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EXPLORATION DIVISION

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EXPLORATION LICENCE 11/88

GOWRIE PARK

TASMANIA

Progress Report for the Year

Ended 1 July, 1990.

Volume 1

Text and Appendices

90-315 3.
Vol 1/2

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1.0 SUMMARY

Exploration by Aberfoyle Resources Ltd. within Exploration Licence 11/88 Gowrie Park during 1989/90, continued from work described in Rand and Noonan (1989). The work programmes concentrated on three main areas:- the Lower Beulah grid (including the Beulah Barite prospect), the Mt. Roland prospect and the Gowrie Park area.

In the Lower Beulah area, mapping was continued on the Lower Beulah grid and on the Beulah Barite prospect. An old adit located to the west of previous drilling exposes a cross-section from Gog Range sediments to Beulah Formation andesite lavas and volcaniclastics. A minor felsic unit, a rhyolitic volcaniclastic, occurs at the contact.

Hydrothermal alteration observed in the adit comprises strong sericite and silica, with weak pyrite and carbonate in the felsic unit, with very strong pervasive carbonate-haematite with minor fuchsite alteration observed in the intermediate units. Associated with the sericite-silica alteration is weak mineralisation in the form of sphalerite, galena and pyrite veining with some barite. The alteration and mineralisation is interpreted to represent a section from probable footwall to hangingwall styles. Lead isotope signatures of the mineralisation, however, indicate a less radiogenic source for the lead than that which has produced typical Cambrian hydrothermal signatures.

Petrology and geochemistry received for diamond drillhole BB6, drilled on the Beulah Barite prospect confirm that only intermediate lithologies with no significant mineralisation have been intersected.

At Mt. Roland, a grid was established over an old lead-zinc mine. Mapping and sampling has indicated that the Cambrian volcanics are predominantly massive hornblende+feldspar phyric andesite lavas. Variable intensity sericite-silica-carbonate and pyrite hydrothermal alteration has affected the rocks in the immediate vicinity of the adit. Associated with the strongly altered rocks is mineralisation in the form of sphalerite, galena and pyrite veining. Lead isotope studies of this mineralisation indicate a probable Cambrian hydrothermal source. UTEM surveys over the grid failed to detect any conductors attributable to massive sulphide mineralisation.

Reconnaissance mapping over a large area in the Mt. Roland-Mt. Claude-Staverton area located a variety of different lithologies, including previously unrecognised andesite lavas. This indicates a bimodality of the volcanism which increases the prospectivity of the area. Some folding and faulting has been recognised. No significant alteration or mineralisation was located outside of the previously identified Cethana alteration zone. Lead isotope studies of mineralised rocks from this zone indicate a high probability of a Cambrian hydrothermal origin.

2.0 INTRODUCTION

Exploration licence EL 11/88 Gowrie Park was granted to Aberfoyle Resources Ltd. on the 1st August, 1988, for ten years, with a required 50% reduction after 5 years.

The licence covers an area of 79 square kilometres south of Sheffield in Tasmania's northwest. The ground covered by the licence extends north from the peaks of Mt. Claude-Mt. Vandyke to the Dasher River in the north and east from near Cethana and Staverton to the Mersey River in the Lower Beulah area (refer to figure GP44).

The ground covered by the licence is predominantly pastoral freehold land and some forestry operations. The topography varies from undulating to steep.

This report details exploration undertaken on EL 11/88 for the year ending 1st July 1990, and continues the record previously reported in Rand and Noonan (1989).

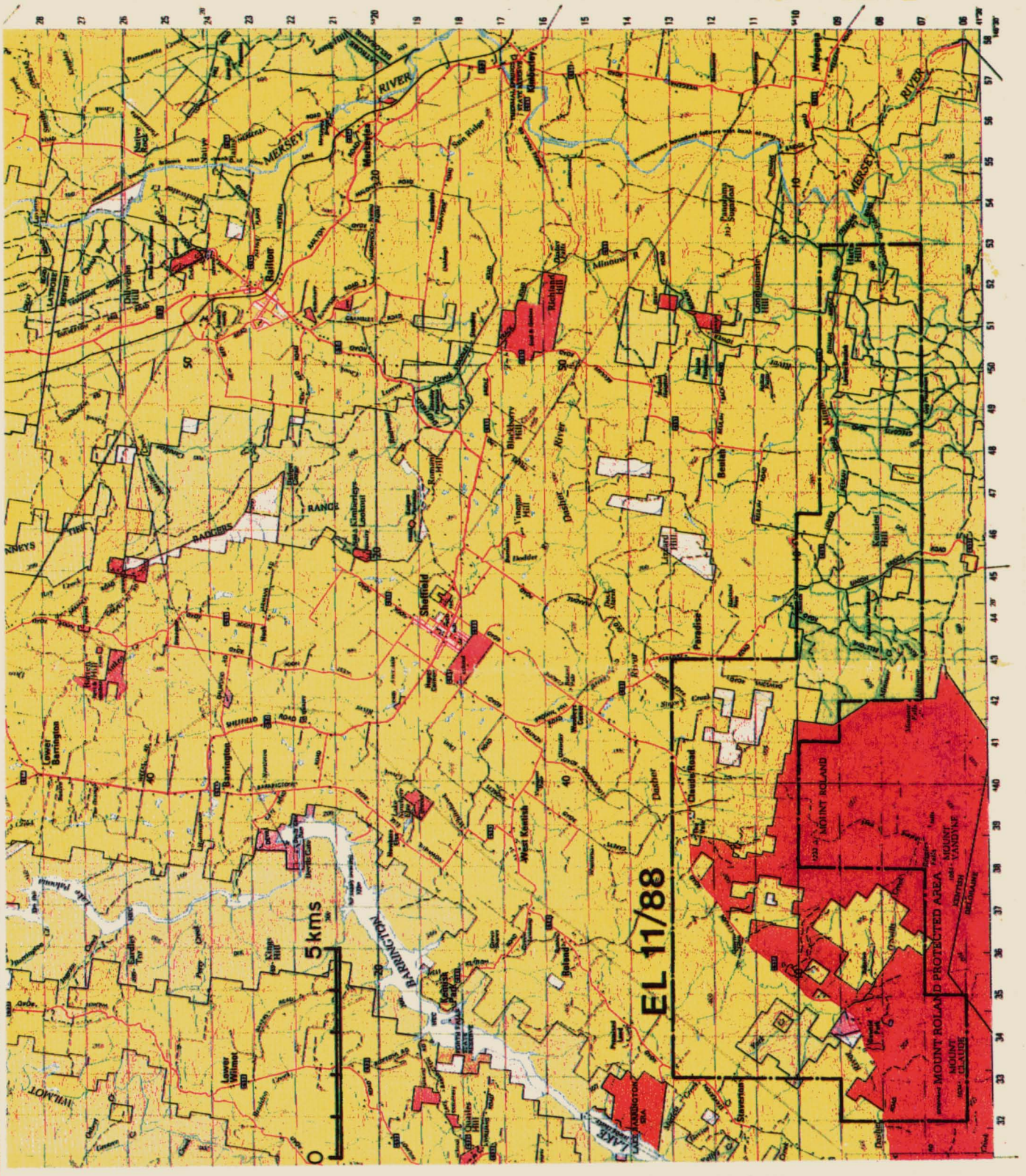
Work undertaken on the licence during the reporting period is summarised on figure GP47. The work undertaken involved:-

1) Further limited mapping and sampling on the Lower Beulah grid.
2) Detailed mapping and sampling in the Beulah Barite area on the above grid.
3) Gridding, mapping, sampling and geophysics (UTEM) on the northern slopes of Mt. Roland (Mt. Roland grid).

and 4) Reconnaissance mapping at 1:2,500 scale over a large area in the Mt. Roland-Gowrie Park-Mt Claude area.

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Aberfoyle Resources Limited

EXPLORATION DIVISION

REVISIONS			
Init.	Date	Init.	Date

NORTH WEST TASMANIA

GOWRIE PARK E.L. 11/88

LOCALITY MAP

Compiled : Lands Dept.

Drawn :

Traced : RJE

Checked :

Location Code :

Scale : As shown

Date : May , 1990

Plate No. : GP 44

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Aberfoyle Resources Li

EXPLORATION DIVISION

NORTHERN TASMANIA

E.L. 11/88 GOWRIE PARK

Summary of 1989/1990 Exploration

Location Code :	
Scale : As shown	
Date : July, 1990	
Plate No. : GP 47	
Compiled : SWR	
Drawn : SWR, RJE	
Traced : RJE	
Checked : SWR	

REVISIONS	Init.	Date	Init.	Date

N

Lake Barrington

SHEFFIELD

DEVONPORT

HOBART

MT. ROLAND
- Gridding
- Mapping
- Pb Isotope Study
- UTEM

RIVER

DASHER

Staverton

Beulah

LOWER BEULAH
- Mapping

MERSEY RIVER

5410000m N

Mt. Roland

Gowrie Park

Cethana

Mt. Vandyke

Mt. Claude

GOWRIE PARK AREA
- Reconnaissance mapping

0 5 Kms.

5cm

430000 mE

440000 mE

450000 mE

CAMBRIAN ROCKS (after Jennings, 1979)

€mk	Acid volcanics
€gg	Greywacke & other sediments
€bf	Basalts, andesites & minor dacites
€	Unassigned

BEULAH BARITE
- Mapping
- Sampling
- Pb Isotope Study

3.0 PREVIOUS EXPLORATION

Systematic exploration for volcanogenic massive sulphide mineralisation was initially conducted on the licence by Asarco during the period 1973 to 1976. CRA Exploration obtained the licence in 1976 and undertook a number of varied programmes until its relinquishment in 1987. The exploration undertaken prior to Aberfoyle gaining control of the licence is described in Rand and Noonan (1989) and summarised on figure GP26.

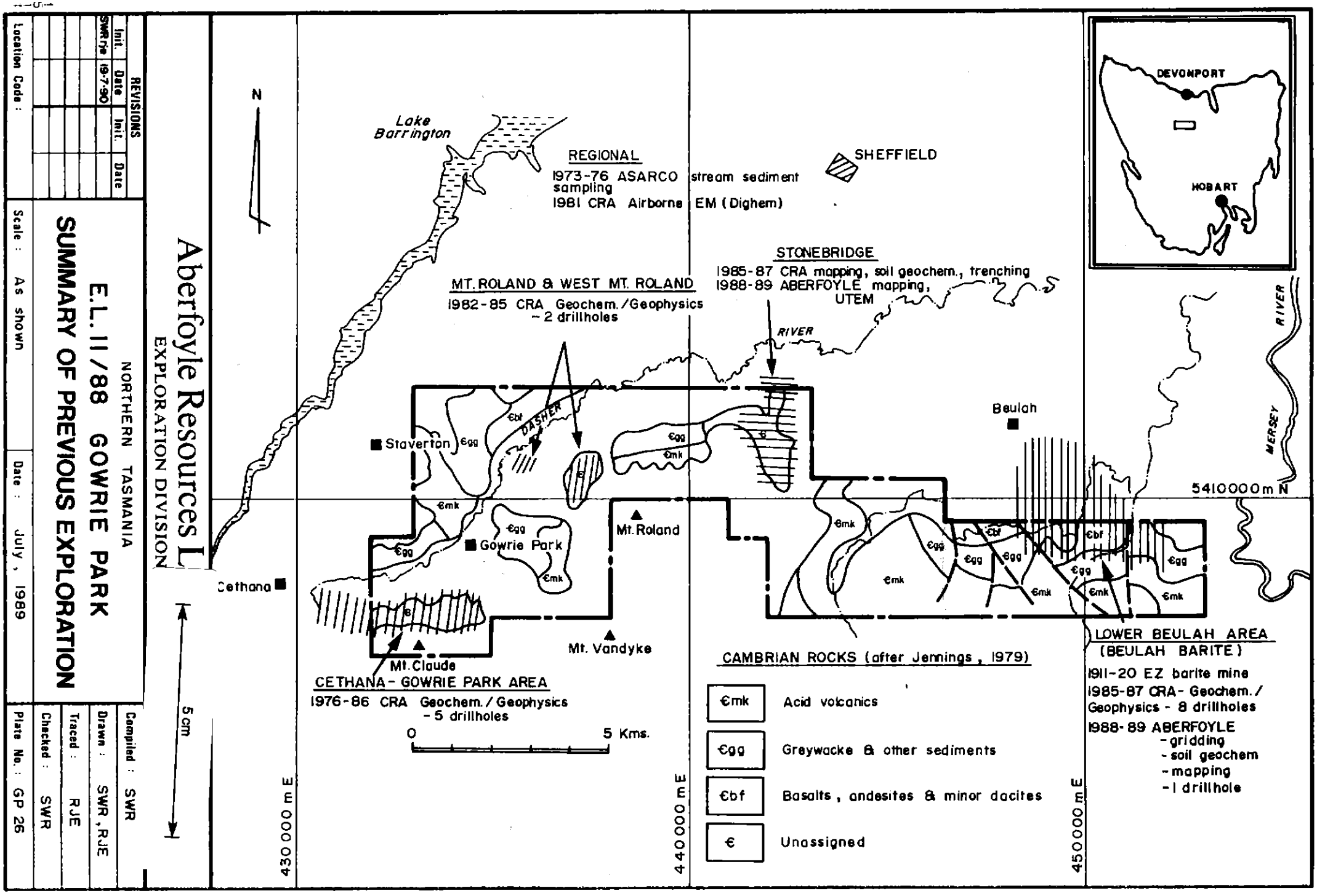
Previous exploration undertaken by Aberfoyle Resources Ltd. up until July 1989 involved work in a number of areas (Rand and Noonan, 1989).

In the Lower Beulah area, a large grid was established over which mapping, soil sampling and ground magnetic surveying programmes were completed. This work produced a number of anomalous zones along a trend from barite mineralisation at the Beulah Barite prospect. Follow-up geology and further geophysics were recommended.

On the Beulah Barite prospect (within the above grid), mapping and re-assessment of previous work produced a diamond drill target. Drilling of the hole (BB6) at a combined geological/geochemical target was completed in July 1989 with no base metal mineralisation intersected. It was considered, however, that the lack of mineralisation in the drill hole did not significantly downgrade the potential for economic mineralisation in the area and further assessment was recommended.

In the Stonebridge area, gridding, mapping and UTEM was completed in late 1988 with no significant anomalies detected. No further work was recommended for the area.

Regional assessment of the licence, up until July 1989, produced a number of encouraging results in the Mt. Roland-Gowrie Park areas. Sampling of surface outcrops and drill core (CRA) indicated the presence of probable Cambrian hydrothermal alteration and mineralisation. Further assessment of the potential for economic mineralisation in the area was recommended.


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EXPLORATION DIVISION
NORTHERN TASMANIA
E.L. 11/88 GOWRIE PARK
SUMMARY OF PREVIOUS EXPLORATION
REVISIONS
Init. Date Init. Date
SWR rje 19-7-90
Location Code :
Scale : As shown
Date : July, 1989
Plate No. : GP 26
Compiled : SWR
Drawn : SWR, RJE
Traced : RJE
Checked : SWR
5 cm
N
Lake Barrington
REGIONAL
1973-76 ASARCO stream sediment sampling
1981 CRA Airborne EM (Dighem)
SHEFFIELD
STONEBRIDGE
1985-87 CRA mapping, soil geochem., trenching
1988-89 ABERFOYLE mapping, UTEM
MT. ROLAND & WEST MT. ROLAND
1982-85 CRA Geochem./Geophysics - 2 drillholes
RIVER
DASHER
Staverton
Beulah
Gowrie Park
Mt. Roland
Cethana
Mt. Vandyke
Mt. Claude
CETHANA - GOWRIE PARK AREA
1976-86 CRA Geochem./Geophysics - 5 drillholes
0 5 Kms.
DEVONPORT
HOBART
MERSEY RIVER
5410000m N
430000mE
440000mE
450000mE
LOWER BEULAH AREA
(BEULAH BARITE)
1911-20 EZ barite mine
1985-87 CRA - Geochem./Geophysics - 8 drillholes
1988-89 ABERFOYLE
- gridding
- soil geochem
- mapping
- 1 drillhole
CAMBRIAN ROCKS (after Jennings, 1979)
€mk Acid volcanics
€gg Greywacke & other sediments
€bf Basalts, andesites & minor dacites
€ Unassigned

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4.0 1989/1990 EXPLORATION

Exploration during 1989/1990 continued from work reported in Rand and Noonan (1989). The work programmes comprised the following:-

Lower Beulah Grid

1. Mapping and sampling with interpretation at 1:2,500 scale.

Beulah Barite Prospect

1. Mapping and sampling at 1:1,000 scale
2. Detailed mapping of an old adit on the prospect.
3. Channel sampling of the adit.
4. Analysis of petrology and geochemistry received for diamond drillhole BB6.
5. DHEM surveying of BB6.
6. Lead isotope study of mineralisation from the prospect.

Mt. Roland Prospect

1. Re-assessment of previous CRA exploration and drilling in the area.
2. Establishment of a grid centred on an old lead-zinc mine.
3. Mapping and sampling at 1:2,500 scale with 1:2,500 interpretation.
4. Lead isotope study of mineralised rocks from the prospect.
5. UTEM surveying over the grid.

Gowrie Park-Mt. Claude-Staverton area

1. Reconnaissance mapping of creeks and tracks at 1:2,500 scale, with interpretation at 1:10,000.
2. Lead isotope study of mineralisation from the Gowrie Park area.

4.1 LOWER BEULAH

4.1.1 Introduction

In late 1988, Aberfoyle established a large grid over Beulah Formation volcanic rocks in the Lower Beulah area (refer to plate GP26)(Rand and Noonan,1989). Initial work on the grid involved soil sampling, ground magnetic surveying and mapping.

The soil sampling identified a large zone of anomalous soil geochemistry extending NW from the Beulah Barite prospect. Mapping on the grid located predominantly massive basaltic and andesitic lavas and lava breccias contacting greywackes and shales. Alteration observed within the basalts comprised a mixture of variable haematite, sericite and calcite alteration with, in places, minor pyrite alteration. Occasionally, the basalts had been subjected to intense epidote/quartz alteration completely obscuring the primary texture of the rocks and producing 'epidosites'.

Following on from work described in Rand and Noonan (1989) additional mapping has been undertaken in the Lower Beulah gridded area.

4.1.2 Geology

Outcrop geology is shown at 1:2,500 scale on plates GP25A and GP25B with interpretation on plates GP 42A and GP42B (refer also to appendices 1 and 2). Limited rock chip samples were collected for petrological and geochemical analysis to aid in mapping of the area (refer to appendices 3 and 4 respectively).

The only significant change to the previous geological interpretation described in Rand and Noonan (1989) involves the contact between the Gog Range sediments and the Beulah Formation lavas just north of the Minnow River on lines 48200E to 48800E. In this area the contact comprises a gradational or intercalated zone from greywackes and shales in the south to andesites and basalts to the north. The unit of dacitic epiclastic sandstone outcropping along the sediment/lava contact on the western edge of the grid also terminates in this area (refer to plate GP42A).

Petrological descriptions of rock chips collected in the area indicate that the samples are all andesitic lavas, slightly varying in composition from acid andesite to more mafic andesites (refer to appendix 3). No significant alteration was observed in the samples with the exception of sample 513681 which contains minor disseminated pyrite cubes. The lack of any evidence of hydrothermal alteration, however, suggests that the pyrite might be of burial metamorphic origin.

4.1.3 Geochemistry

Geochemical analyses of the above samples are included in appendix 4. Lithological elements generally support the petrologists classification of acidic to more mafic andesites. Sample 513678, considered to be the most acidic lava, has a Ti/Zr ratio of 7.6 and a chrome content below the detection limit suggesting a possibly dacitic to even rhyolitic composition. Sample 513681 the most mafic sample has a Ti/Zr ratio of 31.5 and the highest chrome value of 35ppm consistent with the mafic andesite classification.

Base metal values for the samples were generally low with a maximum Cu of 90 ppm and maximum Pb 95ppm. Only Sample 513681 was considered to be weakly anomalous in zinc (520ppm). No samples were anomalous in precious metals or barium.

4.2 BEULAH BARITE

4.2.1 Introduction

Exploration on the Beulah Barite prospect during the reporting period continued from work described in Rand and Noonan (1989). Previous work programmes by Aberfoyle up to July 1989 involved initially soil sampling, mapping and sampling, costeaning and a re-assessment of earlier CRA drilling in the area.

The programmes identified a zone of anomalous soil geochemistry over an area of altered Beulah Formation lavas which host previously mined barite mineralisation. Re-interpretation of the previous drilling indicated that calcite-fuchsite alteration intersected, possibly represented a hangingwall style of alteration similar to that observed above the Hellyer massive sulphide deposit. This resulted in diamond drilling (BB6) of a target beneath previous drilling depths and below the level of effective UTEM coverage.

The drillhole was completed in July 1989. No significant mineralisation was intersected by the drill hole. The hole did not intersect a potential footwall position but remained in what were considered to be strongly hanging wall style hydrothermally altered intermediate and minor felsic lavas.

Work undertaken this reporting period involved an assessment of the geochemistry and petrology results received for the drillhole. Further mapping and sampling was also undertaken on the prospect aimed at better defining a footwall position and assessing the potential for economic mineralisation. This programme located an old adit along strike from the barite mineralisation which intersects a number of lithologies and alteration styles and includes some significant mineralisation.

4.2.2 Geology

Outcrop geology for the Beulah Barite prospect is shown at 1:2,500 scale on plates GP25A and GP25B with interpretation on plates GP42A and GP42B. More detailed outcrop geology and interpretation at 1:1,000 scale is shown on plates GP15 and GP41 respectively. An overlay showing the interpreted alteration on the prospect is shown on plate GP40.

The only significant change in the outcrop geology sheets from that reported in Rand and Noonan (1989) is the geological information obtained from detailed mapping of a 120m long north-south adit located approximately 300m west of the main barite mine shaft (refer to plate GP15). The adit presumedly represents an old exploration adit as it occurs roughly along strike from the barite veins mined in the main shaft.

The adit was mapped in detail at 1:200 scale (refer to plate GP27 and appendix 3 for petrology descriptions) and channel sampled at 5m intervals (refer to section 4.2.3). A summary of the geology of the adit is as follows:-

0-55m Interbedded medium grained orange greywackes and fine grained grey to black shales. Bedding is generally steeply dipping to the south and in places is cut by reverse faulting. At 13-16m and at 23-25m the sediments are intruded by bodies of strongly feldspar and hornblende phyric andesite lava.

55-68m A fine grained recrystallised rhyolitic volcaniclastic unit originally containing sparse quartz and feldspar phenocrysts. Strong alteration (silica-sericite and pyrite) obscures most primary features.

68-85m Feldspar and augite phyric andesite lava and lava breccia. Strong alteration (predominantly carbonate) obscures most primary features.

85-105 Fine grained andesitic volcaniclastics with minor lava, strongly carbonate and silica altered with some sericite alteration and fuchsite spotting.

95-115 Feldspar phyric andesite lava. Strong haematite and calcite-fuchsite alteration with weaker silica sericite alteration has affected the rock.

115-121 (Adit end) Coarse volcaniclastic derived from felsic and andesitic volcanics. Strongly haematite altered with pervasive carbonate alteration and minor fuchsite spotting.

The adit section represents a similar section to that exposed in the costeans (refer to plate GP27). The greywacke and shales observed close to Sweetwater creek grade north (uphill) through a felsic volcaniclastic to aphyric and feldspar phyric andesitic to basaltic lavas.

4.2.3 Alteration

The alteration observed within the adit represents a variety of different styles and varies from weak to intense. The greywackes and shales near the contact with the rhyolitic volcaniclastic unit are weakly to moderately silica and carbonate altered. Strong silica-sericite-pyrite alteration with some fuchsite spotting has affected the rhyolitic unit and also extends into the andesite lavas and volcaniclastics. The adit terminates in strong pervasive haematite-calcite alteration with common fuchsite spotting.

The alteration observed is considered to be of definite hydrothermal origin and is interpreted to represent both footwall and hangingwall styles. Plate GP40 shows an interpretation of the alteration observed for the Beulah Barite area. No evidence of the strong silica-sericite and pyrite alteration seen in the adit is visible in the surface exposures or costeans. The surface and costean outcrops have, however, been strongly affected by carbonate and haematite alteration with minor fuchsite spotting, interpreted to represent the hangingwall style of alteration.

4.2.4 Mineralisation

The only significant mineralisation located on the Beulah Barite prospect during the reporting period comprises weak base-metal sulphide stringer-like veining and disseminations within the most intensely altered rocks in the adit (refer to plate GP27). Mineralisation is visible over a 40m zone from 50m to 90m, but is strongest from 55 to 83m.

The mineralisation comprises veins and veinlets of sphalerite, galena and pyrite up to 1cm thick in strongly carbonate, silica, sericite and pyrite altered rocks. Minor chalcopyrite occurs with the pyrite. Pyrite also occurs as disseminated crystals throughout the mineralised zone. The gangue minerals to the veinlets comprise predominantly quartz and calcite with some barite.

4.2.5 Geochemistry

Rock chip and channel sample geochemical results are shown in appendix 4. Lithological elements confirm the petrological classifications for the rock chip samples. The rhyolitic unit has a titanium to zirconium ratio of between 5 and 8. The andesite lavas and volcaniclastics varied between 31 and 40 suggesting a nearly basaltic composition, while the intrusive unit near the adit mouth has a titanium to zirconium ratio of 54, similar to the anomalous 'core basalt' above Hellyer. Chrome values for the rock chips were similarly consistent, with the felsic units containing chrome values of between 40 and 80 ppm while the andesitic units contained chrome values between 80 and 160ppm.

The highest base metal values were obtained from a rock chip sample containing sphalerite and galena veining (513510). This sample collected from 58m contained 1.07% Pb, 6.16% Zn and the peak silver value (26 ppm). Copper was very low in all of the rock chip samples (maximum 200ppm for sample 513510), arsenic was weakly anomalous (maximum 44ppm) and no gold values assayed above the detection limit.

5m channel samples were collected for the length of the adit with the results shown in appendix 4 and plotted on plate GP30. Lithological element analyses, as for the rock chip samples, confirm the petrological descriptions. Chrome values are generally high in the sediments (reflecting detrital chromite?) and low in the felsic unit. The titanium to zirconium ratios show a distinct drop between 50 and 65m corresponding to the felsic unit.

The base metal results from the channel sampling confirm the peak mineralisation corresponds with the strongly altered felsic unit. Copper values are low (maximum 140ppm) while lead and zinc are strongly anomalous (maximum 790ppm and 1950ppm respectively). The interval with the peak silver value of 3.5ppm corresponds to the peak base metal values, while no gold assayed above the detection limit. The peak arsenic value (140ppm) corresponds to the main zone of mineralisation. Within the strongly mineralised zone barium reached 5200 ppm, but the high values persist into the interpreted hangingwall (peak 6150ppm for the interval 90-95m). The most significant variation in the geochemical results is displayed in the analyses for calcium. Up to 85m the calcium values are weakly anomalous (up to 4850ppm) with low values observed for the mineralised zone. From 85m to the end of the adit, however, the calcium values average 5% indicating an abrupt change to very strong carbonate alteration.

In order to characterise the alteration and mineralisation styles observed within the adit, two samples with high lead contents were submitted for lead isotope analysis. The results received indicate that the lead isotope signatures are less radiogenic than those of previously recognised volcanogenic massive sulphide deposits, though they fall within the field for Cambrian mineralisation (Carr,1989B, appendix 5).

4.2.6 Diamond Drilling

4.2.6.1 Introduction

As described in section 4.2.1, diamond drilling of BB6 on the Beulah Barite prospect was completed last reporting period and reported in Rand and Noonan (1989). Petrology and geochemistry results were unavailable at the end of the previous reporting period, however, and are described herein.

4.2.6.2 Petrology

Petrology descriptions received for BB6 are shown in appendix 1. As interpreted by Rand and Noonan (1989) the drill hole transects a mixture of initially intermediate lavas and volcaniclastics followed by more massive basaltic lavas. The only change from the previously reported geology is the re-classification of the fine grained yellow brown glassy dacite lava units to aphyric andesite lavas. An amended drill log is included as appendix 6 and amended drill sections are shown on plates GP23 and GP24.

4.2.6.3 Geochemistry.

Geochemical results for the petrology samples are shown in appendix 4. Titanium to zirconium ratios are all >24 confirming the presence of only andesitic to basaltic volcanic rocks. The chrome values vary considerably from below detection to 200ppm but generally confirm the intermediate classifications. Base and precious metal values for the petrology samples are all very low. Sample 513656 which contained a minor barite vein yielded the highest barium value of 8.1%, while all others were generally low. Alteration indices [A.I. = 100 x (K2O+MgO)/ (Na2O+CaO+K2O+MgO)] are all low, varying between 29 and 56. This is interpreted to reflect the presence of abundant calcium and sodium introduced during strong carbonate alteration.

Drill core from BB6 was ground at approximately 10m intervals with the results included in appendix 4. As for the petrology samples, the lithological elements indicate that the units intersected are all andesitic to basaltic with no felsic units present. Base and precious metal values are all low throughout the hole (maximum Cu, Pb and Zn are 30ppm, 40ppm and 465ppm respectively). Barium values vary up to 1.15% over intervals containing visible barite veining but are generally low throughout the hole. There appears to be a distinct drop in barium values from above 1000ppm for the intervals down to 134m, to below 1000ppm for the remainder of the hole.

The core grind geochemistry shows a subtle decrease in alteration indices (calculated from the Ca, Na, K and Mg levels) in the more basic units towards the bottom of the hole (from around 200m) due to a very slight increase in the calcium and sodium complimenting a slight drop in the potassium levels. This subtle change could be reflecting a slight change in the primary geochemistry of the lavas down the hole or probably a slight increase in the intensity of the predominantly carbonate alteration.

4.2.7 Geophysics

BB6 was read with down hole EM37 in October, 1989. The loop location is shown on plate GP46 with the results and interpretation included in appendix 7 (Walker,1989). The conclusions reached by Walker (1989) are that no off-hole conductor was detected in the vicinity of the drill-hole. No further work was recommended based on the results of the geophysical survey.

4.3 MT. ROLAND

4.3.1 Introduction

As part of routine regional sampling and mapping, the old Mt. Roland lead-zinc mine on the northern slopes of Mt. Roland was examined early in the reporting period. Sampling of the mullock and outcrop from the adit mouth indicated that the rocks were strongly hydrothermally altered Cambrian andesites which contained, in places, strong sphalerite-galena-pyrite veining (refer to section 4.3.3). Isotopic signatures of the mineralised rocks were considered to be highly likely to represent Cambrian mineralisation (refer to section 4.3.4).

Following a re-assessment of CRA work in the Mt. Roland area, it was considered that the area contained sufficient potential to host economic mineralisation to justify further exploration in the area.

4.3.2 Gridding

In December, 1989, a grid was established in the Mt. Roland area, centred over the Mt. Roland adit. The grid comprised five 1.4km long lines spaced at 200m apart (600E to 1400E). The grid was established at a bearing of 030° magnetic with baselines at 0N and 500N. The grid was accurately picked up by a contract surveyor (appendix 8), with grid point 000N,1200E corresponding to AMG coordinate 436913.8E,5409629.9N (refer to plates GP 35/I4 and I3).

4.3.3 Geology

Outcrop geology is shown at 1:2,500 scale on plates GP35/I4 and I3 with interpretation of the grid geology shown on plate GP35/I4/A.

The majority of the grid is comprised of variably altered hornblende andesite lavas and occasionally lava breccias. The andesite lavas are typically dark brown with minor orange-brown weakly sericite altered feldspar phenocrysts. The samples all commonly contain apatite micro-phenocrysts. Petrology descriptions from rock chips collected on the grid and core samples from CRA's drillhole MR1 (drilled at grid point 1150E,75N) are included in appendix 3.

The only other Cambrian volcanic rock types located on the grid have been one sample of a rhyolitic lava breccia (562303) from the north end of line 1200E, and two possible rhyolites from around 1050E,450N (513695,513696)(refer to appendix 3). These latter two samples of weathered lava, considered by the petrologist to be quartz and feldspar phyric rhyolites (samples 513695 and 513696) have possibly been incorrectly classified? The Ti/Zr ratios of the samples are both >22 indicating an andesitic composition identical to the other andesite lava samples (refer to section 4.3.4). Possible confusion could arise from the presence of rare quartz phenocrysts noted within the samples.

These are also present in some of the less altered andesite lavas, however, and when combined with devitrification of the groundmass to produce silica clots (as for samples 513697 and 513698) could confuse the classification.

Quaternary cover, comprising conglomerate pebbles to boulders shed from Mt. Roland, leaves only a small window of the andesite lava in the immediate gridded area, so no contacts with other lithologies could be observed.

Tentative correlations of the andesite lavas within the MRV stratigraphy by the petrologist suggest possible similarities with hornblende and apatite phyric andesite lavas from the Tyndall group near Lake Dora and Boulder Hill.

Alteration observed in the Cambrian volcanics comprised variable sericite-pyrite-carbonate and occasionally silica (refer to sheet GP35/I4/A). The strongest hydrothermal alteration observed occurs in outcrops within the creek in the immediate area of the adit. In this area, the lavas have been affected by strong sericite, pyrite, silica and carbonate alteration. The alteration observed is considered more intense than would be expected for regional metamorphic alteration and is considered to be of Cambrian hydrothermal origin.

The only significant mineralisation occurs in the immediate area of the adit. This comprises strong sphalerite (honey coloured) and galena with carbonate veining up to 1cm width through strongly altered andesites (samples 513692/3). Disseminated pyrite is common in the adit area and is weakly present in a broader area south from the adit to drillhole MR1 (refer to plate GP35/I4/A).

4.3.4 Geochemistry

4.3.4.1 Primary

Geochemical analyses of rock chips collected from the Mt. Roland grid and CRA drill core are shown in appendix 4. The andesite lavas have primary geochemistry consistent with their petrological descriptions. Copper contents of the samples are all less than 70ppm with the exception of some mineralised samples. Chrome contents are generally low, varying from 10 to 65 ppm, with a maximum of 140ppm for sample 513686. Titanium to zirconium ratios for the andesites are all very consistent with values rarely varying from between 18 and 24.

The sample of probable dacitic to rhyolitic lava (562303) from the north end of the grid has geochemistry consistent with a felsic classification. The Cu value is 25ppm and chrome content is 7ppm, very low, while the titanium to zirconium ratio is 7. The two samples from the centre of the grid thought to be of felsic composition (513695 and 513696) have titanium to zirconium ratios of 22.5 and 25 respectively suggesting that they are probably andesite lavas similar to the majority of the grid. The chrome contents are both very low, however, (<5 and 6 respectively), which varies markedly from the typical andesites.

4.3.4.2 Alteration

A number of samples from the Mt. Roland grid and drill hole were submitted for analysis of CaO, K2O, MgO and Na2O to enable calculation of alteration indices to assist in characterisation of the style of alteration present.

The alteration index [A.I.=100x(K2O+MgO)/(K2O+MgO+CaO+Na2O)] varies from 39 (sample 562014) to a maximum of 99 (sample 562018), with the majority of samples varying between 75 and 95. This indicates that the samples have been depleted in calcium and sodium relative to potassium and magnesium and implies a probable footwall style of alteration. The drill core samples had a slightly different variation in range to the surface samples with values of generally between 60 and 80. This implies a similar alteration style to that interpreted for the surface samples but indicates that surficial weathering processes affect the alteration index by depleting calcium and sodium from the rock.

4.3.4.3 ^@)bralisation

The only significant mineralisation observed on the grid was the sphalerite-galena veined altered andesite samples from the immediate area of the adit. These samples contained generally low copper values, (maximum of 210ppm). The lead and zinc values were strongly anomalous with the best result (sample 513693) returning 1.75% Pb and 4.82% Zn. This sample also contained the highest precious metal values with 9ppm Ag and 0.7 ppm Au. These relative metal abundances are considered to be typical of VMS style mineralisation and confirm the interpreted Cambrian hydrothermal origin of the alteration.

No samples were anomalous in arsenic. Barium values for the mineralised and altered rocks were variable, from low (around 500-800ppm), to slightly anomalous (around 2000-2500ppm) with the maximum value reported of 0.39% for a weakly altered sample (562014) from 1000E,910N (refer to sheet GP35/I4/A). The values for the mineralised rocks are consistent with the mineralisation and alteration observed representing a probable footwall style.

4.3.4.4 Lead Isotope Study

The mineralised samples from the adit (513692/93) were submitted to Sirotope for analysis and characterisation of their lead isotopic signatures (refer to appendix 5, Carr,1989B). The signatures obtained were considered to be similar to values obtained for mineralisation in the Cethana/Gowrie Park area and to represent a probable Cambrian origin for the mineralisation (Carr,1989B).

4.3.5 Geophysics

As a result of the favourable geological and geochemical results obtained for the Mt. Roland grid a two loop UTEM survey was undertaken over the grid in December,1989. Loop locations are shown on plate GWP37 with interpretations and discussion included in Read (1989)(included as appendix 9). No responses indicative of massive sulphide mineralisation at depth were interpreted from the data. No further geophysical exploration was recommended for the grid.

4.4 GOWRIE PARK AREA

4.4.1 Introduction

Extensive previous exploration in the Gowrie Park to Cethana area has been conducted by CRA Exploration during the period 1977 to 1987. During that period their exploration had involved a number of different programmes involving gridding, geochemical and geophysical surveying and some drilling. The programmes identified a large zone of strongly hydrothermally altered and mineralised volcanic rocks extending from the Forth River (now Lake Barrington) to the northern slopes of Mt. Claude. Following a re-assessment of the previous exploration in the area (Rand and Noonan,1989) it was considered that the area provided significant potential to host economic mineralisation and further exploration was recommended.

The work undertaken in the area during the reporting period involved a reconnaissance mapping programme over a large area of previously identified Cambrian volcanic rocks. The programme was aimed at updating geological knowledge in areas not mapped in detail since Jennings (1959) and to produce areas for further detailed exploration. The area covered extends from the Mt. Roland prospect south along the foot slopes of Mt. Roland and Mt. Van Dyke, along the northern slopes of Mt. Claude to the licence boundary and then north from the Dasher River to the northern boundary of the licence.

4.4.2 Geology

Outcrop geology for the reconnaissance mapping programme is shown at 1:2,500 scale on GP35 series sheets, with interpretation shown at 1:10,000 scale on sheet GP43 (refer to appendix 2).

4.4.2.1 Lithology

A large number of different lithological units have been identified in the area (refer to sheet GP43 and appendices 2 and 3). These have been simplistically grouped into felsic (predominantly rhyolitic) volcanic rocks, andesitic to intermediate volcanic rocks and polymict volcaniclastics and other sediments. For detailed descriptions of these units refer to appendix 2. These units have previously been included under the broad groupings of Cambrian felsic rocks (Bamford and

Green,1988)(or Minnow Keratophyre, Jennings,1979), Cambrian volcaniclastics (Bamford and Green,1988)(or Gog Range sediments, Jennings,1979), while no reports of intermediate lithologies in the area have been published.

The felsic units located comprise predominantly massive rhyolitic lavas and lapilli volcaniclastics. These units occur to the immediate southwest of the Mt. Roland grid and also immediately west and north of Gowrie Park. The area marked as HA on plate GP43 to the southeast of Gowrie Park is also interpreted to belong to the above grouping due to the presence of quartz phenocrysts in many of the rocks, combined with CRA interpretations. Problems presented when classifying the volcanics within this general group occur when trying to make precise distinctions between the quartz phyric lavas and quartz crystal volcaniclastics for example. Both units appear similar in hand specimen, though subtle foliations (relict bedding) and occasional flattened pumice fragments and/or lithics can often be observed in weathered samples of the volcaniclastic units.

The polymict volcaniclastic units and shales have been located in a number of areas, between Gowrie Park and the Mt. Roland grid, west of Febeys road, northwest of Gowrie Park and also southeast of Gowrie Park between Mt. Claude and Mt. Van Dyke. The coarse units generally comprise fragments of a mixture of volcanic sources, both felsic and intermediate, and also commonly contain quartz pebbles to 4cm derived from a PreCambrian metamorphic source. Rare detrital pyrite grains have been observed for units near the top of York Creek and Febeys Road. Minor detrital magnetite grains also have been noted in some medium grained units at the top of York Creek.

Precise distinctions between units within this general grouping provides several problems. Differentiation of quartz phyric polymict volcaniclastics (qpYlv) and felsic lithic dominated volcaniclastics (YRlv), for example, has been based on relative abundance of lithics and phenocrysts in hand specimens and subsequently some unit classifications are considered to be tenuous.

Fine grained blue-grey to black shales occur interbedded within the polymict volcaniclastic units but appear to be thin units with limited distribution. Finely laminated bedding and occasional sedimentary features such as graded bedding and flame structures present within the units, however, means that they provide valuable stratigraphic information.

Intermediate lithologies similar to the lavas observed on the Mt. Roland grid have been now been recognised in a number of locations around Gowrie Park. These rocks comprise a mixture of feldspar and hornblende phyric lavas, occasionally strongly porphyritic, and associated andesitic lithic volcaniclastic units.

Quaternary cover derived from the Cambro-Ordovician sediments forming Mt Roland, Mt Van Dyke and Mt. Claude obscures much of the foot slopes of these mountains limiting the outcrop and restricting observation of contact relationships.

4.4.2.2 Alteration

The most significant hydrothermal alteration located during the mapping programme has been the previously recognised zone on the northern slopes of Mt. Claude (here-after referred to as the Cethana alteration zone (CAZ)). This zone (marked as HA on plate GP43) affects a large area of volcanic rocks on the northern slopes of Mt. Claude, southwest of Gowrie Park. The alteration styles observed comprise variable to intense sericite-silica alteration with weak carbonate alteration and some weak pyrite alteration. In places, the rocks are intensely altered to a quartz-sericite schist. The alteration is interpreted to weaken in intensity to east, where it disappears beneath Quaternary cover, directly south of Gowrie Park.

Other alteration styles observed in the mapped area are a strong pervasive haematite alteration within the andesite lavas outcropping in the Dasher River (sheet GP35/G5) and in O'Neills Creek to the southeast of Gowrie Park (sheet GP35/I5 & I6). Weak epidote/quartz alteration with minor epidote veining affects the andesite lava unit at approximately 433200E,5408800N (AMG)(sheet GP35/G5).

4.4.2.3 Mineralisation

Only very limited mineralisation was located during the mapping programme. This comprised weak pyrite veining associated with the strongly sericite and silica altered volcanics of the CAZ near the western boundary of the licence and in a creek bed below the old adit located at approximately 433900E,5407000N (AMG).

CRA drill core has previously been examined and sampled (Rand and Noonan,1989) with mineralisation intersected considered to be stringer-like veining of Cambrian hydrothermal origin. Further samples of this mineralisation were collected for lead isotopic analysis (refer to section 4.4.3.3). No similar mineralisation was noted in surface outcrops during the mapping.

The old adit located on the bank of a minor creek to the immediate south of Gowrie Park has been excavated within strongly sericite and calcite altered volcanic rocks (interpreted to be a fine grained ash volcaniclastic, refer to sheet GP35H6 and appendix 3). This adit could the Mt. Van Dyke prospect marked on Jennings (1959) and Bamford and Green (1988). No significant mineralisation was noted in the area.

Attempts were made to locate the Mt. Roland and Atkinsons prospects (southeast of Mt. Roland grid) (Bamford and Green,1988) but these were unsuccessful. Possible old exploration pits were located in the area of the reported Atkinsons prospect but no mineralisation was located. Similarly, attempts to locate a lead-zinc prospect at the head of Cheeks Creek were unsuccessful with no mineralisation or alteration noted in the area.

4.4.2.4 Structure

The recognition of bedded shale units within the polymict volcaniclastic units has allowed some structural information to be interpreted for the area. An open anticline trending roughly NW-SE has been interpreted in the area west of Febeys Rd. Similarly, providing no significant fault complications exist between the Mt. Roland prospect and Gowrie Park, a synclinal fold must be present to account for the south dipping shales near the Mt. Roland grid and the north dip of units within the altered volcanics of the CAZ. The presence of the quartz sericite schists within the CAZ could, however, imply proximity to significant faulting.

Cleavages measured throughout the mapped area (striking from 120° to 150° magnetic and close to vertical) are consistent with a roughly northwest-southeast orientation for the interpreted folding.

The contact between the large volume of fine grained quartz phyric rhyolitic lapilli volcaniclastics and the polymict volcaniclastics along Cheeks Creek is interpreted to be a fault due to strong cleavage development and shearing of units close to the interpreted fault position (refer to sheets GP35/G4 & H4 and appendix 3).

4.4.3 Geochemistry

Geochemistry results for the petrology samples collected during the mapping programme are included in appendix 4.

4.4.3.1 Lithology Elements.

Lithological elements are generally consistent with petrology classifications, and are all very consistent within individual units. For strongly weathered and/or altered samples the geochemical data has been preferentially used for compositional classification. The felsic volcanics, (rhyolite lavas and volcaniclastics) have very tightly constrained titanium to zirconium ratios of between 5 and 8 (rarely up to 10), with variable chrome contents typically less than 20ppm. Contrastingly, the intermediate volcanics (andesite lavas and volcaniclastics) have titanium to zirconium ratios between 17 and 30 (indicating silicic andesites to true andesites) though some units have ratios of up to 4. The chrome contents of the andesites vary from 20 to 80ppm. The andesite unit located on Mt. Roland walking track (sheet GP35/I6), however, has a high chrome content (120-130ppm).

