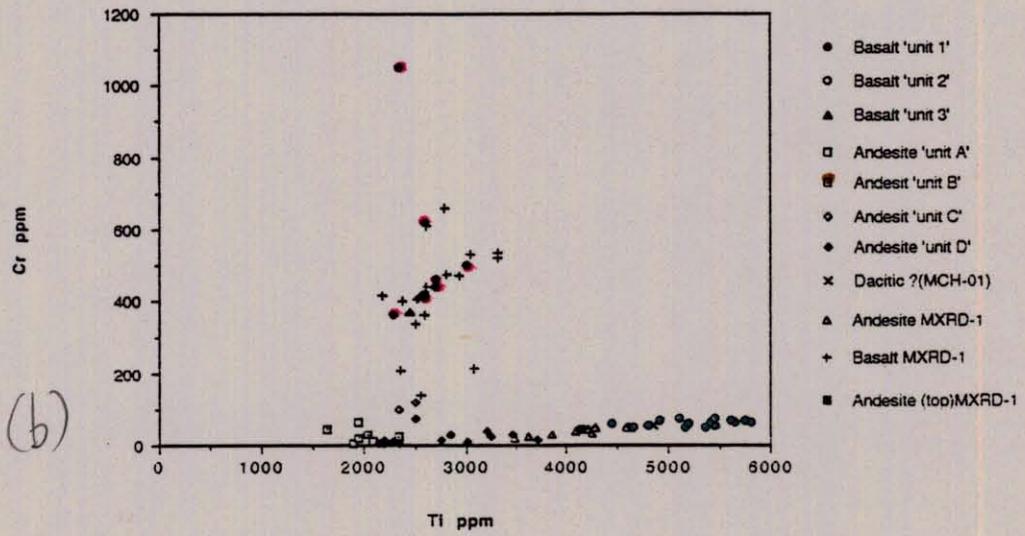
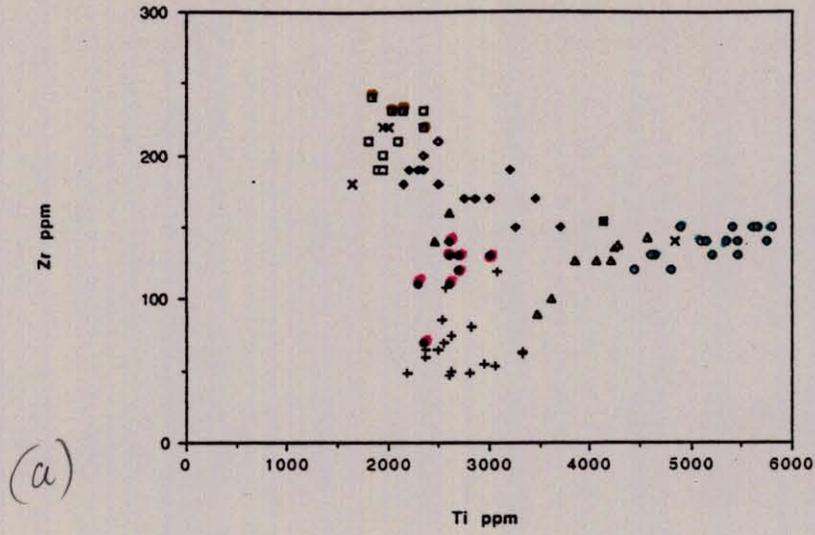


FIG. 3.

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sharp, while the lower contact is gradational into a coarse to pebbly hyaloclastite with up to 40% mud matrix.

Petrographically the remainder of the Hellyer Basalt found in this drill hole consists of porphyritic, weakly vesicular lavas and lava breccias. In thin section the basalts consist of phenocrysts of plagioclase and pseudomorphs after pyroxenes. These two phenocryst phases make up between 2 and 20% of the rock with the remainder consisting of a vesicular, plagioclase rich microlitic groundmass. Sub circular to elliptical and irregular vesicles comprise up to 20 % of the rock and are filled with chlorite, carbonate and quartz. These decrease in abundance over the final few metres of the interval as you approach the contact with the underlying volcanics. All of the main facies found previously within the Hellyer Basalt have been identified in this intersection, with lavas ranging from massive to pillowed with associated pillow breccias, hyaloclastite breccias and peperitic breccias. Contacts between facies are gradational. The contact of this sequence with the underlying volcanics is sharp.

Mixed Sequence equivalents

A narrow, 20 to 25 centimetre, intersection of dark to mid grey crystal lithic sandstone at 525.2 metres separates two petrographically and chemically distinct volcanic sequences in this area (Fig. 2). This unit due to its stratigraphic position, below the Hellyer Basalt equivalents and above those considered FPS equivalents, is interpreted as a correlate of the Mixed Sequence found in the Hellyer - Que River area, and as such an equivalent of the ore position. Texturally the sandstone is massive, consisting of moderate to well sorted, sub-angular to sub-rounded, volcanic and sedimentary lithic fragments as well as crystals. Compositionally the unit is very similar to other volcanics found within the Mixed Sequence to the south, with the crystal component being quartz-alkali feldspar and plagioclase, suggesting at least a partial felsic source for this unit. This source may be to the south, in the Hellyer area, or to the north where felsic volcanics have been recorded at about the same stratigraphic position in drill hole MCPD-3 (Fig. 1). Siliceous sponge spicules and spherical to sub spherical radiolarian have been found in thin sections prepared by the Mines Department (sample No. J 852) suggesting a marine depositional environment. Contacts of this unit are sharp and conformable.

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Feldspar Phyric Sequence equivalent

Conformably underlying the volcanoclastics is a 72.5 metre intersection of dominantly massive to pillowed lavas of andesitic composition which are lateral equivalents of the Feldspar Phyric Sequence at Hellyer. These andesitic lavas are distinct from those found above the volcanoclastic in that they are aphyric and generally paler in colour.

The top of the intersection is peperitic which consists of minor proportions of mud and hyaloclastite material interstitial to what can be identified as pillows and pillow fragments. This grades over a metre in to aphyric, weakly vesicular pillow lavas which exhibits close packing and very minor percentages of interpillow material. This in turn grades into an interval of massive, weakly vesicular (3-5%) andesitic lava in the order of 20 metres thick. The basal 20 to 30 metres of this unit is comprised of pillow lava and pillow breccia which contains vary proportions (5-10%), of black to dark grey mudstone. Many of the fragments show very little chilling, with the margins of larger fragments often rimmed by smaller fragments exhibiting jigsaw fit, suggesting they originated from insitu quench fragmentation.

In thin section the andesites are vesicular and aphyric, with a groundmass which varies from microlitic to cryptocrystalline with abundant disseminated opaques. The microlitic ground mass is comprised of 20 x 100 micron plagioclase laths which give the groundmass a felted, trachytic texture. Interstitial to the plagioclase laths are square to rhombic crystals often pseudomorphed by quartz - alkali feldspar mosaics. These were most likely alkali feldspars or possibly feldspathoids. In some samples, especially toward the base of the unit (ie. Mines Department sample No. J 883), this groundmass was originally perlitic and has since been recrystallised to a chlorite rich mosaic of quartz and feldspar, similar to that observed in the dacitic units in the Que - Hellyer area.

Pumiceous Volcanoclastic

Below the Feldspar Phyric Sequence equivalent in MXRD-1 lies an interval of approximately 10 metres of pumiceous, juvenile rich volcanoclastics. Individual beds within this interval vary in core thickness from 7.5 metres to less than 10 centimetres. This unit is characterised by thick, ≥ 0.5 metre beds of juvenile rich volcanoclastics separated by thin, ≤ 20 centimetre crystal rich sandstones. These volcanoclastics are compositionally

similar to those found in parts of the Southwell sub-Group, and in some respects similar to Mixed Sequence volcanoclastics from the Que River - Hellyer area.

The thicker volcanoclastic units are massive to weakly graded and dominated by poor to very poorly sorted, intermediate to felsic, pumiceous and juvenile volcanic fragments up to 5 centimetres long. These fragments vary from irregular to wispy in appearance. Fragments are often porphyritic, containing euhedral to anhedral phenocrysts of feldspar and quartz, which is often fractured insitu similar to the quartz phenocrysts found in parts of the Southwell sub-Group. The matrix to these volcanoclastics consists of up to 30% pale grey to white silicified muds. In beds toward the base of the unit felsic 'pumiceous' fragments decrease in abundance giving way to more angular intermediate lithic fragments.

The thinner beds which occur between the juvenile rich volcanoclastics consist of medium to coarse grained, sub angular to sub rounded crystal rich sandstones. These are moderate to well sorted and generally contain less than 10% mud matrix. Contacts between these two sediment types is sharp.

Deposition of this unit pumiceous volcanoclastic unit is most likely via a combination of mass flow and high concentration turbidity currents. The coarser (pebble sized and greater), pumiceous, juvenile rich units are most likely deposited via mass flows due to their chaotic poorly sorted matrix rich characteristics. The thinner beds, due to their better sorting and lower matrix content more than likely represent deposits from turbidity currents emplaced between mass flow events. Due to their similar composition it is possible that the turbidity currents may have been generated by the mass flows in a method akin to the described by Hampton (1972).

Part 2: Mount Charter MCH-1 / MC-15.

A drill hole from the Mount Charter area, drilled originally by the Mines Department as part of their Mount Read Volcanics project and later extended by Aberfoyle, was logged in detail to investigate the nature of the volcanics at the southern end of the field area. The hole was collared in Que River Shale and passed through and intersection of ~550 metres of Que - Hellyer Volcanics before passing into Animal Creek Greywacke (Fig. 4). The stratigraphy above the footwall sequences is virtually identical to that seen

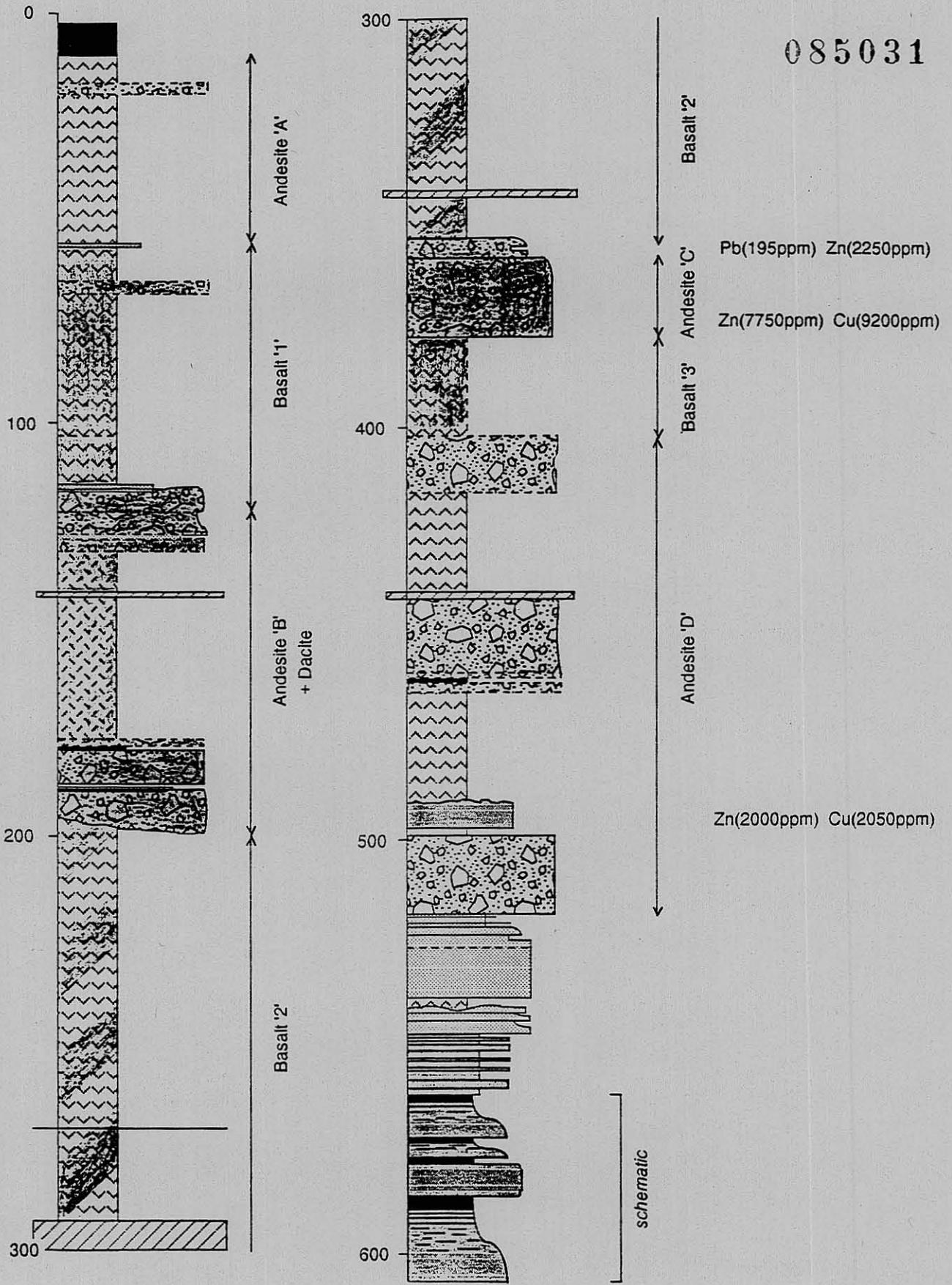


FIGURE 4: Simplified drill hole log for MCH-1 / Mc-15. (see figure 2 for legend)

elsewhere, however the footwall exhibits many complex interfingering relations between basaltic to intermediate lavas and volcanoclastics, these will be discussed below.

Upper Andesitic Sequence

The upper most unit present within the Que - Hellyer Volcanics in MCH-1/Mc-15 is a 46 metre intersection of porphyritic andesitic lava and minor breccia (Fig. 4). The lava is feldspar phyric, containing up to 20% plagioclase phenocrysts up to 1.25 mm long pseudomorphed by sericite \pm clays. The groundmass to the lava appears to have been originally microlitic to spherulitic with the majority of this texture overprinted by quartz - feldspar - chlorite - sericite alteration. The breccias are comprised of fragments of the feldspar phyric lava with a matrix of finely fragmented material of the same composition now exhibiting the same alteration developed in the groundmass of the lavas.

This unit is similar to the andesitic unit found at the top of MXRD-1, although chemically it appears to be slightly more felsic in character. Andesites in the hangingwall have been found elsewhere in the Mount Charter area, but appear rare in the hangingwall to the north of the Que River deposit (Aberfoyle Drill Logs; Corbett and Komysan, 1989).

Hellyer Basalt

The Hellyer Basalt in the Mt. Charter area is represented in MCH-01 by an intersection of approximately 60 metres of basaltic lavas and breccias (Fig. 4). These are petrographically identical to the basaltic units found elsewhere in the sequence at this stratigraphic level.

The Hellyer Basalt at this locality probably consists of two flow units. The lower most flow unit the best developed and is comprised of a basal section of massive lavas which grades into pillow lava and pillow breccia, and is capped by a peperitic basaltic breccia. Individual pillows within the flow vary in size from 1 to 3 metres, are close packed and lack the development of an appreciable chilled margins. The top breccia lies in gradational contact with the pillow lava and consists mainly of 10 to 20 centimetre sized poorly sorted angular fragments.

The basalts are typically clinopyroxene - plagioclase phyrlic, with these two phases comprising up to 20 -25% of the lava. Clinopyroxene occur both as euhedral to anhedral phenocrysts (2 -3 mm) and glomerocrysts of three or more crystals. Plagioclase phenocrysts are generally smaller, being less than 0.5mm, and often exhibit a continuous gradation in size down to the plagioclase microlites which make up the groundmass. Vesicularity in the basalts varies up to 5% with vesicles filled with carbonate - chlorite. Sphalerite has also been observed as a vesicle filling phase.

The base of the Hellyer Basalt consists of an autoclastic / resedimented autoclastic basaltic lithic breccia with up to 15% matrix. The base of this breccia is in gradational contact with the underlying polychromatic / polymict breccia which has been interpreted as a Mixed Sequence lithology.

Mixed Sequence

Conformably below the Hellyer Basalt, at 121.5 metres, is an intersection of approximately 80 metres of Mixed Sequence polymict volcanoclastic breccias, dacitic to andesitic lavas and lava breccias (Fig. 4). Another interval of 25 metres containing possible Mixed Sequence lithologies appears at 354.3 metres (Fig. 4). This second interval is comprised of an upper massive to diffusely laminated greywacke horizon, similar to Animal Creek Greywacke, and a lower dacitic to andesitic breccia, possibly polymict.

The upper most interval of Mixed Sequence lithologies consists of a dacitic to andesitic lava with an associated autoclastic margin enclosed by polymict volcanic lithic breccias. The polymict volcanic lithic breccias are poorly sorted, close framework, chaotic breccias comprised of several types of angular to sub-rounded volcanic lithics with an altered mud matrix of 5 - 10%. There is at least 6 types of framework types present in the breccia, most of which are volcanic lithics. Four types of volcanic lithics have been identified, these being in order of decreasing abundance (i) perlitically fractured aphyric intermediate lava fragments, (ii) aphyric intermediate lava fragments (no perlite), (iii) altered, 'whispy' juvenile to pumiceous fragments, and (iv) strongly plagioclase phyrlic intermediate volcanic lithics. Two other framework types have been identified these being subhedral to anhedral and broken plagioclase crystals and small mud intraclasts. All off these fragments, with the exception of the mud intraclasts could have been derived from the one intermediate volcanic source.

This breccia is in gradational contact with a very shallow intrusive to extrusive lava which has an autoclastic margin up to several metres thick. The massive core of the lava is weakly feldspar phyric containing 7 to 10% plagioclase phenocrysts. The groundmass has been devitrified and altered to a mosaic of quartz and feldspar which maintains a relict spherulitic texture in places. Diffuse flow banding has also been observed in core. These textures combined with the available core ground geochemistry shown in Figure 4, suggest a dacitic (- andesitic) composition.

The second intersection of Mixed Sequence like lithologies occurs below an interval of mafic to intermediate lava (see below) and is comprised of greywackes and volcanic lithic breccias. The greywacke consists of medium grained, well sorted crystal and lithic fragments with up to 15% muddy chlorite - sericite rich matrix. The lithic fragments appear to be Precambrian meta-sedimentary lithics identical to those in the Animal Creek Greywacke, while the crystal component is comprised of quartz - feldspar and minor muscovite. This greywacke does however differ from the Animal Creek Greywacke in that it has elevated Pb (195 ppm) and Zn (2250 ppm) values. The breccia conformably below the greywacke consists of perlitically fractured plagioclase phyric lava fragments and some slightly more mafic vesicular, porphyritic fragments which have a microlitic groundmass. This unit also contains elevated metal contents with values of 9200 ppm Cu and 7750 ppm Zn.

This second interval of Mixed Sequence like lithologies may represent another prospective ore horizon lower in the sequence or may be a faulted repetition of the main Mixed Sequence. Numerous faults with unknown displacement occur between the two intervals and these may be responsible for a repetition of stratigraphy. If such is the case then the units directly above this second horizon would be expected to be Hellyer Basalt equivalents. These lavas in question are similar to the Hellyer Basalt lavas petrographically, but chemically appear to be more intermediate in character than the average Hellyer Basalt (Fig. 3a, 3b and 3c).

Footwall Sequence

The footwall sequence present in DDH MCH-01 is slightly more complex than the footwall or Feldspar Phyric Sequence elsewhere (Fig. 4). It is comprised of a sequence of basaltic through dacitic volcanics and associated

volcaniclastics which show a greater variation in chemistry than seen in drill holes to the north. The lower half of the footwall sequence is comprised dominantly of felsic to intermediate volcanics while the upper part contains basaltic to andesitic units.

The upper part of the footwall, from the base of the first Mixed Sequence lithologies at ~196 metres down to approximately 400 metres consists of a dominantly massive aphyric basalt/andesite chemically different to the Hellyer Basalt (Fig. 3a, 3b and 3c). The base of this interval is separated from a thin intersection of porphyritic basalt, with chemical affinities more akin to the Hellyer Basalt, by a horizon of Mixed Sequence like lithologies. This lower lava is also petrographically similar to the Hellyer Basalt in that it is pillowed and contains plagioclase and clinopyroxene phenocrysts.

Below this unit the footwall is comprised of variably altered andesitic to dacitic lavas and breccias which vary from plagioclase aphyric to plagioclase - quartz aphyric. Lavas in this sequence are often in gradational contact with primary and resedimented autoclastic breccias of the same composition, therefore indicating that the lavas are most likely extrusive. The lavas are typically porphyritic with up to 20% plagioclase \pm quartz, with a quartz-feldspar altered devitrified groundmass which in places may be perlitic. The breccias are of the same composition as the lavas and consist of poorly sorted angular to sub angular fragments up to 15 to 20 centimetres in size. These volcanic lithic breccias are typically close framework, but some open framework types containing up to 40% mud matrix have been observed. Some of the breccias appear to have formed by quench fragmentation as indicated by their blocky appearance and perlitically cracked glassy rims (T.S. 57448, 460 m Mines Dept.).

Basal Volcaniclastic Sequence

The base of the Que - Hellyer Sequence in this hole is marked by an interval of approximate 44 metres of massive to graded volcaniclastics referred to by the Department of Mines as the Lower Tuff and Lava Sequence. It consists of poor to well sorted, thin (< 0.5 metre) to thickly (> 10 metre) bedded green grey crystal lithic volcaniclastics, which range in grain size from fine to very coarse. The finer grain size intervals are generally the thinnest, quite often diffusely laminated and are interpreted as Bouma divisions b or d. The coarser

intervals are generally massive, but can show normal and coarse-tail grading, are interpreted as Bouma a division

In thin section the volcanoclastics are dominated by feldspar \pm quartz crystals euhedral to anhedral in shape, suggesting very little abrasion during transport. The lithic component is dominated by feldspar-phyric intermediate fragments with a microlitic groundmass. The volcanoclastics are closed framework and contain less than 10% mud matrix and chloritic cement.

Erosional contacts between individual beds are common suggesting deposition from multiple small scale events. No tractional features (ie. cross-bedding, cross-laminations) have been observed in core and this combined with other observed characteristics (ie. poor sorting, massive to coarse-tail grading etc), suggests rapid deposition, most likely from multiple moderate to high concentration turbidity currents (Lowe, 1982; Middleton, 1967).

Part 4: Possible relationships between the Que - Hellyer Volcanics and the Mount Read Volcanics south of Mount Charter

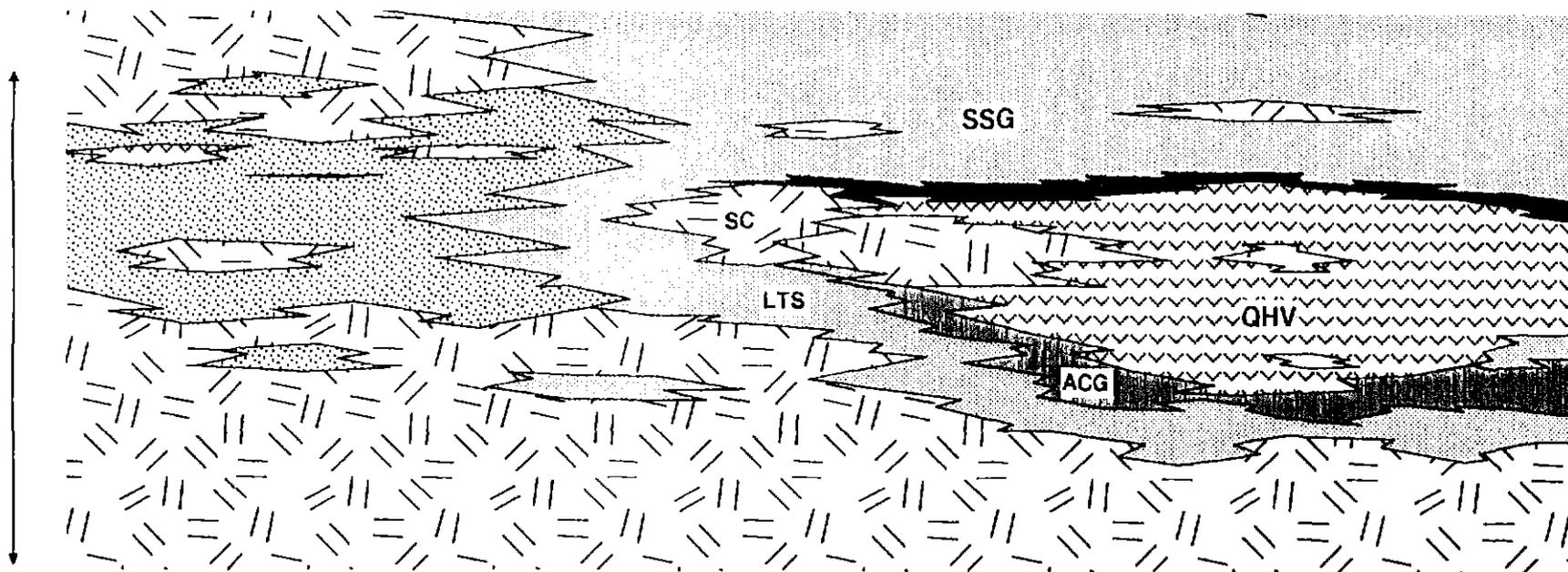
Work carried out to date on the Que - Hellyer Volcanics (this study), combined with some observations made by other workers (Dr. K. Corbett, Dr. J. McPhie and G. Lees) suggest that the current stratigraphic relationships between the Que - Hellyer Volcanics and the Mt. Read Volcanics south of Mt. Charter should be reviewed. It is suggested here that the Que - Hellyer Volcanics may occur as a lens within part of the Central Volcanic Complex (CVC), rather than overlie it as previously thought, making the bulk of the VMS style mineralisation up and down the belt approximately the same age (Fig. 5). The following is a summary of points which may support such a relationship.

(i) Recent work suggests that there is evidence for the correlation of the Que - Hellyer sequence with sequences in the Bulgobac, High Point and Sock Creek areas (see Report 10). This is based on similar petrographic and stratigraphic associations within drill holes from these areas and those from the Que - Hellyer area. This work also suggests that the composition of the footwall becomes more felsic as you move to the south and south-west of Que River. If such a transition in the footwall was to continue to the south then it is possible that a southerly correlate of the Que - Hellyer succession may be partly or wholly felsic in nature, and therefore difficult to distinguish

South

North

Mt. Read Volcanics
Central Volcanic Complex



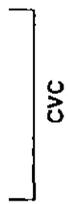
(not to scale)



Felsic-(Intermediate) lavas
minor fragmentals



Felsic-(Intermediate)
autoclastics, volcaniclastics
minor lavas



Felsic-(Intermediate)
autoclastics, volcaniclastics
greywackes, minor lavas



Mafic-Intermediate Volcanics



Black mudstones-
fine sandstones



Greywackes

03.
petrographically from CVC units. This also suggests that the basaltic to andesitic volcanism within the Que - Hellyer Volcanics is only developed locally within the sequence, most like proximal to its source point(s).

(ii) Present at some localities immediately below the Que - Hellyer Volcanics is an interval of volcanoclastics rich in juvenile pumiceous and vitric debris. This unit is especially well developed in MXRD-1 where it consists of massive pumiceous crystal lithic volcanoclastics very similar in appearance and composition to some of the units found in the Southwell Sub-Group overlying the Que - Hellyer sequence. It is therefore likely that similar styles of felsic to intermediate volcanism to that which produced the Southwell Sub-Group sequence was going on prior to the onset of Que - Hellyer volcanism. This is also indicated by the thick (600 m+), juvenile rich volcanoclastics which, along with some felsic volcanics, make up the Lower Vitric Tuff sequence of Pemberton et al., 1991. This sequence is suggested by Pemberton (et al., 1991), as possibly having an interfingering relationship with the CVC units. These volcanoclastic deposits most likely represent explosively produced material erupted at some distance away, and therefore the occurrence of the Que - Hellyer sequence within this material may only represent a relatively small proximally sourced event which occurred during the period of distal felsic volcanism. This implies that the Que - Hellyer sequence may in fact be a lens of volcanics and volcanoclastics within a larger formation containing the Southwell Sub-Group lithologies and the units below the Que - Hellyer Volcanics (ie. Animal Creek Greywacke and the Lower Vitric Tuff sequence of Pemberton et al., 1991). Therefore in areas laterally equivalent to the QHV, where basaltic to andesitic volcanism did not occur, the sequences developed will be dominated by fragmental \pm coherent felsic volcanics. Such sequences may include the one hosting mineralisation at Rosebery and Hercules.

(iii) It has been suggested by other workers (Dr. J. McPhie), that units within the Southwell Sub-group can be traced from the Que - Hellyer region southward through the Sock Creek area possibly to the hangingwall of the Rosebery host succession. If such a relationship can be shown this will support the theory that the Que - Hellyer Volcanics lie as a lens at some position within the CVC and that VMS style mineralisation up and down the belt is approximately the same age.

Future Work:

Future work to be undertaken in the next six months includes:-

- (i) Continue logging and sampling Que River DDH's on selected sections (ie. 7375 N., 7712.5 N., 7800 N., 7900 N., QR 1212)
- (ii) Continue logging and sampling of selected Exploration DDH's. Some of the holes targeted for logging in the near future are Mac-018, HL-469, Hat-003. These holes will help complete regional scale north-south sections.
- (iii) Log a series of holes on a regional east - west cross section in the area around the Que River deposit (~7300 N). This section includes drill holes QR-1169, QR-1060 (logging completed), HAT-006 (logging completed) and the Placer holes BRD-04, BRD-01 and BRD-02.
- (v) This coupled with a few remaining drill holes from the Hellyer deposit should complete the bulk of the field work for the project.
- (v) Continue writing draft copies of thesis chapters commenced during the period covered by this report.

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**ERUPTIVE ACTIVITY, PRODUCTS AND DEPOSITIONAL
SETTING OF THE CAMBRIAN VOLCANIC-SEDIMENTARY
SUCCESSION HOSTING MASSIVE SULPHIDE
MINERALISATION (VMS) AT HELLYER AND QUE RIVER
MINES, MT. READ VOLCANIC BELT, WESTERN
TASMANIA.**

PROGRESS REPORT NO.12

by
John Waters, Ph.D. Student,
Department of Earth Sciences, Monash University.

JULY 1991 - DECEMBER 1991

Introduction

This report is the twelfth in a series of progress reports to Aberfoyle Resources on the Ph.D study of the Hellyer - Que River Volcano - Sedimentary succession. It covers data collected on the Mixed Sequence (host horizon) in the vicinity of the Que River deposit over the six month period July through December 1991.

The immediate host sequence to mineralisation at the Que River deposit differs to that at Hellyer in that it is thicker and contains massive lavas intercalated with the volcanoclastics. The exact nature of the host horizon at Que River, including both the lithology and structure, has to date been difficult to access, mainly due to the pervasive hydrothermal alteration associated with the mineralisation coupled with rapid lateral facies variations within the volcanics.

Previous work on the host horizon at Que River concluded that the sequence was comprised of andesitic and dacitic lavas and pyroclastics as well as intervals of reworked tuffaceous sediments (Young, 1980; Wallace and Green, 1982). Whitford (et. al. 1989) divided the lithologies within the host sequence into four groups, (i) andesites; (ii) dacites; (iii) polymict volcanoclastic rocks; and (iv) hydrothermally altered volcanic rocks. The andesites are dominantly fragmental in character and best developed away from mineralisation outside the alteration envelope. Dacites occurring within the host horizon, intimately associated with the mineralisation, are often identified as massive wedged shaped bodies or as fragmentals (Young, 1980; Wallace and Green, 1982; Whitford et al., 1989). Polymict volcanoclastics are generally thought to lie in the top half of the host sequence and are comprised of breccias and bedded volcanoclastics. Fragments present within the polymict volcanoclastics include dacitic through to basaltic lithics, juvenile pumiceous fragments, silicified sediments and sulphide clasts (Whitford et. al., 1989; Corbett and Komysan, 1989). The hydrothermally altered volcanic rocks of Whitford (et. al., 1989) consist of the highly altered members of the above three groups adjacent to mineralisation in the region of PQ and S lenses.

Due to the intense alteration and rapid lateral facies variations it has been difficult in the past to establish marker horizons for interpreting the structure of the Que River deposit. As a result several structural interpretations for the immediate mine area have been suggested. Early

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models involved a simple west facing sequence with mineralisation occurring as a sequence of stacked sub-vertical ore lenses (Webster and Skey, 1979; Wallace and Green, 1982). This west facing model was also supported by structural data collected by Cox (unpublished data, 1985), and work carried out by Whitford (et al, unpublished data, 1982). Young (1980), proposed a model involving a gently plunging syncline, whereby the two of the major ore lenses (PQ and P north), occurred on the limbs of the syncline. This model was expanded upon by Large (et. al., 1988), proposing that the immediate area around the main ore lens has been tightly folded into a W-fold structure in the hinge area of the syncline.

This report looks at lithological data from drill holes on two sections at Que River with the aim of further interpreting the nature of the host sequence lithologies at Que River. Evidence on the structural style of the host sequence, based on available data from drill holes on these sections, will also be discussed.

Field Work

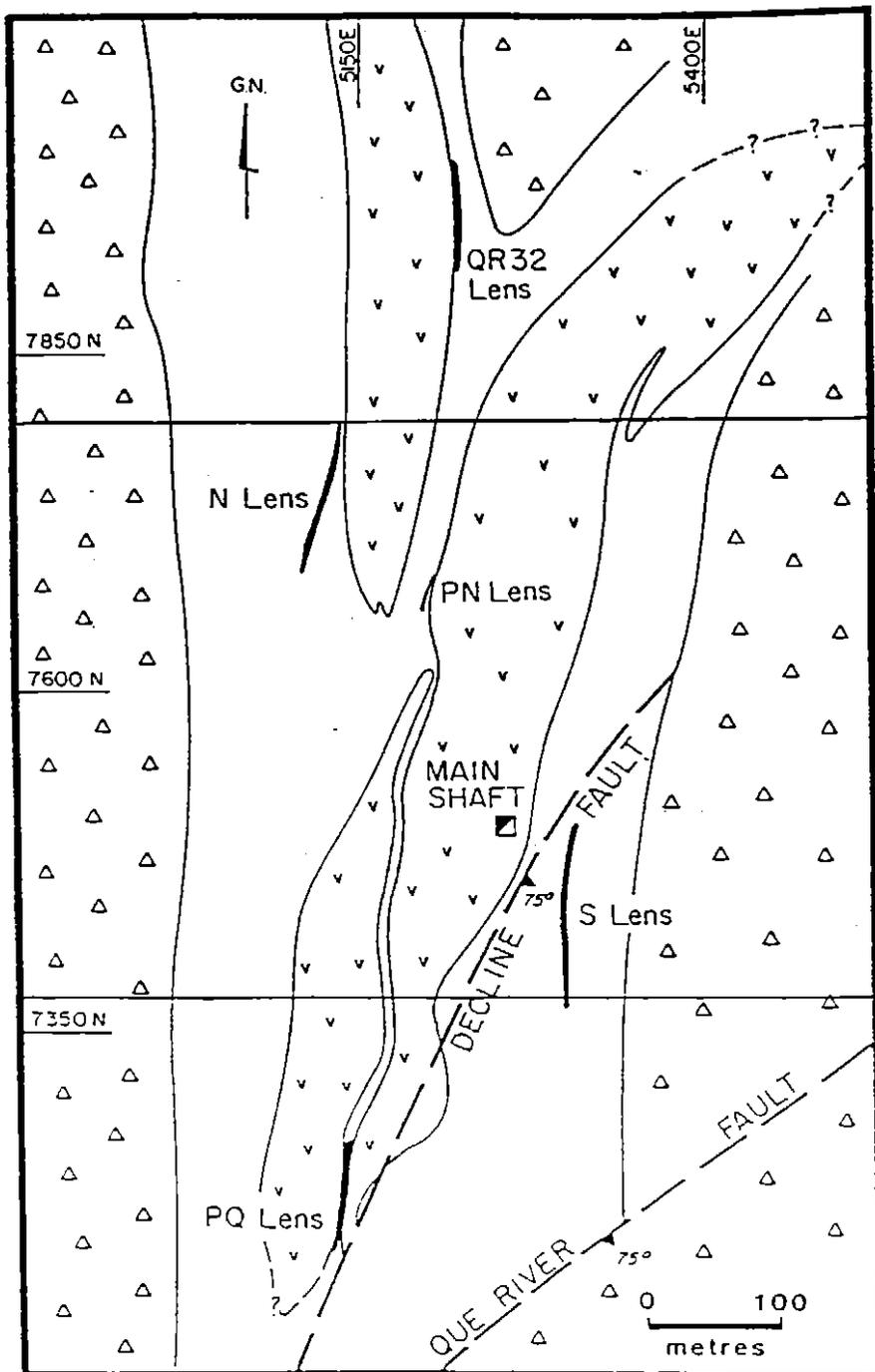
Drill holes on two sections, 7375 N. and 7800 N., through the Que River deposit were logged during the period covered by this report (Fig. 1). A combined total of 19 drill holes were logged from these two section to access the nature of the host succession to the mineralisation at the Que River deposit. Two further sections, 7712.5 N and 7900 N., have also been selected for logging in the near future to complete the six sections through the Que River deposit targeted for this study.

7800 N. - Northern end of Mineralisation at Que River

Of the five main ore lenses two occur at the far northern end of the Que River deposit. These two, N and QR32 lens, lie on the flanks of the 'western dacite' and have average widths of 3 and 4 metres respectively (Fig. 1)(McArthur and Dronseika, 1990). These lenses are of a similar mineralogy to PQ lens but consist mainly of brecciated and stringer type mineralisation and massive pyrite, massive base metal sulphides are generally rare.

The host horizon, or Mixed Sequence, at the northern end of the Que River deposit is comprised of multiple flows of dacitic to andesitic lavas separated by intervals of volcanoclastics and minor lenses of massive sulphides (i.e. QR32 and N lens)(Figs. 2 and 3). This sequence appears to face eastward, as suggested

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- △ Andesitic lavas & volcaniclastics
 - ▽ Dacite lavas & lava breccias
 - Altered pyritic volcaniclastics
- Ore lenses

5 cm

Figure 1: Surface geology of the Que River deposit showing the distribution of ore lenses. Solid black lines through the deposit represent sections studied during the period covered by this report. (from McArthur and Dronseika, 1990).

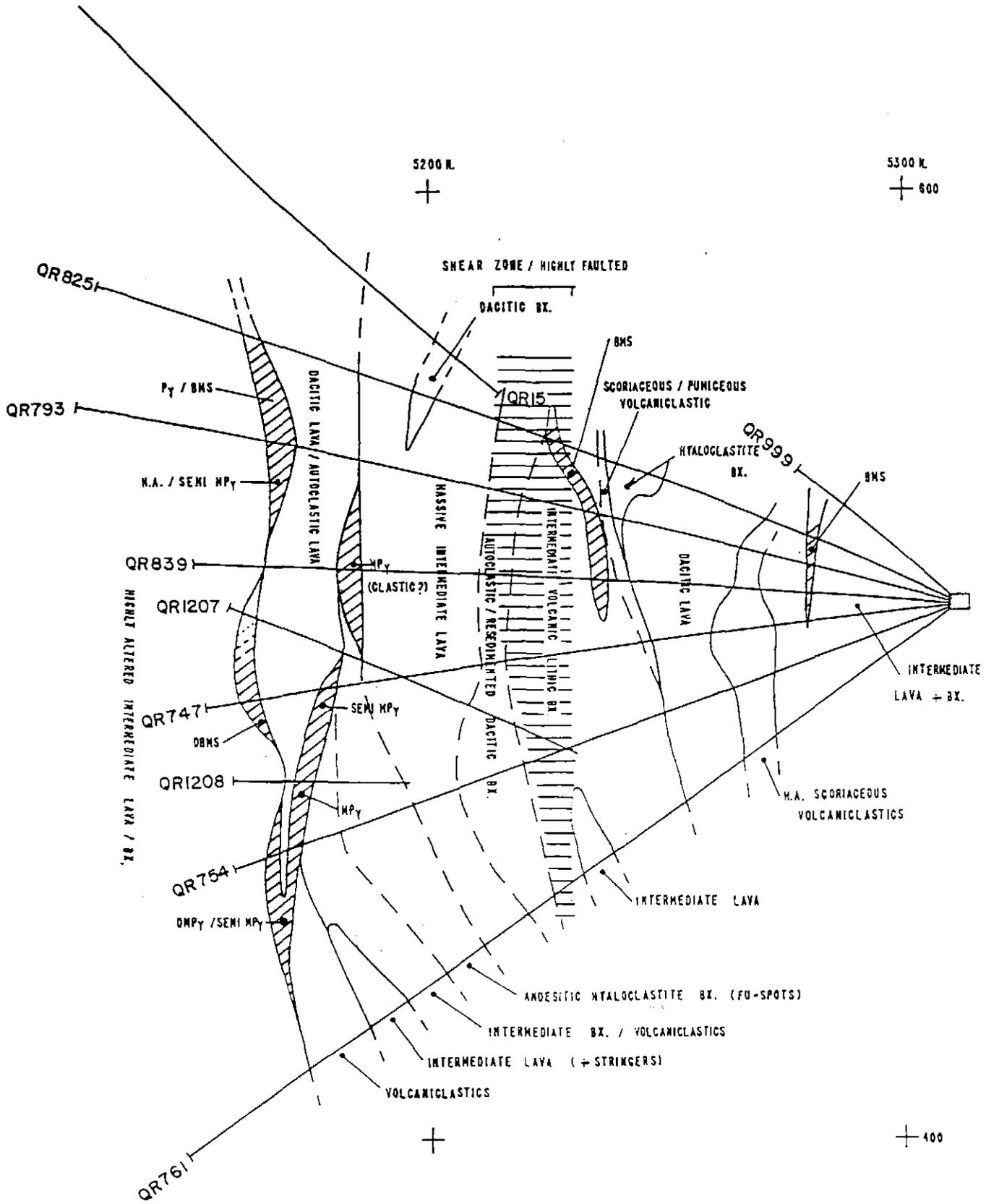


Figure 2: Cross section through 7800 N. at the northern end of the Que River deposit. Units labelled intermediate in composition are dacitic to andesitic.

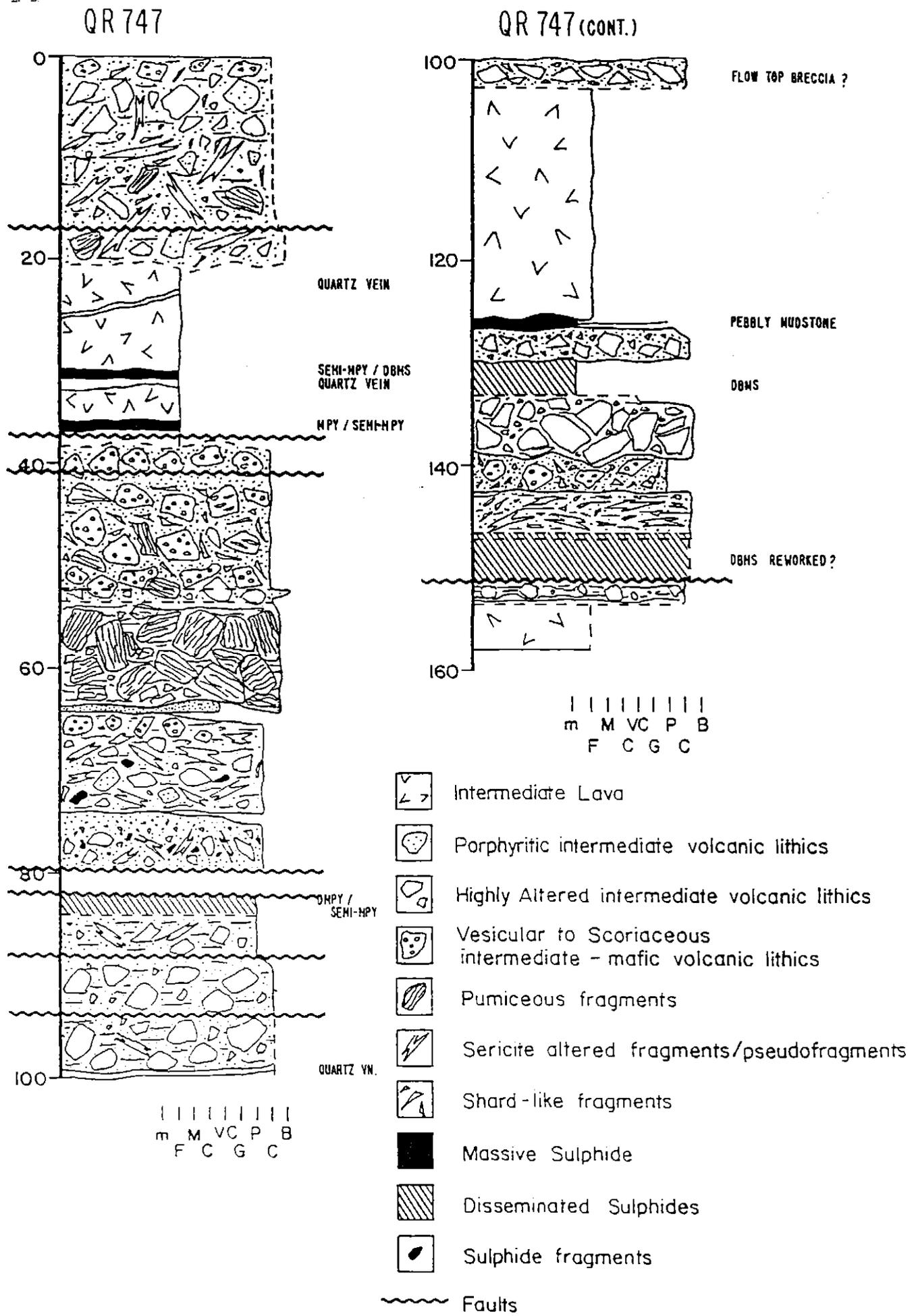


Figure 3: Log of drill hole QR 747 on 7800 N.

by the strong development of hydrothermal alteration and stringer veins being of higher intensity on the western side of the ore lenses, especially at the base of the sequence exposed in drill holes on this section.

The lowest stratigraphic unit observed in drill core on section 7800 N. consists of highly altered intermediate (andesitic to dacitic), lavas and breccias (Figs. 2 and 3). These exhibit very strong 'quellite' style alteration, rich in disseminated pyrite, and a well developed cleavage (e.g. QR 1208, 26 - 37 m). In places the lava appears to have been originally porphyritic with up to 15% feldspar phenocrysts now replaced by sericite-carbonate rich assemblages. All other primary textures within this unit have been obliterated by alteration.

Overlying this highly altered unit is 4 to 5 metres of massive to disseminated sulphides (N Lens?)(Figs. 2 and 3). The mineralisation occurs a series of small bodies which contain variable amounts of primary and in some cases apparently resedimented base metal sulphides and pyrite.

This small mineralising event was interrupted by the emplacement of a 10 to 20 metres thick dacitic lava (Fig. 2). The lava is massive to weakly vesicular, containing 3 to 5 % flattened, mm sized, vesicles. This lava is typical of most of the dacitic lavas at Que River being pale cream to buff coloured and containing up to a few percent bottle green fuchsite 'spots'. The lava is relatively aphyric and was originally glassy as testified by the presence of strong perlitic cracking. The margins of the flow are brecciated with sub-angular autobrecciated and quench fragmented debris ranging in size from 15 centimetres down to millimetre sized. This debris is irregular to wispy in shape and sericitically altered, some appearing pumiceous in character. These breccias are poorly sorted with a muddy to sandy hyaloclastite rich matrix ($\leq 40\%$), giving the breccia a peperitic texture (e.g. QR 839). Along the top of the dacite the autoclastic margin appears to have been resedimented by mass flow processes, probably as a result of the over steepening of debris during the emplacement of the dacite.

Mineralisation apparently continued following the emplacement of the lava resulting in the accumulation of mainly massive to semi massive pyrite (Fig. 2). This mineralisation appears to join with the underlying mineralisation in areas where the dacite was not emplaced. Overlying the dacite within QR 839 is a 4 to 5 metre thick unit comprised of sulphide, barite and volcanic fragments

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set in a fine grained sulphide matrix. This unit has sharp contacts with units above and below and appears to be a mass flow of sulphide debris, and is therefore most likely clastic in origin (Fig. 2)

Overlying this is a sequence of intermediate lavas and volcanoclastic breccias. These intermediate volcanics probably range in composition from dacitic to andesitic. In drill holes QR 754, 761 and 1208 volcanoclastics overlie the mineralisation, and as a result of their permeability are generally moderately altered to quartz - sericite - pyrite rich assemblages. These volcanoclastics are comprised of varying proportions of weakly vesicular to pumiceous vitric debris, porphyritic volcanic lithics and silicified cherty fragments. Fragments are poorly sorted and angular to sub-angular, ranging in size up to 15 centimetres in core. Moving from drill hole QR 1208 to QR 761 the average grain size decreases to medium to coarse grained accompanied by an increase in the matrix from 10% to in excess of 30% transforming the unit into a lithic rich mudstone/sandstone.

In drill holes QR 747, 793, 825, 839 and 1207 approximately 25 metres of massive intermediate lava overlies the mineralisation (Figs. 2 and 3). This lava is dacitic to andesitic in composition and varies from aphyric to weakly porphyritic. Feldspar phenocrysts and glomerocrysts comprise up to 10 to 15% of the lava, with the remaining 85 to 90% being perlitically fractured groundmass. Vesicularity within the lava varies up to 5%, with the highest values generally nearer the margins of the flow. This unit within QR 825 appears to consist of multiple flow unit separated by thin intervals of autoclastic, often peperitic, breccia. An interval of autoclastic and resedimented autoclastic dacitic debris averaging 5 to 6 metres in thickness overlies this lava (Figs. 2 and 3). This breccia has a locally open to closed framework consisting of sub-angular to angular blocky to wispy fragments with straight to weakly cusped margins. These fragments range from aphyric juvenile fragments to weakly porphyritic lithics with up to 10% quartz and feldspar phenocrysts. The juvenile fragments appear glassy and shard like, ranging from 5 centimetres down to sub-millimetre sized, forming part of the matrix component along with mud. This matrix comprises up to 30% and gives the breccia a peperitic texture. Areas of the breccia exhibit jigsaw fit between fragments suggesting fracturing in-situ, most likely via quench fragmentation, where as elsewhere the fragments appear to have suffered some form of transport and

resedimentation. Contacts with the underlying lava are generally gradational, while its top contact with the overlying volcanic lithic breccia is sharp.

The overlying breccia consists of massive to graded lithic rich breccias, which on the whole appear to be compositionally monomict, although some intervals within QR 761 and QR 754 may be polymict. These breccias are poor to very poorly sorted chaotic units consisting of aphyric volcanic lithics (~20%), wispy sericitic fragments (~60 - 50%), and a sandy mud matrix (~20 - 30%). Fragments show vary degrees of alteration and some appear to have been altered prior to being incorporated into this unit (e.g. QR 754). In areas this unit is represented by a medium to very coarse muddy volcanoclastic of similar composition to the coarser breccias (e.g. QR 761). Intercalated with this unit there appears to be a thin (< 5 - 7 metre thick) flow of intermediate lava (Fig. 2). Another lens of mineralisation occurs toward the top of this breccia horizon (Fig. 2). This lens (QR32 ?) in drill holes QR 793 and QR 839 consists of banded base metal sulphides and averages about 4 metres in thickness. The base of this sulphide lens is rich in massive to semi-massive pyrite.

This sulphide lens is separated from another thinner lens of sulphide by an interval of dacitic lavas and pumiceous to scoriaceous(?) volcanoclastics. The main body of lava within this interval is approximately 10 to 20 metres thick and apparently made up of two flows which are similar to the flows found lower in the sequence on this section. In several drill holes this dacitic flow is partially or completely brecciated (i.e. QR 747, 839). The resultant breccias are closed framework and comprised of block, angular fragments of tube pumice in gradational contact with the lava. These breccias are moderately to poorly sorted, depleted in fine grained material less than 0.75-1 millimetres, meaning the unit has very little or no matrix component. The volcanoclastics which surround this brecciated lava are rich in moderately vesicular tube pumice and bubble pumice, or scoriaceous, fragments which appear intermediate to mafic in character. These volcanoclastics are poorly sorted with irregularly shaped fragments up to 15 centimetres across in core. Vesicularity in these fragments ranges up to 40 to 50% with round to ellipsoid vesicles up to 0.5 centimetres in diameter. The matrix is comprised of mud and sandy hyaloclastite resulting from the disintegration of the vesicular fragments. These volcanoclastics are very similar in appearance to the fuchsite-carbonate (IHC_o) units found above the ore a few hundred metres to the south.

The upper most unit encountered in drill holes on this section consists of a sequence of intermediate (andesitic / dacitic) lavas and associated breccias with a minimum thickness of about 30 metres (Fig. 2). This sequence is similar to the interval of intermediate volcanic lithic breccias 30 to 40 metres lower in the sequence. Within this interval there is minor disseminated base metal and pyrite mineralisation.

S-Lens: Host lithology on 7375 N.

The eastern most mineralised horizon at Que River, S lens, consists of a vertical lens averaging 5 metres in east - west thickness with a strike length of approximately 300 metres. Mineralisation within the lens is dominated by massive to disseminated and stringer sulphides. The immediate host lithologies to S lens are dominated by lavas and associated autoclastic rocks, with polymict epiclastics making up only a relatively minor proportion in the immediate hangingwall. Relationships between the mineralisation and immediate host sequence, combined with the distribution and degree of alteration, suggests that S lens is conformable within a west facing sequence (Figs. 4 and 5).

Footwall

The footwall to the mineralisation consists of hydrothermally altered dacitic lavas and volcanoclastics (Figs. 4 and 5). The lavas are weak to moderately porphyritic, containing between 5 and 20% combined feldspar and quartz phenocrysts. Hydraulic fracturing of the lavas is common resulting in the production of jig-saw fit breccia. Elsewhere the lavas show the development of very strong 'quellite' style alteration, which replaces the lavas groundmass with pyrite - phyllosilicate rich assemblages. In places originally massive lavas appear to have gradational contacts with closed framework breccias. These breccias appear to consist of juvenile volcanic fragments of the same composition as the lavas. Fragments range from porphyritic to aphyric and in some cases are pumiceous in character. Aphyric, blocky to irregular shaped, sericitically altered pumiceous fragments have been identified in drill holes QR 1178, 1179, and 1181 where they occur in a strongly altered mud matrix, rich in disseminated pyrite. In QR 1181 these breccias lie in gradation contact with the lavas and this, coupled with their blocky shape, has led to an autoclastic (i.e. pumiceous hyaloclastite), rather than pyroclastic interpretation for their mode of formation (Fig. 5).