4.4.3.2 Mineralisation

The peak values obtained for analysis of copper, lead and zinc were obtained for the weakly silica-pyrite veined samples from the CAZ, with values of up to 125ppm Cu, 90ppm Pb and 1100 ppm Zn. The weakly epidote/quartz altered andesite north of the Dasher River at approximately 433200E,5408800N (AMG)(sheet GP35/G5) is considered to be moderately anomalous in both lead and zinc (250ppm and 795ppm respectively). No samples were considered to be anomalous in precious metals, with the exception of sample 562394, a relatively unaltered crystal rich rhyolitic volcaniclastic. This sample assayed at 0.069ppm Au, which is considered to be moderately anomalous. No samples were considered to be anomalous in barium or arsenic.

4.4.3.3 Lead Isotope Study.

Five samples of strongly mineralised drill core from CRA drilling in the Mt. Claude area were submitted to Sirotope for lead isotope analysis (refer to appendix 5).

Carr (1989A and 1989B) concludes that the isotopic signatures are similar to those for the Rosebery massive sulphide deposit and therefore have a high probability of representing Cambrian mineralisation.

5.0 DISCUSSION AND RECOMMENDATIONS

5.1 Lower Beulah Area

Mapping on the Lower Beulah grid has been completed. The programme, however, has not yet defined the full extent of the Cambrian volcanics which extend beyond the gridded area. Similarly, the alteration located in the Beulah Barite area has not yet been closed off to the east. Further mapping is therefore recommended in the area to determine the distribution of the Beulah Formation volcanics and to locate any lithological variations and /or alteration considered favourable for potential economic mineralisation.

On the Beulah Barite prospect, the presence of intrusive andesites within the sediments near the mouth of the adit supports the interpretation that the Beulah Formation overlies the Gog Range sediments in the Lower Beulah area (Rand and Noonan,1989). The presence of some felsic lava fragments within the predominantly andesitic volcaniclastic unit near the adit end similarly implies a felsic volcanic source existed prior to formation of the Beulah intermediate package.

The styles of alteration and mineralisation observed are interpreted to of probable VMS origin. The presence of footwall style alteration and mineralisation in the adit, (not previously recognised on the prospect) combined with the intensity of the alteration observed suggest relative proximity to a hydrothermal system. The interpreted facing of the alteration system implies a potential host horizon for massive sulphide mineralisation must lie close to the Gog Range sediment/Beulah Formation boundary.

Further exploration is recommended and should include detailed mapping combined with alteration and sulphur isotope studies. These should be undertaken in the immediate adit area to locate any potential host horizons and assess the potential for economic mineralisation.

5.2 Mt. Roland Area

No further work is recommended for the Mt. Roland grid. Reconnaissance mapping should be undertaken to the immediate northeast of the grid, however, to confirm the presence of felsic rocks, establish the nature of the contact and to check for any possible extensions of the alteration and/or mineralisation as noted in the Mt. Roland area.

5.3 Gowrie Park Area

Alteration and mineralisation in the Mt. Claude area has been explored by CRA during the period 1976 to 1986. This work should be reassessed to determine primarily the extent and effectiveness of previous UTEM surveys. CRA's drilling should be re-assessed to determine if any mineralised horizons remain to be tested in the immediate area, to confirm the previous geological interpretation for the area and to relate the geology to the current revised interpretation. The adit south of Gowrie Park should mapped to determine the nature of any mineralisation and/or alteration.

The presence of andesites to the immediate north of the altered volcanics of the Cethana alteration zone (CAZ) indicates a bimodality within the volcanic pile and increases the prospectivity of the area. The andesites are interpreted to occur stratigraphically above the CAZ, which is interpreted to be of Cambrian VMS footwall style. It is recommended that further detailed exploration involving gridding, mapping and UTEM be undertaken in this area.

Reconnaissance mapping in the Cheeks Creek, York Creek and O'Neills Creek areas failed to locate any significant alteration or mineralisation and has subsequently downgraded their prospectivity. No further exploration is recommended for these areas, though reconnaissance mapping over areas not yet covered should continue. This will assist in a regional interpretation and locate any potential alteration or mineralisation for more detailed prospect scale exploration.

6.0 REFERENCES

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Appendix 1. Abbreviations for Outcrop Geology Sheets

Abundant	abn
Adularia	Adl
Agglomerate	agg
Albite	Ab
Alkali feldspar	Afd
Altered	alt
Amphibolitic	amb
Amphibole	Amb
Amygdaloidal	amg
Andalusite	An
Andesite	A
Angular	ang
Aplite	Ap
Approximate	apx
Arcuate	ar
Arenaceous	arn
Argillaceous	arg
Argillite	Arg
Arkose	Ak
Arkosic	ak
Arsenopyrite	Ap
Ash volcaniclastic	av
Autobrecciated	aub
Average	ave
Banded	bnd
Barite	Ba
Basalt	B
Bedded	bd
Biotite	Bio
Black	bk
Black shale	Bsh
Blue	bl
Boulder	bld
Breccia	b
Breccia volcaniclastic	bv
Bright	brt
Brown	br
Calcareous	cc
Calcite	Cc
Carbonaceous	carb
Carbonate	Co
Cavernous	cav
Chalcopyrite	Cp
Chert	Ch
Chlorite	Cl
Chromite	Cr
Chromitiferous	cr
Clay	cy
Coarse	c
Coarse grained	cg
Colloform	coll
Colour	col
Common	com
Conglomerate	Cg
Conglomeratic	cg
Crystal	x
Crystal volcaniclastic	xv
Dacite	D
Dark	dk
Dense	dns
Devitrification	dv
Diorite	Di
Disseminated	dis
Dolerite	Dol
Dolomite	Dm
Dyke	dy
Elongated	el
Emphasised	emp
Epiclastic (adj.)	e
Epiclastic (noun)	E
Epidote	Ep
Euhedral	euh
Eutaxitic	eux
Fabric	fab
Fault	F
Fault zone	FZ
Feldspar	Fd
Feldspar phyric	fp
Felspathic	fel
Ferruginous	fer
Fibrous	fb
Fine	f
Fine grained	fg
Fissile	fis
Flowbanded	fbn
Foliated	fo
Fragments	fr
Fuchsite	Fu
Galena	Gn
Glass	Gl
Glassy	gl
Gossan	Gos
Granular	glr
Graphite	Gt
Graphitic	gt
Green	gn
Grey	gy
Greywacke	Gw
Haematite	Hmt
Hornblende	Hb
Ignimbrite	Ig
Illite	Ill
Interbedded	ibd
Intercalated	icl
Intrusive	int
Jurassic	Ju
K-Feldspar	Kfd
Khaki	kh
Laminated	lm
Lapilli volcaniclastic	lv
Lava	l
Lava breccia	lb
Leached	lch
Limonitic	Lim
Light	lgt
Limestone	Lst
Lithic	lh
Magnetite	Mt
Massive	mas
Matrix	mtx
Matrix dominated	md
Medium	med
Medium grained	mg
Metamorphosed	meta
Mica	Mic
Micaceous	mic
Mineralised	min
Minor	mnr
Mixed	mxd
Mottled	mtl
Mudstone	Mst
Nodule	nd
Off white	ow
Olivine	Ol
Oolitic	oo
Orange	or
Ordovician	O
Oxidised	ox
Patchy	pat
Peperitic	pep
Perlitic	prl
Pervasive	per
Phenocrysts	phn
Phyllite	phyl
Phyric	p
Picrite	Pic
Pillow lava	pl
Pink	pk
Polymict	Y
Porphyritic	por
Predominantly	pred
Pumice	Pu
Pumiceous	pu
Purple	pp
Pyrite	Py
Pyritic	py
Pyroxene	Px
Pyrrhotite	Po
Quartz	Q
Quartzite	Qtz
Quellite	Qll
Questionable	?
Recrystallised	rx
Red	rd
Rehealed	rhd
Reworked	rw
Rhyodacite	RD
Rhyolite	R
Ripple marks	rmk
Round	rnd
Rubble	rbb
Sandstone	Ss
Schist	Sch
Schistose	sch
Sediment	sed
Selected fragments	sfr
Sericite	Se
Serpentine	Srp
Shale	Sh
Sheared	shd
Sheeted	sht
Siderite	Sid
Silica	Si
Siliceous	sil
Siltstone	Slt
Slickenside	slk
Sphalerite	Sp
Spotted	spt
Spotty	spt
Stockwork	stw
Strong	str
Structure controlled	stc
Talc	Tc
Tertiary	T
Tourmaline	Tm
Trace	tr
Trachyte	Tr
Tuff	Tf
Tuffaceous	tf
Variable	var
Variolitic	vr
Vein	vn
Vein concordant to bedd	cV
Vein discordant to bedd	dV
Very	v
Vesicular	ves
Vitric	vtr
Volcanic	vlc
Volcaniclastic	vlcl
Weak	wk
Weathered	wth
White	wh
Yellow	yw

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Appendix 2. Legends For Interpretative Geology Sheets

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LEGEND FOR INTERPRETATIVE GEOLOGY SHEETS

GOWRIE PARK AREA (Sheet GP43).

POST CAMBRIAN LITHOLOGIES

Qt Talus deposits derived predominantly from Cambro-Ordovician quartz conglomerate and sandstone detritus.

Qra Alluvium deposits accumulated in valley floors.

Tb Tertiary basalt flows

Oc and **Om**

Quartz pebble to boulder conglomerates interbedded with fine quartz sandstones (**Oc**) [Roland Conglomerate]. Quartz sandstones and minor shales, typically haematite altered to pink-purple [Moina Sandstone].

CAMBRIAN LITHOLOGIES

Not in any stratigraphic order.

FELSIC VOLCANIC ROCKS.

These rocks have previously been grouped under the general heading (**Cf**, Cambrian felsic volcanic rocks, Bamford and Green,1986, and **Cmk**, Minnow Keratophyre, Jennings,1979).

qpRl.
qfpRl.

Rhyolite lavas and rarely lava breccias. These are typically pale to dark brown and contain quartz phenocrysts (**qp**) to 4mm (commonly slightly resorbed) plus occasionally also stubby feldspar phenocrysts (**qfp**) to 4mm. The lavas typically have a fine grained glassy matrix which devitrifies to a quartz-albite and sericite mixture.

qpRlv.
qfpRlv.

Rhyolite lapilli volcaniclastics. These are typically very fine to fine grained pale brown to pale yellow rocks with quartz phenocrysts (**qp**) to 4mm and rarely feldspar phenocrysts (**qfp**). The phenocrysts vary from being rounded and resorbed to fragmented crystalline. The rocks usually contain rare lithic fragments of predominantly dacitic to rhyolitic lavas and occasionally flattened pumice fragments. Weak alignment of the matrix is best seen in weathered specimens.

POLYMICT VOLCANICLASTICS AND OTHER SEDIMENTS

These rocks have previously been broadly grouped under the term Gog Range Greywacke (**Cgg**)(Jennings,1979), or (**Clv**) lapilli volcaniclastics (Bamford and Green,1986).

Ya-clv.
qpYa-clv.
YRa-clv.
YAa-clv.
Sh.

Polymict ash to coarse lapilli volcaniclastics. These are typically interbedded mixtures of fine grained orange finely laminated ash volcaniclastics or volcanic siltstones to coarse grained polymict lithic volcaniclastic sandstones to fine conglomerates. These are occasionally quartz and or feldspar phyric (**qp,qfp**). Lithic fragments vary from predominantly felsic (**YRa-clv**) to predominantly intermediate (**YAa-clv**). Interbedded within the polymict volcaniclastic units are units of fine grained grey, blue-grey or black finely laminated shales (**Sh**) occasionally with recognisable finely graded bedding.

INTERMEDIATE VOLCANIC LITHOLOGIES

These volcanics have previously not been recognised in the Gowrie Park area.

fpAl.
HbfpAl.

Andesite lavas and rarely lava breccias. These are typically medium grained, feldspar phyric (**fp**) and also hornblende phyric (**Hbfp**). Accessory phenocrysts are often augite and occasionally apatite, and resorbed quartz. The lavas are occasionally coarse grained and porphyritic sometimes with visible flow textures. The andesite lava units are sometimes weakly magnetic.

fpAlv.

Andesitic lapilli volcaniclastics. These are typically dark brown, fine to coarse grained feldspar crystal lithic volcaniclastics. Phenocrysts present comprise common feldspar, less common hornblende +/- augite and occasionally apatite and quartz. Slight alignment of feldspar phenocrysts is sometimes visible along probable bedding planes. The units are often weakly magnetic reflecting detrital magnetite?

ALTERED VOLCANIC ROCKS

HA

Volcanic rocks that have been hydrothermally altered so that the original precursor is generally not recognisable in hand specimen. Alteration typically comprises strong sericite and silica alteration with minor pyrite and/or carbonate alteration. In the Gowrie Park area hydrothermally altered rocks are often quartz phyric suggesting they were originally of rhyolitic composition. The alteration has occasionally resulted in a strong schistosity producing quartz-sericite schists.

LEGEND FOR LOWER BEULAH AREA *INTERPRETATIVE GEOLOGY*
(Sheets GP41, 42A and 42B).

Cbfl
Beulah Formation andesitic to basaltic lavas and minor lava breccias. These are typically massive units with feldspar and mafic (augite) phenocrysts.

Cbfaa
Beulah Formation aphyric andesite lavas. These are typically very fine grained pale yellow lavas.

Cbfal
Beulah Formation feldspar phyric andesite lava. These are typically light green, sparsely feldspar phyric lavas with a fine grained matrix.

CbfRvlcl
Fine grained lapilli volcaniclastic of rhyolitic composition derived predominantly from a felsic volcanic source.

CbfDvlcl
Medium to coarse grained dacitic lithic epiclastic sandstone. The rock contains common detrital quartz fragments and lithic fragments derived predominantly from felsic volcanics with some minor pelitic metamorphics and rarely greywacke.

Cgg
Orange medium grained quartz and feldspar sandstones interbedded with grey to black, occasionally pyritic, shales.

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Appendix 3A. Lower Beulah Area Petrology Descriptions

LOWER BEULAH AREA SAMPLES

Sample	AMG Co-Ordinates	Field Description
513678 P G	448220E, 5409335N	Feldspar + mafic phenocryst volcanic.
513679 P G	448610E, 5409175N	As above.
513680 P G	448700E, 5409260N	Fine grained blue basalt.
513681 PG	448985E, 5409300N	Massive blue-green weakly feldspar phyric basalt lava with minor mafic phenocrysts and traces of disseminated pyrite.

SAMPLE NUMBER: 513678

SUMMARY:

This is a plagioclase-phyric acid andesite lava.

HAND SPECIMEN:

Relatively fresh brown-grey feldspar+mafic-phyric andesite.

THIN SECTION:

This is a plagioclase-phenocryst dominated andesitic lava containing around 10-15 modal % of albitized plagioclase phenocrysts and around 2 modal% of chloritized former mafic phenocrysts in an almost holocrystalline but fine-grained groundmass. The plagioclase phenocrysts are almost always less than 1mm long, and are generally stumpy to elongate twinned euhedral prisms with a fine speckling of sericite. The former mafic phenocrysts, also less than 1mm long, mainly have crystal shapes reminiscent of augite, although several have cross-sections very like former hornblende crystals. They have all been totally replaced by yellowish chlorite with anomalous blue birefringence. Sparse tiny former FeTi oxide microphenocrysts have been replaced by dirty leucoxene aggregates.

The groundmass of this sample is almost holocrystalline, and is composed dominntly of small, randomly orientated albitized plagioclase laths set in a matrix of very fine-grained anhedral albite, quartz and yellowish chlorite. The latter three minerals may replace former devitrified glass, although this need not be the case. If the former case is correct, the relatively coarse-grained groundmass suggests that the sample comes from the central portion of a relatively thick flow.

Numerous small discontinuous veinlets and tension gashes(?) filled by anhedral intergrowths of secondary quartz with intimately sutured grain boundaries are present in this sample. The burial metamorphic assemblage is probably prehnite-pumpellyite facies, and there is no sign of local hydrothermal alteration.

This is a relatively well-preserved acid andesite, probably quite evolved (2-3%MgO), with less augite than most Beulah Formation andesites. It is worth analyzing for the Mount Read data bank.

SAMPLE NUMBER: 513679

SUMMARY:

This is a strongly plagioclase-pjyric acid andesite lava, but not from the same flow unit as 513678.

HAND SPECIMEN:

This is a dark brown abundantly plagioclase-phric andesitic lava.

THIN SECTION:

This sample is composed of approximately 20-25modal% of plagioclase phenocrysts and rare chloritized mafic phenocrysts in a fine-grained groundmass. The plagioclase phenocrysts are up to 2mm across, and are distinctive in that they have notably rounded terminations on many crystals, implying a period of reaction with the magma in which they froze. Many plagioclase phenocrysts are actually aggregates of three or more crystals. All plagioclase phenocrysts are albitized, but their twinnng is preserved; most are partially (to about 30 modal%) replaced by very fine-grained sericite.

Former mafic crystals constitute considerably less than 1 Modal% of this sample. They are now composed of an intergrowth of yellow chlorite and quartz, and were almost certainly augite. They are rarely larger than 0.5mm. Similar sized former FeTi oxide phenocrysts are replaced by leucoxene and quartz, and are even less abundant than former augite.

The groundmass of this sample is vitrophyric to microporphyritic, with tiny plagioclase laths and needles set in an irresolvable intergrowth probably composed dominantly of quartz and chlorite, but speckled with tiny Fe oxide grains.

The metamorphic assemblage is also prehnite-pumpellyite grade, with no sign of localized hydrothermal alteration. This sample is very similar to the previous one in that it is a dominantly plagioclase-phyric evolved andesitic lava. However, the reacted feldspar phenocrysts in this sample rule out it being from the same unit as sample 513678.

SAMPLE NUMBER: 513680

SUMMARY:

This is an abundantly plagioclase-phyric, mafic-crystal poor acid andesite lava with abundant groundmass areas and voids replaced and filled by chlorite, and lined with quartz and Fe oxides.

HAND SPECIMEN:

This is a fine-grained but abundantly plagioclase-phyric very well-preserved andesitic lava.

THIN SECTION:

In thin section, this sample is seen to be highly plagioclase-phyric,with probably 25-30 modal% of small euhedral albite phenocrysts, set in a very fine-grained groundmass containing abundant angular holes filled by pale green chlorite. The albitized plagioclase phenocrysts are mainly less than 0.5mm long, and are well-formed, slightly elongate and randomly orientated prisms, often showing albite twinning, and with very minor sericite alteration. The very few former mafic phenocrysts are replaced by pale green chlorite and minor calcite, and were probably augite.

The groundmass of this sample is a very fine-grained intergrowth of chlorite, albite and quartz, with minor sericite and calcite, and contains abundant tiny albite laths. An unusual and distinctive feature of this sample is the presence of abundant (around 10 modal%) highly irregular tiny voids in the sample, that have been filled by green chlorite and lined with very narrow rims of secondary quartz and Fe oxide. These replace both groundmass and occasional phenocrysts, though usually they run around the margins of phenocrysts; they almost certainly represent tiny fluid passageways along which the hydrous metamorphic fluids moved, reacting with and replacing groundmass.

This sample also is a highly plagioclase-phyric evolved andesite, and should be analyzed for the MRV data file.

SAMPLE NUMBER: 513681

SUMMARY:

This is a typical Beulah Formation plagioclase+augite+FeTi oxide-phyric mafic andesite containing disseminated pyrite (<<1 modal%).

HAND SPECIMEN:

This is a weakly autobrecciated grey-green feldspar+mafic-phyric mafic andesite lava.

THIN SECTION:

This sample contains abundant phenocrysts of highly sericitized plagioclase and fresh augite in a heterogeneous groundmass containing scattered pyrite. The former albitized plagioclase phenocrysts are largely replaced by a dirty fine-grained intergrowth of chlorite, sericite and probably epidote. As similar alteration minerals are abundant in the groundmass, it is frequently difficult to distinguish outlines of former plagioclase phenocrysts, and therefore, to estimate their original abundance. They probably made up at least 20 modal% of this sample.

Augite phenocrysts make up about 3-5 modal% of this sample, and are still largely fresh, although crystals are often fractured and have chlorite along fractures and distended cleavage planes. Quite large (to 0.8mm) FeTi oxide phenocrysts are present throughout the sample, although not common, and are altered to leucoxene.

The groundmass of this ample had originally a heterogeneous texture due to localized autobrecciation. Where best preserved, it is a fine-grained murky intergrowth of chlorite, albite, sericite, minor very fine-grained epidote and quartz, originally probably with a vitrophyric texture. The groundmass is full of angular voids and cracks that have been filled by green chlorite and contain arcs of secondary quartz and small patches of bright green pumpellyite. The latter mineral also occurs throughout the groundmass, but is restricted to sites adjacent to FeTi oxide or pyrite, and clearly requires Fe to form.

Disseminated euhedral grains of pyrite (I guess) are scattered throughout the more autobrecciated part of the sample, and range in size to at least 1mm. It commonly ocurs in trains of small grains elongate along quartz-chlorite-filled fractures.

This more mafic andesite is typical of the Beulah Formation andesites, and contains a prehnite-pumpellyite facies metamorphic assemblage. The association of pumpellyite with pyrite might suggest that the pyrite formed pre- or syn-burial metamorphism.

465040

Appendix 3B. Beulah Barite Adit Petrology Descriptions

P40

465041

Beulah Barite Adit samples

Sample number	Location	Field description
513501 P. G	15.5m	Green, strongly feldspar porphyritic andesite lava. (Field relations suggest this rock is an intrusive).
513502 P.G	52.0m	Strongly cleaved, micaceous black shale.
513503 P.G. (polished thin)	57.8m	White volcanic lava (dacite?) with common **sulphide minerals.**
513504 P G	58.0m	Weakly cleaved, black massive volcanic lava?, weakly silica? altered.
513505 P G	81.0m	White massive lava (dacite?) with occassional fuchsite spots.
513506 P G	87.0m	Fuchsite-calcite, sericite, heamatite altered volcaniclastic.
512507 P G	106.5m	White, fuchsite spotted ?dacite lava (similar to 513505.
513508 P G	121.0m	Heamatite altered volcaniclastic rock.
513510 P.G (polished thin)	58.0m	Strongly altered lava? with large **sulphide** vein
513509 G	89.0m	Fe stalactite.

465042 PART T.C. 16

PAL

SAMPLE NUMBER: 513508

SUMMARY:

This sample is an intrusive contact between a strongly plagioclase+hornblende-phyric andesite and a greywacke derived from a mixed volcanic - pelitic metamorphic source.

HAND SPECIMEN:

This is a contact rock between a strongly plagioclase-phyric andesite, with crystals up to 5mm long, and an olive coloured fine sandstone. Close to the actual contact, the groundmass of the igneous rock is extremely fine-grained and possibly formerly glassy, and much darker green than throughout the same rock further from the contact.

THIN SECTION DESCRIPTION:

This is clearly an irregular intrusive contact between a highly altered strongly plagioclase+mafic-phyric andesite and a greywacke. Former plagioclase phenocrysts in the andesite are quite large, and clearly of two generations, which together make up around 25 modal% of this rock. A coarser generation of large (to 5mm) plagioclase euhedra that are quite rounded are replaced by very fine-grained sericite that is strongly Fe-stained around the margins of crystals; a smaller unrounded second generation of plagioclase phenocrysts are slightly more elongate euhedra, that show a similar alteration style to the larger phenocrysts. Former mafic phenocrysts are considerably less abundant than plagioclase phenocrysts; they are totally replaced by colourless chlorite and sericite, and have shapes that suggest horblende precursors.

The groundmass of the intrusive rock is a pale green-yellow microcrystalline material that probably represents devitrified glass in the chilled margin of a shallow intrusion.

The rock intruded by this andesite is a greywacke containing detritus from both a pelitic metamorphic (Precambrian) terrain and a largely felsic and intermediate volcanic terrain. The former source is indicated by abundant compound grains of strained quartz with scalloped grain boundaries and occasional intergrown muscovite flakes, as well as abundant detrital muscovite flakes. The volcanic source is indicated by common abraded and altered felspar phenocrysts, some unstrained subhedral quartz and some fine-grained devitrified formerly glassy felsic volcanic fragments. These are all set in an altered sericitic and somewhat Fe-stained silty matrix.

SAMPLE NUMBER: 513502

SUMMARY:

This is a strongly carbonate-altered foliated siltstone.

HAND SPECIMEN:

This is a grey very fine-grained foliated shale or siltstone cut by very fine quartz-calcite(?) veinlets and a network of fine fractures.

THIN SECTION DESCRIPTION:

This sample is thinly bedded siltstone composed of small detrital angular quartz grains and less abundant detrital muscovite in a matrix composed almost entirely of finely crystalline calcite and very thin wavy and discontinuous layers of sericite and less abundant intergrown chlorite; the latter define the weak foliation in thin section. It is difficult to determine whether the foliation is along the original bedding direction or not. The discrete crystals of calcite, and the manner in which calcite patches and streaks cross-cut foliation and also form meandering veinlets indicate that the calcite is definitely post-depositional. In more weathered areas of the sample, the calcite has been replaced by a reddish Fe hydroxide mineral.

SAMPLE NUMBER: 513503

SUMMARY:

This is a recrystallized and silicified former rhyolitic vitric crystal tuff cut by bands of chloritic and sericitic material containing disseminated pyrite and chalcopyrite, and minor galena filling cores in calcite veinlets.

HAND SPECIMEN:

This is cream-pale pink slightly sheared and silicified former felsic volcanic cut by a 5mm-wide dark chloritic vein containing abundant pyrite.

THIN SECTION DESCRIPTION:

This sample is a fairly thoroughly recrystallized and silicified former felsic lava that contained only about 1 modal% of quartz and feldspar phenocrysts, the latter being slightly more abundant. The few former feldspar phenocrysts are totally replaced by fairly fine-grained sericite, are smaller than 0.5mm long, and have ragged outlines due to recrystallization of the groundmass. Rare quartz phenocrysts are very small (<0.2mm) and are almost reacted away.

The groundmass of this sample was almost certainly glassy. It has recrystallized as a very fine-grained quartz-dominated intergrowth that is laced by angular sericite-rich zones that in many cases appear to be forming along, and filling brittle fractures in the rock. The groundmass is cut by numerous narrow meandering veinlets of polygonal quartz, and some slightly wider (to 1mm) of brownish calcite. Small pools and patches of calcite are quite abundant throughout the rock, probably constituting around 7 modal% of the sample. Occasional fluidal and curved ghost-like areas in the groundmass are suggestive that this sample may have originally been a vitric crystal tuff.

In polished section, the sulphides in this sample are seen to be of two styles. The first style is represented by quite common pyrite that occurs as cubic grains to 0.5mm across that are dispersed unevenly throughout the sample, and are associated with quite intense speckling of the groundmass by tiny pyrite grains. This pyrite dominated assemblage is accompanied by minor chalcopyrite. The second style of sulphide occurrence, limited to a single vein, involves minor galena filling cores of a calcite-lined fracture - vein. It is not possible to determine a paragenetic sequence for these sulphides, since in some cases quartz-dominated veins cut the irregular calcite veins, and in other areas of the section, it is vice versa. It is clear, however, that the sulphides are associated with a quartz-calcite alteration.

SAMPLE NUMBER: 513504

SUMMARY:

This sample is a slightly disrupted and microbrecciated shale with a variable foliation, and fairly abundant calcite alteration that is cross-cut by quartz veinlets.

HAND SPECIMEN:

This is a foliated, dark grey siltstone transected by abundant fine fractures that give the sample a microbreccia appearance in places.

THIN SECTION DESCRIPTION:

This sample is seen to be a very fine grained sediment with occasional slightly coarser laminae of detrital quartz. Foliation is parallel with bedding and occurs as a variably intense development of subparallel meshworks of sericite-rich cleavage planes marked by concentrations of very fine-grained opaques. The detrital quartz grains in this sample are never coarser than silt grade, and show uniform extinction, suggestive of a felsic volcanic, rather than a pelitic metamorphic source. Narrow veinlets composed of interlocking polygonal quartz cut the sample, and angular space fillings between adjacent 'breccia fragments', along which the shale has been disrupted, are filled with very fine-grained polygonal quartz and sericite, or more coarsely-crystalline calcite. Calcite veinlets and patches are also quite abundant in this sample, although much less so than in sample 513502; in several places, it is quite clear that the quartz veinlets cut, offset and therefore post-date the calcite veins and patches. Also unlike sample 513502, this sample contains virtually no accessory pyrite or other opaques.

SAMPLE NUMBER: 513505

SUMMARY:

This is a thoroughly carbonated former plagioclase+ augite-phyric andesitic lava breccia that contains dispersed but abundant accessory pyrite.

HAND SPECIMEN:

This is a pale grey-green highly carbonated lava-breccia with relics of lava fragments to at least 1.5cm in a slightly lighter coloured groundmass.

THIN SECTION DESCRIPTION:

This sample is a highly carbonate-altered andesitic lava breccia that is almost texturally obliterated. The thin sections is made up of a single lava fragment and its matrix. The latter is a fine-medium grained even-textured intergrowth of clear crystalline to murky very fine-grained calcite, with minor sericite and chlorite, that retains few clues as to its former identity. A few ghost outlines of former elongate plagioclase prisms are discernible, and also some possible more stubby former augite phenocrysts are both totally replaced by granular calcite, and calcite plus fine-grained intergrown sericite replace the groundmass totally, so that no sign of the former texture is preserved. The large lava fragment is mineralogically similar to the matrix, and differs only in that the calcite is slightly more euhedral and less murky, and there is modally slightly less calcite and more secondary very fine-grained quartz. The sample contains about 0.5 modal% of small pyrite cubes, evenly distributed through both the lava fragment and the matrix of the rock.

This rock is difficult to diagnose with certainty, due to the almost total obliteration of the original texture. The suggestion of the former presence of augite phenocrysts and the rather elongate ghost outlines of former plagioclase phenocrysts both suggest that this sample was originally and andesitic lava. The thorough carbonation of the sample is atypical of regional metamorphic degradation, and is clearly of local hydrothermal origin.

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SAMPLE NUMBER: 513506

SUMMARY:

This sample is a contact between a felsic lithic tuff and a dacitic(?) lava, with a calcite-quartz vein along the contact; the sample is extensively carbonate-altered and contains accessory pyrite.

HAND SPECIMEN:

This is a foliated contact rock with a 3mm wide calcite vein separating a dark lithic tuff or epiclastic sediment from a paler, pinkish carbonated felsic volcanic or crystal tuff.

THIN SECTION DESCRIPTION:

The light coloured area of this sample is essentially identical texturally and mineralogically to the previous sample (513505). It has virtually no remnant of the primary texture preserved, being composed of a very fine-grained quartz intergrowth that has been almost totally overprinted by fairly fine-grained calcite. One or two feint outlines of former plagioclase phenocrysts are evident, but are also overprinted by calcite. This light coloured part of the sample appears to have been a sparsely-phyric dacitic lava.

The vein separating the pinkish rock from its darker neighbour is composed of polygonal interlocking quartz with a small amount of intergrown barite, filled by tiny fluid inclusions, overprinted by abundant calcite that is much more coarse-grained than that riddled through the areas of rock outside the vein.

The darker coloured rock is also texturally obliterated by calcite overprinting. However, several lithic fragments are discernible. One is almost certainly a former vesicular felsic pumice that has been flattened and sericitized, and another is a small dacitic lava fragment containing small calcite-altered former plagioclase phenocrysts. The remainder of this part of the sample is texturally similar to the lighter part of the rock, being composed of an intense calcite alteration imprinted over a fine-grained quartz-dominated groundmass of uncertain primary texture. This dark part of the rock is probably a former felsic lithic tuff.

The intensity of the calcite alteration in this sample is indicative of hydrothermal activity that is also responsible for the presence of accessory small pyrite cubes scattered through the rock on both sides of the vein.

SAMPLE NUMBER: 513407

SUMMARY:

This sample is a thoroughly carbonate-altered former plagioclase+augite-phyric andesite lava.

HAND SPECIMEN:

This is a massive, structureless cream-coloured strongly carbonated felsic or andesitic lava with bright green flecks of fuchsite.

THIN SECTION DESCRIPTION:

The original porphyritic volcanic texture of this sample is vaguely evident in a few places in this sample, but most of the rock has been texturally obliterated by an intense carbonate alteration. Former euhedral augite and prismatic plagioclase phenocrysts, mostly less than 1mm long, are occasionally discernible due to their distinctive crystal shapes, despite the fact that they have been totally replaced by granular calcite. The remainder of the rock consists of relatively fine-grained calcite with interspersed small blebs of polycrystalline secondary quartz; no trace of the original groundmass texture is preserved. Several highly irregular meandering veinlets of slightly more pale brown and coarsely-crystalline calcite cut the sample.

The presence of augite and prismatic plagioclase phenocrysts in this even-textured sample strongly suggests that it was originally an andesitic lava. The intensity of the calcite alteration indicates proximity to a hydrothermal system. The sample is essentially an unbrecciated version of 513505.

SAMPLE NUMBER: 513508

SUMMARY:

This sample is a weakly foliated very altered former lithic tuff composed of felsic volcanic fragments in a similar matrix that has been sericitized and carbonated, and the calcite has been replaced by limonitic material.

HAND SPECIMEN:

This is a foliated, strongly limonite-calcite altered coarse-grained lithic tuff or epiclastic sediment, with slightly stretched and flattened fragments of diverse felsic volcanics to about 1cm long.

THIN SECTION DESCRIPTION:

The fragmental texture so obvious in the hand specimen of this sample is barely discernible in thin section due to a very strong calcite overprint, that has obliterated much of the primary texture of this sample. The few fragments or clasts discernible are very fine-grained and sparsely feldspar-phyric dacitic or rhyolitic lavas in which the groundmass has been fairly thoroughly sericitized, and contains dispersed but abundant fairly fine-grained calcite. Much of the calcite has been pseudomorphed by a rusty red-brown limonitic material. The matrix of the sample appears identical to the fragments, and suggests a lithic tuff precursor rather than an epiclastic sediment. The sample is cut by a weak foliation defined by Fe-stained sericite concentrations.

SAMPLE NUMBER: 513510

SUMMARY:

This is a very highly altered former felsic lava or crystal tuff that underwent a series of mineralization events precipitating sphalerite-pyrite and minor galena, with barite, calcite and secondary quartz.

HAND SPECIMEN:

This is a very highly altered and silicified (?) former felsic volcanic or crystal tuff with quite abundant sphalerite and pyrite as both very narrow veinlets and disseminations throughout the sample.

THIN SECTION DESCRIPTION:

Only a few small cores of texturally 'unaltered' rock remain in this sample, and show that it was originally a felsic volcanic or crystal tuff with fairly sparse feldspar phenocrysts and a few phenocrysts of quartz. The feldspar phenocrysts are totally sericitized, subhedral grains less than 1mm long, and the few quartz phenocrysts are rounded and reacted, with some strain lamellae. For the most part, the groundmass of this sample has totally recrystallized as a quartz-rich mixture of highly variable grainsize and texture. Most of those areas of groundmass composed almost entirely quartz are the sites of the greatest sulphide concentration, suggesting that the mineralizing solutions were also responsible for the silicification in this rock.

In reflected light, the slide is seen to contain a fairly complex sulphide assemblage with overall abundances of sulphides being pyrite (8-10 modal%), sphalerite (5-8 modal%) and a trace of galena. The sulphides are distributed unevenly through the rock, but the pyrite grains do appear to be more concentrated in a diffuse zone about 1 cm wide. Pyrite occurs as distinct idiomorphic grains from 0.01 to 2mm across that are embedded in a diffuse vein of polygonal quartz that varies almost to ribbon textures, dirty brown calcite and several large barite grains. They are only occasionally in contact with small patches and stringers of anhedral brown sphalerite up to 5mm across, that often have well-developed quartz pressure fringes; the sphalerite occurs outside the poorly-defined vein that contains most of the pyrite, and shows no relation to the carbonate alteration that hosts much of the pyrite. The barite occurs as several large grains to 3mm across that appear to be being replaced and eaten by quartz leaving an atoll-texture; the barite contains euhedral pyrite, but no sphalerite. Galena occurs as minor overgrowths on pyrite, as a rare small stringers in sphalerite. The paragenetic sequence was probably sphalerite-pyrite-quartz, followed by pyrite-galena-barite-calcite.

465051

Appendix 3C. DDH BB6 Petrology Descriptions

BEULAH BARITE DRILLHOLE BB6 SAMPLES

Sample	Depth	Field Description
513653	14.0m	Fine-medium grained ?andesitic lava? or volcaniclastic? Traces of disseminated red flecks (haematite?).
513654	26.8m	Massive pale green lava, andesitic or dacitic? Sericitised and weakly? silicified.
513655	57.0m	Haematite altered, foliated lava breccia? with common altered lava fragments. Some quartz filled ?vesicles.
513656 (polished thin)	87.0m	Pyrite-Chlorite? veined fine grained siliceous 'crackle' ?dacite lava. Large vein of quartz and ?barite with some pyrite cuts rock. (Sample pyrite for $\delta\ ^{34}S$ sulphur isotopes).
513657	140.5m	?Dacite lava, with minor fragments and weak silica and ?chlorite alteration. Some fuchsite spots.
513658	175.0m	Massive, fine grained ?felsic lava with sericitised feldspar phenocrysts.
512659 (polished thin)	229.8m	Massive, fine grained, green ?basalt lava. Moderately to strongly calcite altered. Cut by haematite + calcite vein.
513660	268.25m	Moderately to strongly calcite altered green ?basalt.
513661	310.4m	Weakly haematite altered moderately calcite altered basalt lava with common small fine grained fragments. Cut by minor calcite vein.
513662	317.3m	Similar to 661 but with abundant fragments. Fragments are weakly haematite altered.
513663 (polished thin)	365.0m	Massive, fine grained, dacitic or andesitic lava, cut by common pyrite and quartz veinlets. Weakly silica altered?, not calcitic. (Sample pyrite for $\delta\ ^{34}S$ sulphur isotopes).
513664	397.0m	Weakly sheared? dacitic lava breccia or volcaniclastic? Not calcite altered.

T.C. 17
435053 BB-6
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PETROGRAPHIC REPORT

Rocks from BEULAH DRILLHOLE

For ABERFOYLE RESOURCES LTD

Attn. SVEN RAND

by
Anthony J. Crawford
Geology Department
University of Tasmania
11/9/89

SAMPLE: 513653

SUMMARY:

This is a foliated and strongly carbonate-hematite-altered former andesitic lava or pyroclastic rock.

HAND SPECIMEN

This is a grey-green, foliated fine to medium-grained and strongly altered andesitic lava or tuff cut by calcite veins to almost 1cm thick. It is spotted by intense reddish hematite alteration.

THIN SECTION DESCRIPTION:

This sample is very difficult to diagnose with certainty. It is a very strongly altered, quite strongly foliated former andesitic (?) lava or tuff that is more than 50% relpaced by calcite. Apart from a few ghost relics of plagioclase phenocrysts, and several probable former mafic phenocrysts now defined only by opacite rims, no trace of the primary texture is evident. Nor can it be determined whether the foliation has overprinted a former primary layering (eg. if the sample was a tuff). In both the hand specimen and the thin section, several dark formerly pumiceous lithic fragments are evident, up to almost 1cm long.

The bulk of the sample is composed of a foliated intergrowth of calcite, very fine-grained quartz-sericite±albite(?), and hematitized pyrite, the latter making up at least 5-8 modal% of the sample. The calcite varies from very messy, very fine-grained trains and patches to clearer, more well-crystallized areas. In the veins, it is quite coarse-grained and intergrown with quartz. Small patches of green chlorite in the matrix may represent relics of former mafic phenocrysts, although no former crystal outlines are preserved.

An andesitic precursor for this sample is likely given the geochemical whole rock data. A rock this carbonated would have minimum MgO relative to the primary rock. As this sample has 3.7% MgO, an original value probably in excess of 5% is likely. In addition, the Zr content (100 ppm) of this sample suggests that it had probably less than 60% SiO2, and is therefore likely to be andesitic. Finally, experience with much less altered rocks from the Beulah barite area has demonstrated the common presence of unusual (for the Mount Read Volcanics) poorly plagioclase-

phyric andesites, many of which may have had vitrophyric or glassy groundmasses. The few dark pumiceous clasts in this sample may simply be small inclusions incorporated during eruption in an andesitic lava, although a primary andesitic pyroclastic origin cannot be ruled out on the evidence provided (or not provided in this case!) in this section.

SAMPLE: 513654

SUMMARY:

This is a weakly foliated strongly carbonate-altered former almost aphyric andesitic lava.

HAND SPECIMEN

This is a foliated pale grey-green strongly carbonate-altered andesitic or felsic lava with a uniform fine-medium grainsize and texture.

THIN SECTION DESCRIPTION:

This sample is very simailar to the preceding sample in most respects. The main differences are that it contains notably less abundant hematite after pyrite, it is less foliated, and probably contains slightly less calcite and more sericite. Primary textures are obliterated and only the wholerock geochemical data for MgO and Ti-Zr provide strong evidence that this sample was originally andesitic. The extremely uniform texture of this sample suggests to me that it was probably a lava. The less pronounced foliation than the previous sample suggests that 513653 came from a high-strain fault zone relative to this sample.

SAMPLE: 513655

SUMMARY:

This is a foliated andesitic lithic tuff or lava breccia that has suffered intense carbonate-sericite±pyrite(hematite) alteration.

HAND SPECIMEN

This is a strongly foliated dark grey andesitic lithic tuff or lava breccia with lava fragments of black pumice(?) and pink felsic lava or tuff set in a strongly carbonate-altered and -veined foliated matrix.

THIN SECTION DESCRIPTION:

This sample is very similar to the previous two samples. Without having seen the hand specimen, there is no way this sample would be recognized as a lithic tuff or lava breccia from the thin section. The primary texture is totally obliterated by intense carbonate-sericite alteration, and there is no trace of the lithic fragments obvious in hand specimen. The sample is less foliated than 513653, but the foliation present is defined by sericite development along the cleavage, and the common occurrence of calcite veinlets and stringers parallel to the sericite-defined foliation. Pyrite, and hematite after pyrite, are both quite common in this sample relative to the previous one. As for the previous samples, the chemistry (MgO, Ti-Zr) strongly suggests that the precursor of this sample was dominantly andesitic. Although the Ba content of this sample is anomalously high (5500ppm), I could find no clear evidence of barite in the fine-grained veins or groundmass/matrix in this sample.

SAMPLE: 513656

SUMMARY:

This is a formerly glassy aphyric andesite with intense sericite-carbonate alteration and a weak foliation; it is cut by a calcite-barite-pyrite vein about 1cm thick.

HAND SPECIMEN

This is a pale grey fine-grained aphyric lava with a less well-developed foliation than the previous samples. The uniform grey lava is 'broken' into a brecciated texture by highly irregularly distributed dark, narrow chlorite(?) veinlets. A single centimeter-wide carbonate-pyrite vein cuts the sample.

THIN SECTION DESCRIPTION:

The textural preservation of this sample is better than for those described above. It appears to have been an essentially aphyric glassy lava that devitrified to a fine-grained mosaic 'snow-flake' texture dominated by patchy inclusion-riddled quartz with minor interstitial sericite and albite. A few microphenocrysts of apatite were noted. This devitrification texture is overprinted by an intense calcite-sericite alteration, with calcite growing as tiny idiomorphic grains in the matrix quartz, and occurring as patches and veinlets. The sample is cut by abundant subparallel strongly foliated sericite bands. Those visible as dark lines in the hand specimen are seen to be foliated stylolitic zones of intense sericitization along which strong dissolution has occurred, leaving an opacite-rich residual material.

Approaching the main calcite-pyrite vein, the foliation and sercicite development becomes more intense. In polarized light, the vein is seen to be composed of coarse-grained calcite intergrown with elongate crystals of inclusion-riddled barite and less inclusion-rich, clearer quartz in which large euhedral pyrite crystals have grown. In reflected light, these pyrite crystals, up to almost 1mm across, are seen to be homogeneous and free of any other sulphide phase as inclusions or rims. A few tiny specks of chalcopyrite were noted in the matrix of the sample, but the calcite-barite-pyrite vein contains no other sulphide phase than pyrite.

For the same reasons as detailed for sample 513653, the wholerock data for this sample suggest an andesitic or more mafic precursor.

SAMPLE: 513657

SUMMARY:

This sample is a strongly carbonate+sericite-altered foliated andesitic lava breccia or lithic tuff.

HAND SPECIMEN

This is a dark grey fairly coarse-grained lava breccia or lithic tuff with fine-grained pale grey-green felsic(?) lava fragments to about 2 cm long dragged out into a fairly well-developed foliation, and less abundant dark coloured formerly vesicular (?) pumiceous fragments.

THIN SECTION DESCRIPTION:

Although the primary texture of this sample is almost obliterated totally by intense carbonate-sericite alteration accompanying foliation development, at least several former lithic clasts can still be identified by their very different response to alteration. Most obvious are the former vesicular pumice fragments that are now flattened, with dark very narrow bands of opacite material (insoluble hematite ?) wrapping around calcite blebs that may have filled former vesicles. The remainder of the rock is composed of a very fine-grained quartz-sericite-calcite intergrowth pervaded by strong localized development of intense sericite - defined foliation. The grainsize of calcite overprinting the matrix of the sample varies from very fine-grained messy material, to bands of quite coarse-grained (to 0.5mm across) subhedral prisms growing in the matrix.

As for the previous samples, the wholerock chemical data supplied suggest an andesitic or even more mafic precursor for this sample; the texture in hand specimen and thin section leaves little doubt that it was originally a lava breccia or coarse andesitic lithic tuff.

SAMPLE: 513658

SUMMARY:

This is a strongly carbonate+sericite altered, but unfoliated formerly plagioclase+ augite+FeTi oxide-phyric andesitic lava.