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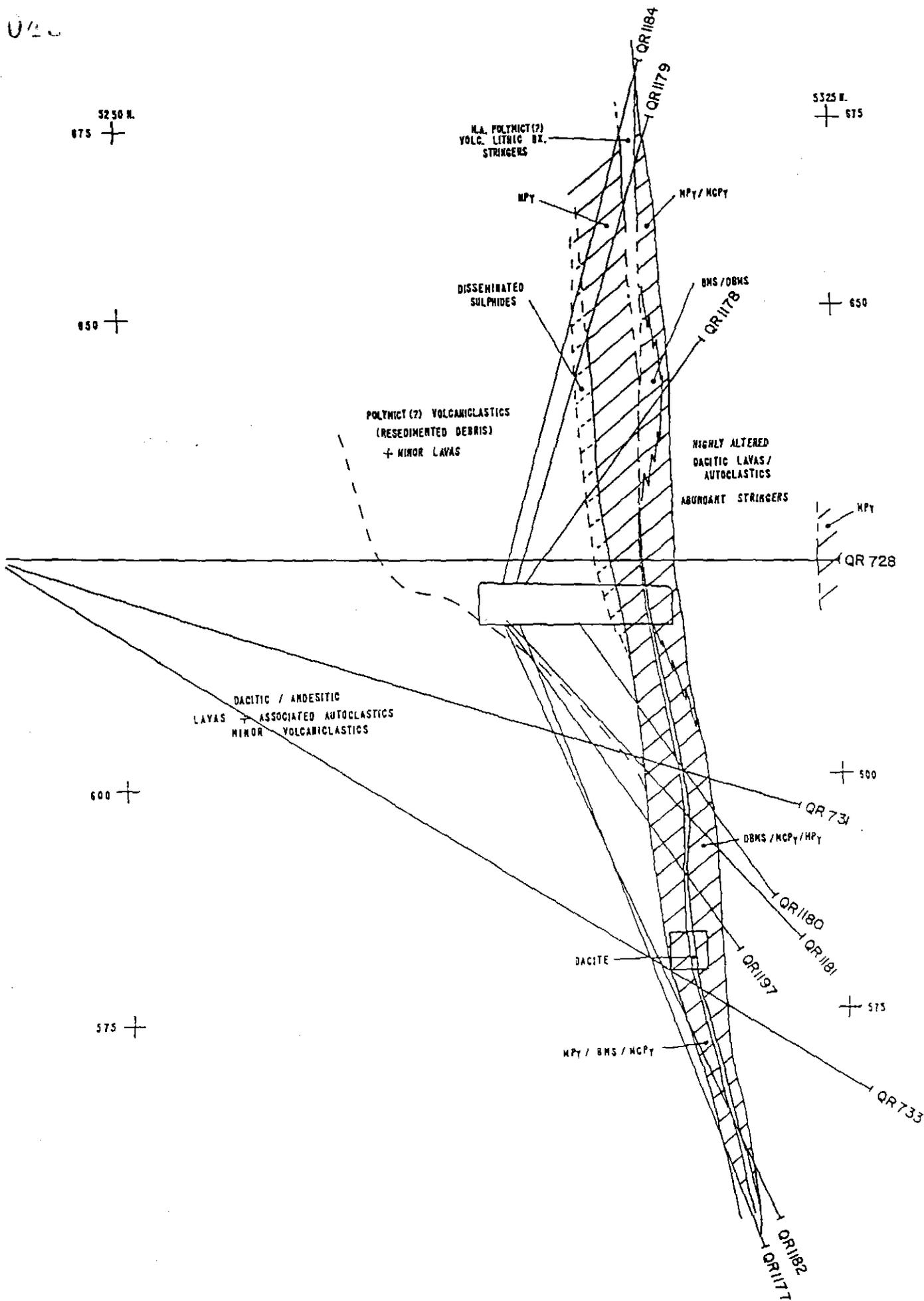


Figure 4: Cross section through the host sequence to S Lens on 7375 N.

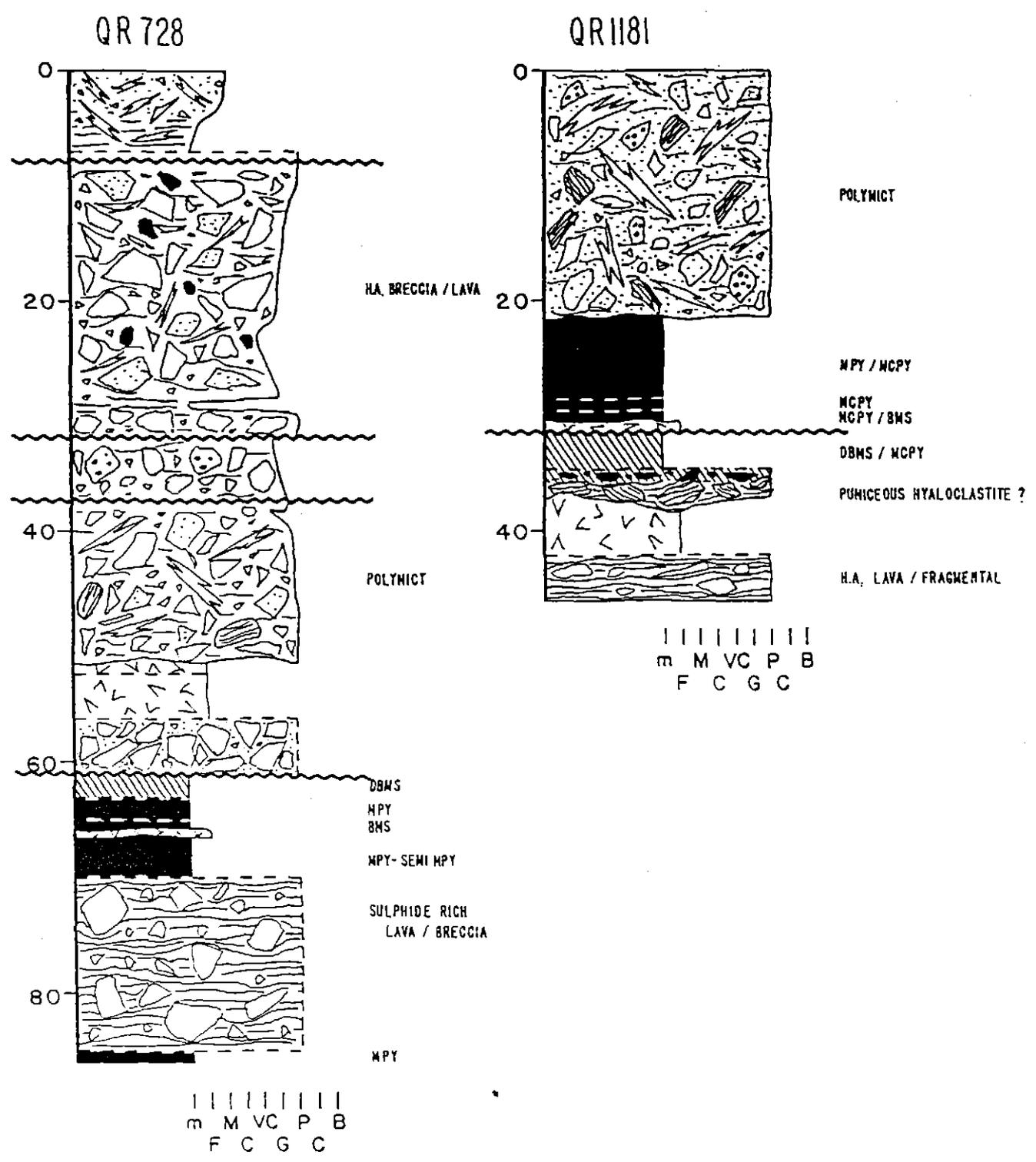


Figure 5: Logged sections from drill holes QR 728 and QR 1181 on 7375 N. (see figure 3 for legend).

Sulphide rich stringer veins cross cut both the lavas and volcanoclastics within the footwall of S lens.

Mineralisation

Mineralisation occurs as a narrow vertical lens which exhibits moderately sharp to gradational contacts with the enclosing lithologies (Fig. 5). The sulphide mineralogy is dominated by pyrite and chalcopyrite with minor base metal sulphides generally found toward the stratigraphic top (west of section). Minor disseminated base metal sulphides are also found toward the base (east of section) separating pods of massive pyrite / chalcopyrite (Fig. 4).

The mineralisation on 7375 N. toward the surface (QR 1179, 1184), is split into two horizons separated by an interval of moderately altered polymict(?) matrix rich breccia (Fig. 4). This breccia consists of angular to sub rounded highly altered volcanic fragments and sulphide clasts with up to 20% matrix. Thin sulphide rich stringers cross cut this unit in core. At about the same stratigraphic position on 7375 N. an approximately 0.5 - 1 metre thick dacitic sill or flow bisects the mineralisation. This dacite is very weakly porphyritic and slight to moderately altered.

Hangingwall

The hangingwall to the S lens mineralisation consists of variably altered volcanics and volcanoclastics. The bulk of the hangingwall sequence cut by drill holes QR 728, 731, and 733 consists of altered coherent volcanics and associated autoclastic debris, with the lavas dominating over all but the lower 10 - 15 metres of the hangingwall exposed in drill core on this section. Polymict epiclastics make up only a minor proportion of the S lens hangingwall in drill holes on this section and are present generally within the lower most 20 metres. In most cases mineralisation is overlain directly by volcanic breccias rather than coherent lavas.

The polymict breccias, which occur toward the base of the S lens hangingwall, have an in core thickness of up to 10 metres. These are poorly sorted massive debris flows with closed to locally open frameworks consisting of fragments up to 6 centimetres in diameter. The breccias are comprised of fragments of andesite (~40-50%), dacite (20-25%), mafics (10-15%) and a muddy matrix (~10-20%). The intermediate fragments range from porphyritic to aphyric and show varying degrees of alteration. Dacitic fragments have irregular wispy

034
outlines and appear to have a pumiceous texture where least altered. Mafic fragments within the breccias are commonly weakly to moderately vesicular / scoriaceous and are very similar in character to fragments found within the 'fuchsite-carbonate' (IHCo) horizon. These polymict breccias show similarities with the polymict units (Y-Bv₁ and Y-Bv₂) within the Hangingwall Volcaniclastic Sequence at Hellyer (see Report 4).

The remainder of the immediate hangingwall to S-lens is comprised of lavas and associated volcaniclastics. The lavas are moderately to strongly altered and often have pseudofragmental textures. Where least altered the lavas appear to have been intermediate (dacitic - andesitic), in composition and aphyric to very weakly porphyritic. Texturally the lavas are often perlitic or spherulitic suggesting that they were originally glassy. Found in gradational contact with these lavas are volcaniclastic breccias comprised of primary and resedimented autoclastic debris. Most of the debris is comprised of volcanic lithics of the same composition as the lavas and weakly vesicular to pumiceous hyaloclastite debris. The breccias are poorly sorted with matrix contents up to 25%, and variably altered to sericite-silica-chlorite-carbonate-pyrite assemblages.

DISCUSSION

The Mixed Sequence or host horizon at Que River, on sections studied to date, consist of a series of thin dacitic to possibly even andesitic volcanics and associated volcaniclastics. Mineralisation appears to occur as a series of bifurcating to stacked lens at slightly varying stratigraphic levels throughout the host sequence. The reason for the geometry of the ore lens appears to be a function of the initial topography on the palaeo-seafloor and the interruption of the ore forming events by the emplacement of small volume dacitic lavas and associated autoclastic debris. This therefore suggests that mineralisation at Que River occurred proximal to and during active volcanism rather than during an interval of volcanic quiescence.

The style of volcanism within the Mixed Sequence is dominated by the rapid emplacement of small volume dacitic to andesitic flows and shallow intrusives with very little time break between successive eruptions. These flows are generally less than 20 metres in thickness and have autobrecciated to quench fragmented margins. These brecciated carapaces pass gradationally via jig saw fit breccias into massive lava indicating in-situ rather than explosive fragmentation. Many of the autoclastic flow margins have been resedimented

and in some cases mixed with other volcanic debris to produce polymict breccias. Resedimentation of the debris occurs most likely as a result of the over steepening of debris on the tops and flanks of advancing flows. Some of the textures within the sulphide lenses also suggest a clastic origin with areas of sulphide and volcanic fragments set within a sulphide mud matrix (e.g. QR 825; 31 m).

Much of the autoclastic debris in the volcanic breccias, both in-situ and resedimented, is moderately vesicular, or pumiceous. Two types of pumiceous fragments can be identified, the first has highly attenuated vesicles and resembles tube pumice, the second has spherical to ellipsoid vesicles and is termed bubble pumice. The second type appears more intermediate to mafic and has therefore been referred to in the logs and cross sections as *scoriaceous debris*.

Breccias containing the blocky tube pumice often grade into massive dacitic lava. This coupled with the lack of fine sub-millimetre sized debris within the matrix of the breccias suggests that they were formed in situ via autoclastic rather than pyroclastic processes. This therefore implies that you can generate tube pumice textures via the eruption and emplacement of subaqueous felsic to intermediate lavas with out explosive eruption. Pumice generated by non explosive extrusion and flow of subaerial felsic magma has been documented previously by Fink and Manley (1987), and Manley and Fink (1987), in Holocene flows of northern California. In these flows the pumice textures were generated during the effusion of the lava when the remaining volatiles, mainly water, exsolved from the melt due to very low confining pressures (Manley and Fink, 1987). Subaqueous examples of pumice generated by non-pyroclastic processes are apparently lacking in the literature.

The tube pumice textures observed here are most likely a result of vesiculation of a moderately viscous lava which has then had a shear stress imposed on it. Vesiculation of the magma most likely took place just prior to extrusion with the viscosity of the melt being high enough to prevent the migration and coalescing of the bubbles. In order for the degree of vesiculation observed to take place the magma must have had a moderately high volatile / water content in order to produce vesicles with vapour pressures equal to or greater than the overlying combined hydrostatic and lithostatic pressures (Manley and Fink, 1987). These small vesicles were then stretched as a result of a shear

stress imposed on them during the rapid extrusion through a small conduit or stresses imposed on the margins of the lava as it was emplaced. This pumiceous lava was then quench fragmented or autobrecciated to produce the breccias observed.

The bubble pumice or scoriaceous vitric debris would have vesiculated under little or no shear stress due to the spherical to ellipsoidal shapes of the vesicles. These vesicles are also noticeable larger than those in the tube pumice and therefore assumed to have formed in a melt with a low enough viscosity to allow the growth migration and coalescing of vesicles. This would have been more likely in a more mafic melt with lower initial viscosities than the dacitic melts.

Generation of pumice of similar composition purely via magmatic explosion would be restricted to water depths of less than 500 - 600 metres assuming 2.0 wt% water in the melt and a gas to liquid volume ratio in the order of 3:1 (i.e. 75% vesicularity of the pumice) (Mc Birney, 1963, Wilson et. al., 1980).

Assuming that the fluids responsible for mineralisation at Que River were similar to those at Hellyer, and assuming most of the mineralisation took place on the seafloor, the minimum water depth at which the sulphide deposit could have formed would be in the order of 900 to 1000 metres (Gemmell, Progress Rept 1., Haas, 1971). This suggests that the generation of pumice at Que River purely via explosion generated by the expansion of magmatic volatiles is unlikely given the water content of the magma is ≤ 2 wt% water. Generation of pumice via phreatomagmatic eruptions at the water depths suggested could theoretically be possible (Mc Birney, 1963, Cas and Wright, 1989), but textural and lithological evidence suggests that this is an unlikely mechanism for the formation of the pumiceous debris at Que River. These tube pumice breccias are texturally very similar to some of the lithologies found at the Rosebery deposit (R. Cas pers. comm.).

Work carried out on the sections to date appears to support the structural model first proposed by Young (1980), suggesting the presence of a synclinal structure through the Que River deposit. Facing within the mixed sequence on the sections studied was determined from lithological associations combined with the distribution of alteration and stringer mineralisation associated with the ore lenses. The sequence around S lens on 7375 N appears to be west facing based on the above criteria. The strongest support for this is the occurrence of

very strong alteration and a high stringer frequency on the eastern side of the ore lens (Fig. 4). To the north on section 7800 N. similar criteria suggest an easterly facing sequence, although with a lesser degree of certainty. This suggest that the major structure through the Que River deposit is a syncline trending roughly north, parallel to the major anticlinal structure that passes through Hellyer. There is however, no evidence to support a complex 'w' fold structure as proposed by Large (et. al. 1983) on the sections studied.

Future Work:

Future work to be undertaken in the next three months includes:-

- (i) Finish the logging of the final two sections at Que River (i.e. 7712.5 N. and 7900 N.)
- (ii) Complete the logging of the final few exploration holes selected for the regional coverage of the volcanics. (i.e. Mac-018, Mac-012 and Hat-003). Time permitting in the field some of the Bulgobac River holes (BRD prefix) will be looked at to provide a westerly extension to one of the regional sections.
- (iii) Look at some of the holes at the far southern end of the Hellyer deposit (i.e. 10100 N. / 10200 N.) to aid in the investigation of the host sequence to mineralisation within the volcanics.

Points (i) through (iii) will complete the field component of the project in early 1992.

- (v) Continue writing draft copies of thesis chapters commenced during the period covered by this report.

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APPENDIX II

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Well - here's the text!

26/5/91
 Glenn Lees
 Department of Earth Sciences
 Monash University
 Wellington Road
 Clayton, Victoria, 3168

To: David Wallace
 Aberfoyle Exploration
 Wivenhoe
 Burnie, Tasmania

RE:

- 1) correlation between units of the Upper Rhyolitic Sequence (Upper Rhyolitic Sequence), and the Massive Pyroclastic Sequence, Rosebery/Hercules
- 2) correlation of the Upper Rhyolitic Sequence units intersected in MAC20/22 and the Hellyer sequence.

Part One

Upper Rhyolitic Sequence Basal Stratigraphy: Potential Regional Stratigraphic Markers

REGIONALLY CORRELATIVE FACIES:

Jocelyn McPhie has proposed a regional correlation between units found in the Upper Rhyolitic Sequence (Southwell Subgroup) and the Massive Pyroclastic sequence in the hanging wall at Rosebery. Further, she would draw tentative correlations between the Upper Rhyolitic Sequence and the Howards Road section, the White Spur Formation, and units cropping out in the Chester-Pinnacles area.

Fairly rapid examination of samples from Hercules and Rosebery indicate at least a very close empirical similarity between rocks from these two areas, especially in the nature of the quartz feldspar rich facies of the potentially correlative sequence.

Whilst I am not able to comment in any more than a vague sense on these correlations, I am able to describe in detail the correlative sequence in the Hellyer area, and speculate on features of these units that may be regionally recognisable.

The regionally correlative sequence consists of the basal three units of the Upper Rhyolitic Sequence. This general stratigraphy is illustrated in figure 1. The detailed occurrence of these units in the Hellyer area is shown in figure 2.

The sequence is described in detail below.

Basal Pumiceous Unit

Distribution

This is the Basal unit of the Hellyer area stratigraphy, and the Upper Rhyolitic Sequence overall. It occurs in virtually all drillholes where the contact between the Que River Shale and the Upper Rhyolitic Sequence is intersected. Exceptions are:

i) MAC19, where the contact is faulted out, and the Hellyer Basalt is in contact with units from higher in the Upper Rhyolitic Sequence stratigraphy (Jocelyn may disagree with this. I logged this hole before I was familiar with the stratigraphy, and so may have missed some correlations).

ii) HP4, where the stratigraphic position of this unit is occupied by a thick auto-brecciated/quench fragmented rhyolite lava. This is a tentative conclusion. This drillhole was collared to intersect a large fault, so the stratigraphic affinities of this unit are uncertain.

Where it occurs, the unit consists of one or more thick, upwards fining volcanoclastic megaturbidites. In the Hellyer area, it is usually ~30m thick. To the southwest in HP2, it thickens to over 100m.

Composition and Character

The unit may consist of either a single graded flow unit (e.g. HL79, HL40), or of a series of 2 or 3 stacked amalgamated units (e.g. HL541, HL489). Where multiple flow are present, the higher flows are always thinner and finer than the preceding flow.

The unit has a variably developed poorly sorted basal breccia zone. Where this is not present, it may be due to faulting (HL40), or due to lack of development during deposition (HL345). In these cases, a sharp depositional contact may be observed between the Que River Shale and this unit.

Compositionally, the breccia zone contains a mixture of dominantly mafic lava clasts, with minor intermediate to acidic clasts, broken quartz and feldspar crystals, as well as tube vesicle pumiceous debris. The mafic clasts are variably vesicular, and in some cases appear very similar to the underlying Hellyer Basalt. Specifically, some clasts display alteration similar to that observed in the Hellyer Basalt, such as pale green fuchsite and talc alteration. The more felsic clasts may display well developed perlitic cracking. The pumiceous debris commonly shows tube pumice textures (slide #2). A Crawford reports glass shards from this basal section in BBD05 (Placer petrology report). Relict shards have been noted in HL541.

Feldspar occurs as both plagioclase and K-feldspar, with rare granophyric intergrowth of quartz and K-spar being observed. The groundmass is altered to sericite-chlorite-quartz-feldspar, as a combination of devitrification of original vitric material, and hydrothermal alteration of feldspar and vitric material.

The basal breccia zone passes gradationally upwards into a pale grey, moderate to poorly sorted massive zone. This zone is characterised by small lava fragments, pink feldspar crystals, and small tube pumice fragments. This massive zone in turn passes upwards into a fine grained massive to diffusely laminated zone in which the percentage of feldspar and lava clasts has decreased. In the upper part of this zone, water escape structures such as convolute lamination may be preserved. The uppermost part of this unit consists of very fine grained banded and massive chert like shales that are usually paler than the body of the unit (slides #3 - #6 show the variation from coarse to fine in HP2).

Eruption and Deposition

The presence of tube pumice and (rare) glass shards indicates that the source for this volcanoclastic material was an explosive subaerial eruption. A submarine eruption is unlikely because of the abundance of tube pumice. Significant vesiculation is not possible below water depths of only a few tens of metres (McSirney, 1963, 1971). Emplacement of this flow in the subaqueous environment was either as a result of the flow entering the sea directly, or as a result of deposition on land followed by immediate reworking and deposition. Examples of the former case are described for the Roseau Tuff, Dominica (Whitham, 1989). In this example, piston cores of the submarine equivalent of a subaerial pyroclastic flow are described. It is noted that in these flows, a single flow may produce several flow units, by ingestion of water at the flow front and budding from the head of the resultant dense turbidity current. This may explain the presence of multiple flows in some intersections of this unit, but only single flows in others.

The large thicknesses of individual depositional units indicate that the source for this pyroclastic debris was a fairly large volume subaerial pyroclastic eruption, producing large volume pyroclastic flows. The presence of large volume units in the restricted Hellyer area imply that the unit should have a large volume overall, and an associated large regional extent. A flow of the order of several tens of cubic kilometres may be envisaged (J. McPhee suggests up to 100's km³). The flow may also be observed to thicken to the south, and so its *potential* as a regionally correlative unit appears to be quite good, especially to the south towards Rosebery and Hercules.

Summary of Important features for correlation

I have compiled a set of features that may be used for identifying this sequence elsewhere. These features are by no means unique, nor are they present in every occurrence of the relevant units. However, by identifying as many of the relevant features as possible, it may be possible to identify the facies package as a whole.

Underlying Stratigraphy

In the Que-Hellyer area, this unit conformably overlies the Que River Shale. The presence of a thick sequence of underlying black shales may provide an indicator of affinities, but is not necessarily required. The Que River Shale may represent a deposition in a restricted basin, and so would not be expected to regionally correlative. The underlying sequence may differ markedly from place to place.

Basal Breccia

The basal part of this unit shows a variably developed coarse breccia zone. The dominant coarse fraction are mafic clasts that show varying degrees of alteration, ranging from highly altered to relatively fresh. Highly altered examples occur in HL469, whilst fresher examples occur in HL345

Fining upward single or multiple depositional units

The depositional texture of the unit is that of very large scale turbidites. The flow units overall show grainsize grading from coarse bases through massive interiors to finely laminated tops. Multiple flow units may be present, with succeeding flows usually being thinner and finer grained than the preceding ones.

Banded Shales

Distribution

This unit is not found in all drillholes at Hellyer. Where it is absent, the overlying Quartz Feldspar Volcaniclastics rest directly on the Pumiceous Breccia Facies. This unit may be absent due to erosion during eruption and deposition of the overlying volcaniclastic.

Description

This facies is a fairly nondescript sequence of fine black shales interbedded with micaceous siltstones and fine sandstones. They display small scale cross bedding and graded bedding, indicating deposition from small turbidity currents.

Marker Horizon

Recognisable over a large area in the Hellyer sequence is a thin band (~10-20cm) of quartz felspar rich mudstone that appears to be a precursor to the following thick volcaniclastics. This thin band may be a regional feature, and may be useful. Its occurrence is shown on figure 2 in yellow.

Quartz Feldspar Volcaniclastics

Distribution

This unit is incorrectly identified by Corbett and Komyschan (1989 - explanatory notes) as being the basal unit of the Upper Rhyolitic Sequence.

Keeping in mind the desire to define a regionally correlative facies association, this facies has been defined to include all similar lithologies that occur within the Upper Rhyolitic Sequence. This requires the inclusion of a very thick sequence of similar and probably genetically related facies. Accurate correlation using the occurrence of this facies on its own is potentially difficult, due to the probable intrabasinal origin of the units, and due to the thickness of the package as a whole. Some small scale control is possible by defining sub units within this facies package. The definition given here extends Corbett and Komyschans original definition to include the facies of similar type that occur above the greywackes cropping out on the Hellyer haul road. Figure 1 shows a schematic subdivision of this facies.

This unit occurs in all holes where the correct stratigraphic interval is intersected, and crops out extensively on the Haul Road, and in the drainage canals (slide #8) around the Hellyer Mine. Corbett and Komyschan (op. cit.) also detail the regional occurrence of these rocks in some detail. Based on the definition of this facies (as presented below), it is on the order of 300-400m thick, with a thick interval of greywackes occurring in the middle section (figure 1, slide #15).

As a facies interval, it is widespread and highly diverse. Facies may vary from coherent lavas to "crystal tuffs", to pebbly mudstones, with less than five percent volcanic material. However, whilst the depositional affinities of units within this facies interval may be highly variable, all facies are related by the distinctive association of strongly resorbed quartz plus feldspar set in a

051

sericitic matrix. The quartz is further distinctive by the presence of intricate fracture networks that are truncated by the resorption embayments, where the fractures are defined by concentrations of fluid inclusions (slides 11,12,13 plus thin sections from HL79). Grains retain crystallographic continuity across fractures, and may display only slight undulose extinction across whole crystals (up to 10° lattice misorientation)

It is worth noting that whilst quartz-feldspar-sericite is not distinctive in itself, the quartz fracture patterns appear to be something of an oddity. No person to whom I have shown these grains (volcanologists and structural geologists alike) has observed anything similar to it.

The origin of these grains is still unclear, although several conclusions may be made:

i) "subgrains[†]" are truncated by resorption embayments, indicating that fracturing probably occurred in the magma chamber, or very early in the eruptive history. Resorption is a feature related to emplacement at high crustal levels and associated decompression and increase in the effect of water.

ii) the crystallographic continuity of the quartz across the fractures indicates that fracturing occurred under isotropic stress conditions, rather than due to the effect of a deviatoric stress (G.S. Lister, M.W. Jessell, S. Cox, *pers. comm.*). The small degree of undulose extinction observed in some grains is probably due to later regional deformation.

iii) the presence of abundant two phase fluid inclusions on the fracture surfaces suggests that they are not the result of thin sectioning, and also possibly that the fractures were resealed before eruption.

Interpretation

That the fractures formed under isotropic stress indicates two possible modes of formation, namely due to an isotropic pressure change, or due to a sudden temperature change (favoured by the Monash structural mafia).

A chilling effect upon eruption would seem to be ruled out as the fractures formed before resorption (i.e. most likely subsurface). A pressure drop on eruption also seems unlikely, simply because one would expect this texture to be quite common (in other rocks) if that were the case.

My favoured interpretation (accompanied by much theatrical arm-waving) is that these quartz grains represent xenocrysts somehow incorporated into the host magma, where the sudden rise/fall in temperature caused the fracturing. The problem with this argument is that it requires a very large volume of monocrystalline volcanic quartz to be available for incorporation. Perhaps this may be achieved by the subsurface interaction of two large volume magma chambers, with significantly different temperatures and compositions (arm waving reaches fever pitch!). I hope to test at least the feasibility of this theory with the assistance of Simon Cox (a brittle fracture specialist), by calculating the expansion of quartz upon significant temperature change, using published expansion coefficients for quartz, and various temperature gradients. However, it remains to be seen if this is a feasible mechanism for formation.

Composition and Character - Facies Characteristics.

The subfacies included within this this facies group may be further subdivided:

Coherent Facies

In drillhole BRD04, this unit is present as several bodies of coherent lava/shallow intrusive (thin section from BRD04). The margins of the lava may display peperitic mixing with the bounding black shales. Emplacement occurred as very high level sills or as lava flows that ploughed into the substrate. Jocelyn McPhee report coherent textures as ~370m in HL469 and HL469a. I will re-examine this hole when I return to Hellyer. Other occurrences of this facies may also be present, but the original texture may have been masked by subsequent strong alteration that is common in this facies. At present, I believe that coherent lavas constitute a relatively minor proportion of this facies.

[†] This is not used in the strict microtextural sense, but loosely to define the small fracture bound quartz grainlets.

Clastic Facies

By far the dominant facies type are the clastic facies. These include units with very little volcanic material, up to thick mass flow units composed of almost 100% volcanoclastic debris (slide #7). Good examples of the complete spectrum of clastic types may be observed from 87m in HL541. Here, depositional units range from scattered crystal set in a mudstone matrix, to 3m thick turbidites composed of 100% quartz-feldspar-sericite clasts. This interval is probably equivalent to the Lower Tuff Unit described by Corbett and Komysan (op. cit.).

A feature of these clastic facies is the large variation in alteration that may be displayed. In core, gradual transitions from obvious clastic material to units that have a "pseudo granitic texture" may be observed. This texture is also very common in HP2 (slide#9). Any small amount of strain also seems to quickly modify or destroy original depositional textures through mobilisation of the sericite in particular. Common alteration appears to be silica and carbonate, with the pink "granitic" zones perhaps representing K-feldspar alteration. A detailed study of these alteration types is probably warranted.

Corbett and Komysan (op. cit.) report that the sericite material represents original pumice. Very little evidence for this is seen, although small alteration domains nominally along original tube pumice vesicles may be seen in HL541, although these may represent original flow banding of dense lava clasts.

"Porphyry Facies"

I believe that many of the so called "porphyry" units reported for the Upper Rhyolitic Sequence are actually thick units of volcanoclastic that display graded bedding over a scale of 10's of metres. Examples of these are found from 206m to 158m in HL78, and in the equivalent position in MAC19. In outcrop, alteration would rapidly mask the subtle grain size variations used to define flow units, making it very easy to mistake them for coherent bodies. Also, the apparent erosional bases of many of the units may give them the appearance of sills that are sub parallel to bedding. Having said that, some porphyries probably do exist. In the Cradle Mountain Link Road, a quartz feldspar porphyry may be seen to be intruding the Animal Creek Greywacke. Interestingly, the intrusion causes significant soft sediment deformation, indicating that the sediment were not lithified at the time. Further, cross cutting bodies of this lithology may be seen intruding pumiceous units of the upper Southwell further west on the Cradle Mountain Link Road. At this time, it is still unclear exactly where the Link Road section sits in relation to the Hellyer sequence, and requires further work (see part two).

Eruption and Deposition

Given the presence of potential feeder dykes intruding the Animal Creek Greywacke, it seems that the likely source for most of the clastic facies at least, is the eruption and immediate degradation of lava domes and flows representing the extrusive equivalents of these intrusives. Mechanisms such as lava dome collapse may be envisaged, especially for the flows with a high volcanoclastic content. The facies which show intimate mixing of volcanic clasts with the basinal shales may represent slower periodic degradation of existing constructional volcanic mounds.

The eruptive activity was probably continuous throughout the early and middle stages of Upper Rhyolitic Sequence deposition, which explains the presence of dikes of the material intruding the clastic facies of the same composition, such as on the Cradle Mountain Link Road.

Important Features for Correlation

Whilst this is a highly diverse facies package, it is distinctive in its depositional textures, and in its internal mineralogical texture. The use of fractured quartz grains as regional markers may at first seem tenuous, but the empirical observation that these quartz grains are unique suggests their value as regional markers. Further work on the formation of these quartz textures is required to determine just how useful they may be as regional markers.

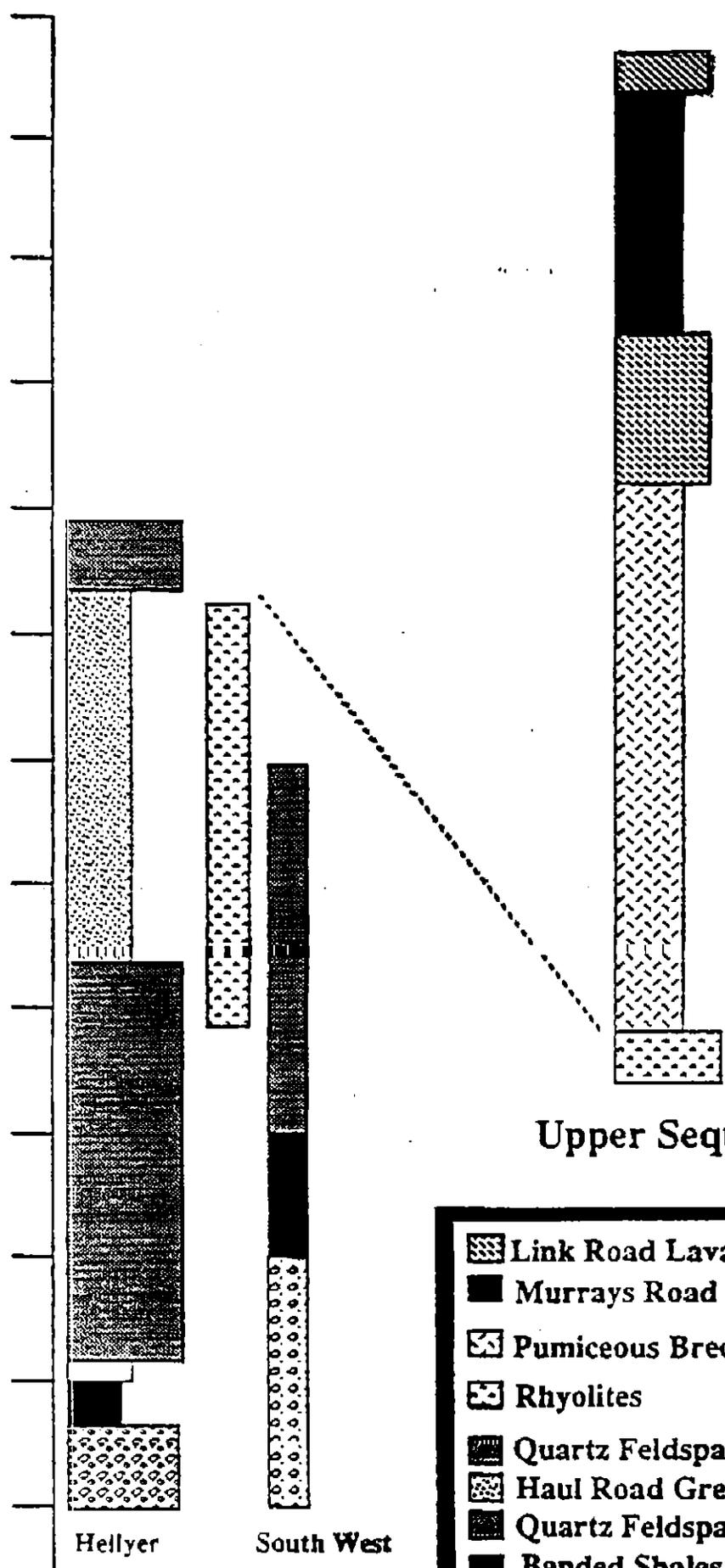
The presence of thick mass flow units rich in quartz feldspar clasts may also be used as an indicator of this unit.

The presence of intimately associated black shales also seems to be consistent across all occurrences of these facies. The matrix to the volcanic material is invariably massive to banded black shale that is very similar in appearance to the Que River Shale.

Geochemical signatures of these shales may prove useful for correlation across the Mount Read Volcanics. Many advances have been made recently in the field of shale and clay mineralogy, and I direct your attention to Weaver (1989) as a guide.

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600
550
500
450
400
350
300
250
200
150
100
50
0



Hellyer
South West
Lower Sequence

Upper Sequence

- Link Road Lava breccias
- Murrays Road Greywackes
- Pumiceous Breccias
- Rhyolites
- Quartz Feldspar Volcaniclastics
- Haul Road Greywackes
- Quartz Feldspar Volcaniclastics
- Banded Shales
- Volcaniclastic Megaturbidite

CORRELATIVE
SEQUENCE

085

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APPENDIX III

ABERFOYLE RESOURCES

Exploration Division

MACKINTOSH EL 106/87

INTERPRETATION REPORT

Downhole EM Surveys

MAC 28

Distribution

Hawthorn (1)
Burnie (1)

Prepared By:

J SILIC

Issued By:

Jan Silic

J SILIC
Chief Geophysicist

August 1991

001

List of Contents

Summary

Introduction

Survey Specifications

Discussion of Results

Conclusions and Recommendations

References

List of Figures

- Figure 1: DHEM Loops.
Figure 2-2b: Loop 3 DHEM Profiles.
Figure 3: Expected Downhole Power Line Effect Profile.
Figure 4-4c: Loop 1 DHEM Profiles.
Figure 5-5b: Loop 2 DHEM Profiles.
Figure 6-6b: Loop 4 DHEM Profiles.
Figure 7: Primary Field Directions Across a Vertically Dipping Conductor.
Figure 8: Primary Field Directions Across a Flat Lying Conductor.
Figure 9: Modelled Response from a conductor to the west of 4900E.
Figure 10: Modelled Response from a conductor to the east of 4950E.
Figure 11: Additive (non interacting) response from a conductor to the west of 4950E and its downfaulted more conductive part to the east of 4950E.
Figure 12: The complete interactive response of the two conductors.
Figure 13: DHEM expected profile from the two conductors, with the eastern downfaulted section carrying four times as much current.
Figure 14: Interpretive cross section on 6000N.

Summary

A complex off-hole EM response has been observed in the MAC 28 four loop DHEM data set.

Although the response from one of the loops could be largely explained by the nearby powerline effect the majority of the data set does not support this.

Instead it is interpreted that the off-hole response is due to relatively flat lying conductors above MAC 28, and most likely extending to the east of the drillhole with the conductivities increasing to the east.

The depth top to this conductor is about 400 metres and as such has most likely made this conductor undetectable by previous UTEM surveys.

It is recommended that the drillhole attempts to intersect the interpreted conductor at 4900E at approximately RL300, as testing of the postulated eastern section would at this stage be risky as no data has been collected over it as MAC 28 does not extend beyond 4950E.

Introduction

Electromagnetic techniques have played an important role in the discoveries of Que River and Hellyer deposits (Webster and Skey, 1979; Silic et al, 1985). Since the Hellyer discovery downhole EM techniques (DHEM, Silic and Eadie 1989) have been an important part of the exploration strategy in the volcanic sequence hosting the above deposits because of the failure of blanket EM surveys to locate targets worthy of follow-up and because no other method can accurately target drillholes at depths beyond the surface EM detection limits.

The purpose of this report is to discuss and present the results from DHEM surveys in DDH MAC 28 on the Mackintosh EL 2/70.

Survey Specifications

The loops were designed so that their magnetic field would couple with both the horizontal and vertically dipping targets at the specified target horizons. Possible variations in the dips of the targets from the predicted dips (based on geological knowledge) was also taken into account as was the detection limitations of the DHEM surveys, the parameters of which are known from in-house research studies. (Silic, 1989).

A four loop programme was completed, with the Zonge GDP-16 unit operating at 32 Hz and considerable care was exercised in collecting the data because of the presence of interfering electromagnetic noise generated by the nearby powerline (Figure 1).

The latter considerably slowed down the data collection, one day being required to collect one loop of data.

Discussion of Results

A clear off-hole response is evident in the MAC 28 DHEM data set, and is recognisable as a set of "early" time peaks or "late" time broad cross-overs at about 600-700 metres down the hole and the loop 3 data (Figure 2 -2b) can be used to summarise these observations.

To understand the nature of the causative source, five things need to be explained.

- (1) The asymmetric peaking of the "early" time magnetic field at about 700 metres down the hole (Figure 2).
- (2) This early time peak changes to a broad flattish negative at "late" time (Figures 2 - 2b).
- (3) Superimposed on this transition is the shifting of the "steepest" part of the profile from between 500 - 700 metres at medium times (eg time windows 9-14), to between 600-700 metres at later times (eg time windows 14-17) (Figure 2b).

-3-

- (4) The "late" time negative trough is "flat", although its nature is not accurately defined at "late" times (eg time windows 19-22) due to the noisy nature of the data at these times (Figure 2b).
- (5) The sign (ie negative trough) of the response is the same for all loops.

Before attempting to explain these observations, however, the effect of the nearby powerline (ie powerline acting as a conductor which is energised by the magnetic field from the loops) has to be considered.

From Figure 3 the plot of the expected profile due to a powerline effect (only the shape of the profile is important, not the absolute values on the plot), we can conclude that the powerline conductor effect increases monotonically towards the top of the hole, although a "flat" negative is also expected at the bottom of the hole, this negative trough being 1/30th of the signal strength at the top of the drillhole.

It may be tempting to reconcile the observed response (particularly point 4) with the powerline effects, however, only loop 1 data (Figures 4 - 4c) has some of the expected powerline profile characteristics, in particular

-4-

the monotonic increase in the signal strength towards the top of the drillhole, the other data sets being characterised by "relatively" flat profiles near the top. (Figures 5 - 6), apart from some obvious powerline effects at "early" times in the Loop 2 data set. (Figure 5).

That loop 1 data set does have some of the powerline effect characteristics is not surprising, as it is closest to the powerline (in fact one of the loop edges is on the powerline) and is expected to energise the powerline most efficiently, and this is also clearly evident in the absolute values in the loop 1 data being the greatest (eg compare plots for loop 1 and loop 3 data sets).

It was therefore concluded that the four loop data set does not support the proposition that the observed effects are entirely due to the powerline effect, however loop 1 data set which is very obviously polluted and dominated by the powerline effect should not be used for interpretation purposes.

Following this conclusion, an attempt was made to guess the "shape" or the orientation of the off-hole conductive source.

The very obvious clue to this problem is in the fact that the sign of the response does not change for the four loops (ie the overall "late" time response is characterised by a downhole negative trough). This indicates the existence of a "deep" relatively flat lying target.

To understand why this is so, Figures 7 and 8, illustrating the direction of the loop's magnetic field across vertical and horizontal targets are used.

For example in the case of a vertical target for both the "shallow" and "deep" conductor cases, the sign of the response will change as the loop is moved with respect to the conductor from positions A and B to C and D. This is because the magnetic field cuts the targets from left to right at locations A and B, and from right to left at locations C and D, and therefore there will be a reversal in the direction of the current induced in the target which manifests itself as a reversal in the sign of the response as the loop is moved across the target.

Using the same logic, we can conclude that in the case of "deep" flat targets ("deep" means depth approximately equal to or greater than the diameter of the loop) no such reversals will occur, as the magnetic field will always cut the target in the same direction. (Figure 8).

This of course is not so for a "shallower" flat target. (Figure 8).

Once this was understood responses over a number of flat targets (dips from 35 to 0) located at approximately 4800-4900E at RL 300 were calculated. It was then recognised that no single simple target could explain the observed data, in particular the "flattish" nature of the negative trough.

Figures 9 and 10 are used to illustrate this problem.

For example, Figure 9, the plot of the expected response from a 150 metre wide target to the west of 4900E, shows that although the asymmetry of the peak in the response at about 700 metres down the drillhole is similar to the "early" time data from loop 3 (Figure 2), as is the fall off in the response - between 500-700 metres down the hole, the "late" time profiles however have similar shapes and are unlike the observed "late" time results.

A conductor to the east of 4950E, essentially a downfaulted version of the previous conductor, however (Figure 10) is expected to produce a profoundly different profile, with no peak evident in the profile, although a persistent negative trough will be evident.

It was then recognised that by adding these two responses (which essentially represents the effect of the two conductors minus their mutual interaction) that the "late" time flat negative, as well as the early time peak may be obtained.

From Figure 11, the plot of this non-interacting response, it is evident that indeed the early time asymmetrical peak is reproduced, as is the flattish negative at "medium" times (eg time windows 13 to 16), however the "late" time response resembles the expected response of the eastern conductor which is not as flat as the observed "late" time data.

The latter results from the necessity that in order to produce these "early" to "medium" time results the eastern body must be characterised by a higher conductivity-thickness product, which results in signal from the eastern body decaying at a slower rate and as such at "late" times the data is only being effected by the currents within the eastern conductor.

However, it was recognised that this model did not take into account the interaction between the two conductors, as it is expected that the energising of the poorer

conductor by the magnetic field from the better one will only enhance their interference, the response from the poorer conductor will last longer in time which is expected to result in a more persistent flatter negative profile.

This effect was modelled, through a facility provided by Lamontagne Geophysics in Sydney.

From Figure 12, the plot of these results, we can conclude that the interaction between these two conductors does not significantly change the overall shape of the profiles (Figure 11) and will not explain the flattish nature of the "late" time negative in the observed data.

Nevertheless, on the modelled data (not presented in this report), it was discovered that the interaction between the two conductors modifies the simple additive response (Figure 11) by about ten percent, however, this is not enough to account for the flat negative.

Using an Aberfoyle modelling facility, however, the overall shape of the "late" time profile was produced by postulating that the eastern downfaulted conductor is carrying 4 times as much current as the poorer western one (Figure 13).

This sort of modelling leads to the conclusion, that the flattish negative trough can be produced through varying combinations of relative current densities within the conductors.

The mathematical modelling however, which calculates the exact amount of current flowing within the conductors has shown that the scenario where eastern conductor is carrying 4 times as much current at "late" times, through the mutual interaction, is not plausible.

However, it must be understood, that this mathematical modelling, is restricted to conductors with uniform conductivity (ie the conductivity does not vary across the conductor) therefore the effect of any systematic variation in the conductivity across the conductor cannot as yet be accounted for, but nevertheless in a qualitative sense it is understood that the existence of current to the east of the drillhole could account for the flattish negative trough, as long as the conductivity and hence the current density increases from west to east. This however, we are incapable of quantifying.

Therefore the "best guess" model for the conductive source is that a flattish dipping conductor exists above the drillhole at about RL300, it's conductivity is increasing

towards the east, and there may be a downfaulted section of it beyond the end of the drillhole at 4950E, as illustrated in Figure 14.

Conclusions and Recommendations

A complex off-hole EM response has been observed in the MAC 28 four loop DHEM data set.

Although the response from one of the loops could be largely explained by the nearby powerline effect the majority of the data set does not support this.

Instead it is interpreted that the off-hole response is due to relatively flat lying conductors above MAC 28, and most likely extending to the east of the drillhole with the conductivities increasing to the east.

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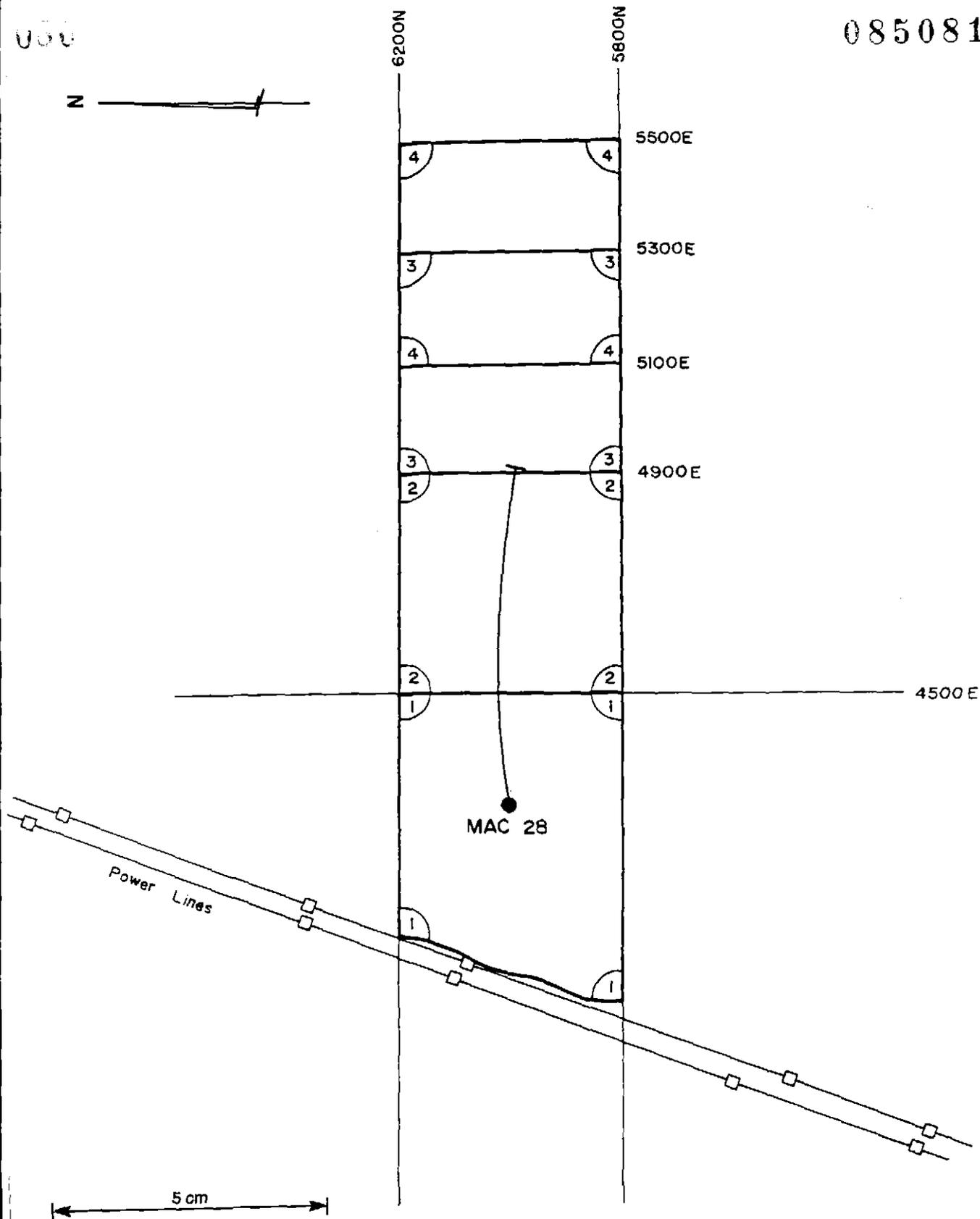


Figure 1

Aberfoyle Resources Limited
EXPLORATION DIVISION

| REVISIONS | | | |
|-----------|------|-------|------|
| Init. | Date | Init. | Date |
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NORTH WEST TASMANIA

MACKINTOSH EL 106/87

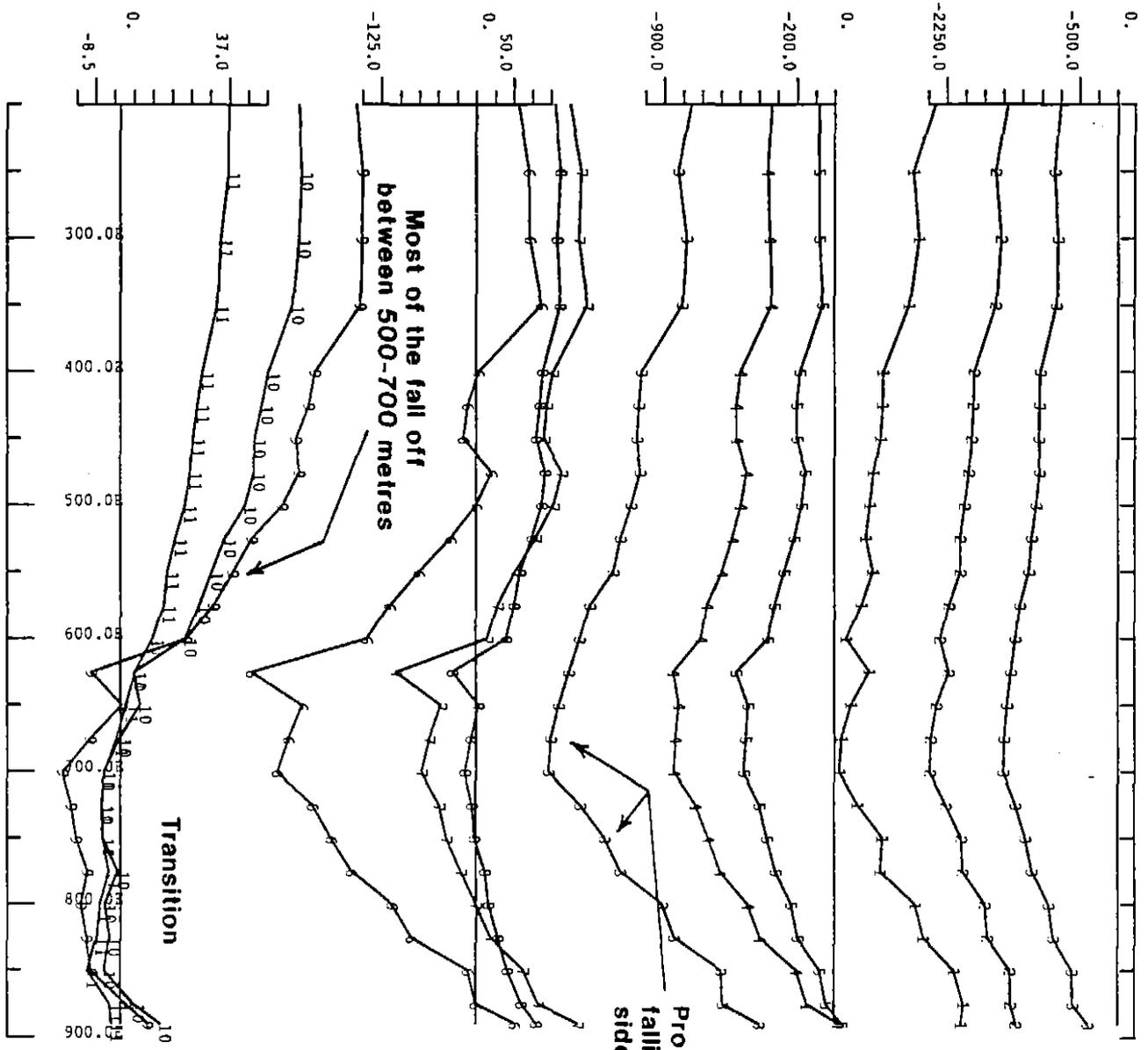
DDH MAC 28 - DHEM LOOPS

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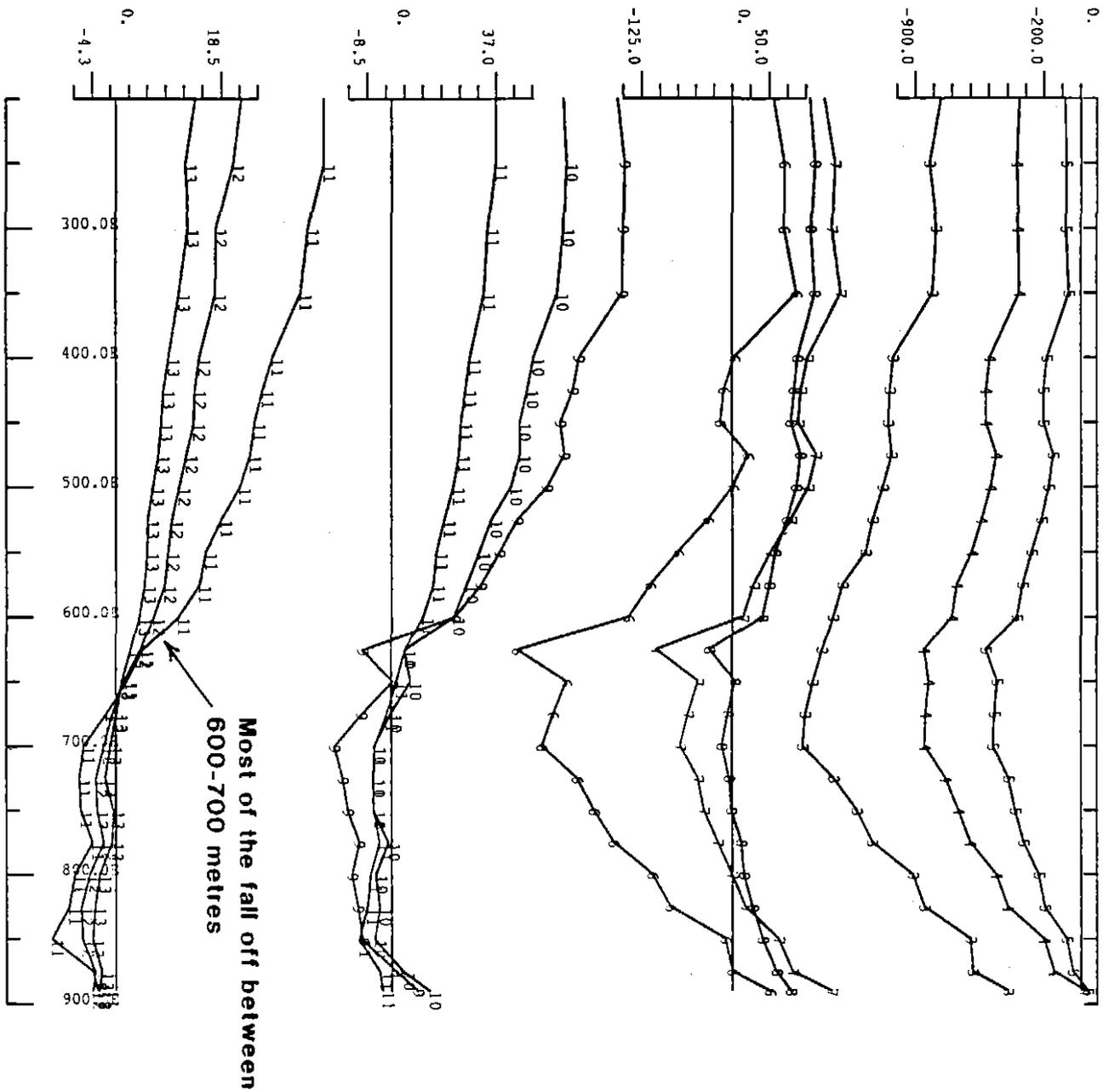
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Date : August 1991



MACKINTOSH EL
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 MAC28
 LOOP 3
 Aberfoyle Resources Limited
 Horiz scale 1: 5000.0 Plot number : 8

Figure 2

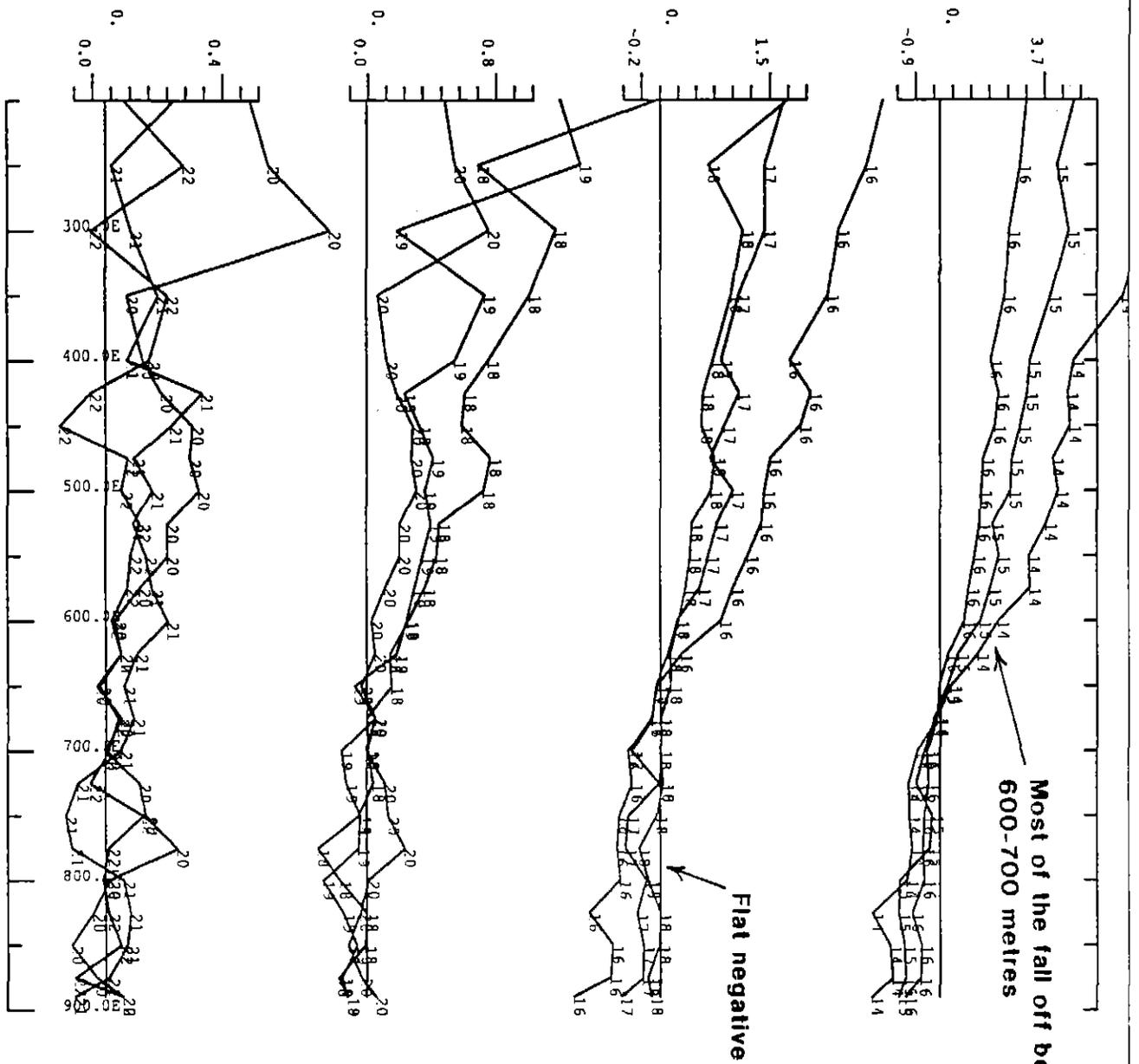


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 LOOP 3
 Aberfoyle Resources Limited
 Horiz scale 1: 5000.0 Plot number : 6

5 cm

Figure 2A

085



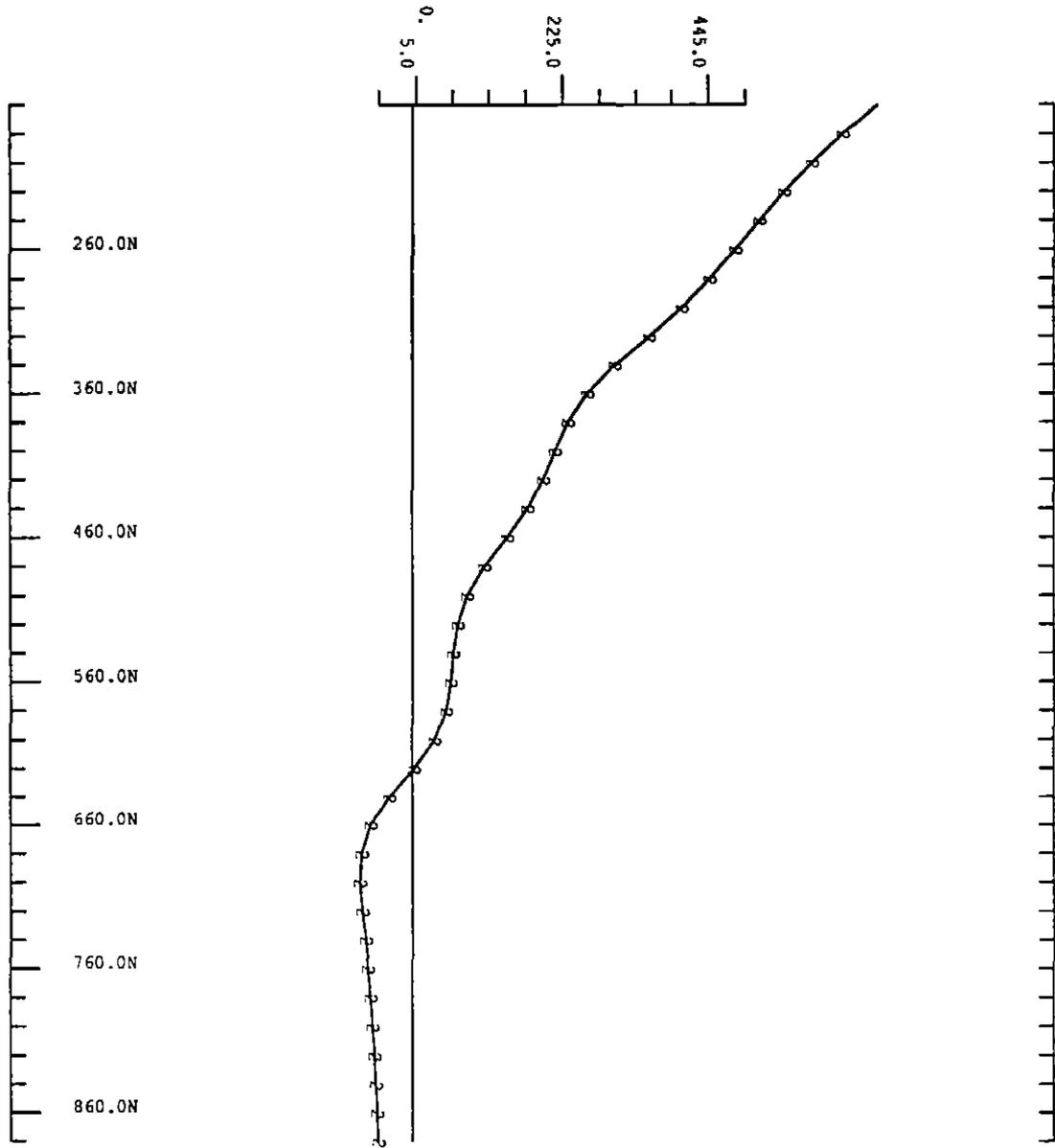
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 MAC28
 LOOP 3

Aberfoyle Resources Limited
 Horiz scale 1: 5000.0 Plot number : 7

5 cm

Figure 2B

U04



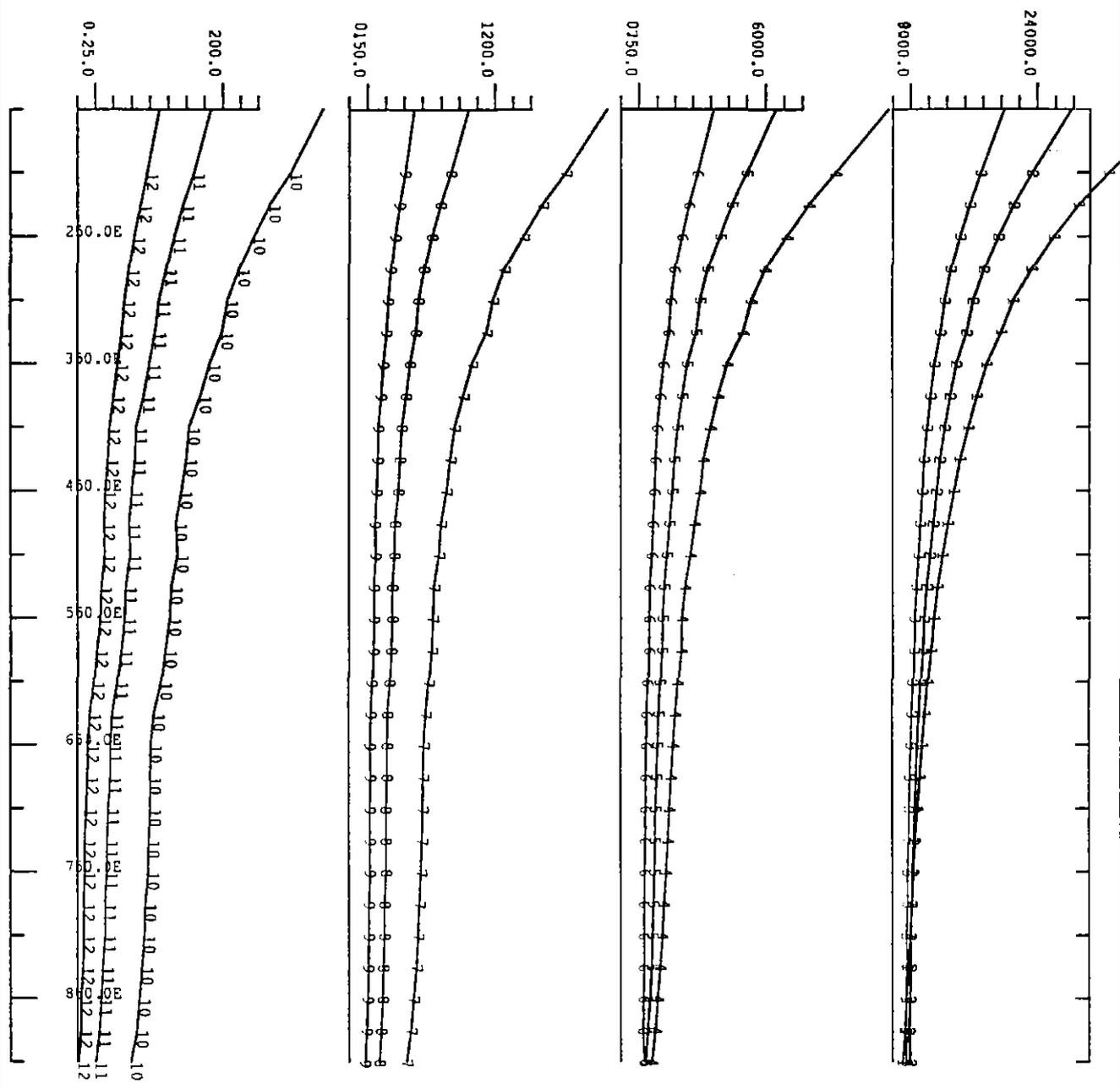
MAC 28
EXPECTED DOWNHOLE POWER LINE PROFILE
Aberfoyle Resources
Horiz scale 1: 5000.0 Plot number : 17

5 cm

Figure 3

002

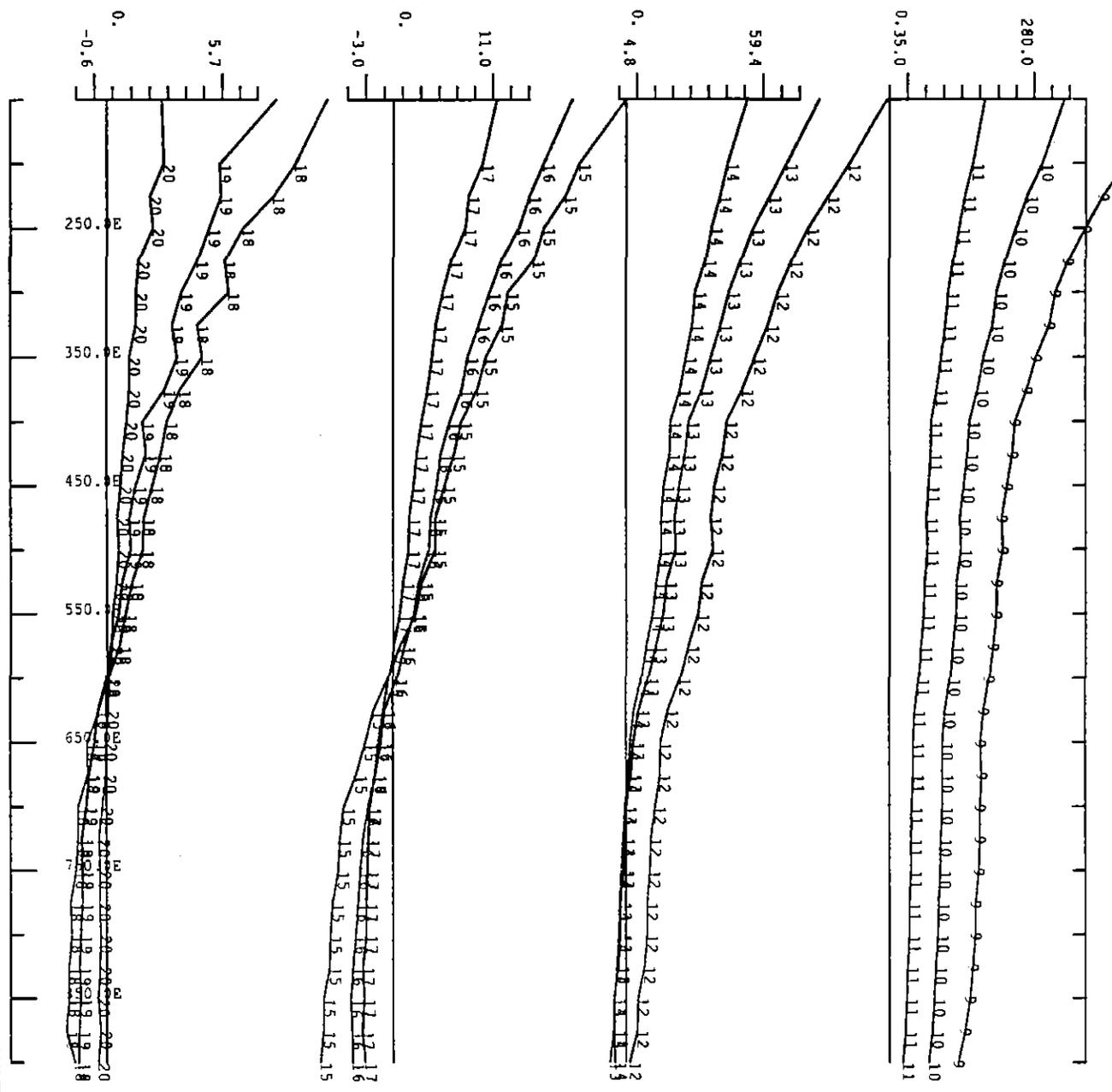
085086



MACKINTOSH EL
 DOWN HOLE EM
 ZONGE GDP 16 32Hz
 MAC28
 LOOP 1
 Aberfoyle Resources Limited
 Horiz scale 1: 5000.0 Plot number : 12

5 cm

Figure 4



MACKINTOSH EL
 DOWN HOLE EM
 ZONGE GDP 16 32Hz
 MAC28
 LOOP 1
 Aberfoyle Resources Limited
 Horiz scale 1: 5000.0 Plot number : 13

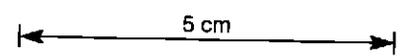
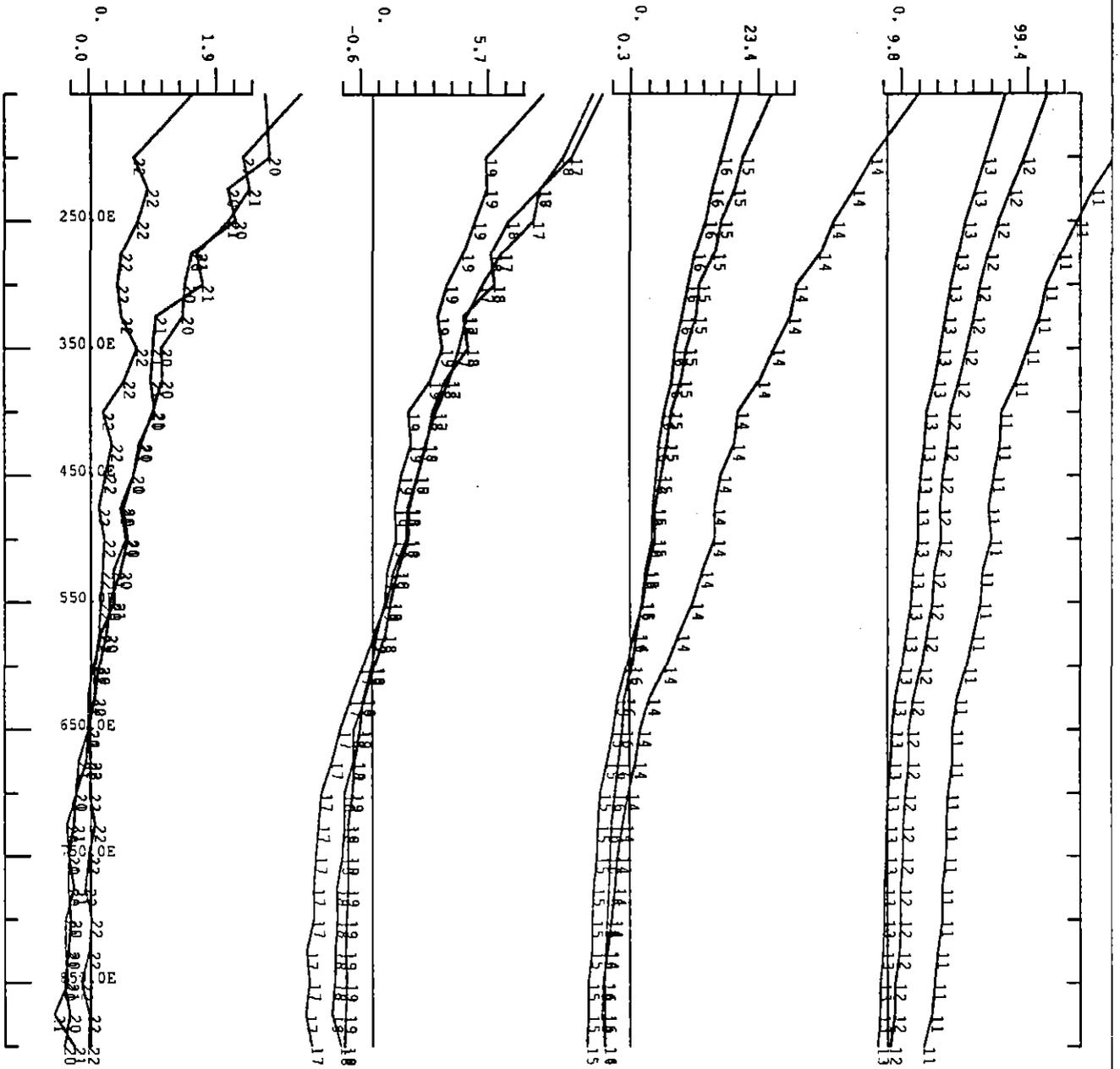


Figure 4A

085

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 MAC28
 LOOP 1
 Aberfoyle Resources Limited
 Horiz scale 1: 5000.0 Plot number : 14

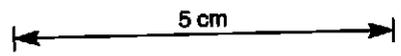
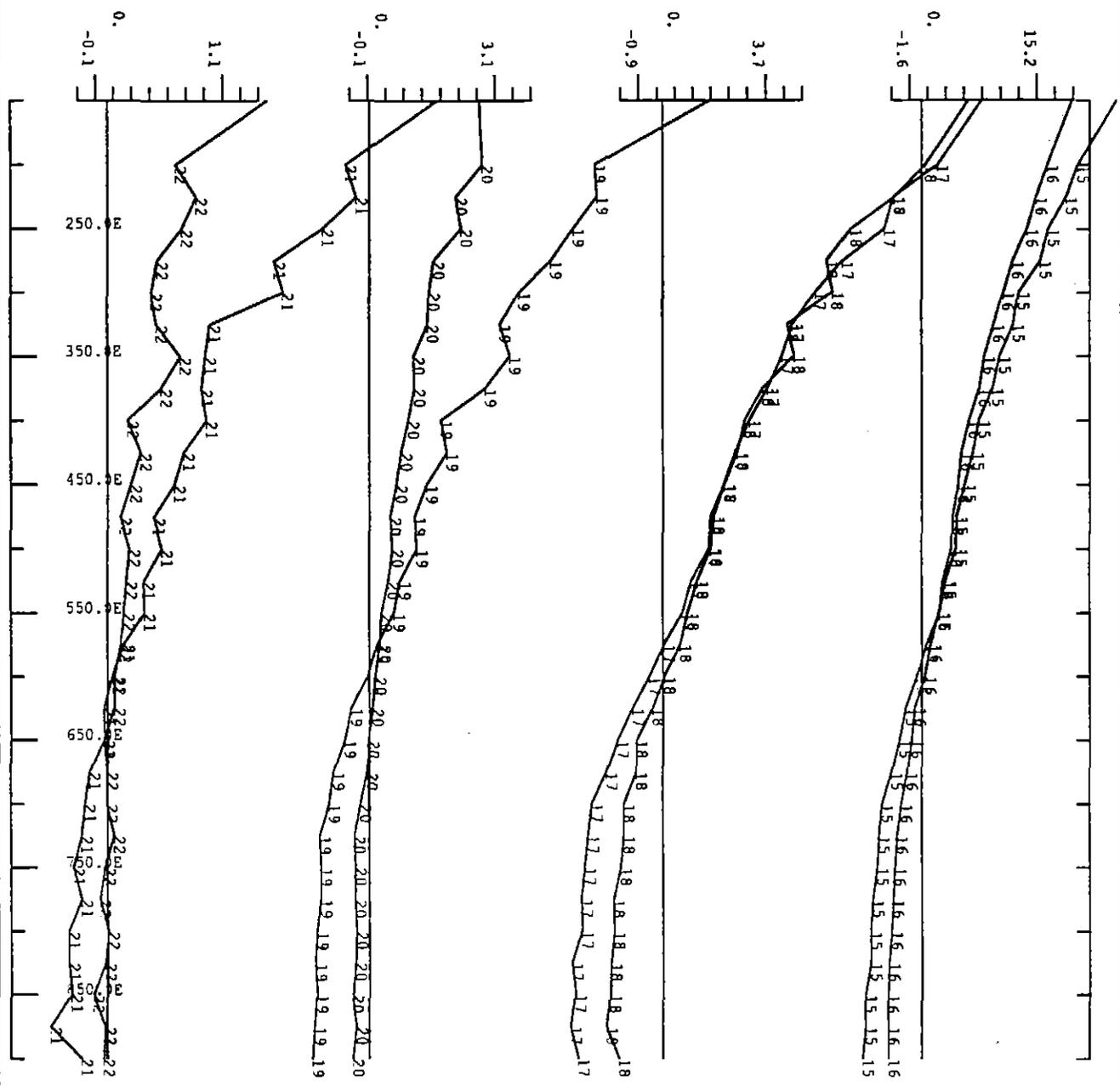


Figure 4B

080



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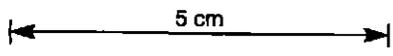
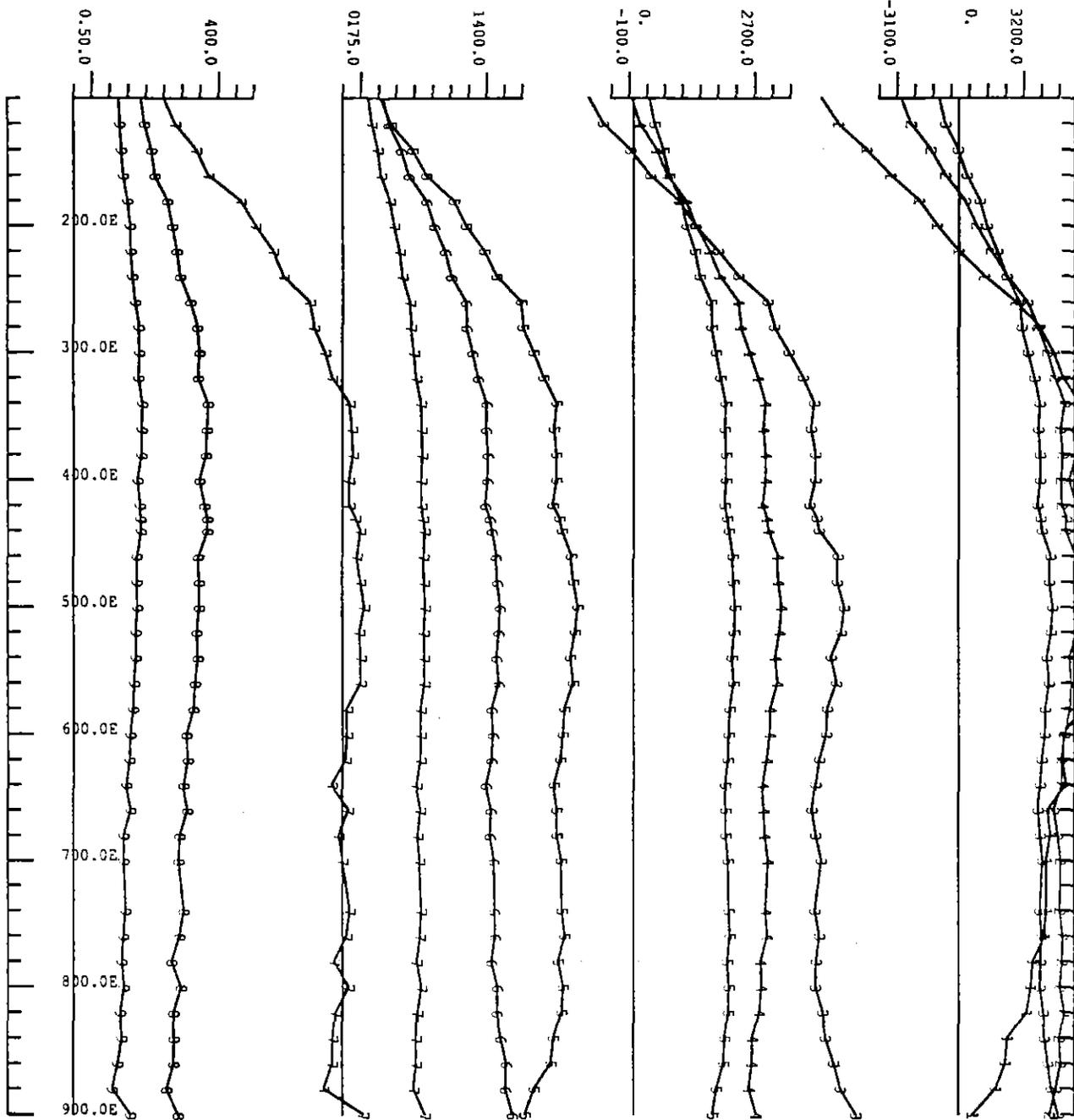


Figure 4C

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085



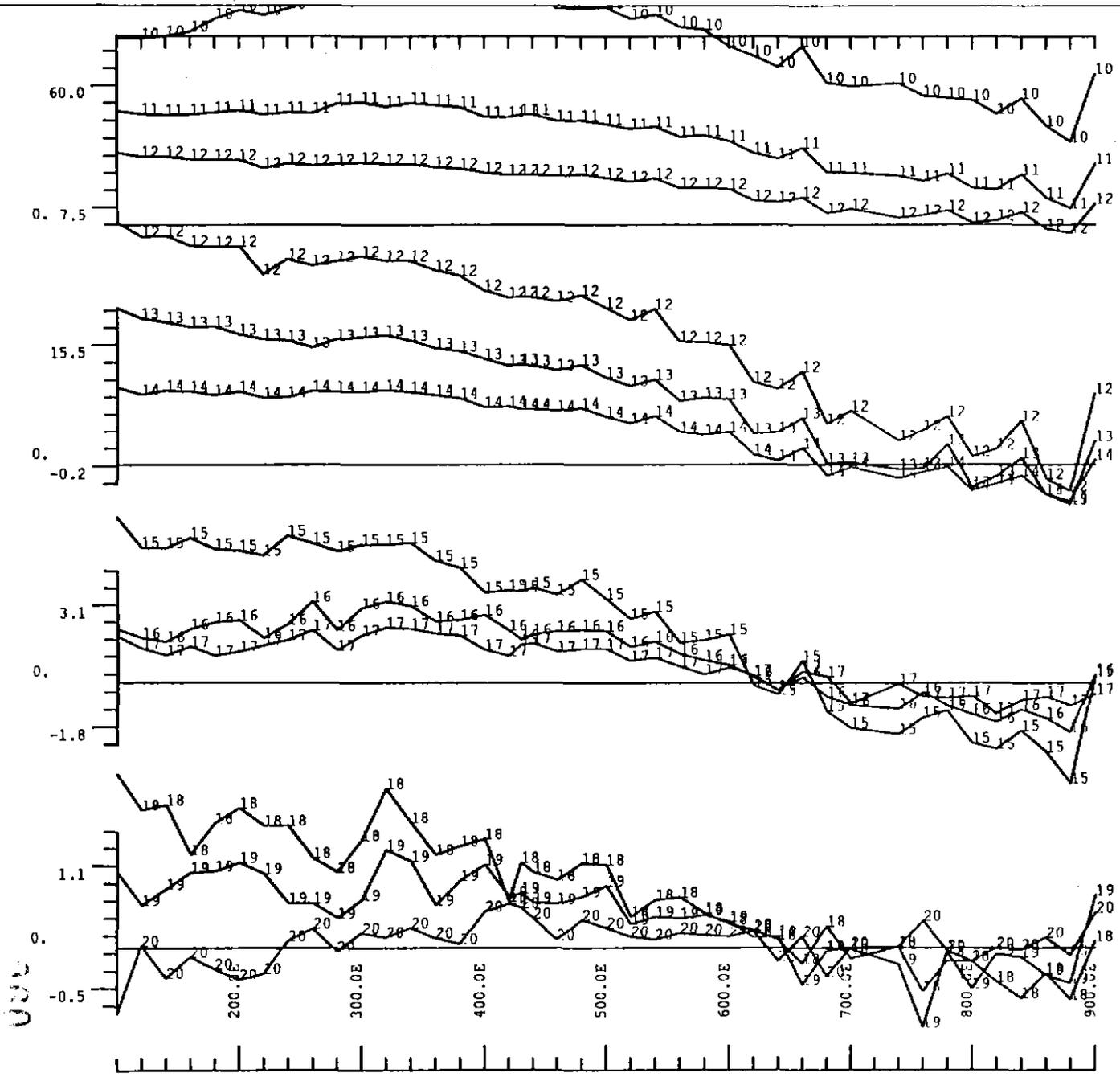
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DOWNEHOLE EM
ZONGE GDP-16 32 Hz
MAC28
LOOP2

Aberfoyle Resources Limited
Horiz scale 1: 5000.0 Plot number : 16

5 cm

Figure 5

085091



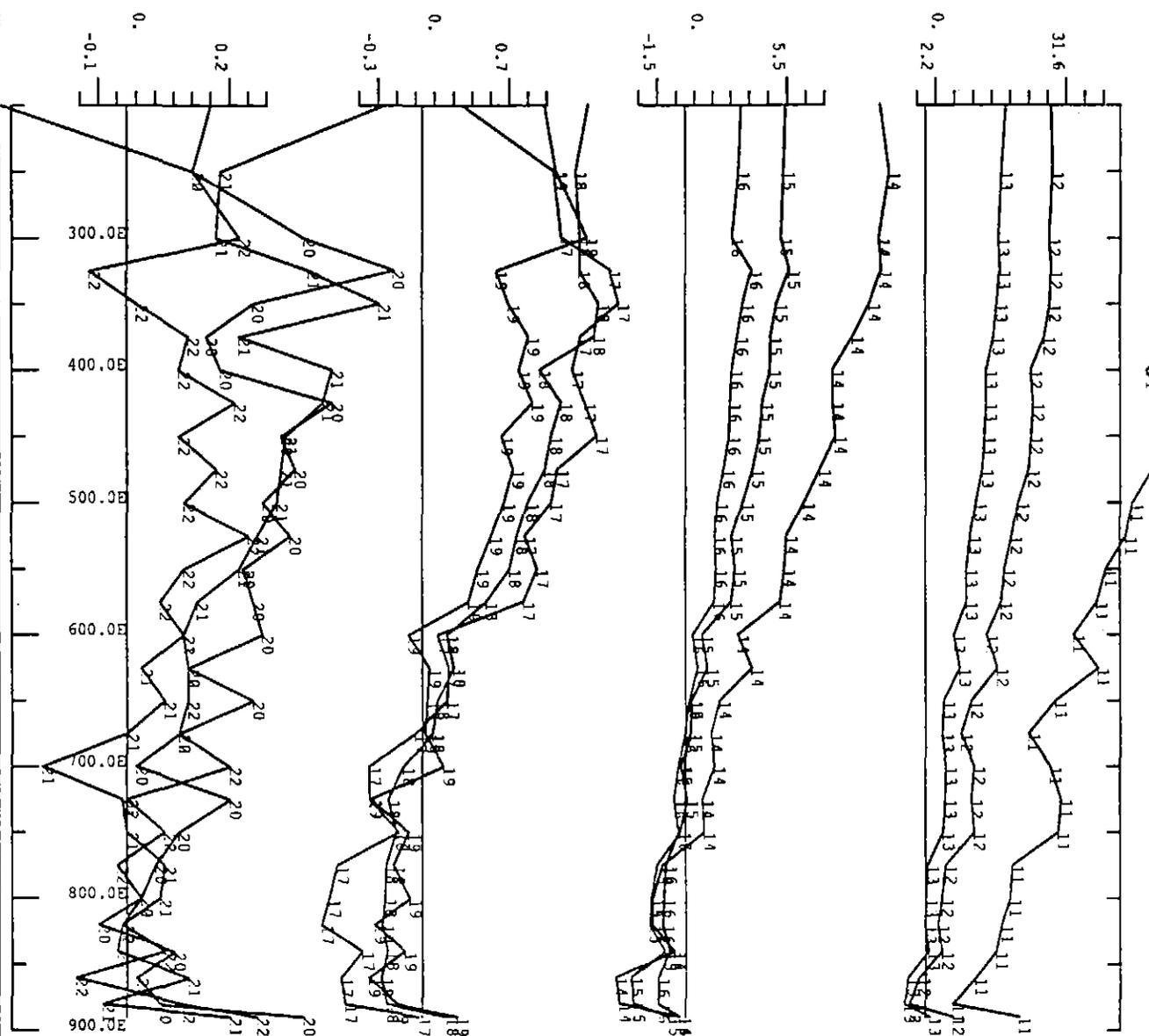
5 cm

MACKINTOSH E/L
 DOWNEHOLE EM
 ZONGE GDP-16 32 Hz
 MAC28
 LOOPZ
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Figure 5A

081

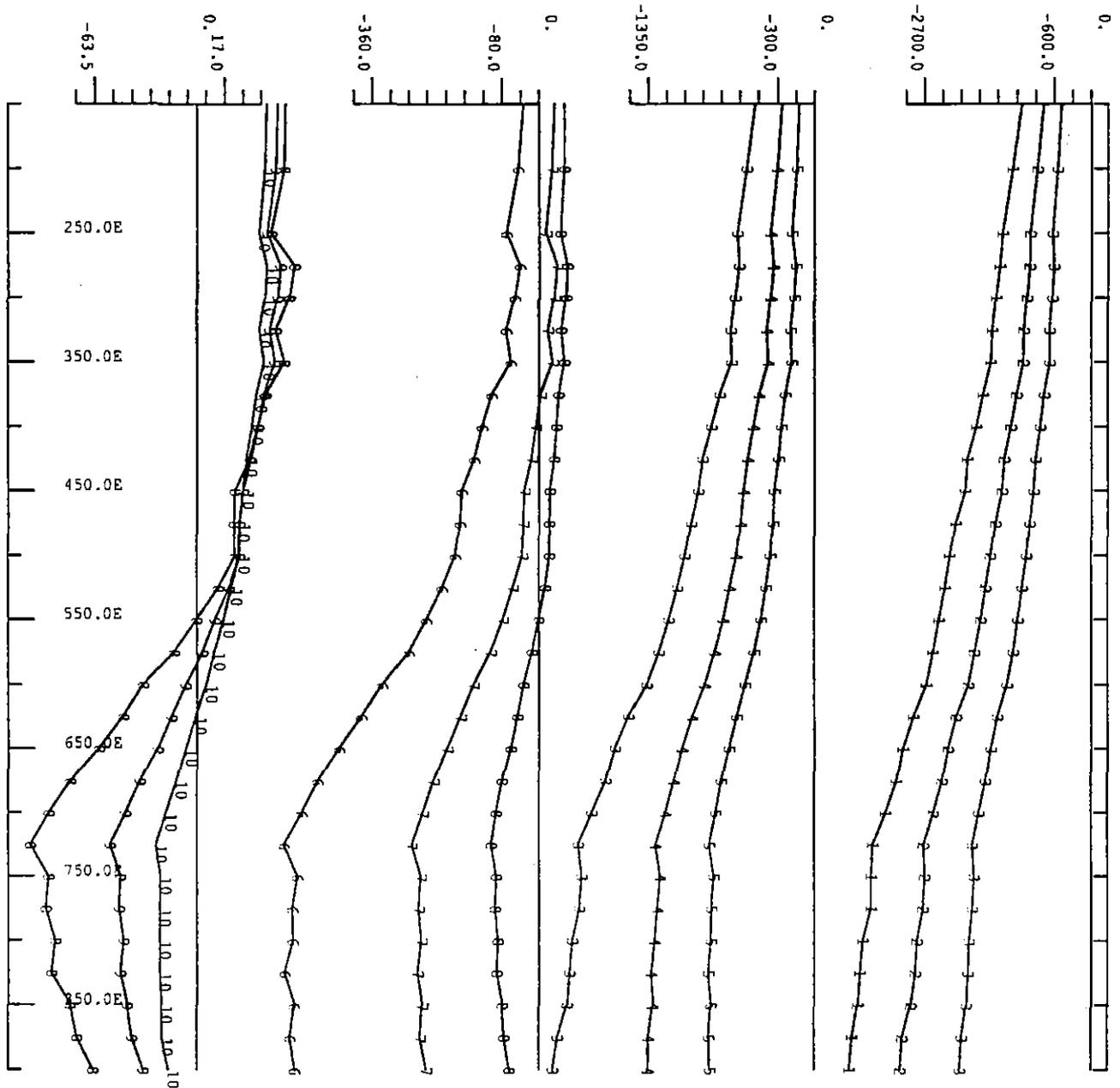
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MACKINTOSH EL
 DOWN HOLE EM
 ZONGE_GDP 16 32Hz
 MAC28
 LOOP 2
 Aberfoyle Resources Limited
 Horiz scale 1: 5000.0 Plot number : 11

5 cm

Figure 5B

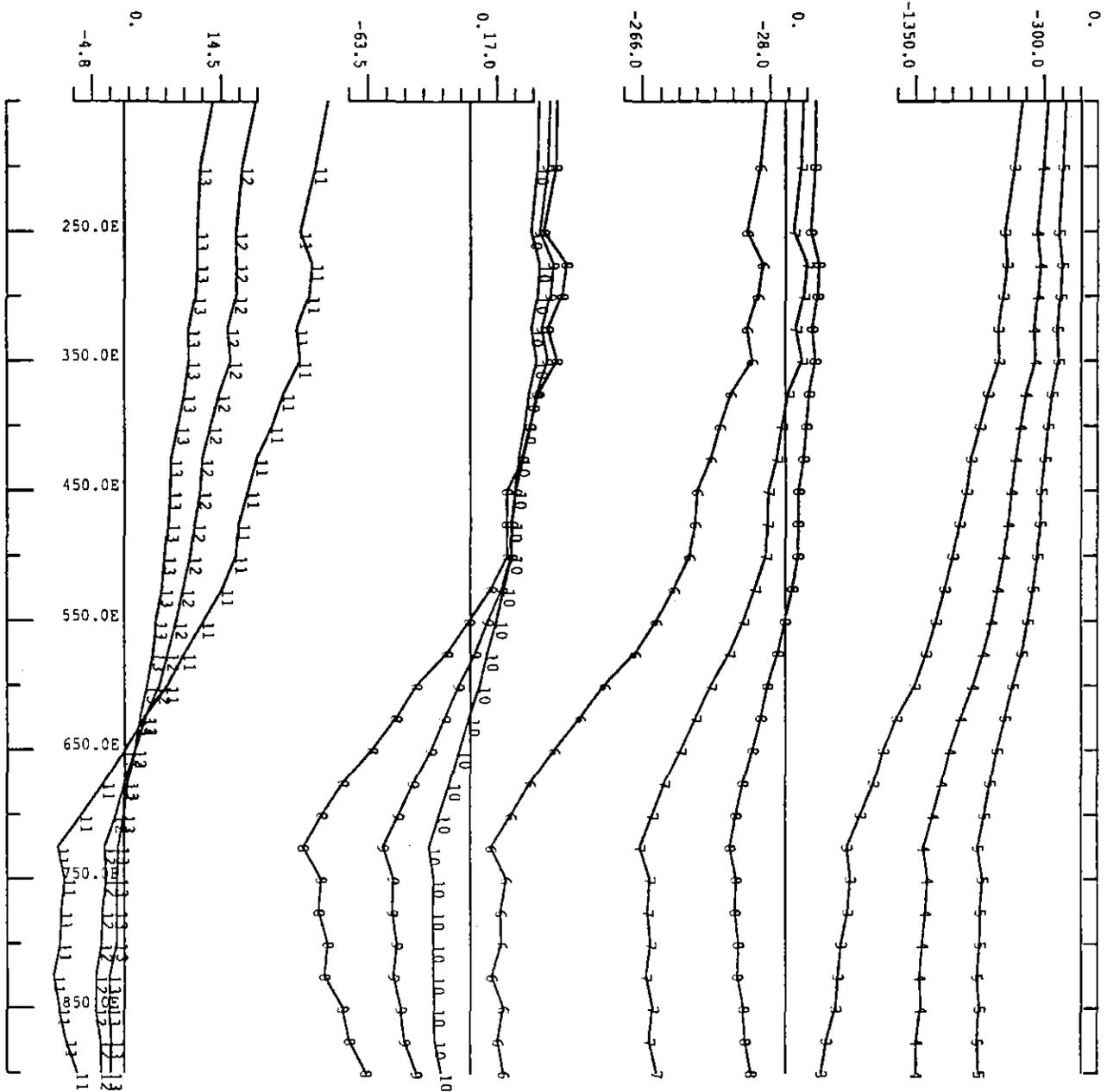


MACKINTOSH EL
 DOWN HOLE EM
 ZONGE GDP 16 32Hz
 MAC28
 LOOP 4
 Aberfoyle Resources Limited
 Horiz scale 1: 5000.0 Plot number : 5

5 cm

Figure 6

085094



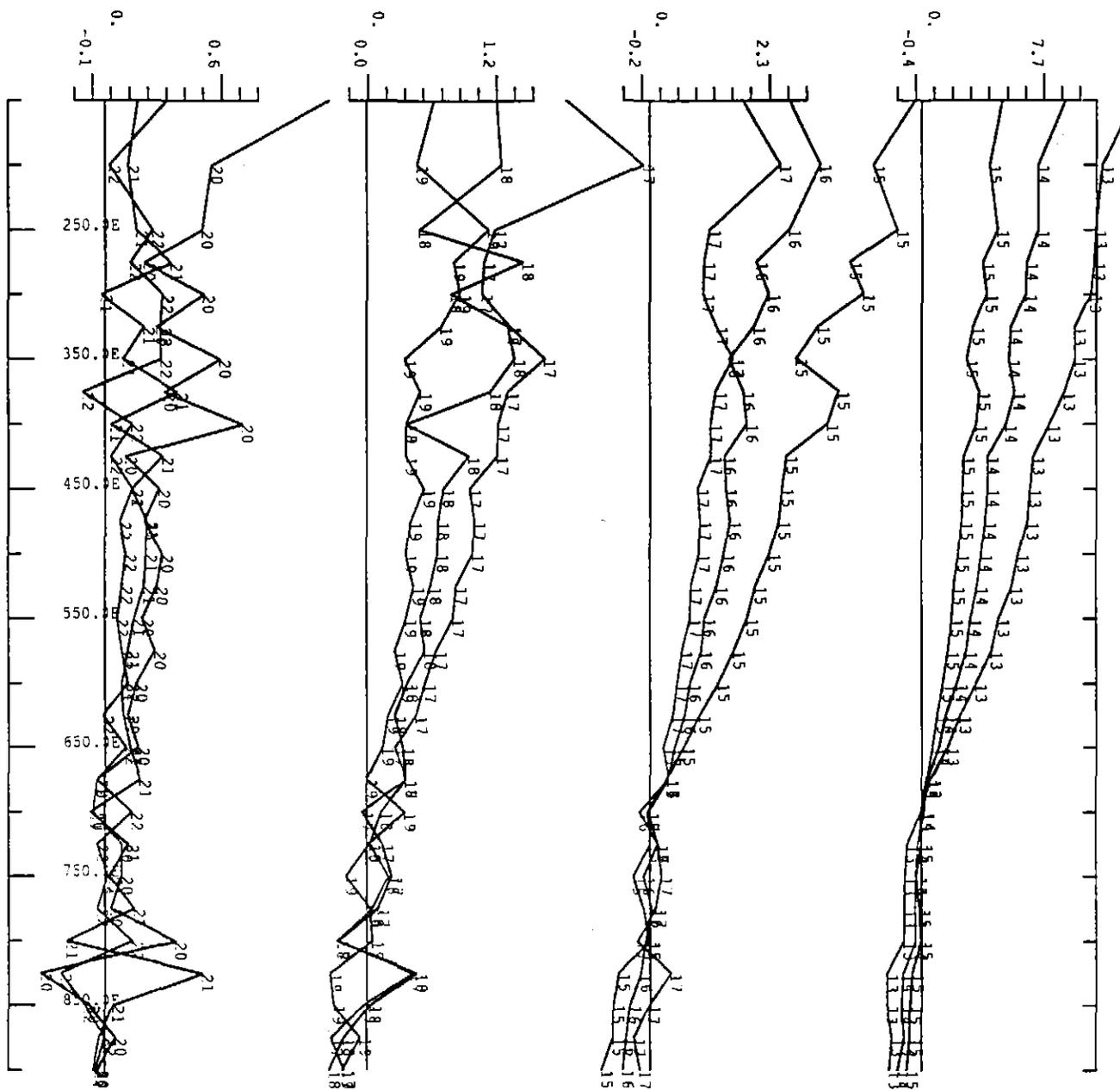
MACKINTOSH EL
DOWN HOLE EM
ZONGE_GDP 16 32Hz
MAC28
LOOP 4
Aberfoyle Resources Limited
Horiz scale 1: 5000.0 Plot number : 4

5 cm

Figure 6A

085095

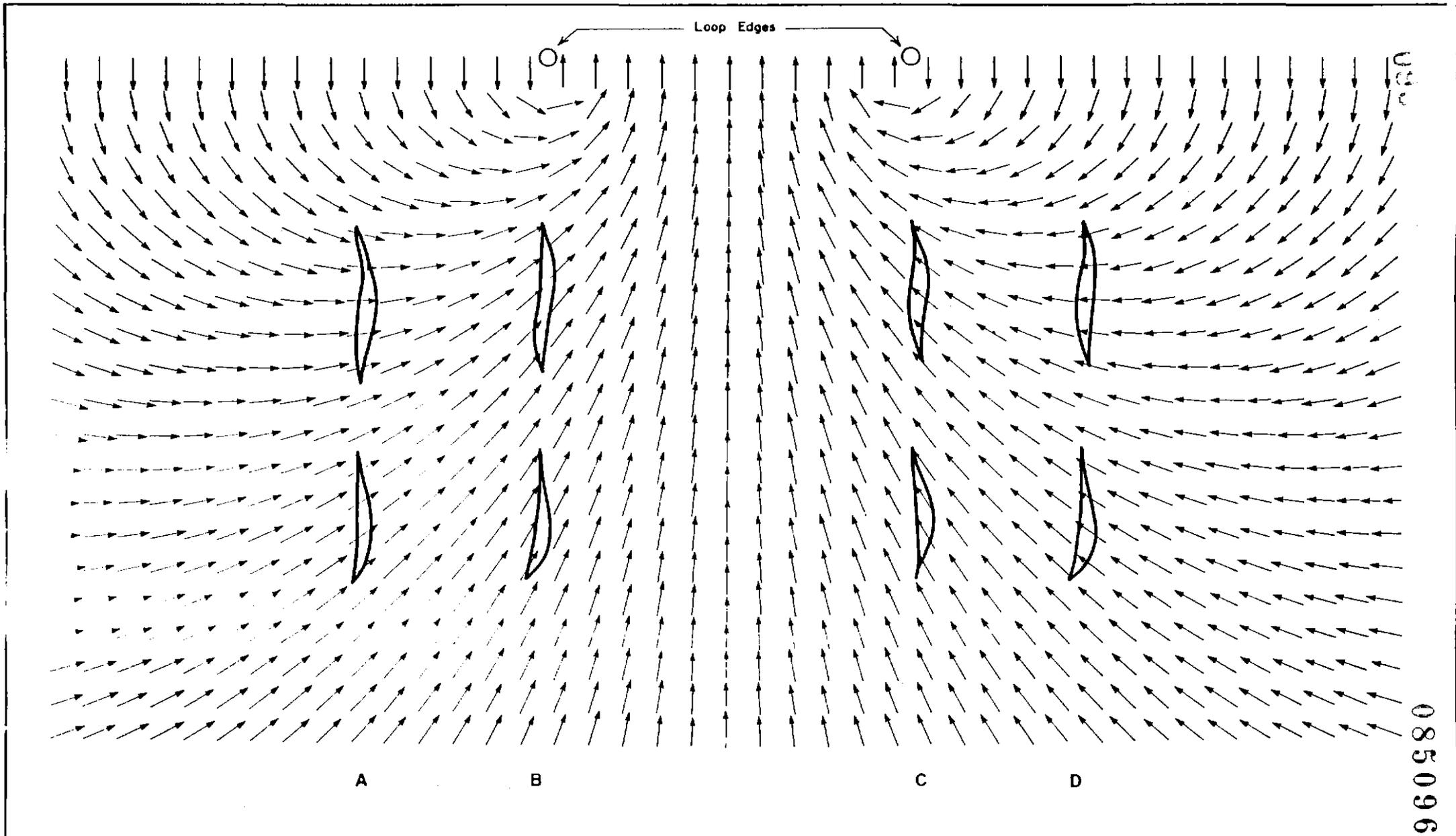
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MACKINTOSH EL
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 MAC28
 LOOP 4
 Aberfoyle Resources Limited
 Horiz scale 1: 5000.0 Plot number : 3