HAND SPECIMEN

This is a massive, speckled, pale grey porphyritic andesitic lava cut by a few dark grey to black quartz-chlorite(?) veinlets and pale calcite veins. Former phenocrysts are abundant and altered to calcite(?).

THIN SECTION DESCRIPTION:

Although still relatively strongly carbonate-sericite altered, this sample is considerably better preserved than any of the foregoing samples. The primary texture is quite evident. The sample was an andesitic or basaltic andesite lava with abundant plagioclase and augite phenocrysts. Former plagioclase phenocrysts are totally sericitized and are beginning to lose their identity amongst the sericitized formerly vitrophyric groundmass. They made up around 15-20 modal% of this sample, and were mainly less than 0.4mm long. Somewhat less abundant but quite distinctive are relatively large calcite-pseudomorphs after augite phenocrysts. These range up to around 1.2mm long, and have characteristic augite shapes, with occasional small rounded FeTi oxide inclusions. Rather reacted-looking former FeTi oxide phenocrysts are not uncommon, and are altered to leucoxenic aggregates.

The groundmass of this sample is largely replaced by a fine-grained almost granular calcite-quartz-albite intergrowth that is riddled with sericite and tiny Fe- or FeTi oxides grains. This sample has a very poorly defined fracture cleavage defined by subparallel stringers of sericite.

I don't believe that this sample is a better preserved variety of those samples described above. Although this is less foliated and slightly less carbonate-altered than the preceding lava samples, I don't believe it is a possible less altered variant of those samples. In my experience, the former strongly phyric nature of samples such as this augite+ plagioclase-phyric andesite can usually be discerned even after intense alteration and foliation development. For this reason, I think many of the foregoing samples were probably virtually aphyric.

SAMPLE: 513659

SUMMARY:

This is a formerly plagioclase+augite-phyric andesitic or basaltic andesite lava with abundant chlorite relative to previous samples

HAND SPECIMEN

This is a massive, uniform textured fine-grained dark grey andesitic or basaltic lava cut by a narrow calcite-hematite vein.

THIN SECTION DESCRIPTION:

This rock in thin section is seen to be a relativey well-preserved (compared to most of the previously described muck) formerly plagioclase+augite+FeTi oxide-phyric andesitic or basaltic andesite lava. Plagioclase phenocrysts up to 1.5mm long are mainly euhedral to subhedral elongate prisms altered entirely to sericite or sericite plus dirty, very fine-grained epidote aggregates. These phenocrysts made up at least 15 modal% of this sample. Slightly less abundant are euhedral former augite phenocrysts to about 1mm long that have been replaced by complex intergrowths of bright green chlorite, blebs of quartz and granular fine-grained epidote. Former FeTi oxide phenocrysts were small equidimensional crystals that are now replaced by leucoxene.

The groundmass of this sample was originally extremely fine-grained and vitrophyric-textured, with abundant glass. The glass has devitrified and crystallized as patchy quartz-albite mosaics that are riddled by tiny opaque oxides and abundant green fine-grained chlorite. Chlorite veinlets are common, and the amount of chlorite dispersed through this sample greatly exceeds that observed in the samples described above..

The sample is transected by a single 2mm-wide calcite-hematite veinlet that in transmitted light can be seen to be made up of abundant tiny blood-red hematite blades set in coarsely crystalline calcite.

The wholerock chemical data supplied support the interpretation from petrography that this was and andesitic or basaltic andesite lava.

SAMPLE: 513660

SUMMARY:

This is a formerly palgioclase+augite-phyric andesitic lava with a strong calcite-sericite alteration and foliation development; it is probably from the same lithological unit as the preceding sample.

HAND SPECIMEN

This sample is a dark grey-green porphyritic meta-andesite lava with a rather more coarse-grained phenocryst population than the preceding sample.

THIN SECTION DESCRIPTION:

This sample is a formerly augite+plagioclase-phyric andesitic lava that has a fairly strong foliation and sericite-calcite alteration. Plagioclase phenocrysts , originally up to about 1mm long, are totally replaced by sericite, or sericite and calcite, and most are stretched out into the foliation. Former augite phenocrysts are ess abundant (around 5-10 modal%) and are replaced by green chlorite, calcite and minor epidote. Small FeTi oxide microphenocrysts are quite common and are leucoxenized.

The groundmass of this sample is very fine-grained and strongly replaced by sericite, calcite and minor chlorite. There is no trace of the primary groundmass texture preserved; it may have beenglassy to vitrophyric. Foliation is mainly defined by fine-grained sericite trains across the groundmass and the elongation and smearing out of the altered former plagioclase phenocrysts.

The chemical data for this sample indicate an andesitic affinity, and combined with the petrography suggest that this sample and 513659 may be from the same lithological unit, with 513660 being from a higher strain zone, perhaps closer to a major fault, than 659.

SAMPLE: 513661

SUMMARY:

This is a former plagioclase+augite-phyric andesitic tuff-breccia that has suffered intense calcite-sericite-hematite(?) alteration.

HAND SPECIMEN

This sample is a massive dark grey-green porphyritic, strongly carbonate altered andesitic tuff-breccia with about 10-15 modal% of hematitized lithic (lava?) fragments, and abundant fine-grained hematite in the matrix.

THIN SECTION DESCRIPTION:

This sample in thin section is seen to be a formerly plagioclase+ augite -phyric andesite lithic tuff or breccia that has, over most of the section, been texturally and mineralogically reconstituted. The few former plagioclase phenocrysts still evident are totally replaced by calcite and sericite, and several ghost outlines of former augite phenocrysts are also present. Several small lithic fragments of the same rock are preserved, and are replaced by calcite and abundant tiny hematite grains.

The matrix of this sample is intensely carbonate-sericite altered, and is peppered by tiny equigranular opaques, possibly hematite. Several narrow chlorite-calcite veinlets cut the sample. The sample lacks any foliation. The origial rock from which this sample was derived by intense hydrothermal alteration was probably little different to the previous two samples compositionally, but was simply a more explosive manifestation of the same magmatism.

SAMPLE: 513662

SUMMARY:

This is a mafic lava breccia composed of porphyritic andesitic to basaltic lava fragments in an andesitic matrix; the rock has suffered strong carbonate-sericite-hematite alteration.

HAND SPECIMEN

This sample is clearly an andesitic lava breccia composed of strongly hematite-altered red lithic volcanic fragments to at least 1cm across in a dark grey porphyritic matrix.

THIN SECTION DESCRIPTION:

This sample is a a former andesitic lava breccia that has been strongly carbonate altered. At least two dominant varieties of lithic clasts are noted. The most abundant, that grades texturally and mineralogically into the groundmass, is a plagioclase+augite-phyric andesite with around 15-20 modal% of totally altered plagioclase phenocrysts (mainly less than 0.5mm) that are now calcite-sericite intergrowths. Sparse augite phenocrysts are replaced by chlorite and calcite. The groundmass of this fragment type is indistinguishable from the matrix of the sample, probably being composed originally of glass that has altered to an exceptionally fine-grained quartz-sericite-albite -hematite intergrowth.

The second lithic fragment variety, obvious in hand specimen as dark red fragments, was clearly originally composed of glassy porphyritic andesitic or basaltic lavas that contained more abundant mafic phenocrysts, possibly including olivine, than the dominant fragment type. These were plagioclase+augite+olivine(?)-phyric, and are similarly altered to the fragments described above. The other main difference from the latter is the abundant tiny opaques that rim former mafic phenocrysts and form slightly larger and abundant grains in the matrix, and the relative abundance of chlorite in the red fragments. The red fragments were probably a pre-existing basaltic to andesitic flow that was caught up in explosive eruption of the brecciated (more abundant) andesite.

063

SAMPLE: 513663

SUMMARY:

This is a formerly plagioclase+augite-phyric andesitic lava that has been strongly carbonate-altered. Abundant calcite-pyrite-chlorite veins are present; the pyrite contains a small amount of chalcopyrite along grain boundaries and cracks.

HAND SPECIMEN

This is a strongly carbonate-altered grey-green porphyritic andesite that is cut by several meandering calcite-pyrite veins.

THIN SECTION DESCRIPTION:

In thin section, this sample is seen to be an intensely altered formerly plagioclase+augite-phyric andesite. Over most of the section, the primary texture has been obliterated, and only ghost relics of former phenocrysts are preserved. I have no doubt that these phenocryst phases were plagioclase and augite, although both are now altered to calcite.

The matrix (groundmass?) of the sample is composed essentially of very fine-grained messy calcite and interstitial exceptionally fine-grained quartz-chlorite- sericite-hematite±albite. Weak local foliation development is defined by subparallel narrow sericite concentrations.

The veins of calcite-chlorite-quartz-pyrite in this sample are variable and apparently zoned. Green chlorite and subhedral pyrite appear to line most veins, and be replaced inward by calcite then quartz-chalcedonic silica(?). Very diffuse chlorite-pyrite concentrations pervade the rock, and in these the grainsize of the pyrite is strikingly variable (about 0.8mm to dust), and many grains appear to be broken fragments.

In reflected light, the broken and ragged nature of the pyrite is obvious, and this may have formed by brecciation of formerly better defined veins, associated with the diffuse chlorite alteration. The pyrite is inclusion free, but commonly contains very minor concentrations of chalcopyrite along cracks and grain boundaries.

SAMPLE: 513664

SUMMARY:

This is a strongly carbonate-altered andesitic lava breccia dominated by formerly plagioclase+augite-phyric andesitic lava fragments.

HAND SPECIMEN

This is a felsic or andesitic lava breccia or lithic tuff-breccia containing a diverse assemblage of cream, pink and grey-green lava fragments up to 2cm long; the sample is strongly carbonate-altered.

THIN SECTION DESCRIPTION:

As is frequently the case for these very altered andesitic or felsic lava breccias, the primary texture is much more evident in hand specimen than in thin section. Relic outlines of former fragments are occasionally discernible due to changes in the texture and extent of alteration of the matrix. Nost fragments were plagioclase+augite-phyric andesites, with a predominance of plagioclase among the phenocryst population. Both phenocryst minerals have been totally replaced by calcite, and minor green chlorite and sericite. The variable groundmasses of the different fragment types are also replaced by calcite-chlorite-sericite-quartz ± albite ± hematite. Euhedral, sharp-edged (fresh?) pyrite grains to 0.5mm are scattered throughout the sample, although never concentrating in veins or patches.

This sample appears to be compositionally and petrographically andesitic rather than dacitic, and seems little different in magma type and implications from the preceding three or four samples.

465066

Appendix 3D. Mt. Roland Grid Petrology Descriptions

SAMPLES SUBMITTED FOR PETROLOGY

Mount Roland Surface Samples

Sample	Location	Comments
513692	437050E, 5410250N	Adit rock pile sample
513693 (Polished thin section)	437050E, 5410250N	Adit rock pile sample
513695	437050E, 5410100N	(CRA line 1100E, 863N)
513696	437060E, 5410110N	(CRA line 1100E, 875N)
513697	437140E, 5410180N	
513698	437190E, 5410170N	
513699	437115E, 5410180N	(CRA line 1100E, 1025N o/c in creek)
513700	437100E, 5410185N	(o/c in creek, 20m down from above)
513901	437090E, 5410190N	(o/c in creek 6m down from above)
513902	437070E, 5410210N	(o/c in creek 25m down from above)
513903 (Polished thin section)	437050E, 541020N	Outcrop from adit mouth

562009	P,G	645E,806N	Andesitic/basaltic lava?
562010	P,G	600E,900N	Andesite Lava?
562011	P,G	800E,1400N	Andesite Lava?
562012	P,G	800E,680N	Silicified Rhyolite?
562013	P,G	1000E,225N	Sericite altered Dacite lava?
562014	P,G	1000E,920N	Carbonate-?silica altered Rhyolitic intrusive?
562015	P,G	1000E,1051N	As above
562016	P,G	1200E,850N	Quartz and feldspar volcaniclastic or lava?
562017	P,G	1200E,560N	Bedded quartz sandstone. Cambrian volcaniclastic?
562018	P,G	1400E,475N	Flow banded Dacite?
562019	geochem only	1200E,350N	Dacitic or andesitic lava?

SAMPLE NUMBER: 513693

SUMMARY:

This sample was originally a hornblende+plagioclase -phyric glassy(?) andesite lava or crystal tuff. It suffered extensive alteration and recrystallization of the groundmass, leading to abundant quartz- and calcite veinlets and patches, and growth of discrete pyrite grains throughout the groundmass. Brownish yellow sphalerite (with subordinate marginal galena) occurs as patches to almost 1cm long associated with the more coarsely and thoroughly recrystallized groundmass.

HAND SPECIMEN:

This is a grey-light brown highly altered rock of uncertain origin in hand specimen, that contains abundant honey-coloured sphalerite.

THIN SECTION:

Although this sample has been thoroughly altered and recrystallized in places, enough primary textural detail has been preserved to indicate that this rock was a originally a hornblende+ plagioclase-phyric andesite lava or crystal tuff. Former hornblende phenocrysts have been replaced by streaky colourless sericite and very fine-grained epidote, and many have been rather sheared out; most hornblende phenocrysts were less than 1mm long. Former feldspar phenocrysts, also less than 1mm long, were elongate lath-shaped prisms, probably not as common as the hornblende phenocrysts, and all have been totally replaced by secondary quartz and albite intergrown on a fine scale.

The groundmass of this sample has been totally recrystallized to a quartz-sericite-albite-calcite-sulphide intergrowth with striking rapid changes in grainsize and texture over small distances. Secondary quartz sometimes occurs in polygonal clusters that grade into veinlets, but more frequently it occurs as anhedral blebs and strings in a matrix of finer-grained quartz-albite-sericite. Dirty brownish calcite veinlets and irregular concentrations overprint the altered groundmass of this sample.

Sulphides are relatively abundant in this sample. Pyrite occurs as discrete single crystals making up around 2 modal% of the sample, but scattered very irregularly through the rock. These crystals are rarely larger than 0.2mm across, and are characteristically rather rounded in shape, although they are clearly not detrital. Modally, the most abundant sulphide in this sample is sphalerite. It occurs in large streaks and blebs, often elongate, to around 1cm long, concentrated in the most coarse-grained and recrystallized areas of groundmass; it is almost always associated with secondary (recrystallized) quartz that resembles disrupted vein quartz in many places. Sphalerite also occurs as tiny irregular blebs and patches throughout the more coarsely-recrystallized

groundmass. In the large patches, sphalerite is riddled with tiny blebs of chalcopyrite, although not enough to be 'diseased'. Galena forms small elongate patches most commonly found around the edges of large sphalerite patches. It is considerably less abundant than sphalerite or pyrite.

Although it is not at all certain, textural relations in this rock suggest to me that pyrite formed first, during recrystallization of the possibly formerly glassy groundmass. Sphalerite-galena mineralization occurred sometime later, possibly associated with a quartz veining event. No sulphide is unambiguously associated with the carbonate veining.

SAMPLE NUMBER: 613695

SUMMARY:

This sample is a quartz+plagioclase-phyric, formerly glassy rhyolitic lava.

HAND SPECIMEN:

This is an extremely weathered and fractured, bleached former felsic volcanic rock with abundant tiny holes where pyrite(?) has weathered out.

THIN SECTION:

In thin section, this sample is clearly a rhyolitic lava that contained quartz and feldspar phenocrysts in a formerly glassy groundmass. Quartz phenocrysts are mainly 0.5-1mm across, and markedly rounded and reacted. They frequently contain tiny round melt inclusions that have crystallized to a very fine-grained intergrowth of quartz and feldspar. Many rounded quartz phenocrysts have narrow reaction rims where they have been resorbed by the crystallizing (devitrifying) groundmass. Former feldspar phenocrysts are blocky tabular prisms to about 2mm long that have been totally replaced by sericite, that in turn, has been replaced by a red-brown Fe-stained clay or limonitic material.

The groundmass of this sample is a very uniform textured fine-grained quartz-feldspar intergrowth almost certainly crystallizing from devitrifying rhyolitic glass. This is pervaded by the same red-brown clay-limonite alteration product that has replaced feldspar phenocrysts.

The abundant quartz phenocrysts in this sample, plus the characteristic groundmass texture, indicate that this sample was a glassy rhyolitic lava. Much of the alteration may be ascribed to surficial weathering.

SAMPLE NUMBER: 513696

SUMMARY:

This protolith of sample was identical to 513695, but this rock shows much less surficial oxidation and weathering. It was a quartz+feldspar-phyric rhyolitic lava.

HAND SPECIMEN:

This is a cream-coloured quartz-phyric felsic lava with slight oxidation along fractures.

THIN SECTION:

There is no doubt that this sample was derived from an identical flow of quartz+feldspar-phyric formerly glassy rhyolitic lava as 513695. The only difference between this sample and 513695 is that the sericitized feldspar phenocrysts in this sample do not show the intense red-brown clay-limonite alteration produced by intense surficial weathering of the former.

SAMPLE NUMBER: 513697

SUMMARY:

This is a sericitized, but otherwise well-preserved hornblende+plagioclase+FeTi oxide-phyric andesitic lava.

HAND SPECIMEN:

This is a reasonably well-preserved grey-green feldspar+ mafic-phyric andesitic lava.

THIN SECTION:

This rock is texturally very well-preserved, although all former phenocryst minerals have been replaced by secondary phases. The rock was a very crystal-rich andesitic lava, with abundant plagioclase, hornblende and FeTi oxide phenocrysts. The most abundant phenocryst phase was clearly plagioclase, which makes up around 25-30 modal% of the sample. Plagioclase phenocrysts were originally rather elongate tabular prisms to about 2mm long maximum. All have been totally replaced by very fine-grained colourless sericite. Former hornblende phenocrysts, some with distinctive amphibole crystal shapes, are also replaced by sericite, but differ from altered plagioclase crystals in having relatively abundant opaque oxide dust scattered through the sericite, and they also contain small patches of pale gren chlorite and dirty yellow, very fine-grained epidote. Former hornblende phenocrysts make up around 5 modal % of this sample. Equidimensional small phenocrysts of FeTi oxide were not uncommon in this sample, and have been altered to dirty brown leucoxene.

The groundmass of this sample was extremely fine-grained vitrophyric to glassy. It has devitrified and recrystallized to irregular quartz-albite patches that are peppered with tiny sericite flakes and occasional green chlorite flakes. The sample is cut by narrow veinlets of ribbon quartz and subordinate chlorite.

COMMENT: This sample is petrographically like some hornblende+plagioclase-phyric andesites from the western side of Lake Dora and from the Boulder Hill area much further south in the MRV. These are considered to be Tyndall Gp by K Corbett, but the area is not well mapped. Their analyses are in the April 1986 AMIRA report and sample numbers are 3403, 3402, 3399, and Ti/Zr values are 19-22. This sample is probably very close petrographically to the precursor of mineralized sample 513693.

SAMPLE NUMBER: 513698

SUMMARY:

This is a former hornblende+plagioclase+FeTi oxide -phyric andesitic lava essentially identical to, and probably from the same flow unit as sample 513697. It is much less altered than 513697.

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HAND SPECIMEN:

This is a dark brown abundantly plagioclase+mafic phyric andesitic lava, with phenocryst size less than 1mm.

THIN SECTION:

This sample is virtually identical to the previous rock (513697) in being a hornblende + plagioclase+FeTi oxide-phyric andesitic lava. This sample, however, is much better preserved than 697. Plagioclase phenocrysts are not sericitized, and are composed of twinned albite. Hornblende phenocrysts are quite large (to 1.5mm long) and show two types of replacement: either by a polygonal quartz intergrowth with minor interstitial chlorite and abundant FeTi oxide dust, or by calcite. Characteristic crystal shapes of hornblende are common, and reinforce the identification. FeTi oxide phenocrysts have exsolved ilmenite along octahedral planes, and altered to leucoxene, leaving skeletal magnetite grains in many cases. Small apatite euhedra are quite common as microphenocrysts. Three strongly resorbed, rounded quartz phenocrysts are also present in this sample, and several chlorite-sericite plates that may be replacing former biotite crystals.

The groundmass of this sample was vitrophyric to glassy. It has devitrified and coarser-grained patches of quartz-chlorite are interspersed in a very fine-grained quartz-albite-sericite-chlorite matrix. Calcite has overprinted the devitrified groundmass and also the altered phenocrysts, and makes up about 5-8 modal% of this sample.

This sample is simply a less altered version of the previous sample, and is worth analyzing; both samples probably come from the same flow unit they are so similar.

SAMPLE NUMBER: 513699

SUMMARY:

This is a hornblende+plagioclase+FeTi oxide-phyric andesite lava from the same unit as the previous two rocks described above.

HAND SPECIMEN:

This is a relatively fine-grained and well-preserved plagioclase+mafic-phyric andesite.

THIN SECTION:

This sample is also essentially identical to 513697 and 513698. Like the former, the abundant plagioclase phenocrysts have been totally sericitized. Former hornblende phenocrysts have been replaced by yellow-green chlorite. Former FeTi phenocrysts have been replaced by sericite and leucoxene, and often have a shell of magnetite or goethite. Several former biotite phenocrysts, now replaced by sericite and chlorite, are also present in this sample, occurring as elongate narrow book-like plates. The vitrophyric groundmass of this sample is slightly more sericitized than the previous sample, but otherwise is texturally similar to both the previous samples. I have no doubt that this sample and the previous two (513697 and 513698) come from the same unit or sequence of hornblende andesite units. This sample lacks the calcite present in the previous sample, and would also be worth analyzing.

SAMPLE NUMBER: 513700

SUMMARY:

This sample was a hornblende+plagioclase+FeTi oxide-phyric andesitic lava basically identical to the previous three, differing only in showing more intense sericitization and alteration (quartz-sericite) of the groundmass than the other three lavas.

HAND SPECIMEN:

This is an altered brown plagioclase+mafic-phyric andesite.

THIN SECTION:

As for the previous three samples, this was also a hornblende+ plagioclase+FeTi oxide-phyric andesite, but this sample is both more altered and more weathered than any of the other three described above. The former plagioclase and hornblende phenocrysts may still be discerned, but they have been almost obliterated by extensive sericite alteration. Former hornblende phenocrysts have strong Fe-oxide-hydroxide alteration running through the sericite replacing the hornblende, and the sericite is often yellowish and Fe-stained relative to sericite replacing plagioclase phenocrysts. Well-former apatite microphenocrysts are not uncommon.

The groundmass of this sample is considerably more altered than any of the previous three samples. The formerly vitrophyric to glassy groundmass has been strongly fractured and replaced by patchy secondary quartz, limonite, and sericite. The secondary quartz forms irregular polycrystalline aggregates immersed in sericite throughout most of the rock.

This sample was undoubtedly from the same unit(s) as the previous three samples but shows more intense alteration, especially of the groundmass.

SAMPLE NUMBER: 513901

SUMMARY:

This is a formerly hornblende+plagioclase+FeTi-oxide -phyric andesite lava basically similar in most respects to the previous four samples described above. It contains notably more intense calcite alteration than all but 513697.

HAND SPECIMEN:

This is a pale grey plagioclase+mafic-phyric andesitic lava with a dark brown weathering rind, and phenocrysts less than 1mm long.

THIN SECTION:

This is yet another formerly hornblende+plagioclase+FeTi oxide-phyric andesite lava, very similar to the previous four. Major differences between this and the previous sample are that this sample contains slightly more plagioclase and less hornblende than any of the previous four, and that this sample contains significantly more calcite than any of the others except 513697. Apatite microphenocrysts are common, but both hornblende and plagioclase are thoroughly sericitized. In this sample, former hornblende phenocrysts contain no Fe-stained sericite or Fe oxide-hydroxide phases. The formerly glassy to vitrophyric groundmass is devitrified and, like the previous sample, contains quite large (to 2mm across) areas of polycrystalline secondary quartz.

This sample is from the same sequence as the previous four hornblende andesites, but shows abundant calcite alteration, most similar to 513697.

SAMPLE NUMBER: 513902

SUMMARY:

This is a plagioclase+hornblende+FeTi oxide +augite-phyric andesitic lava, probably related to those described above but somewhat more primitive. It contains abundant chlorite in the groundmass, and differs markedly in this respect from the other hornblende andesites described above.

HAND SPECIMEN:

This is a dark grey plagioclase+mafic phenocryst-phyric lava with quite abundant chlorite.

THIN SECTION:

This sample differs from the preceding five lavas in several respects, although it was also probably originally a hornblende+ plagioclase- phyric andesite. Firstly, it contains notably less abundant phenocrysts than any of the preceding andesites, although there is probably at least 15 modal% phenocrysts in this sample. Secondly, plagioclase is probably modally dominant over hornblende phenocrysts; plagioclase phenocrysts are totally replaced by very fine-grained sericite. Former hornblende phenocrysts are replaced by pale green chlorite and quartz, with abundant tiny Fe or FeTi oxides scattered throughout former hornblende crystal sites. Not uncommon small phenocrysts replaced by deep green chlorite have shapes more reminiscent of augite than hornblende. Abundant FeTi oxide phenocrysts are replaced by tiny opaque granules and leucoxene. Apatite microphenocrysts are again quite common.

The groundmass of this sample was glassy to vitrophyric and is relatively well-preserved compared to the two previous samples. It has devitrified to an extremely fine-grained intergrowth of quartz (+albite?)-chlorite-sericite. The abundance of chlorite in the groundmass of this sample serves to distinguish it from the other hornblende andesites described above. This feature, and the presence of probable former augite microphenocrysts might suggest that this sample is a slightly less evolved precursor of the other andesites described above, although I would argue that this sample is from the same suite as those previously described.

SAMPLE NUMBER: 513903

SUMMARY:

This is a plagioclase+hornblende-phyric andesite lava, less phenocryst-rich but certainly related to those described above, that contains abundant dispersed pyrite and sphalerite (+cpy+galena) mainly localized in quartz-calcite veins. The sulphide occurrence is identical to that in sample 513693.

HAND SPECIMEN:

This is a pale brown plagioclase-phyric andesite or dacite lava cut bt several calcite-sulphide bands up to almost 1cm thick.

THIN SECTION:

This sample was originally a plagioclase+hornblende-phyric andesitic lava quite similar in most respects to the last sample described above. It contains less hornblende phenocrysts (probably <5 modal%) than the other hornblende andesites above, and also less plagioclase phenocrysts, but it contains occasional small chloritized augite microphenocrysts and the same distinctive euhedral apatite crystals that are common in all the hornblende andesites described above. Plagioclase phenocrysts are totally sericitized, and former hornblende phenocrysts are replaced by sericite and messy calcite, plus common Fe(Ti?) oxide dust.

The groundmass was glassy, and has devitrified to a patchy quartz-albite-sericite intergrowth, with quartz occurring as irregular anhedral patches in the groundmass. Dirty brown calcite overprints the devitrification assemblage, and occurs as stringers and small patches throughout the rock.

The veins transecting this sample are calcite-quartz-sulphide dominated, but contain minor sericite. Calcite and quartz are quite coarse-grained and polygonal.

In reflected light, the sulphide assemblage is seen to be composed of pyrite-sphalerite-galena-chalcopyrite. The occurrence of these sulphides is identical to that described for sample 513693. Pyrite occurs as discrete slightly rounded grains to 0.3mm across dispersed throughout the sample, making up about 2-4 modal% of the rock. Sphalerite, containing abundant small chalcopyrite inclusions and a few larger patches of cpy, is limited to the quartz-calcite veins, where it occurs as very irregular-shaped, ragged-edged grains to 1mm long. It sometimes contains concentrations of galena along contacts with the gangue, but galena is volumetrically subordinate to the other sulphides. The paragenesis, as for sample 513693, would appear to be dispersed pyrite before more localized sphalerite (+cpy+galena) associated with the localized quartz-calcite veining.

079

SAMPLE NUMBER: 562009

SUMMARY:

This is a strongly weathered formerly plagioclase+ hornblende + quartz-phyric dacitic or rhyodacitic lava that had suffered strong carbonate alteration before surficial weathering.

HAND SPECIMEN:

This is a very strongly weathered, clayey, weakly foliated metavolcanic rock with altered feldspar phenocrysts and possibly altered former mafic phenocrysts.

THIN SECTION:

This rock is a very weathered and altered former felsic lava. Former plagioclase phenocrysts, mostly less than 1mm long, have been thoroughly altered to dirty, almost opaque Fe-stained clay. Quite a few phenocrysts have outlines strongly suggestive of hornblende precursors, although these too are totally altered to clay. Within pseudomorphs of both plagioclase and probable hornblende, many small rhombic crystals now composed of Fe-stained isotropic clay are probably altered and weathered former calcite crystals. About 1 modal% of the rock is composed of quite rounded and reacted quartz phenocrysts.

The groundmass of this sample was originally largely glassy, but has devitrified and crystallized as a rather heterogeneously textured quartz-sericite-clay mixture, in which dark brown rhombic clay pseudomorphs after calcite are also common. The groundmass is pervaded by a weak foliation, with foliation planes being defined by diffuse bands of closely spaced, irregular wavy fractures picked out by opaque Fe-stained clay.

This sample was probably originally a dacitic or rhyodacitic plagioclase+hornblede-phyric lava. It appears to have suffered strong calcite-dominated alteration after devitrifiaction of the groundmass, but preceding an episode of intense probably surficial alteration that produced a clay-limonite of Fe-stained clay throughout most of the sample.

SAMPLE NUMBER: 562010

SUMMARY:

This is a formerly hornblende+plagioclase+augite-phyric andesitic lava that has suffered total replacement of all feldspar and mafic silicate phases by sericite and quartz.

HAND SPECIMEN:

This is a rather weathered, brownish plagioclase+mafic-phyric andesitic lava.

THIN SECTION:

This is a fairly strongly altered and weakly foliated meta-lava, possibly slightly autobrecciated, with totally altered phenocrysts of hornblende, plagioclase and augite, and microphenocrysts of FeTi oxide. Hornblende phenocrysts formed approximately 5-8 modal% of the rock, and is completely altered to yellowish chlorite or ferri-chlorite, sericite and secondary quartz. Some former hornblende crystals are more than 3mm long, and most are well-formed elongate to diamond-shaped prisms. Former plagioclase phenocrysts are slightly more abundant than hornblende, but generally smaller, around 0.5-1mm long. They are thoroughly altered to very low-relief, fine-grained sericite, and unlike the hornblende, are often slightly stretched into the weak foliation. Former augite phenocrysts are much less abundant than plagioclase or hornblende, and are also replaced by chlorite and quartz, being identified as augite only by crystal shape. All FeTi oxide microphenocrysts have been replaced by leucoxenic aggregates that have been replaced, in turn, by hematite or limonite.

The groundmass of this rock was originally quite heterogeneous in texture and grainsize, to the extent that I feel this may have been a slightly autobrecciated formerly glassy andesite. Any glass has now been replaced by very fine-grained quartz and sericite, in places riddled with Fe oxide dust. Pale yellow green chlorite also occurs in streaks and small patches throughout the rock, and with sericite defines the weak foliation. Unlike the previous sample, there is no evidence that this rock suffered calcite alteration before weathering.

This rock was clearly a hornblende+plagioclase+augite-phyric andesite lava. It probably contained common albite replacing phenocrysts and groundmass plagioclase, but this has been totally replaced by sericite and quartz.

SAMPLE NUMBER: 562011

SUMMARY:

This sample was a plagioclase+augite-phyric andesitic lava.

HAND SPECIMEN:

This is a relatively even-textured, reddish, strongly plagioclase-phyric andesite or dacite lava.

THIN SECTION:

This is a texturally beautifully preserved exceptionally plagioclase-phyric andesite lava. The plagioclase phenocrysts probably make up around 35-40 modal% of this sample; they occur as mainly elongate prismatic euhedra rarely longer than 1mm, that often occur as crystal clots and aggregates of several crystals, all of which have been faithfully pseudomorphed by albite. The albite shows only slight sericite alteration. Mafic phenocrysts are much less abundant than plagioclase, and have been totally replaced by green matted, fibrous chorite. Crystal shapes strongly suggest that the sole mafic phenocryst phase was augitic clinopyroxene. FeTi oxide microphenocrysts are apparently little altered, and maintain sharp crystal edges atypical of oxides that have suffered incipient leucoxenization. A number of quite brownish apatite microphenocrysts were also noted.

The groundmas of this sample is very uniform textured, being originally microcrystalline to vitrophyirc. It is peppered with tiny opaque grains, imparting the reddish colour to the rock. Most of the groundmass is a very fine-grained intergrowth of albite microlites and chlorite, and possibly some Kspar; extremely fine-grained dispersed sericite is also common in the groundmass.

This sample is clearly a well-preserved plagioclase+augite-phyric andesite with a prehnite-pumpellyite facies regional metamorphic alteration assemblage.

082

465033

SAMPLE NUMBER: 562012

SUMMARY:

This is a thoroughly silicified former plagioclase+ hornblende - phyric andesite lava.

HAND SPECIMEN:

This is a white, silicified former porphyritic felsic or intermediate lava.

THIN SECTION:

This sample is a thoroughly silicified former andesitic lava in which the ghost primary porphyritic texture and phenocryst shapes may still be discerned. The rock is now composed of granular, sugary-textured silica that is coarser grained and cleaner where it replaces former plagioclase phenocrysts. Outlines of former hornblende phenocrysts are distinctive, since they have characteristic crystal shapes and finely disseminated Fe oxide dust throughout.

The groundmass of this rock is also totally silicified, but is slightly cloudy, due probably to impurities on grain boundaries of groundmass quartz. Former FeTi oxide grains are replaced by quartz, sphene and possibly hematite; the latter forms exsolution lamellae through quartz defining octahedral planes typical of ilmenite exsolution from titanomagnetite. A few well-formed zircon grains are present in the sample.

It is obvious from the relic texture and ghost mineralogy that this was a hornblende+plagioclase-phyric andesite. Given that the rock probably analyzes at more than 90% SiO_2, having been thoroughly silicified, it is quite remarkable that the Ti/Zr value of 20 is little removed from assumed original values around 22-25, as evidenced by the considerably less altered preceding two samples. It further supports the use of this, and similar immobile element ratios, in determining original rocktypes from highly altered samples.

SAMPLE NUMBER: 562013

SUMMARY:

This is a weathered and foliated formerly plagioclase+ hornblende-phyric andesite lava, very similar to 562010.

HAND SPECIMEN:

This is a cream to pale brown strongly weathered and altered, foliated formerly plagioclase=phyric felsic or intermediate lava.

THIN SECTION:

This sample is almost identical to 562010, in being a foliated, formerly plagioclase+hornblende-phyric andesite that has suffered quite strong surface alteration. Plagioclase phenocrysts have been stretched into the cleavage, and totally replaced by almost fibrous sericite. Former hornblende phenocrysts, probably slightly more abundant in this sample than in 562010, are also all sericitized, although the sericite is Fe-stained and yellow-brown in former hornblende sites. Only very narrow Fe oxide or hydroxide rims of former FeTi oxide microphenocrysts are preserved, the remainder being replaced by quartz and sericite. Groundmass is totally replaced by fine-grained quartz and streaky sericite, the latter defining a fairly pronounced foliation. Foliation and cross-cutting fracture planes are highlighted by Fe staining. This sample does not show evidence for calcite alteration before weathering, as was the case for 562010.

465035

SAMPLE NUMBER: 562014

SUMMARY:

This sample is a plagioclase+hornblende+augite-phyric andesite lava.

HAND SPECIMEN:

This is a relatively well-preserved reddish-brown plagioclase+ hornblende- phyric andesite lava.

THIN SECTION:

This sample is texturally very well preserved, and consists of around 20 modal% of albitized plagioclase phenocrysts and 3-5 modal% of each of chloritized hornblende and chloritized augite phenocrysts. The sample ispetrographically very like 562011 petrographically, differing only in the hornblende in this sample being absent (or less evident due to alteration) in 562011. Albitized plagioclase phenocrysts are mainly less than 1mm long, well-formed euhedral prisms with minor sericite speckling. Hornblende phenocrysts were mainly larger (1-3mm long), and are totally replaced by aggregates of green chlorite in which abundant Fe (or FeTi) oxide grains are embedded. Formre augite phenocrysts are generally much smaller, and lack the Fe oxide grains present in altered hornblende. FeTi oxide microphenocrysts are small and leucoxenized. A number of quite large (0.5-1mm long) perfectly formed apatite prisms were noted.

The groundmass of this sample was vitrophyric to microcrystalline, and contains minor sericite throughout an interlocking extremely fine-grained mesh of albite microlites and intertitial quartz and chlorite. Minor spots and veinlets of calcite are present in this sample. Some of the groundmass chlorite, as well as flakes in albite phenocrysts, are almost brown and strongly pleaochroic, and may well be biotite.

SAMPLE NUMBER: 562015

SUMMARY:

This sample was a plagioclase+hornblende+augite+apatite - phyric andesite essentially identical to 562014, except that this rock suffered carbonate alteration and more sericitization than 562014.

HAND SPECIMEN:

This is a red-brown, weathered plagioclase+hornblende-phyric andesite lava.

THIN SECTION:

The precursor of this altered sample was probably almost identical to the previous sample, that is, a plagioclase+ hornblende + augite+apatite-phyric andesite. This sample differs, however, from 562014 in being more sericitized and having more calcite alteration. The latter is notable, in that relics of well-formed calcite rhombs are common in the sample, but many are replaced by a reddish-black opaque clay material. The groundmass contains far more sericite than 562014, but is otherwise texturally identical.

SAMPLE NUMBER: 562016

SUMMARY:

This is a strongly sericitized former plagioclase+ hornblende - phyric evolved andesite or dacite lava with sparse quartz phenocrysts.

HAND SPECIMEN:

This is a pale brown strongly sericitized feldspar-phyric andesite with sparse altered mafic phenocrysts.

THIN SECTION:

This is a quite strongly altered formerly plagioclase-phenocryst dominated porphyritic andesite to dacite lava. The rock originally consisted of around 20 modal% of well-formed plagioclase phenocrysts, and a few modal% of hornblende phenocrysts, plus less than 1% of quartz phenocrysts, in a fairly glassy groundmass. The plagioclase phenocrysts have all been replaced by messy, yellowish, fine-grained sericite aggregates, similar to the groundmass alteration. Ghost compositional zoning is preserved in many former plagioclase phenocrysts. Hornblende phenocrysts are largish (mainly >1mm long) totally altered euhedra replaced by pale yellow, rather fibrous chlorite. A few rounded relics of quartz phenocrysts are present, although much more abundant aggregates of intergrown euhedral secondary quartz occur throughout the strongly altered groundmass. FeTi oxide microphenocrysts are leucoxenized, and no apatite could be found in this sample.

The groundmass of this rock was probably originally glassy to microcrystalline, but it has been thoroughly altered to sericite, brown, almost isotropic clay, and minor calcite, most of which is altered to reddish clay. Angular patches and veinlets of secondary, clear quartz are common throughout the groundmass.

The much less abundant hornblende, and occasional quartz phenocrysts in this sample compared to the five or six andesites, implies that this rock is more evolved, perhaps approaching a dacitic composition. The somewhat lower Ti/Zr value for this sample supports this interpretation.

SAMPLE NUMBER: 562017

SUMMARY:

This is a quartz-rich poorly sorted sandstone derived entirely from a pelitic ?metamorphic source; it is essentially an Owen Conglomerate-type unit.

HAND SPECIMEN:

This is a graded, quartz-rich sandstone with some clasts up to 5mm across.

THIN SECTION:

This is a poorly sorted, well graded sandstone composed almost entirely of angular detrital quartz grains or quartzose rock fragments forming a framework supported texture with very minor originally clayey matrix. The quartz grains are either reef/vein quartz, or quartz derived from pelitic metamorphic rocks. They are often strained. Foliated rock fragments of quartz-mica schist and gneiss are abundant, as are very fine-grained siltstone/shale and cherty fragments. Quite large, kinked detrital muscovite grains are common, and several rounded tourmaline grains with strong blue-green colouring were noted, along with not uncommon detrital zircons.

A striking feature of this sandstone is the total absence of a single grain or clast that is demonstrably of volcanic origin. All the detrital grain population in this rock are reasonably interpreted as deriving from a pelitic metamorphic terrain. The sample therefore, if it occurs interbedded in volcanics, probably represents a single mass flow influx (turbidity current) of detritus derived from the Rocky Cape or Tyennan Regions. It heralds the later accumulation of immense volumes of identical quartz-rich sediment that form the Owen Conglomerate and its correlates.

psammitic ?

SAMPLE NUMBER: 562018

SUMMARY:

This is a strongly sericitized, formerly plagioclase+ hornblende - phyric andesite lava.

HAND SPECIMEN:

This is a pale brown, altered, strongly sericitized feldspar-phyric andesite or dacite lava.

THIN SECTION:

This sample is a formerly strongly plagioclase-phyric andesite, with considerably less abundant altered hornblende phenocrysts and leucoxenized FeTi oxide grains. All plagioclase phenocrysts, which probably make up around 25-30 modal% of this sample, have been totally replaced by fibrous, pale yellow sericite. Uncommon former hornblende phenocrysts, mostly less than 1mm long, have been replaced by secondary granular quartz, Fe oxide dust and granules, and minor yellowish chlorite.

This rock originally has a glassy groundmass that has devitrified, then recrystallized as a relatively coarse-grained intergrowth of quartz and probably albite. The latter, however, has been thoroughly sericitized, and sericite streaks and patches are common throughout the groundmass.

This sample is probably compositionally mid-way between the more mafic-crystal rich plagioclase+hornbelnde-phyric andesites (eg 562013, 015) and the quartz phenocryst-bearing, hornblende-poor more evolved andesitesor low-Si dacite lavas such as 562010 and 017.

465030

Appendix 3E. DDH MR1 (CRA) Petrology Descriptions

MOUNT ROLAND DRILLHOLE (MR1)

Sample	Depth	
513682 P G	38.2m	typical of 31m to 40m
513683 P G	55.0m	typical of 53m to 60m
513684 P G	74.3m	typical of 63m to 76m and 82 to 88m
513685 P G	79.7m	typical of 76m to 82m and 100 to 105m
513686 P G	108.5m	typical of 106 to 124m
513687 S (Polished section)	120.7m	Sulphur isotope sample.
513688 P G	135.3m	typical of 130 to 140m
513689 P G S?	157.5m	possible sulphur isotope sample?
513690 P G S	194.5m	
513691 P G	228.0m	typical of ~ 200m to E.O.H.

SAMPLE: 513682

SUMMARY:

This is a former plagioclase+hornblende-phyric andesite lava, still containing common chlorite and albite. It is the least altered of the samples in this Mount Roland Drillhole suite.

HAND SPECIMEN

This is a dark brownmassive, even-textured intermediate metavolcanic with altered plagioclase and mafic phenocrystsmainly <1mm long.

THIN SECTION DESCRIPTION:

The primary texture of this unfoliated sample is well-preserved, although the primary mineralogy is obliterated by alteration. The sample was clearly a porphyritic andesite with former plagioclase and mafic phenocrysts. These phenocryst phases are approximately equally abundant (around 10 modal%); plagioclase phenocrysts are totally sericitized blocky to elongate prisms rarely more than 2mm long, and generally much less. They are often hard to see in the sericitized groundmass. Former mafic phenocrysts are clearly show hornblende shapes, and have altered to a chlorite-calcite-Fe oxide mixture. Small phenocrysts of FeTi oxide are quite common, and are always altered to leucoxene.

The groundmass of this sample is rather heterogeneous, and it is impossible to determine the original texture, although a fine-grained volcanic groundmass is almost certain. The groundmass is composed of quartz-albite-sericite-chlorite-Fe oxide dust, and differs from the groundmass of most of the other samples in this suite by the presence of albite and chlorite. Small polycrystalline patches and grains of strained quartz to about 2mm across are probably small parts of disrupted quartz veinlets. Also, small patches of green chlorite with euhedral quartz growing into the chlorite fill small cavities in the groundmass.

This is the best preserved of the samples examined for this suite, although it too is much more altered than regional alteration produces in the Mount Read Volcanics.

SAMPLE: 513683

SUMMARY:

This is a strongly hydrothermally calcite-sericite-Fe oxide altered former plagioclase+hornblende-phyric andesite lava.

HAND SPECIMEN

This is a heavily calcite-veined metabasic or intermediate volcanic with streaked out mafic phenocrysts or vesicles through a brownish matrix.

THIN SECTION DESCRIPTION:

This sample is very strongly altered and rather sheared. However enough primary texture is preserved to diagnose the sample with confidence. In the least altered parts of the sample, a porphyritic volcanic texture is evident, with stretched outlines of plagioclase phenocrysts, to almost 2mm long, are abundant, and totally replaced by sericite. Deformed and fractured, but less stretched former hornblende phenocrysts are slightly lessabundant than the plagioclase phenocrysts, and are completly replaced by calcite. Several euhedral large microphenocrysts of apatite are notable.

The matrix in which the altered phenocrysts are set is texturally highly variable and reconstituted. It is largely composed of granular quartz and a mesh of pale sericite with abundant dispersed Fe oxide granules. The grainsize of the quartz varies enormously from domain to domain within the sample. Some of the domains of large angular, strained quartz probably represent disrupted, pre-final deformation quartz veinlets. It is notable that chlorite is absent from this sample.

The sample is cut by several calcite veins parallel to the stretching; these are composed of interlocking polygonal grains of calcite that is clearer than that replacing former hornblende phenocrysts. Often marginal to these veins are semi-continuous bands of Fe oxide, with grainsize rarely being >0.1mm across.

The alteration in this sample is significantly greater than is developed regionally in the Mt Read Volcanics, and is clearly of local hydrothermal derivation. The alteration assemblage is essentially calcite-sericite-magnetite (or hematite?), and lacks the epidote commonly observed with otherwise similar alteration in the Beulah Barite drillhole samples.

SAMPLE: 513684

SUMMARY:

This is a strongly carbonate-sericite altered plagioclase+ hornblende-phyric andesite with a well-developed foliation.