5 cm

Figure 6B

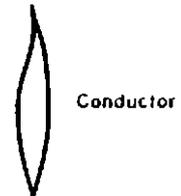


A

B

C

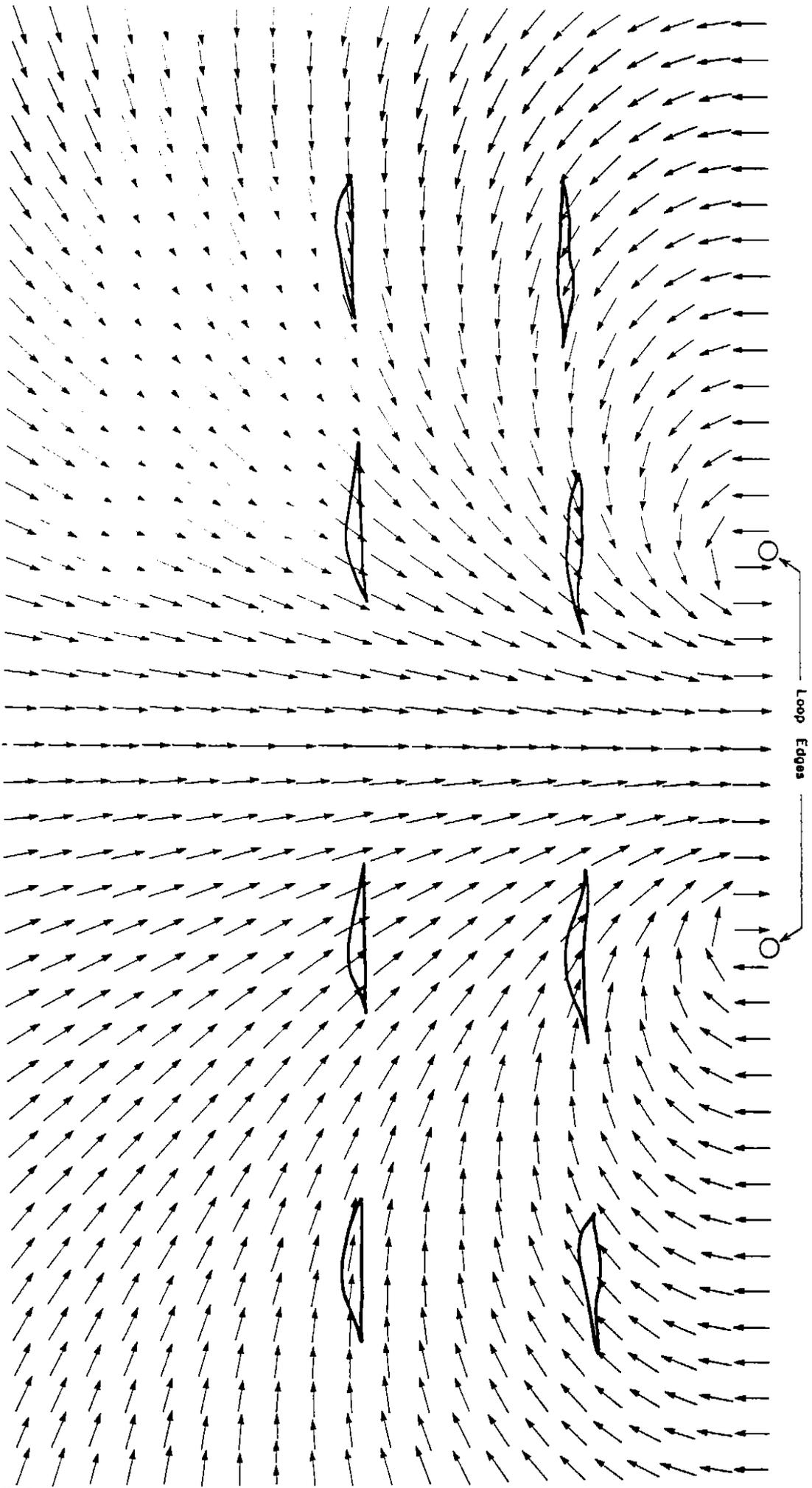
D



085096

Figure 7

| | | | | | |
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| Aberfoyle Resources Limited | | | | | |
| EXPLORATION DIVISION | | | | | |
| NORTH WEST TASMANIA | | | | Completed | JS |
| MACKINTOSH EL 106/87 | | | | Drawn | JS |
| PRIMARY FIELD DIRECTIONS | | | | Traced | GLC |
| ACROSS A VERTICALLY DIPPING CONDUCTOR | | | | Checked | JS |
| REVISIONS | | | | | |
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Conductor

A

B

C

D

Loop Edges

Aberloyle Resources Limited

EXPLORATION DIVISION

NORTH WEST TASMANIA

MACKINTOSH EL 106/87

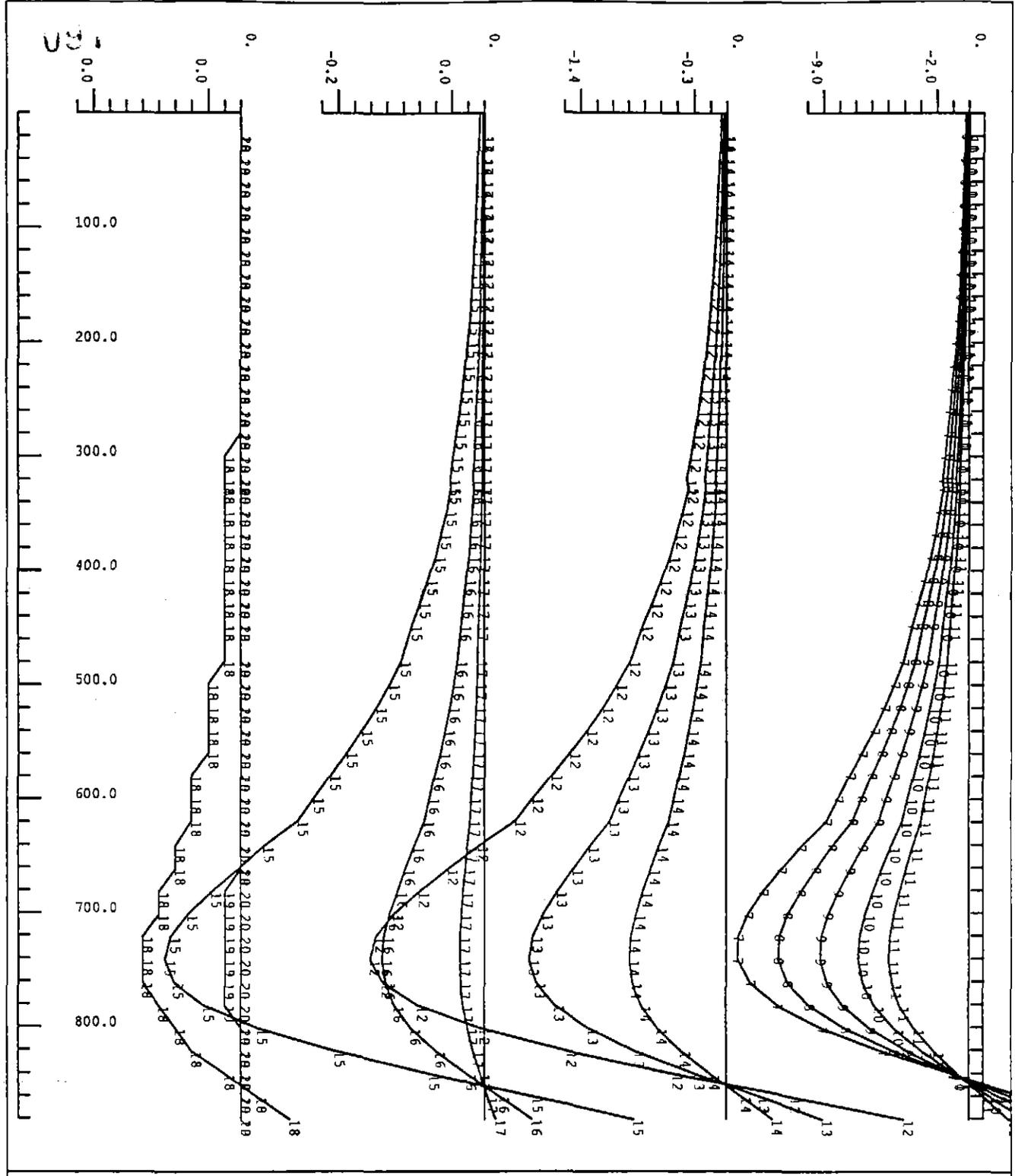
PRIMARY FIELD DIRECTIONS

ACROSS A FLAT LYING CONDUCTOR

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| GLC | GLC |
| JS | JS |

Figure 8



MAC 28
 35 DEG DIPPING 150 METER WIDE CONDUCTOR
 UPPER EDGE AT 4900E RL 300
 CONDUCTOR DIPS FROM THE WEST
 JS 1/7/91
 Horiz scale 1: 5000.0 Plot number : 31

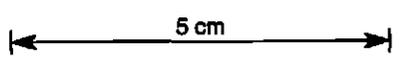
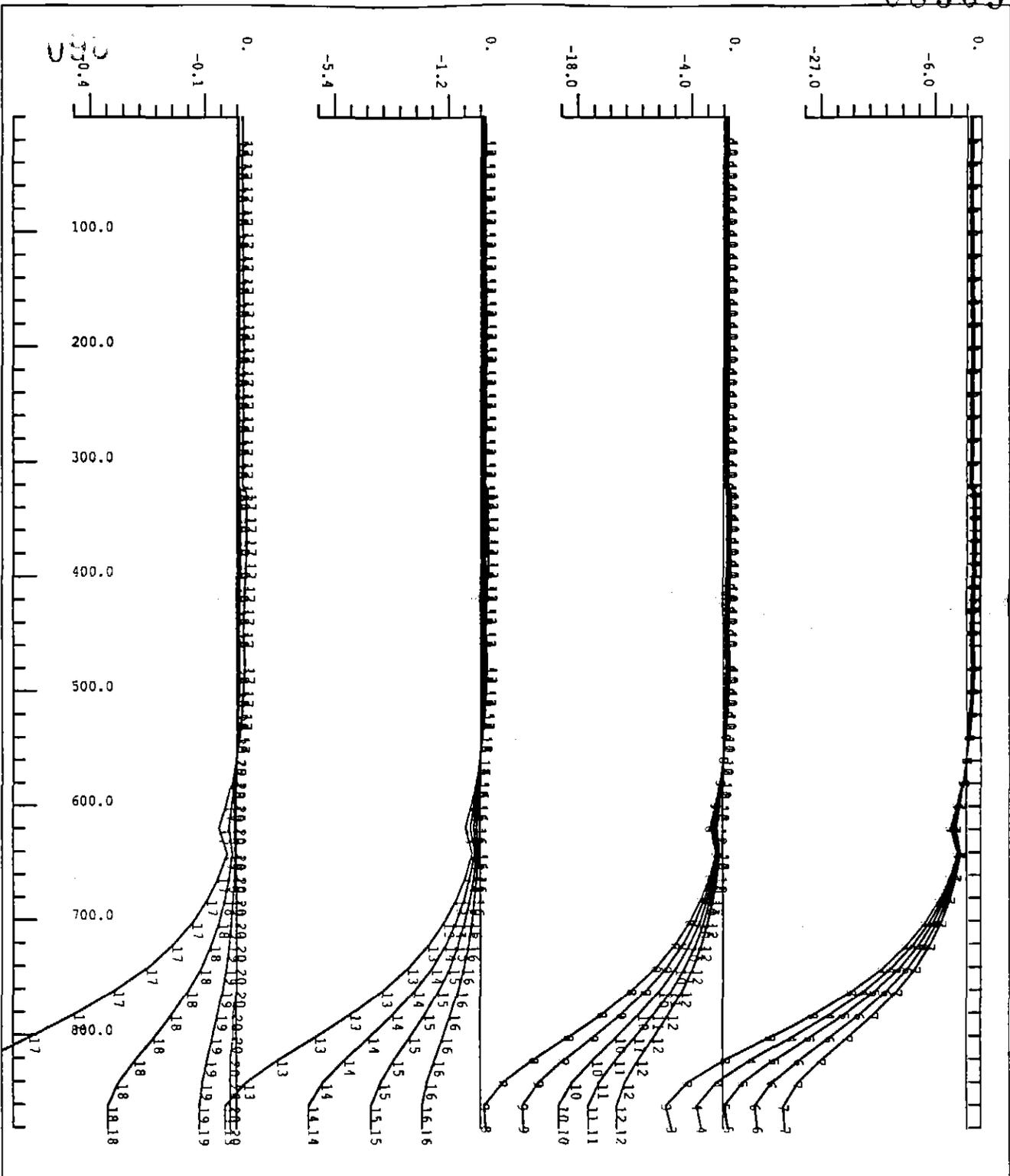


Figure 9



MAC 28
 20 deg dipping conductor 100 meters wide
 upper edge at 5050 rl 230
 conductor dips from the east
 JS 1/7/91
 Horiz scale 1: 5000.0 Plot number : 34

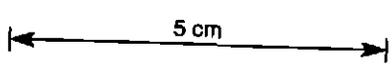
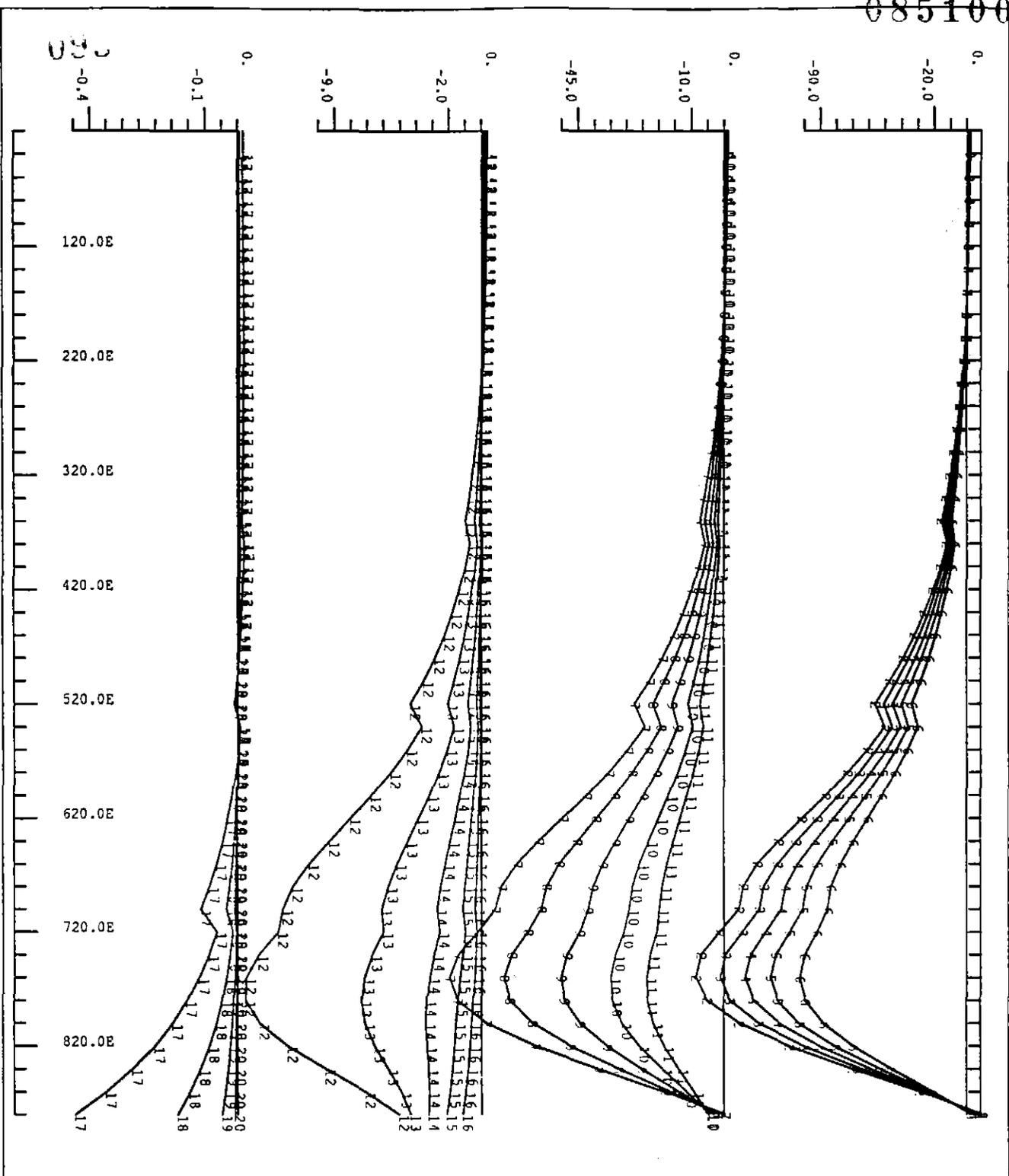


Figure 10



MACKINTOSH EL
DOWN HOLE EM
MAC28
TWO NON INTERACTING CONDUCTORS
Aberfoyle Resources Limited
Horiz scale 1: 5000.0 Plot number : 15

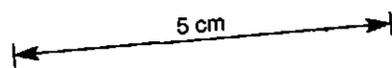
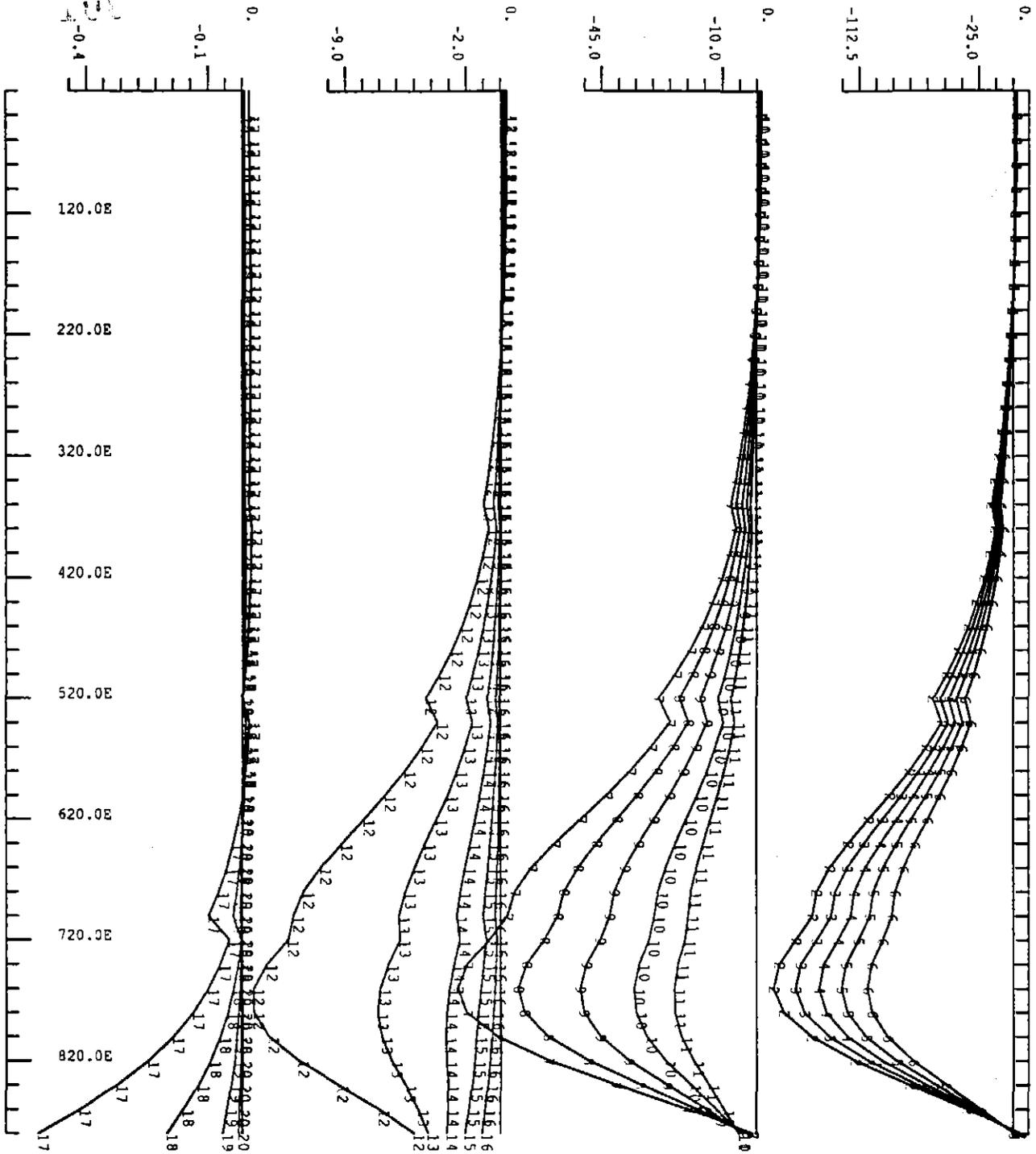


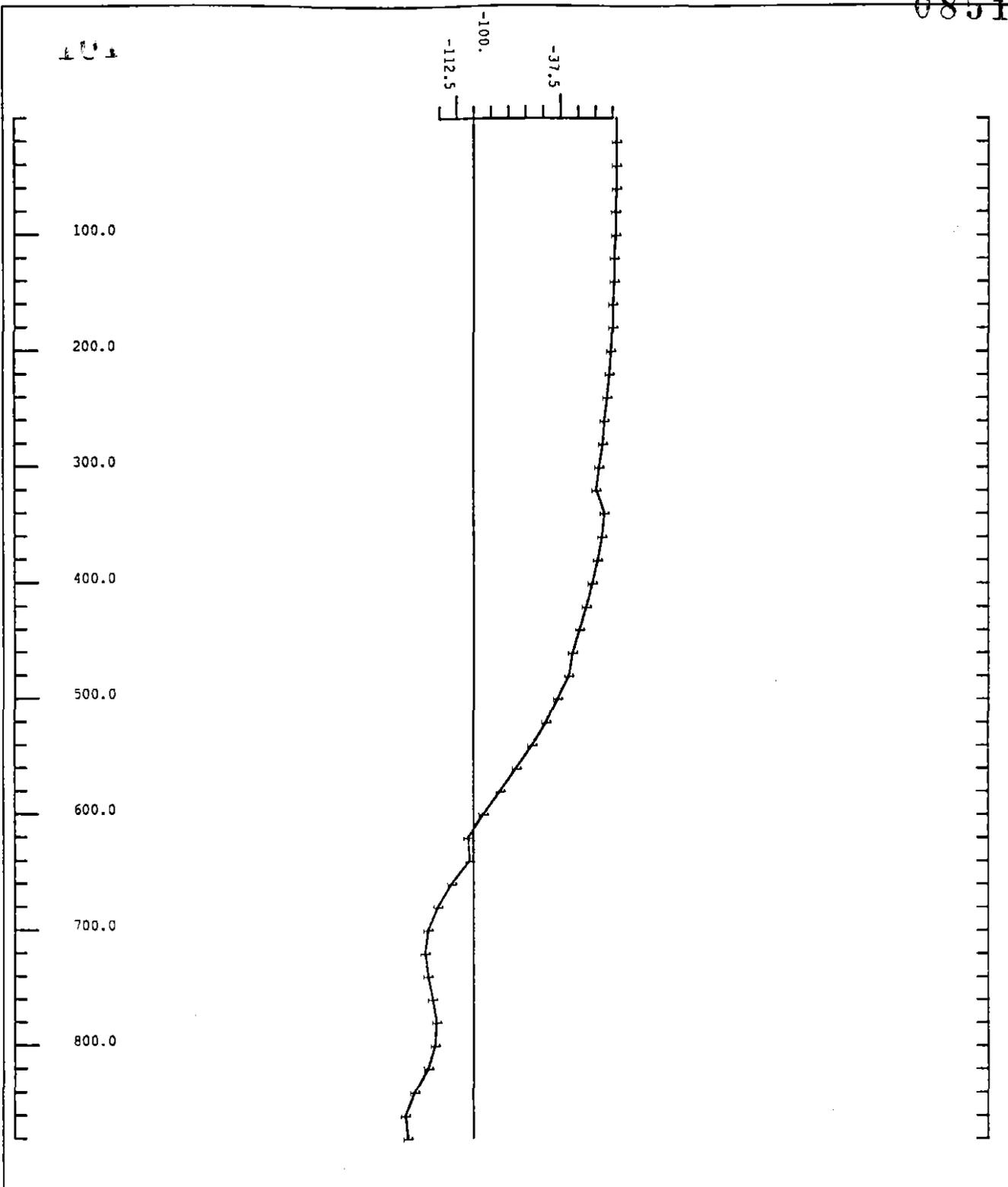
Figure 11



MACKINTOSH EL
DOWN HOLE EM
MAC28
TWO INTERACTING CONDUCTORS
Aberfoyle Resources Limited
Horiz scale 1: 5000.0 Plot number : 14

5 cm

Figure 12



MAC 28
 DOWN HOLE EM EXPECTED PROFILE
 FAULTED STRUCTURE
 BODY 1 4800,4810 AT 300 RL DIP 20
 BODY 2 5050,5060 AT 230 RL DIP 160
 BODY 2 CARRIES FOUR TIMES AS MUCH CURRENT
 VORTEX CURRENT MODEL
 Aberfoyle Resources Limited
 Horiz scale 1: 5000.0 Plot number : 3

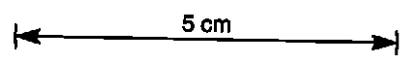


Figure 13

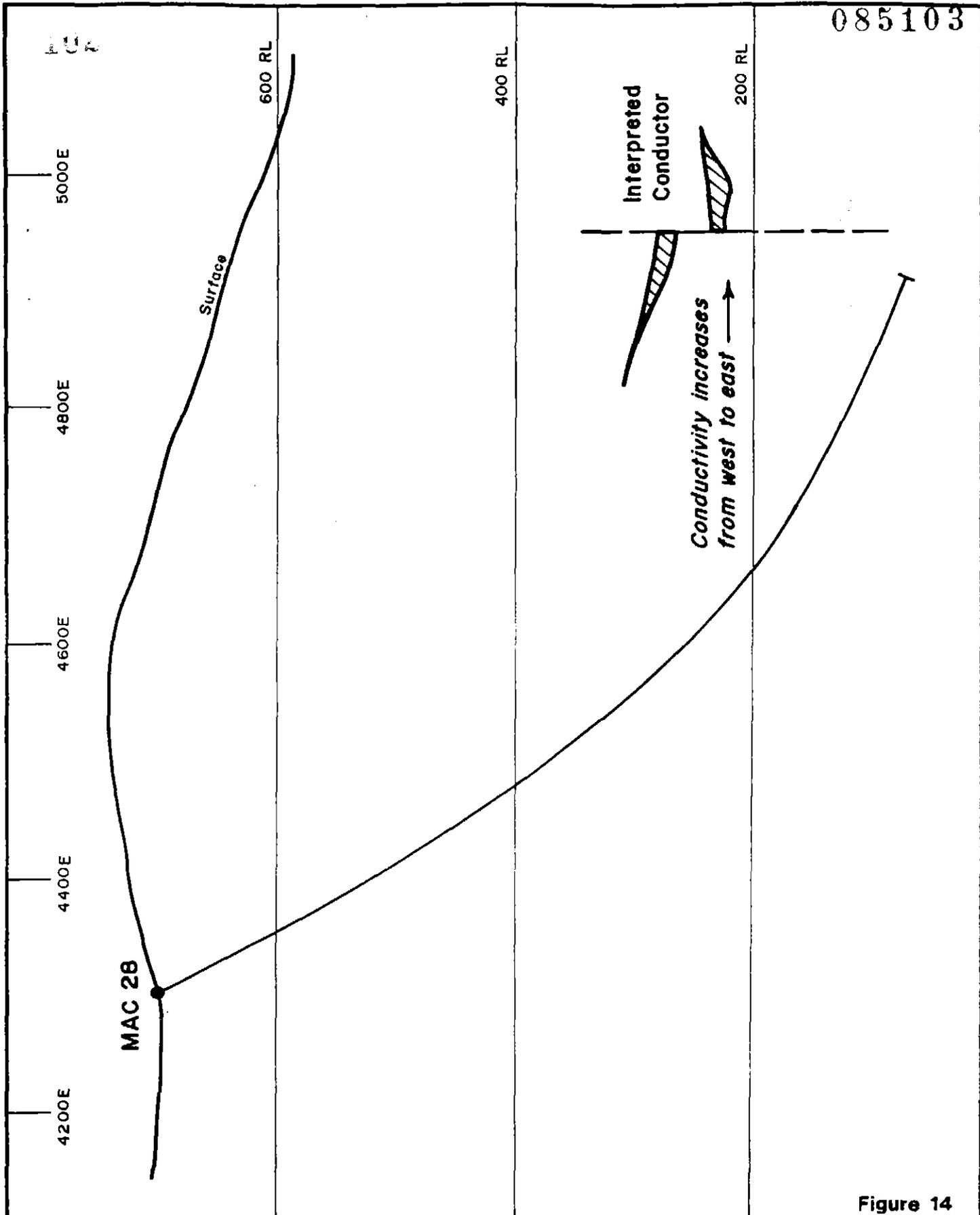


Figure 14

Aberfoyle Resources Limited
EXPLORATION DIVISION

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NORTH WEST TASMANIA

MACKINTOSH EL 106/87

6000N - INTERPRETIVE SECTION

Compiled : JS

Drawn : JS

Traced : GLC

Checked : JS

Location Code : K55/3

Scale : As shown

Date : August 1991

Plate No. : MAC 336

APPENDIX IV

THE
MAC28 - SOUTH OUE RIVER
AREA.
GEOLOGY, INTERPRETATION AND IMPLICATIONS.

EL 106/87 MACKINTOSH

TABLE OF CONTENTS

| | Page No. |
|---|----------|
| i. TABLE OF CONTENTS | i |
| ii. LIST OF PLATES | ii |
| 1. INTRODUCTION | 1 |
| 2. 1:10000 INTERPRETIVE GEOLOGY SUMMARY SQR | 1 |
| 3. SOIL GEOCHEMISTRY | 1 |
| 4. DDH MAC-28 | 4 |
| 4.1. Down Hole Geology | 4 |
| 4.2. Down Hole Geophysics | 4 |
| 5. DATA SYNTHESIS AND INTERPRETATION | 6 |
| 5.1. Structural/Stratigraphic Interp., Line 6000N | 6 |
| 5.2. Lineament Analysis | 6 |
| 5.3. Data Synthesis and Interpretation | 7 |
| 6. DRILL TARGETS - SQR | 8 |
| 6.1. The MAC-28 Conductor | 8 |
| 6.2. Area A | 8 |
| 6.3. Area B | 8 |
| 7. CONCLUSION | 9 |
| 8. APPENDICES | 10 |
| 8.1. MAC-28 Core Grind Geochemistry ✓ | |
| 8.2. MAC-28 DHEM Profiles | |

LIST OF PLATES

| Plate No. | Title | Page No. |
|-----------------|--|----------|
| Plate MAC330 / | South Que River Summary Plan | 2 |
| Plate MAC220 / | Mackintosh Stratigraphic Column | 3 |
| Plate MAC161c ✓ | Mackintosh Area, Interpretive Geology | " |
| Plate QR47/67 | Que River Prospect, Section 6700N | " |
| Plate MAC322 ✓ | Summary Geological Overlay, South Que River | " |
| Plate MAC319 / | DDH MAC-28, Section 6000N | " |
| Plate MAC321 | Interpretive Cross Section, MAC28/Line 6000N | " |
| Plate MAC323 / | Interpretive Cross Sections, South Que River | " |
| Plate MAC306 ✓ | Summary Interpretation Plan, Linears | " |
| Plate MAC311 / | Summary Compilation Plan, Linears | " |

1. INTRODUCTION

The South Que River (SQR) area lies between Que River and Mount Charter. The area is incorporated within CML 68M/84 and EL 105/87 "Mackintosh".

Although, the SQR area abuts the Que River deposit and incorporates a base metal anomalous alteration system, its exploration potential was perceived to be low due to the dominance of footwall lithologies. However, as recent drilling at SQR has intersected hanging wall lithologies, this new data, and the resulting stratigraphic re-interpretation, significantly increases the exploration potential of the area.

2. 1:10000 INTERPRETIVE GEOLOGY SUMMARY - SQR

The SQR area is dominated by andesitic, basaltic and dacitic lavas(?). The area is bounded to the north by the Que Fault and to the east by Mica Sandstone basement lithologies (Plate 161c). This basalt/Mica Sandstone contact appears to be conformable (AMcN, Shark Fin track), which suggest that the SQR basalt, or at least its eastern portion, is the Lower Basalt (Plate MAC220).

The SQR alteration system, trending south from the Que Fault, represents a zone of intense Si, Se, Py alteration. This alteration system is base metal anomalous. Four early exploration holes (QR24, 29, 28, 82) were drilled to test the alteration zone on line 6700N (Plate QR47/67). All four holes intersected base metal stringers. Reported assays include: 0.56% at .2% Cu, 4.5% Pb, 3.2% Zn; 0.55m at .7% Cu, 6.1% Pb, 10.7% Zn; and 2.09m at .1% Cu, 3.1% Pb, 3.3% Zn.

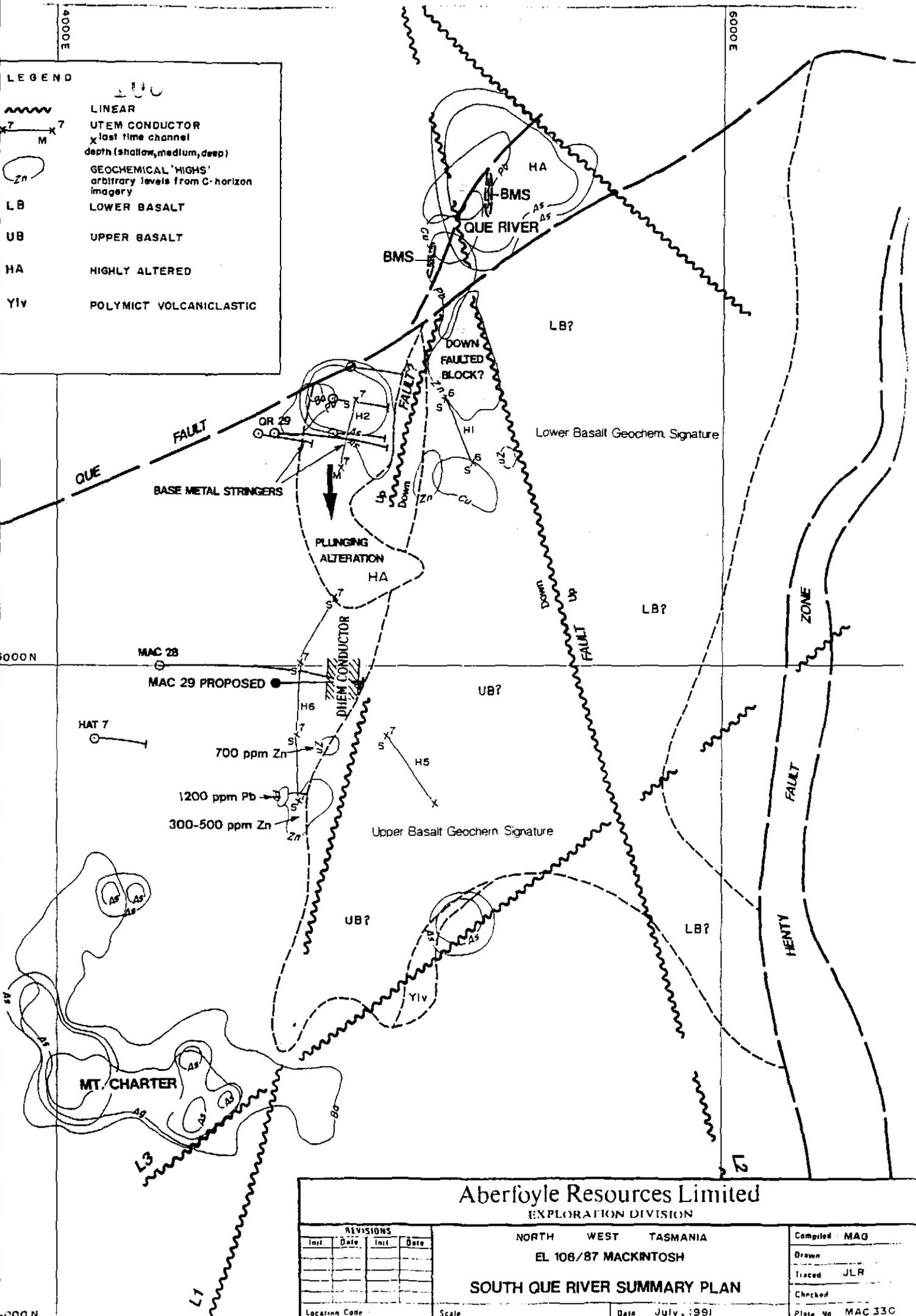
3. SOIL GEOCHEMISTRY

Imaged processed C-horizon soil geochemical data for the Hellyer-Que-Charter area is presented on Plates MAC290a-j. A geology summary overlay is provided by Plate MAC322. The following anomalies/associations are noted:

- . The SQR alteration zone has a well defined Pb, As, Ba coincident soil anomaly.
- . The area immediately to the east of the SQR alteration zone (Area A, Plate MAC306) has a well defined Zn, Cu, Pb soil anomaly.

LEGEND

-  LINEAR
-  UTEM CONDUCTOR
x last time channel
depth (shallow, medium, deep)
-  GEOCHEMICAL 'HIGHS'
arbitrary levels from C-horizon
imagery
- LB** LOWER BASALT
- UB** UPPER BASALT
- HA** HIGHLY ALTERED
- Yiv** POLYMICT VOLCANICLASTIC



Aberfoyle Resources Limited
EXPLORATION DIVISION

NORTH WEST TASMANIA
EL 106/87 MACKINTOSH

SOUTH QUE RIVER SUMMARY PLAN

| REVISIONS | | | |
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| Plate No | MAC 33C |

Location Code Scale Date July, 1991

Tholeiitic flood basalt

Limestone

Biocorrobed quartz sandstone

Silicic conglomerate and sandstone

Quartz feldspar phytic lavas and volcanoclastics with latest middle Cambrian fossils

A felsic complex of breccia and ash volcanoclastics and minor lavas. Intercalated shale and greywacke

Black shale with late middle Cambrian fossils

Basic, intermediate to acid calc alkaline volcanics comprising lavas, autoclastics, hyaloclastics and epiclastics

Micaceous lithicwacke with interbedded siltstone shale and minor Que-Hellyer volcanics

A calc alkaline suite of felsic lavas, pyroclastics and other volcanoclastics

INTRUSIVES

 Dolerite sills of Devonian? age

 Rhyolite sills and dykes. Cambrian age

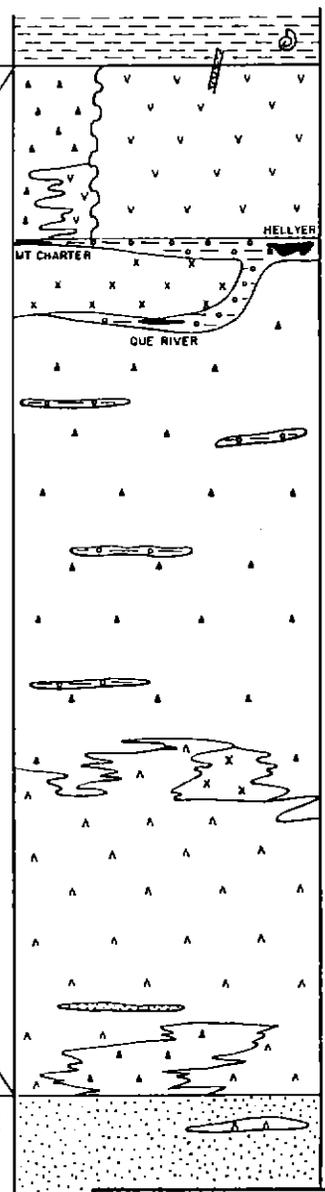


ESTABLISHED NOMENCLATURE

QUE RIVER BEDS (Que, 1970)

QUE - HELLYER VOLCANICS (Kumysnan, 1986)

ANIMAL CREEK GREYWACKE (Collins, 1981)



QRS Black carbonaceous pyritic shale. Massive to finely bedded.



UB Amygdaloidal basalt lava. Massive, pillowed, autobrecciated, hyaloclastitic, peperitic varieties.



HVS Polymict breccia to ash volcanoclastics. Predominantly mass flow units with finer bedded volcanic sediments.



D Dacite. Massive to flow banded lava with autobrecciated hyaloclastic varieties. Minor intrusives



A Andesite. Typically albite porphyritic with autobrecciated, hyaloclastic varieties with minor massive lava. Prominent development of metamorphic epidote and pumpellyite.



LB Basalt lava. Massive to autobrecciated hyaloclastic varieties. Prominent development of metamorphic epidote and pumpellyite.



MSs Lithic rich micaceous sandstone with interbedded shale and volcanoclastic units near base

INTRUSIVES



Probable Cretaceous lamprophyre dykes

085110

085110

Aberfoyle Resources Limited
EXPLORATION DIVISION

NORTH WEST TASMANIA

MACKINTOSH DISTRICT
STRATIGRAPHIC COLUMN

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| Page No. | MAC 220 |
|----------|---------|

- . The contact between the large basalt mass and the andesite to the west, has a patchy Zn, Pb, Cu association along its length. This trend lies within and partly defines the Hellyer-Que-Charter mineralised corridor.
- . The southern contact between the large basalt mass and the andesite/Mt. Charter Dacite shows a subtle As, Pb anomaly.

4. DDH MAC-28

4.1. Down Hole Geology

MAC-28 was drilled to test the interpreted buried southern plunge extension to the SQR alteration system. The hole intersected dacitic and basaltic lavas (?) above a coarse, 5.5m thick polymict horizon at 149.5m (Plate MAC319). Below the polymict horizon, dominantly andesitic lavas were intersected to approximately 715m. Intense, although patchy, Se, Si, Cl, Py alteration dominated the remainder of the hole. MAC-28 was terminated within a strongly altered andesitic lava. A summary log appears on page 3.

Core grind geochemistry confirms the above lithological interpretation. Base metal core grind results are uniformly low, with Zn, Pb, Cu assay returns rarely exceeding 200ppm, 100ppm and 100ppm, respectively. However the intersected sequence is Ba anomalous, with assay returns of >1000ppm common throughout the hole. Core grind assays for MAC-28 are given in Appendix 1.

4.2. Down Hole EM

MAC-28 was surveyed with DHEM in May/June 1991. A clear off hole response was identified (JS Memo 4/6/91) in the four loop data set. The response is most easily recognised as a set of broad late time cross-overs at about 600-700 metres down the drill hole (Appendix 2).

Data interpretation indicates that the conductor is centred on about 4800E, some 150-200m above the hole. A gentle (20°) westerly dip and a width of 150m (? open to the east) is interpreted. A structured (faulted/faulted), but roughly tabular geometry is modelled/invoked.

MAC28 SUMMARY LOG

| INTERVAL | ROCK TYPE | ALTERATION | MINERAL. |
|----------------------|--|-------------------|-------------------------------|
| 0- 24.6m | Dacite | | |
| 24.6- 84.3 | Basaltic lava breccia, vesicular | (CoSeC11) | (Py1) |
| 84.3- 93.3 | Andesitic feldspar-phyric lava | (SelSil) | |
| 93.3-100.3 | Basaltic lava breccia, vesicular | (SelSilC11+Fu) | (Py1) |
| 100.3-119.5 | Andesitic feldspar-phyric lava | (SelSilC11+Fu) | (Py1) |
| 119.5-146.5 | Basaltic lava breccia, vesicular | (Co2C11) | (Py1) |
| 146.5-149.5 | Andesitic lava breccia volcanic-lastic | (SilFd1) | |
| 149.5-155.0 | Fine to medium lapilli polymict volcaniclastic. Andesitic, dacitic and basaltic lava fragments | | (Py1) |
| 155.0-268.8 | Andesitic feldspar-phyric lava | | |
| 168.8-275.9 | Andesitic lapilli volcaniclastic | (Se2Si2) | |
| 275.9-331.1 | Andesitic feldspar-phyric lava | (SelEpl) | |
| 331.1-334.8 | Andesitic fine lapilli volcanic-lastic | (SelSil) | (QCo+Spt Cpy Vein) |
| 334.8-341.4 | Andesitic feldspar-phyric lava | (SelSil) | |
| 341.4-342.4 | Laminated ash volcaniclastic | (SelSil) | |
| 342.4-445.7 | Andesitic feldspar-pyroxene-phyric lava | (SE12Sil) | (diss Sp+Cpy 384.5-396.0m) |
| 445.7-460.5 | Andesitic lapilli volcaniclastic | (SilCol) | |
| 460.5-480.7 | Andesitic lava and lava breccia | (SilC11) | (Py1) |
| 480.7-490.0 | Polymict Andesitic lapilli volcaniclastic | (SilC11) | (Py1-2) |
| 490.0-544.0 | Andesitic lava and lava breccia | (SilC11) | (Py1-2) |
| 544.0-563.2 | Polymict andesitic lava breccia | (SilC11) | (Py0-1) |
| | Andesitic and basaltic+dacitic lava fragments | | |
| 563.2-613.0 | Andesitic to basaltic lava | (SilC11) | (Py0-1) |
| 613.0-634.2 | Basaltic lava and lava breccia | | |
| 634.2-715.0 | Andesitic to basaltic lava and lava breccia | (SelSil) | (Py1-2) |
| 715.0-718.0 | Highly altered lava | (Se3Si2C11Ful) | (Py4) |
| 718.0-740.2 | Strongly altered andesitic lava | (Se2Si2C12) | (Py3) |
| 740.2-751.6 | Andesitic feldspar-phyric vesicular lava | (Se2C12) | (Py1) |
| 751.6-753.9 | Highly altered lava | (Se3S;C12Col) | (Py3) |
| 753.9-769.0 | Andesitic feldspar-phyric lava | (SelC11) | (Py1) |
| 769.0-801.1 | Strongly altered lava | (Se4Si2C12FulCol) | (Py2-4) |
| 801.1-812.7 | Andesitic lava | (SilC11) | (Py1) |
| 812.7-827.7 | Altered lava | (Se4Si2C12) | (Py3) |
| 827.7-888.3 | Strongly altered lava | (Se4Si2C12Ful) | (Py4) |
| 888.3-899.6 | Andesitic vesicular lava | (Se2Si2) | (Py2) |
| 899.6-907.5 (EOH) | Altered lava "Quellite" | (Se3Si2C11) | (Py3) |

5. DATA SYNTHESIS AND INTERPRETATION

5.1. Stratigraphic-Structural Interpretation, MAC28/6000N SECTION

The sequence intersected in MAC-28 is similar to that found at Que and Hellyer. The polymict horizon intersected at 149.5m is interpreted (AMcN P2 Report) to represent the Que-Hellyer stratigraphic position.

Bedding to core angle measurements, taken from un-orientated core, suggest a dip reversal down MAC-28. Measurements towards the middle of the hole suggest that the intersected strata is east dipping, while measurements taken near the end of the hole suggest the strata is west dipping strata. This dip reversal down MAC-28, together with surface geology and geochemical trends, suggest the presence of a gentle syncline centred on about 4700E (Plate MAC321). If this interpretation is correct, the conductor can be inferred to lie within the Que-Hellyer polymict horizon, on the eastern limb of the syncline.

5.2. Lineament Analysis

A preliminary lineament study of the Hellyer-Que-Charter area was undertaken by IBF in March 1990. The results of this study are presented on Plates MAC306, 311, 313 and 323. It should be noted that the conclusions presented on the above plates are derived primarily from empirical observations. IBF suggests that the interpretation should be refined with more work, and that important conclusions or concepts be tested as far as possible with allied data sets.

Three fundamental airphoto/geochem linears (L1, L2, and L3, Plate MAC306) intersect the SQR area. L1 is inferred to represent a part/axis of a major feeder zone - the Hellyer-Que-Charter mineralised corridor. The alteration intersected in the bottom of MAC-28 lies within and partly defines this corridor.

L2 is a prominent linear of EL extent. It is well defined in both the airphoto and geochem data sets. This linear (fault?) cuts through the SQR basalt mass. Empirical observations derived from the derived from the image processed data set, suggests that the portion of basalt to the west of the L2 has Cr, Ti, Cu signature more characteristic of the Upper Basalt, while the portion of the basalt on the eastern side has a signature more characteristic of the Lower Basalt. A west block down movement along L2 is inferred. This interpretation is supported by the intersection of hanging wall lithologies in MAC-28, and the exposed conformable basalt/Mica Sandstone contact just to the west of the Henty Fault (5950/6000 Plate MAC161c).

L3 is also a prominent linear break. This linear/fault is inferred to represent the southern boundary to the down faulted block. Its orientation suggests it may be related to the Que Fault.

5.3. Data Synthesis and Implications

5.3.1. The SQR Alteration System

Synthesis of geological and geophysical information (Sections 2, 3 and 4) suggests that the SQR alteration system plunges south from the surface (RL700) on line 6700N to at least line 6000N where it has been intersected at 550m below surface (RL100) in MAC-28. The alteration zone can be inferred to trend south, south-east from MAC-28 to possibly underlie Ba alteration at 5100/4500.

5.3.2. SQR 1:10000 Interpretive Cross Sections

1:10000 interpretive cross sections for the SQR area (5200N, 5800N, 6700N and 7300N) are presented on Plate MAC323. For reference, previous interpretations are provided on Plate MAC269c. If the new interpretation is correct, the presence of the Que-Hellyer host horizon and underlying footwall alteration, significantly increases the prospectivity of the SQR area.

The area of greatest potential is considered to be that bounded by the Que Fault and the L2 and L3 structural linears. This area incorporates the SQR alteration zone and is interpreted to contain the Que-Hellyer host horizon at a depth below UTEM detection. The dacitic unit (? topographic high prior to Upper Basalt extrusion) to the west of the MAC-28 collar is inferred to represent the western (chemical sedimentation) boundary to the prospective paleo basin.

The interpretation for Line 6700N (Plate MAC323) indicates the presence of a highly prospective down faulted block, immediately to the east of the SQR alteration system. Strong faulting intersected in the bottom of QR29 is interpreted to represent the western boundary to this block, while the L2 linear marks the eastern boundary. If this is correct, it is reasonable to assume that a portion of the Que-Hellyer host horizon that once existed above the alteration system, is preserved at depth, within the down faulted block. A strong C-horizon Zn anomaly (Area A, Plate 306) is located over the down faulted block within this position.

6. Drill Targets - SQR

Three drill targets presently exist within the SQR area. They are: the MAC-28 DHEM conductor; the interpreted down faulted host horizon immediately to the east of the SQR alteration zone (Area A, Plate MAC306); and the zone of anomalous soil geochemistry (Area B) 300m south of the MAC-28 conductor.

6.1 MAC-28 DHEM Conductor

The MAC-28 conductor represents a significant late time DHEM anomaly. Geological interpretation suggests that the conductor lies within the Que-Hellyer host horizon on the eastern flank of a gentle syncline.

The DHEM conductor lies vertically above the pyritic footwall style alteration intersected in the bottom of MAC-28. Although this alteration/conductor geometry is encouraging, the lack of base metal mineralisation is of some concern. However, this association may simply reflect structuring or a more unusual alteration/ore geometry to that at Hellyer.

The presence of a significant late time EM response, an indicated polymict host horizon, and underlying footwall style alteration, combine to make the MAC-28 conductor an attractive VMS target.

6.2 SQR Alteration Zone - Eastern Target (Area A)

Re-interpretation of the SQR area has suggested that the Que-Hellyer host horizon may be preserved within a down faulted block on the eastern side of the SQR alteration system (Plate MAC323). As the SQR alteration zone contains abundant base metal stringers, the possibility that the interpreted, juxtaposed, Que-Hellyer host horizon contains base metal mineralisation is worth testing. The presence of a coincident base metal soil anomaly, and the close proximity (300m) to the Que River deposit, reinforces the potential of this interpreted host horizon.

6.3 South MAC-28 Soil Anomaly (Area B)

The base metal soil anomaly centred approximately 300m south of the projected position of the MAC-28 conductor represents an interesting drill target. The anomaly lies above the interpreted southern strike extension of the interpreted host horizon and underlying pyritic footwall type alteration.

7. CONCLUSION

The intersection of hanging wall rocks in MAC-28 and the resulting stratigraphic re-interpretation, has significantly increased the prospectivity of the SQR area.

The footwall type alteration intersected in MAC-28 suggests that the SQR alteration system plunges south beneath relatively unaltered hanging wall lithologies. Such a alteration/host horizon geometry is highly permissive for VMS mineralisation. The location of this zone within the Hellyer-Que-Charter mineralised corridor, together with sympathetic structuring, coincident Zn, Pb soil anomalies and nearby base metal mineralisation (QR29, Que River), reinforces the potential of the SQR area.