HAND SPECIMEN

This is a foliated pale grey-green altered andesitic lava with a uniform fine-medium grainsize and texture, cut by a few thin (<1mm thick) calcite veinlets..

THIN SECTION DESCRIPTION:

This sample is very simailar to the preceding sample in most respects, except that the calcite alteration more limited to veins in 513683 occurs evenly distributed through the sample and also as small veinlets in this sample. The sample shows a pronounced foliation, defined by strongly stretched sericitized plagioclase now averaging around 1mm long. The former hornblende phenocrysts are replaced by dirty brownish calcite, and are generally finer-grained and less abundant than the altered plagioclase phenocrysts, and many are broken and stretched into the foliation. A notable feature of this sample is the large and abundant (at least 10 in this section) apatite microphenocrysts, which form pale brownish-clear uniaxial elongate prisms with hexagonal outlines; they are typically cut along a parting perpendicular to (001) by films of sericite. Quite large (to at least 1mm across) former FeTi oxide phenocrysts are present, but altered to leucoxene; these make up << 1 modal% of the sample.

The groundmass of this sample is more even-textured than sample 513683, and is composed of a rather coarse-(relatively) grained intergrowth of quartz, sericite, calcite and minor Fe oxide grains. As for the previous sample,chlorite is notably absent from this alteration assemblage. The extent of recrystallization and alteration of this sample precludes determination of whether this sample was a lava or a more coarse-grained shallow intrusive.

The comments on alteration given for the previous sample apply equally to this sample, which is a hydrothermally altered plagioclase+hornblende-phyric andesite.

SAMPLE: 513685

SUMMARY:

This is a former plagioclase+hornblende-phyric andesite that has been very strongly calcite-sericite altered; unlike the previous two samples, this one has relatively common chlorite in the groundmass.

HAND SPECIMEN

This is a slightly less foliated (than the previous two samples) pale brown-grey strongly altered intermediate volcanic rock with occasional poorly preserved plagioclase phenocrysts.

THIN SECTION DESCRIPTION:

This sample is almost identical to the previous sample 513684 in being a strongly plagioclase+hornblende-phyric andesite that has undergone strong carbonate-sericite alteration, with development of a small amount of secondary Fe oxides dispersed in the matrix. Again, large and common apatite phenocrysts are notable.The main differences from the preceding sample are that

1. the foliation is less well-developed in this sample, as seen by the less stretched sericitized plagioclase phenocrysts, and more diffuse sericite mesh through the groundmass.
2. chlorite, which is conspicuously absent in both the previous samples is a common but minor (relative to sercite and calcite) phase in the groundmass of this sample.
3. quartz occurs as quite large polycrystalline aggregates to more than 2mm across, with intimately sutured grain boundaries and strong internal deformation; these form discontinuous bands across the slide and probably represent disrupted narrow quartz veinlets.

SAMPLE: 513686

SUMMARY:

This is a former plagioclase+hornblende-phyric andesite with less altered cores of dark grey-green lava with abundant chlorite in a much more strongly altered calcite-sericite-Fe oxide matrix from which all chlorite has been reacted out.

HAND SPECIMEN

This is a very strongly altered pale brown metabasic or intermediate volcanic that is riddled by calcite-sericite alteration, leaving only several small centimeter cores of dark grey-green less altered rock.

THIN SECTION DESCRIPTION:

The textural preservation in the grey-green less altered cores of this sample is better than for those described above. The rock was clearly a plagioclase+hornblende-phyric andesitic lava. Hornblende phenocrysts have been thoroughly altered to chlorite, calcite and opacite material, whereas former plagioclase phenocrysts have been totally sericitized. Large apatite phenocrysts and microphenocrysts are present. The groundmass of this least-altered area is a highly altered and recrystallized formerly vitrophyric-textured material now composed largely of chlorite, quartz and minor sericite and Fe oxides. This alteration may be considered as an intense regional alteration, probably related to burial metamorphism. It has been overprinted by a much more intense hydrothermal event that leached away all the chlorite, and precipitated large quantities of calite and sericite, and quite common Fe oxide granules. Several curving and deformed veinlets of ribbon quartz, calcite and abundant Fe oxides transect the sample.

SAMPLE: 513687

SUMMARY:

This sample is a very strongly carbonate-sericite-pyrite -altered former plagioclase+hornblende-phyric andesite. The abundant pyrite contains a small amount of chalcopyrite, and occurs as aggregates of smaller pyrite grains.

HAND SPECIMEN

This is a dark grey metabasic or intermediate lava with intense local alteration and bleaching dispersed around calcite veinlets and angular patches of calcite and a pinkish feldspar or carbonate(?). It contains abundant localizations of very fine-grained pyrite up to about 1cm long.

THIN SECTION DESCRIPTION:

The protolith of this sample was undoubtedly similar to the (better preserved) samples described above. In least altered areas of this rock, former hornblende prisms are obvious from their outline, and former plagioclase phenocrysts strongly altered to fine-grained sericite are also obvious. The style of alteration, with total removal of chlorite and strong sericite-calcite alteration, is similar to the above samples.

Intense alteration dominated by veins and patches of polygonal calcite and abundant pyrite (see below). Fine-grained quartz, often with ribbon-like textures when occurring in pressure fringes around pyrite, fills interstices between grains in pyrite aggregates. The pink mineral intergrown with cream calcite in the veins and patches in this sample is seen to be coarse-grained twinned K spar.

In reflected light, the abundant pyrite in this sample is seen to be essentially free of other sulphides, except for very small amounts of chalcopyrite occurring at rims of pyrite grains, and also occasionally as tiny grains in gangue. The larger pyrite grains are clearly concretions or aggregates formed by massing together of small pyrite grains (mainly <0.2mm across), so that the centres of some of the largest pyrite masses are essentially gangue-free.

SAMPLE: 513688

SUMMARY:

This is a strongly carbonate+sericite+Fe oxide altered, but unfoliated formerly plagioclase+hornblende-phyric andesitic lava.

HAND SPECIMEN

This is a dark brown altered metabasic or intermediate lava broken during intense calcite-dominated alteration in to angular blocks at least 5cm across. Calcite veinlets are abundant in the sample.

THIN SECTION DESCRIPTION:

The protolith of this sample was a plagioclase+hornblende-phyric andesite probably identical to those of the previously described samples. Relic less altered small areas show strongly sericitized plagioclase phenocrysts and totally obliterated hornblende phenocrysts replaced by calcite ad sericite. An interesting feature of the alteration of this sample is that many but not all of the sericitized plagioclase phenocrysts are sites of precipitation (growth?) of small Fe oxide or pyrite grains.

Several generations of calcite veins crosscut the sample. At least one generation is characterized by en echelon disruption and curved fibre growth. The groundmass of this sample is totally recrystallized and composed dominantly of quartz-sericite-calcite- Fe oxides, with highly variable textural and grainsize distribution over short distances. Chlorite has been leached out. The alteration assemblage and original rocktype rpresented by this sample are essentially the same as those above, and record intense local hydrothermal alteration of a plagioclase+hornblende-phyric andesite.

SAMPLE: 513689

SUMMARY:

This is a strongly carbonate-sericite altered plagioclase+ minor hornblende-phyric andesite with abundant disseminated pyrite.

HAND SPECIMEN

This is a massive, heterogeneous textured fine-grained dark brown meta-andesitic lava cut by a zones of intense calcite-sericite-pyrite alteration, with abundant disseminated pyrite.

THIN SECTION DESCRIPTION:

This rock in the least altered areas of this thin section is seen to be petrographically identical to the preceding samples, although perhaps containing slightly less modal hornblende. Plagioclase phenocrysts are totally sericitized, and in this sample are somewhat stretched out into a weak foliation defined largely by sericite streaking through the groundmass. In addition, several small quartz phenocrysts are present in this sample, perhaps supporting the argument following from the less abundant hornblende that this sample might be slightly more evolved than most of the preceding samples (althoughthe similar Cr and Zr contents as the other samples don't really support this).

Calcite occurs as abundant small veinlets and patches of small polygonal grains, often associated with abundant Fe oxide granules and minor pyrite. Pyrite makes up about 1-2 modal% of this sample, and occurs as grains variable from small discrete crystals in narow veinlets, often with pressure fringes of quartz, to lensoid aggregates of tiny grains elongate in the weak foliation.

SAMPLE: 513690

SUMMARY:

This is a strongly carbonate-sericite-pyrite altered plagioclase+hornblende-phyric andesite lava containing abundant disseminated pyrite in close association with calcite; the pyrite contains a small amount of chalcopyrite.

HAND SPECIMEN

This sample is a heterogeneous-textured dark brown andesitic lava with variable and often intense calcite-sericite alteration replacing darker grey-green lava. Pyrite as tiny grains is relatively abundant as an accessory phase in this sample.

THIN SECTION DESCRIPTION:

This sample is also a highly carbonate-sericite-altered former plagioclase+hornblende-phyric andesite lava. Plagioclase phenocrysts are probably less abundant in this sample than in the others desribed above, although this may be a feature of the intensity of the alteration. A notable feature better shown in this sample than any preceding rock is the well-preserved fomer FeTi oxide microphenocrysts showing good exsolution of ilmenite and replacement of remaining magnetite with leucoxene/quartz/chlorite.

The groundmass is extremely heterogeneous in texture, varying from areas rich in sericite and calcite, to areas poor in sericite and more quartz-rich. Pyrite is scattered through the sample in irregular fashion (see below), but is clearly associated with a coarse polygonal calcite vein, where it forms well-formed prisms close to the contacts of the calcite vein with the groundmass.

In reflected light, the disseminated pyrite is seen to be present mainly as rather 'moth-eaten' slightly ragged-edged euhedra, in strong association with calcite. A very small amount of chalcopyrite occurs as discontinuous rims on some of the larger pyrite grains, and as extremely thin fillings along some microfractures in the pyrite. Chalcopyrite also occurs as rare discrete grains in calcite.

SAMPLE: 513691

SUMMARY:

This is a former plagioclase+hornblende phyric andesite that shows variable alteration (mainly sericite-chlorite-quartz-calcite-pyrite), and a notable abundance of chlorite and disseminated pyrite relative to most of the other samples.

HAND SPECIMEN

This sample is a dark grey altered andesite with a variable texture that in places appears to be due to the presence of two different types of lava fragments making up the rock, although this may be an artifact of the strong alteration. One is very fine-grained, and shows an abrupt gradation over about 1mm to a more coarse-grained lithology. The sample is cut by numerous calcite veilets and contains small patches of pink carbonate or K spar adjacent to some veins. Relatively fine-grained disseminated pyrite is an abundant accessory phase dispersed throughout the sample.

THIN SECTION DESCRIPTION:

The finer-grained part of thissample is seen in thin section to be a former plagioclase+hornblende-phyric andesite, very similar to those described above. Plagioclase is sericitized, and the less abundant former mafic phenocryst phase is altered to green chlorite. Small apatite phenocrysts are not uncommon, and FeTi oxide microphenocrysts are leucoxenized. The groundmass of this finer-grained part of the sample is a totally recrystallized and composed of an unfoliated intergrowth of quartz-sericite-chlorite-FeTi oxide-pyrite.

The more coarse-grained part of this sample is more difficult to diagnose. It is composed of fairly abundant irregular large (to 3mm) quartz grains set in a heterogeneous matrix composed of swirling sericite-chlorite-quartz-calcite and pyrite trains. The large quartz grains are strained, and contain small chlorite flakes and sericite patches. They do not appear to be phenocrysts, an interpretation supported by their abundance and association with abundant chlorite. Thie texture of this coarse-grained area resembles silicified epidosite, although not a single grain of epidote has been seen in this suite of rocks. It appears that the coarser-grained areas represent much more highly altered lava soaked in quartz (perhaps forming small veinlets that were disaggregated during subsequent alteration) then thoroughly replaced in turn by calcite, sericite and abundant chlorite.

455102

Appendix 3F. Gowrie Park Reconnaissance Mapping Petrology Descriptions

465103

Cethana-Gowrie Park Drillcore

Sample	Location	Comments
513904 (Polished thin section)	GP C3 37.5m	Galena veined altered volcanic. Sample submitted for lead isotope analysis
513905 (Polished thin section)	GP 5 81.65m	Prominent galena in quartz-sericite volcanic. Sample submitted for lead isotope analysis

Sample No:	AMG Co-Ordinates		Description
562301 P G	437840E	5410620N	Se alt str fp Hbl A .1.?
562302 P G	437850E	5410550N	wk Hmt alt Fg fp + mafic phyric A 1b or vlcl (frags to 2cm)
562303 P G	437970E	5410470N	y-br ext fg A? 1b? (com frags to 2cm)
562304 G	437240E	5410120N	y-gr fg ext Si Py alt Hb A. 1.
562305 P G	437150E	5409150N	Se alt Fol^{d}? Fp + q vlc, bdd vlcl? or f.bnd 1?
562306 P G	437170E	5409090N	mg str fp mnr q vlcl Sst.
562307 P G	437150E	5409050N	or-br fg str wth, st clv vlcl?
562308 P G	436980E	5409060N	lt gn se alt fp.1.
562309 P G	436980E	5409250N	Lt gn wk se alt, mod Si alt, Q + fp Por R.1.
562310 P G	434975E	5408420N	Or wth, lt gn, Se alt, fg, q + fp.1.
562311 P G	435375E	5408470N	pp br qz + fp vlc breccia?
562312 P G	435540E	5408400N	dk br fg q + fp.1. mnr Se alt frags
562313 P G	435730E	5408290N	pp (Hmt alt) q + fp + mafic por.1.
562314 P G	436300E	5408285N	br mas fp lava with mod com. chl alt patches?
562315 P G	437020E	5408840N	Fg str clay alt Fp + q vlcl Sst.
2316 P G	437015E	5408840N	br ibd vlcl shale with fg Sst. (with graded bedding).
562317 P G	437025E	5408850N	cg Se alt q + fp lithic vlcl Sst.
562318 P G	437060E	5408900N	mg fg por 1? or vlcl Sst?
562319 P G	437150E	5409030N	fg St Si Se chl alt 1?
562320 P G	43650E	5409000N	Mas br fp + qz + mnr mafic por.1.
562321 P G	435900E	5407690N	Orange brown volcanic with common orange feldspars (rarely rectangular) more commonly small square to slightly rounded? minor quartz phenocrysts? in siliceous feldspathic matrix. Common disseminated magnetite. Magnetic.

562322 P G (o/c)	436035 E	5407680N	fg pp-br q + fp.1.
562323 P G (o/c)	436300E	5407620N	Hmt alt Q + fp phyric volc, com chl alt patches + com qz vnlets through rock, weak alignment flow banded lava? or volcaniclastic?
562324 P G (o/c)	436390E	5407620N	wkly Hmt alt Feldspar rich volcaniclastic with minor quartz
562325 P G (o/c)	436430E	5407620N	Lt gn Se alt qz lithic vlcl with mnr Hmt alt
562331 P G	(outcrop 1m away)		pp fg Se alt Fd + Qz + mafic lava breccia or vlcl.
562326	436590E	5407650N	pp, wkly Hmt alt qz + feldspar + chl alt mafic (Hbl?) str por.1.
562327 P G	436940E	5407650N	br qz + fp por.R.1.
562328 P G	437450E	5407550N	br fp volc with mnr Hmt vns + rare chl vns .1? or vlcl?
562329 P G	437760E	5407590N	mas br Q + fp + mafic lava with mnr Hmt vns.
562330 P G	436800E	5407930N	fp + q phyric lithic vlcl Sst.
562331 (see 562325)			

GOWRIE PARK - CETHANA - CHEEKS CREEK

Sample No:

562377 P, G
433020E, 5406830N

562378 P, G
433680E, 5406850N

562379 Petrology only
433160E, 5409940

562380 P, G
432950E, 5409960N

562381 Geochem only
432900E, 5409950N

562382 P, G
433285E, 5410180N

562383 P, G
433520E, 5409950N

562384 P, G
433285E, 5410010N

562385 P, G
433610E, 5410290N

562386 Geochem only
432700E, 5410300N

562387 Geochem only
432750E, 5410200N

562388 Geochem only
432780E, 5410160N

562389 P, G
432850E, 5410070N

562390 P, G
433780E, 5410110N

562391 P, G
433650E, 5409050N

562392 P, G
433220E, 5408860N

562393 P, G
432660E, 5409080N

562394 P, G
432500E, 5408950N

562395 P, G
432490E, 5409720N

562396 P, G
432540E, 5408480N

562397 P, G
432670E, 5408100N

562398 P, G
432640E, 5408050N

562399 P, G
432610E, 5408000N

562400 P, G
433010E, 5408970N

562020 Geochem only
432010E, 5407265N

562021 Geochem only
431990E, 5407200N

562022 P, G
431970E, 5407075N

562023 Polished T/S, G
431980E, 5406840N

562024 P, G
433085E, 5406750N

562025 Geochem only
433810E, 5407300N

562026 P, G
433840E, 5407070N

562027 P, G
432820E, 5407170N

Samples from North of Dasher River in the Gowrie Par area

Sample No:		AMG Co-Ordinate
562028	P, G,	432290E, 5408625N
562029	P, G,	432190E, 5408740N
562030	G only	432125E, 5408840N
562031	P, G,	431980E, 5408950N
562032	P, G,	431635E, 5408815N
562033	P, G,	431675E, 5408810N
562034	P, G,	431720E, 5408500N
562035	P, G,	431750E, 5408200N
562036	P, G,	431940E, 5408030N
562037	P, G,	432220E, 5408100N

Samples from Cheeks Creek - York Creek area

562038	G only	434240E, 5410320N
562039	G only	433330E, 5410820N
562040	P, G,	433560E, 5411160N
562041	G only	433450E, 5411300N
562042	G only	434180E, 5410780N
562043	P, G,	433850E, 5411075N
562044	Polished Thin G	433850E, 5411125N

Sample Number	AMG Coordinates	Summary description
562071 P,G	434150E,5411930N	A. lithic volcaniclastic?
562072 G only (Cr,Ti,Zr)	434210E,5411940	Massive A or B? lava breccia
562073 P,G	434475E,5411790N	Massive magnetic feldspar + mafic andesite lava? or volcaniclastic?
562074 P,G	434535E,5411745N	Bedded volcanic siltstone. Right way up?
562075 P,G	434540E,5411730N	Massive magnetic fp + mafic andesite l? or lv?
562076 P,G	434800E,5411695N	quartz phyric lithic volcaniclastic.

SAMPLE NUMBER: 513904

SUMMARY:

This is a strongly foliated quartz-phyric glassy rhyolitic lava or crystal tuff cut by sericite-rich veinlets rich in galena with subordinate sphalerite.

HAND SPECIMEN:

This is a sheared and altered andesitic or more felsic lava with abundant calcite alteration and galena concentrated along a half-cm wide vein.

THIN SECTION:

This sample is so recrystallized and sheared that it is difficult to gauge with certainty its original lithology. Large deformed and strained quartz grains are common, often occurring in broken aggregates. At least two of the larger of these show indisputable melt inclusions, indicating a phenocryst origin. Many of the other larger grains may have a similar origin. Smaller quartz grains are also abundant, immersed in a foliated sericite-calcite matrix. Many of these may have grown from a rhyolitic glassy groundmass following devitrification of the glass, then been strained and rotated during foliation development. The sample was probably originally a quartz-phyric rhyolitic lava or crystal tuff. Streaks and veins of sericite and calcite are common throughout the rock, calcite commonly growing as well-formed rhombs from a murky structureless carbonate vein system. Sulphides occur as streaks and concentrations mainly within a sericite-rich band paralleling the foliation.

In reflected light, it can be seen that the dominat sulphide mineral in this section is galena. It occurs as poorly-formed patches and irregular concentrations within sericite-rich bands up to about o.5cm across. Modal variation of galena abundance in the band is extreme. Sphalerite occurs as a minor phase intergrown with the galena. Pyrite occurs, as in the other two polished sections described above, as slightly rounded euhedra dispersed throughout the sample, not associated with any vein assemblage. Wispy sphalerite also occurs scattered throughout the rock, but in greater concentrations within and adjacent to the galena-rich vein. Although galena is the dominant sulphide in this sample, in contrast to samples 513693 and 513903, the paragenesis appears to be essentially similar. THe association of abundant galena with abundant sericite is notable, and contrasts with abundant sphalerite and more cpy with quartz-calcite veins in the other two samples.

465111

SAMPLE NUMBER: 513905

SUMMARY:

This is a texturally well-preserved quartz+feldspar-phyric rhyolitic lava cut by a calcite vein that contains abundant galena, with subordinate chalcopyrite and minor sphalerite. It is clearly a similar (identical) original lithology to the previous strongly foliated sample.

HAND SPECIMEN:

Too small.

THIN SECTION:

Away from the prominent calcite-galena vein in this sample, this rock is texturally well-preserved. It is an abundantly quartz+feldspar -phyric rhyolitic lava with a recrystallized formerly glassy groundmass. Quartz phenocrysts to almost 2mm across make up at least 20-25 modal% of the sample, and are mainly slightly resorbed and often broken euhedra. Former feldspar phenocrysts, modally subordinate to quartz, have been totally altered to sericite, then partially smeared out, so that they are difficult to distinguish from sericite that streaks the groundmass.

The groundmass of this sample was probably glassy, but has crystallized after devitrification to a fine-grained intergrowth dominated by granular secondary quartz and sericite. Fairly fine-grained calcite is not uncommon throughout the groundmass, and also occurs as an almost 1cm-wide vein intergrown with galena.

In polished section, the coarse-grained polygonal calcite hosting the galena is seen to be riddled with very fine-grained galena, and also minor sphalerite and chalcopyrite. The centre of the calcite vein is filled by a mass of galena that contains local concentrations of chalcopyrite and sphalerite at its margins with gangue calcite. Galena is easily the dominat sulphide, followed by chalcopyrite and sphalerite. As in the other three polished sections described in this report, pyrite occurs as slightly rounded discrete grains that appear to predate the other sulphides. It occurs within the galena vein as a few 'islands' of rounded and reacted pyrite that appear to have been stranded within the galena.

This sample is clearly a texturally better-preserved (less foliated and fractured) example of the sample 513904, for which the lithological diagnosis regarding origin was less certain. The sulphide paragenesis in 304 and 305, with abundant galena, contrasts with the dominant sphalerite in the hornblende andesites 693 and 903, and the association of galena with calcite in this sample is different from 904, in which galena is associated with abundant sericite.

SAMPLE NUMBER: 562023 LOCATION: Gowrie 431980E 5406840N

SUMMARY: This is a quartz-phyric rhyolitic lava cut by a mesh of magnetite veinlets that have partially to completely altered to hematite and limonite/goethite.

HAND SPECIMEN: This is a dark quartz-phyric felsic lava or lava breccia with a meandering and curved network of ferruginous sericitic fractures.

THIN SECTION:

This sample is clearly a massive, unbrecciated rhyolitic lava. It consists of around 3-5 modal% of rather rounded and reacted subhedral quartz grains, many with complex 'dissolved' outlines, and approximately equal amounts of sericitized small plagioclase phenocrysts. Much less abundant are small former FeTi oxide crystals altered to leucoxene, hematite and sericite. These phenocrysts are set in a groundmass of extremely fine-grained quartz-feldspar, recrystallized from devitrified glass; this is characterized by angular discontinuous sericite concentrations probably filling brittle fractures in the sample, and curving, dense networks of fractures defined by Fe-stained sericitic material, and hematite in wider veinlets. Variably and randomly developed in the groundmass is a fine-grained snowflake texture also characteristic of devitrified glass.

OPAQUE MINERALOGY

This sample is transected by fairly abundant but narrow unaligned veinlets of Fe oxides. These are composed of magnetite that has mainly altered to hematite, which itself has altered to disorganized red Fe hydroxides such as limonite or goethite in the central regions of veinlets. Magnetite is occasionally preserved as subhedral crystals growing against quite crystalline chlorite at some vein margins, but this alters progressively inward to hematite and crustiform limonitic material. No sulphides were noted in this rock.

SAMPLE NUMBER: 562024 LOCATION: Gowrie 433085E 5406750N

SUMMARY: This is a texturally well-preserved quartz+ feldspar-phyric formerly glassy rhyolitic lava with a relatively coarse-grained but unfoliated polygonal quartz-sericite groundmass.

HAND SPECIMEN: This is a pale greenish-cream quartz and feldspar-phyric rhyolitic lava with green sericite-altered feldspar phenocrysts.

THIN SECTION:

This sample in thin section is clearly a quite strongly recrystallized formerly glassy quartz+feldspar-phyric rhyolitic lava in which the groundmass has suffered strong silica-sericite alteration. Quartz phenocrysts make up about 8-10 modal% of the sample and are quite large, several being 2-4mm across. Most are slightly rounded subhedral crystals often with internal strain features or significant cross-grain fractures. Many quartz grains have fine-scale scalloping of crystal margins, due to recrystallization with groundmass. Former feldspar phenocrysts, making up about 10 modal% of this sample, are also quite large euhedral grains, mainly 1-3 mm long, and they have been totally sericitized. Some have speckled intergrowths of quartz and sericite within distinct former crystal margins, suggesting some degree of silicification accompanying sericite alteration. Former small FeTi oxide phenocrysts are not uncommon, and are characteristically composed of orientated magnetite lamellae (originally exsolved along octahedral planes from FeTi oxide grains) set in chlorite, leucoxene and sericite.

The groundmass of this sample is composed of an intergrowth of rather coarsely polygonal quartz and interstitial sericitized feldspar, lacking any directional fabric, and being essentially chlorite-free. Relatively abundant zircons occur in the groundmass of this sample.

This was definitely a glassy quartz+feldspar-phyric rhyolitic lava. The groundmass has suffered stronger static recrystallization than normally seen in formerly glassy rhyolitic lavas, probably with introduction of silica accompanying strong sericitization of both phenocrystal and groundmass feldspar.

465114

SAMPLE NUMBER: 562026 LOCATION: Gowrie 433840E 5407070N

SUMMARY: This is a distinctive plagioclase+hornblende+FeTi oxide+apatite+zircon-phyric acid andesite lava that has suffered fairly strong sericite-hematite-calcite alteration and strong stretching of phenocrysts.

HAND SPECIMEN: This is a weakly foliated purple-brown epiclastic sediment with visible detrital albite, lithic clasts (some elongate and flattened) and dark chloritic patches.

THIN SECTION:

In thin section, this sample is seen to be not an epiclastic sediment but a rather foliated andesitic to dacitic lava. About 8-10 modal% of the sample consists of remarkably stretched, feldspar phenocrysts, all of which are totally replaced by sericite and overprinting albite. Former mafic phenocrysts are much less abundant and are replaced by calcite and chlorite; crystal shapes are more suggestive of former hornblende than augite. Apatite phenocrysts are large and relatively common, and zircon microphenocrysts are distinctive by both their relatively large size and their abundance, making this a distinctive rock type. Large equigranular FeTi oxide phenocrysts are altered to leucoxene.

The groundmass of this lava has been so recrystallized and altered that its original nature could not be ascertained. It has been overprinted by strong, fine-grained calcite-sericite alteration speckled with tiny hematite grains. Small spots of secondary quartz have crystallized from the altered groundmass, but are not common.

This sample is a distinctive evolved andesite lava, reminiscent of some of the lavas from the Beatrice lava dome being mapped by Danny Noonan; the relatively large and abundant apatite and zircon crystals, and the associated mafic phase being hornblende or biotite rather than augite, are notable features of these rocks.

465115

SAMPLE NUMBER: 562027 LOCATION: Gowrie 432820E 5407170N

SUMMARY: This is a tuffaceous shale in which the large vitroclastic component has recrystallized to quartz-albite. The rock has two cleavage sets and strong calcite-sericite alteration.

HAND SPECIMEN: *This is a strongly foliated, mottled former felsic* lava(?) with wavy, dark narrow bands of chloritic or hematitic alteration cutting a buff coloured matrix.

THIN SECTION:

Thin section shows that this rock is a foliated formerly vitroclastic fine-grained sediment. It is composed of a fairly even-textured intergrowth of quartz and albite pervaded by fine-grained sericite, in which occasional small spherulites of quartz showing radial extinction have grown. The texture is distinctive and almost certainly derived from devitrification and recrystallization of fine-grained glass (ash). The sample is transected by two sets of cleavages that intersect at a low angle (20-30 degrees); the wavy, discontinuous cleavage planes are picked out by *Fe-stained sericite. The rock contains abundant tiny euhedral pits* where limonitized calcite crystals have been plucked or weathered out; other limonite-altered tiny calcite rhoms are scattered through the sample as dirty brown crystals, sometimes in elongate masses.

This rock was clearly an even-textured very fine-grained vitroclastic sediment composed originally probably of tiny ash shards that have recrystallized during burial or subsequent alteration. It is probably best described as a tuffaceous shale.

465116

SAMPLE NUMBER: 562028 LOCATION: Gowrie 432290E 5408625N

SUMMARY: This is a plagioclase+augite-phyric low-Si dacite or andesite lava with abundant hematite in a flow-textured groundmass.

HAND SPECIMEN: This is a dark brown feldspar-phyric dacitic lava with a hematite-altered groundmass.

THIN SECTION:

This is a texturally well-preserved feldspar+augite-phyric dacitic to andesitic lava with a very fine-grained flow-textured groundmass. It contains around 15-20 modal% of rather elongate blocky albitized plagioclase phenocrysts and 2-4 modal% of chlorite-calcite altered former augite phenocrysts, with quite abundant 0.2-0.4mm sized equigranular FeTi oxide microphenocrysts that show only marginal apparent leucoxene alteration. The plagioclase phenocrysts are only slightly flecked with sericite, and show minimal reaction and rounding compared with typical feldspar phenocrysts in typical dacitic-rhyolitic volcanics such as many described elsewhere in this report. Former mafic phenocrysts with typical augite shapes, rarely larger than 0.8mm long, have been replaced by variable mixtures of green chlorite and dirty brown, almost microcrystalline calcite. A few small apatite microphenocrysts were noted.

The groundmass of this sample is well-preserved and composed of former glass charged with tiny flow-aligned microlites of albite and tiny equigranular FeTi oxide grains. The interstitial glassy material has devitrified to quartz and albite. Chlorite-altered hematite (limonite?) line fractures along which limited pressure solution of the groundmass has definitely occurred. This style of weak hematitic alteration, involving tiny hematite grains being concentrated in altering glassy groundmass, is probably a primary oxidation feature rather than a post-burial 'hydrothermal-type' alteration. The sample is probably compositionally in the low-Si dacite to high-Si andesite range (Ti/Zr ~ 17-25).

465117

SAMPLE NUMBER: 562029 LOCATION: Gowrie 432190E 5408740N

SUMMARY: This is a plagioclase+augite-phyric holocrystalline andesitic or low-Si dacite dyke(?) rock with a prehnite-pumpellyite metamorphic assemblage.

HAND SPECIMEN: This is a well-preserved porphyritic grey dacitic to andesitic lava with chlorite-calcite-filled narrow fractures.

THIN SECTION:

This is a holocrystalline plagioclase-phyric andesite or low-Si dacitic lava with a flow-textured groundmass defined by elongate, narrow albite crystals. Albitized plagioclase phenocrysts to about 3mm long make up about 15 modal% of the rock and are mostly clots of two or more crystals with green chlorite on contacts between crystals and replacing lines of melt inclusions. Three or four small fresh augite phenocrysts were observed, with rather resorbed crystal outlines; most mafic phenocrysts (<2 modal% of the rock) are chloritized , and were probably augite. FeTi oxide phenocrysts are notably absent.

The groundmass of this sample is a holocrystalline intergrowth of flow-aligned albite laths, chloritized granular augite crystals, and quite abundant equigranular FeTi oxides. Common fractures through the sample show several quite distinct vein assemblages. Most common is green chlorite, sometimes occurring intergrown with clear fans of prehnite and bright apple green spots of pumpellyite. This same assemblage is common in angular fracture fillings. Less abundant are veins composed entirely of clear albite.

This is a well-preserved rock with enough chlorite and relic augite to suggest that it may be andesitic, or at the low-Si end of the dacite spectrum (Ti/Zr=15-22!). The holocrystalline nature suggests that it is either a dyke rock, or from the interior of a very thick flow. The prehnite-pumpellyite assemblage is unusual in these rocks, and diagnostic of regional burial metamorphism at low grade.

465118

SAMPLE NUMBER: 562031 LOCATION: Gowrie 431980E 5408950N

SUMMARY: This is a contact between a plagioclase+quartz -phyric rhyolitic to dacitic lava and a vitroclastic shale; both rock types have suffered significant chloritization.

HAND SPECIMEN: This is a contact between a plagioclase-phyric felsic lava and a fine-grained epiclastic sediment. It appears that the lava has baked the shale and chilled against it.

THIN SECTION:

This sample cuts the contact between a porphyritic felsic lava and a silty shale. The lava shows an irregular contact, with obvious chilling against the shale evident in the much greater abundance of chlorite after glass in the contact zone. The shale is definitely recrystallized to some degree along the contact with the lava. The lava is a plagioclase+quartz -phyric rhyolitic to dacitic lava composed of about 5 modal% of coarse-grained (to 4mm across) subhedral to rounded quartz phenocrysts, many with chloritized melt inclusions, and slightly more large, often multi-crystal albitized plagioclase phenocrysts. These are free of sericitic alteration, and occasionally occur intergrown with a few small chloritized augite phenocrysts in microgabbroic inclusions. Leucoxenitized small FeTi oxide phenocrysts are not uncommon. The lava contains at least three lithic fragments of snowflake-textured aphyric lava that may represent the quenched skin of this flow turned back into the flowing/erupting lava.

The groundmass of the lava is composed of a fairly strongly chloritized quartz-albite-chlorite-sericite intergrowth probably after glass charged with small feldspar microlites.

The shale abutting the lava in this sample is composed of rare angular quartz grains and more abundant chloritic spots in a very fine-grained quartz-feldspar groundmass probably recrystallized from vitroclastic silt. It is liberally spotted with calcite, whereas the lava is calcite -free, suggesting that the sediment may have had a minor primary carbonate component.

SAMPLE: 562032: Gowrie Park 431635E 5408815N

SUMMARY:

This is a quartz+feldspar-phyric crystal lithic tuff very similar to 562034 and 562396.

HAND SPECIMEN

This is a brown feldspar + qaurtz-phyric lava with distinct pink localized Kspar(?) alteration spots.

THIN SECTION DESCRIPTION:

This sample is an abundantly porphyritic crystal lithic tuff composed of around 20-25 modal% of albitized feldspar phenocrysts and around 10 modal % of rounded quartz phenocrysts, each mainly from 0.5-2mm across. The quartz phenocrysts are notably reacted and resorbed and have either almost spherical, or very complex tunneled and resorbed shapes. Feldspar phenocrysts are also very broken and resorbed, and are slightly to strongly sericitized. No grains resembling Kspar were noted. Small leucoxenized FeTi oxide phenocrysts are fairly uncommon.

The lithic clasts in this sample make up less than a few modal% of the rock, and are mainly dacitic to rhyolitic, formerly glassy rocks with snowflake devitrification textures; the largest is about 5mm long. Several clusters of quite crystalline small albitized plagioclase grains intergrown with chlorite may be former small microgabbro nodues, or else fragments of more slowly-cooled lava caught up in this pyroclastic eruptive event.

The matrix of this sample is very similar texturally to 562396 and 562034, also crystal lithic tuffs. The groundmass was originally vitroclastic, although strong and variable recrystallization has obliterated any shardy texture. It varies from very fine-grained quartz-feldspar intergrowths pervaded by a weak mesh of pale green chlorite and less abundant sericite, to relatively coarse domains up to a few mm long composed of intergrown albite prisms and anhedral quartz, with quite abundant chlorite. These coarser domains strongly resemble lithic clasts, but definitely are not; they may represent spots in which volatiles concetrated during incipient recrystallization and devitrification of the vitroclastic groundmass. The pinkish spots obvious in the hand specimen are the result of local concentration and alteration of tiny Fe oxides, not Kspar. Except for the apparent absence of Kspar in this rock, this sample is very similar indeed to 562034 and 562396.

SAMPLE NUMBER: 562033 LOCATION: Gowrie 431675E 5408810N

465120

SUMMARY: This is an epiclastic coarse sandstone composed essentially of dacitic to rhyolitic lithic clasts and crystal debris, with a minor component from Precambrian pelitic metamorphics. The matrix of the sample has been strongly hematite-altered.

HAND SPECIMEN: This is a hematitized coarse-grained epiclastic sandstone.

THIN SECTION:

This sample is clearly a volcanogenic sandstone composed of a framework-supported, remarkably diverse assemblage of volcanic lithic clasts in a silty matrix that is strongly hematite-altered. Most lithic clasts are formerly glassy felsic lava with quartz and albitized plagioclase phenocrysts. A striking range of groundmass devitrification and recrystallization textures is notable, and some almost holocrystalline clasts may be from shallow intrusive dacitic bodies rather than typically glassy flows and breccias. A few clasts with chloritized mafic phenocrysts may tend towards andesitic compositions, but no clear indisputable andesite or more mafic clasts were observed. Discrete detrital grains of angular volcanic quartz are not uncommon in the matrix of the rock, and at least two lithic clasts of presumably Precambrian muscovite-quartz schist were noted. It is particularly noteworthy that some clasts are extensively sericitized or hematitized, whereas others are quite 'fresh', indicating that these various styles of alteration almost certainly occurred prior to erosion and deposition of the clasts in this sediment.

The silty to sandy matrix of this sample probably forms less than 10-15 modal% of this rock and the clasts appear to have been packed in, possibly by limited pressure solution. The matrix is very strongly hematite-altered, and this alteration is clearly post-depositional.

120

465121

SAMPLE NUMBER: 562034 LOCATION: Gowrie 431720E 5408500N

SUMMARY: This is a former quartz+feldspar-phyric crystal lithic tuff with a recrystallized and chloritized formerly vitroclastic matrix. It is very similar to 562396.

HAND SPECIMEN: This is a dark epiclastic sediment or crystal tuff with common pink albite phenocryst fragments.

THIN SECTION:

Thin section shows that this is probably a crystal lithic tuff, composed of abundant angular feldspar and quartz phenocryst fragments (each about 15 modal% through most of the rock) and sparse lithic clasts in a formerly glassy matrix. One distinct bed about 3-5mm thick, composed of abundant crystal debris and little matrix, is evident. The quartz phenocrysts are broken and resorbed angular fragments that commonly show strong marginal resorption into the formerly glassy, devitrified matrix. Feldspar phenocrysts are also broken and reacted and appear to include both pinkish albite, and less abundant Kspar grains with checquerboard twinning. The few small lithic clasts are formerly glassy feldspar-and quartz phyric rhyolite. The narrow crystal-rich 'bed' mentioned above contains little matrix, and is composed essentially of ragged and disrupted, crowded Kspar and albite broken crystal fragments with chlorite filling all 'pore' areas, and abundant tiny FeTi oxides and leucoxene blebs. This is not a bed, but a narrow shear zone from which matrix material has been dissolved out and replaced by green chlorite.

The matrix of most of this sample is a variable-textured fine-grained quartz-feldspar intergrowth after glass, that is now strongly flecked by green chlorite. Patches of coarser-grained groundmass containing more abundant feldspar resemble lithic clasts, but are fairly typical of recrystallization mode of vitroclastic material in these rocks (see also 562396, which also has checquerboard Kspar phenocrysts!). This is a crystal lithic tuff with a highly recrystallized, chloritized vitroclastic matrix.

165122

SAMPLE NUMBER: 562035 LOCATION: Gowrie 431750E 5408200N

SUMMARY: This is an epiclastic sandstone composed of quartz, albite and FeTi oxide phenocryst fragment debris set between larger clasts of formerly glassy dacitic to rhyolitic lava, and a few Precambrian-derived quartz muscovite schist clasts.

HAND SPECIMEN: This is an epiclastic sandstone with distinct and fairly abundant red hematitized lava (?) clasts and feldspar debris.

THIN SECTION:

This rock is a framework-supported epiclastic sandstone composed of approximately equal modal amounts of felsic formerly glassy lava clasts, and crystal debris. The latter is notably finer-grained on average than the lithic clasts, and tends to form a 'coarse' matrix filling in between adjacent lithic clasts. The crystal debris is composed of slightly more feldspar than quartz phenocryst fragments, and a notable abundance of leucoxenized, quite large FeTi oxide phenocrysts; the feldspar is albitized plagioclase with slight sericite speckling. Probably 80% of the lithic clasts in the sample are from probably the same flow, being generally rather rounded and worn fragments of a sparsely plagioclase-phyric, once-glassy dacite to rhyolite with a groundmass intensely spotted with tiny Fe oxide grains. The only other distinctive clast varieties are five or six quartz-muscovite schists of probable Precambrian derivation, and two unusual dacite clasts with elonagte small plagioclase phenocrysts set in an almost black matrix probably composed of hematitized glass. The 'pore spaces' between the crystal debris grains is strongly chloritized.

SAMPLE: 562036: Gowrie Park 431940E 5408030N

SUMMARY:

This is an olivine+clinopyroxene-phyric Tertiary alkali olivine basalt, probably from a dyke or core of a thick flow.

HAND SPECIMEN

This is a grey, fresh, finely porphyritic basalt with quite abundant olivine phenocrysts.

THIN SECTION DESCRIPTION:

This is a very fresh, strongly olivine+augite-phyric Tertiary basaltic lava. It consists of around 15 modal% of olivine phenocrysts and 5 modal% of pale greenish diopside-augite phenocrysts in a holocrystalline groundmass with a fine-grained intergranular texture. The olivine phenocrysts are mainly fresh, unzoned subhedra about 0.4-1mm long, often with tiny chromite inclusions and cut by curving cracks enhanced by reddish oxidation products. Clinopyroxene phenocrysts are similar sized, but show notable zoning and often occur in multi-crystal clots, but rarely intergrown with olivine.

The groundmass shows an excellent intergranular texture defined by elonagte laths of intermediate plagioclase intergrown with anhedral granular augite and less common bladed to acicular plates of ilmenite. The minor amount of mesostasis between plagioclase and augite grains in the groundmass appears to be an alkali feldspar.

This sample is clearly a Tertiary alkalai olivine basalt, and the absence of glass, even in the mesostasis suggests that this may be a dyke rock or from the core of a thick flow.

SAMPLE: 562037: Gowrie Park 432220E 5408100N

SUMMARY:

This is a quartz+feldspar-phyric crystal lithic vitric tuff.

HAND SPECIMEN

This is a grey sericitic crystal rich epiclastic sediment or crystal lithic tuff.

THIN SECTION DESCRIPTION:

This sample is a strongly sericitized crystal lithic tuff composed of around 25 modal% of angular volcanic quartz phenocryst fragments and somewhat less abundant totally sericitized blocky to slightly stretched feldspar phenocryst and phenocryst fragments. Leucoxenized FeTi oxide phenocrysts are not uncommon, and some unusual, particularly elongate ponty zircon crystals were noted. A few distinct lithic fragments are small (<2mm long) rounded grains of formerly glassy felsic lava or tuff.

The groundmass of this sample is fairly strongly sericitized, but also contains quite a significant amount of chlorite as patches and streaks intergrown with sericite and minor calcite. It has a rather fluidal texture that swirls between phenocryst fragments, and gives the distinct impression of banded (welded) vitric groundmass. Sericite streaks tend to follow (or define?) the swirling fluidal texture. As the framework grains are clearly not packed together in the manner of an epiclastic sediment, and the groundmass where it is not sericitized has a texture indicative of recrystallization from devitrified glass, this sample is assumed to have been a crystal lithic vitric tuff.

SAMPLE: 562040: Gowrie Park 432010E 5407265N

SUMMARY:

This is a weakly cleaved silty shale composed of detrital muscovite and quartz, derived entirely from pelitic metamorphics. It strongly resembles the Que Rv Shale.

HAND SPECIMEN

This is a bedded and weakly foliated grey siltstone with bands (beds) of darker, more carbonaceous(?) material up to 5mm thick separating much thicker grey beds.

THIN SECTION DESCRIPTION:

This is an unusually micaceous siltstone composed of densely packed, abundant well-formed detrital muscovite grains mainly between 0.05 and 0.1mm long and lying subparallel with bedding, and less abundant angular tiny detrital quartz grains. Other detrital grains include oxidized and altered Fe(Ti?) oxide granules that are clearly concentrated more in the darker beds in this rocks, and sparse but notable strongly pleochroic tourmaline grains. No grading was noted in any beds sampled in this section. There appears to be no clear evidence for any volcanic component in this sample. A weak but persistent cleavage cuts the sample at about 75 degrees to bedding, and is picked out by very fine-grained Fe oxide grains and staining along the cleavage planes. Cleavage has rotated mica grains up or down away from bedding, producing a fine-scale herringbone effect. A very narrow quartz-calcite veinlet cutting the sample along a bedding parting is similarly offset by the cleavage.

This sample is very similar to standard Que River Shale, being a pelitic metamorphic-derived quartz-muscovite rock with no volcanic input.

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SAMPLE: 562043 and 562044:
Gowrie Park 562043 43 E 54 N 562044

465126

SUMMARY:

These rocks are very similar epiclastic sandstones derived largely from felsic volcanic and pyroclastic sources, but also containing Precambrian quartz-muscovite schist clasts; both contain a single 3mm sized clast of pyrite.

HAND SPECIMEN

These are weakly foliated sericitized epiclastic sandstones; 044 is less chloritic than 043, and more oxidized and altered.

THIN SECTION DESCRIPTION:

These samples are weakly foliated epiclastic sediments made up mainly of approximately equal proportions of sericitized blocky feldspars phenocrysts and formerly glassy felsic lava and tuff fragments, some almost 1cm long. Less important components are broken fragments of rounded subhedral quartz phenocrysts (~5 modal%), a few small quartz-muscovite schist lithic clasts, and a small amount of leucoxenitized FeTi oxide phenocrysts. Both samples are almost framework grain- supported, and matrix makes up less than 20 modal% of both rocks. All feldspar crystals are totally sericitized, being replaced by dense, rather coarse-grained sericite and minor calcite. Most lithic clasts are rather rounded fragments of devitrified formerly glassy felsic lava and possibly vitric crystal tuff. They are mainly fairly thoroughly sericite-calcite altered. At least one clast appears to be a tuffaceous shale. Both samples contain quartz-muscovite schist clasts presumably derived from the local pelitic Precambrian metamorphics, although these are much more abundant in 562044. Both samples also contain a single clastic compound grain of pyrite, each about 3mm long, and having a pressure fringe of quartz.

The matrix of both samples is brownish devitrified and partially recrystallized vitroclastic material in the silt to shale grade, that has been variably and locally quite strongly sericite-calcite altered. Sample 562044 contains much less chlorite dispersed through the matrix than 043, in which chlorite occurs as common green streaks and elongate patches not apparently replacing lithic fragments. In 044, the calcite is altered to messy brownish ferruginous clay.

OPAQUE MINERALOGY: Sample 562044 was examined in reflected light to assess the nature of the preumed clastic pyrite(?) fragment. This supported the presumption that this pyritic grain is a transported, clastic fragment deposited with the rock and not forming within the sample post-deposition (ie it is not diagenetic or epigenetic). The clast is composed of size graded idiomorphic pyrite crystals from about 0.5mm across at the base(?) of the clast to extremely fine-grained at the top. The finer pyrite is replaced along its contact with the adjacent matrix by hematite, that forms a crusty layer no more than 0.2mm thick. The pyrite is free of incluisons and no other sulphides were seen within this clast.

SAMPLE NUMBER: 562071 Gowrie Park 434150E 5411930N

SUMMARY:

This is a chloritized epiclastic sandstone containing crystal debris and lithic fragments derived probably from limited waterborne transport and sorting of material from a single eruptive event of a low-Si dacite or silicic andesite lava.

HAND SPECIMEN:

This is a dark grey fine-grained porphyritic andesitic to dacitic lava or crystal tuff.

THIN SECTION:

This sample is rather difficult to diagnose exactly, although it is texturally well-preserved. It consists of approximately equal amounts of blocky sericitized plagioclase phenocrysts to at least 3mm long and fine sand-sized fragments of plagioclase-phyric dacitic to andesitic lava with a very dark possibly hematite-altered groundmass. The plagioclase phenocrysts are albitized and show three types of alteration; most abundant is fairly strong sericitization, but also not uncommon is alteration to pale prehnite and/or calcite. No mafic phenocrysts were noted in this sample. Two small fairly rounded quartz phenocryst fragments are present, and small leucoxenitized FeTi oxide phenocrysts are also present but not common. The lava fragments are all fairly similar, mostly less than 2mm across, and are characterized by small blocky albitized plagioclase phenocrysts and microphenocrysts in an almost black formerly glassy groundmass that was clearly (hematite-?) altered before incorporation into this sample.

The groundmass or matrix of this sample is strongly chloritized, and appears to be composed of albitized plagioclase crystal fragments, and very small chlorite and hematite-altered dacitic or more felsic lithic fragments in chloritized ash. It is cut by occasional discontinuous veinlets of chlorite .

I think that this sample is probably a chloritized epiclastic sediment derived from ejectamenta from a single explosive eruption, with some minor size sorting and transport before deposition. The sample is probably at the low-Si end of the dacite compositional spectrum

SAMPLE NUMBER: 562073 Gowrie Park 434475E 5411790N

SUMMARY:

This is a well-preserved plagioclase +augite-phyric silicic andesite or low-Si dacite lava.

HAND SPECIMEN:

This is a grey-green porphyritic mafic lava cut by abundant calcite veins.

THIN SECTION:

This sample is a texturally very well-preserved strongly porphyritic andesitic lava consisting of abundant albitized plagioclase feldspar phenocrysts and less abundant chloritized mafic phenocrysts and FeTi oxide microphenocrysts in a very fine-grained formerly vitrophyric groundmass. The albite phenocrysts are quite strongly sericitized rather elongate to blocky prisms mainly 1-2mm long, making up around 30-35 modal% of the rock. Former mafic phenocrysts are much less abundant (~3-5 modal%), smaller (mainly 0.5-1mm) and totally chloritized, sometimes with tiny blebs of secondary quartz in the chlorite. Shapes are typical of augite. About 1 modal% of this sample is composed of equigranular FeTi oxide microphenocrysts, that appear to be leucoxenitized.

The groundmass of this sample is particularly even-textured and homogeneous, being composed of devitrified glass now recrystallized to patchy albite, chlorite and quartz in which tiny albite microlites and abundant tiny grains of FeTi oxides are set. The groundmass is cut by meandering veinlets composed of chlorite with calcite cores and concentrations of black Fe oxide granules along their margins. Also common are more complex veins composed of rather coarse-grained intergrowth of albite crystals and almost certainly Kspar, with cores of particularly polygonal calcite.

This is a well-preserved low-Si dacite to silicic andesite lava.

SAMPLE NUMBER: 562074 Gowrie Park 434535E 5411745N

SUMMARY:

This is a cleaved tuffaceous siltstone derived dominantly from a felsic volcanic source, but with a minor component *derived from pelitic metamorphics*. The sample as marked is 'right-way-up'.

HAND SPECIMEN:

This is a very fine-grained grey tuffaceous(?) shale or siltstone with bed thickness from <1mm to about 6mm in the specimen provided: way up is marked by arrow.

THIN SECTION:

This rock is a bedded fine-grained tuffaceous siltstone showing a well-defined but not strong cleavage that has offset bedding planes so that smooth bedding surfaces are no longer preserved, and grading is the only possible way to identify 'way up'. The coarser grained beds in this rock are made up of silt-sized grains of albitized feldspar phenocryst fragments, many of which are sericitized. Less abundant are detrital quartz grains, some of which are clearly of volcanic derivation, whereas a few others are polycrystalline strained grains that may be derived either from pelitic metamorphics or quartz veins. A few tiny strongly pleochroic green tourmaline grains and a small amount of clearly detrital rather coarse muscovite-sericite flakes indicate that some input from pelitic metamorphics into this sample is likely. The finer grained beds are composed of almost indeterminate and submicroscopic material in which occasional coarser angular grains of quartz or albite are set. The cleavage in this sample is defined by a fine-grained sericitic net highlighted by very fine-grained Fe oxides (or less likely, graphitic material) in places. Several graded beds unambiguously show grading upwards to finer-grained material in the direction of the arrow; that is, the sample appears almost certain to be 'right-way-up'.

465130

SAMPLE NUMBER: 562075 Gowrie Park 434540E 5411730N

SUMMARY:

This is a foliated formerly plagioclase+augite-phyric andesite lava, very similar to 562073.

HAND SPECIMEN:

This is a dark green foliated meta-andesite or strongly chloritized epiclastic fine sandstone.

THIN SECTION:

This sample is clearly a foliated former andesitic lava. It is composed of abundant albitized plagioclase phenocrysts and a somewhat smaller amount of chloritized mafic phenocrysts in a weakly foliated groundmass. The former mafic phenocrysts are quite stretched and dragged out to themselves form a distinct foliation. Former plagioclase phenocrysts are mainly around 0.5-2mm long, and make up around 20-25 modal% of the rock; they are much less deformed than the chloritized mafic phenocrysts, and are quite strongly sericitized. Mafic phenocrysts were chloritized before the deformation which affected this rock. The alteration assemblage (chlorite ± calcite) and a few relic, less deformed phenocryst shapes indicate that these mafic phenocrysts were almost certainly augite. Most have been strongly stretched and flattened, and more than anything else in the rock, these chloritized augite phenocrysts defined the foliation most clearly. Small leucoxenitized FeTi oxide microphenocryst are not uncommon.

The groundmass of this sample is weakly foliated and was probably originally a vitrophyric intergrowth of glass and tiny plagioclase microlites, with abundant tiny granular FeTi oxides that are totally leucoxenitized. The glass devitrified and recrystallized to albite chlorite and minor quartz, and the sample has been chloritized to some extent, judging by the abundance of chlorite in the groundmass. Very fine-grained calcite overprints areas of groundmass, but calcite is not a major alteration phase.

This sample was undoubtedly a plagioclase+augite+FeTi oxide-phyric andesitic lava. It is very similar to 562073 in most respects, except that it probably had slightly more mafic phenocrysts and less plagioclase phenocrysts. The fact that the chloritized mafic phenocrysts are so deformed indicates that deformation followed chloritization, and might therefore be Devonian.

SAMPLE NUMBER: 562305

165131

SUMMARY:

This sample was a plagioclase+hornblende-phyric andesite lava that has suffered relatively strong foliation development accompanied by significant sericite alteration.

HAND SPECIMEN:

This is a fairly weathered, rather schistose former porphyritic andesite(?) lava containing altered phenocrysts of both feldspar and mafics.

THIN SECTION:

In thin section, this sample is seen to be a foliated and relatively strongly altered former hornblende+plagioclase-phyric andesite lava. The former plagioclase phenocrysts are granulated and recrystallized as a number of discrete anhedral albite and quartz crystals intergrown within the site of the former phenocrysts; these are commonly wrapped around by dirty Fe-stained sericite. It is not possible to determine the original abundance of these phenocrysts due to the extent of alteration and recrystallization of this sample. Former hornblende phenocrysts are totally altered and are commonly streaked out into the foliation. They probably made up around 10 modal% of this sample, and are altered to very messy chlorite, sericite and small opaque oxide grains, and possibly clay minerals. Microphenocrysts of FeTi oxide are not uncommon, and are always broken and leucoxenized. Apatite microphenocrysts are present, although perhaps less notable in this sample than some others described in this set.

The groundmass of this sample was probably largely glassy, and crystallized eventually to patchy quartz-albite mosaics. The sample comes from a relatively high-strain zone compared with many other samples from this set, and has a definite foliation. although the foliation planes are fairly widely-spaced and rather wavy. The foliation is defined by sericite streaking, elongate flattened quartz lenses composed of polycrystalline quartz grains (crystallizing from the formerly glassy groundmass) and stretched former hornblende and feldspar phenocrysts. Chlorite is not a major alteration phase in this sample, although it not uncommon . Calcite is absent in this sample.

SAMPLE NUMBER: 562306

SUMMARY:

This sample was a plagioclase+hornblende-phyric andesite lava that has suffered some sericite alteration, followed by clay alteration in the weathering environment.

HAND SPECIMEN:

This is a fairly weathered porphyritic andesite(?) with Fe-stained clay replacing feldpsar phenocrysts.

THIN SECTION:

This sample was clearly a feldspar+hornblende-phyric andesite lava, although it is quite strongly altered. It is probably very similar to the **pre**-foliation **pre**cursor of the **pre**vious sample (562305). The rock was composed of around 15-20 modal% of quite large (1-2mm) totally altered plagioclase phenocrysts, about 5-10 modal% of thoroughly altered hornblende phenocrysts, some as long as 3mm (although most are much smaller), and a few modal percent of quartz phenocrysts. The former plagioclase phenocrysts are entirely replaced by dense, very fine-grained sericite; this is commonly partly replaced by subopaque, messy Fe-stained clayey material. Former hornblende prisms are chloritized, and often contain small FeTi oxide grains that are leucoxenized. Quartz phenocrysts are strongly resorbed and reacted, and difficult to distinguish from larger patches of secondary quartz crystallizing from the formerly glassy groundmass. FeTi microphenocrysts are common, and are mainly altered to leucoxene. Rather more euhedral and less altered-looking opaques disseminated through the sample may be magnetite (several larger grains are notable in the hand specimen).

The groundmass was largely glassy and has crystallized to quartz, albite and minor chlorite, and suffered a quite strong sericite overprinting. It should be noted, however, that it is very difficult to distinguish between surficial clay alteration and true hydrothermal sericite alteration. I think this is a clay-altered sericitic meta-andesite.

465133

SAMPLE NUMBER: 562307

SUMMARY:

This is a fairly strongly foliated former plagioclase+ hornblende-phyric andesite lava with a strong stretching and alignment of altered phenocrysts.

HAND SPECIMEN:

This is a very strongly weathered orange-brown meta-lava or tuff with a well-developed foliation.

THIN SECTION:

This highly weathered and foliated sample retains abundant textural evidence that it was originally a plagioclase+ hornblende±augite(?)-phyric andesitic lava. Former plagioclase phenocrysts probably make up at least 20 modal% of this sample, and are quite elongate and stretched into the foliation. They were originally at least 1-2mm long on average, but are now replaced thoroughly by fine-grained sericite and tiny clots of dirty dark brown, subopaque Fe-stained clay. Former mafic phenocrysts are only slightly less abundant than plagioclase, and are also completely altered, mainly to very fine-grained yellow-green chlorite; they also are streaked out into the foliation, and may now be several times longer than their original length. Former FeTi oxide show remarkable stretching, with length-width ratios of these usually equigranular crystals being typically 2 to 5; they are strongly altered to magnetite or hematite rims with very fine-grained chlorite-sericite core regions. Although stretched and altered, former hornblende crystal shapes are still preserved, but the original presence of augite crystals cannot be ruled out from this section. Interestingly, given the strong similarity of this sample with other hornblende andesites from this area, the absence of apatite in this rock is notable. Perhaps apatite crystals disaggregate easily in foliation development. (?)

The groundmass of this lava is very fine-grained quartz-albite -sericite ± chlorite, and is characterized by a streaky foliation more noticeable by the elongate, aligned phenocrysts. It was probably glassy. I have no doubt that this was a plagioclase+hornblende-phyric andesite lava.

465134

SAMPLE NUMBER: 562308

SUMMARY:

This sample was a plagioclase+sparsely quartz-phyric glassy dacitic lava.

HAND SPECIMEN:

This is a very weathered and altered pale green-brown meta-lava or tuff.

THIN SECTION:

This is a strongly weathered and altered formerly quartz+ plagioclase-phyric dacitic lava. It is composed of less than 10 modal% of thoroughly sericitized former plagioclase phenocrysts, mainly less than 2mm long, many of which have altered subsequently to Fe-stained clay. Quartz phenocrysts form around 1 modal% of the sample, and are somewhat rounded and resorbed; they are less than 1mm across. Former FeTi oxide microphenocrysts are altered to an unusual speckled aggregate of hematite/magnetite(?) and chlorite, and are quite common, but there is no convincing evidence for the former presence of mafic silicate phenocrysts in this rock. Apatite microphenocrysts are not uncommon.

The groundmass of this sample is abundantly fractured and criss-crossed by a lacework of fine cracks; nevertheless, the texture of the groundmass is quite uniform, and it is composed of very equigranular intergrowth of quartz and albite, with common fine-grained flakes of chlorite and small pockets of fine-grained polygonal secondary quartz. It was almost certainly glassy. Many fractures are defined by Fe-stained clay or sericite, and some red-brown limonite or goethite as linings and margins.

This sample was probably a dacitic lava at the andesitic end of the dacite spectrum

165135

SAMPLE NUMBER: 562309

SUMMARY:

This is a polymict formerly glassy rhyolitic lava breccia.

HAND SPECIMEN:

This is a green and pink felsic polymict lava breccia or lithic tuff, with fragments of aphyric very fine-grained felsic lava to 1cm across.

THIN SECTION:

In thin section, the only clue that this sample is a lava breccia, and not a massive lava, is the rapid and pronounced changes in grainsize of the groundmass. The sample is composed of quartz+plagioclase-phyric lava fragments with devitrified glassy groundmasses that have crystallized to quartz and albite, and probably been silicified to some degree. The quartz phenocrysts are mainly somewhat rounded and reacted euhedra, although many have broken in situ into fragments that have jostled apart and occasionally commenced to subgrain recrystallize. Most quartz phenocrysts are 1-2mm across, and they make up perhaps 5-8 modal% of this sample. Plagioclase phenocrysts are perfectly fresh albite, although grains vary from quite euhedral to highly angular and broken crystals: the latter may be crystal fragments in the matrix between lava fragments. Most are 1-2mm long, and they comprise around 2-5 modal% of the lava fragments. Quite sparse former FeTi oxide phenocrysts are replaced by a speckled, very fine-grained aggregate of magnetite(?) and chlorite. No apatite was noted in this sample.

The groundmass of all lava fragments in this sample was originally glassy. Responses to devitrification and subsequent crystallization varied from fragment to fragment, resulting in variable grainsize and texture; several fragments have relatively abundant chlorite in the groundmass, and may have been more dacitic glass. Some fragments have a sugary-textured groundmass composed almost entirely of silica, suggesting limited silicification of the former glass. Sericite is not common, and occurs on a few major fractures and dispersed as fine webs through the groundmass of some lava fragments. Weak, patchy calcite overprinting, with small (~0.2mm long rhombs), is pressent, but the calcite has altered completely to a secondary Fe mineral (goethite?).

This was a rhyolitic lava breccia, probably polymict, that may have shed from an active lava dome.

465136

SAMPLE NUMBER: 562310

SUMMARY:

This is a highly sericite-clay altered, weakly foliated porphyritic dacite or andesite with abundant altered plagioclase phenocrysts, and quartz and FeTi oxide phenocrysts.

HAND SPECIMEN:

This is an orange-brown strongly weathered meta-andesite lava or tuff.

THIN SECTION:

In thin section, this sample is seen to be a strongly porphyritic lava in which abundant phenocrysts of altered plagioclase and somewhat less abundant but common quartz phenocrysts are obvious, but the presence of former mafic silicate phenocrysts is much less easy to determine. Former plagioclase phenocrysts make up around 30 modal% of the sample and are slightly stretched euhedra to around 1-2mm average size, entirely replaced by sericite and Fe-stained clay. Quartz phenocrysts make up around 2 modal% of the sample and vary from about 0.3mm across to 1mm across. They are mainly quite strongly resorbed rounded crystals, but a few large well-formed euhedral crystals are present. An unusual feature of this sample is the presence of quite common, notably large FeTi oxide phenocrysts that are always altered to leucoxene and chlorite. No crystals positively identifieable as altered hornblende or augite are present, . although the sample is so altered that it may be impossible to discern altered hornblende from the altered stretched plagioclase phenocrysts. A few small lithic fragments are present in the rock, and appear to be recrystallized formerly glassy felsic(?) lava; these are strongly clay-altered..

The groundmass of this sample is weakly foliated and strongly sericite-clay altered, and was almost certainly largely glassy originally. Fine-grained quartz-albite-sericite ±chlorite makes up most of the groundmass; carbonate is not present.

Both the abundance of FeTi oxides and the general appearance of the rock suggest to me that it was a hornblende andesite to (hornblende) dacite lava.

465137

SAMPLE NUMBER: 562311

SUMMARY:

This is an interbedded andesitic crystal tuff and tuffaceous shaley epiclastic sediment.

HAND SPECIMEN:

This is a compound sample showing a contact between a sericite+ hematite-altered plagioclase+hbd(?) andesite and a dark red-brown very fine-grained tuff or shale. The latter forms a clear sedimentary dyke into the lava in one place.

THIN SECTION:

The lava-like portion of this sample is a quite strongly plagioclase-phyric andesite with less abundant chlorite-altered mafic phenocrysts that may have included both augite and hornblende. The plagioclase phenocrysts make up at least 25 modal% of the sample. They are clean albitized plagioclase to around 2mm maximum length, and many are fragmentary and packed against one another. Former mafic phenocrysts make up around 5 modal% of the sample and are all now composed of pale green chlorite and minor Fe oxide and sphene. Crystal shapes suggest that both augite and hornblende phenocrysts may have been present in this rock. The groundmass of this rock was probably an ash, with tiny plagioclase and augite microlites and crystal fragments set in a devitrified glassy matrix; it is now a rather messy, and contains abundant quartz, chlorite and FeTi or Fe oxide grains (and possibly very fine-grained albite) after glass. It also contains streaks of chlorite, and common spots of dirty brown microcrystalline epidote, as well as occasional grains of yellow, crystalline epidote. This rock is probably an andesitic crystal tuff.

The contact between the crystal tuff and the shale is irregular and unchilled. Occasional coarse plagioclase phenocrysts are embedded a few mm into the shale. The shale is extremely fine-grained and clearly tuffaceous, with tiny volcanic plagioclase crystal fragments visible, and abundant dirty amorphous epidote spots and tiny Fe oxide granules scattered evenly through the rock. The shale is clearly graded on a very small scale, with the apparent fine-grained top of the bed abutting the tuff. A small inclusion of crystal tuff identical to the main lava in this section occurs about 1cm into the shale.

This sample is probably interbedded andesitic crystal tuff and shaley epiclastic (volcanogenic) sediment.

185138

SAMPLE NUMBER: 562312

SUMMARY:

This is a crystal lithic tuff derived from a mixed felsic and intermediate lava source that included the apatite-rich andesites described above.

HAND SPECIMEN:

This is a very dark grey-black quartz+feldspar-phyric dacitic lava or crystal tuff containing a few large (to almost 1cm) lithic fragments of pinkish and grey altered felsic lava or tuff.

THIN SECTION:

This sample is clearly a crystal lithic tuff in thin section. It contains a diverse array of crystal fragments and subordinate small lithic fragments of glassy felsic lavas. By far the most abundant crystal component is albitized plagioclase, that occurs as crystals from 0.1 to almost 2mm long, most of which are decidedly fragmentary in appearance and spotted with chlorite and sericite. Many have rather blocky shapes suggestive of derivation from dacitic or more silicic magmas. Quartz phenocrysts make up about one modal percent of the sample. An interesting aspect of this sample is the number of relatively large FeTi oxide grains, many with attached apatite crystals. Similarly, chloritized mafic phenocrysts, probably augite, are not uncommon, and large apatite crystals are notable by their size and abundance. A few lithic fragments were sampled by this section; these are mainly andesitic lava fragments with trachytic textured groundmasses and albitized plagioclase phenocrysts and chloritized augite phenocrysts. Also present are a few formerly highly glassy aphyric dacite to rhyolite lava fragments.

The matrix of this sample was probably a glassy ash; it has altered to quartz and albite, and contains abundant chlorite, and about 5 modal% of the sample, mainly matrix, is overprinted by dirty brownish calcite.

This sample is clearly a crystal lithic tuff derived from a mixed felsic- intermediate lava source that contained the distinctive apatite-rich andesites such as seen in samples 562301 and 2.

465139

SAMPLE NUMBER: 562076 Gowrie Park 434800E 5411695N

SUMMARY:

This is a welded crystal lithic tuff probably of dacitic to rhyodacitic composition, containing sparse hornblende and biotite phenocrysts in addition to abundant quart and albitized plagioclase phenocrysts and pumiceous fragments.

HAND SPECIMEN:

This is a well-preserved brown felsic lava or crystal lithic tuff with phenocrysts of quartz, feldspar, not uncommon small matic phenocrysts and a few altered pumice fragments to almost 1cm long.

THIN SECTION:

This sample is very well-preserved texturally, and the relative abundance of formerly glassy lithic clasts and broken crystals indicates that it is a pyroclastic rock rather than a lava. Phenocrysts are mainly fragmented and are dominantly albitized plagioclase and quartz, and quartz phenocrysts are notably larger (mainly 1-3mm across) than feldspar. The quartz crystal fragments are mainly quite rounded and resorbed on most crystal faces, and they frequently contain round chloritized melt inclusions. The albitized plagioclase phenocryst crystal fragments are slightly sericitized and make up around 20 modal% of this sample. Chloritized matic phenocrysts are surprisingly abundant for a felsic rock containing so much quartz, perhaps making up 2-4 modal% of this rock. They are mainly well-formed prisms probably after augite, but one crystal with abundant tiny leucoxenitized FeTi oxide granules defining former cleavage was almost certainly biotite, and several other crystals now composed of chlorite, leucoxene (opacite), calcite and quartz have shapes suggestive of hornblende precursors. Altered FeTi oxide phenocrysts to almost 1mm long are not uncommon, and small apatite and zircon crystals were also notable by their relative abundance.

Lithic fragments in this sample are formerly glassy plagioclase-phyric dacite to rhyolite that have devitrified to fine-grained snowflake-textured intergrowths that are slightly browner in plane polarized light (due to brownish albite) than the rest of the formerly glassy matrix of this rock. Some of these lithic fragments have been clearly flattened around large phenocrysts, whereas others are quite equigranular and show matrix wrapping around part of all of them. The matrix of this sample was almost certainly entirely glassy, and it has devitrified to a very fine-grained quartz-albite intergrowth.

This sample was probably a very hot ash flow. It has not been transported by water in my opinion (ie. it is not a volcaniclastic or epiclastic sediment) and was probably welded at the time it formed.

SAMPLE NUMBER: 562301

SUMMARY:

This is a weathered, plagioclase+hornblende-phyric andesite lava with notably large and common apatite phenocrysts that suggest it is a quite high-K, possibly shoshonite series lava.

HAND SPECIMEN:

This sample is a weathered, sericite (limonite) -altered hornblende andesite with strongly altered plagioclase phenocrysts.

THIN SECTION:

This sample is a strongly porphyritic andesite lava characterized by quite large and abundant phenocrysts of plagioclase and hornblende in a very fine-grained groundmass. The former plagioclase phenocrysts make up around 20 modal% of the sample, and are mainly 1-2mm long euhedra, occuring mainly as single crystals, but sometimes as crystal clots. They have been albitized, then fairly strongly clay-sericitize altered, possibly by surficial alteration, leaving only occasional cores of 'cleaner' albite that is flecked with sericite and has common flakes of green chlorite along cracks and cleavages. The former hornblende phenocrysts are entirely altered, but retain distinctive, diagnostic grain shapes and alteration assemblages. They make up aroun 10-12 modal% of this sample, and are mainly 0.5-2mm long elongate euhedral prisms. They are invariably altered to rather messy assemblages of quite strongly pleochroic green chlorite, sericite, and relatively large altered FeTi oxide grains. The chlorite is unusual in that it is rather more highly birefringent than typical chlorite, so that I initially thought it was actinolite. However, the habit and paragenesis are atypical of low greenschist facies rocks, and I'm sure the mineral is chlorite. Minor phenocryst phases include FeTi oxides, that occur as quite large (to about 0.6mm across) euhedral blocky grains with marginal leucoxene-chlorite alteration, and relatively common, notably large apatite phenocrysts (to 1mm long).

The groundmass of this sample is a very fine-grained quartz-albite -sericite intergrowth with tiny Fe oxide grains and chlorite flecks being abundant. It probably largely crystallized from devitrified glass. The sample is clearly a plagioclase+hornblende-phyric andesite lava, with minimal hydrothermal alteration. The big, relatively common apatite phenocrysts are notable, and suggest affinities with the more K- and P-enriched basalt-andesite lavas (ie. Lynchford-Hellyer-types) from the MRV rather than the andesites from the Central Volcanic Complex. Strong similarities to the Crown Hill hornblende-phyric andesites are noted.

SAMPLE NUMBER: 562302

465141

SUMMARY:

This is an autobrecciated plagioclase+augite-phyric andesitic lava with weak sericite-hematite alteration.

HAND SPECIMEN:

This is a lava breccia, probably monomict, with pale brown angular fragments to at least 2cm long of altered plagioclase-phyric andesite in a darker fine-grained matrix.

THIN SECTION

The lava breccia nature of this sample is quite evident in thin section, with strongly plagioclase-phyric lava fragments all from an identical petrographic unit, set in a darker less plagioclase-phyric andesitic ash. The lava fragments in a few places show boundaries suggestive of a jigsaw-fit relationship. The lava fragments are all very highly plagioclase-phyric andesite. The plagioclase is entirely sericitized, as is much of the albite in the devitrified formerly glassy groundmass, making the outline of the former plagioclase phenocrysts hard to distinguish. Thus modal estimation of the abundance of former plagioclase phenocrysts is difficult, but a figure of around 30-40 modal% would seem reasonable. Most plagioclase phenocrysts were 1-22mm across, although they extend down to the microphenocryst size range. Former mafic phenocrysts were much less abundant, probably around 2 modal%. They have shapes suggestive of augite precursors and are entirely altered to rather birefringent chlorite. Microphenocrysts of FeTi oxide are not uncommon, and appear to have marginal alteration to leucoxene. As for the previous sample, quite large apatite microphenocrysts are present, and notable.

The groundmass of the lava fragments is very fine-grained and shows fairly strong sericite alteration, with abundant tiny Fe oxide granules and subopaque dirty brown very fine-grained blebs of microcrystalline epidote(?).

The dark matrix between the lava fragments is also andesitic, and contains altered plagioclase and augite phenocrysts. However, the phenocrysts in the matrix are commonly broken and irregular-shaped crystal fragments, suggesting that the matrix is an ash composed of comminuted lava from the same flow. The matrix also contains much more abundant small Fe oxide grains than the groundmass of the lava, suggesting that it was more 'permeable' to percolating solutions that may have introduced the relatively abundant Fe in this sample.

This sample is a plagioclase-augite-phyric andesitic lava breccia, or autobrecciated lava flow.

465142

SAMPLE NUMBER: 562303

SUMMARY:

This sample was a totally aphyric rhyolitic to dacitic glassy hyaloclastite or subaqueous chill breccia.

HAND SPECIMEN:

This is a breccia composed of very similar, angular fragments to around 1cm across of aphyric felsic lava, themselves transected by fracture networks into microbreccias.

THIN SECTION:

This sample is a lava breccia composed of very angular fragments of aphyric rhyolitic to dacitic lava cut by abundant angular fracture sets creating a meshwork of lacy microbrecciation. The lava fragments contain about three microphenocrysts of sericitized albite in the entire thin section, making this an exceptionally aphyric lava. The lava fragments were entirely glassy, and have devitrified and crystallized to a very well-preserved mosaic quartz-albite intergrowth characterized by common 0.1mm-sized spherulitic growths of quartz-albite with radiating extinction, and well-formed relatively large sericite or muscovite plates spread through the rock but forming << 1modal% of the sample. The matrix between fragments is very difficult to discern, and is composed essentially of the same assemblage as the fragments, with slightly finer- and more variable grainsize and texture. Within the microbrecciation zones, glass has crystallized to a much finer-grained assemblage of quartz and albite, with more abundant sericite. The brecciation is almost certainly primary (not tectonic), as the fracture networks are highly variable in orientation and concentration. Post-brecciation quartz-sericite veinlets cut the sample, but are not abundant.

This is an unusual totally aphyric lava breccia (autobreccia) or hyaloclastite of dacitic to rhyolitic composition, more probably the latter.

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465143

SAMPLE NUMBER: 562313

SUMMARY:

This is an andesitic to dacitic crystal lithic tuff containing epidosite lithic fragments in adition to abundant plagioclase crystal debris; the matrix is strongly hematite-altered.

HAND SPECIMEN:

This is a crystal-rich andesitic lava or tuff containing several lithic fragments to about 5mm across, and with a dark red hematite-altered groundmass.

THIN SECTION:

This sample is seen in thin section to be a very crystal-rich crystal lithic tuff. It contains around 40-50 modal% of albite crystals up to 4mm across, many of which are grouped in crystal clots. These are more often broken crystal fragments than entire euhedra, and are only weakly speckled by sericite. Chloritized augite prisms make up much less than 1 modal% of the sample, and leucoxene-altered FeTi oxide microphenocrysts are similarly abundant. About 10-15 modal% of the sample is made up of lithic fragments, most of which are distinctive yellowish plagioclase- phyric andesitic to dacitic lava fragments with strongly epidotized groundmasses. Associated with the epidote is bright green pumpellyite, and dull green chlorite. The absence of these phases in the groundmass of the rock indicates that the epidote alteration was hydrothermal and pre-eruption of this tuff. That is, epidote altered lavas existed in the lava pile which was disrupted and incorporated into this tuff.

The matrix of this tuff was probably a crystal-rich vitric tuff; the glassy component has crystallized to albite and quartz, with common chlorite, but the entire matrix has suffered strong hematite alteration. Hematite occurs as a fairly intense dusting of almost submicroscopic dust through the matrix.

465144

SAMPLE NUMBER: 562314

SUMMARY:

This is an intensely calcite+chlorite-altered probably hornblende andesite lava breccia with abundant apatite phenocrysts.

HAND SPECIMEN:

This is a dark grey, fairly strongly altered andesitic lava breccia with fragments less than 1cm long.

THIN SECTION:

This sample is very strongly altered with fairly intense calcite alteration almost obliterating much of the original texture and mineralogy. A few lava fragments that may still be discerned seem to have been plagioclase+mafic-phyric andesite, but both phenocryst types have been totally altered to calcite and chlorite. About five (to 1.5mm across but mainly smaller) quartz phenocrysts are present, set in a very fine-grained, probably devitrified and crystallized formerly glassy groundmass that has possibly been silicified. Large altered FeTi oxides are common, and relatively abundant large apatite phenocrysts are a notable feature of this sample.

This sample was probably a hornblende andesite lava breccia related to the lavas described above, such as 562301, and those described from the same area in previous reports. The large and abundant apatite phenocrysts are diagnostic, and many hornblende andesites from previous Mt Roland sets and also from the Crown Hill area N of Queenstown contain sparse quartz phenocrysts. The intense calcite-chlorite alteration contrasts with samples such as 562301, and is almost certainly of local hydrothermal origin.

465145

SAMPLE NUMBER: 562315

SUMMARY:

This is a felsic crystal vitric tuff, with a small lithic component, with a fine sandstone grainsize.

HAND SPECIMEN:

This is a fine-grained volcanogenic sandstone or tuff.

THIN SECTION:

This sample is seen to be a crystal tuff in which abundant fine sand-sized volcanic quartz grains, mainly <0.2mm across, and totally altered feldspar grains are set in a formerly glassy groundmass. The quartz grains probably make up around 15 modal% of the sample and are angular to subrounded and unstrained. Former plagiolaclase crystal fragments are much less common than quartz, and are thoroughly sericite-clay altered. FeTi xoide microphenocrysts are altered, so that they are now rims of hematite around leucoxene cores. Small lithic fragments of devitrified glassy felsic lava are not uncommon, and are difficult to discern in the altered formerly glass-rich matrix. In many places, the matrix appears to have an almost fluidal texture, like a welded tuff, and this is picked up and enhanced by sericitic alteration of the glass. It is the matrix texture of this sample, and the quite dispersed framework grains that lead me to think that this sample was a tuff derived from a felsic volcanic source, rather than an epiclastic fine sandstone.

145

SAMPLE NUMBER: 562316

465146

SUMMARY:

This sample consists of three 1cm-thick graded beds of mainly felsic volcanic derived siltstone and mudstone, with a minor component (muscovite) derived from pelitic metamorphics.

HAND SPECIMEN:

This is a grey-brown layered siltstone-mudstone, with bed thickness around 1cm.

THIN SECTION:

This sample is essentially composed of three identical graded beds that grade from silt to mud grainsize across the ~1cm bed thickness. The coarsest part of each bed is composed of fairly angular volcanic quartz with even extinction, minor sericitized albite, FeTi oxides, and minor detrital relatively coarse-grained muscovite. The very fine-grained matrix of the coarser sections of each bed are strongly overprinted by yellow-green chlorite. The fine-grained sections of each bed are composed essentially of quartz, chlorite, and sericite, with a weak cleavage defined by chlorite and sericite at a very high angle to the bedding planes.

Calcite rhombs overprinted about 20-40 modal% of both the finer and coarser parts of each bed, but they have been replaced by messy brown clay and limonite during surficial weathering.

This sample is clearly volcanogenic, being apparently derived mainly from a felsic volcanogenic source. The detrital muscovite grains suggest, however, that a small component derived from the Precambrian pelitic metamorphics is incorporated in this rock.

146

465147

SAMPLE NUMBER: 562317

SUMMARY:

This is a largely volcanogenic sandstone dominated by crystal and lithic clasts derived from felsic volcanics, but included also are pelitic metamorphic clasts from the Tyennan block(?).

HAND SPECIMEN:

This is a weathered coarse lithic tuff or volcanogenic sandstone, with some fragments of lava up to 1cm long.

THIN SECTION:

This sample is a quite coarse-grained volcanogenic sandstone with the average grainsize of the lithic clasts being around 2mm, although some fragments are much larger. Clats are packed together with little obvious matrix between the clasts. The clast population is dominated by quartz and altered feldpar phenocrysts and crystal fragments, and felsic lava fragments. Most of the latter are rhyolitic to dacitic lava fragments with quartz and albite phenocrysts and altered formerly glassy groundmasses. Several distinctive fragments have orange-brown foliated groundmasses composed of oxidized chlorite after glass.

A notable feature of this sample is the presence of several large (to 2cm in one instance) clasts of pelitic metamorphic rocks. The largest of these is a quartz-muscovite-graphite schist with metamorphic mineral layering, strong foliation and kinking of the foliation. The smaller pelitic metamorphic fragments are quartz-muscovite schists, and clearly indicate a contribution from the adjacent Tyennan metamorphics.

465148

SAMPLE NUMBER: 562318

SUMMARY:

This is a strongly weathered plagioclase+sparsely augite(?)- phyric acid andesite or dacite lava.

HAND SPECIMEN:

This is a foliated pale brown porous, strongly weathered plagioclase-phyric andesite or dacite lava with clay-altered plagioclase phenocrysts.

THIN SECTION:

This sample is a strongly plagioclase-phyric andesite lava very similar to 562307. It is composed of totally altered and notably stretched plagioclase phenocrysts to around 3mm maximum length, that make up around 30 modal% of the rock. These are composed of streaky sericite that has altered to dirty subopaque clayey aggregates in many places. Former mafic phenocrysts are also stretched, and altered to yellowish (oxidized?) chlorite; it is impossible to identify whether these were augite or hornblende, although I favour the former.

The groundmass is extremely fine-grained and was probably highly glassy. It is strongly sericite-clay altered, and weakly foliated. Coarser foliation planes and curving fractures are also the locus of development of strongly Fe-stained clay and sericite.

The sample probably lies somewhere in the high-Si andesite to dacite compositional range.

146

465149

SAMPLE NUMBER: 562319

SUMMARY:

This is a weakly foliated hornblende-andesite lava breccia with a small poymict component, and strong calcite-chlorite alteration; it is very similar to 562314.

HAND SPECIMEN:

This is a grey, weakly foliated polymict lava breccia or lithic tuff with fragments of felsic lava(?) to about 5mm long.

THIN SECTION:

The polymict breccia nature of this asmple is well shown in this section, which is striking similar to 562314. Angular lava fragments overprinted almost completely by calcite and chlorite were probably hornblende-phyric andesite. Occasional former hornblende phenocrysts are still discernible, but have been replaced by chlorite. Quartz phenocrysts are not uncommon, and are reacted and rounded. Common former FeTi oxide phenocrysts are altered to a very fine-grained chlorite-magnetite(?) intergrowth, and apatite phenocrysts and microphenocrysts are also relatively common. A few very fine-grained devitrified felsic lava fragments are present.

The matrix of this sample is highly altered and hetrogeneous in texture. Much of it was probably andesitic ash with a very high glassy component, probably comminuted material of the same composition as the main lava fragments. Quartz, quartz-calcite and quartz-sericite-calcite veinlets transect the sample and form a weak cleavage.

This sample was probably a lava breccia derived largely from a single flow of hornblende andesite; it is strikingly similar to sample 562314 in both origin and alteration.

465150

SAMPLE NUMBER: 562320

SUMMARY:

This is a well-preserved plagioclase+quartz-phyric rhyolite lava.

HAND SPECIMEN:

This is a dark brown quartz+feldspar-phyric felsic lava or crystal tuff, possibly with hematite alteration of the groundmass.

THIN SECTION:

This is a beautifully preserved rhyolitic lava composed of around 40 modal% plagioclase phenocrysts and about 10 modal% of quartz phenocrysts in an exceptionally fine-grained devitrified glass groundmass. The plagioclase phenocrysts are albitized crystals, mainly blocky subhedra, with slight to strong sericite speckling and pinkish tones due to submicroscopic Fe oxide dust produced during albitization. The quartz phenocrysts are mainly around 1mm across, and are strongly reacted and resorbed, and many have margins grading into the crystallizing devitrified glassy groundmass. Seven or eight small chloritized mafic phenocrysts were probably augite. FeTi oxide phenocrysts are not uncommon, and are often attached to chloritized augite phenocrysts. Apatite microphenocrysts are not uncommon, and are also commonly attached to FeTi oxides and former augite crystals.

The groundmass of this sample was undoubtedly a glass that devitrified to a finely-banded, almost fluidal-textured material that has subsequently crystallized to a very fine-grained quartz and albite mosaic intergrowth with abundant tiny Fe oxide grains.

This sample is worth analyzing. I have kept a few small chips of it.

465151

SAMPLE NUMBER: 562321

SUMMARY:

This is a very plagioclase crystal-rich crystal tuff, probably of andesitic to dacitic derivation, that has suffered strong chlorite-magnetite alteration, with the production of little spots and clots of magnetite.

HAND SPECIMEN:

This is a reddish, altered felsic to intermediate lava or crystal tuff with abundant brick red feldspar phenocrysts and common fine-grained opaque oxide grains.

THIN SECTION:

This sample is seen to be a very plagioclase phenocryst-rich crystal tuff. It is composed of probably 60+ modal% of angular to euhedral albite phenocrysts from <<0.1mm across to about 2mm long. These are often packed against each other in the manner of clastic grains in a sand. Many of the albite phenocrysts and crystal fragments are quite reddish, presumably due to a combination of the common, very fine-grained Fe-stained sericite flecking and submicroscopic Fe oxides within the albite lattice. Other crystal components making up this rock, in order of decreasing abundance are chloritized augite, resorbed quartz, FeTi oxides (altered to leucoxene) and apatite. An interesting feature of this sample is the occurrence of about 2-3 modal% of the rock as clots of extremely fine-grained magnetite that become more diffuse towards their outer margins. In some cases it appears that these magnetite clots have developed from original FeTi oxide grains, whereas in other places this is less convincing.

The groundmass or matrix of this sample is heterogeneous and variable in grainsize and texture. It was probably quite glassy, but has crystallized to quartz-albite, with abundant chlorite and tiny Fe oxide grains.

This sample was a plagioclase crystal-rich crystal tuff, probably derived from and andesitic to dacitic source. It has suffered an unusual chlorite-magnetite alteration that has produced small clots of magnetite in the sample.

165152

SAMPLE NUMBER: 562322

SUMMARY:

This is a plagioclase crystal-rich tuff or epiclastic sandstone derived from an andesitic to dacitic source. Apatite is common, as is magnetite-hematite alteration in the heterogeneous groundmass.

HAND SPECIMEN:

This is a dark, altered feldspar-phyric andesitic lava or crystal tuff with a dark red hematite altered matrix.

THIN SECTION:

This sample is an exceptionally plagioclase-phyric crystal tuff or epiclastic sediment. It is composed of abundant sand-sized crystal fragments of albitized plagioclase that make up at least 50 modal% of the sample. Most albites are 0.5-1mm long, and only slightly sericite-flecked, and they are commonly packed together with little or no intra-crystal matrix. Former mafic phenocrysts are not abundant, probably making up only 0.5-1 modal% of the sample; they are small chloritized augite crystals, often associated with FeTi oxide microphenocrysts. The latter are skeletal relics of exsolution of ilmenite from FeTi oxide grains, with interstices replaced by chlorite, albite and/or quartz. Apatite microphenocrysts, and several 1mm-sized phenocrysts are notable..

The matrix of this sample is very irregularly distributed through the sample, and highly variable in texture, alteration and grainsize. A possible explanation for this is that lithic clots derived from glassy lavas are more abundant in the sample than easily recognized. The general appearance of the variable matrix is very suggestive of an origin via crystallization from glassy ash, although whether the sample is a sediment or an airfall tuff is dificult to judge. Magnetite or hematite patches seem to be developing in small spots in the matrix, and fine-grained hematite dust is abundant in the matrix of this rock.

465153

SAMPLE NUMBER: 562323

SUMMARY:

This is a weakly foliated plagioclase-phyric crystal tuff with significant calcite-hematite alteration. It is very similar to 562321.

HAND SPECIMEN:

This is a dark red-brown porphyritic andesite lava or crystal tuff with highly altered plagioclase and mafic phenocrysts in a hematite(?)-altered groundmass.

THIN SECTION:

This sample is a weakly foliated andesitic crystal tuff composed of abundant phenocrysts of altered plagioclase, and less common quartz, altered hornblende and augite, FeTi oxides and apatite in a hematite-calcite-altered groundmass. The albite phenocrysts make up about 10-15 modal% of the rock and are unevenly distributed through the rock, occurring almost in feldspar-rich bands in a few places. They are often subhedral or broken crystals, mainly less than 1.5mm long, and show slight sericite flecking. Occasional large angular and broken quartz phenocrysts have reacted with the groundmass to produce ragged, scalloped edges.Former mafic silicate phenocrysts are fairly rare, and are replaced by calcite and chlorite; the few preserved well enough to retain crystal outline could have been either hornblende or augite or both. Quite large FeTi oxide phenocrysts have exsolved skeletal ilmenite from magnetite, then broken down to leucoxene. Apatite microphenocrysts are common.

The rock is pervaded by a weak foliation picked out by discontinuous streaky masses of dirty brown microcrystalline calcite, at first glance (but not second!) resembling altered fiammae. The groundmass is exceptionally heterogeneous in texture, mineralogy and grainsize. It almost certainly crystallized from glassy ash, or welded ash, and is composed essentially of quartz and albite, with common calcite and hematite dusting, minor chlorite, and streaky pale sericite aligned along the weak foliation.

This sample is similar in many respects to 562321. It was probably a crystal tuff derived from an apatite-bearing andesite source similar some of the andesites described herein. It lacks, however, the chlorite alteration notable in 562321.