110

8. APPENDICES

8.1. Appendix 1, MAC-28 Core Grind Geochemistry

** Geochemical data set report for : DDMA0028

| From | To | Sample | Type | Rock | Cu | Pb | Zn | Ag | Au | Ba | As | Cr | Zr | Ti |
|--------|--------|--------|------|------|-----|-----|-----|------|-------|------|-----|-----|-----|------|
| | | | | | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm |
| 3.00 | 13.30 | 562701 | cgri | | 20 | 15 | 210 | <.50 | <.008 | 1176 | <2 | 42 | 195 | 2139 |
| 13.30 | 23.30 | 562702 | cgri | | 15 | 10 | 180 | <.50 | <.008 | 1147 | <2 | 13 | 194 | 2182 |
| 23.30 | 33.30 | 562703 | cgri | | 105 | 25 | 210 | <.50 | <.008 | 755 | <2 | 312 | 114 | 3071 |
| 33.30 | 43.30 | 562704 | cgri | | 240 | 40 | 285 | <.50 | <.008 | 660 | <2 | 315 | 123 | 3241 |
| 43.30 | 53.30 | 562705 | cgri | | 115 | 85 | 430 | <.50 | .010 | 1099 | 3 | 432 | 113 | 3128 |
| 53.30 | 63.30 | 562706 | cgri | | 140 | 115 | 470 | <.50 | <.008 | 1463 | 3 | 518 | 98 | 2826 |
| 63.30 | 73.30 | 562707 | cgri | | 65 | 170 | 525 | <.50 | <.008 | 1031 | <2 | 506 | 98 | 2708 |
| 73.30 | 84.30 | 562708 | cgri | | 130 | 65 | 300 | <.50 | .020 | 431 | <2 | 614 | 88 | 2431 |
| 84.30 | 93.30 | 562709 | cgri | | 35 | 20 | 70 | <.50 | <.008 | 427 | 7 | 12 | 196 | 2671 |
| 93.30 | 103.10 | 562710 | cgri | | 40 | 10 | 175 | <.50 | <.008 | 220 | <2 | 510 | 99 | 2807 |
| 103.10 | 110.20 | 562711 | cgri | | 165 | 20 | 185 | <.50 | <.008 | 592 | <2 | 169 | 105 | 2740 |
| 110.20 | 119.50 | 562713 | cgri | | 90 | 20 | 255 | <.50 | <.008 | 727 | <2 | 244 | 98 | 2414 |
| 119.50 | 129.50 | 562714 | cgri | | 90 | 200 | 690 | <.50 | <.008 | 1480 | <2 | 488 | 91 | 2484 |
| 129.50 | 139.50 | 562715 | cgri | | 75 | 155 | 400 | <.50 | .015 | 582 | 5 | 547 | 87 | 2380 |
| 139.50 | 145.20 | 562716 | cgri | | 100 | 135 | 360 | <.50 | .010 | 414 | 4 | 514 | 89 | 2397 |
| 145.20 | 149.45 | 562717 | cgri | | 75 | 25 | 140 | <.50 | <.008 | 585 | 6 | 227 | 164 | 2395 |
| 149.45 | 155.00 | 562718 | cgri | | 55 | 30 | 110 | <.50 | <.008 | 568 | 4 | 99 | 138 | 3448 |
| 155.00 | 165.70 | 562719 | cgri | | 40 | 15 | 100 | <.50 | <.008 | 647 | <2 | 56 | 110 | 2972 |
| 165.70 | 175.00 | 562720 | cgri | | 50 | 30 | 160 | <.50 | <.008 | 810 | <2 | 118 | 124 | 3125 |
| 175.00 | 186.00 | 562721 | cgri | | 75 | 35 | 170 | <.50 | <.008 | 926 | <2 | 114 | 130 | 3176 |
| 186.00 | 189.20 | 562722 | cgri | | 55 | 15 | 180 | <.50 | .010 | 764 | 3 | 34 | 128 | 2688 |
| 189.20 | 199.20 | 562723 | cgri | | 70 | 215 | 495 | <.50 | <.008 | 1133 | 3 | 64 | 117 | 2999 |
| 199.20 | 209.20 | 562724 | cgri | | 70 | 145 | 265 | <.50 | .010 | 680 | <2 | 69 | 115 | 2889 |
| 209.20 | 219.20 | 562725 | cgri | | 115 | 210 | 270 | <.50 | .010 | 434 | <2 | 62 | 107 | 2809 |
| 219.20 | 229.20 | 562726 | cgri | | 60 | 90 | 350 | <.50 | <.008 | 539 | 2 | 71 | 113 | 2976 |
| 229.20 | 239.20 | 562727 | cgri | | 60 | 30 | 190 | <.50 | <.008 | 549 | 2 | 68 | 125 | 3061 |
| 239.20 | 249.20 | 562728 | cgri | | 90 | 45 | 275 | <.50 | <.008 | 798 | <2 | 60 | 114 | 2923 |
| 249.20 | 259.20 | 562729 | cgri | | 35 | 45 | 375 | <.50 | .010 | 1036 | 5 | 76 | 121 | 3117 |
| 259.20 | 267.70 | 562730 | cgri | | 40 | 40 | 420 | <.50 | .010 | 1028 | <2 | 94 | 113 | 2949 |
| 267.70 | 276.00 | 562731 | cgri | | 45 | 50 | 385 | <.50 | .010 | 189 | 3 | 38 | 124 | 3142 |
| 276.00 | 286.00 | 562732 | cgri | | 45 | 75 | 180 | <.50 | <.008 | 1266 | 3 | 91 | 95 | 2963 |
| 286.00 | 296.00 | 562733 | cgri | | 65 | 30 | 150 | <.50 | <.008 | 898 | 3 | 93 | 96 | 2987 |
| 296.00 | 306.00 | 562734 | cgri | | 45 | 125 | 345 | <.50 | .010 | 528 | 5 | 101 | 96 | 3018 |
| 306.00 | 316.00 | 562735 | cgri | | 50 | 35 | 150 | <.50 | <.008 | 478 | 2 | 82 | 103 | 3087 |
| 316.00 | 326.00 | 562736 | cgri | | 40 | 45 | 180 | <.50 | <.008 | 1082 | <2 | 79 | 100 | 2869 |
| 326.00 | 336.00 | 562737 | cgri | | 45 | 45 | 205 | <.50 | <.008 | 1144 | <2 | 60 | 112 | 3074 |
| 336.00 | 345.40 | 562738 | cgri | | 50 | 60 | 185 | <.50 | <.008 | 491 | 3 | 90 | 96 | 2984 |
| 345.40 | 355.50 | 562740 | cgri | | 65 | 35 | 125 | <.50 | .010 | 540 | 7 | 63 | 94 | 2712 |
| 355.50 | 365.50 | 562741 | cgri | | 80 | 100 | 155 | <.50 | .010 | 654 | 11 | 74 | 100 | 2850 |
| 365.50 | 375.50 | 562742 | cgri | | 75 | 35 | 160 | <.50 | <.008 | 747 | 3 | 36 | 98 | 2907 |
| 375.50 | 385.50 | 562743 | cgri | | 55 | 15 | 135 | <.50 | <.008 | 731 | 3 | 96 | 113 | 3182 |
| 385.50 | 395.50 | 562744 | cgri | | 55 | 35 | 300 | <.50 | <.008 | 761 | 3 | 80 | 109 | 3114 |
| 395.50 | 405.50 | 562745 | cgri | | 75 | 20 | 120 | <.50 | .010 | 834 | 3 | 67 | 123 | 3240 |
| 405.50 | 410.50 | 562746 | cgri | | 30 | 30 | 175 | <.50 | .010 | 591 | 3 | 71 | 112 | 3087 |
| 410.50 | 420.50 | 562747 | cgri | | 70 | 10 | 145 | <.50 | .010 | 734 | 4 | 34 | 109 | 3379 |
| 420.50 | 430.50 | 562748 | cgri | | 55 | 5 | 150 | <.50 | <.008 | 893 | 3 | 37 | 113 | 3745 |
| 430.50 | 440.50 | 562749 | cgri | | 45 | 20 | 130 | <.50 | <.008 | 677 | 10 | 98 | 116 | 3680 |
| 440.50 | 451.50 | 562750 | cgri | | 50 | 15 | 120 | <.50 | <.008 | 580 | 7 | 117 | 110 | 3623 |
| 451.50 | 463.90 | 562751 | cgri | | 55 | 5 | 130 | <.50 | .010 | 1073 | 3 | 130 | 103 | 3651 |
| 463.90 | 468.40 | 562752 | cgri | | 70 | 20 | 160 | <.50 | .010 | 1087 | 63 | 85 | 102 | 3249 |
| 468.40 | 480.70 | 562753 | cgri | | 45 | 10 | 210 | <.50 | .010 | 556 | 3 | 155 | 102 | 3901 |
| 480.70 | 493.50 | 562754 | cgri | | 60 | 45 | 160 | <.50 | <.008 | 685 | 3 | 70 | 118 | 4002 |
| 493.50 | 503.30 | 562755 | cgri | | 75 | 45 | 110 | <.50 | .010 | 917 | 21 | 32 | 100 | 4551 |
| 503.30 | 513.30 | 562756 | cgri | | 55 | 45 | 120 | <.50 | <.008 | 539 | 73 | 210 | 134 | 4665 |
| 513.30 | 523.30 | 562757 | cgri | | 60 | 45 | 125 | <.50 | .030 | 724 | 3 | 18 | 136 | 4395 |
| 523.30 | 532.10 | 562758 | cgri | | 65 | 10 | 130 | <.50 | <.008 | 808 | 17 | 29 | 126 | 3975 |
| 532.10 | 544.00 | 562759 | cgri | | 55 | 5 | 120 | <.50 | .010 | 436 | 73 | 22 | 124 | 4254 |
| 544.00 | 554.00 | 562760 | cgri | | 70 | 30 | 160 | <.50 | <.008 | 979 | 6 | 79 | 116 | 3810 |
| 554.00 | 563.20 | 562761 | cgri | | 85 | 15 | 115 | <.50 | .010 | 497 | 3 | 124 | 102 | 3393 |
| 563.20 | 573.50 | 562762 | cgri | | 40 | 45 | 170 | <.50 | .040 | 52 | 4 | 201 | 84 | 2702 |
| 573.50 | 584.30 | 562763 | cgri | | 60 | 45 | 170 | <.50 | .010 | 136 | 2 | 197 | 81 | 2726 |
| 584.30 | 597.20 | 562764 | cgri | | 65 | 15 | 150 | <.50 | .015 | 497 | 4 | 179 | 74 | 2639 |
| 597.20 | 607.20 | 562765 | cgri | | 50 | 45 | 105 | <.50 | <.008 | 204 | 5 | 309 | 104 | 3838 |
| 607.20 | 613.20 | 562766 | cgri | | 25 | 45 | 120 | <.50 | <.008 | 103 | 5 | 481 | 95 | 3318 |
| 613.20 | 623.20 | 562767 | cgri | | 65 | 5 | 110 | <.50 | <.008 | 804 | 7 | 527 | 81 | 3017 |
| 623.20 | 632.40 | 562768 | cgri | | 80 | 25 | 175 | <.50 | <.008 | 429 | 9 | 272 | 102 | 3416 |
| 632.40 | 644.00 | 562769 | cgri | | 55 | 5 | 105 | <.50 | <.008 | 801 | 2 | 153 | 104 | 3103 |
| 644.00 | 653.50 | 562770 | cgri | | 30 | 10 | 90 | <.50 | .010 | 775 | <2 | 72 | 126 | 2867 |
| 653.50 | 663.50 | 562771 | cgri | | 35 | 40 | 550 | <.50 | <.008 | 884 | 5 | 66 | 117 | 2703 |
| 663.50 | 673.50 | 562773 | cgri | | 110 | 15 | 300 | <.50 | <.008 | 735 | 7 | 153 | 96 | 2983 |
| 673.50 | 680.30 | 562774 | cgri | | 80 | 5 | 220 | <.50 | <.008 | 810 | 7 | 118 | 99 | 2511 |
| 680.30 | 691.30 | 562775 | cgri | | 80 | 5 | 155 | <.50 | <.008 | 1306 | 6 | 419 | 111 | 3565 |
| 691.30 | 701.90 | 562776 | cgri | | 25 | 45 | 95 | <.50 | .010 | 240 | 7 | 286 | 111 | 3096 |
| 701.90 | 710.00 | 562777 | cgri | | 15 | 45 | 60 | <.50 | .010 | 436 | 2 | 74 | 126 | 2936 |
| 710.00 | 718.00 | 562778 | cgri | | 90 | 5 | 125 | <.50 | .010 | 198 | 13 | 523 | 87 | 3252 |
| 718.00 | 722.30 | 562779 | cgri | | 45 | 45 | 108 | <.50 | <.008 | 516 | 4 | 23 | 141 | 2752 |
| 722.30 | 731.00 | 562780 | cgri | | 75 | 65 | 290 | .50 | .010 | 395 | 16 | 482 | 117 | 4036 |
| 731.00 | 740.15 | 562781 | cgri | | 70 | 25 | 110 | .50 | .010 | 417 | 22 | 264 | 102 | 3599 |
| 740.15 | 751.60 | 562782 | cgri | | 85 | 45 | 125 | <.50 | .015 | 587 | 8 | 128 | 102 | 3288 |
| 751.60 | 753.90 | 562783 | cgri | | 65 | 5 | 110 | <.50 | .015 | 638 | 9 | 151 | 122 | 3473 |
| 753.90 | 763.00 | 562784 | cgri | | 25 | 45 | 80 | <.50 | .010 | 802 | 7 | 11 | 142 | 2614 |
| 763.00 | 770.60 | 562785 | cgri | | 25 | 45 | 75 | <.50 | .010 | 725 | 5 | 15 | 140 | 2624 |
| 770.60 | 772.10 | 562786 | cgri | | 75 | 15 | 85 | .50 | .010 | 708 | 33 | 144 | 110 | 3625 |
| 772.10 | 776.80 | 562787 | cgri | | 30 | 45 | 65 | <.50 | .015 | 588 | 4 | 45 | 152 | 1668 |
| 776.80 | 787.30 | 562788 | cgri | | 65 | 20 | 110 | <.50 | .010 | 841 | 31 | 171 | 99 | 3111 |

| | | | | | | | | | | | | | |
|--------|--------|--------|------|----|----|-----|------|-------|-----|----|-----|-----|------|
| 787.30 | 790.40 | 562789 | cgri | 90 | 30 | 165 | <.50 | .020 | 868 | 56 | 303 | 109 | 3507 |
| 790.40 | 801.10 | 562790 | cgri | 65 | 30 | 115 | <.50 | .015 | 929 | 47 | 361 | 119 | 3718 |
| 801.10 | 812.65 | 562791 | cgri | 35 | <5 | 80 | <.50 | <.008 | 934 | 6 | 24 | 154 | 1811 |
| 812.65 | 821.40 | 562792 | cgri | 80 | 20 | 100 | <.50 | .010 | 844 | 42 | 249 | 103 | 3472 |
| 821.40 | 827.20 | 562793 | cgri | 20 | <5 | 70 | <.50 | <.008 | 868 | 7 | 9 | 135 | 2748 |
| 827.20 | 839.00 | 562794 | cgri | 65 | 10 | 130 | <.50 | <.008 | 599 | 30 | 354 | 111 | 3403 |
| 839.00 | 849.50 | 562795 | cgri | 45 | <5 | 80 | <.50 | <.008 | 674 | 13 | 140 | 124 | 3221 |
| 849.50 | 859.50 | 562797 | cgri | 90 | 25 | 135 | <.50 | .015 | 427 | 39 | 496 | 60 | 2548 |
| 859.50 | 869.50 | 562798 | cgri | 80 | 25 | 80 | <.50 | .015 | 433 | 36 | 655 | 68 | 2790 |
| 869.50 | 879.50 | 562799 | cgri | 70 | 20 | 95 | <.50 | .010 | 524 | 32 | 514 | 77 | 2822 |
| 879.50 | 889.50 | 562800 | cgri | 60 | 20 | 100 | <.50 | .020 | 660 | 42 | 329 | 100 | 2849 |
| 889.50 | 899.50 | 562826 | cgri | 75 | 10 | 130 | <.50 | <.008 | 764 | 10 | 88 | 103 | 3404 |
| 899.50 | 907.50 | 562827 | cgri | 70 | 30 | 160 | <.50 | .010 | 665 | 20 | 93 | 108 | 3482 |

085119

APPENDIX V

SAMPLE NUMBER: MAC 29 562974

SUMMARY: This rock is a plagioclase+augite-phyric basaltic lava that has suffered restricted post-eruption brecciation and weak silica veining.

HAND SPECIMEN:

This is a dark green plagioclase+augite-phyric andesite that shows quite strong but localized brecciation and groundmass silica alteration.

THIN SECTION DESCRIPTION:

Over most of this thin section, this andesitic lava is texturally well preserved, consisting of subequal proportions (~10 modal% each) of former plagioclase and augite phenocrysts. The plagioclase phenocrysts are blocky to slightly rounded euhedral to subhedral crystals to 3mm long, although most are around 1mm long. They are entirely altered to a very messy intergrowth of rather coarse-grained sericite and abundant patches of almost isotropic dirty brown aggregates of almost microcrystalline epidote. The augite phenocrysts vary from perfectly fresh to totally chloritized euhedral crystals mainly less than 1mm long, although much of the augite occurs as intergrowths of four or five augite crystals making clots up to 3mm across. They often show compositional zoning, and contain small crystalline inclusions of plagioclase and FeTi oxides. Small gabbroic clots of intergrown augite and plagioclase are not uncommon.

The groundmass of this sample, where best preserved, was very weakly vesicular and vitrophyric, defined by a slightly fluidal arrangement of tiny acicular plagioclase through former glass that has devitrified to an exceptionally fine-grained and almost isotropic quartz-feldspar-chlorite intergrowth. Small vesicles (< 0.5mm across) make up less than a few modal% of this lava and are filled by chalcedonic quartz, often with a core of almost colourless epidote. Brecciation, probably associated with fluid overpressure and hydrofracturing post-eruption has produced regions in the rock of quite pronounced false breccia textures. Occasional jigsaw fit fragments are notable, and most fragments are clearly separated one from the other by silica veinlets that often contain tiny rosettes and blebs of chlorite. Where veining and brecciation are most intense, the formerly largely groundmass has recrystallized more thoroughly and is less 'isotropic' than in less altered parts of the rock.

The abundance of augite phenocrysts and the groundmass textures suggests to me that this is a basaltic composition, tending towards a basaltic andesite. It has suffered post-eruption brecciation associated with weak silica alteration.

SAMPLE NUMBER: MAC 29 562975

SUMMARY: This sample is a mass flow volcanogenic conglomerate probably slumped off an andesitic volcano; it is dominated by strongly recrystallized formerly glassy andesite lava fragments.

HAND SPECIMEN:

This is a dark green quite polymict lava breccia or volcanogenic sandstone that contains diverse clasts of lava up to at least several cm long, in an altered volumetrically minor matrix.

THIN SECTION DESCRIPTION:

The diversity of lithic fragments in this sample show clearly that it is a polymict lava breccia or coarse volcanogenic sedimentary rock. Most fragments are 1-3mm long, and consist of plagioclase-phyric andesite, plagioclase+augite-phyric basalt and andesite, and glassy mafic to andesitic lava, but a few perlitic textured dacite fragments with sparse plagioclase phenocrysts are also present. Many of the fragments constituting this sample were glassy and vesicular, probably andesitic and have altered to quartz-albite-magnetite±chlorite assemblages. Less glassy fragments are often better preserved and were dominantly plagioclase-phyric andesites. Fragments containing abundant quite large, albitized blocky plagioclase phenocrysts in chlorite have probably been strongly affected by volume loss associated with pressure solution. Former augite phenocrysts in more mafic fragments are always altered to chlorite. There is no volcanic quartz in this rock. The alteration assemblages are quartz-dominated, although chlorite and epidote are not uncommon, the latter occurring as small pockets of well-formed prismatic pale yellow crystals.

I think that the exceptional diversity of lava fragments in this rock indicates that it has been redeposited, probably from a mass flow unit slumping off an andesite-dominated volcanic terrain. The matrix of this rock was possibly silty comminuted glass shards that were largely washed out during deposition, so that the formerly largely glassy lava fragments were compacted as they devitrified and recrystallized during burial metamorphism. This has led to strongly intergrown fragment margins and identification of former matrix is impossible. Occasional small concentrations of rather dark sphalerite were also noted.

195.0 m

SAMPLE NUMBER: MAC 29 562976

SUMMARY: This sample is a andesitic lava breccia dominated by plagioclase+minor augite-phyric glassy andesite lava fragments; it has suffered weak silica alteration that has enhanced the brecciated appearance of this rock.

HAND SPECIMEN:

This is a dark green andesitic lava breccia or volcanogenic conglomerate with less diverse lava fragments, although one pale plagioclase-phyric dacite(?) fragment at least several cm long is obvious in the hand specimen.

THIN SECTION DESCRIPTION:

The 'dacitic' clast noted above in the hand specimen description is actually a quite vesicular, formerly glassy plagioclase+sparsely augite-phyric andesite fragment. The perfectly round vesicles are filled with radiating fibrous quartz, and are cored with either pale yellow epidote, or bundles of pale green pleochroic pumpellyite, sometimes associated with fibrous albite. Plagioclase in this large clast occurs as small (mainly <1mm long) phenocrysts totally altered to albite, and often containing granular yellow epidote inclusions.

The remainder of this rock is dominated by formerly glassy fragments of plagioclase+augite-phyric andesite that have suffered strong alteration, dominated by silification. Plagioclase phenocrysts and groundmass microlites are mainly replaced by albite and epidote, whereas much less abundant augite phenocrysts are partly or wholly chloritized. The fragment groundmasses, and especially those areas in between fragments (very poorly defined due to recrystallization of glass) have all been altered to, or replaced by, granular fine-grained silica in which chlorite, very fine-grained to quite granular epidote, and large patches of prehnite occur. Minor amounts of disseminated reddish sphalerite occur in this sample.

Although several different types of lava fragments are present in this rock, the dominance of the one andesitic fragment type in this sample suggest that it is a lava breccia. The breccia texture has certainly been enhanced by silica alteration and 'false' brecciation. The metamorphic assemblage is clearly prehnite-pumpellyite facies.

085144

238.0m

SAMPLE NUMBER: MAC 29 562977

SUMMARY: This is a well-preserved augite+plagioclase-phyric vesicular basaltic lava.

HAND SPECIMEN:

This is a fairly massive dark grey-green vesicular andesitic to basaltic lava with sparse plagioclase and augite phenocrysts, chlorite-filled vesicles and occasional quartz veinlets.

THIN SECTION DESCRIPTION:

This is a texturally well-preserved basaltic lava consisting of about 5 modal% of fresh to chloritized augite phenocrysts and slightly less abundant and smaller albitized plagioclase phenocrysts in a formerly quite glass-rich groundmass in which acicular plagioclase microlites are abundant. Augite phenocrysts are mainly <1mm long euhedral crystals, but they often occur in multi-crystal clots, and intergrown with a few plagioclase crystals in gabbroic clots. Albitized plagioclase phenocrysts are rarely as long as 1mm, and often contain tiny chloritized melt inclusions paralleling crystal faces.

A feature of this rock is the relative abundance (5-8 modal%) of quite large (to 5mm across) ovoid vesicles that have been filled by a range of secondary products including radiating to botryoidal chalcedonic silica, patchy to radiating albite, granular yellow epidote and masses of green chlorite. The groundmass of this sample was vitrophyric, dominated by tiny acicular plagioclase microlites in glass. Devitrification of glass has produced a rather mottled appearance of the groundmass, due to concentrations of chlorite defining boundaries of lighter coloured zones in which quartz and albite produced during recrystallization of the devitrified glass are concentrated.

This is an augite+plagioclase-phyric vesicular basaltic lava.

319.2 m

SAMPLE NUMBER: MAC 29 562978

SUMMARY: This was a well-preserved quite primitive clinopyroxene+olivine-phyric vesicular basaltic lava.

HAND SPECIMEN:

This is a vesicular, rather massive grey-green basaltic lava with abundant clinopyroxene phenocrysts and calcite-filled vesicles up to almost 1cm across.

THIN SECTION DESCRIPTION:

This is a quite primitive basalt dominated by abundant phenocrysts of fresh clinopyroxene and altered olivine in a vitrophyric groundmass. The clinopyroxene phenocrysts make up about 12-15 modal% of this sample and are euhedral to subhedral and mainly 0.5-2mm long; they often show compositional zoning and are frequently intergrown in clots of three or more crystals. Former olivine phenocrysts make up about 5 modal% of this rock and have characteristic prismatic shapes to about 1.5mm long and have been entirely replaced by granular secondary quartz intergrown with pale green chlorite and calcite. Small chromite euhedra are commonly included in the olivine phenocrysts. There were no plagioclase phenocrysts in this sample, as it is too mafic (and thus hot) to crystallize plagioclase.

The groundmass of this sample is a mottled intergrowth of tiny acicular plagioclase microlites in devitrified glass that is almost isotropic, and contains small lighter coloured domains in which quartz (and albite?) have crystallized from the devitrified glass. The common large vesicles are filled by polycrystalline calcite, and the same mineral occurs in occasional narrow veinlets and fractures. This sample differs from those described above in that it lacks the plagioclase phenocrysts and is considerably more primitive (or magnesian). I would have guessed that it was from the Upper Basalt if I did not have the drill log.

357.8 m

SAMPLE NUMBER: MAC 29 562979

SUMMARY: This is a rather altered polymict basaltic lava breccia in which the dominant fragments are augite+plagioclase-phyric basalt and clinopyroxene+olivine-phyric basalt. It has suffered quite strong silica (\pm albite) alteration and veining.

HAND SPECIMEN:

This sample is a dark grey-green basaltic lava breccia with fragments of clinopyroxene-phyric basaltic lava to several cm long.

THIN SECTION DESCRIPTION:

This is a polymict lava breccia with much stronger alteration than the previous sample. The dominant fragment type is a vesicular augite+plagioclase-phyric basalt, not unlike sample 977 above. In these, augite phenocrysts predominate over albitized plagioclase phenocrysts, (about 8 modal% and 3-5 modal% respectively), and vesicles are filled with chalcedonic silica, chlorite and calcite. The groundmass of these lava fragments varies from what was clearly entirely glassy (now brownish devitrified almost isotropic glass) to strongly vitrophyric and 'trachytic' textures in which abundant often aligned plagioclase microlites predominate. Less abundant fragment types include augite+olivine-phyric basaltic lava fragments very similar to 978 above, and a few mafic phenocryst-free plagioclase-phyric andesites.

The matrix of this lava breccia is very altered and recrystallized, and has been soaked and veined by secondary silica and albite in which dark green chlorite and patchy to granular yellow epidote are not uncommon. Although I have no doubt that this was a polymict lava breccia, it is clear that the silica solutions exploded many fragments as they invaded the rock.

This basaltic lava breccia is dominated by fragments similar to the basalts described under 977 and 978 above (I realize the latter two are stratigraphically higher - it is simply a petrographic comparison without implications).

085147

469.6m

SAMPLE NUMBER: MAC 29 562980

SUMMARY: This is a distinctive sparsely plagioclase-phyric evolved andesite that texturally is more likely to be a shallow intrusive than a lava flow.

HAND SPECIMEN:

This is an aphyric, very even-textured pale grey-pinkish massive dacitic lava or shallow intrusive.

THIN SECTION DESCRIPTION:

This is a petrographically distinctive almost aphyric dacite or very silicic andesite lava that is quite unlike the more intermediate and mafic samples described above in this report. Small albitized plagioclase phenocrysts make up around 2-4 modal% of this rock, and one or two small totally chloritized former mafic phenocrysts (probably augite) were noted.

The remainder of this sample is an intergrowth of microlitic to somewhat more blocky small albite crystals with interstitial quartz and chlorite, and larger rather ragged and angular patches of coarser polycrystalline secondary quartz. The texture is not absolutely diagnostic, but I suggest that it is more likely that it represents a shallow intrusive rock in which there was not much glass, rather than the usual perlitic, highly glassy felsic lavas that occur in similar sequences in the region. I think the core log would better answer whether this rock is from the central portion of a quite thick flow, or else represents a shallow intrusive dacite body.

The alteration assemblage in this sample contains dispersed messy brownish yellow epidote, rather more than I would expect to see developed from degradation of a dacitic lava. Perhaps this is more andesitic than dacitic, although the paucity of mafic phenocrysts suggests that it is a low-MgO andesite (maybe 2-3%). This rock is probably a shallow andesitic to dacitic intrusive.

085148

110

480.6m

SAMPLE NUMBER: MAC 29 562981

SUMMARY: This sample was a vesicular plagioclase+augite+ sparse olivine-phyric basaltic lava.

HAND SPECIMEN:

This is a green rather altered massive plagioclase-phyric vesicular andesitic lava.

THIN SECTION DESCRIPTION:

This sample is mineralogically more altered than all those described above, as shown mainly by the thorough replacement of all former clinopyroxene phenocrysts by chlorite. The rock was a basaltic lava dominated by quite large phenocrysts of clinopyroxene and smaller plagioclase phenocrysts, but a few unambiguous former olivine phenocrysts are quite obvious in this section. The clinopyroxene phenocrysts reach 4mm long, but most are 1-2mm long euhedral crystals replaced entirely by green chlorite with deep blue anomalous pleochroism. Plagioclase phenocrysts were mainly euhedral prisms 0.5-1mm long, that were albitized then replaced virtually completely by calcite. They make up around 10 modal% of this rock, a similar amount to the augite phenocrysts. The few former olivine phenocrysts are pointed euhedra replaced by polycrystalline quartz, magnetite, calcite and chlorite.

The groundmass of this rock was probably glass charged with tiny acicular plagioclase microlites. The glass has devitrified and been partially and unevenly replaced by fine-grained calcite. Calcite is also the dominant vesicle filling. Zones of fluid-induced alteration brecciation in the sample are defined by almost jigsaw fit fragments being separated by lighter coloured and coarser-grained zones dominated by secondary silica, often intergrown with minor magnetite(?). A zone of more intense deformation has produced an almost schistose fabric in a limited part of the thin section.

This was a vesicular plagioclase+augite+sparse olivine-phyric basaltic lava.

085149

SAMPLE NUMBER: MAC 29 562982

SUMMARY: This rock is a strongly altered formerly plagioclase+augite±olivine-phyric basaltic lava with relatively intense calcite-pyrite alteration compared with the overlying samples.

HAND SPECIMEN:

This is a strongly carbonate-altered andesitic (?) lava with stringer pyrite.

THIN SECTION DESCRIPTION:

This sample is considerably more altered than the preceding samples in this report. It was clearly a porphyritic basalt with at least two types of phenocrysts. Relic crystal shapes suggest that the dominant phenocrysts were augite and plagioclase, although it is impossible to rule out that olivine phenocrysts were also present. Former plagioclase phenocrysts make up about 3-5 modal% of this rock and were mainly elongate prisms around 1mm long. They have altered totally to fine-grained sericite and minor carbonate. Former mafic phenocrysts were almost certainly mainly augite. They also make up around 5 modal% of this sample and are mainly 1-3mm long. They have been entirely replaced by messy very fine-grained intergrowths of secondary silica, chlorite and common calcite, spattered with tiny magnetite(?) streaks and grains that often tend to rim crystals and define former grain shapes.

The groundmass of this rock is so altered as to preclude positive identification of the original texture, although I am inclined to think it was quite glassy, since there are no tiny plagioclase microlites dispersed throughout it. The groundmass probably devitrified and secondary patchy silica crystallized from the devitrified glass before strong carbonate alteration overprinted the lot. Veinlets composed of calcite and dispersed aggregates of small pyrite euhedra are common, but much less than 1mm thick usually.

This sample was a plagioclase+augite±olivine-phyric basaltic lava that has suffered strong carbonate+pyrite alteration, clearly of local hydrothermal origin.

SAMPLE NUMBER: MAC 29 562983

SUMMARY: This sample was an augite+plagioclase-phyric basaltic lava that has undergone strong silica-carbonate (\pm pyrite) alteration.

HAND SPECIMEN:

This is an intensely altered former mafic lava or lava breccia with strong silica-carbonate alteration.

THIN SECTION DESCRIPTION:

This rock consists of cores of relatively weakly altered lava fragments set in a very strongly altered, in places schistose, matrix. Most of the lava fragments appear to have been petrographically similar, so the rock may have been a massive lava, or a lava breccia. The intense brecciation that dominates the sample is clearly associated with the strong alteration.

Most lava fragments were augite+plagioclase-phyric basalts, with large chloritized augite phenocrysts being somewhat more abundant than the smaller (mainly <1mm long) albitized plagioclase phenocrysts. In the more schistose lava fragments, the chloritized former augite phenocrysts are stretched out into the weak foliation, whereas albitized plagioclase phenocrysts have maintained their euhedral shapes. It is impossible to tell whether any of the altered formerly mafic phenocrysts were olivine, although the relative abundance of plagioclase phenocrysts might suggest that this basalt was rather evolved.

The groundmass of most fragments was clearly vitrophyric, with acicular albite microlites set in devitrified and altered glass. However, large areas of groundmass have been swamped by relatively coarse- to very fine-grained silica, with subordinate dirty brownish calcite or siderite as a minor alteration phase. Schistose fabrics in high strain zones are more chloritic and have sericitic streaks compared with less altered parts of the rock. Quite large idiomorphic pyrite cubes are associated with ribbon quartz veinlets that transect this rock.

This was an augite+plagioclase-phyric basaltic lava that has suffered strong silica-carbonate alteration.

SAMPLE NUMBER: MAC 29 562984

SUMMARY: This rock was an augite+plagioclase-phyric basaltic lava that is quite altered (silica-pyrite) compared to similar lithologies higher in MAC 29.

HAND SPECIMEN:

This is a massive dark green slightly carbonate-altered porphyritic basalt with abundant very fine-grained disseminated pyrite and abundant altered augite(?) and plagioclase phenocrysts.

THIN SECTION DESCRIPTION:

This sample was originally an augite+plagioclase-phyric basaltic lava. Augite phenocrysts to about 3mm long maximum are entirely altered to admixtures of pale green chlorite and fine-grained silica. A few crystals with outlines suggestive of former olivine phenocrysts are also quartz-chlorite-altered, although these also have rims of very fine-grained opaques. The former mafic phenocrysts, clearly dominated by augite, make up about 7-10 modal% of this rock. Plagioclase phenocrysts make up about 5-7 modal% of this rock and are tabular prismatic crystals, generally less than 1mm long, that show a flow alignment and are invariably strongly altered to fine-grained sericite, chlorite and calcite.

The groundmass of this rock was vitrophyric to trachytic, being composed largely of tiny plagioclase microlites showing strong flow alignment. Interstitial glass in the groundmass has devitrified to irresolvable felsic material with dispersed tiny Fe or FeTi oxides. Scattered abundantly throughout the groundmass are patches of polycrystalline quartz that appears to have segregated from the altering groundmass, commonly in association with granular epidote and small pyrite crystals. The groundmass is transected by many discontinuous high-strain zones which have focussed both pressure solution and the concentration of dark fine-grained insoluble residues, and deposition of pyrite.

569.8m

SAMPLE NUMBER: MAC 29 562985

SUMMARY: This is a quite strongly altered formerly plagioclase + augite-phyric basaltic andesite or andesite lava with an earlier alteration assemblage of silica-magnetite-pyrite, and a later overprinting calcite±pyrite alteration assemblage.

HAND SPECIMEN:

This is a grey quite altered plagioclase-phyric andesitic lava with veins of calcite, and disseminated calcite-pyrite alteration.

THIN SECTION DESCRIPTION:

In thin section, this sample is clearly seen to have been a plagioclase+augite-phyric andesite or basaltic andesite lava. Small (mainly <1.5mm long) albitized plagioclase phenocrysts make up about 10 modal% of the rock, show no preferred orientation, and are strongly overprinted by sericite-calcite alteration. Former augite phenocrysts are less abundant but larger than the plagioclase phenocrysts, and are totally altered to chlorite-silica-magnetite intergrowths that have also been overprinted by calcite.

The groundmass of this rock was largely glassy, and has devitrified to a near-isotropic irresolvable material containing small spots of secondary quartz and riddled with tiny opaques (magnetite? or pyrite?). Meandering veinlets and fractures are filled either with dark very fine-grained epidote spotted with magnetite/hematite grains, or else quartz-calcite veins with dispersed coarser-grained pyrite. Concentrations of pyrite not associated with banding are also present, although the individual pyrite crystals are usually <0.1mm across.

This is a strongly altered plagioclase+augite-phyric basaltic andesite or andesite lava in which a silica-magnetite-pyrite alteration appears to have been overprinted by calcite (±pyrite) alteration.

085153

SAMPLE NUMBER: MAC 29 562986

SUMMARY: This was a relatively well-preserved vesicular glassy augite+ plagioclase-phyric basaltic lava, with weak autobrecciation, probably from close to the top of a cooling unit. It is significantly less altered than samples in this core immediately above and below it.

HAND SPECIMEN:

This is a dark grey autobrecciated augite-phyric basaltic lava that is much less altered than the preceding four samples. Fragments are up to at least 1cm across.

THIN SECTION DESCRIPTION:

This is an autobrecciated and vesicular augite+plagioclase - phyric basaltic lava with a largely (formerly) glassy groundmass texture. Some augite phenocrysts are euhedra up to almost 5mm long, commonly occurring in clots of three or more crystals. Augite phenocrysts vary from perfectly fresh to totally chloritized, and they make up around 7-10 modal% of the rock. Former plagioclase phenocrysts are slightly less abundant and generally smaller than the augite phenocrysts, and they are always totally replaced by fine-grained sericite, although ghost twinning and compositional zoning is often still visible.

The groundmass texture of this sample varies from fragment to fragment, although there is no doubt that all fragments are from a single flow, probably near the top of that flow, and represent textural variation reflecting variable cooling rate. In some fragments, the groundmass was essentially entirely glass with few microlites of plagioclase, and the glass has devitrified to a near isotropic exceedingly fine-grained brownish material. In other more slowly-cooled fragments, the devitrified glass is charged with tiny plagioclase microlites. Ovoid to round vesicles make up around 2-4 modal% of the rock and are lined with a narrow band of quartz and filled by pale green chlorite. In zones between fragments, alteration is far more intense, with strong chlorite-silica alteration accompanied by trains and concentrations of tiny magnetite(?) granules. Cross-cutting calcite veins are clearly the latest alteration feature.

This formerly augite+plagioclase-phyric basaltic lava is notably less altered than those samples from above it (81 - 85) and below it (87-89) in MAC 29. This may simply be a relatively weakly altered 'core' surrounded by more intense alteration in the 'footwall alteration zone'. Alternatively, it may be that the alteration zone is repeated or thickened by faulting.

SAMPLE NUMBER: MAC 29 562987

SUMMARY: This is a very strongly altered formerly augite(+plagioclase?)-phyric basaltic hyaloclastite, with variable vesicularity in fragments. Alteration was early silica-pyrite-(sericite/fuchsite) followed by later calcite overprinting.

HAND SPECIMEN:

This is a grey green strongly carbonate altered formerly augite+plagioclase-phyric basaltic lava breccia, with common fuchsite and disseminated pyrite.

THIN SECTION DESCRIPTION:

This is probably the most strongly altered sample in the set being examined. It appears to have been a basaltic lava breccia or hyaloclastite, and unlike most of the other samples from this hole, contains abundant very strongly vesicular basaltic lava fragments, resembling scoria. These contain stretched and totally altered (chloritized, then overprinted by calcite) former augite phenocrysts, and the degree of alteration is too intense to decide for certain whether smaller carbonate-altered phenocrysts in these vesicular fragments were plagioclase or augite. The formerly glassy groundmass of these fragments is a very messy heterogeneous and often weakly foliated intergrowth of sericite and fine-grained carbonate, and brown less altered devitrified glass, riddled with small rounded vesicles filled by silica and calcite.

Less vesicular (vesicles < ~ 10 modal%) fragments appear to have been quite glassy augite-phyric basalts, in which the groundmass is dominantly brown devitrified glass now containing abundant fine-grained brown carbonate. Former augite phenocrysts are chlorite-calcite altered, and barely recognizable, and the former existence of smaller plagioclase phenocrysts is arguable. Vesicles in these less vesicular fragments are larger (to 2mm across) and filled by a similar carbonate-dominated assemblage as in the highly vesicular fragments.

The fuchsite so obvious in the hand specimen is certainly not obvious in thin section, although the thin section cut-off shows that the sample cut for thin section unfortunately came from the least fuchsitic part of the hand specimen provided. Disseminated pyrite is most concentrated in the inter-fragment areas and in vesicles and fractures. It is definitely associated with the earlier alteration phase, which was silica-sericite(fuchsite?)-pyrite. Subsequent calcite alteration had overprinted and veined this rock.

SAMPLE NUMBER: MAC 29 562988

SUMMARY: This sample was a basaltic lava breccia dominated by augite+plagioclase (\pm olivine?)-phyric basalt fragments and considerably more vesicular and glassy fragments, probably of similar phenocryst assemblage. The latter have focussed and absorbed deformation and are now foliated and far more altered than the less glassy, less vesicular fragments. Silica-pyrite-chlorite alteration preceded calcite overprinting.

HAND SPECIMEN:

This is a coarse basaltic lava breccia in which paler-coloured porphyritic and altered basaltic lava fragments to at least several cm long are set in a dark green strongly altered and foliated matrix; the rock contains disseminated pyrite.

THIN SECTION DESCRIPTION:

The large paler-coloured fragments in this sample are porphyritic basalt in which former augite phenocrysts make up around 5 modal% of the rock, and a few small tabular prismatic altered plagioclase phenocrysts are usually present. The former presence of olivine phenocrysts is very difficult to ascertain, due to the strong alteration, although relic crystal shapes of a few phenocrysts are very reminiscent of olivine. All the former mafic phenocrysts are pseudomorphed by calcite, and the plagioclase phenocrysts are replaced by fine-grained sericite.

The matrix areas between the basalt fragments in this rock are dominantly composed of green chlorite that is quite foliated, and clearly replacing strongly vesicular and deformable basaltic glass fragments. Augite phenocrysts in the former glass have been stretched into the foliation, microcrystalline silica-filled vesicles likewise, and blebby calcite overprints and veins much of the inter-fragment areas. In these areas, disseminated pyrite occurs as narrow veinlets and trains, and occasional coarser clumps of pyrite crystals up to a few mm across occur. Tiny sericitized plagioclase microlites are present in chloritized glass in some of these fragments.

It could be that the glassy, vesicular fragments now smeared out between the more competent basalt fragments represent parts of the same flow, mixed together during explosive eruption and production of hyaloclastite-type lava breccia.

SAMPLE NUMBER: MAC 29 562989

SUMMARY: This is a weakly altered sparsely plagioclase-phyric glassy andesite more similar to the rocks at the base of MAC 28 than the overlying basaltic lava pile in MAC 29.

HAND SPECIMEN:

This is a massive finely plagioclase-porphyritic dark grey andesite lava.

THIN SECTION DESCRIPTION:

This rock was a weakly plagioclase-phyric andesitic lava with a glassy groundmass. Plagioclase phenocrysts, mainly less than 1mm long, make up a few modal% of this lava and are albitized and partly overprinted by fine-grained sericite-calcite alteration. They show distinct flow alignment. There are no unambiguous former mafic phenocrysts in this section.

The groundmass of this rock was originally quite homogeneous, and largely glassy, with occasional small vesicles (now quartz-calcite filled). The groundmass has been totally devitrified, and variably altered across the slide, mainly reflected in the intensity of sericite meshing. Sericite defines a weak foliation in the most altered regions of the thin section, and small blebs of clear quartz have grown from the altered glass. Pyrite occurs as small crystals growing in abundance in meandering veinlets of fibrous quartz.

This rock was a sparsely plagioclase-phyric glassy andesite, and is quite distinctly different from the other lavas in the lower part of this hole, which are entirely basaltic. It resembles more the rock at the base of MAC 28 (808).



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Division of In-house Inspection and Testing Services Australia Pty Ltd.

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22 OCT 1991

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Mirkell St. COOEE TAS 7320

Fax (004) 318890

ANALYTICAL REPORT No.

100560.60.08298

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INVOICE TO:

Aberfoyle Resources Limited
Exploration Division
P.O. Box 952
BURNIE TAS 7320

ORDER No.

13283

PROJECT

MAC - 29

DATE RECEIVED

23/09/91

RESULTS REQUIRED

ASAP

No. OF PAGES OF RESULTS

3

DATE REPORTED

21/10/91

No. OF COPIES

1

TOTAL No. OF SAMPLES

16

SAMPLE NUMBERS

SAMPLE DESCRIPTION

ELEMENT/METHOD

562974/989

DC Prep : 6P009,6P018

Cu,Pb,Zn,Ag/6A101

562974/989

DC Prep :

Ba,As,Cr,Zr,Ti,Rb,Sr/6X401

562974/989

DC Prep :

TiZr/6X401

562974/989

DC Prep :

Whole Rock Analysis/6X408

RESULTS

TO

Mr R de Romford
Aberfoyle Resources Limited
PO Box 952
BURNIE TAS 7320

REMARKS

PETROLOGY SAMPLING

RESULTS

TO

RESULTS

TO

AUTHORISED OFFICER

ANALABS

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ANALYTICAL DATA

SAMPLE PREFIX REPORT NUMBER REPORT DATE CLIENT ORDER No PAGE

1.00560.60.08298 21/10/91 13283 1 OF 3

| TUBE No. | SAMPLE No. | Cu | Pb | Zn | Ag | Ba | As | Cr | Zr | Ti |
|----------|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1 | 562974 | 46 | 149 | 421 | <0.5 | 880 | 17 | 130 | 130 | 4300 |
| 2 | 562975 | 108 | 190 | 2250 | <0.5 | 2150 | 30 | 20 | 140 | 3730 |
| 3 | 562976 | 104 | 760 | 427 | <0.5 | 760 | 27 | 40 | 145 | 3820 |
| 4 | 562977 | 50 | 19 | 82 | <0.5 | 560 | 6 | 235 | 140 | 3330 |
| 5 | 562978 | 73 | <5 | 102 | <0.5 | 240 | 5 | 555 | 80 | 2340 |
| 6 | 562979 | 70 | 14 | 91 | <0.5 | 870 | 11 | 210 | 95 | 2900 |
| 7 | 562980 | <5 | <5 | 81 | <0.5 | 1010 | 11 | 10 | 190 | 2400 |
| 8 | 562981 | 79 | 8 | 257 | <0.5 | 180 | 48 | 1065 | 65 | 2860 |
| 9 | 562982 | 79 | <5 | 88 | <0.5 | 370 | 48 | 305 | 115 | 3030 |
| 10 | 562983 | 74 | <5 | 120 | <0.5 | 130 | 18 | 590 | 95 | 2760 |
| 11 | 562984 | 87 | <5 | 104 | <0.5 | 250 | 37 | 725 | 80 | 2630 |
| 12 | 562985 | 94 | 327 | 748 | <0.5 | 360 | 48 | 365 | 95 | 3370 |
| 13 | 562986 | 68 | 119 | 223 | <0.5 | 470 | 17 | 540 | 75 | 2500 |
| 14 | 562987 | 65 | 17 | 79 | <0.5 | 650 | 19 | 515 | 65 | 1950 |
| 15 | 562988 | 78 | 11 | 139 | <0.5 | 330 | 5 | 515 | 70 | 2310 |
| 16 | 562989 | 50 | 11 | 69 | <0.5 | 610 | 8 | <5 | 160 | 3930 |
| 18 | | | | | | | | | | |
| 19 | | | | | | | | | | |
| 20 | | | | | | | | | | |
| 21 | | | | | | | | | | |
| 22 | | | | | | | | | | |
| 23 | DETECTION | 5 | 5 | 5 | 0.5 | 10 | 2 | 5 | 5 | 50 |
| 24 | UNITS | ppm |
| 25 | METHOD | GA101 | GA101 | GA101 | GA101 | GX401 | GX401 | GX401 | GX401 | GX401 |

Results in ppm unless otherwise specified
 T = element present, but concentration too low to measure
 X = element concentration is below detection limit
 - = element not determined

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ANALYTICAL DATA

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13283

2 OF 3

| TUBE No. | SAMPLE No. | TiZr | Rb | Sr | Al2O3 | SiO2 | TiO2 | Fe2O3 | MnO | Na2O |
|----------|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1 | 562974 | 33.08 | 45 | 615 | 15.68 | 53.2 | 0.717 | 9.35 | 0.38 | 1.96 |
| 2 | 562975 | 26.64 | 115 | 385 | 13.95 | 62.0 | 0.622 | 8.10 | 0.19 | 2.32 |
| 3 | 562976 | 26.34 | 35 | 575 | 15.34 | 59.0 | 0.637 | 8.11 | 0.23 | 3.80 |
| 4 | 562977 | 23.78 | 30 | 465 | 11.88 | 66.1 | 0.555 | 6.47 | 0.16 | 3.42 |
| 5 | 562978 | 29.25 | 15 | 380 | 11.35 | 54.9 | 0.390 | 6.99 | 0.19 | 2.74 |
| 6 | 562979 | 30.52 | 55 | 455 | 13.09 | 56.7 | 0.483 | 7.86 | 0.17 | 2.71 |
| 7 | 562980 | 12.63 | 70 | 355 | 14.70 | 66.5 | 0.400 | 5.07 | 0.12 | 3.97 |
| 8 | 562981 | 44.00 | 10 | 315 | 14.10 | 47.0 | 0.477 | 9.58 | 0.35 | 2.80 |
| 9 | 562982 | 26.35 | 90 | 95 | 12.19 | 51.8 | 0.505 | 8.88 | 0.12 | 0.75 |
| 10 | 562983 | 29.05 | 10 | 165 | 11.47 | 57.7 | 0.461 | 7.44 | 0.16 | 0.93 |
| 11 | 562984 | 32.88 | 10 | 355 | 13.86 | 52.9 | 0.439 | 8.60 | 0.15 | 2.32 |
| 12 | 562985 | 35.47 | 45 | 360 | 15.25 | 55.8 | 0.562 | 8.31 | 0.15 | 3.70 |
| 13 | 562986 | 33.33 | 15 | 385 | 14.41 | 51.4 | 0.417 | 8.94 | 0.21 | 2.39 |
| 14 | 562987 | 30.00 | 60 | 195 | 12.06 | 53.3 | 0.326 | 7.26 | 0.22 | 0.85 |
| 15 | 562988 | 33.00 | 35 | 310 | 11.69 | 47.1 | 0.385 | 8.18 | 0.19 | 1.37 |
| 16 | 562989 | 24.56 | 85 | 140 | 14.40 | 63.9 | 0.656 | 6.08 | 0.05 | 1.96 |
| 17 | | | | | | | | | | |
| 18 | | | | | | | | | | |
| 19 | | | | | | | | | | |
| 20 | | | | | | | | | | |
| 21 | | | | | | | | | | |
| 22 | | | | | | | | | | |
| 23 | DETECTION | 0.01 | 5 | 5 | 0.05 | 0.1 | 0.005 | 0.01 | 0.01 | 0.05 |
| 24 | UNITS | % | ppm | ppm | % | % | % | % | % | % |
| 25 | METHOD | GX401 | GX401 | GX401 | OX408 | OX408 | GX401 | OX408 | OX408 | OX408 |

Results in ppm unless otherwise specified
 T = element present, but concentration too low to measure
 X = element concentration is below detection limit
 - = element not determined

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100

085161

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ANALYTICAL DATA

SAMPLE PREFIX

REPORT NUMBER

REPORT DATE

CLIENT ORDER No.

PAGE

100560.60.08298

21/10/91

13283

3 OF 3

| TUBE No. | SAMPLE No. | CaO | K2O | MgO | F2O5 | S | LOI | TOTAL | | |
|----------|------------|-------|-------|-------|-------|-------|-------|--------|--|--|
| 1 | 562974 | 8.11 | 1.24 | 5.58 | 0.176 | 0.07 | 3.21 | 99.76 | | |
| 2 | 562975 | 2.65 | 3.79 | 2.34 | 0.200 | 0.97 | 2.32 | 100.91 | | |
| 3 | 562976 | 5.63 | 1.16 | 2.92 | 0.192 | 0.11 | 2.32 | 99.62 | | |
| 4 | 562977 | 4.63 | 0.96 | 3.66 | 0.274 | 0.08 | 1.42 | 99.74 | | |
| 5 | 562978 | 10.33 | 0.37 | 6.60 | 0.182 | 0.17 | 5.12 | 99.58 | | |
| 6 | 562979 | 6.82 | 1.85 | 5.87 | 0.143 | 0.42 | 2.80 | 99.57 | | |
| 7 | 562980 | 2.10 | 2.86 | 1.73 | 0.181 | 0.04 | 2.03 | 99.71 | | |
| 8 | 562981 | 7.05 | 0.30 | 8.43 | 0.105 | 0.27 | 8.76 | 99.61 | | |
| 9 | 562982 | 6.44 | 2.12 | 4.84 | 0.279 | 3.03 | 6.77 | 102.20 | | |
| 10 | 562983 | 1.82 | 0.29 | 11.79 | 0.186 | 1.42 | 6.67 | 102.48 | | |
| 11 | 562984 | 5.25 | 0.20 | 8.05 | 0.126 | 2.11 | 4.91 | 102.17 | | |
| 12 | 562985 | 3.64 | 1.17 | 5.01 | 0.119 | 2.68 | 5.17 | 105.54 | | |
| 13 | 562986 | 5.50 | 0.48 | 9.74 | 0.075 | 0.45 | 5.56 | 100.24 | | |
| 14 | 562987 | 7.27 | 1.69 | 5.35 | 0.057 | 1.68 | 7.49 | 100.06 | | |
| 15 | 562988 | 10.83 | 0.75 | 6.70 | 0.133 | 0.80 | 10.87 | 100.21 | | |
| 16 | 562989 | 2.26 | 2.16 | 1.94 | 0.230 | 1.37 | 3.45 | 100.51 | | |
| 17 | | | | | | | | | | |
| 18 | | | | | | | | | | |
| 19 | | | | | | | | | | |
| 20 | | | | | | | | | | |
| 21 | | | | | | | | | | |
| 22 | | | | | | | | | | |
| 23 | DETECTION | 0.01 | 0.01 | 0.01 | 0.005 | 0.01 | 0.01 | 0.01 | | |
| 24 | UNITS | % | % | % | % | % | % | % | | |
| 25 | METHOD | OX408 | OX408 | OX408 | OX408 | OX408 | OM615 | OX408 | | |

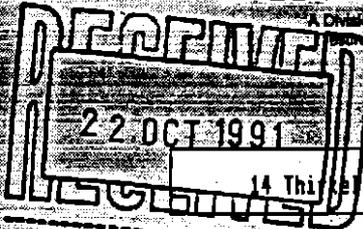
Results in ppm unless otherwise specified
 T = element present but concentration too low to measure
 X = element concentration is below detection limit
 - = element not determined

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A Division of Incharge Inspection and Testing Services Australia Pty Ltd



14 Thistle St. COOEE TAS 7320

Phone (004) 316837

Fax (004) 318890

ANALYTICAL REPORT No.