465154

SAMPLE NUMBER: 562324

SUMMARY:

This is a volcanogenic epiclastic sandstone derived from a felsic to intermediate volcanic source, and rich in albite crystal debris. It is very similar in most respects to 562322, though it has a less hematitized matrix.

HAND SPECIMEN:

This is a greyish epiclastic sandstone containing volcanic lithic fragments mainly less than a few mm long, and altered feldspar crystals. Spots of red hematite-magnetite alteration are developing in the groundmass.

THIN SECTION:

This sample is quite strongly similar to sample 562322 in many respects being a volcanogenic epiclastic sandstone rich in feldspar crystal debris, with an average grainsize around 0.5mm. However, three features are different enough from 562322 to warrant comment. Firstly, this sample contains around 2-3 modal% of quartz crystal fragments that were not present in 562322, implying a more rhyolitic source for this rock. Secondly, volcanic lithic fragments are better defined, and probably more abundant in this slide than in 562322. Most lithic fragments are sparsely albite-phyric formerly glassy felsic lavas. Thirdly, there is less hematite, and more chlorite in the matrix of this rock than in 562322.

165155

SAMPLE NUMBER: 562325

SUMMARY:

This is an epidosite derived from a fairly coarse-grained lithic crystal tuff that included andesitic to rhyolitic lava fragments and phenocrysts of quartz and albite. Intense quartz-epidote-hematite(?) alteration of the matrix of the sample, and many lava fragments, is notable.

HAND SPECIMEN:

This is a yellowish lithic tuff composed of abundant lava fragments, many brick red in colour and mainly less than 8mm across, in a strongly epidote-altered matrix.

THIN SECTION:

This rock in thin section is seen to be a very strongly altered former lithic crystal tuff, composed of fragments of glassy andesitic to dacitic lava, and less abundant crystal debris, mainly of quartz and albite. Fragments include sparsely plagioclase-phyric glassy dacite lava with devitrified groundmass that has crystallized to a mosaic quartz-feldspar texture, and also probably formerly glassy albite+mafic-phyric andesitic fragments. Angular quartz phenocryst fragments to almost 2mm long, and broken albite crystals occur between lithic fragments. Former FeTi oxide phenocrysts are strongly altered to leucoxene and magnetite, and small apatite phenocrysts are not uncommon.

Almost 75 modal% of this sample is altered to granular epidote or granular quartz, or intergrowths of these two minerals. The rock is appropriately called an epidosite, as fine-grained to relatively coarse-grained yellow epidote overprints entire rock fragments, whereas others are totally silicified. Quartz-epidote veins are common, and dark hematite- or magnetite alteration of the groundmass of many lithic fragments is common.

This sample was a lithic crystal tuff or fine-grained polymict lava breccia derived probably from a mixed andesite-rhyolite source.

165156

SAMPLE NUMBER: 562327

SUMMARY:

This is probably a crystal-lithic tuff that contained abundant albite and quartz crystal debris, and dacitic to rhyolitic lithic fragments from a felsic volcanic source terrain. The possibility that it is an epiclastic sandstone of similar derivation is difficult to rule out.

HAND SPECIMEN:

This is a dark brown crystal rich felsic lava or crystal tuff with strongly altered plagioclase phenocrysts and some quite large quartz phenocrysts.

THIN SECTION:

Thin section examination shows that this sample is a crystal rich crystal lithic tuff, with a possibly formerly (welded?) glassy matrix. Quartz and albite crystal fragments are about equally abundant, and probably each make up around 10 modal% of the rock. Quartz occurs as discrete crystals and as phenocrysts in the lithic fragments in the sample, up to 3mm across. Most quartz is rounded and reacted, or broken fragments of rounded crystals. Albite crystal debris is slightly smaller than quartz on average, falling mainly in the 0.5-1mm size range. Albite crystals are angular and broken fragments with sericite flecking. Small former mafic phenocrysts and crystal fragments are sparse, and chloritized, and altered FeTi oxide and apatite microphenocrysts are also present but not abundant. Lithic fragments make up probably in excess of 25 modal% of this sample. Most are altered formerly glassy felsic lavas with fine-grained quartz-albite and chlorite mosaic intergrowths replacing groundmass.

This rock, as for the previous one, has many petrographic features falling somewhere between an epiclastic sandstone and a crystal lithic tuff. The matrix of this sample is less heterogeneous and more 'originally glassy=looking' than that of the previous sample. In places, the matrix looks almost like altered fluidal-textured glass with flowlines wrapping around some lithic and crystal fragments, and giving a stronger impression of a tuff, than an epiclastic sediment. As in most of these sample, the former glass has crystallized to quartz-albite-chlorite. Chlorite is quite abundant in the matrix of this rock.

465157

SAMPLE NUMBER: 562328

SUMMARY:

This is a weakly chloritized formerly plagioclase+ hornblende-phyric andesitic lava.

HAND SPECIMEN:

This is a very dark brown plagioclase+mafic-phyric andesitic lava or crystal tuff.

THIN SECTION:

This sample is a texturally very well preserved plagioclase+ hornblende-phyric andesitic lava. It contains around 25 modal% of albitized plagioclase phenocrysts, some 2-3mm long, that are mainly sericite-free subhedral to euhedral prisms that often contain very fine reddish Fe oxide dust, imparting the reddish colour in hand specimen. Former hornblende phenocrysts are mainly around 1mm long but some are almost 3mm long euhedral prisms. They make up around 10-15 modal% of the sample, and are totally altered to a distinctive and unusual intergrowth of pale green chlorite, granular small Fe oxides, small clots of yellow epidote, and minor sphene or leucoxene. It is difficult to be sure, but some of these chlorite-Fe oxide-epidote pseudomorphs after hornblende might have been augite; a few crystal shapes noted were more reminiscent of augite than hornblende, although the majority were almost certainly the latter mineral. Apatite phenocrysts to almost 1mm long are quite common, and a notable feature of this sample. Former FeTi oxide microphenocrysts have altered to chlorite spottedby abundant tiny Fe oxide granules and leucoxene.

The groundmass of this sample has a vitrophyric texture. It was probably composed of abundant plagioclase laths and microlites, and possibly small hornblende quench crystals and FeTi oxides in a glassy mesostasis. Chlorite is abundant in the groundmass, to the extent that I would say the sample has been chloritized. Spots of granular epidote and patchy secondary quartz are quite common in the chloritized groundmass.

157

165158

SAMPLE NUMBER: 562329

SUMMARY:

This is a well-preserved plagioclase+augite-phyric andesitic lava with some hematite veining.

HAND SPECIMEN:

This is a very dark brown, porphyritic andesite lava with several notable bright red hematite veinlets.

THIN SECTION:

This is a texturally and mineralogically well-preserved plagioclase+ augite-phyric andesitic lava. Albitized plagioclase phenocrysts make up around 20-25 modal% of the sample, and ae mainly small (0.5-1.5mm long) euhedral prisms largely free of sericite alteration, but commonly flecked by pale green chlorite. Augite phenocrysts, many of them still unaltered, are mainly smaller than 1mm long, and make up around 10 modal% of the sample. They are sometimes partly to thoroughly chloritized. Small gabbroic nodules (to about 4mm across) composed of interlocking augite and albite prisms with effectively no groundmass, probably represent cognate inclusions plucked from the magma chamber walls and conduits during eruption of this sample. Small FeTi oxide microphenocrysts are not uncommon, and apatite microphenocrysts are also quite common, though not nearly as large as in the preceding sample.

The groundmass of this sample was vitrophyric, composed of abundant plagioclase microlites in glass; the latter has devitrified and partially crystallized as quartz, albite and chlorite, with minor epidote and leucoxene, and abundant tiny Fe oxide granules. Veinlets of chlorite form an open mesh through the sample, and several veins of strong oxidation and hematite alteration are notable. Within the veinlets, hematite occurs as narrow encrustations on phenocrysts, as well as tiny dusty particles scattered through the groundmass of the rock within the vein areas.

I have kept a small piece of this useful sample to analyze.

465159

SAMPLE NUMBER: 562330

SUMMARY:

This is an epiclastic sandstone derived largely from felsic volcanics, but containing some andesitic detritus.

HAND SPECIMEN:

This is a red, strongly hematite-altered quartz+feldspar- phyric felsic lithic tuff or epiclastic sediment containing several quite large (to 1.5cm across) lithic clasts of darker coloured lava.

THIN SECTION:

In thin section, this sample is quite clearly seen to be a volcaniclastic sandstone, derived principally from a felsic volcanic source. The rock is composed of closely packed 0.5-2mm sized grains of albite (50-60 modal%), subrounded volcanic lithic fragments (20-30 modal%), and subordinate quartz and chloritized mafic phenocrysts (~10 modal%) in about 5-10 modal% of fine-grained matrix. Albite crystals are blocky, slightly sericitized, show pink submicroscopic hematite dust alteration, and are almost certainly derived from dacitic to rhyolitic lavas or crystal tuffs. Identical albite phenocrysts occur in many of the lithic fragments in this rock, most of which are formerly glassy albite+quartz- phyric rhyodacitic to rhyolitic lavas; many have sugary-textured silicified groundmasses. However, the larger dark coloured lithic clast obvious in the hand specimen is a chloritized augite+plagioclase-phyric andesite. Discrete quartz phenocryst detrital grains in the rock are up to 4mm across, and mainly highly resorbed and reacted. FeTi oxide phenocrysts also are quite common as discrete detrital grains in this rock, and appear little altered. Several quite large apatite phenocrysts were noted.

The matrix of this sample has probably decreased in volume due to pressure solution and packing of the framework grains, and is composed of very fine-grained glassy ash that has crystallized to quartz and subordinate albite. There is no obvious sign of a component derived from the Tyennan pelitic metamorphics in this slide.

465160

SAMPLE NUMBER: 562331

SUMMARY:

This is a plagioclase+augite-phyric andesitic lava notably containing several pelitic metamorphic clasts of quartz-sericite schist.

HAND SPECIMEN:

This is a dark brown porphyritic andesite containing a few small lithic clasts of felsic lava(?).

THIN SECTION:

This is a texturally well-preserved andesitic lava. It consists of around 20 modal% of fairly thoroughly sericite-altered albitized plagioclase phenocrysts, mostly around 0.5-1mm long euhedral to subhedral crystals. Former augite phenocrysts 0.5-1mm long are less abundant (2-5 modal%) and are replaced by green chlorite, calcite and sphene or leucoxene. Several somewhat rounded euhedra of quartz about 0.2-0.8mm across are notable, and FeTi oxide microphenocrysts are not uncommon and have narrow rims of leucoxenic alteration. Well-formed prismatic apatite microphenocrysts, while not as abundant as in some other andesites in this set, are quite common.

The groundmass of this sample was formerly highly glassy, but now shows a well-developed fine-grained snowflake mosaic texture due to devitrification and crystallization to albite and quartz, with subordinate chlorite.

A striking feature of this sample is the presence of three lithic fragments of what appear to be quartz sericite schists, with flattened aggregates of quartz and layers of very fine-grained sericite replacing muscovite(?); small scale folding is obvious in these clasts. The presence of pelitic metamorphic clasts in a definite andesite lava demands that some Tyennan-type metamorphic basement underlies this area. I feel that the metamorphic clasts are too folded and flattened to be fragments of recrystallized Animal Creek-type greywacke.

165161

SAMPLE NUMBER: 562377 LOCATION: Gowrie 433020E 5406830N

SUMMARY: This is a quartz+feldspar+FeTi oxide-phyric formerly glassy rhyolitic lava that has suffered fairly strong sericite alteration.

HAND SPECIMEN: This is a pale brown porphyritic felsic lava with quartz and altered feldspar phenocrysts.

THIN SECTION:

This sample is a strongly sericitized quartz+feldspar-phyric rhyolitic lava. It consists of around 10 modal% of quite large (to 3mm long) quartz phenocrysts that are rounded and resorbed subhedral crystals with occasional chloritized melt inclusions. Former feldspar phenocrysts are somewhat less abundant but are totally sericitizedwith diffuse crystal margins that merge into the strongly sericitized groundmass. Small leucoxenized FeTi oxide phenocrysts are not uncommon, and often have tiny adhering zircon crystals attached.

The groundmass of this lava was glassy. It has recrystallized as an even-textured but relatively coarse-grained polygonal intergrowth of quartz and subordinate albite, and has been extensively sericitized, although the sericite shows no preferred orientation. Tiny spots of green chlorite are common in the groundmass but are insignificant modally compared with sericite.

465162

SAMPLE NUMBER: 562378 LOCATION: Gowrie 433680E 5406850N

SUMMARY: This is probably a very strongly weathered and clay-hematite -altered former polymict felsic to andesitic lava breccia.

HAND SPECIMEN: This is a strongly weathered and ferruginized, foliated epiclastic sediment or lava breccia with clasts/fragments up to at least 1cm diameter.

THIN SECTION:

This rock is difficult to diagnose with certainty due to the extent of alteration and weathering. It consists of streaked-out domains of quartz-feldspar after devitrified glass, in which large totally altered feldspar phenocrysts (to 2mm long) are quite abundant. These are altered to a dense mixture of Fe-stained sericite and green chlorite. Quite a few more chlorite-rich former phenocrysts may have been former mafic crystals. Only a few small rounded quartz phenocrysts are present. The groundmass texture is haighly variable, and with superimposed alteration is hard to diagnose. It was probably largely glassy, although whether the rock was polymict or a monomict lava breccia, or a vitroclastic epiclastic sediment is impossible to say. The groundmass is strongly sericitized, with the sericite being Fe-stained and forming a weak foliation. Much of the groundmass is permeated by a reddish Fe-stained clay, in which small grains of hematite are set.

This is probably a polymict felsic lava breccia, although the intense weathering-alteration make this conclusion tentative. The relatively abundant former mafic phenocrysts and paucity of quartz may indicate a more andesitic nature for this sample. Geochemistry might clarifiy this assertion.

165163

SAMPLE NUMBER: 562379 and 562390

LOCATION: Gowrie 433160E 5409940N

SUMMARY: These are strikingly similar strongly foliated former felsic crystal-lithic tuffs or epiclastic sediments derived from such tuffs. They would best be described as quartz-sericite -calcite schists. Calcite probably existed in the samples prior to the main foliation-forming deformation, which may have occurred in a major fault zone. Sample 562390 is considerably more weathered, the calcite being replaced by dirty red-brown ferruginous clay or limonitic material.

HAND SPECIMEN: Sample 562379 is a green, chloritic, quite strongly foliated epiclastic sediment, whereas 562390 is texturally identical but strongly weathered and reddish coloured..

THIN SECTION:

Sample 562379 is a quite strongly foliated epiclastic sediment or crystal lithic tuff composed mainly of angular quartz phenocryst fragments and stretched and flattened felsic lithic fragments in a sericite-calcite matrix. Quartz phenocryst fragments are mainly 0.5-1mm across and notably angular; they make up around 10 modal% of the sample and occur both as discrete crystal fragments and as phenocrystal inclusions in felsic lava fragments. A few possible former feldspar phenocrysts have been totally altered to calcite and sericite. The lithic fragments in this rock are mainly formerly glassy felsic lavas or felsic vitric crystal tuffs in which the groundmass has variably recrystallized to quartz and albite; some appear to have been silicified, being composed of very saccharoidal-textured polygonal quartz. Most are many times longer than they are thick, and they have clearly been stretched into the plane of the foliation. Leucoxenized FeTi oxide microphenocryst grains are not uncommon. Most of the lithic fragments have been quite closely packed together, and they are pervaded, mainly between adjacent fragments, by a dense and rather coarsely-crystalline sericitic mesh that defines a strong foliation. Calcite occurs as probably two generations; the earlier is dragged into the foliation and occurs as elongate crystal trains intergrown with sericite in the foliation. The second overprints the foliation and the lithic fragments, and makes up about 30-40 modal% of this sample. Chlorite is a subordinate alteration phase, although not uncommon; it occurs mainly intergrown with sericite and first-generation calcite.

More oxidized and weathered sample 562390 is remarkably similar to 562379 in every respect, except that the calcite is almost entirely replaced by dirty brown ferruginous clay or goethite-limonite minerals. Both these rocks were almost certainly epiclastic sediment sourced in felsic volcanics, or else felsic crystal-lithic tuffs. The foliation is to strong to see through to the correct alternative. Both samples have notably stronger foliation than most other samples in this set except 562380, and imply recrystallization in a fault/shear zone.

165164

SAMPLE NUMBER: 562380 LOCATION: Gowrie 432950E 5409960N

SUMMARY: This is a thoroughly recrystallized sericite-calcite schist probably derived from a felsic lava or tuff; it clearly comes from a fault zone.

HAND SPECIMEN: This is a very fine-grained, foliated and possibly carbonated tuff?.

THIN SECTION:

This is a very strongly foliated and probably totally recrystallized rock with little evidence remaining of its original identity. Two subhedral areas about 1mm across, now composed of coarse calcite, may have been former feldspar phenocrysts. The remainder of the sample is a foliated, dense intergrowth of sericite, fine-grained calcite and about 5 modal% of tiny granular angular opaques. This sample could originally have been a carbonate-altered felsic tuff or lava, or even a lava breccia. It must come from a high-strain zone, and it is equally possible that the calcite was introduced into the sample during the recrystallization in a fault zone

SAMPLE NUMBER: 562382 LOCATION: Gowrie 433285E 5410290N

SUMMARY: This is a strongly sericite-calcite-altered quartz-phyric rhyolitic vitric crystal tuff or epiclastic sandstone.

HAND SPECIMEN: This is a fractured and strongly sericite altered felsic lava(?) or tuff..

THIN SECTION:

This sample is a strongly quartz-phyric epiclastic sediment with a vitroclastic matrix or else a crystal vitric tuff. It consists of about 10-15 modal% of quartz grains, clearly of volcanic origin, that are mainly quite angular and broken crystal fragments. Some of these reach 4mm long. There is some suggestion that the quartz crystal fragments are concentrated in weakly defined bands. There were no obvious feldspar phenocrysts in this rock.

The matrix of this sample was definitely glassy, but it has devitrified and recrystallized to a rather heterogeneous textured matrix of quartz and minor albite which has been fairly thoroughly sericitized, producing a weak foliation. Calcite rhombs, mainly much less than 0.4mm long, are scattered throughout the rock, and are mainly replaced by dirty brown limonitic material or Fe-stained clay. The style of alteration of this sample is very similar to sample 562384. This rock was probably an epiclastic sediment composed of quartz crystal fragments in fine-grained glassy ash; however, there is no ruling out on available criteria that the rock may have been a vitric crystal tuff.

165

165166

SAMPLE NUMBER: 562383 LOCATION: Gowrie 433250E 5409950N

SUMMARY: This is a quartz+feldspar-phyric vitric crystal tuff very similar to sample 562382.

HAND SPECIMEN: This is a strongly altered mottled felsic lava or tuff with abundant chloritic or hematitic hairline fractures and thin quartz veinlets.

THIN SECTION:

This rock is almost identical to 562383, except that the groundmass (recrystallized glass) is somewhat finer-grained and contains far more abundant quartz veinlets. It is composed of quite angular fragments of quartz phenocrysts, mainly less than 0.5mm across, and less common similar sized albitized plagioclase phenocryst fragmments.

The fine-grained grounmdass contains small patches of slightly coarser-grained quartz-feldspar intergrowths, the whole lot having been originally glassy. The groundmass is transected by a fairly extensive and well-developed meshwork of pale sericite, that appears to form or follow two weak cleavage directions that intersect at about 40 degrees. The rock is cut by subparallel veinlets of strained quartz and subordinate albite almost perpendicular to the sericite orientation. Calcite occurs as dispersed concentrations of tiny rhombs that have been largely replaced by Fe-stained clay or goethite. The similarity between this sample and 562382 is so strong as to suggest that they come from the same unit, that was probably a rhyolitic vitric crystal tuff.

156

465167

SAMPLE NUMBER: 562384 LOCATION: Gowrie 433285E 5410010N

SUMMARY: This is a strongly sericite-hematite-calcite altered quartz-phyric, formerly glassy rhyolitic lava.

HAND SPECIMEN: This is a brown and red strongly altered and weathered weakly foliated epiclastic sediment or crystal tuff.

THIN SECTION:

This is a very difficult sample to diagnose with certainty due to the intense alteration. It consists of about 5-8 modal% of well-formed quite large (to 3mm across) quartz phenocrysts mainly with sharp terminations and little sign of magmatic or mechanical rounding, in a foliated sericitic groundmass in which islands of mosaic-textured quartz-albite intergrowth after devitrified glass are preserved. If former feldspar phenocrysts were present, the intense sericitic alteration has obliterated them so former crystal sites are no longer evident.

The formerly glassy groundmass is largely replaced by pale sericite that forms an intense wavy mesh through the rock, leaving isolated small islands of devitrified groundmass relatively unaltered. In several of these areas, excellent perlitic cracks are preserved. Associated with the sericite is fine-grained dispersed hematite (or altered hematite) and disseminated limonitized tiny calcite rhombs. Coarser-grained patches of calcite are also not uncommon overprinting the sericite.

465168

SAMPLE NUMBER: 562385 LOCATION: Gowrie 433610E 5410290N

SUMMARY: This is a well-preserved pumiceous vitric crystal tuff.

HAND SPECIMEN: This is a distinctive pinkish quartz-phyric tuff with large (to at least 4cm long) fragments of green devitrified pumice in a pink matrix.

THIN SECTION:

The distinctive and unambiguous pumice fragments in this sample are composed of about 5 modal% of well-formed quartz phenocrysts 0.5-1mm across in a fluidal-textured devitrified glassy matrix; it is not apparently vesicular. The pumice has devitrified to an even-textured quartz-albite intergrowth, fairly fine-grained, and streaked with a weak mesh of sericite parallel to the fluidal banding. The remainder of the rock consists of about 3-5 modal% of angular quartz phenocryst fragments and small felsic devitrified glassy felsic lava clasts in a rather heterogeneous matrix composed of intergrown quartz and albite with weak sericite meshing, that is definitely after replacing glass. Whether the glassy matrix was vitroclastic or welded is impossible to say, due to the extent of recrystallization. This is a relatively unaltered pumiceous vitric crystal tuff.

465169

SAMPLE NUMBER: 562389 LOCATION: Gowrie 432850E 5410070N

SUMMARY: This is probably a vitric crystal tuff that has suffered weak sericite alteration accompanying weak foliation development, and subsequent strong carbonate alteration.

HAND SPECIMEN: This is a carbonated and quite strongly fractured and altered felsic lava or lava breccia.

THIN SECTION:

The thin section of this sample confirms that it is a rock, but not much more can be determined for this very altered sample. It undoubtedly had a large felsic glassy component, that has recrystallized to granular fine-grained quartz and minor albite. Rare angular quartz phenocryst fragments are evident. The sample is cut by a weak sericite-defined foliation, but is overprinted by strong and abundant calcite alteration. Calcite occurs as clusters of rhombs mainly less than 0.2mm across, that are commonly altered to ferruginous clay. Several large angular fracture fillings of colourless chlorite are present, and are cross-cut by the carbonate alteration.

465170

SAMPLE NUMBER: 562391 LOCATION: Gowrie 433650E 5409050N
SUMMARY: This is a epiclastic sediment derived dominantly from a felsic volcanic terrain, with a high, recrystallized fine-grained vitric component. Other notable components in the source area included hornblende andesites and pelitic metamorphics
HAND SPECIMEN: This is a speckled pink and dark green crystal-rich tuff with a few obvious cherty (or formerly glassy lithic clasts).
THIN SECTION:

This rock is an an epiclastic sandstone or a very crystal-rich tuff. It consists of abundant detritial grains in a recrystallized formerly glassy ash matrix, probably reworked. The detritial grains include about 2-4 modal% of quartz phenocryst grains, about 50 modal% of former albitized plagioclase grains and about equal proportions (2-4 modal%) of felsic volcanic lithic fragments and chloritized mafic phenocrysts. Quartz grains are subhedral and partly resorbed, with recrystallized tiny melt inclusions; they are clearly derived from felsic lavasor tuffs, and are fractured and fragmented in situ(ie. individual grains are made up of jigsaw-fit pieces of strained quartz, often showing subgrain recrystallization along microshears). Albite phenocrysts are pinkish, presumably due to submicroscopic inclusions of Fe oxide dust, and are lightly sericitized. They are mainly fragments or entire blocky euhedra around 1mm long. Many albite grains have ragged, convolute margins where they abut matrix of this rock, and have clearly recrystallized or resorbed themselves to some extent. The great majority of the former mafic phenocryst detrital grains have hornblende, not augite shapes, and have been replaced by bright green chlorite and pale yellow-green epidote. Also common are highly altered quite large (to almost 1mm) former FeTi oxide grains that seem to have altered to chlorite, Fe oxide and leucoxene.

The lithic fragments in this sample, with one exception, are all formerly glassy sparsely plagioclase-phyric rhyolites and dacites with snowflake devitrification textures. Most are around 0.5-1mm across and vary from angular to subrounded. The exception is a foliated pelitic quartz-muscovite schist fragment that is probably derived from the Precambrian rocks bounding the MRV.

The matrix of this sample is heterogeneous and strongly recrystallized, with characteristic textures derived from devitrification and recrystallization of felsic glass. Some areas of recrystallization are relatively coarse-grained and appear to contain Kspar and quartz. There is no textural evidence for the former presence of glass shard material in this sample, but the extent of recrystallization makes this unlikely anyway. Weak chlorite alteration is dispersed through the matrix, and a few discontinuous veinlets of epidote are also present.

465171

SAMPLE NUMBER: 562392 GOWRIE PARK 433220E 5408860N

SUMMARY:

This is a plagioclase+augite+hornblende(?)-phyric meta-andesite lava with abundant epidote alteration of mafic phenocrysts, and quartz-epidote veining.

HAND SPECIMEN:

This is a brown porphyritic andesitic lava with phenocrysts of plagioclase and altered mafic minerals (augite), chloritic spots, cut by a vein 5mm wide composed of quartz and epidote.

THIN SECTION:

This is a texturally very well-preserved andesitic lava composed of around 20 modal% of albitized plagioclase phenocrysts and 5-8 modal% of altered augite phenocrysts set in a trachytic-textured groundmass. The albite phenocrysts are mainly single blocky prismatic crystals rarely larger than 2mm long, flecked by sericite, and occasionally occurring as multi-crystal clots. Augite phenocrysts are generally less than 1mm long, perfectly euhedral, and faithfully pseudomorphed by polycrystalline pale yellow to almost colourless epidote; no trace of fresh augite is preserved. A second set of former mafic phenocrysts, mainly rather elongate prisms, is replaced by green chlorite decorated by tiny leucoxene globules around crystal margins. Crystal shape, and the presence of Ti-bearing leucoxene in the alteration assemblage suggests that these mafic phenocrysts may have been hornblende. They make up less than 1 modal% of the sample. Small euhedral apatite microphenocrysts are not uncommon. Former FeTi oxide phenocrysts are also not uncommon, and are replaced by minor chlorite and abundant leucoxene.

The groundmass of this sample is composed of a felted trachyitic (flow-) -textured intergrowth of tiny acicular plagioclase microlites intergrown with subordinate chlorite after augite and tiny Fe oxide granules after FeTi oxides. Abundant plagioclase microphenocrysts grade in size down to the tiny groundmass microlites.

The rock is cut by a number of slightly different vein types, the most prominent being the 5mm-wide quartz-epidote vein composed of coarse-grained quartz in which are set pale yellow-green pleochroic discrete prisms of epidote and less abundant clusters of vermiform(1) tiny chlorite books. This vein appears to cut narrow fine-grained quartz veinlets, and be cut, in turn, by an excetionally sinuous vein composed of elongate, strained very fine-grained epidote with much more poorly.

developed crystal shapes than epidote in the thicker veinlet.

The amount of augite, the plagioclase phenocryst shapes, and the amount of epidote in the oxidized alteration assemblage all indicate that this is an andesitic lava.

465172

SAMPLE NUMBER: 562393 LOCATION: Gowrie 432660E 5409080N

SUMMARY: This was a quartz+feldspar-phyric welded vitric crystal tuff with a weakly banded groundmass and a single flattened pumice fragment. It shows minimal alteration.

HAND SPECIMEN: This is a dark brown well-preserved quartz+feldspar -phyric felsic lava with a few veinlets of dull red hematite(?) alteration.

THIN SECTION:

This is a texturally very well-preserved unusually strongly quartz+feldspar- phyric rhyolitic lava or vitric crystal tuff with a recrystallized formerly glassy groundmass. It is composed of around 10 modal% of each of quartz and albitized plagioclase phenocrysts, and rare chloritized mafic phenocrysts and leucoxene-altered FeTi oxide microphenocrysts, in an almost flow-banded groundmass. The quartz phenocrysts are mainly 0.5-1mm across and are strongly resorbed and rounded. Feldspar phenocrysts are also rather fragmented and fractured and are only lightly flecked by sericite. The few small former mafic phenocrysts now replaced by chlorite were probably augite.

The groundmass of this lava is well-preserved but unusual.. It is distinctly but weakly flow-banded microscopically, and clearly wraps around larger phenocrysts. It is fairly fine-grained mosaic-textured, and definitely replacing glass, but there are many spots throughout the slide where suggestions of former flattened glassy shards are present. In one area resembling an elongate flattened pumice fragment, the groundmass is quite different textured, being dominated by spherulitic quartz-feldspar rosettes.

Several features of this sample suggest that it was a genuine welded felsic vitric crystal tuff. Firstly, the vague flattened shardy shapes throughout the recrystallized groundmass. Second, the decidedly fluidal or banded nature of the groundmass; thirdly, the notably fragmentary nature of the phenocrystal feldspar in particular, and lastly, the single flattened pumice fragment.

465173

SAMPLE NUMBER: 562394 LOCATION: Gowrie 432500E 5408950N

SUMMARY: This is an unusually crystal-rich quartz+feldspar -phyric rhyolitic lava with an unusual texture in the formerly glassy groundmass. It shows no significant alteration.

HAND SPECIMEN: This is a pinkish abundantly quartz+feldspar-phyric felsic lava or crystal tuff.

THIN SECTION:

This sample is a formerly glassy, relatively crystal-rich quartz+feldspar-phyric rhyolitic lava. Albitized plagioclase phenocrysts make up about 10-12 modal% of this sample and are quite large (to 3mm long) and notably angular in many cases; most crystals seem to have suffered marginal resorption during recrystallization of the glassy groundmass. Quartz phenocrysts are only slightly less abundant than feldspar and are generally somewhat smaller and rather resorbed and rounded. Small FeTi oxide phenocrysts are not uncommon, but are altered to leucoxene and minor chlorite.

The most unusual feature of this sample is its groundmass. It is clearly derived from devitrification and recrystallization of glass, as over part of the slide, perlitic cracks are preserved and enhanced by concentrations of tiny Fe oxide dust particles. However, in other areas the groundmass has recrystallized to quite coarse-grained quartz-albite with intergrown crystal mosaics rather than intergrown tiny blebs of the same minerals, as is usually the case for devitrified glassy lavas in the MRV. These relatively coarse-grained domains at first resemble lithic clasts, but large phenocrysts extending from coarse-grained groundmass into normal very fine-grained groundmass, exclude that possibility. In addition, the coarse domains are rather elongate in many cases and meander across the slide almost like quartz veins. I have no idea how this texture develops, but it may be analogous to pegmatitic fabrics in more hydrous zones of large dykes and sills. Crystalline epidote is a minor phase overprinting these coarse domains, and small spots of green chlorite are sparsely distributed through all the groundmass.

173

465174

SAMPLE NUMBER: 562395 LOCATION: Gowrie 432490E 5409720N

SUMMARY: This is an epiclastic sandstone derived largely from felsic volcanics, and it is very similar to 562391, but with more detrital quartz and relatively strong chlorite-calcite alteration.

HAND SPECIMEN: This is a rather chloritic epiclastic sandstone containing abundant quartz and feldspar and a few prominent fine-grained felsic volcanic lithic clasts to almost 1cm across.

THIN SECTION:

In most respects, this sample is very similar to 562391, in that it is a coarse-grained epiclastic sandstone dominated by detrital grains of feldspar and quartz, with subordinate felsic volcanic clasts in a recrystallized probably originally glassy matrix. Notable differences from sample 562391 include: (1) that this sample contains two or three times more detrital volcanic quartz grains, and the correspondingly less abundant albitized plagioclase grains are toatlly sericitized, and in many places overprinted by calcite alteration. (2) former detrital mafic phenocryst grains are sparse and totally altered to chlorite, and not able to be identified (3) lithic fragments are less abundant and are mainly former felsic volcanics, but several slightly foliated muscovite-bearing schistose rocks are probably derived from Precambrian pelitic metamorphics.

The matrix of this rock is much finer-grained than that in 562391, and is also recrystallized to a very fine-grained quartzo-feldspathic material that is flecked by sericite and overprinted by fairly strong chlorite-alteration. Calcite alteration overprints the chloritic groundmass.

465175

SAMPLE NUMBER: 562396 LOCATION: Gowrie 432540E 5408480N

SUMMARY: This is a feldspar+quartz-phyric vitric crystal tuff that has variable recrystallized groundmass texture, including probably abundant Kspar.

HAND SPECIMEN: This is a pinkish-red quartz-phyric rhyolitic lava breccia with dark chlorite-quartz veinlets.

THIN SECTION:

In thin section, the brecciated nature of this sample is far less evident than in the hand specimen. The sample is composed of about 20 modal% albite phenocrysts and 2 modal% quartz phenocrysts in a sugary, texturally variable recrystallized glassy matrix. The feldspar phenocrysts are mainly angular, ragged pinkish albitized plagioclase full of submicroscopic Fe oxide dust; they are mainly 1-2mm long, and show reaction-ragged edges indicating resorption and recrystallization as the adjacent groundmass recrystallized from devitrified glass. Several feldspar phenocrysts show quite clear checquerboard-twinning, suggesting that they are Kspr. It is impossible to tell if these are primary, or were produced from albite during Kspar alteration of the groundmass. Quartz phenocrysts are resorbed and show long tunnels of recrystallized glassy groundmass invading the reacting crystals. Small FeTi oxide microphenocrysts have altered to leucoxene and chlorite.

The groundmass of this sample was originally glassy. It has recrystallized to fine- to variably coarse-grained quartz, albite and Kspar. The finer-grained areas are dominantly quartz, whereas the patchy development of coarser-grained groundmass is intergrown Kspar and possibly albite, with minor quartz. In many instances, these coarser-grained areas resemble discrete fragments. However, several examples were noted where they grade gradually into normal fine-grained groundmass, indicating that they are probably not fragments but simply more coarsely-recrystallized areas of former glassy groundmass. Chlorite occurs as very fine-grained flakes in local concentrations, and as meandering veinlets. It also occurs intergrown with quartz in narrow veinlets. This rock shows little alteration after the silica-Kspar recrystallization of the groundmass. It was probably a glassy rhyolitic lava or vitric crystal tuff; the degree of recrystallization of the groundmass precludes definitive assigment, but the variable groundmass texture and the rather angular and fractured phenocrysts suggest a pyroclastic origin.

465176

SAMPLE NUMBER: 562397 Gowrie Park 432670E 5408100N

SUMMARY:

This is an epiclastic sandstone composed dominantly of detrital volcanic quartz and albite phenocrysts, and is obviously derived from a local felsic volcanic terrain.

HAND SPECIMEN:

This is a mottled, quite strongly altered epiclastic sediment with prominent black chlorite segregations.

THIN SECTION:

This is clearly an epiclastic sandstone composed of abundant 0.5-2mm diameter grains of detrital volcanic quartz, feldspar and sparse lithic fragments in a reworked silty ash(?) matrix. More than 50 modal% of the detrital grains are blocky albite phenocrysts, many slightly pinkish due to fine hematite dust dispersed throughout, and partially replaced by pale sericite flakes. Somewhat less abundant, but still common are, detrital quartz grains, many still with one or more crystal faces preserved, often with chloritized melt inclusions and resorbed margins typical of volcanic quartz phenocrysts. A few former mafic phenocrysts replaced by chlorite were noted, and leucoxenized FeTi oxide phenocrysts are not uncommon. Lithic fragments are sparse, and are mainly snowflake-textured aphyric, formerly glassy dacite lava, although several clasts of polycrystalline vein quartz were noted.

The groundmass of this sample is composed of very fine-grained silt that is permeated by wispy pale sericite. It may be reworked volcanic ash, although no trace of altered glassy shards were noticed. Sericite concentrates in patches into felted masses almost defining a local foliation. Green chlorite is quite abundant as angular fracture fillings and irregular masses intergrown with sericite. The chlorite is abundant enough to suggest that the sample has suffered quite strong chloritic alteration.

This sample is clearly an epiclastic sediment derived almost entirely from a proximal felsic volcanic terrain. The abundance of detrital quartz phenocrysts is an interesting feature.

165177

SAMPLE NUMBER: 562398 Gowrie Park 432640E 5408050N

SUMMARY:

This is a highly plagioclase-phyric acid andesite or low-Si dacite lava with strong fine-grained, dispersed hematite alteration of the groundmass.

HAND SPECIMEN:

This is a dark red strongly hematite-altered andesitic lava with prominent clay-altered feldspar phenocrysts; the sample shows a contact against a paler coloured lava or tuff

THIN SECTION:

This sample appears to be the contact between a strongly plagioclase-phyric lava and a vitric crystal tuff. The lava makes up 90% of the slide. It is composed of at least 25 modal% of large prismatic albitized plagioclase euhedra, some to 5mm long, set in a very strongly hematite-altered groundmass. Most are strongly flecked by sericite, and rather rounded and resorbed-looking. Rows of melt inclusions in the plagioclase have been replaced by hematite. Plagioclase phenocrysts also occur in multi-crystal clots of smaller phenocrysts. A few small resorbed quartzphenocrysts are present, but there is no sign of the former presence of mafic silicate phenocrysts in this rock. Equigranular FeTi oxide phenocrysts are also replaced by messy brown-red hematite. Microphenocrysts of unusual brownish coloured apatite are not uncommon.

The groundmass of this sample was undoubtedly largely glassy, with tiny acicular plagioclase microlites relatively common in the glass. After devitrifying to a very fine-grained quartz-albite intergrowth, the groundmass was pervaded by Fe-rich solutions that precipitated hematite. The latter occurs as concentrations of microscopic flakes that define almost spherical areas less than 0.05mm across in which hematite is strongly concentrated, with core areas of much less abundant hematite, producing an almost 'oolitic' cellular texture.

This rock was originally probably an acid (high-Si) andesite to low-Si dacite compositionally. I have seen this same type of rock many times in the MRV (can't remember where except for one sample from the Noddy Ck Volcanics on Sorrell Peninsula); they have 5-8% Na2O.

The small section of lighter coloured rock present in the slide abutting the andesite is a lithic crystal tuff with angular volcanic quartz fragments and subrounded formerly glassy dacitic lava fragments in an altered glassy groundmass that is intensely sericitized.

177

465178

SAMPLE NUMBER: 562399 LOCATION: Gowrie 432610E 5408000N

SUMMARY: This is a plagioclase+augite+FeTi oxide-phyric formerly glassy andesite lava with quite strong hematite alteration as curving diffuse-edged bands through the groundmass.

HAND SPECIMEN: This is a brown plagioclase-phyric andesitic or slightly more felsic lava with dark chloritic spots and a prominent curved network of red hematite veinlets.

THIN SECTION:

This sample was a plagioclase+augite+FeTi oxide phyric lava with a totally glassy groundmass. About 8-10 modal% of the rock consists of albitized plagioclase phenocrysts that are quite often rather elongate prisms from 0.5-2mm long that are slightly flecked by sericite but which have deep red hematite defining fracture planes and occasional cleavage planes through the crystals. There is a striking variation in the albite phenocrysts from entirely rounded, to perfectly euhedral, suggesting some magma mixing was involved in the generation of this rock. This is supported by the presence of a single 2mm long very resorbed quartz xenocryst, that also has hematite along fractures. Former mafic phenocrysts are much less abundant than albite, probably making up only 2-3 modal% of the rock: they are totally replaced by calcite, chlorite and hematite, but have crystal shapes suggestive of augite predecessors. Both plagioclase and augite occur in tiny cognate gabbroic crystal clots up to several mm across. Former FeTi oxide microphenocrysts to almost 1mm across are replaced by leucoxene and chlorite and have unusual haloes of very fine-grained hematite. Several prominent apatite phenocrysts to almost 1mm long are also present.

The groundmass of this sample was entirely glassy. It has devitrified to an excellent, rather coarse-grained snowflake texture composed of quartz and albite riddled with tiny sericite flecks and hematite dust. The groundmass is transected by abundant curved 'fronts' up to 3mm wide composed of dense concentrations of very fine-grained red hematite that clearly replace groundmass rather than being vein/fracture fillings. They seem to represent diffusion fronts where Fe-bearing fluids permeating the rock dropped out hematite.

This is a silicic andesite lava probably produced by magma chamber mixing of an andesitic magma with a more felsic rhyolitic or dacitic magma. It has suffered fairly strong hematite alteration.

165179

SAMPLE NUMBER: 562400 LOCATION: Gowrie 433010E 5408970N

SUMMARY: This is a polymict felsic lava breccia containing at least two dominant varieties of felsic lava fragments with contrasting groundmass textures; it is foliated, with strong sericite-calcite alteration.

HAND SPECIMEN: This is a foliated sericitic felsic lava or lava breccia.

THIN SECTION:

This is a strongly calcite-sericite altered quartz-phyric felsic lava breccia. Two fragment types are obvious, although the transition from one type through matrix (if any) to the other is imperceptible due to the intense alteration In the commoner fragment type, quartz phenocrysts are more abundant, and were mainly less than 1mm long, and are now fractured and disrupted due to cleavage development; they probably made up less than 7-8 modal% of the rock. A few stretched totally sericitized plagioclase phenocrysts are present, drawn out into the foliation. Similar rare elongate and stretched chlorite clots may be former mafic phenocrysts, although their original identity cannot be determined. Hollow rims of former FeTi oxide microphenocrysts are not uncommon, filled by calcite and sericite. The less abundant fragment type contains notably more sericitized feldspar phenocrysts, and has a much finer-grained groundmass.

The groundmass of the more abundant fragment is a relatively coarse-textured snowflake intergrowth of quartz and subordinate albite, clearly replacing devitrified glass. It is pervaded by a dense mesh of pale sericite and lesser calcite that forms quite a strong foliation. The groundmass of the more feldspar-rich fragments is extremely fine-grained quartz-albite intergrowth flecked with tiny sericite flakes and also cut by coarse wavy sericite meshes.

This sample is a polymict felsic lava breccia strongly overprinted by sericite-calcite alteration during foliation development.

465130

Aberfoyle Resources Limited

EXPLORATION DIVISION

EXPLORATION LICENCE 11/88

GOWRIE PARK

TASMANIA

Progress Report for the Year

Ended 1 July, 1990

Volume 1 (Part 2)
Text and Appendices

90-3153
VOL 1B/2

Appendix 4A Lower Beulah Rock Chip Geochemistry

465132

LOWER BEULAH AREA SAMPLES

Sample	AMG Co-Ordinates	Field Description
513678 P G	448220E, 5409335N	Feldspar + mafic phenocryst volcanic.
513679 P G	448610E, 5409175N	As above.
513680 P G	448700E, 5409260N	Fine grained blue basalt.
513681 PG	448985E, 5409300N	Massive blue-green weakly feldspar phyric basalt lava with minor mafic phenocrysts and traces of disseminated pyrite.