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PROJECT

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MAC - 29

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TOTAL No. OF SAMPLES

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21/10/91

1

81

SAMPLE NUMBERS

SAMPLE DESCRIPTION

ELEMENT/METHOD

562725/805

DC Prep : 6P009,6P012,6P018

Au,Au(R)/66309

562725/805

DC Prep :

Cu,Pb,Zn,Ag/6A101

562725/805

DC Prep :

Ba,As,Cr,Zr,Ti,Rb,Sr/6X401

562725/805

DC Prep :

TiZr/6X401

562725/805

DC Prep :

Whole Rock Analysis/6X408

REMARKS

RESULTS

TO

Mr R de Bomford
Aberfoyle Resources Limited
PO Box 952
BURNIE TAS 7320

Core Grids MAC-29

RESULTS

TO

RESULTS

TO

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APPENDIX VI

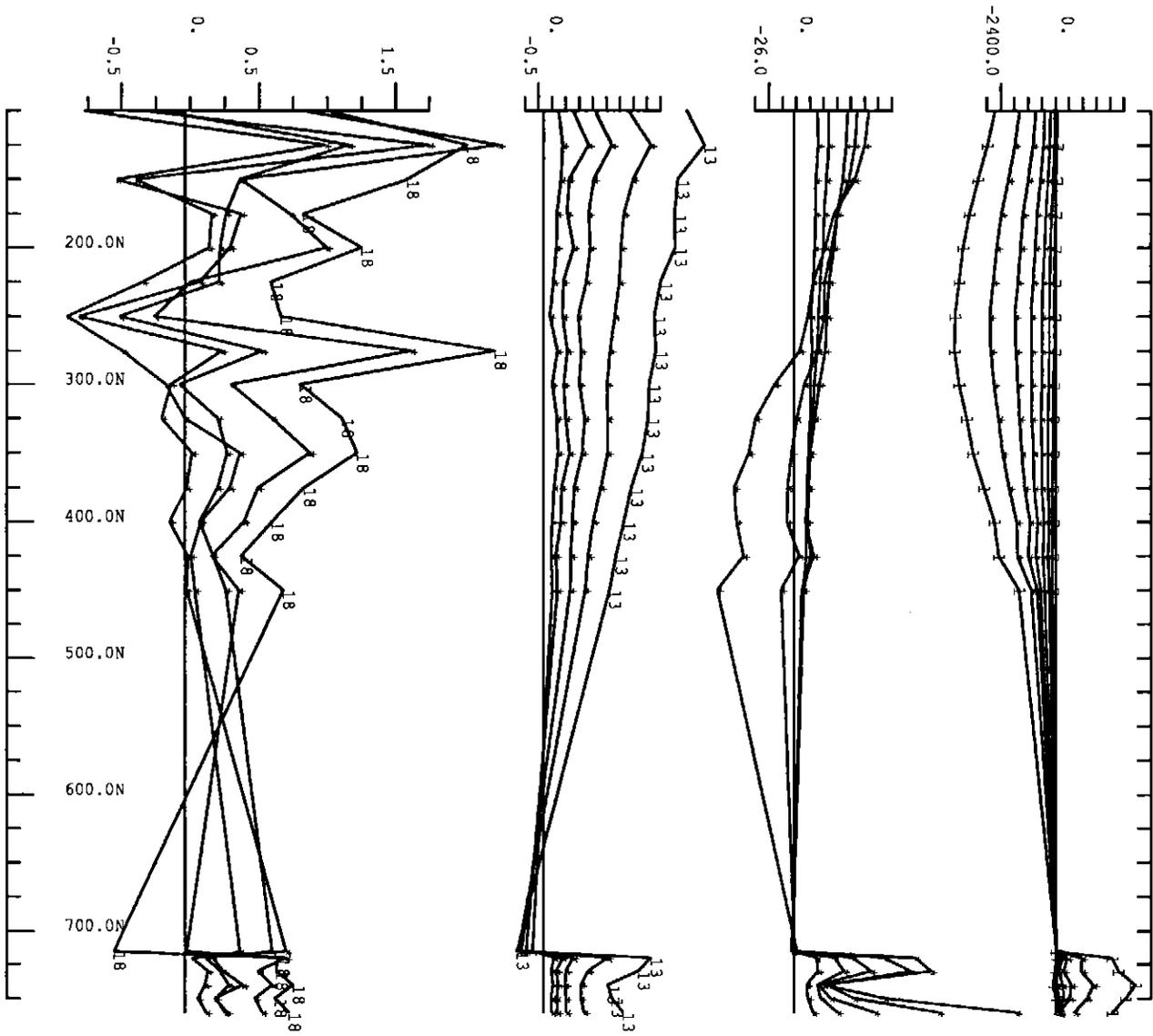
163

| From | To | Sample | Cu | Pb | Zn | Ag | Au | Ba | As | Cr | Zr | Ti | Rb | Sr |
|--------|--------|--------|-----|-----|------|------|-------|------|-----|-----|-----|------|-----|-----|
| | | | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm |
| .00 | 7.00 | 622001 | 59 | 274 | 256 | <.50 | <.008 | 795 | 11 | 145 | 140 | 4300 | 50 | 250 |
| 7.00 | 20.70 | 622002 | 38 | 254 | 293 | <.50 | .010 | 1435 | 5 | 20 | 200 | 3250 | 95 | 150 |
| 20.70 | 38.60 | 622003 | 67 | 164 | 422 | <.50 | <.008 | 1150 | 14 | 115 | 140 | 4510 | 85 | 190 |
| 38.60 | 45.00 | 622004 | 50 | 7 | 131 | <.50 | <.008 | 880 | 16 | 110 | 115 | 3600 | 60 | 405 |
| 45.00 | 55.00 | 622005 | 36 | 47 | 191 | <.50 | <.008 | 940 | 11 | 105 | 130 | 3830 | 50 | 460 |
| 55.00 | 62.50 | 622006 | 63 | 77 | 196 | <.50 | <.008 | 1355 | 6 | 80 | 125 | 3680 | 70 | 550 |
| 62.50 | 70.30 | 622007 | 53 | 58 | 157 | <.50 | <.008 | 915 | 8 | 75 | 130 | 3730 | 45 | 535 |
| 70.30 | 79.30 | 622008 | 16 | 13 | 89 | <.50 | <.008 | 1285 | 4 | 10 | 150 | 2810 | 70 | 540 |
| 79.30 | 86.40 | 622009 | 44 | 21 | 116 | <.50 | <.008 | 840 | 11 | 115 | 135 | 4440 | 55 | 385 |
| 86.40 | 96.00 | 622010 | 41 | 62 | 294 | <.50 | <.008 | 900 | 11 | 130 | 125 | 4460 | 55 | 390 |
| 96.00 | 106.00 | 622011 | 46 | 82 | 284 | <.50 | <.008 | 870 | 5 | 130 | 115 | 4090 | 50 | 410 |
| 106.00 | 116.60 | 622012 | 21 | 20 | 233 | <.50 | <.008 | 855 | 5 | 130 | 115 | 4060 | 60 | 410 |
| 116.60 | 119.90 | 622013 | 20 | 5 | 93 | <.50 | <.008 | 340 | 2 | 20 | 165 | 2380 | 55 | 210 |
| 119.90 | 130.00 | 622016 | 50 | 64 | 228 | <.50 | <.008 | 1300 | 19 | 145 | 115 | 3790 | 50 | 480 |
| 130.00 | 142.80 | 622017 | 57 | 35 | 136 | <.50 | <.008 | 1095 | 13 | 150 | 115 | 3300 | 60 | 505 |
| 142.80 | 147.00 | 622018 | 46 | 184 | 525 | <.50 | <.008 | 845 | 16 | 150 | 120 | 3420 | 35 | 505 |
| 147.00 | 157.50 | 622019 | 59 | 148 | 542 | <.50 | <.008 | 1555 | 20 | 125 | 115 | 3360 | 65 | 470 |
| 157.50 | 162.20 | 622020 | 38 | 73 | 1815 | <.50 | <.008 | 1415 | 19 | 35 | 150 | 4030 | 65 | 360 |
| 162.20 | 169.60 | 622021 | 39 | 54 | 193 | <.50 | <.008 | 1730 | 8 | 55 | 135 | 3970 | 100 | 520 |
| 169.60 | 180.00 | 622022 | 42 | 182 | 568 | .80 | <.008 | 1215 | 14 | 65 | 125 | 3580 | 60 | 530 |
| 180.00 | 190.00 | 622023 | 28 | 42 | 245 | <.50 | <.008 | 705 | 14 | 55 | 130 | 3670 | 40 | 540 |
| 190.00 | 200.00 | 622024 | 65 | 223 | 438 | <.50 | <.008 | 1430 | 19 | 180 | 120 | 3410 | 60 | 595 |
| 200.00 | 210.00 | 622025 | 47 | 22 | 132 | <.50 | <.008 | 860 | 8 | 430 | 115 | 3020 | 50 | 525 |
| 210.00 | 219.20 | 622026 | 45 | 7 | 87 | <.50 | .025 | 1010 | 11 | 300 | 125 | 3160 | 60 | 535 |
| 219.20 | 234.20 | 622027 | 35 | 25 | 119 | <.50 | <.008 | 900 | 8 | 295 | 150 | 3700 | 50 | 575 |
| 234.20 | 247.80 | 622028 | 38 | 74 | 379 | <.50 | <.008 | 1265 | 8 | 405 | 145 | 3610 | 65 | 560 |
| 247.80 | 259.10 | 622029 | 22 | 53 | 426 | <.50 | <.008 | 760 | 8 | 240 | 140 | 3790 | 35 | 605 |
| 259.10 | 272.00 | 622030 | 78 | 52 | 696 | <.50 | <.008 | 1915 | 12 | 915 | 80 | 2830 | 75 | 340 |
| 272.00 | 286.30 | 622031 | 66 | 18 | 170 | <.50 | <.008 | 1335 | 9 | 885 | 70 | 2750 | 55 | 470 |
| 286.30 | 295.00 | 622032 | 59 | 10 | 201 | <.50 | <.008 | 530 | 10 | 555 | 100 | 2780 | 25 | 550 |
| 295.00 | 305.50 | 622033 | 69 | 31 | 135 | <.50 | <.008 | 810 | 12 | 385 | 115 | 2910 | 35 | 575 |
| 305.50 | 315.90 | 622034 | 78 | 24 | 458 | <.50 | <.008 | 980 | 7 | 750 | 85 | 2700 | 30 | 430 |
| 315.90 | 326.70 | 622035 | 58 | <5 | 119 | <.50 | <.008 | 145 | 5 | 645 | 75 | 2450 | 5 | 425 |
| 326.70 | 334.50 | 622036 | 40 | 53 | 198 | <.50 | <.008 | 40 | 9 | 740 | 80 | 2680 | 5 | 375 |
| 334.50 | 339.40 | 622037 | 47 | <5 | 137 | <.50 | <.008 | 1065 | 3 | 370 | 80 | 2740 | 80 | 400 |
| 339.40 | 353.00 | 622038 | 55 | 19 | 135 | <.50 | <.008 | 765 | 11 | 330 | 90 | 2820 | 35 | 400 |
| 353.00 | 366.50 | 622039 | 33 | 21 | 115 | <.50 | <.008 | 650 | 15 | 255 | 105 | 3220 | 35 | 455 |
| 366.50 | 383.70 | 622040 | 16 | 75 | 259 | <.50 | <.008 | 1115 | 15 | 155 | 130 | 4080 | 50 | 460 |
| 383.70 | 393.30 | 622042 | 28 | 60 | 141 | <.50 | <.008 | 395 | 21 | 150 | 120 | 4070 | 15 | 400 |
| 393.30 | 406.50 | 622043 | 16 | 34 | 121 | <.50 | <.008 | 1220 | 17 | 215 | 115 | 4230 | 80 | 405 |
| 406.50 | 415.90 | 622044 | 30 | 129 | 255 | <.50 | <.008 | 1460 | 46 | 425 | 105 | 4060 | 60 | 255 |
| 415.90 | 430.40 | 622045 | 8 | 227 | 789 | <.50 | <.008 | 1940 | 18 | 335 | 115 | 3910 | 60 | 350 |
| 430.40 | 436.30 | 622046 | 48 | 8 | 109 | <.50 | <.008 | 825 | 7 | 45 | 145 | 3090 | 60 | 465 |
| 436.30 | 449.00 | 622047 | 61 | 32 | 159 | <.50 | .012 | 990 | 63 | 810 | 155 | 4410 | 25 | 365 |
| 449.00 | 461.70 | 622048 | 79 | 37 | 138 | <.50 | .012 | 1450 | 86 | 825 | 145 | 3780 | 30 | 470 |
| 461.70 | 478.20 | 622049 | 16 | <5 | 71 | <.50 | <.008 | 1045 | 14 | 5 | 160 | 2090 | 65 | 600 |
| 478.20 | 485.20 | 622050 | 62 | 57 | 257 | <.50 | <.008 | 195 | 42 | 835 | 65 | 2670 | 25 | 275 |
| 485.20 | 492.90 | 622051 | 100 | 61 | 147 | <.50 | <.008 | 350 | 39 | 550 | 80 | 2760 | 80 | 105 |
| 492.90 | 493.80 | 622052 | 98 | <5 | 129 | <.50 | <.008 | 385 | 30 | 70 | 90 | 2860 | 75 | 200 |
| 493.80 | 500.20 | 622053 | 72 | 23 | 121 | <.50 | <.008 | 380 | 50 | 280 | 90 | 2960 | 70 | 165 |
| 500.20 | 510.00 | 622054 | 59 | 22 | 168 | <.50 | <.008 | 145 | 51 | 780 | 150 | 3340 | 20 | 175 |
| 510.00 | 522.90 | 622055 | 62 | 15 | 159 | <.50 | <.008 | 215 | 50 | 685 | 145 | 3190 | 15 | 255 |
| 522.90 | 533.00 | 622056 | 85 | 13 | 174 | <.50 | <.008 | 250 | 31 | 585 | 80 | 2420 | 5 | 450 |
| 533.00 | 543.00 | 622057 | 87 | 11 | 123 | <.50 | <.008 | 530 | 32 | 615 | 80 | 2650 | 20 | 340 |
| 543.00 | 553.00 | 622058 | 82 | <5 | 102 | <.50 | <.008 | 305 | 26 | 335 | 75 | 2610 | 15 | 395 |
| 553.00 | 563.00 | 622059 | 82 | 13 | 135 | <.50 | <.008 | 510 | 36 | 510 | 65 | 2650 | 25 | 390 |
| 563.00 | 571.30 | 622060 | 75 | 149 | 281 | <.50 | .038 | 535 | 84 | 440 | 80 | 2970 | 50 | 345 |
| 571.30 | 580.10 | 622061 | 78 | 9 | 138 | <.50 | <.008 | 375 | 25 | 410 | 70 | 2870 | 40 | 320 |
| 580.10 | 588.60 | 622062 | 72 | <5 | 122 | <.50 | <.008 | 350 | 24 | 510 | 70 | 2850 | 15 | 555 |
| 588.60 | 595.20 | 622063 | 66 | <5 | 85 | <.50 | <.008 | 575 | 12 | 290 | 80 | 2810 | 30 | 495 |
| 595.20 | 597.60 | 622064 | 60 | 14 | 105 | <.50 | <.008 | 525 | 8 | 525 | 60 | 2260 | 30 | 240 |
| 597.60 | 601.20 | 622065 | 94 | <5 | 144 | <.50 | <.008 | 495 | 11 | 40 | 95 | 2900 | 25 | 540 |
| 601.20 | 608.10 | 622066 | 91 | 80 | 304 | <.50 | <.008 | 150 | 19 | 485 | 50 | 2300 | 5 | 360 |
| 608.10 | 619.90 | 622068 | 66 | <5 | 116 | <.50 | <.008 | 130 | 11 | 460 | 55 | 2270 | 5 | 370 |
| 619.90 | 628.70 | 622069 | 69 | 101 | 220 | <.50 | <.008 | 475 | 6 | 400 | 40 | 2070 | 25 | 365 |
| 628.70 | 635.30 | 622070 | 52 | 11 | 86 | <.50 | <.008 | 570 | 19 | 530 | 65 | 2170 | 55 | 145 |
| 635.30 | 641.80 | 622071 | 53 | 9 | 115 | <.50 | <.008 | 370 | 11 | 695 | 105 | 2840 | 30 | 215 |
| 641.80 | 652.00 | 622072 | 55 | <5 | 85 | <.50 | <.008 | 635 | 19 | 550 | 60 | 2120 | 55 | 175 |
| 652.00 | 661.70 | 622073 | 51 | <5 | 84 | <.50 | <.008 | 580 | 18 | 575 | 65 | 2110 | 55 | 190 |
| 661.70 | 677.10 | 622074 | 49 | <5 | 74 | <.50 | <.008 | 500 | 3 | 425 | 75 | 2160 | 45 | 185 |
| 677.10 | 695.40 | 622075 | 60 | <5 | 117 | <.50 | <.008 | 595 | 8 | 350 | 65 | 2100 | 45 | 185 |
| 695.40 | 705.90 | 622076 | 59 | <5 | 98 | <.50 | <.008 | 385 | 5 | 500 | 90 | 2970 | 30 | 250 |
| 705.90 | 718.00 | 622077 | 76 | <5 | 94 | <.50 | <.008 | 315 | 7 | 510 | 75 | 2610 | 20 | 325 |
| 718.00 | 731.00 | 622078 | 67 | <5 | 97 | <.50 | <.008 | 270 | 3 | 530 | 60 | 2570 | 20 | 305 |
| 731.00 | 743.60 | 622079 | 67 | <5 | 75 | <.50 | <.008 | 405 | 16 | 305 | 75 | 2910 | 50 | 245 |
| 743.60 | 749.50 | 622080 | 60 | <5 | 84 | <.50 | <.008 | 405 | 12 | 245 | 100 | 3010 | 55 | 220 |
| 749.50 | 760.10 | 622081 | 80 | <5 | 70 | <.50 | <.008 | 470 | 14 | 300 | 90 | 3050 | 65 | 190 |

085164

| From | To | Sample | SiO2 | TiO2 | Al2O3 | Fe2O3 | MnO | MgO | CaO | Na2O | K2O | P2O5 | LOI | TOTAL | S |
|--------|--------|--------|-------|------|-------|-------|-----|------|-------|------|------|------|-------|--------|------|
| | | | % | % | % | % | % | % | % | % | % | % | % | % | % |
| .00 | 7.00 | 622001 | 54.00 | .72 | 17.50 | 9.35 | .20 | 3.83 | 4.00 | 1.56 | 1.43 | .15 | 7.05 | 99.81 | .03 |
| 7.00 | 20.70 | 622002 | 64.90 | .54 | 17.19 | 4.80 | .16 | .68 | .51 | .66 | 2.87 | .14 | 7.77 | 100.22 | .01 |
| 20.70 | 38.60 | 622003 | 58.40 | .75 | 18.09 | 7.36 | .20 | 1.65 | 1.22 | 1.14 | 2.08 | .14 | 8.72 | 99.75 | <.01 |
| 38.60 | 45.00 | 622004 | 59.30 | .60 | 15.82 | 7.22 | .13 | 2.87 | 4.45 | 2.99 | 1.72 | .14 | 4.84 | 100.15 | .01 |
| 45.00 | 55.00 | 622005 | 56.80 | .64 | 16.20 | 7.82 | .16 | 3.63 | 5.32 | 2.69 | 1.44 | .15 | 4.71 | 99.58 | <.01 |
| 55.00 | 62.50 | 622006 | 57.80 | .61 | 15.81 | 7.73 | .19 | 4.11 | 6.03 | 1.65 | 1.71 | .16 | 3.87 | 99.71 | .01 |
| 62.50 | 70.30 | 622007 | 57.00 | .62 | 15.73 | 7.60 | .16 | 3.92 | 7.51 | 2.04 | 1.43 | .16 | 3.30 | 99.58 | .05 |
| 70.30 | 79.30 | 622008 | 63.30 | .47 | 15.01 | 6.24 | .10 | 1.83 | 3.98 | 3.47 | 2.45 | .26 | 2.42 | 99.54 | <.01 |
| 79.30 | 86.40 | 622009 | 54.20 | .74 | 15.81 | 8.28 | .15 | 3.43 | 7.19 | 3.25 | 1.96 | .18 | 4.35 | 99.67 | .05 |
| 86.40 | 96.00 | 622010 | 55.10 | .75 | 15.92 | 8.77 | .26 | 4.18 | 5.74 | 2.53 | 1.84 | .19 | 4.63 | 99.96 | .03 |
| 96.00 | 106.00 | 622011 | 53.80 | .68 | 15.36 | 8.49 | .29 | 4.59 | 7.91 | 2.28 | 1.46 | .17 | 4.63 | 99.70 | .01 |
| 106.00 | 116.60 | 622012 | 55.20 | .68 | 15.49 | 8.80 | .26 | 5.40 | 5.84 | 2.05 | 1.55 | .16 | 4.13 | 99.57 | <.01 |
| 116.60 | 119.90 | 622013 | 71.20 | .40 | 14.78 | 2.35 | .11 | .74 | 1.37 | 5.49 | 1.43 | .18 | 1.84 | 99.84 | <.01 |
| 119.90 | 130.00 | 622016 | 56.00 | .63 | 15.04 | 8.47 | .21 | 4.76 | 6.77 | 2.43 | 1.61 | .17 | 3.28 | 99.61 | .10 |
| 130.00 | 142.80 | 622017 | 56.90 | .55 | 15.11 | 7.99 | .18 | 4.84 | 6.76 | 2.83 | 1.61 | .18 | 2.83 | 99.87 | .02 |
| 142.80 | 147.00 | 622018 | 56.50 | .57 | 15.13 | 8.64 | .21 | 4.45 | 6.52 | 3.40 | .93 | .19 | 3.04 | 100.22 | .25 |
| 147.00 | 157.50 | 622019 | 58.20 | .56 | 15.22 | 8.06 | .23 | 4.02 | 5.34 | 2.90 | 2.14 | .19 | 3.05 | 100.01 | .04 |
| 157.50 | 162.20 | 622020 | 58.20 | .67 | 15.14 | 9.05 | .21 | 3.54 | 2.41 | 3.49 | 2.30 | .20 | 3.40 | 99.97 | .54 |
| 162.20 | 169.60 | 622021 | 57.10 | .66 | 15.58 | 8.24 | .24 | 3.66 | 5.53 | 2.26 | 2.96 | .18 | 3.05 | 99.54 | .03 |
| 169.60 | 180.00 | 622022 | 57.50 | .60 | 15.37 | 8.16 | .22 | 3.60 | 6.09 | 2.90 | 2.09 | .18 | 2.78 | 99.59 | .04 |
| 180.00 | 190.00 | 622023 | 57.80 | .61 | 15.64 | 8.29 | .23 | 3.40 | 5.75 | 3.88 | 1.25 | .18 | 2.73 | 99.86 | .02 |
| 190.00 | 200.00 | 622024 | 57.00 | .57 | 14.71 | 8.03 | .21 | 4.47 | 6.52 | 2.99 | 1.90 | .19 | 2.85 | 99.62 | .05 |
| 200.00 | 210.00 | 622025 | 54.90 | .50 | 13.31 | 8.09 | .17 | 7.06 | 7.67 | 2.31 | 1.52 | .19 | 3.77 | 99.59 | .04 |
| 210.00 | 219.20 | 622026 | 54.80 | .53 | 14.42 | 8.47 | .18 | 6.33 | 7.52 | 2.71 | 1.81 | .22 | 3.06 | 100.15 | .04 |
| 219.20 | 234.20 | 622027 | 55.80 | .62 | 13.63 | 8.46 | .18 | 5.40 | 7.67 | 2.57 | 1.43 | .28 | 3.83 | 100.21 | .13 |
| 234.20 | 247.80 | 622028 | 57.40 | .60 | 13.38 | 8.71 | .21 | 5.08 | 6.73 | 2.09 | 1.96 | .28 | 3.20 | 99.97 | .14 |
| 247.80 | 259.10 | 622029 | 59.40 | .63 | 14.04 | 7.87 | .20 | 3.94 | 5.89 | 3.71 | 1.02 | .22 | 2.85 | 100.20 | .18 |
| 259.10 | 272.00 | 622030 | 50.10 | .47 | 12.11 | 9.79 | .30 | 8.17 | 10.06 | 1.14 | 2.32 | .20 | 4.60 | 100.01 | .31 |
| 272.00 | 286.30 | 622031 | 50.50 | .46 | 11.90 | 10.00 | .28 | 8.70 | 9.12 | 1.03 | 1.64 | .18 | 5.50 | 99.58 | .11 |
| 286.30 | 295.00 | 622032 | 53.40 | .46 | 12.53 | 8.29 | .22 | 5.96 | 10.53 | 2.77 | .73 | .22 | 4.30 | 99.60 | .07 |
| 295.00 | 305.50 | 622033 | 52.20 | .49 | 13.25 | 8.36 | .19 | 5.94 | 10.14 | 2.36 | 1.09 | .27 | 4.89 | 99.57 | .15 |
| 305.50 | 315.90 | 622034 | 49.00 | .45 | 12.82 | 9.36 | .27 | 8.36 | 9.81 | 1.74 | 1.03 | .18 | 6.22 | 100.10 | .33 |
| 315.90 | 326.70 | 622035 | 46.40 | .41 | 11.31 | 9.12 | .23 | 7.18 | 13.29 | 2.30 | .20 | .17 | 8.77 | 100.20 | .32 |
| 326.70 | 334.50 | 622036 | 45.70 | .45 | 12.08 | 9.74 | .24 | 8.29 | 10.73 | 1.94 | .07 | .18 | 10.66 | 100.32 | .10 |
| 334.50 | 339.40 | 622037 | 50.50 | .46 | 12.76 | 8.76 | .19 | 7.09 | 8.41 | 1.07 | 1.82 | .14 | 8.23 | 99.67 | .10 |
| 339.40 | 353.00 | 622038 | 53.00 | .47 | 13.83 | 8.53 | .18 | 7.32 | 7.92 | 2.56 | 1.11 | .11 | 3.52 | 99.66 | .45 |
| 353.00 | 366.50 | 622039 | 52.20 | .54 | 14.43 | 8.59 | .17 | 6.66 | 8.54 | 2.77 | 1.14 | .14 | 3.48 | 99.67 | .40 |
| 366.50 | 383.70 | 622040 | 51.20 | .68 | 15.00 | 8.76 | .23 | 6.02 | 8.09 | 2.77 | 1.61 | .22 | 4.69 | 99.51 | .10 |
| 383.70 | 393.30 | 622042 | 52.50 | .68 | 14.73 | 8.47 | .18 | 5.82 | 8.91 | 3.61 | .58 | .22 | 3.35 | 99.66 | .25 |
| 393.30 | 406.50 | 622043 | 51.30 | .71 | 13.67 | 8.93 | .21 | 6.97 | 8.12 | 1.62 | 3.03 | .22 | 3.98 | 99.60 | .34 |
| 406.50 | 415.90 | 622044 | 52.50 | .68 | 12.56 | 8.66 | .22 | 7.51 | 9.51 | 1.55 | 2.02 | .19 | 3.61 | 99.70 | .28 |
| 415.90 | 430.40 | 622045 | 50.10 | .65 | 12.86 | 8.58 | .30 | 6.69 | 8.20 | 1.44 | 2.11 | .21 | 8.09 | 99.63 | .16 |
| 430.40 | 436.30 | 622046 | 59.80 | .52 | 13.91 | 6.23 | .14 | 1.82 | 6.18 | 3.78 | 1.96 | .17 | 4.97 | 99.76 | .13 |
| 436.30 | 449.00 | 622047 | 51.50 | .74 | 11.96 | 9.15 | .24 | 8.01 | 7.78 | 2.16 | 1.13 | .36 | 5.66 | 99.57 | .35 |
| 449.00 | 461.70 | 622048 | 50.60 | .63 | 11.49 | 8.89 | .29 | 7.93 | 8.98 | 1.89 | 1.30 | .39 | 5.79 | 99.56 | .57 |
| 461.70 | 478.20 | 622049 | 64.30 | .35 | 13.93 | 4.42 | .13 | 1.23 | 5.39 | 3.54 | 2.64 | .15 | 3.95 | 100.09 | .03 |
| 478.20 | 485.20 | 622050 | 50.00 | .45 | 13.02 | 8.62 | .31 | 7.12 | 7.82 | 2.49 | .58 | .11 | 8.71 | 100.56 | .54 |
| 485.20 | 492.90 | 622051 | 50.30 | .46 | 12.84 | 8.19 | .17 | 5.17 | 7.94 | .51 | 2.15 | .16 | 7.28 | 100.69 | 2.19 |
| 492.90 | 493.80 | 622052 | 49.00 | .48 | 14.88 | 8.35 | .17 | 4.88 | 8.62 | 2.18 | 2.00 | .12 | 9.94 | 99.58 | .39 |
| 493.80 | 500.20 | 622053 | 54.00 | .50 | 14.91 | 8.19 | .11 | 5.19 | 3.89 | 3.09 | 1.77 | .11 | 5.92 | 105.00 | 2.94 |
| 500.20 | 510.00 | 622054 | 49.70 | .56 | 11.54 | 9.34 | .17 | 8.46 | 6.37 | 1.89 | .44 | .44 | 5.88 | 103.18 | 3.38 |
| 510.00 | 522.90 | 622055 | 50.30 | .53 | 11.31 | 8.57 | .16 | 8.05 | 7.38 | 1.87 | .38 | .42 | 5.80 | 101.54 | 2.72 |
| 522.90 | 533.00 | 622056 | 50.50 | .40 | 12.56 | 8.47 | .14 | 7.73 | 7.52 | 1.88 | .26 | .14 | 4.59 | 100.46 | 2.52 |
| 533.00 | 543.00 | 622057 | 49.60 | .44 | 13.37 | 7.97 | .13 | 7.64 | 8.09 | 1.73 | .73 | .12 | 5.83 | 100.93 | 2.09 |
| 543.00 | 553.00 | 622058 | 50.60 | .44 | 13.18 | 8.46 | .12 | 6.02 | 7.35 | 2.51 | .43 | .12 | 6.87 | 102.70 | 2.66 |
| 553.00 | 563.00 | 622059 | 50.40 | .44 | 13.01 | 8.68 | .17 | 6.40 | 7.67 | 2.04 | .74 | .11 | 6.16 | 103.00 | 2.85 |
| 563.00 | 571.30 | 622060 | 51.20 | .50 | 13.91 | 8.78 | .16 | 3.94 | 6.87 | 2.90 | 1.34 | .13 | 7.32 | 103.90 | 2.75 |
| 571.30 | 580.10 | 622061 | 50.90 | .48 | 14.13 | 7.96 | .17 | 5.49 | 6.92 | 2.35 | 1.01 | .10 | 7.39 | 99.92 | 1.22 |
| 580.10 | 588.60 | 622062 | 51.10 | .47 | 14.38 | 8.93 | .16 | 7.87 | 6.20 | 2.43 | .43 | .08 | 6.26 | 100.46 | .87 |
| 588.60 | 595.20 | 622063 | 53.90 | .47 | 14.60 | 7.25 | .14 | 3.65 | 7.90 | 3.24 | .91 | .12 | 6.34 | 100.03 | .61 |
| 595.20 | 597.60 | 622064 | 52.40 | .38 | 13.06 | 8.63 | .19 | 6.60 | 6.90 | 1.93 | .82 | .06 | 7.70 | 99.94 | .49 |
| 597.60 | 601.20 | 622065 | 52.70 | .48 | 15.61 | 7.38 | .16 | 3.23 | 7.83 | 4.37 | .72 | .11 | 6.87 | 99.81 | .12 |
| 601.20 | 608.10 | 622066 | 49.10 | .38 | 13.15 | 9.14 | .21 | 8.57 | 8.00 | 3.33 | .17 | .06 | 6.50 | 100.12 | .61 |
| 608.10 | 619.90 | 622068 | 51.20 | .38 | 14.22 | 8.34 | .16 | 6.87 | 6.86 | 4.12 | .16 | .06 | 6.18 | 100.07 | .61 |
| 619.90 | 628.70 | 622069 | 50.10 | .35 | 12.86 | 7.79 | .20 | 7.75 | 8.24 | 1.50 | .76 | .05 | 9.76 | 99.96 | .23 |
| 628.70 | 635.30 | 622070 | 51.80 | .36 | 12.11 | 7.81 | .13 | 5.36 | 7.90 | .33 | 1.79 | .08 | 7.57 | 100.35 | 2.05 |
| 635.30 | 641.80 | 622071 | 47.80 | .47 | 11.57 | 7.75 | .15 | 6.66 | 10.51 | 1.10 | .84 | .23 | 10.30 | 100.49 | 1.26 |
| 641.80 | 652.00 | 622072 | 51.90 | .35 | 12.57 | 7.59 | .14 | 5.51 | 7.34 | 1.08 | 1.76 | .06 | 6.91 | 100.38 | 2.06 |
| 652.00 | 661.70 | 622073 | 53.40 | .35 | 12.59 | 6.84 | .12 | 4.66 | 6.96 | 1.60 | 1.70 | .06 | 6.24 | 99.69 | 2.07 |
| 661.70 | 677.10 | 622074 | 53.20 | .36 | 12.27 | 6.44 | .14 | 4.80 | 8.50 | 1.65 | 1.35 | .06 | 8.50 | 100.02 | 1.10 |
| 677.10 | 695.40 | 622075 | 51.40 | .35 | 13.56 | 7.34 | .15 | 6.46 | 7.28 | 1.49 | 1.32 | .06 | 9.22 | 99.76 | .45 |
| 695.40 | 705.90 | 622076 | 48.80 | .50 | 12.52 | 8.61 | .15 | 6.53 | 8.99 | 1.66 | .87 | .19 | 9.78 | 100.20 | .64 |
| 705.90 | 718.00 | 622077 | 46.90 | .44 | 11.79 | 8.56 | .17 | 6.68 | 10.27 | 1.66 | .63 | .14 | 10.38 | 99.84 | .89 |
| 718.00 | 731.00 | 622078 | 47.00 | .43 | 11.72 | 8.06 | .16 | 7.38 | 10.52 | 1.32 | .73 | .11 | 11.30 | 100.15 | .57 |
| 731.00 | 743.60 | 622079 | 49.10 | .49 | 12.71 | 7.50 | .16 | 4.88 | 9.34 | 1.24 | 1.77 | .10 | 9.96 | 99.65 | .97 |
| 743.60 | 749.50 | 622080 | 53.00 | .50 | 13.52 | 7.25 | .13 | 4.15 | 7.20 | 1.70 | 1.80 | .15 | 8.96 | 99.57 | .48 |
| 749.50 | 760.10 | 622081 | 51.30 | .51 | 13.00 | 7.35 | .17 | 4.67 | 8.11 | 1.29 | 1.78 | .14 | 10.01 | 99.72 | .55 |

APPENDIX VII

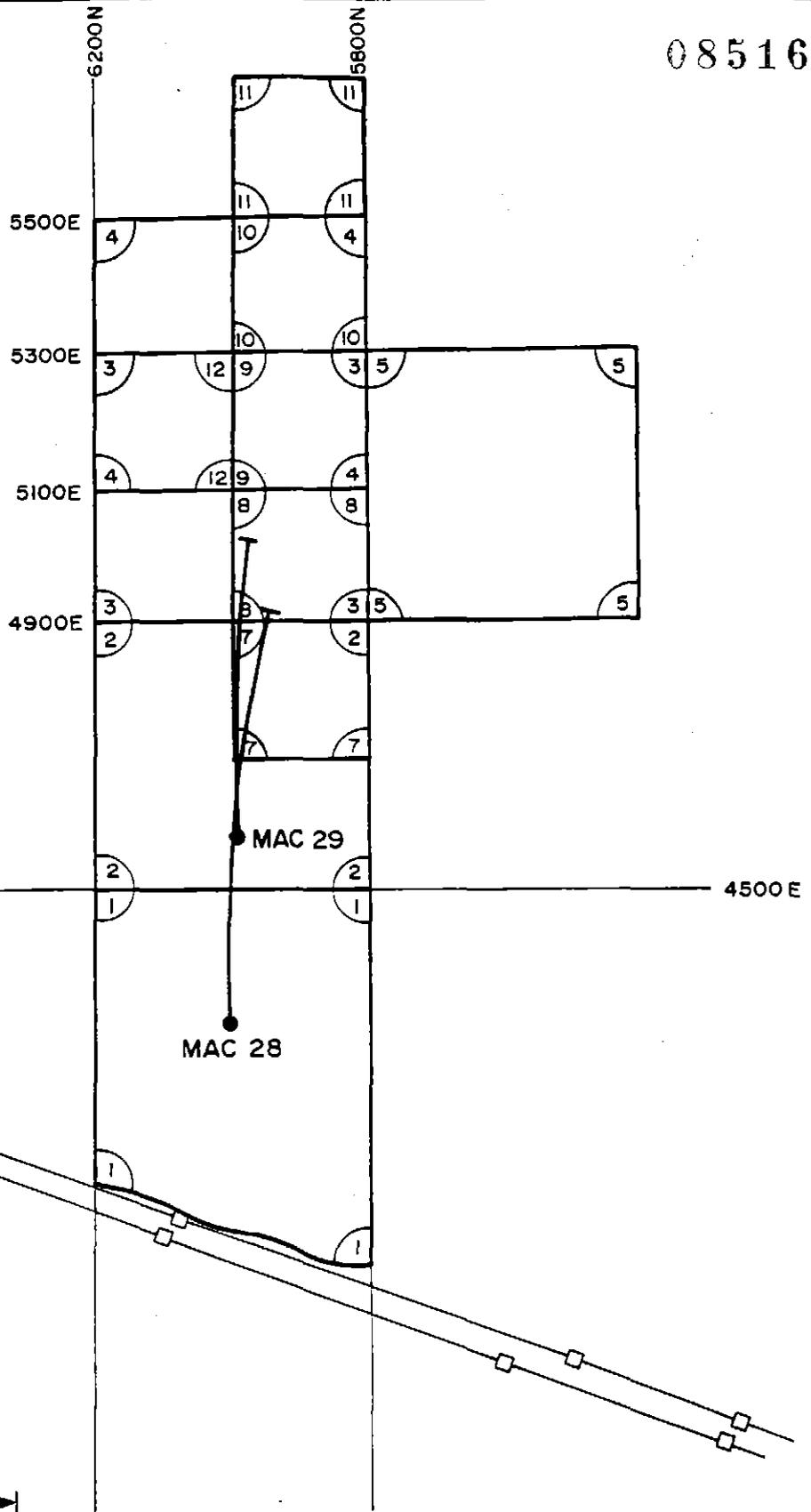


MAC29
DHEM
LOOP 5
ZONGE GDP_16 32 HZ
Horiz scale 1: 5000.0 Plot number : 25

APPENDIX VIII

085169

150



Aberfoyle Resources Limited
EXPLORATION DIVISION

| REVISIONS | | | |
|-----------|-------|-------|------|
| Init. | Date | Init. | Date |
| GLC | 10/91 | | |
| | | | |
| | | | |
| | | | |

NORTH WEST TASMANIA
MACKINTOSH EL 106/87
DDH MAC 28, 29 - DHEM LOOPS

| | |
|-------------|---------|
| Compiled : | JS |
| Drawn : | JS |
| Traced : | GLC |
| Checked : | JS |
| Plate No. : | MAC 334 |

Location Code : K55/3

Scale : 1 : 10 000

Date : August 1991

Date 18 October 1991 Ref JS:AAI
To S Richardson From J Silic
At Burnie At Hawthorn
Copies to DBW Keep

Subject Mac 28 DHEM Loop 5 Data

The Mac 28 Loop 5 data is confirming the previous interpretation that the downhole EM response is due to two conductors.

The effect of the conductor to the west of 4950E is evident at "early times" (eg time windows 1 - 12, Figures 1 and 2), with the profiles peaking at about 725 metres down the hole.

This pronounced negative trough in the response, however does not change to a "flattish negative" profile as was observed in the Loops 1 - 4 data. Instead a clear increasing fall-off in the response (tending to a negative) is observed (eg Figures 3, 4, time windows 16 - 20) at "late times" indicating the presence of a conductor beyond the end of a drillhole.

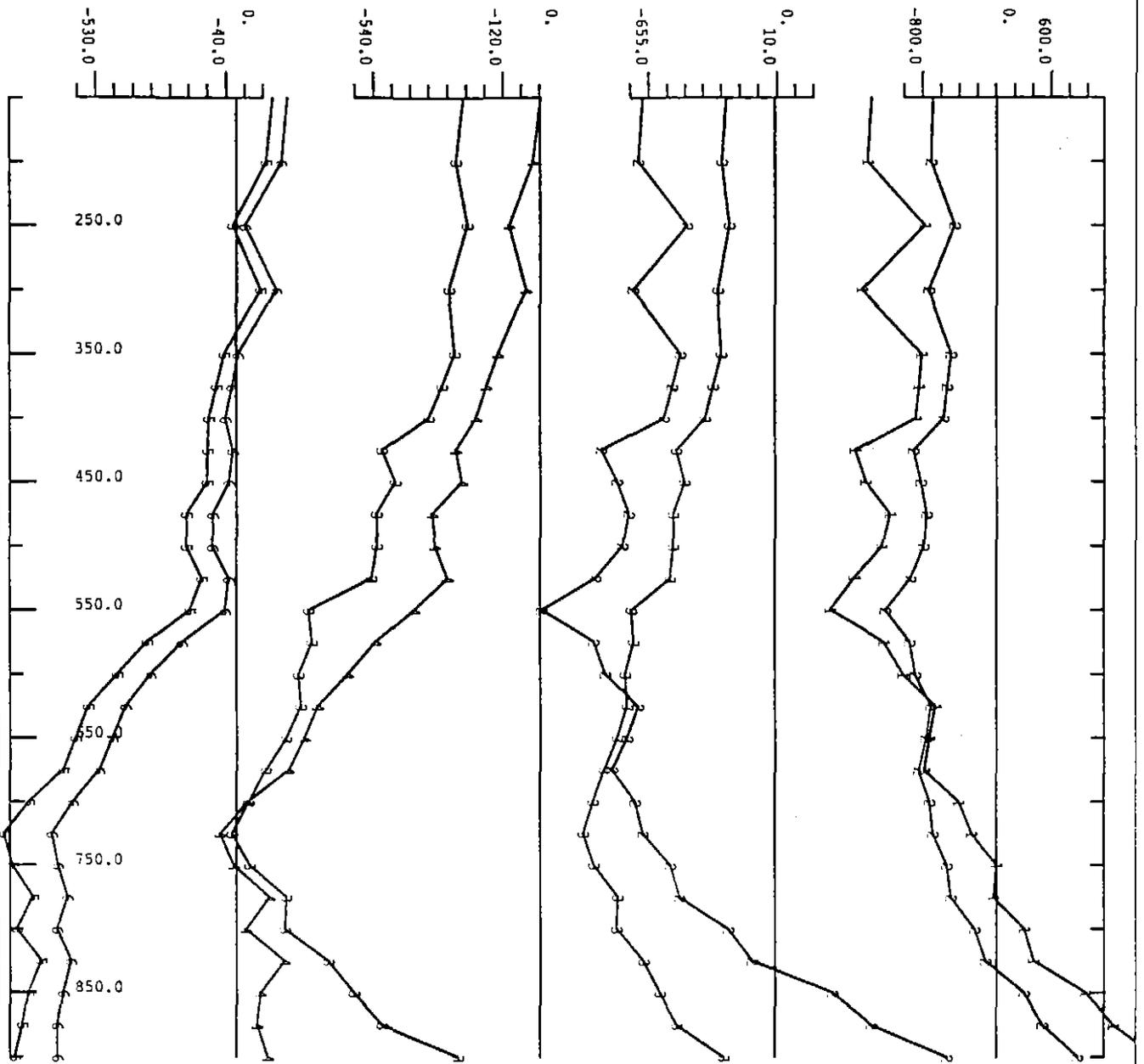
It is postulated that Loop 5 has energised the eastern conductor more effectively than the previous loops, and as such the separation in the response from the two conductors was achieved.

That the effect from the eastern conductor is dominating the response at "late" times, supports the previous assertion (Reporting J. Silic) that the conductivity is increasing from west to east.

The data set however, cannot be used to locate the conductors accurately (particularly it cannot be used to determine whether the conductors are on the Mac 29 section), however considering that Loop 5 is to the south of the drillhole it can be implied that the conductors extend to the south of the Mac 29 section.

Regards
Jovan
JOVAN SILIC

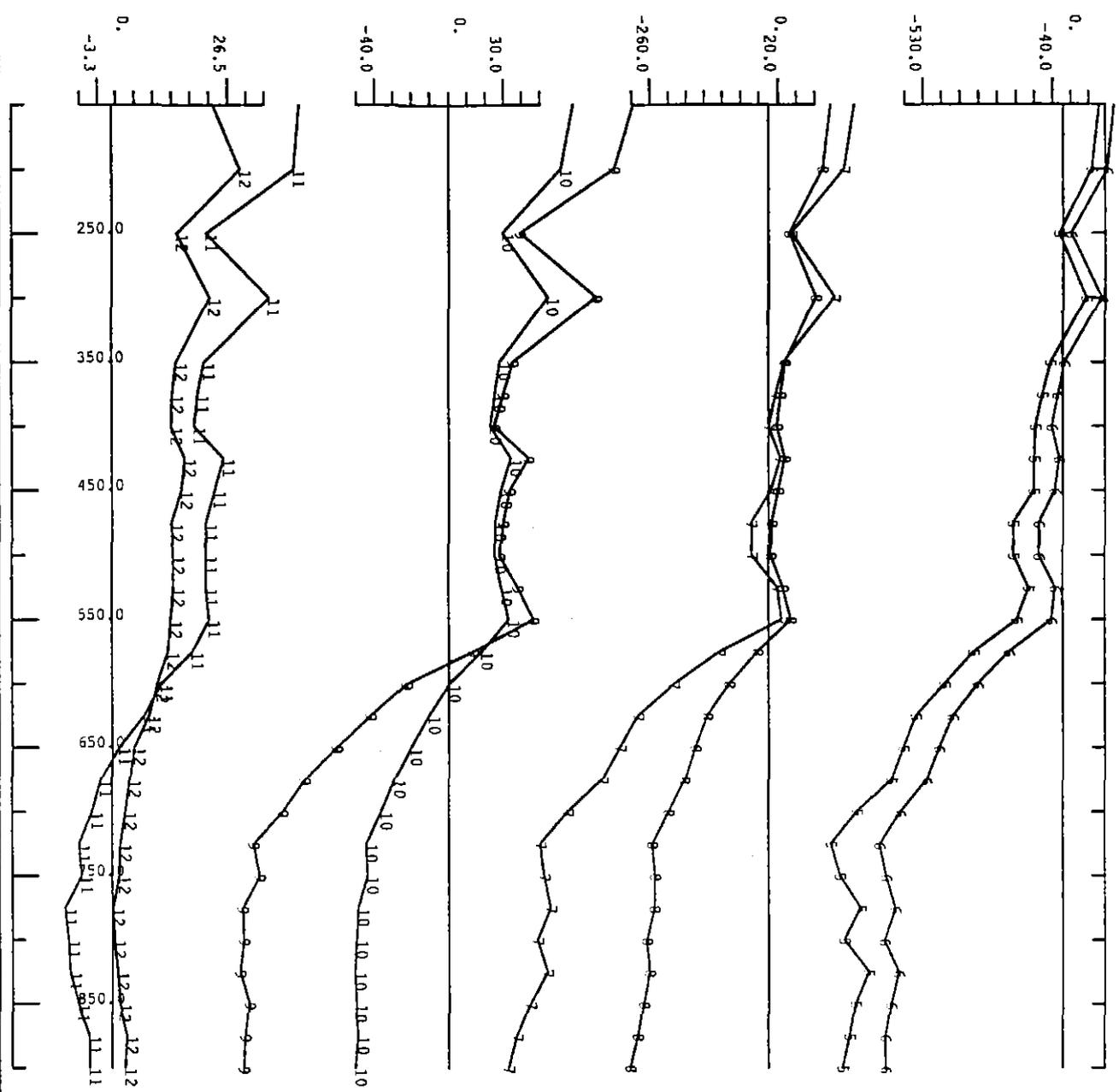
085171



MACKINTOSH EL
DOWNHOLE EM
MAC28 LOOP 5
ZONGE GDP_16 32HZ
Aberfoyle Resources Limited
Horiz scale 1: 5000.0 Plot number : 13

Fig 1

5 cm

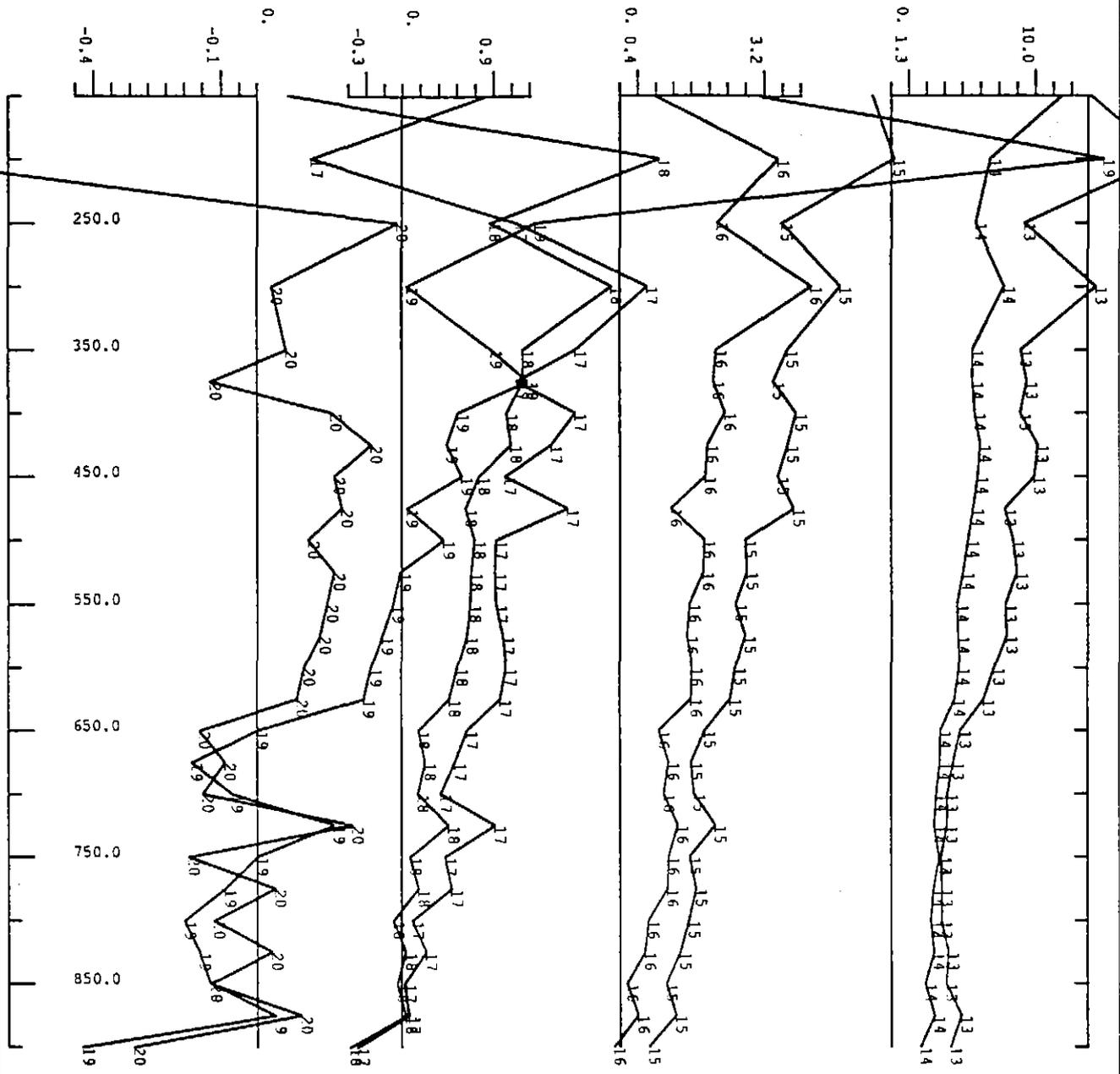


MACKINTOSH EL
DOWNHOLE EM
MAC28 LOOP 5
ZONGE GDP_16 32HZ
Aberfoyle Resources Limited
Horiz scale 1: 5000.0 Plot number : 12

Fig 2

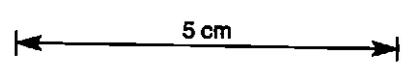
5 cm

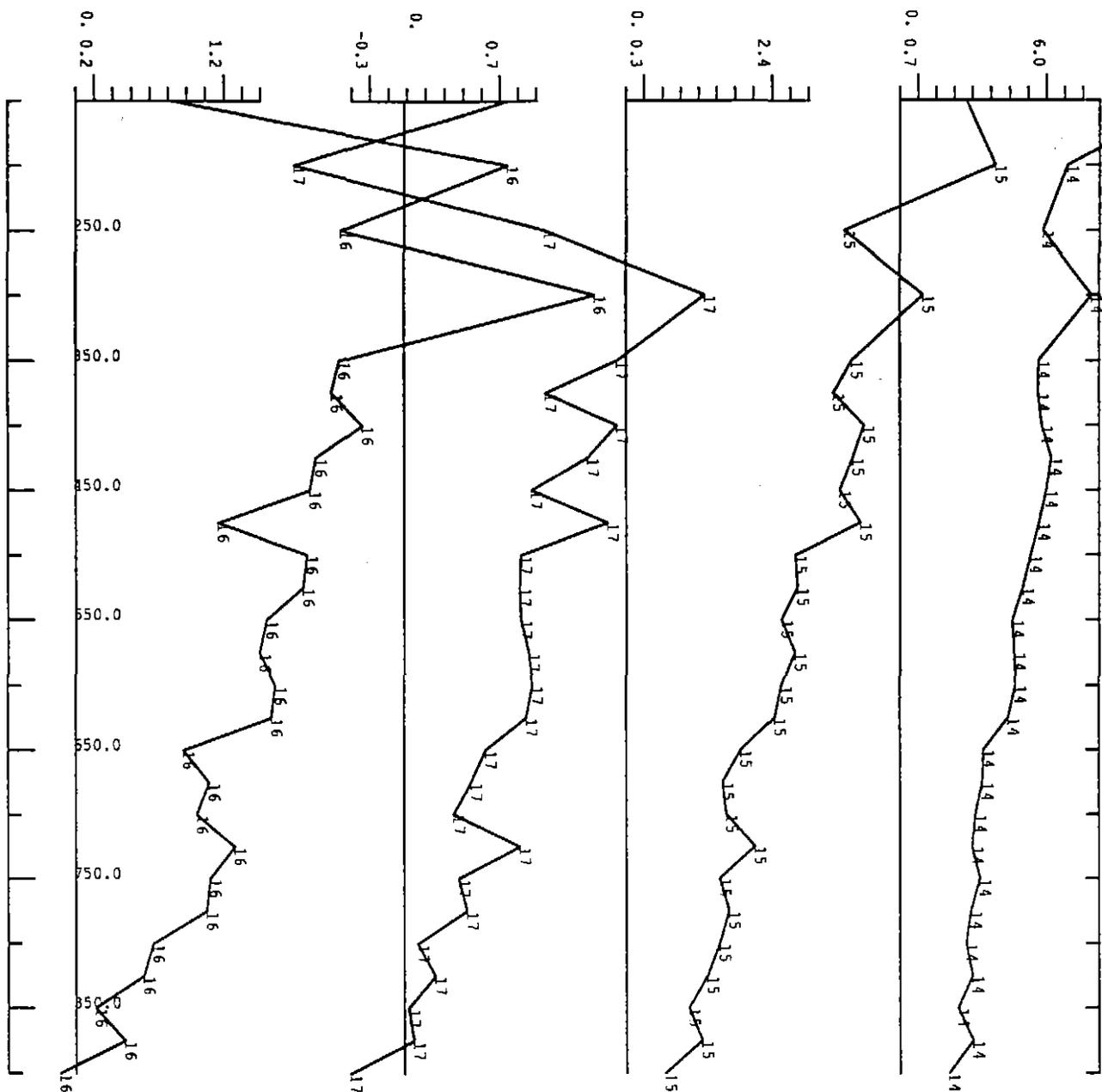
085173



MACKINTOSH EL
 DOWNHOLE EM
 MAC28 LOOP 5
 ZONGE GDP_16 32HZ
 Aberfoyle Resources Limited
 Horiz scale 1: 5000.0 Plot number : 11

Fig 3

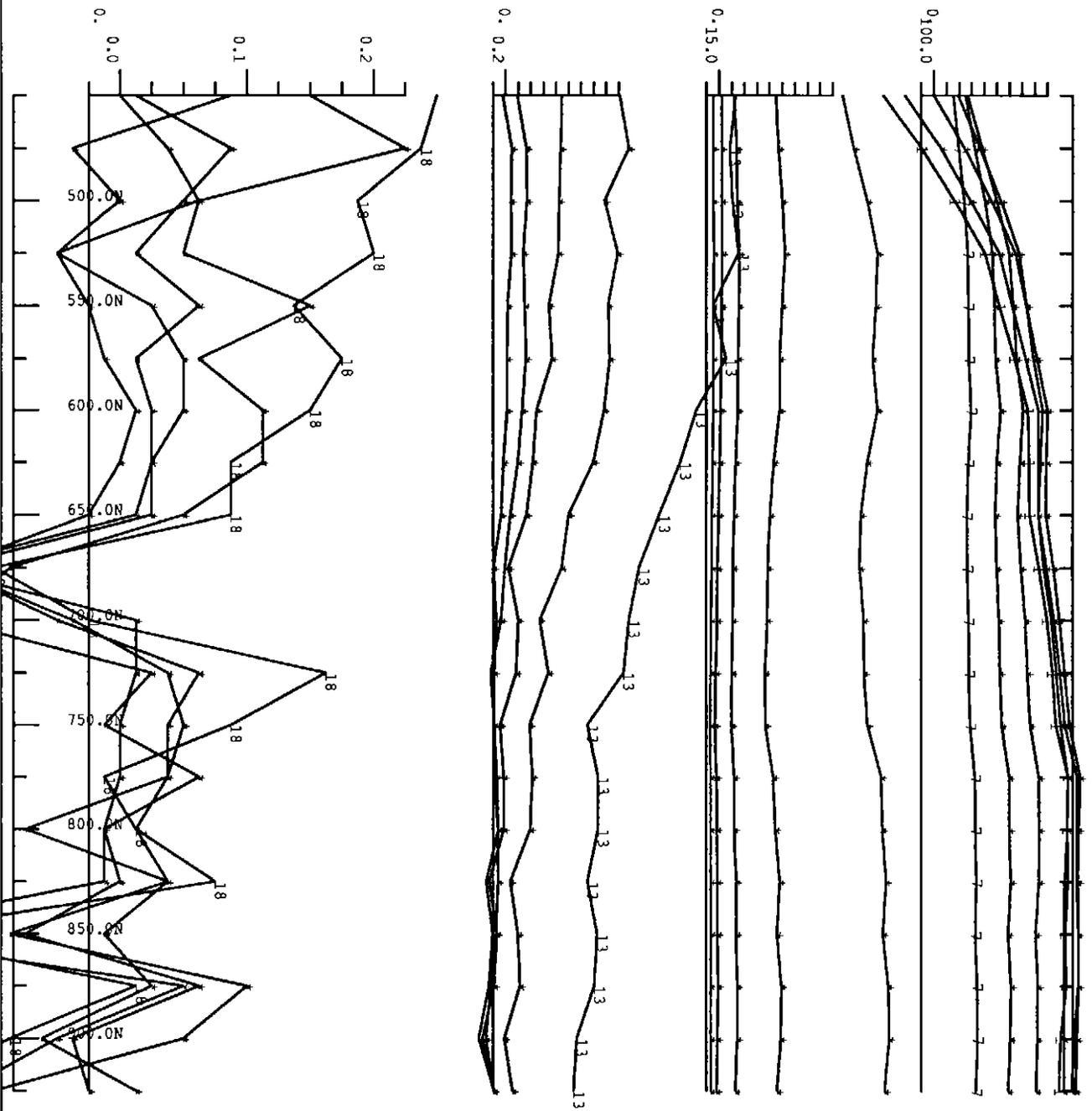




MACKINTOSH EL
DOWNHOLE EM
MAC28 LOOP 5
ZONGE GDP_16 32HZ
Aberfoyle Resources Limited
Horiz scale 1: 5000.0 Plot number : 14