ANALABS

52 Murray Road, Waratah, N.W. 7315 Tel. (004) 424560

ANALYTICAL REPORT No: 23.3.08.06488

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

Aberfoyle Resources Limited
Exploration Division
P.O. Box 952
Burnie Tasmania 7320

ORDER No: 8449

PROJECT:

DATE RECEIVED: 05/09/89

RESULTS REQUIRED: ASAP

No. OF PAGES OF RESULTS	DATE REPORTED	No. OF COPIES	TOTAL No. OF SAMPLES
1	29/09/89	1	4

STATE OF SAMPLES	PRE-TREATMENT							ANALYSIS		
REFER BELOW	SAMPLE NUMBERS	DRY	CRUSH	SPLIT	PULVERISE	SIEVE	OTHERS (or SEE REMARKS)	NONE	REFER TO ANALYSIS SECTION	PREPARATION	MET
	513678/81	Rc	Prep: 005,010,012,017						Cu,Pb,Zn,Ag/101,As/114		
	513678/81	Pu							CaO/104		
	513678/81	Pu							Ba,Cr,Zr,Ti,Ti:Zr/401		
	513678/81	Pu							Au,AuChk/309		

RESULTS TO:

Aberfoyle Resources Limited
Exploration Division
P.O. Box 952
Burnie Tasmania 7320

RESULTS TO:

REMARKS

STATE OF SAMPLES		ANALYSIS — PREPARATION				ANALYSIS — METHOD	
whole core	WC	perchloric acid	A1	cold acid	C	atomic absorption	AAS
split core	SC	hydrochloric acid	A2	specific sulphide	SS	x-ray fluorescence	XRF
cuttings	CU	nitric acid	A3	other mixed acids	MA	spectrography/photometry	SPEC
rock	RK	aqua regia	A4	alkaline attack	AA	colorimetry	COL
soil	SO	nitric perchloric	A5	volatilization	VO	chromatography	CHR
pulp	PU	fire assay	A6	ignition	IG	titration	TTN
water	WT	other or not specified	A7	pressed powder (XRF)	PP	other chemical means	CHEM
other	OT		A8	glass fusion (XRF)	GF	miscellaneous	MISC
stream sediment	SS					fluorimetry	FLUO
heavy mineral	HM					inductively coupled plasma	ICP

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ANALYTICAL DATA

SAMPLE PREFIX	REPORT NUMBER	REPORT DATE	CLIENT ORDER No.	PAGE
	23.3.08.06488	29/09/89	8449	1 OF 1

TUBE No.	SAMPLE No.	Cu	Pb	Zn	Ag	Au	AuChk	Ba	As	Cr
1	513678	<5	<5	35	<0.5	0.008	0.009	1300	4	
2	513679	90	30	360	<0.5	<0.008	-	1550	<2	
3	513680	<5	<5	390	<0.5	<0.008	-	1200	<2	
4	513681	30	95	520	<0.5	<0.008	-	830	6	
5										
6										
7										
8										
9										
10										
11										
12										
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14										
15										
16										
17										
18										
19										
20										
21										
22										
23	DETECTION	5	5	5	0.5	0.008	0.008	10	2	
24	UNITS	PPM	PPM	PPM	PPM	PPM	PPM	PPM	PPM	PP
25	METHOD	101	101	101	101	309	309	401	401	4

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

SAMPLE PREFIX	REPORT NUMBER	REPORT DATE	CLIENT ORDER No.	PAGE
	23.3.08.06488	29/09/89	8449	1 OF 1

TUBE No.	SAMPLE No.	Zr	Ti	Ti:Zr	CaO					
1	513678	190	1450	7.6	1888					
2	513679	160	4000	25.0	839					
3	513680	200	3750	18.8	6050					
4	513681	130	4100	31.5	37100					
5										
6										
7										
8										
9										
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17										
18										
19										
20										
21										
22										
23	DETECTION	5	50	0.1	25					
24	UNITS	PPM	PPM	-	PPM					
25	METHOD	401	401	199	104					

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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Appendix 4B. Beulah Barite Adit Rock Chip Geochemistry

Beulah Barite Adit samples

Sample number	Location	Field description
513501 P. G	15.5m	Green, strongly feldspar porphyritic andesite lava. (Field relations suggest this rock is an intrusive).
513502 P.G	52.0m	Strongly cleaved, micaceous black shale.
513503 P.G. (polished thin)	57.8m	White volcanic lava (dacite?) with common **sulphide minerals.**
513504 P G	58.0m	Weakly cleaved, black massive volcanic lava?, weakly silica? altered.
513505 P G	81.0m	White massive lava (dacite?) with occassional fuchsite spots.
513506 P G	87.0m	Fuchsite-calcite, sericite, heamatite altered volcaniclastic.
512507 P G	106.5m	White, fuchsite spotted ?dacite lava (similar to 513505.
513508 P G	121.0m	Heamatite altered volcaniclastic rock.
513510 P.G (polished thin)	58.0m	Strongly altered lava? with large **sulphide** vein
513509 G	89.0m	Fe stalactite.

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A division of MacDonald Hamilton & Co. Pty. Ltd.

Phone (09) 458 7999 52 Murray Road, Welshpool, W.A. 6106 Telex AA92560

ANALYTICAL REPORT No: 23.3.08.06315

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Aberfoyle Resources Exp. Division
P.O. Box 952
Burnie
Tasmania 7320

ORDER No. 7894 PROJECT

DATE RECEIVED 28/06/89 RESULTS REQUIRED ASAP

No. OF PAGES OF RESULTS	DATE REPORTED	No. OF COPIES	TOTAL No. OF SAMPLES
2	17/07/89	1	11

STATE OF SAMPLES REFER BELOW	SAMPLE NUMBERS	PRE-TREATMENT: DRY	CRUSH	SPLIT	PULVERISE	SIEVE	OTHER SEE REMARKS	NONE	ANALYSIS: REFER TO ANALYSIS SECTION	PREPARATION	METHOD
	513501/10,515376	RO	Prep: 009,011,012,013,016						Cu,Pb,Zn,Ag,Fe/101,As/114,Ca/104		
	513509	RO							Mn/101		
	513501/10,515376	RO							Ba,Cr,Zr,Ti/401,Au/309		
	513501/10,515376	RO	Prep: 009,011,012,013,016						Pb,Zn,Ag/104		

REMARKS

RESULTS TO

Aberfoyle Resources Exp. Division
P.O. Box 952
Burnie
Tasmania 7320

RESULTS TO

STATE OF SAMPLES		ANALYSIS — PREPARATION				ANALYSIS — METHOD	
whole core	WC	perchloric acid	A1	cold acid	CA	atomic absorption	AAS
split core	SC	hydrochloric acid	A2	specific sulphide	SS	x-ray fluorescence	XRF
cutting	CU	nitric acid	A3	other mixed acids	Ma	spectrophotometry	SPEC
rock	Ro	aqua regia	A4	alkaline attack	AA	colorimetry	COL
soil	SO	nitric-perchloric	A5	volatilization	VO	chromatography	CHR
pulp	PU	HF mixture	A6	ignition	IG	titration	TTN
water	WA	HF under pressure	A7	pressed powder (XRF)	PP	other chemicals means	CHEM
tissue	TI	fusion	A8	glass fusion (XRF)	GF	miscellaneous	MISC
stream sediment	SS					fluorescence	FLUOR
heavy mineral	HM					inductively coupled plasma	ICP

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ANALYTICAL DATA

SAMPLE PREFIX | REPORT NUMBER | REPORT DATE | CLIENT ORDER No. | PAGE

		23.3.08.06315		24/07/89	7894		1 OF 2		
TUBE No.	SAMPLE No.	Cu	Pb	Pb	Zn	Zn	Ag	Ag	Au	Ba
1	513501	110	110	-	260	-	<0.5	-	<0.008	55
2	513502	90	370	-	5300	-	<0.5	-	<0.008	245
3	513503	115	1020	-	1300	-	2.0	-	<0.008	690
4	513504	140	780	-	470	-	8.0	-	<0.008	245
5	513505	10	20	-	155	-	<0.5	-	<0.008	16
6	513506	10	15	-	95	-	<0.5	-	<0.008	220
7	513507	10	15	-	180	-	0.5	-	<0.008	6
8	513508	50	255	-	310	-	<0.5	-	<0.008	215
9	513509	15	675	-	6000	-	<0.5	-	<0.008	150
10	513510	200	-	1.07	-	6.16	-	26	<0.008	585
11	~~513576~~ 513665	30	260	-	660	-	<0.5	-	<0.008	165
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23	DETECTION	5	5	0.05	5	0.05	0.5	2	0.008	
24	UNITS	PPM	PPM	%	PPM	%	PPM	PPM	PPM	PP
25	METHOD	101	101	104	101	104	101	104	309	

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

SAMPLE PREFIX | REPORT NUMBER | REPORT DATE | CLIENT ORDER No. | PAGE

		23.3.08.06315		24/07/89	7894			OF 2 2
TUBE No.	SAMPLE No.	As	Cr	Zr	Ti	Fe	Mn	Ca	CaO %
1	513501	8	120	140	7500	8.13	–	50	0.007
2	513502	39	210	75	3150	19.20	–	1450	0.2029
3	513503	16	40	220	1200	3.56	–	425	0.0595
4	513504	31	55	140	1150	9.66	–	1525	0.2133
5	513505	6	80	95	3550	7.90	–	37500	5.2462
6	513506	3	80	95	3350	4.81	–	50700	7.0929
7	513507	.3	70	95	2950	7.10	–	10800	1.5109
8	513508	4	160	110	4350	9.14	–	1200	0.1679
9	513509	3	80	<5	75	32.70	8.70	4175	0.5841
10	513510	44	40	170	890	1.65	–	75	0.0105
11	515376	17	20	160	1000	2.13	–	325	0.0455
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23	DETECTION	1	5	5	50	0.05	0.05	25	
24	UNITS	PPM	PPM	PPM	PPM	%	%	PPM	
25	METHOD	114	401	401	401	101	101	104	

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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Appendix 4C. Beulah Barite Adit Channel Sample Geochemistry

BEULAH BARITE
ADIT

465192

0-5	515363	
5-10	515364	
10-15	515365	
15-20	515366	
20-25	515367	
25-30	515368	
30-35	515369	2 SAMPLE BAGS
35-40	515370	2 SAMPLE BAGS
40-45	515371	2 SAMPLE BAGS
45-50	515372	2 SAMPLE BAGS
50-55	515373	2 SAMPLE BAGS
55-60	515374	2 SAMPLE BAGS
60-65	515375	
67-70	515376B	
70-75	515377	
75-80	515378	
80-85	515379	
85-90	515380	
90-95	515381	
95-100	515382	
100-105	515383	
105-110	515384	
110-115	515385	
115-121	515386	

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Phone (09) 458 7999 52 Murray Road Welshpool W.A. 6106 Telex AA92560
FAX: 004 53 8890

ANALYTICAL REPORT No: 23.3.08.06295

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Aberfoyle Resources Exp. Division
P.O. Box 952
Burnie
Tasmania 7320

ORDER No.	PROJECT
7866	

DATE RECEIVED	RESULTS REQUIRED
21/06/89	ASAP

No. OF PAGES OF RESULTS	DATE REPORTED	No. OF COPIES	TOTAL No. OF SAMPLES
4	11/07/89	1	24

SAMPLE NUMBERS	PRE-TREATMENT: DRY	CRUSH	SPLIT	PULVERISE	SIEVE	OTHER SEE REMARKS	NONE	ANALYSIS: REFER TO ANALYSIS SECTION	PREPARATION	METHOD
515363/86	SO	Prep: 01						Cu,Pb,Zn,Ag,Fe/101,As/114		
515363/86	SO							Ca/104		
515363/86	SO							Ba,Cr,Zr,Ti/401,Au/309		

RESULTS TO

Aberfoyle Resources Exp. Division
P.O. Box 952
Burnie
Tasmania 7320

RESULTS TO

REMARKS

GOURLEY PARK.

ADIT

STATE OF SAMPLES

core	WC
core	SC
	CH
	SO
	PU
	VA
	U
stream sediment	SS
heavy mineral	HM

ANALYSIS — PREPARATION

perchloric acid	A1	cold acid extraction	CA
hydrochloric acid	A2	specific sulphide	SS
nitric acid	A3	other mixed acids	MA
aqua regia	A4	alkaline attack	AA
nitric-perchloric	A5	volatilization	VO
HF mixture	A6	ignition	IG
HF under pressure	A7	pressed powder (XRF)	PP
fusion	A8	glass fusion (XRF)	GF

ANALYSIS — METHOD

atomic absorption	AAS
X-ray fluorescence	XRF
spectrophotometry	SPEC
colorimetry	COL
chromatography	CHR
titration	TITN
other chemicals means	CHEM
miscellaneous	MISC
fluorescence	FLUOR
inductively coupled plasma	ICP

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465194

ANALABS

A Division of Macdonald Hamilton & Co. Pty. Ltd.

ANALYTICAL DATA

SAMPLE PREFIX	REPORT NUMBER	REPORT DATE	CLIENT ORDER No.	PAGE
	23.3.08.06295	11/07/89	7866	1 OF 4

BE No.	SAMPLE No.	Cu	Pb	Zn	Ag	Au	Ba	As	Cr	Zr
	515363	95	30	150	<0.5	<0.008	630	7	440	120
	515364	95	55	195	<0.5	<0.008	300	1	520	130
	515365	115	60	210	<0.5	<0.008	500	7	770	140
	515366	100	95	470	<0.5	<0.008	750	6	400	130
	515367	130	15	650	<0.5	<0.008	670	6	280	110
	515368	85	<5	645	<0.5	<0.008	1050	4	280	130
	515369	45	70	515	<0.5	<0.008	1950	27	160	180
	515370	115	150	640	<0.5	<0.008	2100	69	280	170
	515371	80	790	240	2.0	<0.008	2600	140	370	200
	515372	100	540	435	1.5	<0.008	2650	74	160	190
	515373	140	530	1900	1.0	<0.008	3000	51	210	140
	515374	80	750	1950	3.5	<0.008	5200	47	190	220
	515375	130	105	935	1.5	<0.008	2150	55	190	150
4	515376	20	130	1800	<0.5	<0.008	2000	13	190	150
5	515377	10	<5	685	<0.5	<0.008	2200	3	170	140
6	515378	10	120	730	<0.5	<0.008	1600	11	190	110
	515379	10	25	1700	<0.5	<0.008	1600	5	180	70
	515380	10	<5	155	<0.5	<0.008	1800	2	200	95
9	515381	35	115	160	<0.5	<0.008	6150	5	200	100
0	515382	15	85	145	<0.5	<0.008	820	<1	210	95
21	515383	20	15	165	<0.5	<0.008	800	1	85	100
2	515384	20	55	170	<0.5	<0.008	710	2	90	100
23	515385	15	55	150	<0.5	<0.008	1100	3	110	110
24	515386	25	60	200	<0.5	<0.008	750	<1	160	120
5										

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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435195

ANALABS

A Division of Macdonald Hamilton & Co. (Pty.) Ltd.

ANALYTICAL DATA

SAMPLE PREFIX	REPORT NUMBER	REPORT DATE	CLIENT ORDER No.	PAGE
	23.3.08.06295	11/07/89	7866	2 OF 4

BE o.	SAMPLE No.	Cu	Pb	Zn	Ag	Au	Ba	As	Cr	Zr
1										
2										
5										
4										
6										
16										
21										
2	DETECTION	5	5	5	0.5	0.008	10	1	5	5
23	UNITS	PPM	PPM	PPM	PPM	PPM	PPM	PPM	PPM	PPM
24	METHOD	101	101	101	101	309	401	114	401	401
5										

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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465196

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A Division of Macdonald

ANALYTICAL DATA

SAMPLE PREFIX	REPORT NUMBER	REPORT DATE	CLIENT ORDER No.	PAGE
	23.3.08.06295	11/07/89	7866	3 OF 4

BE	SAMPLE No.	Ti	Ca	Fe	Ti/Zr	Rock TYPE		CaO %		
	515363	4150	1150	4.15	34.6	GwSh	0-5	.1609		
	515364	4950	875	5.55	38.1	GwSh	5-10	.1224		
	515365	4900	2350	6.00	35.0	Aint	10-15	.3288		
	515366	4400	1100	7.65	33.8	GwSh	15-20	.1539		
	515367	4850	3625	8.50	44.1	GwSh	20-25	.5071		
	515368	4900	625	6.50	37.7	GwSh	25-30	.0874		
	515369	4600	3500	5.25	25.5	GwSh	30-35	.4896		
	515370	4000	225	5.85	23.5	GwSh	35-40	.0315		
	515371	4000	300	2.45	20.0	GwSh	40-45	.0420		
	515372	3150	775	2.25	16.6	Dvc	45-50	.1084		
	515373	3800	1250	6.90	27.1	GwSh	50-55	.1749		
	515374	1850	950	5.35	8.4	RxVt	55-60	.1329		
	515375	2350	950	7.45	15.7	Dvc	60-65	.1329		
	515376	2750	1025	7.45	18.3	Dvc	67-70	.1434	513665	
	515377	4400	1500	8.85	31.4	Avc	70-75	.2098	65-67m	
	515378	4050	2000	10.50	36.8	Al	75-80	.2798	(JDS 6315)	
	515379	3050	3450	12.50	43.6	Avc	80-85	.4826		
	515380	3450	34300	6.10	36.3	Avc	85-90	4.7986		
	515381	3500	36600	6.00	35.0	Avc	90-95	5.1203		
	515382	3400	39500	5.45	35.8	Al	95-100	5.5260		
	515383	3500	47600	4.85	35.0	Al	100-105	6.6592		
	515384	3600	34900	5.35	36.0	Avc	105-110	4.8825		
	515385	3450	44200	5.80	31.4	Avc	110-115	6.1836		
	515386	4450	13100	6.30	37.1	Al	115-121	1.8327		

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 Macdonald Hamilton & Co. Pty. Ltd.

ANALYTICAL DATA

SAMPLE PREFIX	REPORT NUMBER	REPORT DATE	CLIENT ORDER No.	PAGE
	23.3.08.06295	11/07/89	7866	4 OF 4

BE o.	SAMPLE No.	Ti	Ca	Fe						

465198

Appendix 4D. DDH BB6 Petrology Sample Geochemistry

BEULAH BARITE DRILLHOLE BB6 SAMPLES

Sample	Depth	Field Description
513653	14.0m	Fine-medium grained ?andesitic lava? or volcaniclastic? Traces of disseminated red flecks (haematite?).
513654	26.8m	Massive pale green lava, andesitic or dacitic? Sericitised and weakly? silicified.
513655	57.0m	Haematite altered, foliated lava breccia? with common altered lava fragments. Some quartz filled ?vesicles.
513656 (polished thin)	87.0m	Pyrite-Chlorite? veined fine grained siliceous 'crackle' ?dacite lava. Large vein of quartz and ?barite with some pyrite cuts rock. (Sample pyrite for $\delta^{34}S$ sulphur isotopes).
513657	140.5m	?Dacite lava, with minor fragments and weak silica and ?chlorite alteration. Some fuchsite spots.
513658	175.0m	Massive, fine grained ?felsic lava with sericitised feldspar phenocrysts.
512659 (polished thin)	229.8m	Massive, fine grained, green ?basalt lava. Moderately to strongly calcite altered. Cut by haematite + calcite vein.
513660	268.25m	Moderately to strongly calcite altered green ?basalt.
513661	310.4m	Weakly haematite altered moderately calcite altered basalt lava with common small fine grained fragments. Cut by minor calcite vein.
513662	317.3m	Similar to 661 but with abundant fragments. Fragments are weakly haematite altered.
513663 (polished thin)	365.0m	Massive, fine grained, dacitic or andesitic lava, cut by common pyrite and quartz veinlets. Weakly silica altered?, not calcitic. (Sample pyrite for $\delta^{34}S$ sulphur isotopes).
513664	397.0m	Weakly sheared? dacitic lava breccia or volcaniclastic? Not calcite altered.

465200

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Analabs (WA) Pty. Ltd.

[illegible] Murray Road, Welshpool, W.A. 6106 Telex AA92560

ANALYTICAL REPORT No. 23.3.08.06421

[illegible] IN CONJUNCTION WITH THE ACCOMPANYING ANALYTICAL DATA

Aberfoyle Resources Exp. Division
P.O. Box 952
Burnie
Tasmania 7320

ORDER No.	PROJECT
8288	

DATE RECEIVED	RESULTS REQUIRED
15/08/89	ASAP

No. OF PAGES OF RESULTS	DATE REPORTED	No. OF COPIES	TOTAL No. OF SAMPLES
1	06/09/89	1	12

DATE OF SAMPLES / ROW	SAMPLE NUMBERS	PRE-TREATMENT: DRY	CRUSH	SPLIT	PULVERISE	SIEVE	OTHER (SEE REMARKS)	NONE	ANALYSIS: REFER TO ANALYSIS SECTION	PREPARATION	METHOD
	513653/664	CG	Prep: 009,016,013						Cu,Pb,Zn,Ag/101,As/114,CaO,Na2O,K2O,MgO/104		
	513653/664	CG							Au,AuChk/309		
	513653/664	CG							Ba,Cr,Zr,Ti/401		
	513653/664	CG							Ba/406		

RESULTS TO

Aberfoyle Resources Exp. Division
P.O. Box 952
Burnie
Tasmania 7320

RESULTS TO

REMARKS

BB-6
PET.

STATISTICS: SAMPLES	ANALYSIS — PREPARATION	ANALYSIS — METHOD
ole core TC it co tin ock soil pulp th st strea heav	pressed powder fusion cold acid specific digestion other	atomic absorption X-ray fluorescence AAS XRF

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A Division of [illegible]

ANALYTICAL DATA

SAMPLE PREFIX	REPORT NUMBER	REPORT DATE	CLIENT ORDER No.	PAGE
	23.3.08.06421	06/09/89	8288	1 OF 1

TUBE No.	SAMPLE No.	CaO	Na2O	K2O	MgO					
1	513653	8.81	0.70	1.93	3.73					
2	513654	5.64	0.73	3.43	3.07					
3	513655	7.97	0.48	3.33	4.15					
4	513656	9.16	0.41	1.53	3.78					
5	513657	5.62	0.50	4.27	3.37					
6	513658	6.25	3.32	2.17	1.71					
7	513659	6.65	3.33	0.66	4.81					
8	513660	7.32	1.60	2.37	2.77					
9	513661	11.30	0.71	3.58	3.53					
10	513662	9.96	1.43	3.75	2.97					
11	513663	4.77	2.05	2.45	2.82					
12	513664	6.81	0.97	3.17	2.77					
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23	DETECTION	0.01	0.01	0.01	0.01					
24	UNITS	%	%	%	%					
25	METHOD	104	104	104	104					

200

465202

ANALABS

A Division of Macdonald Hamilton & Co. Pty. Ltd.

ANALYTICAL DATA

SAMPLE PREFIX	REPORT NUMBER	REPORT DATE	CLIENT ORDER No.	PAGE
	23.3.08.06421	06/09/89	8288	1 OF 2

TUBE No.	SAMPLE No.	Cu	Pb	Zn	Ag	Au	AuChk	Ba	Ba	As
1	513653	45	10	75	<0.5	<0.008	<0.008	1800	-	10
2	513654	25	15	95	<0.5	<0.008	-	1700	-	3
3	513655	20	15	85	<0.5	<0.008	-	5550	-	2
4	513656	40	25	75	<0.5	<0.008	-	>6500	8.1	6
5	513657	25	10	90	<0.5	0.008	-	1050	-	15
6	513658	40	20	215	<0.5	<0.008	-	530	-	3
7	513659	20	20	110	<0.5	<0.008	-	480	-	3
8	513660	15	15	140	<0.5	<0.008	-	510	-	3
9	513661	5	10	90	<0.5	<0.008	-	650	-	3
10	513662	5	15	55	<0.5	<0.008	-	590	-	3
11	513663	90	80	155	3.0	<0.008	-	480	-	8
12	513664	25	10	135	<0.5	<0.008	-	860	-	2
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23	DETECTION	5	5	5	0.5	0.008	0.008	10	0.1	1
24	UNITS	PPM	PPM	PPM	PPM	PPM	PPM	PPM	%	PPM
25	METHOD	101	101	101	101	309	309	401	406	114

Results in ppm unless otherwise specified

- element present, but concentration too low to measure
- element concentration is below detection limit
- element not determined

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465203

ANALABS

A Division of Macdonald Hamilton & Co. Pty. Ltd.

ANALYTICAL DATA

SAMPLE PREFIX	REPORT NUMBER	REPORT DATE	CLIENT ORDER No.	PAGE
	23.3.08.06421	06/09/89	8288	2 OF 2

TUBE No.	SAMPLE No.	Cr	Zr	Ti %						
1	513653	65	100	2400						
2	513654	75	100	2650						
3	513655	110	85	2600						
4	513656	<5	55	2400						
5	513657	200	110	3700						
6	513658	20	120	4000						
7	513659	110	110	3750						
8	513660	110	100	3700						
9	513661	50	85	2600						
10	513662	65	85	2800						
11	513663	85	110	3350						
12	513664	95	85	3050						
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23	DETECTION	5	5	50						
24	UNITS	PPM	PPM	PPM						
25	METHOD	401	401	401						

Results in ppm unless otherwise specified

F element present, but concentration too low to measure

< element concentration is below detection limit

- element not determined

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465204

Appendix 4E. DDH BB6 Core Grind Geochemistry

~~2013~~ 465205

CORE GRIND SAMPLING - ~~MACKINTOSH / HATFIELD~~ GOWRIE PARK

HOLE No. BB6

Cu, Pb, Zn, Ag, Au, As, Ba, Cr, Ti, Zr, CaO, MgO, Na_2O, K_2O

DATE 11-Aug-89

No.	SAMPLE NUMBER	INTERVAL	ELEMENTS REQUIRED	ST	SAMPLE NUMBER	INTERVAL	ELEMENTS REQUIRED
1	513601	0-10.0m	A.1b?		~~29~~ 513633	240-250	B.1.
2	" 602	10.0-19.5	A.1b?		513634	250-257.6	B.1
3	" 603	19.5-33.0	AD? 1.		" 635	257.6-261	D? 1.
4	" 604	33.0-35.4	A.1v.		" 636	261-271	AB.1.
5	" 605	35.4-45	AD.1.		" 637	271-277	AB.1
6	" 606	45.0-51.0	D? 1.		" 638	277-287	B.1.
7	" 607	51-58.0	A.1.		" 639	287-297	B.1.
8	" 608	58-65.0	D? 1.		" 640	297-307	B.1
9	" 609	65-76.0	A.1.		" 641	307-313	B.1b
10	" 610	76.0-82.7	D? 1		" 642	313-323.5	B.1b
11	" 611	82.7-88.6	D.1. "crackle"		" 643	323.5-328	AB.1v. 1b?
12	" 612	88.6-96.0	D.1		" 644	328-337	AB.1.
13	" 613	96-108.0	D.1		" 645	337-343	AB.1
14	" 614	STANDARD ✱			" 646	343-350	AB.1
15	" 615	108.0-109.5	A.1v.		" 647	350-360	AD? 1b
16	" 616	109.5-121.5	D.1		" 648	360-370	A.1.
17	" 617	121.5-129.5	AD. 1b?		" 649	370-376	AD.1.
18	" 618	129.5-134.0	A.D.1.		" 650	376-382	AD.1b.
19	" 619	134-139.0	D? 1.		" 651	382-390	AD? 1.
20	" 620	139-148.0	Y.1v		" 652	390-400	AD.1b
21	" 621	148-156	D.1.			E.O.H 400.0m.	
22	" 622	156-166	AD? 1.				
23	" 623	166-176	D.1.				
24	" 624	176-185	D.1.				
25	" 625	185-190	D.1b.				
26	" 626	190-196	AD.1b.				
27	" 627	196-203	AD.1.1b?				
28	" 628	203-211	A.1b				
29	" 629	211-220	B.1.				
30	" 630	220-230	B.1.				
31	" 631	STANDARD ✱					
32	" 632	230-240	B.1				

ANALABS

ANALYTICAL REPORT No. 23508.0648A

	ORDER No.	PROJECT
Aberfoyle Resources Limited Exploration Division P.O. Box 952 Burnie Tasmania 7320	8445	Gowrie Park
	DATE RECEIVED	RESULTS REQUIRED
	05/09/89	ASAP

No. OF PAGES OF RESULTS	DATE REPORTED	No. OF COPIES	TOTAL No. OF SAMPLES
3	11/10/89	1	52

STATE OF SAMPLES		PRE-TREATMENT							ANALYSIS		
(REFER BELOW)	SAMPLE NUMBERS	DRY	CRUSH	SPLIT	PULVERISE	SIEVE	OTHER (SEE REMARKS)	NONE	REQUIRED ANALYSIS (SEE SECTIONS)	PREPARATION	METHOD
	513601/652	CB	Prep: 010,016						Cu,Pb,Zn,Ag/101,As/114		
	513601/652	CB							CaO,MgO,Na2O,K2O/104		
	513601/652	CB							Ba,Cr,Zr,Ti/401		
	513601/652	CB							Au,AuChk/309		
	513601/652	CB							Ti:Zr/199		

RESULTS TO

R. de Bomford
Aberfoyle Resources Limited
Exploration Division
P.O. Box 952
Burnie Tasmania 7320

RESULTS TO

REMARKS

BB-6

STATE OF SAMPLES	ANALYSIS PREPARATION	ANALYSIS METHOD
whole core split core cuttings	Perchloric acid Hydrochloric acid Nitric acid	AAS XRF SPEC COL GRAV TITR ISE OES OTHER

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465207

ANALABS

A Division of Inchcape Inspection and Testing Services Australia Pty Ltd

ANALYTICAL DATA

SAMPLE PREFIX	REPORT NUMBER	REPORT DATE	CLIENT ORDER No.	PAGE
	23.3.08.06486	11/10/89	8445	1 OF 6

TUBE No.	SAMPLE No.	Cu	Pb	Zn	Ag	Au	Ba	Ba	As	Cr
1	513601 0-10	30	30	180	<0.5	<0.008	2750	-	<2	60
2	513602 10-19.5	5	10	90	<0.5	<0.008	1850	-	<2	75
3	513603 19.5-33	10	15	95	<0.5	<0.008	1750	-	<2	60
4	513604 33-35.4	10	15	100	<0.5	<0.008	1700	-	2	70
5	513605 35.4-45	10	15	100	<0.5	<0.008	2800	-	<2	75
6	513606 45-51	10	10	90	<0.5	<0.008	1800	-	<2	70
7	513607 51-58	5	20	90	<0.5	<0.008	2450	-	<2	65
8	513608 58-65	5	15	80	<0.5	<0.008	>5000	0.80	<2	80
9	513609 65-76	5	10	65	<0.5	<0.008	4100	-	<2	80
10	513610 76-82.7	20	15	85	<0.5	<0.008	>5000	1.15	<2	90
11	513611 82.7-88.6	10	25	105	<0.5	<0.008	>5000	0.99	6	60
12	513612 88.6-96	20	30	100	<0.5	<0.008	1350	-	10	65
13	513613 96-108	15	5	100	<0.5	<0.008	1650	-	<2	75
14	513614 SD	125	175	2350	<0.5	<0.008	1050	-	20	1050
15	513615 108-109.5	10	5	90	<0.5	<0.008	2450	-	<2	85
16	513616 109.5-121.5	20	10	120	<0.5	<0.008	1250	-	7	95
17	513617 121.5-129.5	30	10	165	<0.5	<0.008	1300	-	<2	80
18	513618 129.5-134	25	5	145	<0.5	<0.008	940	-	<2	65
19	513619 134-139	20	15	160	<0.5	<0.008	770	-	<2	90
20	513620 139-148	25	20	110	<0.5	<0.008	750	-	9	160
21	513621 148-156	10	5	110	<0.5	<0.008	740	-	<2	140
22	513622 156-166	25	10	125	<0.5	<0.008	600	-	5	80
23	513623 166-176	30	10	170	<0.5	<0.008	640	-	<2	85
24	513624 176-185	30	20	135	<0.5	<0.008	410	-	2	80
25	513625 185-190	15	10	125	<0.5	<0.008	480	-	<2	120

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

AUTHORISED OFFICER

2nd

465208

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A Division of Inchcape Inspection and Testing Services Australia Pty Ltd

ANALYTICAL DATA

SAMPLE PREFIX | REPORT NUMBER | REPORT DATE | CLIENT ORDER No. | PAGE

		23.3.08.06486		11/10/89	8445		2 OF 6		
TUBE No.	SAMPLE No.	Cu	Pb	Zn	Ag	Au	Ba	Ba	As	Cr
1	513626 190-196	20	5	100	<0.5	<0.008	660	-	<2	120
2	513627 196-203	15	5	65	<0.5	<0.008	560	-	<2	130
3	513628 203-211	30	5	110	<0.5	<0.008	520	-	<2	120
4	513629 211-220	25	10	145	<0.5	<0.008	460	-	<2	100
5	513630 220-230	15	15	125	<0.5	<0.008	470	-	<2	120
6	513631 STD	130	190	2450	<0.5	0.009	1000	-	15	1000
7	513632 230-240	25	15	160	<0.5	<0.008	350	-	<2	110
8	513633 240-250	20	15	180	<0.5	<0.008	480	-	2	120
9	513634 250-257.6	15	5	125	<0.5	<0.008	640	-	<2	90
10	513635 257.6-261	20	5	130	<0.5	<0.008	710	-	<2	85
11	513636 261-271	25	10	145	<0.5	<0.008	520	-	<2	95
12	513637 271-277	25	20	160	<0.5	<0.008	360	-	6	75
13	513638 277-287	25	5	140	<0.5	<0.008	600	-	2	100
14	513639 287-297	30	10	150	<0.5	<0.008	640	-	<2	80
15	513640 297-307	30	5	150	<0.5	<0.008	470	-	<2	85
16	513641 307-313	5	<5	110	<0.5	<0.008	630	-	<2	95
17	513642 313-323.5	5	5	85	<0.5	<0.008	630	-	<2	85
18	513643 323.5-328	15	<5	125	<0.5	<0.008	800	-	<2	90
19	513644 328-337	25	15	195	<0.5	<0.008	380	-	<2	120
20	513645 337-343	25	10	465	<0.5	<0.008	680	-	<2	100
21	513646 343-350	25	15	320	<0.5	<0.008	1200	-	<2	120
22	513647 350-360	20	10	170	<0.5	<0.008	1100	-	<2	110
23	513648 360-370	25	20	165	<0.5	<0.008	670	-	<2	120
24	513649 370-376	20	20	270	<0.5	<0.008	1450	-	<2	120
25	513650 376-382	30	40	385	<0.5	<0.008	500	-	<2	95

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 Inchcape Inspection and Testing Services Australia

ANALYTICAL DATA

SAMPLE PREFIX — REPORT NUMBER — REPORT DATE — CLIENT ORDER No. — PAGE

	23.3.08.06486	11/10/89	8445	3 OF 6

TUBE No.	SAMPLE No.	Cu	Pb	Zn	Ag	Au	Ba	Ba	As	Cr
1	513651 382-390	25	15	140	<0.5	<0.008	660	-	<2	110
2	513652 390-400.0	25	<5	125	<0.5	0.012	980	-	<2	100
3										
4										
5										
6										
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19										
20										
21										
22										
23	DETECTION	5	5	5	0.5	0.008	10	0.01	2	5
24	UNITS	PPM	PPM	PPM	PPM	PPM	PPM	%	PPM	PPM
25	METHOD	101	101	101	101	309	401	403	401	401

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

SAMPLE PREFIX | REPORT NUMBER | REPORT DATE | CLIENT ORDER No. | PAGE

	23.3.08.06486	11/10/89	8445	4 OF 6

TUBE No.	SAMPLE No.	Zr	Ti	Ti:Zr						
1	513601	120	4450	37.1						
2	513602	100	3200	32.0						
3	513603	110	3250	29.5						
4	513604	110	3450	31.4						
5	513605	110	3900	35.5						
6	513606	110	3550	32.3						
7	513607	100	3200	32.0						
8	513608	110	3650	33.2						
9	513609	100	3350	33.5						
10	513610	110	3750	34.1						
11	513611	120	3750	31.3						
12	513612	110	3700	33.6						
13	513613	100	4050	40.5						
14	513614 SD	80	2300	28.7						
15	513615	110	3900	35.5						
16	513616	110	4100	37.3						
17	513617	100	3350	33.5						
18	513618	100	3450	34.5						
19	513619	100	3350	33.5						
20	513620	110	3900	35.5						
21	513621	100	3800	38.0						
22	513622	100	3650	36.5						
23	513623	110	4200	38.2						
24	513624	100	3750	37.5						
25	513625	90	3200	35.5						

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 Inchcape Inspection and Testing Services Australia Pty Ltd

ANALYTICAL DATA

SAMPLE PREFIX | REPORT NUMBER | REPORT DATE | CLIENT ORDER No. | PAGE

	23.3.08.06486	11/10/89	8445	5 OF 6

TUBE No.	SAMPLE No.	Zr	Ti	Ti:Zr						
1	513626	100	3750	37.5						
2	513627	85	3650	42.9						
3	513628	95	3750	39.5						
4	513629	100	3700	37.0						
5	513630	100	3700	37.0						
6	513631 STD	85	2300	27.1						
7	513632	90	3450	38.3						
8	513633	100	3850	38.5						
9	513634	100	3850	38.5						
10	513635	100	3950	39.5						
11	513636	100	3800	38.0						
12	513637	110	4150	37.7						
13	513638	100	3800	38.0						
14	513639	95	3700	38.9						
15	513640	110	3650	33.2						
16	513641	100	3350	33.5						
17	513642	100	3350	33.5						
18	513643	120	3650	30.4						
19	513644	100	3800	38.0						
20	513645	110	3800	34.5						
21	513646	100	3800	38.0						
22	513647	100	3700	37.0						
23	513648	100	3800	38.0						
24	513649	110	3850	35.0						
25	513650	80	3000	37.5						

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

SAMPLE PREFIX | REPORT NUMBER | REPORT DATE | CLIENT ORDER No. | PAGE

		23.3.08.06486	11/10/89	8445	6 OF 6

TUBE No.	SAMPLE No.	Zr	Ti	Ti:Zr						
1	513651	100	3550	35.5						
2	513652	110	3700	33.6						
3										
4										
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6										
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18										
19										
20										
21										
22										
23	DETECTION	5	50	0.1						
24	UNITS	PPM	PPM	-						
25	METHOD	401	401	199						

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 Inchcape Inspection and Testing Services Australia Pty. Ltd.

ANALYTICAL DATA

SAMPLE PREFIX	REPORT NUMBER	REPORT DATE	CLIENT ORDER No.	PAGE
	23.3.08.06486	11/10/89	8445	1 OF 3

TUBE No.	SAMPLE No.	CaO	MgO	Na2O	K2O					
1	513601	0.05	0.13	0.88	2.54					
2	513602	5.67	2.50	0.57	2.72					
3	513603	5.40	3.02	0.59	2.75					
4	513604	6.07	2.92	0.55	3.92					
5	513605	5.34	3.12	0.56	3.47					
6	513606	6.60	3.47	0.42	2.93					
7	513607	5.85	3.23	0.43	3.23					
8	513608	3.60	2.52	0.51	3.71					
9	513609	6.02	2.98	0.47	3.94					
10	513610	5.02	2.98	0.57	2.81					
11	513611	5.76	2.70	0.77	2.60					
12	513612	5.97	2.57	0.65	2.57					
13	513613	4.62	2.65	0.53	2.87					
14	513614	3.79	7.56	3.61	1.28					
15	513615	3.37	2.42	0.44	3.53					
16	513616	5.19	3.05	0.54	2.92					
17	513617	5.19	2.79	0.38	2.89					
18	513618	6.11	2.72	0.33	3.01					
19	513619	6.41	3.56	0.45	3.30					
20	513620	6.69	3.37	0.48	3.41					
21	513621	8.04	3.58	0.44	3.41					
22	513622	8.72	3.28	0.93	2.51					
23	513623	8.62	2.92	1.15	2.90					
24	513624	6.59	2.60	1.06	2.31					
25	513625	7.76	3.32	0.29	2.86					

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 Inchcape Inspection and Testing Services Australasia Pty Ltd

ANALYTICAL DATA

SAMPLE PREFIX	REPORT NUMBER	REPORT DATE	CLIENT ORDER No.	PAGE
	23.3.08.06486	11/10/89	8445	2 OF 3

TUBE No.	SAMPLE No.	CaO	MgO	Na2O	K2O					
1	513626	6.44	3.03	0.31	4.18					
2	513627	5.40	3.22	0.43	2.70					
3	513628	6.69	2.98	0.52	2.83					
4	513629	6.73	2.84	1.71	2.02					
5	513630	7.15	3.86	2.88	0.77					
6	513631	3.55	7.44	3.38	1.05					
7	513632	8.63	3.61	2.56	0.72					
8	513633	7.90	3.60	3.18	0.92					
9	513634	7.00	2.88	2.40	1.35					
10	513635	6.06	2.45	0.78	1.58					
11	513636	7.27	3.00	2.04	1.63					
12	513637	6.55	2.55	1.55	1.76					
13	513638	9.04	3.28	2.32	1.34					
14	513639	9.30	3.58	2.60	0.98					
15	513640	8.62	2.37	2.31	2.46					
16	513641	7.90	2.70	1.59	2.65					
17	513642	8.60	2.80	1.35	2.99					
18	513643	6.35	3.32	1.51	2.70					
19	513644	6.39	3.65	2.22	1.46					
20	513645	8.88	2.64	2.49	1.55					
21	513646	7.26	3.47	2.49	1.31					
22	513647	6.87	3.17	0.57	3.33					
23	513648	6.70	3.02	2.02	2.59					
24	513649	6.94	2.54	1.63	2.39					
25	513650	3.53	2.32	0.77	1.52					

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 Intertek Inspection and Testing Services Australia Pty Ltd.

ANALYTICAL DATA

SAMPLE PREFIX	REPORT NUMBER	REPORT DATE	CLIENT ORDER No.	PAGE
	23.3.08.06486	11/10/89	8445	3 OF 3

TUBE No.	SAMPLE No.	CaO	MgO	Na2O	K2O					
1	513651	7.55	2.42	1.00	3.34					
2	513652	7.43	2.70	0.81	3.52					
3										
4										
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6										
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11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23	DETECTION	0.01	0.01	0.01	0.01					
24	UNITS	%	%	%	%					
25	METHOD	104	104	104	104					

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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Appendix 4F. Mt. Roland Rock Chip Geochemistry

SAMPLES SUBMITTED FOR PETROLOGY

Mount Roland Surface Samples

Sample	Location	Comments
513692	437050E, 5410250N	Adit rock pile sample
513693 (Polished thin section)	437050E, 5410250N	Adit rock pile sample
513695	437050E, 5410100N	(CRA line 1100E, 863N)
513696	437060E, 5410110N	(CRA line 1100E, 875N)
513697	437140E, 5410180N	
513698	437190E, 5410170N	
513699	437115E, 5410180N	(CRA line 1100E, 1025N o/c in creek)
513700	437100E, 5410185N	(o/c in creek, 20m down from above)
513901	437090E, 5410190N	(o/c in creek 6m down from above)
513902	437070E, 5410210N	(o/c in creek 25m down from above)
513903 (Polished thin section)	437050E, 541020N	Outcrop from adit mouth

562009 P,G	645E,806N	Andesitic/basaltic lava?
562010 P,G	600E,900N	Andesite Lava?
562011 P,G	800E,1400N	Andesite Lava?
562012 P,G	800E,680N	Silicified Rhyolite?
562013 P,G	1000E,225N	Sericite altered Dacite lava?
562014 P,G	1000E,920N	Carbonate-?silica altered Rhyolitic intrusive?
562015 P,G	1000E,1051N	As above
562016 P,G	1200E,850N	Quartz and feldspar volcaniclastic or lava?
562017 P,G	1200E,560N	Bedded quartz sandstone. Cambrian volcaniclastic?
562018 P,G	1400E,475N	Flow banded Dacite?
562019 geochem only	1200E,350N	Dacitic or andesitic lava?

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A division of MacDonald Hamilton & Co. (W.A.) Pty. Ltd.
Phone (09) 458 7999 52 Murray Road, Welshpool, W.A. 6106 Telex AA92560
FAX: 004 518897

ANALYTICAL REPORT No: 23.3.08.06508

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

Aberfoyle Resources Limited
Exploration Division
P.O. Box 952
Burnie Tasmania 7320

ORDER No.	PROJECT
8467	Gowrie Park

DATE RECEIVED	RESULTS REQUIRED
13/09/89	ASAP

No. OF PAGES OF RESULTS	DATE REPORTED	No. OF COPIES	TOTAL No. OF SAMPLES
1	03/10/89	1	14

SAMPLE NUMBERS	PRE-TREATMENT: DRY	CRUSH	SPLIT	PULVERISE	SIEVE	OTHER (SEE REMARKS)	NONE	ANALYSIS: REFER TO ANALYSIS SECTION	PREPARATION	METHOD
513692/700,513901/905	RC	Prep: 005,009,016						Cu,Pb,Zn,Ag/101		
513692/700,513901/905	RC							Au,AuChk/309		
513692/700,513901/905	RC							Ba,As,Cr,Zr,Ti/401		
513692/700,513901/905	RC							Ti:Zr/199		
513903/905	RC							K2O,MgO,CaO,Na2O/104		

RESULTS TO

R. de Bomford
Aberfoyle Resources Limited
Exploration Division
P.O. Box 952
Burnie Tasmania 7320

RESULTS TO

REMARKS

STATE OF SAMPLES — ANALYSIS — PREPARATION — ANALYSIS — METHOD

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

ANALYTICAL DATA

SAMPLE PREFIX	REPORT NUMBER	REPORT DATE	CLIENT ORDER No.	PAGE
	23.3.08.06508	03/10/89	8467	1 OF 2

JBE No.	SAMPLE No.	Cu	Pb	Pb	Zn	Zn	Ag	Ag	Au	AuChk
	513692	210	-	0.97	-	1.39	-	<2	0.456	0.453
	513693	65	-	1.75	-	4.82	-	9	0.708	-
3	513694	10	110	-	820	-	<0.5	-	<0.008	-
	513695	75	165	-	180	-	<0.5	-	<0.008	-
3	513696	40	160	-	75	-	<0.5	-	<0.008	-
	513697	<5	30	-	220	-	<0.5	-	<0.008	-
	513698	<5	35	-	170	-	<0.5	-	<0.008	-
)	513699	20	25	-	215	-	<0.5	-	<0.008	-
	513700	10	45	-	390	-	<0.5	-	<0.008	-
0	513901	10	30	-	240	-	<0.5	-	<0.008	-
1	513902	5	2300	-	3400	-	<0.5	-	0.018	-
2	513903	10	2850	-	2300	-	<0.5	-	0.016	-
3	513904	<5	2250	-	2050	-	<0.5	-	<0.008	-
4	513905	700	-	1.79	-	0.14	-	12	0.016	-
5										
6										
7										
8										
9										
20										
1										
22										
23	DETECTION	5	5	0.01	5	0.01	0.5	2	0.008	0.008
4	UNITS	PPM	PPM	%	PPM	%	PPM	PPM	PPM	PPM
25	METHOD	101	101	104	101	104	101	104	309	309

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 Inchcape Inspection and Testing Services Australia Pty. Ltd.