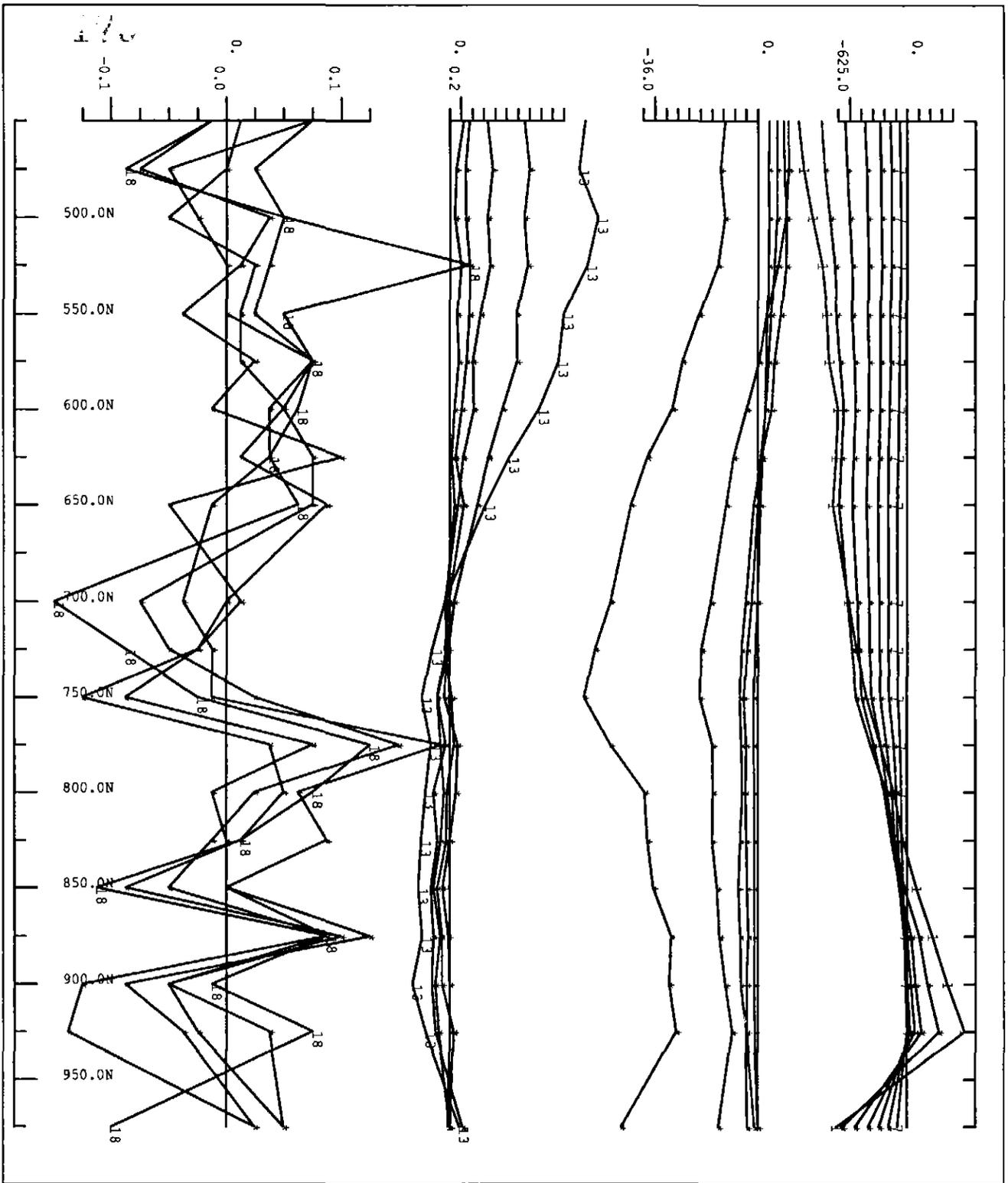
Fig 4

5 cm



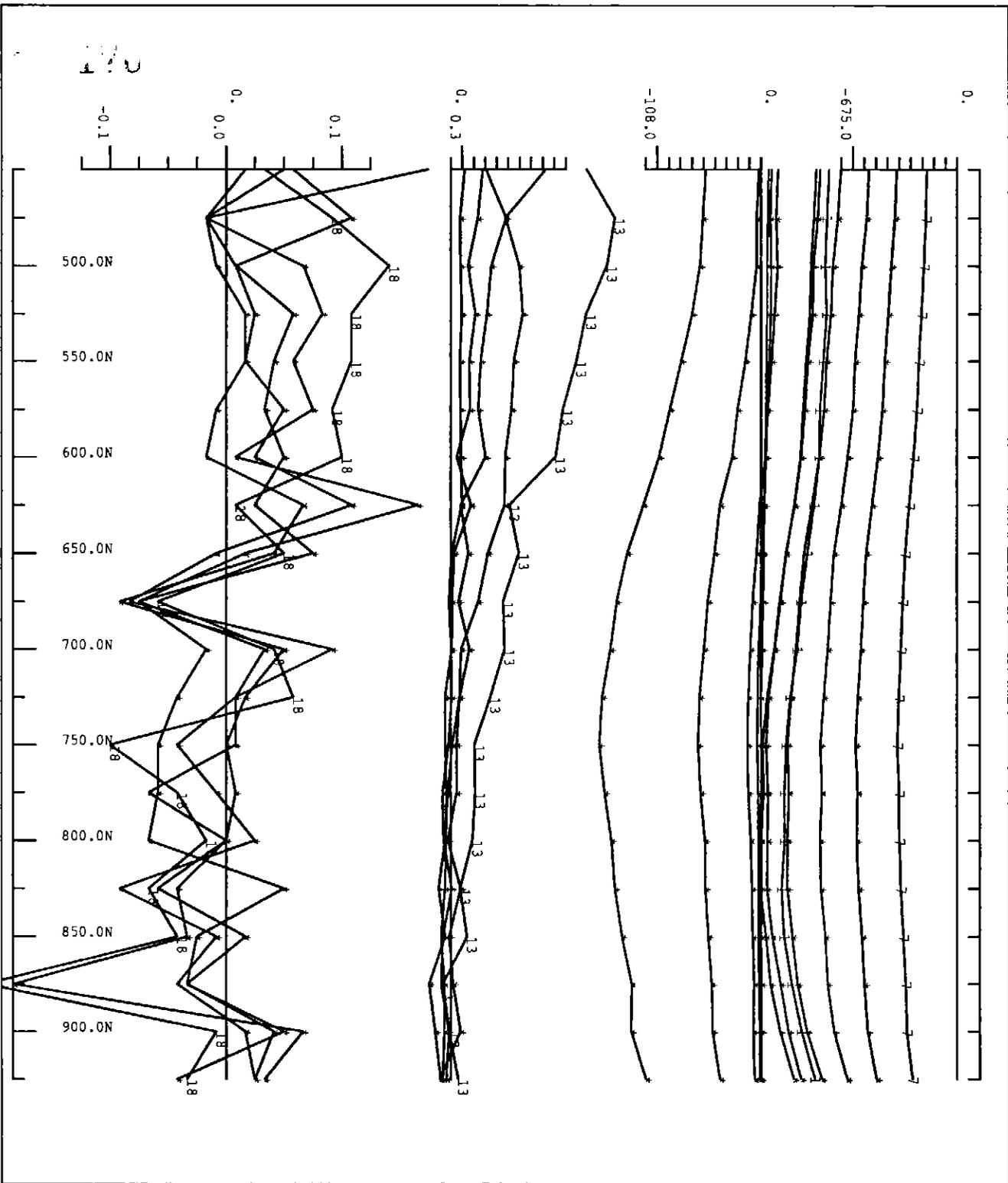
MAC28
 DHEM
 LOOP 7
 ZONGE GDP_16 32 HZ
 Horiz scale 1: 3000.0 Plot number : 19

5 cm



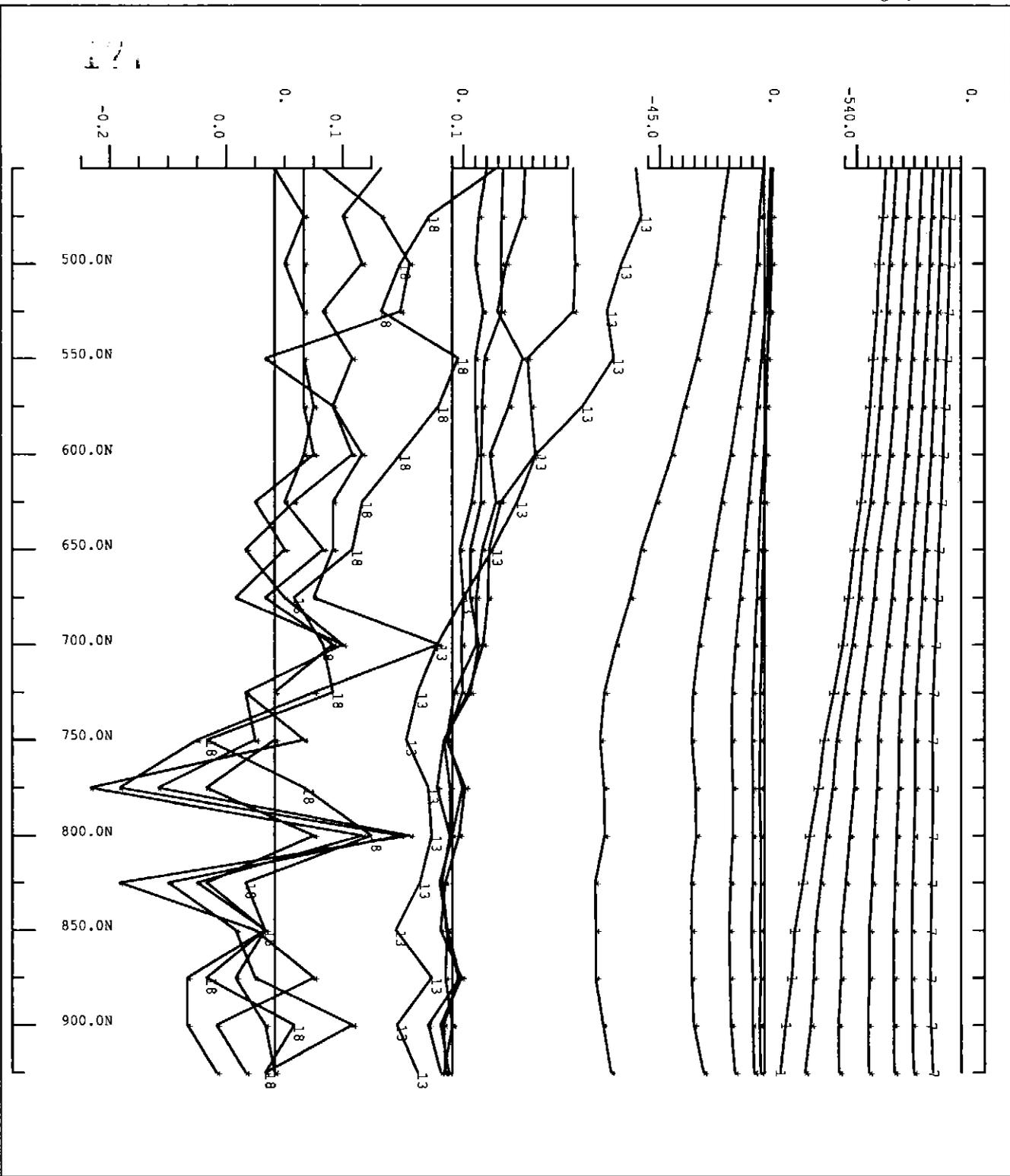
MAC28
DHEM
LOOP 8
ZONGE GDP_16 32 HZ
Horiz scale 1: 3000.0 Plot number : 20

5 cm



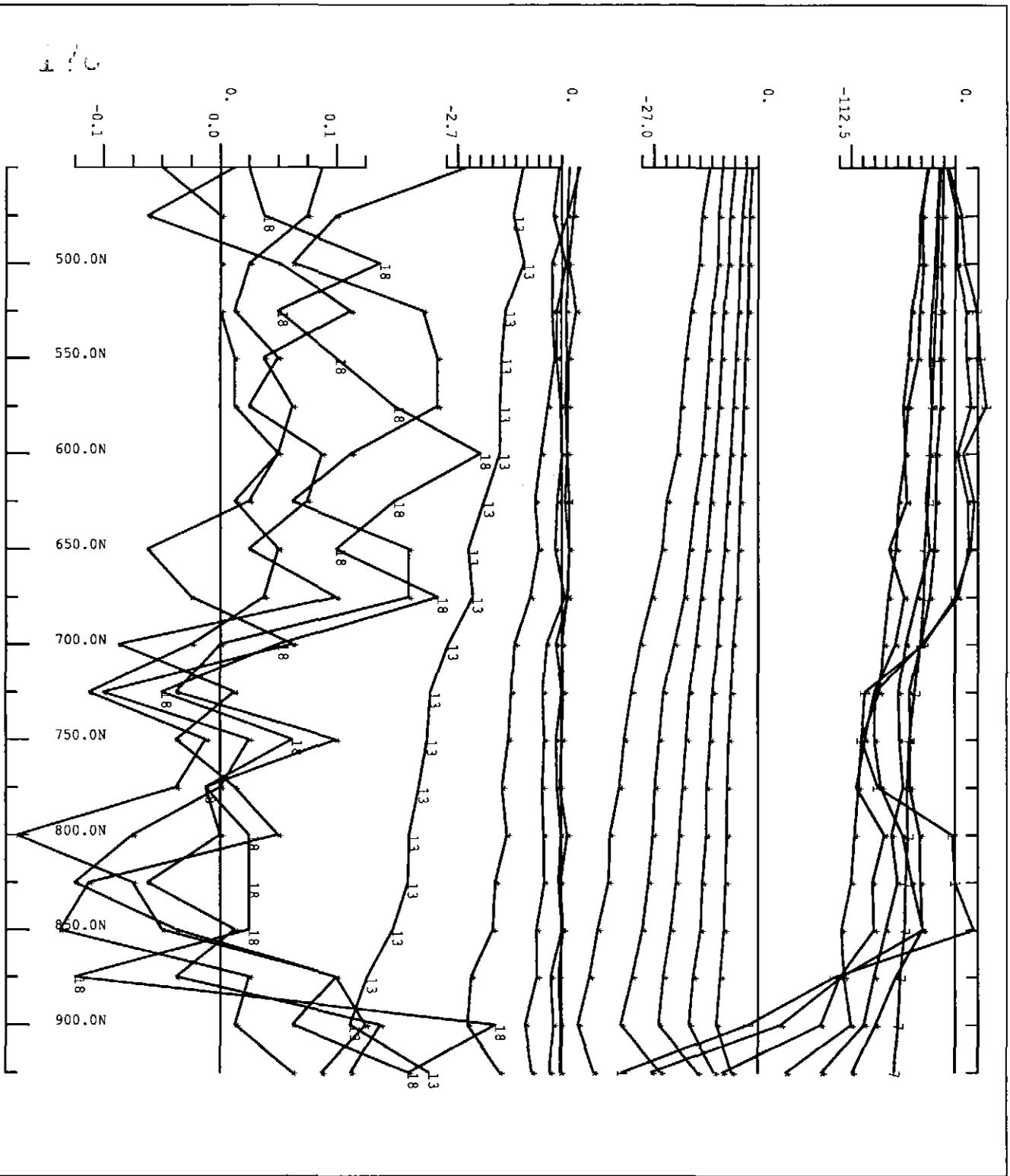
MAC28
DHEM
LOOP 9
ZONGE GDP_16 32 HZ
Horiz scale 1: 3000.0 Plot number : 21

5 cm



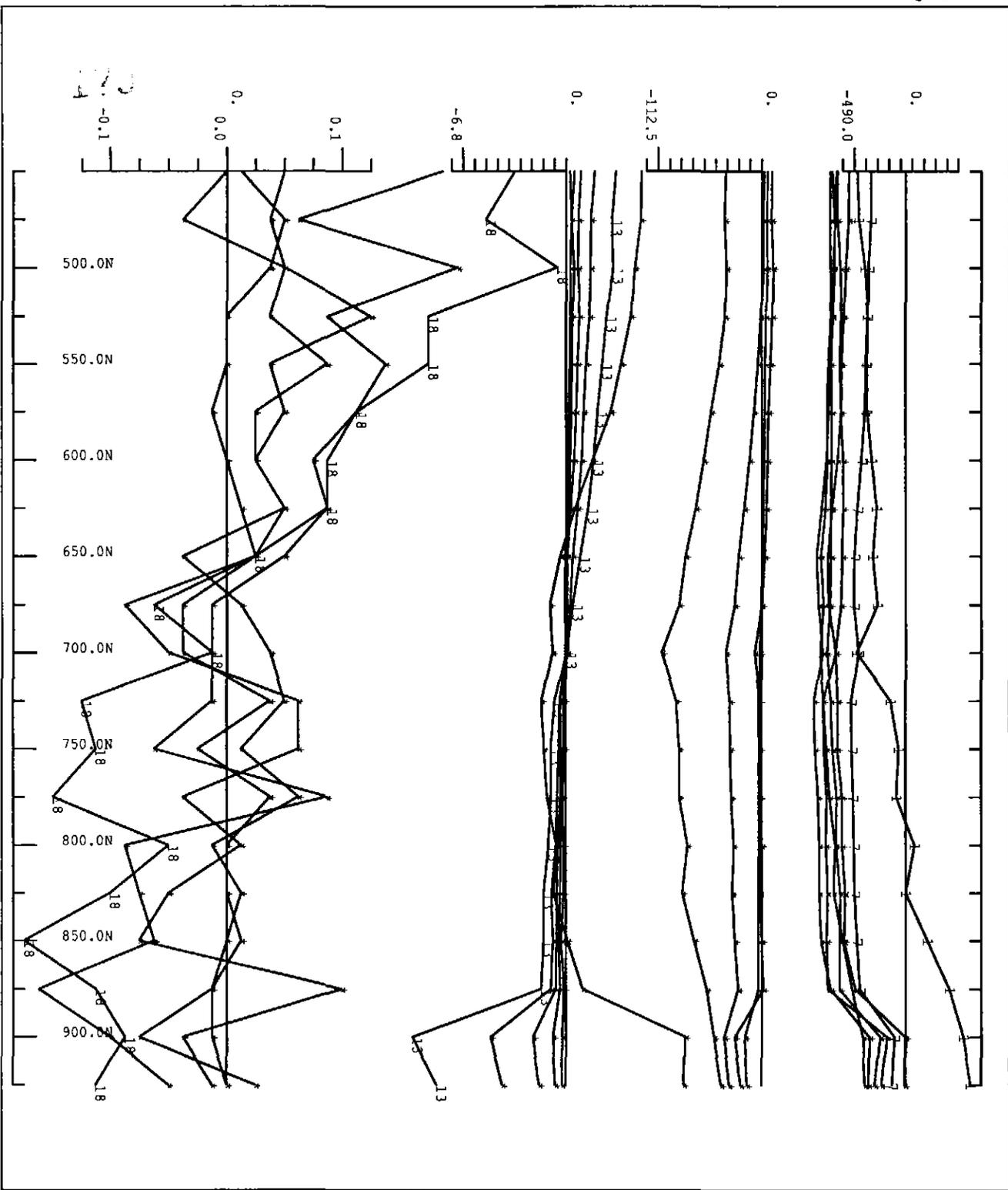
MAC28
DHEM
LOOP 10
ZONGE GDP_16 32 HZ
Horiz scale 1: 3000.0 Plot number : 22

5 cm



MAC28
DHEM
LOOP II
ZONGE GDP_16 32 HZ
Horiz scale 1: 3000.0 Plot number : 23

5 cm



MAC28
DHEM
LOOP 12
ZONGE GDP_16 32 HZ
Horiz scale 1: 3000.0 Plot number : 24

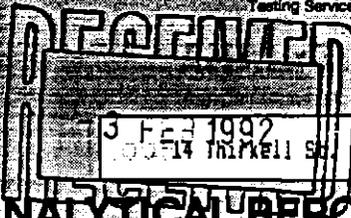
5 cm

APPENDIX IX



ANALABS

A Division of Incharge Inspection and Testing Services Australia Pty. Ltd.



Phone (004) 316837

3 Feb 1992
14 Thirkell St, CODEE TAS 7320

Fax (004) 318890

ANALYTICAL REPORT No. 100560.60.08533

THIS REPORT MUST BE READ IN CONJUNCTION WITH THE ACCOMPANYING ANALYTICAL DATA

INVOICE TO:

- Aberfoyle Resources Limited
- Exploration Division
- P.O. Box 952
- BURNIE TAS 7320

ORDER No. 12102 PROJECT MACK

DATE RECEIVED 10/01/92 RESULTS REQUIRED ASAP

| No. OF PAGES OF RESULTS | DATE REPORTED | No. OF COPIES | TOTAL No. OF SAMPLES |
|-------------------------|---------------|---------------|----------------------|
| 3 | 31/01/92 | 1 | 12 |

| SAMPLE NUMBERS | SAMPLE DESCRIPTION | ELEMENT/METHOD |
|----------------|-----------------------|---------------------------|
| 622351/362 | DC Prep : GP009,GP018 | Cu,Pb,Zn,Ag/GA101 |
| 622351/362 | DC Prep : | Ba,As,Cr,Zr,Rb,Sr/GX401 |
| 622351/362 | DC Prep : | Ti,Zr/GX401,Ti/GX408 |
| 622351/362 | DC Prep : | Whole Rock Analysis/OX408 |

RESULTS TO

Mr R de Bomford
Aberfoyle Resources Limited
PO Box 952
BURNIE TAS 7320

REMARKS

MAC-30
PETROLOGY
SAMPLING

RESULTS TO

| RESULTS | UNITS | ppm | ppm | ppm | ppm |
|---------|-------|-------|-------|-------|-------|
| METHOD | GA101 | GA101 | GA101 | GA101 | GA101 |

AUTHORISED OFFICER

085205

ANALABS

A Division of Inchoape Inspection and Testing Services Australia Pty. Ltd.

A.C.N. 004 581 664

ANALYTICAL DATA

SAMPLE PREFIX

REPORT NUMBER

REPORT DATE

CLIENT ORDER No.

PAGE

100560.60.08533

31/01/92

12102

1 OF 3

| TUBE No. | SAMPLE No. | Cu | Pb | Zn | Ag | Ba | As | Cr | Zr | Ti |
|----------|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1 | 622351 | 35 | 13 | 89 | <0.5 | 810 | 6 | 65 | 100 | 3050 |
| 2 | 622352 | <5 | <5 | 60 | <0.5 | 1950 | <2 | 9 | 160 | 2150 |
| 3 | 622353 | 47 | <5 | 87 | <0.5 | 340 | 8 | 320 | 90 | 2800 |
| 4 | 622354 | 118 | <5 | 61 | <0.5 | 780 | 5 | 45 | 95 | 3300 |
| 5 | 622355 | 68 | <5 | 71 | <0.5 | 350 | 8 | 80 | 100 | 3550 |
| 6 | 622356 | 71 | 89 | 131 | <0.5 | 610 | 10 | 240 | 90 | 3150 |
| 7 | 622357 | 87 | 21 | 227 | <0.5 | 640 | 14 | 70 | 80 | 2900 |
| 8 | 622358 | 61 | 49 | 121 | <0.5 | 540 | 20 | 480 | 70 | 2250 |
| 9 | 622359 | 17 | <5 | 56 | <0.5 | 740 | 3 | 14 | 130 | 2800 |
| 10 | 622360 | 111 | 7 | 107 | <0.5 | 890 | 8 | 65 | 80 | 2850 |
| 11 | 622361 | 73 | <5 | 96 | <0.5 | 200 | 13 | 260 | 95 | 3100 |
| 12 | 622362 | 84 | 6 | 133 | <0.5 | 280 | 11 | 740 | 60 | 2700 |
| 13 | | | | | | | | | | |
| 14 | | | | | | | | | | |
| 15 | | | | | | | | | | |
| 16 | | | | | | | | | | |
| 17 | | | | | | | | | | |
| 18 | | | | | | | | | | |
| 19 | | | | | | | | | | |
| 20 | | | | | | | | | | |
| 21 | | | | | | | | | | |
| 22 | | | | | | | | | | |
| 23 | DETECTION | 5 | 5 | 5 | 0.5 | 10 | 2 | 5 | 5 | 50 |
| 24 | UNITS | ppm |
| 25 | METHOD | GA101 | GA101 | GA101 | GA101 | GX401 | GX401 | GX401 | GX401 | GX401 |

085206

ANALABS

A Division of Incharge Inspection and Testing Services Australia Pty. Ltd.
A.C.N. 004 591 864

ANALYTICAL DATA

SAMPLE PREFIX REPORT NUMBER REPORT DATE CLIENT ORDER No. PAGE

100560.60.08533 31/01/92 12102 2 OF 3

| TUBE No. | SAMPLE No. | Ti:Zr | Rb | Sr | SiO ₂ | TiO ₂ | Al ₂ O ₃ | Fe ₂ O ₃ | MnO | MgO |
|----------|------------|-------|-------|-------|------------------|------------------|--------------------------------|--------------------------------|-------|-------|
| 1 | 622351 | 30.5 | 65 | 390 | 58.5 | 0.51 | 14.99 | 7.68 | 0.15 | 3.91 |
| 2 | 622352 | 13.4 | 130 | 380 | 67.3 | 0.36 | 14.43 | 4.50 | 0.10 | 1.05 |
| 3 | 622353 | 31.1 | 20 | 400 | 51.1 | 0.47 | 14.48 | 9.36 | 0.19 | 9.06 |
| 4 | 622354 | 34.7 | 60 | 400 | 53.6 | 0.55 | 16.15 | 8.58 | 0.15 | 5.58 |
| 5 | 622355 | 35.5 | 25 | 470 | 58.3 | 0.59 | 13.47 | 7.99 | 0.15 | 4.85 |
| 6 | 622356 | 35.0 | 35 | 460 | 55.6 | 0.53 | 12.57 | 7.46 | 0.24 | 5.93 |
| 7 | 622357 | 36.3 | 20 | 520 | 58.8 | 0.48 | 12.40 | 7.18 | 0.26 | 4.39 |
| 8 | 622358 | 32.1 | 19 | 390 | 58.3 | 0.37 | 10.90 | 7.31 | 0.28 | 6.16 |
| 9 | 622359 | 21.5 | 100 | 370 | 60.8 | 0.47 | 13.44 | 5.90 | 0.13 | 1.46 |
| 10 | 622360 | 35.6 | 40 | 720 | 54.3 | 0.47 | 15.43 | 7.53 | 0.19 | 4.17 |
| 11 | 622361 | 32.6 | 25 | 310 | 55.1 | 0.52 | 14.12 | 7.43 | 0.22 | 5.87 |
| 12 | 622362 | 45.0 | 20 | 410 | 50.1 | 0.45 | 13.81 | 7.74 | 0.19 | 5.47 |
| 13 | | | | | | | | | | |
| 14 | | | | | | | | | | |
| 15 | | | | | | | | | | |
| 16 | | | | | | | | | | |
| 17 | | | | | | | | | | |
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| 19 | | | | | | | | | | |
| 20 | | | | | | | | | | |
| 21 | | | | | | | | | | |
| 22 | | | | | | | | | | |
| 23 | DETECTION | 0.1 | 0.5 | 0.5 | 0.1 | 0.01 | 0.05 | 0.01 | 0.01 | 0.01 |
| 24 | UNITS | % | ppm | ppm | % | % | % | % | % | % |
| 25 | METHOD | GX401 | GX401 | GX401 | GX408 | GX408 | GX408 | GX408 | GX408 | GX408 |

AUTHORISED OFFICER

085207

ANALABS

A Division of Incharge Inspection and Testing Services Australia Pty. Ltd.
A.C.N. 004 991 884

ANALYTICAL DATA

SAMPLE PREFIX

REPORT NUMBER

REPORT DATE

CLIENT ORDER No

PAGE

100560.60.08533

31/01/92

12102

3 OF 3

| TUBE No. | SAMPLE No. | CaO | Na2O | K2O | P2O5 | S | LOI | TOTAL | | |
|----------|------------|-------|-------|-------|-------|-------|-------|--------|--|--|
| 1 | 622351 | 7.71 | 2.19 | 1.77 | 0.156 | 0.06 | 2.41 | 100.03 | | |
| 2 | 622352 | 2.61 | 3.15 | 4.14 | 0.174 | 0.05 | 1.72 | 99.59 | | |
| 3 | 622353 | 8.29 | 2.74 | 0.66 | 0.107 | 0.14 | 3.40 | 99.95 | | |
| 4 | 622354 | 7.61 | 2.65 | 1.82 | 0.124 | 0.07 | 3.27 | 100.16 | | |
| 5 | 622355 | 7.44 | 2.63 | 0.77 | 0.210 | 0.16 | 3.05 | 99.59 | | |
| 6 | 622356 | 9.33 | 2.44 | 1.20 | 0.176 | 0.27 | 3.89 | 99.63 | | |
| 7 | 622357 | 7.49 | 3.52 | 0.82 | 0.120 | 0.15 | 4.40 | 100.00 | | |
| 8 | 622358 | 8.03 | 2.54 | 0.68 | 0.164 | 0.40 | 4.51 | 99.69 | | |
| 9 | 622359 | 6.67 | 2.72 | 2.47 | 0.163 | 0.06 | 5.95 | 100.24 | | |
| 10 | 622360 | 8.41 | 2.58 | 1.54 | 0.101 | 0.18 | 5.34 | 100.23 | | |
| 11 | 622361 | 5.15 | 3.60 | 0.64 | 0.212 | 0.64 | 6.70 | 100.25 | | |
| 12 | 622362 | 9.54 | 3.05 | 0.51 | 0.115 | 0.59 | 8.52 | 100.08 | | |
| 13 | | | | | | | | | | |
| 14 | | | | | | | | | | |
| 15 | | | | | | | | | | |
| 16 | | | | | | | | | | |
| 17 | | | | | | | | | | |
| 18 | | | | | | | | | | |
| 19 | | | | | | | | | | |
| 20 | | | | | | | | | | |
| 21 | | | | | | | | | | |
| 22 | | | | | | | | | | |
| 23 | DETECTION | 0.01 | 0.05 | 0.01 | 0.005 | 0.01 | 0.01 | 0.01 | | |
| 24 | UNITS | % | % | % | % | % | % | % | | |
| 25 | METHOD | OX408 | OX408 | OX408 | OX408 | OX408 | OM615 | OX408 | | |

085208

200

SAMPLE NUMBER: 622351 MAC 30

57.8m

SUMMARY: This is a quite strongly altered augite-phyric basaltic breccia derived from a quench-fragmented flowtop. Alteration is variable, with a localized epidosite alteration and a more pervasive silica (\pm chlorite) alteration.

HAND SPECIMEN:

This is a dark porphyritic basaltic breccia with variably altered fragments to at least 6-8 cm across. A zone of lighter coloured intense epidote-dominated alteration is present at one end of the block, and has minor fuchsite I think.

THIN SECTION:

This sample in thin section contains essentially two petrographic domains, reflecting different styles of alteration. It is likely that this was a monomict basaltic lava breccia, with fragments derived quench fragmentation from the same eruptive unit. The basalt was strongly augite-phyric, with less abundant phenocrysts of plagioclase and olivine, set in a variably glassy to vitrophyric groundmass. Augite phenocrysts are mainly still fresh, make up about 10 modal% of the sample, and are frequently fractured euhedra to about 1.5-2mm long that show strong compositional zoning. They are occasionally altered to pale green chlorite. Former olivine phenocrysts make up less than 1 modal% of the rock and are totally altered to intergrowths of chlorite and polygonal quartz. Former plagioclase phenocrysts are albitized, and many are riddled with very fine-grained, almost isotropic epidote aggregates. In that part of the rock that is strongly epidote-altered, former plagioclase phenocrysts are obliterated.

The groundmass of various fragments shows a significant textural variation, due initially to slightly varying crystallization rates (from quenching producing crystal-free glass, to crystallite-charged glass further in from fragment margins), and enhanced by variable response to alteration. The glassy fragments (most of the dark areas of the section) have groundmass glass devitrified and crystallized to form fine-grained blebby quartz set in darker messy chlorite-quartz-Fe(Ti?) oxide intergrowths. Patches of coarser-grained chlorite are common, often with globular quartz rimming their margins. Occasional inter-fragment patches of chalcedonic quartz also occur, possibly with minor prehnite and fibrous sericite. In the lighter-coloured areas of the section, alteration is of a different style. Quite coarse-grained patches of monomineralic epidote, or epidote plus quartz

085209

200

(epidosite) are dominant, and replace large areas of this section, leaving core and spots of less altered fragments little different from the darker areas of this thin section. Strangely, it appears that the silica-dominated alteration post-dated the epidosite alteration, as the former invades the latter in places along the contact.

This sample is a basaltic breccia, probably derived from the quench fragmentation of the upper part of a submarine flow. It has suffered localized epidosite alteration, overprinted in part by recrystallization of unepidotized formerly glassy groundmass to silica-dominated assemblages.

085210

SAMPLE NUMBER: 622352

SUMMARY: This is a plagioclase+hornblende-phyric andesitic dyke rock, very atypical of the Hellyer lava sequence.

HAND SPECIMEN:

This is an unusual rather coarse-grained brown feldspar-phyric andesite (?) quite unlike most rocks I've looked at from the Hellyer Volcanics.

THIN SECTION:

This is an unusual and interesting rock. It is clearly a shallow intrusive andesite, and former phenocryst phases were dominantly plagioclase and probably hornblende, present in about subequal proportion and making up about 5-8 modal% of the rock. Former plagioclase phenocrysts are up to about 3mm long and vary from elongate but stout prisms to rather rounded equidimensional crystals. All have been albitized, and an unusual feature is that the outer rims of the plagioclase crystals are quite pinkish, probably reflecting Fe-tainted albite (submicroscopic hematite) rather than pink K feldspar, although without microprobe analysis it is difficult to prove this supposition. Former hornblende phenocrysts are entirely replaced by epidote and occasional quartz, and exhibit characteristic elongate hexagonal prismatic sections on crystals up to 3mm long.

The groundmass of this sample is little altered, and clearly holocrystalline, and consists of a relatively coarse-grained intergrowth of albitized feldspar, quartz and minor chlorite-altered mafic blades, probably once hornblende. Feldspar in the groundmass is subhedral, growing into anhedral quartz. Tiny altered FeTi oxides, and occasional larger FeTi oxide microphenocrysts are present, mainly replaced by leucoxenitic material. Patches of secondary quartz, yellow epidote, and pale green chlorite are typically developed throughout the groundmass, and veinlets of secondary quartz are common.

This feldspar+plagioclase-phyric andesitic dyke is an unusual lithology in the Hellyer sequence. It appears to intrude Hellyer basalts, and thus must be very late in the magmatic sequence in the Mount Read Volcanics. The nearest analogues are probably the plagioclase+hornblende -phyric andesites that intrude the top section of the Central Volcanic Complex at Crown Hill etc. This should be analyzed.

SAMPLE NUMBER: 622353

SUMMARY: This is a texturally well-preserved, strongly augite-phyric basaltic lava, typical of the Hellyer basalt.

HAND SPECIMEN:

This is a strongly augite-phyric fairly well-preserved basaltic lava with occasional clots and tension gashes filled by quartz and chlorite.

THIN SECTION:

This is a texturally well-preserved basaltic lava dominated by abundant (approx. 12-15 modal%) of euhedral, clear fresh augite phenocrysts, most less than 1mm across. The augite phenocrysts commonly occur in multi-crystal clots, and some small cognate nodules (to almost 1cm across) composed of aggregates of augite phenocrysts are present, with devitrified glass between the cumulate crystals. Albitized plagioclase phenocrysts, mainly much less than 1mm long, make up about 0.5-1% of the rock, and often contain inclusions of dirty brown to isotropic fine-grained epidote, and or minor sericite streaking.

The groundmass of this rock was vitrophyric, but dominated by bladed microlites of augite and more acicular plagioclase crystallites, with tiny altered FeTi oxide grains. The limited volume of interstitial glass has altered to very fine-grained quartz-chlorite intergrowths. Occasional clots of secondary quartz in the groundmass are intergrown with pale prehnite, and sometimes deeper yellow epidote. Clots of chlorite are also common, and some veinlets of quartz-epidote contain a fine-grained clear mineral with a cleavage, and higher relief than quartz, that is probably albite. Patches of chalcedonic silica are also not uncommon.

This is a typical Hellyer basalt (is such a thing exists).

216

342.5m

SAMPLE NUMBER: 622354 MAC 30

SUMMARY: This is a well-preserved augite-phyric vesicular basaltic lava, typical also of the Hellyer basalts.

HAND SPECIMEN:

This is a slightly vesicular augite-phyric basaltic lava with quartz and epidote filling vesicles.

THIN SECTION:

This sample is a texturally well-preserved augite-phyric basaltic lava with notably less abundant phenocrysts (~ 5 modal%) than in the previous sample, although like 353, it also carries subordinate small albitized plagioclase phenocrysts. Augite phenocrysts are mainly less than 1mm long, fresh, with slight compositional zoning; they typically occur in multi-crystal clots. In a few areas, they are replaced by brownish-green pumpellyite and minor chlorite. Plagioclase phenocrysts are spotted by fine-grained isotropic epidote and minor sericite. Vesicles are filled by chalcedonic quartz, patchy prehnite and more granular and crystalline epidote, and deeper green-brown pumpellyite is intergrown with chlorite in several vesicles.

The groundmass of this basalt was a fairly fine-grained vitrophyric-textured intergrowth of randomly orientated acicular plagioclase microlites intergrown with very small chlorite-altered augite blades and subordinate altered FeTi oxide granules. The mesostasis glass is devitrified, but volumetrically much less abundant than the microlites in the groundmass.

This is another typical Hellyer basalt, although the vesicularity, and especially the significantly lower modal abundance of augite phenocrysts indicates that it is unlikely to come from the same flow unit as 353.

085213

210

355 = 395.9m

356 = 453.8m

SAMPLE NUMBER: 662355 and 662356

SUMMARY: These are identical olivine+augite+ plagioclase - phyric vesicular basaltic lavas formed by mixing of primitive and more evolved Hellyer basalts.

HAND SPECIMEN:

These are vesicular basaltic lavas with black chlorite-filled vesicles and less abundant quartz-filled vesicles.

THIN SECTION:

These samples are remarkably similar in thin section, and must surely come from the same eruptive unit. They were more primitive than the basalts described above, as both contain common former olivine phenocrysts in addition to augite phenocrysts and albitized plagioclase microphenocrysts. The former olivine phenocrysts are mainly euhedral prisms less than about 1mm long, and make up around 3 modal% of the rock. They are replaced by a very fine-grained intergrowth of secondary quartz and minor chlorite and hematite flakes. Augite phenocrysts are also mainly less than 1mm long, and show unusual rounding in many crystals and crystal aggregates, suggesting strong reaction with the transporting magma. Plagioclase phenocrysts are albitized and strongly altered, so that it is often difficult to discern the crystal margins; many appear to be rounded and resorbed.

Vesicles in sample 355 are up to 1cm across, and make up at least 30 modal% of the rock, whereas they are somewhat smaller and less abundant in 356. Most are circular with cores of radial grown pale green chlorite, rimmed by blebby quartz. In a few of the larger vesicles, the cores are composed of intergrown rosettes of epidote and pumpellyite in a fabulous colour range that Maggie Tabberer would just adore. Minor calcite alteration overprints the more typical quartz-albite-epidote- prehnite-pumpellyite-chlorite alteration.

The groundmass of both samples were texturally identical to that in the previous sample 354, although in places it approaches a quench texture, with sheaves of tiny augite blades and plagioclase microlites in devitrified glass.

085214

The presence in both samples of quite abundant euhedral olivine phenocrysts, and rather rounded and resorbed plagioclase and augite phenocrysts, indicates that they formed from a mixed magma, produced from thorough mixing of a primitive olivine-bearing basalt and a more evolved basaltic lava that was probably petrographically close to 354. Such mixing typically occurs when a new batch of hot primitive magma drives into the magma chamber in which an earlier magma batch is cooling and fractionating through to augite and plagioclase saturation. In most respects, these are typical Hellyer basalts.

SAMPLE NUMBER: 622357

SUMMARY: This is a sparsely vesicular, sparsely augite-phyric probably fairly evolved Hellyer basaltic lava.

HAND SPECIMEN:

This is an almost aphyric fine-grained basaltic lava with common calcite-filled fractures.

THIN SECTION:

In thin section, this sample is seen to be a sparsely augite-phyric basaltic lava, composed of around 1-3 modal% of small augite phenocrysts, most of which occur as small clots of four of five fresh euhedral crystals. Rather flattened or stretched vesicles, filled by pale green chlorite make up about 1-3 modal% of the rock.

The groundmass of this sample was probably vitrophyric, dominated by rather long acicular plagioclase microlites in glass that has devitrified to very fine-grained quartz-chlorite intergrowths. Bladed crystals of groundmass augite are subordinate to the plagioclase microlites, but mainly highly fractured or replaced by chlorite. A few veinlets of epidote and quartz transect the section, and are overprinted by calcite in places. Coarser-grained foliated calcite occurs in a few larger tension gashes and fractures.

This is a rather evolved Hellyer basalt compared to most of the preceding samples, judging by the relative sparsity of mafic phenocrysts. However, it is not an uncommon lithology in the Hellyer basalts.

SAMPLE NUMBER: 662358

SUMMARY: This is a primitive olivine+augite-phyric basaltic lava typical of the more mafic Hellyer basalts.

HAND SPECIMEN:

This is a strongly vesicular and strongly augite-phyric basaltic lava with quartz- and chlorite-filled vesicles.

THIN SECTION:

This is a quite primitive olivine+augite-phyric basaltic lava. The former olivine phenocrysts make up about 5-8 modal% of this rock and are altered to very fine-grained silica with minor chlorite and hematite, identical to the olivine alteration observed in samples 355 and 356. They also contain small chromite euhedra. Unlike those samples, however, the augite phenocrysts in this sample are abundant, large (to 2mm long) and euhedral, with complex compositional zoning. They often occur intergrown with olivine phenocrysts. Albitized plagioclase microphenocrysts are much less abundant than the mafic phenocrysts. A few small clinopyroxenite cognate nodules are present, with interstitial devitrified glass.

Vesicles in this sample make up about 7-10 modal% of the rock and are mainly less than 2mm across. They are filled by pale green chlorite, with quartz along the margins. Less abundant vesicles contain intergrown prehnite and quartz with hematite flakes and occasionally also epidote needles and prisms. Calcite overprints many vesicle assemblages.

The groundmass of this basalt was vitrophyric, with abundant plagioclase microlites (albitized) showing weak preferred (flow) orientation, and less obvious, possibly altered tiny augite blades in devitrified glassy mesostasis speckled with tiny altered FeTi oxide granules.

This is a quite primitive Hellyer basaltic lava, clearly derived from a different, much less evolved flow unit than sample 357.

SAMPLE NUMBER: 662359 MAC 30

SUMMARY: This is a rather altered plagioclase+augite-phyric intrusive andesite, unlike andesitic dyke 662352 in that it lacks the hornblende phenocrysts notable in 352.

HAND SPECIMEN:

This is a rather altered but homogeneous dark grey aphyric basaltic lava(?) with calcite veinlets.

THIN SECTION:

Thin section shows that this is likely to be an intrusive rock. It is a finely porphyritic evolved basalt or andesite composition dominated by strongly altered plagioclase phenocrysts (~ 5 modal%) and less abundant phenocrysts of a chloritized mafic phase (2-3 modal%); former FeTi oxide phenocrysts are also not uncommon, unlike the lavas in this sequence. Former plagioclase phenocrysts are mainly less than 1mm long and are albitized, and strongly sericitized, so that few fresh albitic areas remain. The former mafic phenocrysts are replaced by green chlorite; most are less than 1mm long, and they are mainly prismatic with shapes suggestive of augite precursors. I can't convince myself that any of the chloritic pseudomorphs were originally hornblende (and thus be similar to 352). FeTi oxide phenocrysts are altered to leucoxene.

The groundmass of this rock was holocrystalline, and dominated by a ragged intergrowth of albitized plagioclase with interstitial quartz, chlorite and tiny altered FeTi oxide granules. Alteration assemblages include patches of intergrown quartz and chlorite, sericite and quartz, and calcite, the latter clearly overprinting earlier alteration. A few veinlets of epidote cut the sample, but epidote is notably less abundant in this rock than the basalts described above, implying less Ca availability, and thus a more andesitic composition for this rock.

This is an andesitic dyke rock notably more evolved (as indicated by the relative paucity of mafics compared to the above basalts). It appears to be petrographically different from the andesitic dyke rock 662352, as indicated by the lack of phenocrystal hornblende in this sample.

SAMPLE NUMBER: 662360

SUMMARY: This is a sparsely plagioclase+augite-phyric evolved basaltic rock with a texture suggestive of crystallization in either a shallow dyke, or the central portion of a thick flow.

HAND SPECIMEN:

This is a homogeneous dark fine-grained, possibly aphyric basaltic lava.

THIN SECTION:

This is an evolved basaltic rock, with a texture that I would judge (after much soul searching and reading your notes) to be very shallow intrusive. It is sparsely plagioclase + augite-phyric with about 2-3 modal% of each phase. Plagioclase phenocrysts are albitized and largely sericite-altered, but also contain areas of dark, very fine-grained epidote alteration. Augite phenocrysts are rarely larger than 1mm long, and are fractured and largely replaced by almost isotropic chlorite and fine-grained calcite, although fresh cores are not uncommon.

The groundmass of this sample is quite altered, but clearer patches indicate that it was close to holocrystalline, with intergrown weakly flow-aligned plagioclase laths with interstitial and subordinate chloritized augite and leucoxene-altered FeTi oxide granules. Formerly glassy mesostasis is difficult to recognize with certainty. Abundant segregations of secondary quartz are present throughout the groundmass. Calcite veinlets, and some calcite-hematite veinlets cut the sample.

This is an evolved basalt. Without your notes suggesting that it is probably intrusive, I would have argued that it came from the internal part of a thick flow. It is not nearly as clearly intrusive as 352 and 359.

SAMPLE NUMBER: 662361

SUMMARY: This rock is very close to 662360 and is a sparsely plagioclase+augite-phyric evolved basalt either from the interior of thick flow, or from a dyke or shallow intrusive body.

HAND SPECIMEN:

This is a vesicular sparsely porphyritic basaltic lava.

THIN SECTION:

In most respects this sample is petrographically very similar to the previous sample, except that it is more vesicular and more altered. Altered plagioclase and augite phenocrysts were present in subequal abundances (<3-5 modal%). Plagioclase phenocrysts are sericitized to a large degree. Unlike in 360, in which augite phenocrysts were partially preserved, the augite phenocrysts in this rock are totally altered to calcite, pale green chlorite and a messy brown material (oxychlorite?). Vesicles are mainly filled by calcite

The groundmass of this rock is petrographically very similar to that of the previous rock in that it apparently approached a holocrystalline texture dominated by intergrown plagioclase laths with interstitial bladed augite (chloritized) and quite common altered FeTi oxides and disseminated fine-grained hematite. Calcite is the main veinlet mineral, but is not abundant.

This rock is an evolved basalt, and like 360, it is either from the central portion of a thick flow, or from a shallow intrusive body.

220

7814m

SAMPLE NUMBER: 662362

SUMMARY: This is a notably strongly-altered (calcite-sericite) formerly olivine+augite+plagioclase-phyric basaltic lava.

HAND SPECIMEN:

This is a fairly strongly altered, weakly vesicular and aphyric basaltic lava or dyke.

THIN SECTION:

This sample is considerably more altered than all the samples described above, and the alteration is typical of localized hydrothermal alteration rather than pervasive regional alteration. The sample is in fact, not aphyric, but rather strongly porphyritic. However, strong alteration makes it difficult to determine the original abundances and identity of many of the phenocrysts. Clearly, many were plagioclase, which has been albitized and then strongly sericitized. These are mainly less than 1.5mm long. The former mafic phenocrysts are so strongly altered, and even partly deformed, that it is difficult to determine with certainty their original identity. However, relic shapes and experience suggest that most were probably augite; they range up to at least 3mm long, and are now replaced by fine-grained calcite. A few phenocrysts replaced by very fine-grained quartz, and containing small red chromite inclusions, were almost certainly olivine.

There is no hope of telling from the groundmass texture whether this sample was intrusive or a lava, although a few places better preserved have textures very close to the previous two samples (with their inherent ambiguities). Abundant fine-grained calcite and sericite pervades the groundmass, in which blebs of secondary quartz are the only other notable feature. A few veinlets of fine-grained yellowish epidote are present.

This was an olivine+augite+plagioclase-phyric basaltic lava (?) with a far stronger alteration signature (calcite-sericite) than any of the foregoing samples.

085221

APPENDIX X

23

085223

PAGE 1 OF 2

CORE GRIND SAMPLING

HOLE No. MAC 30

DATE

MAC
30
DMAC
30
A

| No. | SAMPLE NUMBER | INTERVAL | ELEMENTS REQUIRED | ST | SAMPLE NUMBER | INTERVAL | ELEMENTS REQUIRED | S |
|-----|----------------|-------------|-------------------|----|---------------|-------------|-------------------|-------|
| 1 | 622101 | 0-18.5 | | | 622133 | 416.6-423.8 | | |
| 2 | 102 | 18.5-39.9 | | | 134 | 423.8-433.0 | | |
| 3 | 103 | 39.9-55.0 | | | 135 | 433.0-443.6 | | |
| 4 | 104 | 55.0-70.0 | | | 136 | 443.6-457.4 | | |
| 5 | 105 | 70.0-85.0 | | | 137 | 457.4-473.7 | | |
| 6 | 106 | 85.0-100.0 | | | 138 | 473.7-482.3 | | |
| 7 | 107 | 100.0-118.6 | | | 139 | 482.3-495.2 | | |
| 8 | 108 | 118.6-131.0 | | | 140 | 495.2-508.3 | | |
| 9 | 109 | 131.0-142.6 | | | 141 | 508.3-512.5 | | |
| 10 | X 110 | STANDARD | | | 142 | 512.5-525.0 | | |
| 11 | 111 | 143.0-152.8 | | | 143 | 525-540.0 | | |
| 12 | 112 | 152.8-162.1 | | | 144 | 540.0-555.0 | | |
| 13 | 113 | 162.1-175.0 | | | 145 | 555.0-570.4 | | |
| 14 | 114 | 175.0-193.5 | | | 146 | 570.4-580.0 | | |
| 15 | 115 | 193.5-199.6 | | | 147 | 580.0-589.7 | | |
| 16 | 116 | 199.6-209.6 | | | 148 | 589.7-600.0 | | |
| 17 | 117 | 209.6-226.4 | | | 149 | 600.0-609.3 | | |
| 18 | 118 | 226.4-243.5 | | | 150 | 609.3-612.4 | | |
| 19 | 119 | 243.5-255.7 | | | 151 | 612.4-622.0 | | |
| 20 | 120 | 255.7-268.3 | | | 152 | 622.0-632.1 | | |
| 21 | 121 | 268.3-273.8 | | | 153 | 632.1-634.9 | | SCORE |
| 22 | 122 | 273.8-292.3 | | | 154 | 634.9-636.2 | | SCORE |
| 23 | 123 | 292.3-300.3 | | | 155 | 636.2-649.1 | | |
| 24 | X 124 | STANDARD | | | 156 | 649.1-656.7 | | |
| 25 | 125 | 300.3-315.0 | | | 157 | 656.7-660.9 | | |
| 26 | 126 | 315.0-329.4 | | | 158 | 660.9-667.9 | | |
| 27 | 127 | 329.4-345.0 | | | 159 | 667.9-678.3 | | |
| 28 | 128 | 345.0-360.0 | | | 160 | 678.3-691.2 | | |
| 29 | 129 | 360.0-376.8 | | | 161 | 691.2-698.6 | | |
| 30 | 130 | 376.8-390.0 | | | 162 | 698.6-710.0 | | |
| 31 | 131 | 390.0-403.0 | | | 163 | 710.0-723.2 | | |
| 32 | 132 | 403.0-416.6 | | | 164 | 723.2-724.9 | | SCORE |

220
CORE GRIND SAMPLING

085224

HOLE No.

DATE

| No. | SAMPLE NUMBER | INTERVAL | ELEMENTS REQUIRED | ST | SAMPLE NUMBER | INTERVAL | ELEMENTS REQUIRED |
|-----|---------------|-------------|-------------------|----|---------------|----------|-------------------|
| 1 | 622165 | 724.9-729.5 | | | | | |
| 2 | 166 | 729.5-735.4 | | | | | |
| 3 | 167 | 735.4-747.0 | | | | | |
| 4 | X 168 | STANDARD | | | | | |
| 5 | 169 | 747.0-756.4 | | | | | |
| 6 | 170 | 756.4-766.6 | | | | | |
| 7 | 171 | 766.6-773.3 | | | | | |
| 8 | 172 | 773.3-784.4 | | | | | |
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085225



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A Division of Incharge Inspection and Testing Services Australia Pty. Ltd.

ANALYTICAL DATA

Phone (004) 316837

14 Thirkell St. COOEE TAS 7320

Fax (004) 318890

ANALYTICAL REPORT No. 100560.60.08632

THIS REPORT MUST BE READ IN CONJUNCTION WITH THE ACCOMPANYING ANALYTICAL DATA

INVOICE TO:
 1. Aberfoyle Resources Limited
 Exploration Division
 2. P.O. Box 952
 3. BURNIE TAS 7320

ORDER No. 12141
PROJECT
DATE RECEIVED 10/03/92
RESULTS REQUIRED ASAP

| | | | |
|--------------------------------|----------------------|----------------------|-----------------------------|
| No. OF PAGES OF RESULTS | DATE REPORTED | No. OF COPIES | TOTAL No. OF SAMPLES |
| 6 | 03/04/92 | 1 | 72 |

| SAMPLE NUMBERS | SAMPLE DESCRIPTION | ELEMENT/METHOD |
|----------------|-------------------------------|--------------------------------|
| 6ZZ101/172 | CS Prep : 6P009, 6P012, 6P018 | Cu, Pb, Zn, Ag/6A101 |
| 6ZZ101/172 | CS Prep : | Au, Au(R)/6E309 |
| 6ZZ101/172 | CS Prep : | Ba, As, Cr, Zr, Ti, TiIz/6X401 |

| RESULTS TO | REMARKS |
|---|-----------------------|
| Mr S Richardson Aberfoyle Resources Limited P.O. Box 952 BURNIE TAS 7320 | MAC-30(A) GRINDING |
| RESULTS 20 | |
| RESULTS 21 | |
| RESULTS 24 | |
| RESULTS 25 | |

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ANALYTICAL DATA

SAMPLE PREFIX REPORT NUMBER REPORT DATE CLIENT ORDER No. PAGE

100560.60.08632 03/04/92 12141 1 OF 6

| TUBE No. | SAMPLE No. | Cu | Pb | Zn | Ag | Au | Au (R) | Ba | As | Cr |
|----------|------------|-----|-----|------|----|--------|--------|------|----|------|
| 1 | 622101 | 58 | 39 | 155 | <2 | <0.008 | - | 744 | 10 | 76 |
| 2 | 622102 | 62 | 24 | 144 | <2 | <0.008 | - | 845 | 7 | 151 |
| 3 | 622103 | 58 | 11 | 90 | <2 | <0.008 | - | 788 | 6 | 100 |
| 4 | 622104 | 46 | 38 | 168 | <2 | <0.008 | - | 851 | 13 | 94 |
| 5 | 622105 | 56 | 34 | 162 | <2 | <0.008 | - | 973 | 14 | 114 |
| 6 | 622106 | 61 | 21 | 143 | <2 | <0.008 | - | 525 | 14 | 92 |
| 7 | 622107 | 54 | 38 | 134 | <2 | <0.008 | - | 605 | 7 | 89 |
| 8 | 622108 | 34 | <5 | 96 | <2 | <0.008 | - | 1136 | 3 | 12 |
| 9 | 622109 | 85 | 5 | 142 | <2 | <0.008 | - | 1259 | 6 | 18 |
| 10 | 622110 | 116 | 194 | 2250 | <2 | <0.008 | - | 1148 | 29 | 1090 |
| 11 | 622111 | 83 | 51 | 261 | <2 | <0.008 | - | 916 | 9 | 138 |
| 12 | 622112 | 63 | 5 | 171 | <2 | <0.008 | <0.008 | 957 | 2 | 28 |
| 13 | 622113 | 66 | 37 | 147 | <2 | <0.008 | <0.008 | 854 | 14 | 141 |
| 14 | 622114 | 67 | 7 | 142 | <2 | <0.008 | - | 546 | 6 | 189 |
| 15 | 622115 | 131 | 39 | 170 | <2 | <0.008 | - | 563 | 12 | 160 |
| 16 | 622116 | 105 | 6 | 182 | <2 | <0.008 | - | 441 | 8 | 175 |
| 17 | 622117 | 47 | 34 | 752 | <2 | <0.008 | - | 1533 | 18 | 46 |
| 18 | 622118 | 182 | 14 | 452 | <2 | <0.008 | - | 1345 | 8 | 70 |
| 19 | 622119 | 84 | 36 | 390 | <2 | <0.008 | - | 1765 | 15 | 254 |
| 20 | 622120 | 95 | 85 | 211 | <2 | <0.008 | - | 1003 | 12 | 222 |
| 21 | 622121 | 87 | 17 | 200 | <2 | <0.008 | - | 1031 | 9 | 276 |
| 22 | 622122 | 69 | 44 | 198 | <2 | <0.008 | <0.008 | 706 | 14 | 233 |
| 23 | 622123 | 107 | 34 | 134 | <2 | <0.008 | - | 939 | 4 | 383 |
| 24 | 622124 | 117 | 193 | 2310 | <2 | <0.008 | - | 1153 | 32 | 1049 |
| 25 | 622125 | 96 | 58 | 134 | <2 | <0.008 | <0.008 | 1161 | 8 | 279 |

Results appropriate to the sample type.
 (= element present, but concentration is below the detection limit.
 X = element concentration is below detection limit.
 - = element not determined.

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226

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ANALYTICAL DATA

SAMPLE PREFIX REPORT NUMBER REPORT DATE CLIENT ORDER No. PAGE

100560.60.08632 03/04/92 12141 2 OF 6

| TUBE No. | SAMPLE No. | Cu | Pb | Zn | Ag | Au | Au (R) | Ba | As | Cr |
|----------|------------|-------|-------|-------|-------|--------|--------|-------|-------|-------|
| 1 | 622126 | 75 | 154 | 273 | <2 | <0.008 | - | 1029 | 25 | 550 |
| 2 | 622127 | 95 | 9 | 98 | <2 | <0.008 | - | 558 | 11 | 297 |
| 3 | 622128 | 80 | 6 | 96 | <2 | <0.008 | - | 524 | 10 | 124 |
| 4 | 622129 | 66 | 13 | 100 | <2 | <0.008 | - | 612 | 9 | 141 |
| 5 | 622130 | 70 | 48 | 176 | <2 | <0.008 | - | 658 | 13 | 148 |
| 6 | 622131 | 66 | 38 | 140 | <2 | <0.008 | - | 645 | 13 | 113 |
| 7 | 622132 | 53 | 55 | 158 | <2 | <0.008 | - | 712 | 13 | 172 |
| 8 | 622133 | 82 | 296 | 270 | <2 | <0.008 | - | 634 | 10 | 191 |
| 9 | 622134 | 94 | 85 | 260 | <2 | <0.008 | - | 493 | 10 | 122 |
| 10 | 622135 | 78 | 182 | 466 | <2 | <0.008 | - | 511 | 14 | 289 |
| 11 | 622136 | 85 | 176 | 431 | <2 | <0.008 | - | 812 | 10 | 257 |
| 12 | 622137 | 70 | 63 | 194 | <2 | <0.008 | <0.008 | 860 | 13 | 243 |
| 13 | 622138 | 59 | 87 | 304 | <2 | <0.008 | - | 640 | 14 | 262 |
| 14 | 622139 | 87 | 45 | 420 | <2 | <0.008 | - | 804 | 10 | 369 |
| 15 | 622140 | 82 | 270 | 995 | <2 | <0.008 | <0.008 | 1353 | 17 | 387 |
| 16 | 622141 | 90 | 67 | 660 | <2 | <0.008 | - | 2433 | 24 | 976 |
| 17 | 622142 | 99 | 68 | 320 | <2 | <0.008 | - | 555 | 27 | 821 |
| 18 | 622143 | 81 | 81 | 280 | <2 | <0.008 | - | 785 | 25 | 797 |
| 19 | 622144 | 99 | 114 | 360 | <2 | <0.008 | - | 776 | 40 | 734 |
| 20 | 622145 | 87 | 123 | 204 | <2 | <0.008 | - | 1255 | 40 | 753 |
| 21 | 622146 | 79 | 9 | 130 | <2 | <0.008 | - | 1149 | 46 | 450 |
| 22 | 622147 | 82 | 64 | 369 | <2 | <0.008 | <0.008 | 490 | 35 | 718 |
| 23 | 622148 | 50 | <5 | 109 | <2 | <0.008 | - | 997 | 6 | 23 |
| 24 | 622149 | p36 | p55 | p82 | <2 | <0.008 | - | 1001 | p27 | p23 |
| 25 | 622150 | GA116 | GA119 | GA179 | GA122 | 0.015 | 0.016 | GA124 | GA161 | GA169 |

X - element concentration below detection limit
- element not determined

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PAGE

100560.60.08632

03/04/92

12141

3 OF 6

| TUBE No. | SAMPLE No. | Cu | Pb | Zn | Ag | Au | Au(R) | Ba | As | Cr |
|----------|------------|-------|-------|-------|-------|--------|--------|-------|-------|-------|
| 1 | 622151 | 32 | 9 | 102 | <2 | <0.008 | - | 1028 | 16 | 18 |
| 2 | 622152 | 29 | 8 | 116 | <2 | <0.008 | - | 951 | 4 | 34 |
| 3 | 622153 | 46 | 22 | 183 | <2 | <0.008 | - | 280 | 17 | 150 |
| 4 | 622154 | 175 | 77 | 194 | <2 | 0.018 | - | 740 | 45 | 140 |
| 5 | 622155 | 112 | 40 | 250 | <2 | 0.008 | - | 533 | 22 | 351 |
| 6 | 622156 | 81 | 29 | 197 | <2 | <0.008 | - | 335 | 16 | 702 |
| 7 | 622157 | 104 | 17 | 170 | <2 | <0.008 | - | 1092 | 7 | 81 |
| 8 | 622158 | 80 | 15 | 147 | <2 | <0.008 | - | 324 | 10 | 601 |
| 9 | 622159 | 46 | <5 | 126 | <2 | <0.008 | - | 773 | 6 | 213 |
| 10 | 622160 | 89 | 8 | 134 | <2 | <0.008 | - | 578 | 11 | 481 |
| 11 | 622161 | 120 | 7 | 154 | <2 | <0.008 | - | 299 | 12 | 717 |
| 12 | 622162 | 60 | 6 | 99 | <2 | <0.008 | <0.008 | 617 | 6 | 121 |
| 13 | 622163 | 74 | <5 | 99 | <2 | <0.008 | - | 619 | 4 | 142 |
| 14 | 622164 | 92 | 9 | 133 | <2 | <0.008 | - | 640 | 10 | 480 |
| 15 | 622165 | 124 | 6 | 138 | <2 | <0.008 | - | 562 | 7 | 138 |
| 16 | 622166 | 295 | 28 | 138 | <2 | <0.008 | - | 404 | 22 | 504 |
| 17 | 622167 | 79 | <5 | 85 | <2 | <0.008 | - | 754 | 4 | 66 |
| 18 | 622168 | 110 | 183 | 2220 | <2 | <0.008 | - | 1141 | 27 | 1038 |
| 19 | 622169 | 70 | 20 | 143 | <2 | <0.008 | - | 877 | 9 | 491 |
| 20 | 622170 | 86 | 14 | 135 | <2 | <0.008 | <0.008 | 791 | 10 | 181 |
| 21 | 622171 | 194 | 161 | 235 | <2 | <0.008 | - | 485 | 11 | 625 |
| 22 | 622172 | 181 | 33 | 194 | <2 | <0.008 | <0.008 | 518 | 12 | 573 |
| 23 | DETECTION | 4 | 225 | 1.4 | 2 | 0.008 | 0.008 | 10 | 2 | 5 |
| 24 | 6221 UNITS | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm |
| 25 | 622 METHOD | GA101 | GA101 | GA101 | GA101 | GG309 | GG309 | GX401 | GX401 | GX401 |

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REPORT DATE

CLIENT ORDER No.

PAGE

100560.60.08632

03/04/92

12141

4 OF 6

| TUBE No. | SAMPLE No. | Zr | Ti | TiZr | | | | | |
|----------|------------|-----|------|------|--|--|--|--|--|
| 1 | 622101 | 177 | 4021 | 22.7 | | | | | |
| 2 | 622102 | 135 | 4194 | 31.1 | | | | | |
| 3 | 622103 | 138 | 3281 | 23.8 | | | | | |
| 4 | 622104 | 134 | 3264 | 24.4 | | | | | |
| 5 | 622105 | 146 | 3715 | 25.4 | | | | | |
| 6 | 622106 | 167 | 3775 | 22.6 | | | | | |
| 7 | 622107 | 155 | 3784 | 24.4 | | | | | |
| 8 | 622108 | 185 | 2213 | 12.0 | | | | | |
| 9 | 622109 | 197 | 2216 | 11.2 | | | | | |
| 10 | 622110 | 102 | 2693 | 26.4 | | | | | |
| 11 | 622111 | 133 | 4055 | 30.5 | | | | | |
| 12 | 622112 | 178 | 2587 | 14.5 | | | | | |
| 13 | 622113 | 131 | 4193 | 32.0 | | | | | |
| 14 | 622114 | 130 | 3694 | 28.4 | | | | | |
| 15 | 622115 | 124 | 3245 | 26.2 | | | | | |
| 16 | 622116 | 127 | 3512 | 27.6 | | | | | |
| 17 | 622117 | 174 | 4474 | 25.7 | | | | | |
| 18 | 622118 | 152 | 3959 | 26.0 | | | | | |
| 19 | 622119 | 141 | 3306 | 23.4 | | | | | |
| 20 | 622120 | 156 | 3312 | 21.2 | | | | | |
| 21 | 622121 | 169 | 3729 | 22.1 | | | | | |
| 22 | 622122 | 153 | 3196 | 20.9 | | | | | |
| 23 | 622123 | 198 | 2621 | 26.7 | | | | | |
| 24 | 622124 | 199 | 2655 | 28.8 | | | | | |
| 25 | 622125 | 118 | 2981 | 25.3 | | | | | |



 AUTHORIZED OFFICER

ANALABS

A Division of Incharge Inspection and Testing Services Australia Pty. Ltd.
A.C.N. 004 591 664

ANALYTICAL DATA

SAMPLE PREFIX

REPORT NUMBER

REPORT DATE

CLIENT ORDER No.

PAGE

100560.60.08632

03/04/92

12141

5 OF 6

| TUBE No. | SAMPLE No. | Zr | Ti | TiZr | | | | | |
|----------|------------|-----|------|------|--|--|--|--|--|
| 1 | 622126 | 126 | 3470 | 27.5 | | | | | |
| 2 | 622127 | 123 | 3623 | 29.5 | | | | | |
| 3 | 622128 | 136 | 4045 | 29.7 | | | | | |
| 4 | 622129 | 144 | 4231 | 29.4 | | | | | |
| 5 | 622130 | 137 | 4075 | 29.7 | | | | | |
| 6 | 622131 | 154 | 4082 | 26.5 | | | | | |
| 7 | 622132 | 143 | 3882 | 27.1 | | | | | |
| 8 | 622133 | 137 | 3733 | 27.2 | | | | | |
| 9 | 622134 | 118 | 3572 | 30.3 | | | | | |
| 10 | 622135 | 133 | 3850 | 28.9 | | | | | |
| 11 | 622136 | 143 | 3741 | 26.2 | | | | | |
| 12 | 622137 | 140 | 3638 | 26.0 | | | | | |
| 13 | 622138 | 138 | 3978 | 28.8 | | | | | |
| 14 | 622139 | 137 | 3786 | 27.6 | | | | | |
| 15 | 622140 | 146 | 3936 | 27.0 | | | | | |
| 16 | 622141 | 165 | 4138 | 25.1 | | | | | |
| 17 | 622142 | 168 | 3725 | 22.2 | | | | | |
| 18 | 622143 | 167 | 3954 | 23.7 | | | | | |
| 19 | 622144 | 116 | 3137 | 27.0 | | | | | |
| 20 | 622145 | 105 | 2972 | 28.3 | | | | | |
| 21 | 622146 | 105 | 2761 | 26.3 | | | | | |
| 22 | 622147 | 101 | 2832 | 28.0 | | | | | |
| 23 | 622148 ON | 159 | 3174 | 20.0 | | | | | |
| 24 | 622149 ITG | 158 | 3006 | 19.0 | | | | | |
| 25 | 622150 ON | 106 | 3066 | 28.9 | | | | | |

Results in ppm unless otherwise specified.
 Element present but concentration too low to measure.
 Element present but concentration is below detection limit.
 Element not determined.

AUTHORISE OFFICER

085231

ANALABS

A Division of Incharge Inspection and Testing Services Australia Pty. Ltd.
A.C.N. 004 601 604

ANALYTICAL DATA

SAMPLE PREFIX

REPORT NUMBER

REPORT DATE

CLIENT ORDER No.

PAGE

100560.60.08632

03/04/92

12141

6 OF 6

| TUBE No. | SAMPLE No. | Zr | Ti | TiZr | | | | | |
|----------|------------|-------|-------|-------|--|--|--|--|--|
| 1 | 622151 | 180 | 2494 | 13.9 | | | | | |
| 2 | 622152 | 167 | 3263 | 19.5 | | | | | |
| 3 | 622153 | 140 | 3600 | 25.7 | | | | | |
| 4 | 622154 | 110 | 3350 | 30.4 | | | | | |
| 5 | 622155 | 103 | 3247 | 31.5 | | | | | |
| 6 | 622156 | 88 | 2689 | 30.6 | | | | | |
| 7 | 622157 | 92 | 2891 | 31.4 | | | | | |
| 8 | 622158 | 78 | 2736 | 35.1 | | | | | |
| 9 | 622159 | 112 | 3152 | 28.1 | | | | | |
| 10 | 622160 | 105 | 3308 | 31.5 | | | | | |
| 11 | 622161 | 99 | 2748 | 27.8 | | | | | |
| 12 | 622162 | 141 | 3525 | 25.0 | | | | | |
| 13 | 622163 | 138 | 3442 | 24.9 | | | | | |
| 14 | 622164 | 85 | 2350 | 27.6 | | | | | |
| 15 | 622165 | 105 | 2889 | 27.5 | | | | | |
| 16 | 622166 | 85 | 2566 | 30.2 | | | | | |
| 17 | 622167 | 153 | 3435 | 22.4 | | | | | |
| 18 | 622168 | 95 | 2615 | 27.5 | | | | | |
| 19 | 622169 | 85 | 2402 | 28.3 | | | | | |
| 20 | 622170 | 89 | 2679 | 30.1 | | | | | |
| 21 | 622171 | 78 | 2575 | 33.0 | | | | | |
| 22 | 622172 | 99 | 2728 | 27.6 | | | | | |
| 23 | DETECTION | 5 | 50 | 0.1 | | | | | |
| 24 | UNITS | ppm | ppm | % | | | | | |
| 25 | METHOD | GX401 | GX401 | GX401 | | | | | |

* element present but concentration too low to measure
X element concentration below detection limit

ALLOTTED OFFICERY

OPEN FILE

085232

Aberfoyle Resources Limited
EXPLORATION DIVISION
A.C.N. 004 864 108

92-3355

| | |
|----------------------------------|-----------|
| MINES | |
| File Ref. | EL 106/87 |
| Covering letter on File Folio 36 | |

MACKINTOSH DISTRICT

MACKINTOSH DISTRICT

EXPLORATION LICENCE 106/87

TASMANIA

Progress Report for the Period

April 1991 - April 1992

Volume 2

Plates

92-3355.
VOL 2/2

Distribution

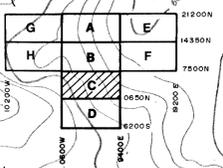
- Aberfoyle - Burnie (1/3)
- Aberfoyle - Hawthorn (2/3)
- Department of Resources and Energy (3/3)



EL. 106/87 MACKINTOSH

EL. 99/85 BULGOBAC RIVER
EL. 37/89 PASMINCO

EL. 2/90 S-HELL



Aberfoyle Resources Limited
EXPLORATION DIVISION **085233**

NORTH WEST TASMANIA
MACKINTOSH AREA
INTERPRETIVE GEOLOGY

| REVISIONS | | | |
|-----------|------|------|------|
| Int. | Date | Int. | Date |
| | | | |
| | | | |
| | | | |
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| | | | |

Location Code: K55/G/44 Scale: 1:10,000 Date: September, 1987 Plate No: MAC 161C

Compiled: AMH, AMcN
Drawn: AMH, AMcN
Traced: RJE
Checked: AMH

Limestone

Bioturbated quartz sandstone

Silicic conglomerate and sandstone

Quartz feldspar phryic lavas and volcanics with latest middle Cambrian fossils.

A felsic complex of breccia and ash volcanics and minor lavas. Intercalated shale and greywacke

Black shale with late middle Cambrian fossils

Basic, intermediate to acid calc alkaline volcanics comprising lavas, autoclastics, hyaloclastics and epiclastics

Micaceous lithicwacke with interbedded siltstone shale and minor Que-Hellyer volcanics

A calc alkaline suite of felsic lavas, pyroclastics and other volcanics.

INTRUSIVES

 Dolerite sills of Devonian? age

 Rhyolite sills and dykes. Cambrian age

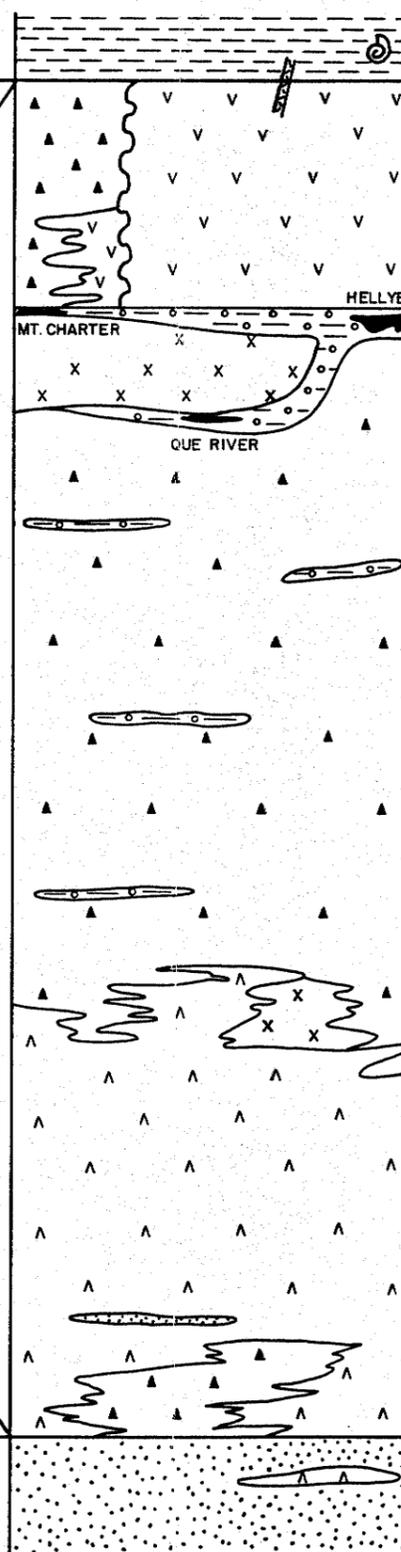


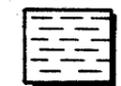
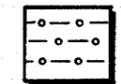
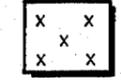
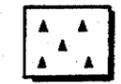
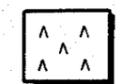
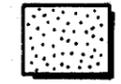
PUBLISHED NOMENCLATURE

QUE RIVER BEDS
(Gee, 1970)

QUE - HELLYER VOLCANICS
(Komysan, 1986)

ANIMAL CREEK GREYWACKE
(Collins, 1981)



-  QRS Black carbonaceous pyritic shale. Massive to finely bedded.
-  UB Amygdaloidal basalt lava. Massive, pillowed, autobrecciated, hyaloclastitic, peperitic varieties.
-  HVS SWV RWP Polymict breccia to ash volcanics. Predominantly mass flow units with finer bedded volcanic sediments.
-  D Dacite. Massive to flow banded lava with autobrecciated hyaloclastic varieties. Minor intrusives
-  A Andesite. Typically albite porphyritic with autobrecciated, hyaloclastic varieties with minor massive lava. Prominent development of metamorphic epidote and pumpellyite.
-  LB Basalt lava. Massive to autobrecciated hyaloclastic varieties. Prominent development of metamorphic epidote and pumpellyite.
-  MSs Lithic rich micaceous sandstone with interbedded shale and volcanoclastic units near base
- INTRUSIVES
-  Probable Cretaceous lamprophyre dykes

Aberfoyle Resources Limited

EXPLORATION DIVISION

085234

NORTH WEST TASMANIA

**MACKINTOSH DISTRICT
STRATIGRAPHIC COLUMN**

Compiled : DBW

Drawn : DBW

Traced : RJE

Checked : DBW

Plate No. : MAC 220

| REVISIONS | | | |
|-----------|------|------|------|
| Init | Date | Init | Date |
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Location Code :

Scale : NTS

Date : December, 1988



Tertiary Basalt

015° TREND-ORE FEEDERS AND STAGE 2A PYRITIC VEINS

045° TREND-STAGE 2B BASE METAL VEINS

Areas D and E are interesting geochemical anomalies in structurally favourable locations, without much drilling. A critical factor may be in stratigraphic position, particularly the relationship of "dacitic lavas" to ore horizon.

Lineaments L1-L5 are considered major fault lines. Their influence on volcanism and VMS mineralization has not been followed up at this stage.

1000N

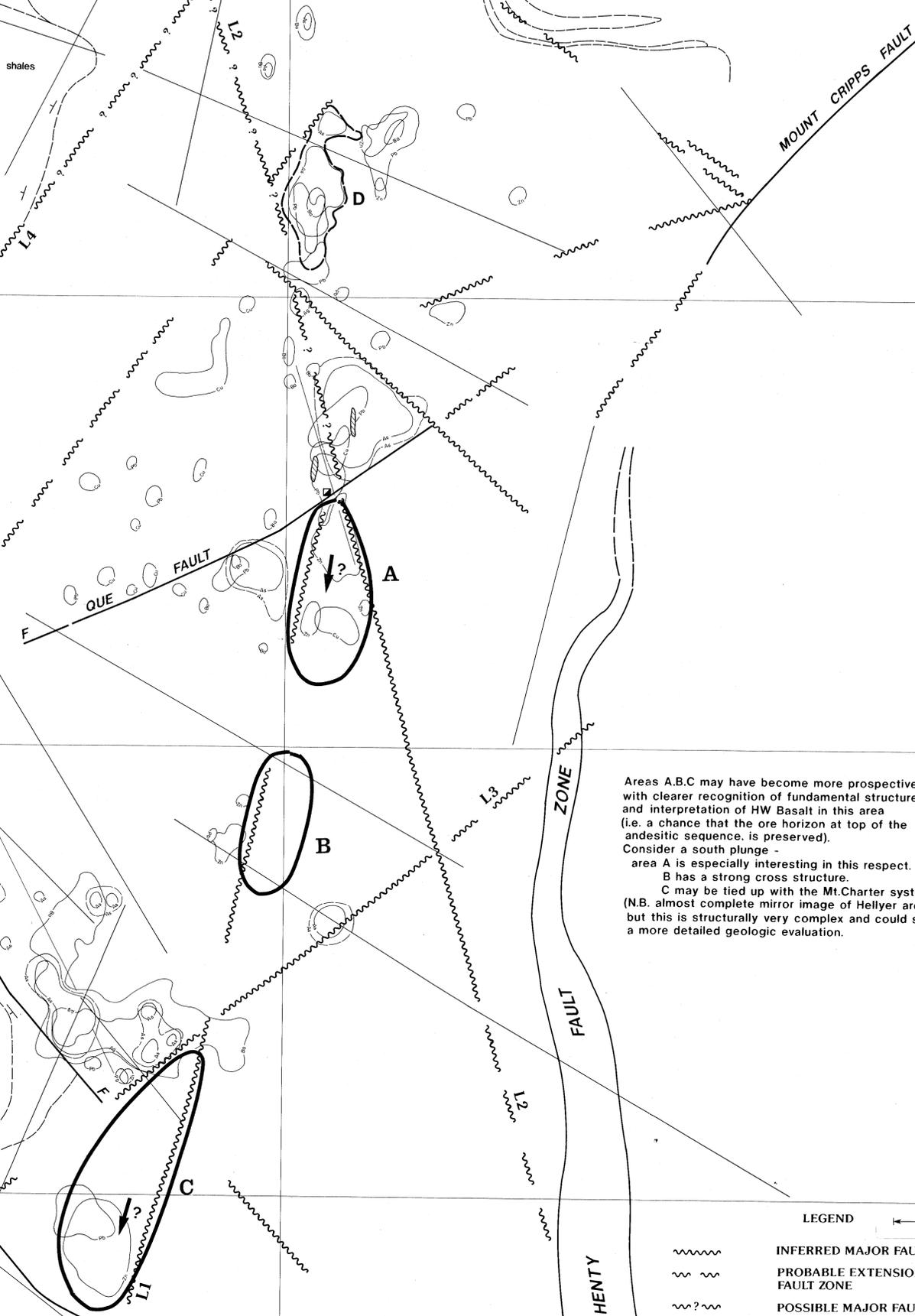
8000N

6000N

4000N

8000E

5000E



Areas A.B.C may have become more prospective with clearer recognition of fundamental structure L1, and interpretation of HW Basalt in this area (i.e. a chance that the ore horizon at top of the andesitic sequence, is preserved). Consider a south plunge - area A is especially interesting in this respect. B has a strong cross structure. C may be tied up with the Mt.Charter system (N.B. almost complete mirror image of Hellyer area), but this is structurally very complex and could stand a more detailed geologic evaluation.

Apparent H-Q-C exhalative zone defined by metal highs and structure

LEGEND

- INFERRED MAJOR FAULT
- PROBABLE EXTENSION, INFERRED FAULT ZONE
- POSSIBLE MAJOR FAULT ZONE
- MAPPED FAULT
- AIRPHOTO LINEAR

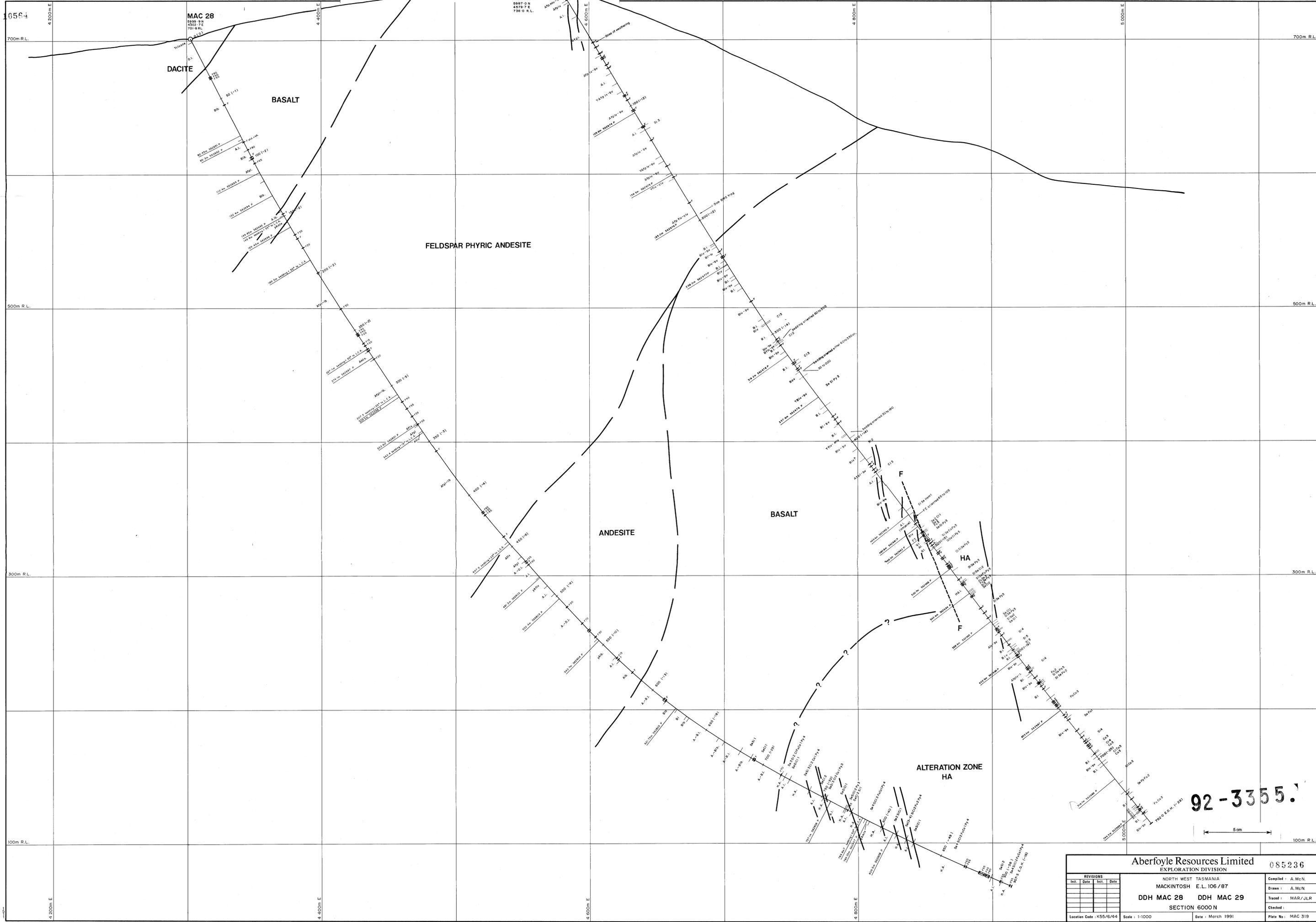
GEOCHEMICAL "HIGHS" (arbitrary levels from imagery)

- Cu
- Ba
- Pb
- As
- Zn
- Ag

92-3355

| | | | |
|--|-----------------|----------------------|-------------------|
| Aberfoyle Resources Limited | | EXPLORATION DIVISION | 085235 |
| REVISIONS | | MACKINTOSH EL 106/87 | Compiled: IBF |
| Init. | Date | Init. | Date |
| | | | |
| SUMMARY MAP | | Drawn: IBF | |
| STRUCTURAL LINES, QUE RIVER SHALE MARKER | | Traced: RJE | |
| AND EXHALATIVE GEOCHEMISTRY | | Checked: | |
| Location Code: | Scale: 1:10,000 | Date: October, 1990 | Plate No: MOC 306 |

2000E



92-3355.

5 cm

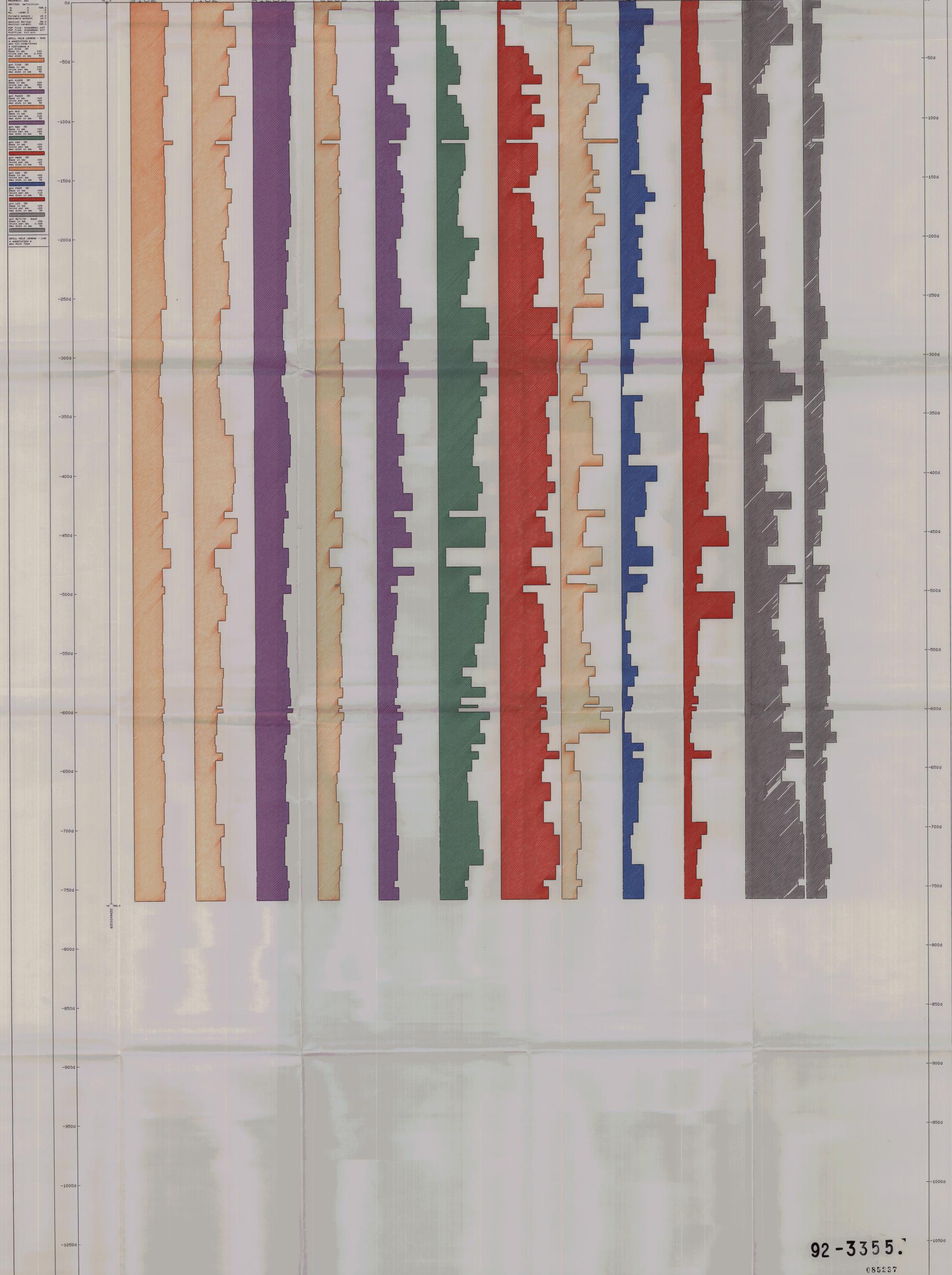
Aberfoyle Resources Limited 085236
EXPLORATION DIVISION

NORTH WEST TASMANIA
MACKINTOSH E.L. 106/87
DDH MAC 28 DDH MAC 29
SECTION 6000N

| REVISIONS | | | |
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| Int. | Date | Int. | Date |
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Compiled: A.McN.
Drawn: A.McN.
Traced: MAR/JLR
Checked:
Scale: 1:1000
Date: March 1991
Plate No.: MAC 319

S102 T102 Al2O3 Fe2O3 MnO MgO CaO Na2O K2O P2O5 DT SpTi/Zr



SECTION DEFINITION - MIN
 S102
 T102
 Al2O3
 Fe2O3
 MnO
 MgO
 CaO
 Na2O
 K2O
 P2O5
 DT
 SpTi/Zr

92-3355

085237

| | | | |
|-----------------------------|----------------|----------------------|-------------------|
| Aberfoyle Resources Limited | | EXPLORATION DIVISION | |
| TASMANIA | | | |
| MACKINTOSH E. L. 106/87 | | | |
| GEOCHEMICAL PROFILES | | | |
| DDH MAC-20 (major) | | | |
| Location: | Scale: 1: 1000 | Date: 09/04/92 | Plate No: MAC1901 |
| REVISIONS | Author: RMB | Drawn: | Checked: |
| | | | |
| | | | |

N

Tertiary Basalt

1000N

8000N

6000N

4000N

3000N

An interesting "clean" Cu anomaly included in the HWB area but without associated Cr or Ti -compare to Cu anomaly over Que River deposit Could it be part of metal-zoned system with Pb anomaly adjacent to the north-east?

Cu-Cr-Ti signature of Hanging Wall Basalt -M₂-"Mafics 2" on cross section. Interesting association of isolated Cr and/or Ti high spots? ?? extrusive centres.

Eastern copper signature (M-"Mafics 3" on cross sections) spotty Cu with relatively moderate contrast, lacking Cr(-Ti) association. = Lower Basalt ?

Slightly distinctive Cu(-Cr-Ti) signature of Mt.Charter Dolerite. M₁- "Mafics 1" on cross section (not that different to M₂ HWB)

The Cu-Cr-Ti association on this map probably outlines the main areas of near-surface mafic rocks, and may help to differentiate, on geochemical evidence, the lower basalts from those higher in the section. Some statistical correlations and further detailed interpretation of the imagery may improve this picture.

M₂ Hanging Wall Basalt?

M₂ Hanging Wall Basalt

LEGEND

- ~~~~~ INFERRED MAJOR FAULT
- ~~~~~ PROBABLE EXTENSION, INFERRED FAULT ZONE
- ~~~~~ POSSIBLE MAJOR FAULT ZONE
- MAPPED FAULT
- AIRPHOTO LINEAR

GEOCHEMICAL HIGHS IN "C" HORIZON (arbitrary levels chosen from imagery)

- Cu ——
- Cr ——
- Ti ——

0 500 1000 metres

92-3355.

Aberfoyle Resources Limited EXPLORATION DIVISION 085239

| REVISIONS | | | |
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| Init. | Date | Init. | Date |
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MACKINTOSH EL 106/87 SUMMARY MAP SELECTED LARGER LINEAMENTS AND LINEARS. GEOCHEMICAL HIGHS IN "C" HORIZON

Compiled: IBF Drawn: IBF Traced: RJE Checked: []

Location Code: Scale: 1:10,000 Date: November, 1990 Plate No: MOC 311

2000E

5000E

3000E

3000E

10567

2000 E

5000 E

8000 E

10000 N

10000 N

8000 N

8000 N

6000 N

6000 N

4000 N

4000 N

2000 E

5000 E



92-3355.

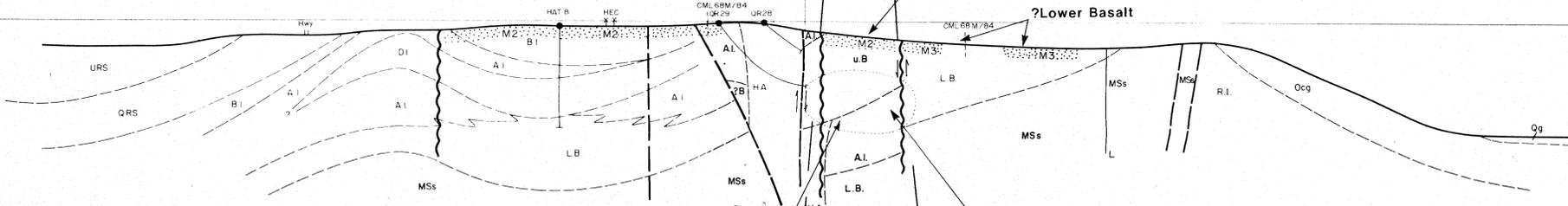
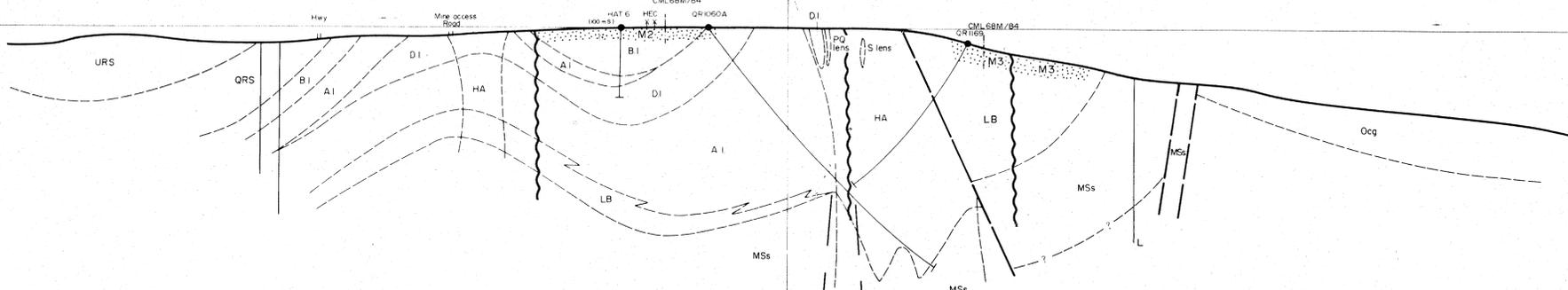
Aberfoyle Resources Limited 085240
EXPLORATION DIVISION

MACKINTOSH E.L. 106/87
SUMMARY OVERLAY
SOUTH QUE RIVER AREA

| REVISIONS | | | |
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| Init. | Date | Init. | Date |
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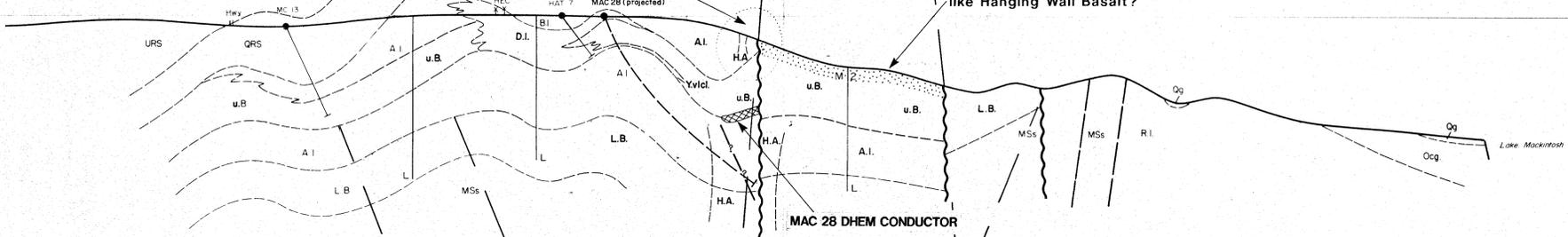
Location Code: Scale: 1:10,000 Date: JUNE 1991

Compiled: MAG
Drawn: JLR
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Checked: Plate No: MAC 322



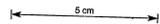
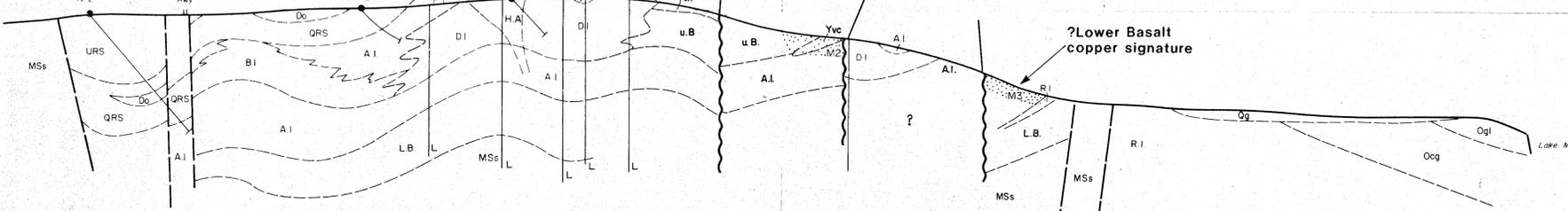
*Very interesting target position geologically and geochemically. Look for target down thrown on the east side of L1, with a south plunge. This could be the Que River ore system expressed at the surface (i.e. up-plunge to the north) by a strong Zn anomaly.

QUE HELLYER HOST HORIZON



MAC 28 DHEM CONDUCTOR

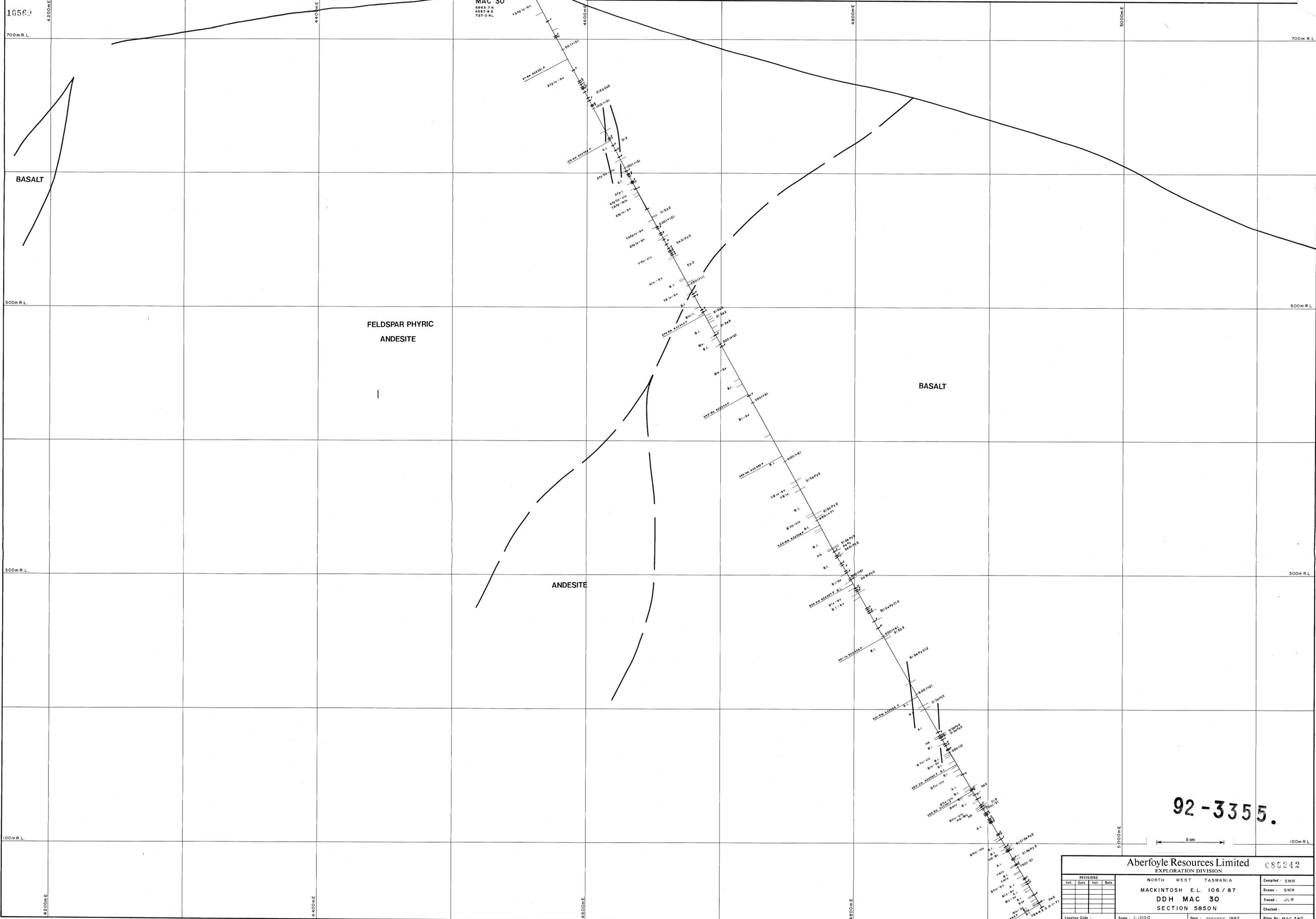
NORTH - WEST
CORRIDOR



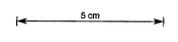
Refer Plate MAC 320D for Legend
Refer Plate MAC 247 for Legend
N.B. Replaces Plate MAC 97A and 97B

92-3355.

| | | | | | |
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| Aberfoyle Resources Limited | | EXPLORATION DIVISION | | 085241 | |
| NORTH WEST TASMANIA | | | | | |
| MACKINTOSH E.L. 106/87 | | | | | |
| INTERPRETIVE CROSS SECTION - LINEARS | | | | | |
| SOUTH QUE RIVER AREA | | | | | |
| REVISIONS | | Date | | Compiled: AMCN, IBF | |
| Int | Date | Ent | Date | Drawn: MAC19F, AMCN | |
| MAC 28 | 28-9-90 | | | Traced: MAR | |
| Location Code | | | | Checked: | |
| Scale: 1:10,000 | | Date: JULY 1991 | | Plate No: MAC 323 | |



92-3355.



Aberfoyle Resources Limited 085242
EXPLORATION DIVISION

NORTH WEST TASMANIA
MACKINTOSH E.L. 106 / 87
DDH MAC 30
SECTION 5850N

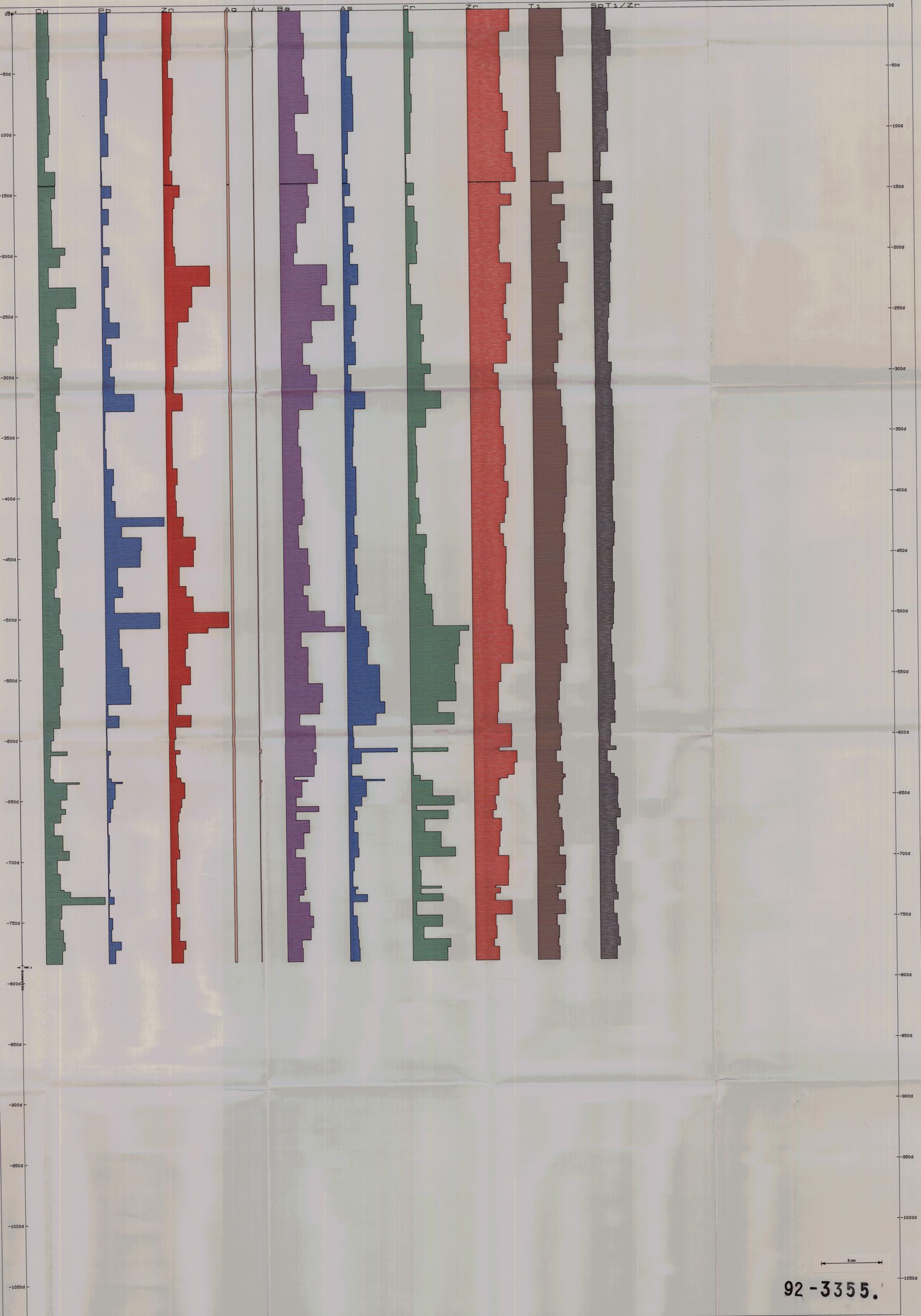
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Location Code: _____ Scale: 1:1000 Date: January, 1992 Plate No: MAC 340

Compiled: SMR
Drawn: SMR
Traced: JLR
Checked: _____

PROJECT NO. 10570
SECTION REFERENCE: 10570-01
SECTION NO. 10570-01
SECTION DATE: 10/04/82
SECTION DRAWN BY: [Name]
SECTION CHECKED BY: [Name]

WELL HOLE LEGEND - MM
WELL HOLE NO. 10570-01
WELL HOLE DATE: 10/04/82
WELL HOLE DEPTH: 10570
WELL HOLE DIAMETER: 10570
WELL HOLE TYPE: 10570
WELL HOLE STATUS: 10570
WELL HOLE LOCATION: 10570
WELL HOLE COORDINATES: 10570
WELL HOLE ELEVATION: 10570
WELL HOLE TEMPERATURE: 10570
WELL HOLE PRESSURE: 10570
WELL HOLE FLOW RATE: 10570
WELL HOLE YIELD: 10570
WELL HOLE QUALITY: 10570
WELL HOLE CONDITION: 10570
WELL HOLE PROBLEMS: 10570
WELL HOLE RECOMMENDATIONS: 10570
WELL HOLE NOTES: 10570



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92-3355

| | | | | |
|-----------------------------|---------------|----------------------|------------|--------|
| Aberfoyle Resources Limited | | EXPLORATION DIVISION | | 085243 |
| TASMANIA | | | | |
| MACKINTOSH E.L. 108/87 | | | | |
| GEOCHEMICAL PROFILES | | | | |
| DDH MAC-30 | | | | |
| Location Code: | Scale: 1:1000 | Date: 10/04/82 | Sheet No.: | MACH41 |