ANALYTICAL DATA

SAMPLE PREFIX	REPORT NUMBER	REPORT DATE	CLIENT ORDER No.	PAGE
	23.3.08.06508	03/10/89	8467	2 OF 2

JBE	SAMPLE No	Ba	As	Cr	Zr	Ti				
	513692	840	<2	<5	120	1800				
	513693	540	<2	9	150	1550				
	513694	520	<2	25	85	3650				
	513695	550	10	<5	120	2700				
	513696	680	15	6	140	3000				
	513697	970	<2	35	160	3100				
	513698	850	<2	30	150	2500				
	513699	1200	<2	45	170	3000				
	513700	2450	<2	35	150	2850				
	513901	930	<2	40	140	2500				
	513902	2250	<2	15	160	2750				
2	513903	1100	<2	45	160	3300				
3	513904	350	<2	<5	100	670				
4	513905	420	60	<5	200	1450				
5										
6										
7										
8										
9										
20										
1										
22										
23	DETECTION	10	2	5	5	50				
24	UNITS	PPM	PPM	PPM	PPM	PPM				
25	METHOD	401	401	401	401	401				

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 Inchcape Inspection and Testing Services Australia Pty. Ltd.

ANALYTICAL DATA

SAMPLE PREFIX	REPORT NUMBER	REPORT DATE	CLIENT ORDER No.	PAGE
	23.3.08.06508	03/10/89	8467	1 OF 1

SAMPLE No.	Ti:Zr	K2O	MgO	CaO	Na2O				
513692	15.0	-	-	-	-				
513693	10.3	-	-	-	-				
513694	42.9	-	-	-	-				
513695	22.5	-	-	-	-				
513696	21.4	-	-	-	-				
513697	19.4	-	-	-	-				
513698	16.7	-	-	-	-				
513699	17.6	-	-	-	-				
513700	19.0	-	-	-	-				
513901	17.9	-	-	-	-				
513902	17.2	-	-	-	-				
513903	20.6	5.09	2.90	1.86	505				
513904	6.7	2.39	1.06	1.15	370				
513905	7.2	2.71	1.03	0.42	674				
DETECTION	0.1	0.01	0.01	0.01	25				
UNITS	-	%	%	%	PPM				
METHOD	199	104	104	104	104				

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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23.3.08.06811

Aberfoyle Resources Limited
Exploration Division
P.O. Box 952
Burnie Tasmania 7320

9384 | Gowrie Park

DATE ACCEPTED: 23/01/90 | RESULTS REQUIRED: ASAP

No. OF PAGES OF RESULTS	DATE REPORTED	No. OF COPIES	TOTAL No. OF SAMPLES
1	31/01/90	1	11

REFER BELOW	SAMPLE NUMBERS	PRE-TREATMENT: DRY	Other	Split	Pulv.	Sieve	OTHER & FIRE ASSAY REMARKS	MONO	ANALYSIS: ANALYSIS SELECTION	PREPARATION	METHOD
	K5620,09/19	RC	Prep: 006,010,011,012,013,016						Cu,Pb,Zn,Ag/101		
	K5620,09/19	RC							Ba,As,Cr,Zr,Ti/401		
	K5620,09/19	RC							K20,MgO,CaO,Na20/104		
	K5620,09/19	RC							Ba/403		

RESULTS TO

R. de Bomford
Aberfoyle Resources Limited
Exploration Division
P.O. Box 952
Burnie Tasmania 7320

RESULTS TO

REMARKS

GOWRIE PARK
MT. ROLAND
ROCK CHIPS.

STATE OF SAMPLES		ANALYSIS PREPARATION		ANALYSIS METHOD	
whole core	WC	perchloric acid	AT	total acid	GA
split core	SC	hydrochloric acid	AC	specific sulphide	SS
cutting	CU	nitric acid	AN	other mixed acids	MA
rock	RO	aqua regia	AR	alkali fusion	AF
soil	SO		AS		
pulp	PU		AP		
water	WA		AW		
tissue	TI		AT		
stream sediment	SS		AS		
heavy mineral	HM				

		atomic absorption	AAS
		x-ray fluorescence	XRF
		spectrophotometry	SPEC
		colorimetry	COL
			CHR
			TRN
			CHEM
			MISC
			FLUOR

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ANALYTICAL DATA

SAMPLE PREFIX	REPORT NUMBER	REPORT DATE	CLIENT ORDER No.	PAGE
	23.3.08.06811	31/01/90	9384	1 OF 1

TUBE No.	SAMPLE No.	Cu	Pb	Zn	Ag	Ba	Ba	As	Cr	Zr
1	562009	285	525	450	0.8	1100	-	<2	30	1
2	562010	10	20	400	0.5	550	-	3	65	1
3	562011	5	120	225	<0.5	1600	-	<2	15	1
4	562012	30	40	40	0.5	2050	-	5	40	
5	562013	40	40	70	<0.5	550	-	<2	20	1
6	562014	55	10	130	<0.5	>2500	0.39	2	35	1
7	562015	75	25	175	<0.5	1350	-	<2	40	1
8	562016	30	80	230	2.0	990	-	5	75	1
9	562017	5	25	30	<0.5	480	-	3	140	2
10	562018	10	10	35	<0.5	730	-	3	20	1
11	562019	10	5	130	<0.5	700	-	<2	35	1
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23	DETECTION	5	5	5	0.5	10	0.01	2	5	
24	UNITS	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	p
25	METHOD	101	101	101	101	401	403	401	401	4

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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465225

ANALABS

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

ANALYTICAL DATA

SAMPLE PREFIX	REPORT NUMBER	REPORT DATE	CLIENT ORDER No.	PAGE
	23.3.08.06811	31/01/90	9384	1 OF 1

TUBE No.	SAMPLE No.	Ti	K20	MgO	CaO	Na20				
1	562009	2300	4.53	1.49	0.14	0.04				
2	562010	3100	4.96	2.68	0.22	0.07				
3	562011	3800	5.57	3.70	0.33	2.95				
4	562012	2400	0.17	0.13	0.07	0.02				
5	562013	3500	4.19	0.77	0.07	0.05				
6	562014	3050	2.17	5.00	2.69	3.47				
7	562015	7450	3.13	2.30	1.83	4.18				
8	562016	2800	5.18	2.02	0.10	0.78				
9	562017	3200	3.99	0.41	0.05	0.08				
10	562018	3750	6.87	0.64	0.04	0.05				
11	562019	3500	5.05	2.14	0.10	0.08				
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23	DETECTION	50	0.01	0.01	0.01	0.01				
24	UNITS	ppm	%	%	%	%				
25	METHOD	401	104	104	104	104				

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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Appendix 4G. DDH MR1 (CRA) Geochemistry

465227

MOUNT ROLAND DRILLHOLE (MR1)

Sample	Depth	
513682 P G	38.2m	typical of 31m to 40m
513683 P G	55.0m	typical of 53m to 60m
513684 P G	74.3m	typical of 63m to 76m and 82 to 88m
513685 P G	79.7m	typical of 76m to 82m and 100 to 105m
513686 P G	108.5m	typical of 106 to 124m
513687 S (Polished section)	120.7m	Sulphur isotope sample.
513688 P G	135.3m	typical of 130 to 140m
513689 P G S?	157.5m	possible sulphur isotope sample?
513690 P G S	194.5m	
513691 P G	228.0m	typical of ~ 200m to E.O.H.

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465228

ANALABS

ANALYTICAL REPORT No. 23.3.08.06487

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

Aberfoyle Resources Limited
Exploration Division
P.O. Box 952
Burnie Tasmania 7320

ORDER No.	PROJECT
8448	

DATE RECEIVED	RESULTS REQUIRED
05/09/89	ASAP

No. OF PAGES OF RESULTS	DATE REPORTED	No. OF COPIES	TOTAL No. OF SAMPLES
1	26/09/89	1	9

PRE-TREATMENT								ANALYSIS		
LAB. NUMBERS	DRY	CRUSH	PULP	SPLIT	SIEVE	OTHER (SPECIFY) REMARKS	PHONE RESULTS	REQUIRED ANALYSES (SEE CODE)	PREPARATION	METHOD
<513,682/86,688/91	Dr	Prep: 005,010,011,012,017						Cu,Pb,Zn,Ag/101,As/114		
<513,682/86,688/91	Pu							CaO,K2O,Na2O,MgO/104		
<513,682/86,688/91	Pu							Ba,Cr,Zr,Ti,Ti:Zr/401		
<513,682/86,688/91	Pu							Au,AuChk/309		

RESULTS TO

Aberfoyle Resources Limited
Exploration Division
P.O. Box 952
Burnie Tasmania 7320

RESULTS TO

REMARKS

STATE OF SAMPLES	ANALYSIS PREPARATION	ANALYSIS METHOD

2?1

465229

ANALABS

A Division of Macdonald Hamilton & Co. Pty. Ltd.

ANALYTICAL DATA

SAMPLE PREFIX	REPORT NUMBER	REPORT DATE	CLIENT ORDER No.	PAGE
	23.3.08.06487	26/09/89	8448	1 OF 1

JBE No.	SAMPLE No.	Cu	Pb	Zn	Ag	Au	AuChk			
	513682	10	<5	155	<0.5	<0.008	-			
2	513683	30	40	45	<0.5	0.022	0.022			
	513684	45	<5	50	<0.5	<0.008	-			
	513685	25	<5	125	<0.5	<0.008	-			
5	513686	65	<5	75	<0.5	<0.008	-			
	513688	35	60	140	<0.5	0.011	-			
	513689	35	105	125	<0.5	0.013	-			
	513690	75	<5	140	<0.5	<0.008	-			
	513691	120	<5	120	<0.5	<0.008	-			
10										
12										
15										
20										
22										
	DETECTION	5	5	5	0.5	0.008	0.008			
	UNITS	PPM	PPM	PPM	PPM	PPM	PPM			
25	METHOD	101	101	101	101	309	309			

Results in ppm unless otherwise specified

T = element present, but concentration too low to measure

< = element concentration is below detection limit

- = element not determined

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ANALYTICAL DATA

SAMPLE PREFIX	REPORT NUMBER	REPORT DATE	CLIENT ORDER No.	PAGE
	23.3.08.06487	26/09/89	8448	1 OF 1

JBE No.	SAMPLE No.	Ba	As	Cr	Zr	Ti	Ti:Zr			
	513682	370	6	25	140	3200	22.9			
2	513683	1350	35	30	95	2200	23.2			
3	513684	970	<2	65	120	2250	18.8			
	513685	1100	<2	50	130	2550	19.6			
6	513686	560	9	140	130	2600	20.0			
	513688	950	15	50	120	2550	21.2			
	513689	600	15	65	120	2500	20.8			
	513690	550	15	55	130	2700	20.8			
	513691	1150	6	70	100	2750	27.5			
10										
12										
15										
20										
22										
	DETECTION	10	2	5	5	50	0.1			
	UNITS	PPM	PPM	PPM	PPM	PPM	–			
25	METHOD	401	401	401	401	401	401			

ppm unless otherwise specified
element present; but concentration too low to measure
element concentration is below detection limit
element not determined

AUTHORISED OFFICER

465231

ANALABS

A Division of Macdonald Hamilton & Co. Pty Ltd.

ANALYTICAL DATA

SAMPLE PREFIX	REPORT NUMBER	REPORT DATE	CLIENT ORDER No.	PAGE
	23.3.08.06487	26/09/89	8448	1 OF 1

BE No.	SAMPLE No.	CaO	K2O	Na2O	MgO					
	513682	1.79	2.86	2.05	3.83					
2	513683	5.32	3.83	0.08	3.03					
	513684	2.98	3.98	0.08	2.72					
	513685	3.46	4.22	0.43	3.73					
	513686	1.87	5.30	0.12	1.44					
	513688	4.13	3.37	0.08	2.90					
	513689	3.04	3.90	0.06	3.71					
	513690	1.61	3.05	0.13	4.43					
	513691	5.57	2.82	1.44	4.21					
9										
12										
3										
4										
5										
6										
8										
9										
0										
1										
22										
3	DETECTION	0.01	0.01	0.01	0.01					
24	UNITS	%	%	%	%					
5	METHOD	104	104	104	104					

Results in parts unless otherwise specified

E = element present, but concentration too low to measure

X = element concentration is below detection limit stated

— = element not determined

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465232

Appendix 4H. Gowrie Park Rock Chip Geochemistry

465233

Cethana-Gowrie Park Drillcore

Sample	Location	Comments
513904 (Polished thin section)	GP C3 37.5m	Galena veined altered volcanic. Sample submitted for lead isotope analysis
513905 (Polished thin section)	GP 5 81.65m	Prominent galena in quartz-sericite volcanic. Sample submitted for lead isotope analysis

465234

Sample No:	AMG Co-Ordinates		Description
562301 P G	437840E	5410620N	Se alt str fp Hbl A .1.?
562302 P G	437850E	5410550N	wk Hmt alt Fg fp + mafic phyric A lb or vlcl (frags to 2cm)
562303 P G	437970E	5410470N	y-br ext fg A? lb? (com frags to 2cm)
562304 G	437240E	5410120N	y-gr fg ext Si Py alt Hb A. 1.
562305 P G	437150E	5409150N	Se alt Fol^{d}? Fp + q vlc, bdd vlcl? or f.bnd 1?
562306 P G	437170E	5409090N	mg str fp mnr q vlcl Sst.
562307 P G	437150E	5409050N	or-br fg str wth, st clv vlcl?
562308 P G	436980E	5409060N	lt gn se alt fp.1.
562309 P G	436980E	5409250N	Lt gn wk se alt, mod Si alt, Q + fp Por R.1.
562310 P G	434975E	5408420N	Or wth, lt gn, Se alt, fg, q + fp.1.
562311 P G	435375E	5408470N	pp br qz + fp vlc breccia?
562312 P G	435540E	5408400N	dk br fg q + fp.1. mnr Se alt frags
562313 P G	435730E	5408290N	pp (Hmt alt) q + fp + mafic por.1.
562314 P G	436300E	5408285N	br mas fp lava with mod com. chl alt patches?
562315 P G	437020E	5408840N	Fg str clay alt Fp + q vlcl Sst.
562316 P G	437015E	5408840N	br ibd vlcl shale with fg Sst. (with graded bedding).
562317 P G	437025E	5408850N	cg Se alt q + fp lithic vlcl Sst.
562318 P G	437060E	5408900N	mg fg por 1? or vlcl Sst?
562319 P G	437150E	5409030N	fg St Si Se chl alt 1?
562320 P G	43650E	5409000N	Mas br fp + qz + mnr mafic por.1.
562321 P G	435900E	5407690N	Orange brown volcanic with common orange feldspars (rarely rectangular) more commonly small square to slightly rounded? minor quartz phenocrysts? in siliceous feldspathic matrix. Common disseminated magnetite. Magnetic.

562322 (o/c)	P G	436035 E 5407680N	fg pp-br q + fp.1.
562323 (o/c)	P G	436300E 5407620N	Hmt alt Q + fp phyric volc, com chl alt patches + com qz vnlets through rock, weak alignment flow banded lava? or volcaniclastic?
562324 (o/c)	P G	436390E 5407620N	wkly Hmt alt Feldspar rich volcaniclastic with minor quartz
562325 (o/c)	P G	436430E 5407620N	Lt gn Se alt qz lithic vlcl with mnr Hmt alt
562331	P G	(outcrop 1m away)	pp fg Se alt Fd + Qz + mafic lava breccia or vlcl.
562326		436590E 5407650N	pp, wkly Hmt alt qz + feldspar + chl alt mafic (Hbl?) str por.1.
562327	P G	436940E 5407650N	br qz + fp por.R.1.
562328	P G	437450E 5407550N	br fp volc with mnr Hmt vns + rare chl vns .1? or vlcl?
562329	P G	437760E 5407590N	mas br Q + fp + mafic lava with mnr Hmt vns.
562330	P G	436800E 5407930N	fp + q phyric lithic vlcl Sst.
562331 (see 562325)			

465236

GOWRIE PARK - CETHANA - CHEEKS CREEK

Sample No:

562377 P, G
433020E, 5406830N

562378 P, G
433680E, 5406850N

562379 Petrology only
433160E, 5409940

562380 P, G
432950E, 5409960N

562381 Geochem only
432900E, 5409950N

562382 P, G
433285E, 5410180N

562383 P, G
433520E, 5409950N

562384 P, G
433285E, 5410010N

562385 P, G
433610E, 5410290N

562386 Geochem only
432700E, 5410300N

562387 Geochem only
432750E, 5410200N

562388 Geochem only
432780E, 5410160N

562389 P, G
432850E, 5410070N

562390 P, G
433780E, 5410110N

562391 P, G
433650E, 5409050N

562392 P, G
433220E, 5408860N

562393 P, G
432660E, 5409080N

562394 P, G
432500E, 5408950N

562395 P, G
432490E, 5409720N

562396 P, G
432540E, 5408480N

562397 P, G
432670E, 5408100N

562398 P, G
432640E, 5408050N

562399 P, G
432610E, 5408000N

562400 P, G
433010E, 5408970N

562020 Geochem only
432010E, 5407265N

562021 Geochem only
431990E, 5407200N

562022 P, G
431970E, 5407075N

562023 Polished T/S, G
431980E, 5406840N

562024 P, G
433085E, 5406750N

562025 Geochem only
433810E, 5407300N

562026 P, G
433840E, 5407070N

562027 P, G
432820E, 5407170N

Samples from North of Dasher River in the Gowrie Par area

Sample No:		AMG Co-Ordinate
562028	P, G,	432290E, 5408625N
562029	P, G,	432190E, 5408740N
562030	G only	432125E, 5408840N
562031	P, G,	431980E, 5408950N
562032	P, G,	431635E, 5408815N
562033	P, G,	431675E, 5408810N
562034	P, G,	431720E, 5408500N
562035	P, G,	431750E, 5408200N
562036	P, G,	431940E, 5408030N
562037	P, G,	432220E, 5408100N

Samples from Cheeks Creek - York Creek area

562038	G only	434240E, 5410320N
562039	G only	433330E, 5410820N
562040	P, G,	433560E, 5411160N
562041	G only	433450E, 5411300N
562042	G only	434180E, 5410780N
562043	P, G,	433850E, 5411075N
562044	Polished Thin G	433850E, 5411125N

Sample Number	AMG Coordinates	Summary description
562071 P,G	434150E,5411930N	A. lithic volcaniclastic?
562072 G only (Cr,Ti,Zr)	434210E,5411940	Massive A or B? lava breccia
562073 P,G	434475E,5411790N	Massive magnetic feldspar + mafic andesite lava? or volcaniclastic?
562074 P,G	434535E,5411745N	Bedded volcanic siltstone. Right way up?
562075 P,G	434540E,5411730N	Massive magnetic fp + mafic andesite l? or lv?
562076 P,G	434800E,5411695N	quartz phyric lithic volcaniclastic.

ANALABS

ANALYTICAL REPORT 23.3.08.07151

ORDER NO. PROJECT

Aberfoyle Resources Limited
Exploration Division
P.O. Box 952
Burnie Tasmania 7320

9893 | Gowrie Park

DATE RECEIVED | RESULTS REQUIRED

06/06/90 | ASAP

No. OF PAGES OF RESULTS	DATE REPORTED	No. OF COPIES	TOTAL No. OF SAMPLES
1	04/07/90	1	17

STATE OF SAMPLES	SAMPLE NUMBERS	PRE-TREATMENT							ANALYSIS		
		DRY	CRUSH	SPLIT	PULVERISE	SIEVE	OTHER SEE REMARKS	NONE	REFER TO ANALYSIS SECTION	PREPARATION	METH
	<562,028/044	RC Prep: 016							Cu,Pb,Zn,Ag/101		
	<562,028/044	RC							Au,AuChk/309		
	<562,028/044	RC							Ba,As,Cr,Zr,Ti/401		
	<562,028/044	RC							Ti:Zr/9825		

RESULTS TO

R. de Bomford
Aberfoyle Resources Limited
Exploration Division
P.O. Box 952
Burnie Tasmania 7320

RESULTS TO

REMARKS

Gowrie Park
Rock Chips.

STATE OF SAMPLES	ANALYSIS — PREPARATIONS			ANALYSIS — METHOD	
whole core	perchloric acid	A1	cold acid	atomic absorption	AAS
split core	hydrochloric acid	A2	specific sulphides	x-ray fluorescence	XRF
cuttings	nitric acid	A3	other mixed acids	spectrophotometry	SPEC
rock	aqua regia	A4	alkaline attack	colorimetry	COL
soil	sulphuric acid	A5			CHR
pulp	hydrofluoric acid	A6			LTN
					CHEM
					MISC
					FLUOR

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ANALABS

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

ANALYTICAL DATA

SAMPLE PREFIX	REPORT NUMBER	REPORT DATE	CLIENT ORDER No.	PAGE
	23.3.08.07151	04/07/90	9893	1 OF 1

TUBE No.	SAMPLE No.	Cu	Pb	Zn	Ag	Au	AuChk	Ba	As	Cr
1	562028	12	10	699	1.0	<0.008	<0.008	1604	6	27
2	562029	13	<5	198	1.0	<0.008	–	709	2	16
3	562030	8	15	201	1.0	<0.008	–	620	<2	19
4	562031	11	28	363	1.0	<0.008	–	426	<2	17
5	562032	7	7	132	0.5	<0.008	–	170	3	25
6	562033	6	24	239	1.0	<0.008	–	1863	6	24
7	562034	6	111	520	1.0	<0.008	–	1260	<2	30
8	562035	9	6	261	0.5	<0.008	–	1193	<2	27
9	562036	44	23	279	0.5	<0.008	–	476	<2	280
10	562037	9	18	92	0.5	<0.008	–	590	<2	19
11	562038	<5	<5	28	<0.5	<0.008	–	354	<2	23
12	562039	<5	<5	38	1.5	<0.008	<0.008	468	<2	17
13	562040	14	77	148	2.5	<0.008	–	888	52	306
14	562041	20	<5	73	1.5	<0.008	–	669	<2	29
15	562042	<5	<5	31	1.5	<0.008	–	298	<2	17
16	562043	11	<5	160	2.0	<0.008	–	561	<2	45
17	562044	13	5	58	2.0	<0.008	–	569	<2	61
18										
19										
20										
21										
22										
23	DETECTION	5	5	5	0.5	0.008	0.008	10	2	5
24	UNITS	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
25	METHOD	101	101	101	101	309	309	401	401	401

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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465242

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

ANALYTICAL DATA

SAMPLE PREFIX	REPORT NUMBER	REPORT DATE	CLIENT ORDER No.	PAGE
	23.3.08.07151	04/07/90	9893	1 OF 1

TUBE No.	SAMPLE No.	Zr	Ti	Ti:Zr						
1	562028	143	4185	29.3						
2	562029	79	4325	54.7						
3	562030	517	2897	5.6						
4	562031	449	2808	6.2						
5	562032	287	2547	8.9						
6	562033	169	4300	25.4						
7	562034	301	2604	8.6						
8	562035	183	5878	32.1						
9	562036	184	10983	59.7						
10	562037	290	2972	10.2						
11	562038	203	1058	5.2						
12	562039	202	1068	5.3						
13	562040	164	3206	19.5						
14	562041	170	2468	14.5						
15	562042	204	1111	5.4						
16	562043	139	4157	29.9						
17	562044	156	4326	27.7						
18										
19										
20										
21										
22										
23	DETECTION	5	50	0.1						
24	UNITS	ppm	ppm	%						
25	METHOD	401	401	9825						

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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465243

ANALABS

23.3.OB.07180

	ORDER No.	PROJECT
Aberfoyle Resources Limited Exploration Division P.O. Box 952 Burnie Tasmania 7320	10014	Gowrie Park
	DATE RECEIVED: 19/06/90	DATE REQUIRED: ASAP

No. OF PAGES OF RESULTS	DATE REPORTED	No. OF COPIES	TOTAL No. OF SAMPLES
2	17/07/90	1	6

STATE OF SAMPLES (REFER BELOW)	SAMPLE NUMBERS	PRE-TREATMENT: No.	CRUSH	PULP	OVEN DRY	SIEVE	OTHER (SEE REMARKS)	WORK ORDER	ANALYSIS: REFER TO ANALYSIS SECTION	PREPARATION	METHOD
	<5620,71/76	RC Prep: 01							Cu,Pb,Zn,Ag/101		
	<5620,71/76	RC							Au,AuChk/309		
	<5620,71/76	RC							Cr,Zr,Ti/401		
	<5620,71,73/76	RC							Ba,As/401		

RESULTS TO:

R. de Bomford
Aberfoyle Resources Limited
Exploration Division
P.O. Box 952
Burnie Tasmania 7320

REMARKS

RESULTS TO:

STATE OF SAMPLES		ANALYSIS — PREPARATION		ANALYSIS — METHOD	
whole core	WC	perchloric acid	A1	cold acid	CA
split core	SC	hydrochloric acid	A2	specific sulphide	SS
cuttings	CU	nitric acid	A3	other mixed acids	MA
rock	RK				
soil	SO				
pulp	PU				
water	WA				
float	FL				
stream sediment	SS				
heavy mineral	HM				

	AAS
	XRF
	SPEC
	COL
	SHR
	FIN
	CHEM
	MISC
	EMISSION
	OTHER

AUTHORISED OFFICER

465244

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

ANALYTICAL DATA

SAMPLE PREFIX	REPORT NUMBER	REPORT DATE	CLIENT ORDER No.	PAGE
	23.3.08.07180	17/07/90	10014	1 OF 2

TUBE No.	SAMPLE No.	Cu	Pb	Zn	Ag	Au	AuChk	Ba	As	Cr
1	562071	12	<5	85	<0.5	<0.008	<0.008	352	<2	45
2	562072	21	25	190	<0.5	<0.008	–	–	–	29
3	562073	12	<5	601	<0.5	<0.008	<0.008	836	<2	13
4	562074	66	5	111	<0.5	<0.008	–	1493	<2	26
5	562075	29	<5	187	<0.5	<0.008	–	331	<2	29
6	562076	11	<5	107	<0.5	<0.008	–	898	<2	16
7										
8										
9										
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11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23	DETECTION	5	5	5	0.5	0.008	0.008	10	2	5
24	UNITS	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
25	METHOD	101	101	101	101	309	309	401	401	401

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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465245

2-4913

ANALABS

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

ANALYTICAL DATA

SAMPLE PREFIX	REPORT NUMBER	REPORT DATE	CLIENT ORDER No.	PAGE
	23.3.08.07180	17/07/90	10014	2 OF 2

TUBE No.	SAMPLE No.	Zr	Ti	Ti/Zr
1	562071	95	3982	41.9
2	562072	92	3932	42.7
3	562073	114	4651	40.7
4	562074	241	2826	11.7
5	562075	85	4033	47.4
6	562076	220	2579	11.7
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23	DETECTION	5	50	
24	UNITS	ppm	ppm	
25	METHOD	401	401	

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 REPORT No. 23.3.08.06967

	ORDER No.	PROJECT
Aberfoyle Resources Limited Exploration Division P.O. Box 952 Burnie Tasmania 7320	8696	Gowrie Park
	DATE RECEIVED	RESULTS REQUIRED
	28/03/90	ASAP

No. OF PAGES OF RESULTS	DATE REPORTED	No. OF COPIES	TOTAL No. OF SAMPLES
4	20/04/90	1	34

STATE OF SAMPLES	PRE-TREATMENT							ANALYSIS		
REFER BELOW	SAMPLE NUMBERS	DRY	CRUSH	SPLIT	PULVERISE	SIEVE	OTHER SEE REMARKS	NONE		REFER TO ANALYSIS SECTION	PREPARATION	METHO
	K5623,01/32	RC	Prep: 018						Cu,Pb,Zn,Ag/101			
	K5623,01/32	RC							Au,AuChk/309			
	K5623,01/32	RC							Ba,As,Cr,Zr,Ti,/401			
	K3335,64,69	PU							Cr/401			

RESULTS TO:

R. de Bomford
Aberfoyle Resources Limited
Exploration Division
P.O. Box 952
Burnie Tasmania 7320

REMARKS

RESULTS TO:

STATE OF SAMPLES		ANALYSIS—PREPARATION				ANALYSIS—METHOD	
whole core	WC	perchloric acid	A1	gold acid	CA	atomic absorption	AAS
split core	SC	hydrochloric acid	A2	specific sulphide	SS	X-ray fluorescence	XRF
cutting	CU	nitric-hydrofluoric	A3	other mixed acid	MA	spectrographic	SPEC
rock	RO	aqua regia	AR	alkaline fusion	AF	colorimetric	COL
soil	SO	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	CHR
pulp	PU	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	TTN
water	WA	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	CHEM
tissue	TI	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	MISC
stream sediment	SS	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	FLUOR
heavy mineral	HM	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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ANALYTICAL DATA

SAMPLE PREFIX	REPORT NUMBER	REPORT DATE	CLIENT ORDER No.	PAGE
	23.3.08.06967	20/04/90	8696	1 OF 4

TUBE No	SAMPLE No.	Cu	Pb	Zn	Ag	Au	AuChk	Ba	As	Cr
1	562301	60	10	160	<0.5	0.016	<0.008	1000	<2	4
2	562302	10	20	160	<0.5	<0.008	–	530	<2	2
3	562303	15	25	45	<0.5	<0.008	–	510	3	
4	562304	30	25	20	<0.5	<0.008	–	740	20	5
5	562305	10	5	110	<0.5	<0.008	–	510	<2	2
6	562306	25	5	140	<0.5	<0.008	–	530	2	4
7	562307	50	5	130	<0.5	<0.008	–	570	<2	
8	562308	20	10	90	<0.5	<0.008	–	530	2	2
9	562309	15	10	25	<0.5	<0.008	–	190	<2	1
10	562310	15	10	100	<0.5	<0.008	–	620	<2	2
11	562311	175	20	80	<0.5	<0.008	–	870	<2	4
12	562312	20	15	75	<0.5	0.010	–	960	10	2
13	562313	25	5	90	<0.5	<0.008	–	300	<2	1
14	562314	10	10	360	<0.5	<0.008	–	300	<2	2
15	562315	15	<5	65	<0.5	<0.008	–	650	<2	1
16	562316	15	5	70	<0.5	<0.008	<0.008	580	<2	3
17	562317	10	<5	105	<0.5	<0.008	–	380	<2	4
18	562318	45	<5	150	<0.5	<0.008	–	570	<2	1
19	562319	30	10	70	<0.5	<0.008	–	1000	<2	4
20	562320	20	<5	40	<0.5	<0.008	–	780	<2	1
21	562321	25	15	90	<0.5	<0.008	–	430	<2	3
22	562322	15	10	115	<0.5	<0.008	–	260	2	3
23	562323	450	<5	125	<0.5	<0.008	–	430	<2	2
24	562324	15	<5	110	<0.5	<0.008	–	140	<2	7
25	562325	45	30	20	<0.5	<0.008	–	<10	3	2

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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465248

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

ANALYTICAL DATA

SAMPLE PREFIX	REPORT NUMBER	REPORT DATE	CLIENT ORDER No.	PAGE
	23.3.08.06967	20/04/90	8696	2 OF 4

TUBE No.	SAMPLE No.	Cu	Pb	Zn	Ag	Au	AuChk	Ba	As	Cr
1	562326	15	10	120	<0.5	<0.008	-	2100	<2	1
2	562327	30	<5	70	<0.5	<0.008	-	1200	2	6
3	562328	95	5	125	<0.5	<0.008	-	820	2	13
4	562329	70	10	70	<0.5	<0.008	-	830	2	12
5	562330	20	30	90	<0.5	<0.008	-	380	<2	1
6	562331	50	<5	120	<0.5	<0.008	-	1550	<2	1
7	562332	20	<5	50	<0.5	<0.008	<0.008	710	5	85
8	333564	-	-	-	-	-	-	-	-	
9	333569	-	-	-	-	-	-	-	-	
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23	DETECTION	5	5	5	0.5	0.008	0.008	10	2	1
24	UNITS	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
25	METHOD	101	101	101	101	309	309	401	401	401

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

SAMPLE PREFIX	REPORT NUMBER	REPORT DATE	CLIENT ORDER No.	PAGE
	23.3.08.06967	20/04/90	8696	3 OF 4

TUBE No.	SAMPLE No.	Cr	Zr	Ti						
1	562301	–	130	2950						
2	562302	–	140	3350						
3	562303	–	75	530						
4	562304	–	55	3050						
5	562305	–	160	3100						
6	562306	–	160	3350						
7	562307	–	130	4600						
8	562308	–	240	4550						
9	562309	–	156	830						
10	562310	–	190	3850						
11	562311	–	170	3000						
12	562312	–	220	3900						
13	562313	–	270	5300						
14	562314	–	190	3750						
15	562315	–	180	4300						
16	562316	–	220	2250						
17	562317	–	95	6450						
18	562318	–	170	4600						
19	562319	–	210	3800						
20	562320	–	250	2300						
21	562321	–	210	4450						
22	562322	–	190	4900						
23	562323	–	210	4700						
24	562324	–	160	9500						
25	562325	–	200	7050						

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 Inchcape Inspection and Testing Services Australia Pty. Ltd.

ANALYTICAL DATA

SAMPLE PREFIX	REPORT NUMBER	REPORT DATE	CLIENT ORDER No.	PAGE
	23.3.08.06967	20/04/90	8696	4 OF 4

TUBE No.	SAMPLE No.	Cr	Zr	Ti						
1	562326	–	230	3150						
2	562327	–	220	3000						
3	562328	–	150	3550						
4	562329	–	130	2500						
5	562330	–	260	3900						
6	562331	–	230	4050						
7	562332	–	230	2700						
8	333564	–	–	–						
9	333569	–	–	–						
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23	DETECTION	0.01	5	50						
24	UNITS	%	ppm	ppm						
25	METHOD	404	401	401						

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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465251

ANALABS

ANALYTICAL REPORT

23.3.08.07125

ORDER No. | PROJECT

9879 | Gowrie Park

Aberfoyle Resources Limited
Exploration Division
P.O. Box 952
Burnie Tasmania 7320

DATE RECEIVED | RESULTS REQUIRED

28/05/90 | ASAP

No. OF PAGES OF RESULTS	DATE REPORTED	No. OF COPIES	TOTAL No. OF SAMPLES
2	03/07/90	1	31

STATE OF SAMPLES REFER BELOW	SAMPLE NUMBERS	PRE-TREATMENT: DRY	CRUSH	SPLIT	PULP	SIEVE	OTHER (KEEP REMARKS)	REJECTS	ANALYSIS: ANALYSIS METHOD	PREP TO ANALYSIS SECTION	PREPARATION METHOD	METH
	<562,020/027,377/378,380/400	RC	Prep: 086						Cu,Pb,Zn,Ag/101			
	<562,020/027,377/378,380/400	RC							Au,AuChk/309			
	<562,020/027,377/378,380/400	RC							Ba,As,Cr,Zr,Ti/401			
	<562,020/027,377/378,380/400	RC							Ba/403			
	<562,020/027,377/378,380/400	RC							Ti:Zr/199			

RESULTS TO

R. de Bomford
Aberfoyle Resources Limited
Exploration Division
P.O. Box 952
Burnie Tasmania 7320

RESULTS TO

REMARKS

Gowrie Park - Cheeks Ck.

STATE OF SAMPLES		ANALYSIS — PREPARATION				ANALYSIS — METHOD	
whole core	WC	perchloric	A1	cold acid	CA	atomic absorption	AAS
split core		hydrofluoric	A2	special digest		x-ray fluorescence	XRF
cuttings		nitric	A3	aqua regia			SPEC
rock							COL
soil	SO						CHR
pulp							TTN
							CHEM
tissue							MISC
stream sediment							FLUOR
heavy mineral							ICP

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

465252

ANALYTICAL DATA

SAMPLE PREFIX	REPORT NUMBER	REPORT DATE	CLIENT ORDER No.	PAGE
	23.3.08.07125	03/07/90	9879	1 OF 2

TUBE No.	SAMPLE No.	Cu	Pb	Zn	Ag	Au	AuChk	Ba	Ba	As
1	562020	20	65	90	<0.5	0.016	0.015	716	–	<
2	562021	125	90	1100	<0.5	<0.008	<0.008	–	0.68	4
3	562022	10	50	595	<0.5	<0.008	–	1246	–	<
4	562023	5	165	175	<0.5	<0.008	–	1053	–	<
5	562024	5	30	150	<0.5	0.012	–	402	–	<
6	562025	10	130	570	<0.5	<0.008	–	–	0.35	1
7	562026	5	35	235	<0.5	0.010	–	869	–	<
8	562027	5	80	225	<0.5	0.018	–	1035	–	<
9	562377	5	25	70	<0.5	<0.008	–	909	–	<
10	562378	45	20	105	<0.5	<0.008	–	1333	–	<
11	562380	5	10	140	<0.5	<0.008	–	1145	–	<
12	562381	5	15	255	<0.5	<0.008	–	970	–	<
13	562382	5	25	80	<0.5	<0.008	–	444	–	<
14	562383	5	10	40	<0.5	<0.008	–	814	–	<
15	562384	5	20	50	<0.5	0.011	–	538	–	
16	562385	5	5	40	0.5	<0.008	<0.008	365	–	<
17	562386	5	20	170	<0.5	<0.008	–	1118	–	<
18	562387	5	15	95	0.5	<0.008	–	1243	–	<
19	562388	5	<5	45	<0.5	<0.008	–	740	–	<
20	562389	5	<5	80	<0.5	<0.008	–	506	–	<
21	562390	5	5	105	<0.5	0.010	–	1529	–	<
22	562391	10	15	110	<0.5	0.010	–	374	–	<
23	562392	45	250	785	<0.5	0.013	–	1270	–	<
24	562393	10	80	240	0.5	<0.008	–	1004	–	<
25	562394	35	175	105	0.5	0.069	–	112	–	<

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

SAMPLE PREFIX	REPORT NUMBER	REPORT DATE	CLIENT ORDER No.	PAGE
	23.3.08.07125	03/07/90	9879	2 OF 2

TUBE No.	SAMPLE No	Cu	Pb	Zn	Ag	Au	AuChk	Ba	Ba	As
1	562395	5	10	160	<0.5	<0.008	–	680	–	<
2	562396	5	35	185	0.5	<0.008	–	470	–	<
3	562397	5	20	155	0.5	<0.008	–	786	–	
4	562398	5	30	130	0.5	<0.008	–	515	–	<
5	562399	5	25	205	<0.5	<0.008	–	1030	–	<
6	562400	5	30	285	<0.5	<0.008	<0.008	690	–	<
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23	DETECTION	5	5	5	0.5	0.008	0.008	10	0.01	
24	UNITS	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm
25	METHOD	101	101	101	101	309	309	401	403	40

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 Inchcape Inspection and Testing Services Australia Pty Ltd.

ANALYTICAL DATA

SAMPLE PREFIX	REPORT NUMBER	REPORT DATE	CLIENT ORDER No.	PAGE
	23.3.08.07125	03/07/90	9879	1 OF 2

TUBE No.	SAMPLE No.	Cr	Zr	Ti	Ti:Zr					
1	562020	9	230	3151	13.7					
2	562021	7	130	2048	15.7					
3	562022	29	200	3437	17.2					
4	562023	8	280	2251	8.0					
5	562024	9	250	2156	8.6					
6	562025	9	190	2592	13.6					
7	562026	11	510	4505	8.8					
8	562027	21	65	496	7.6					
9	562377	7	280	2251	8.0					
10	562378	51	160	6488	40.5					
11	562380	9	75	3488	46.5					
12	562381	117	75	5357	71.4					
13	562382	7	190	1023	5.4					
14	562383	18	190	1043	5.5					
15	562384	7	210	1077	5.1					
16	562385	16	190	968	5.1					
17	562386	19	190	1659	8.7					
18	562387	21	190	4420	23.3					
19	562388	42	35	1183	33.8					
20	562389	8	330	1984	6.0					
21	562390	30	140	5921	42.3					
22	562391	28	240	4124	17.2					
23	562392	20	130	4842	37.2					
24	562393	22	240	2482	10.3					
25	562394	18	260	2211	8.5					

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 Inchcape Inspection and Testing Services Australia Pty. Ltd.

ANALYTICAL DATA

SAMPLE PREFIX	REPORT NUMBER	REPORT DATE	CLIENT ORDER No.	PAGE
	23.3.08.07125	03/07/90	9879	2 OF 2

TUBE No.	SAMPLE No.	Cr	Zr	Ti	Ti:Zr					
1	562395	19	230	2712	11.8					
2	562396	17	240	2104	8.8					
3	562397	14	270	3126	11.6					
4	562398	22	290	4277	14.7					
5	562399	26	240	4129	17.2					
6	562400	22	260	2607	10.0					
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23	DETECTION	5	5	50	0.1					
24	UNITS	ppm	ppm	ppm	%					
25	METHOD	401	401	401	199					

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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465256

Appendix 5A. (CARR,1989A). Lead Isotope Study, Gowrie Park

465257

Sirotope

CSIRO
AUSTRALIA

Division of Exploration Geoscience
Delhi Road, North Ryde, NSW Postal Address: PO Box 136, North Ryde NSW 2113
Telephone (02) 887 8666. Telex AA25817. Fax (02) 887 8909

Chief: Dr. B.J.J. Embleton

REPORT TO ABERFOYLE RESOURCES LIMITED

ON THE Pb ISOTOPIC COMPOSITIONS

AND METALLOGENIC ASSOCIATION OF EXPLORATION SAMPLES

FROM THE CETHANA AREA OF N.W. TASMANIA

REPORT SR 091

GRAHAM R. CARR
JUDITH A. DEAN

29/8/89

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Telex: AA92178

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Telex: AA26296
Fax: (02) 467 1902

465258

1. AIMS OF STUDY

The aim of this study has been to determine the likely metallogenic association of exploration samples from the Cethana area in N.W. Tasmania by comparing their Pb isotopic compositions with those of known mineralization in the region.

2. SAMPLES

Two high-Pb drill core pulps (428017, 428019) of altered volcanics with prominant galena veining were provided by Sven Rand. The samples are from drill holes through CRA interpreted possible stringer style mineralization and alteration.

3. TARGET SIGNATURES

All major Cambrian ore deposits of western Tasmania have similar Pb isotopic compositions confirming that they formed as part of a major metallogenic event (see Gulson and Porritt, 1987). A relatively homogeneous isotopic composition over such a region suggests the hydrothermal systems were very large, leaching Pb and other elements from a significant volume of crust and thus tending to average out local variations in the Pb isotopic composition of the source rocks. The Cambrian massive sulfide ("target") signature is represented in this study by the overlapping fields for Hellyer, Que River and Rosebery(+Hercules) (Fig. 1). The fields are 95% confidence ellipses which depict the mean +/- 2 x standard deviations of the data for each deposit. Despite the averaging effect of the hydrothermal systems, minor differences can be expected between deposits, as is exemplified by Rosebery/Hercules and Que River/Hellyer fields.

Minor mineralization in western Tasmania commonly consists of discontinuous pods or veins. The isotopic composition of such

mineralization varies between occurrences indicating that the hydrothermal systems were probably much smaller. Most examples of this mineralization have isotopic compositions that are more radiogenic than the Cambrian target (i.e. higher $^{206}Pb/^{204}Pb$ ratios, Fig 1.) and some can be associated with Devonian plutonism (e.g. Queen Hill, Mt Farrell).

However, other examples have isotopic compositions that are less radiogenic than the Cambrian target, e.g. WOW/CAB, an old Comstaff prospect in the Oonah Formation and the Marionoak mineralization on the Pieman Dam road (Fig. 1). While the origin of such mineralization remains enigmatic, the low $^{206}Pb/^{204}$ ratios may result from leaching of Pb from nearby Precambrian source rocks. At both WOW/CAB and Marionoak both more radiogenic and less radiogenic populations are present indicating a complex

Although it is likely that Devonian thermal events were responsible for the generation of these relatively localized hydrothermal systems, it is possible they developed at other times, even during the Cambrian. Irrespective of the age, it is unlikely that such mineralization would have significant economic potential.

4. METHODS

Whole rock powders provided by Aberfoyle were leached in a mixture of 7N HNO_3 and 7N HCl acids. Lead was purified from the leachate by anion exchange in HBr solutions and by micro-electrodeposition techniques.

Analyses were performed on an ISOMASS 54E thermal ionization mass spectrometer run in fully automated mode. Precision estimates for the ratios are depicted as error bars in the upper left hand corner of the ratio plots and are based on the analyses

of over 1000 standards.

5. RESULTS

The results are presented in Table 1 and in Figure 2. The two samples have similar isotopic compositions, and have slightly lower $^{206}Pb/^{204}Pb$ ratios than the Rosebery deposit.

6. DISCUSSION AND CONCLUSIONS

As was noted in section 3, some regional variation in the Cambrian massive sulfide signature occurs throughout the Mount Read Volcanic belt. Based on studies of a number of prospects in the Sheffield region, we expect the Cambrian signature in this northern extension of the Mt Read Volcanics to have $^{206}Pb/^{204}Pb$ ratios in the range 18.23 to 18.27; that is, slightly less than or equal to the Rosebery signature. These Cethana samples plot within or close to this field, although with only 2 samples it is not possible to estimate the likely spread of the population. Thus we are moderately confident that the prospect represents alteration associated with the major Cambrian mineralizing event of the region. However, to be more confident at least two more samples need be analysed.

7. REFERENCE

Gulson, B.L. and Porritt, P.M., 1987. Base metal exploration of the Mount Read Volcanics, Western Tasmania: Pt II. Lead isotope signatures and genetic implications. Econ. Geol., 82, pp. 291-307.

465261

TABLE 1. LEAD ISOTOPE RATIOS OF CETHANA AREA SAMPLES.

Sample	$\frac{208\ Pb}{206\ Pb}$	$\frac{207\ Pb}{206\ Pb}$	$\frac{206\ Pb}{204\ Pb}$	$\frac{207\ Pb}{204\ Pb}$	$\frac{208\ Pb}{204\ Pb}$	Pb(ppm)
1 428017	2.0871	0.8552	18.216	15.579	38.019	146,300
2 428019	2.0857	0.8547	18.231	15.581	38.026	128,500

Sample No prefixes are used for plotting points in Figure 2.

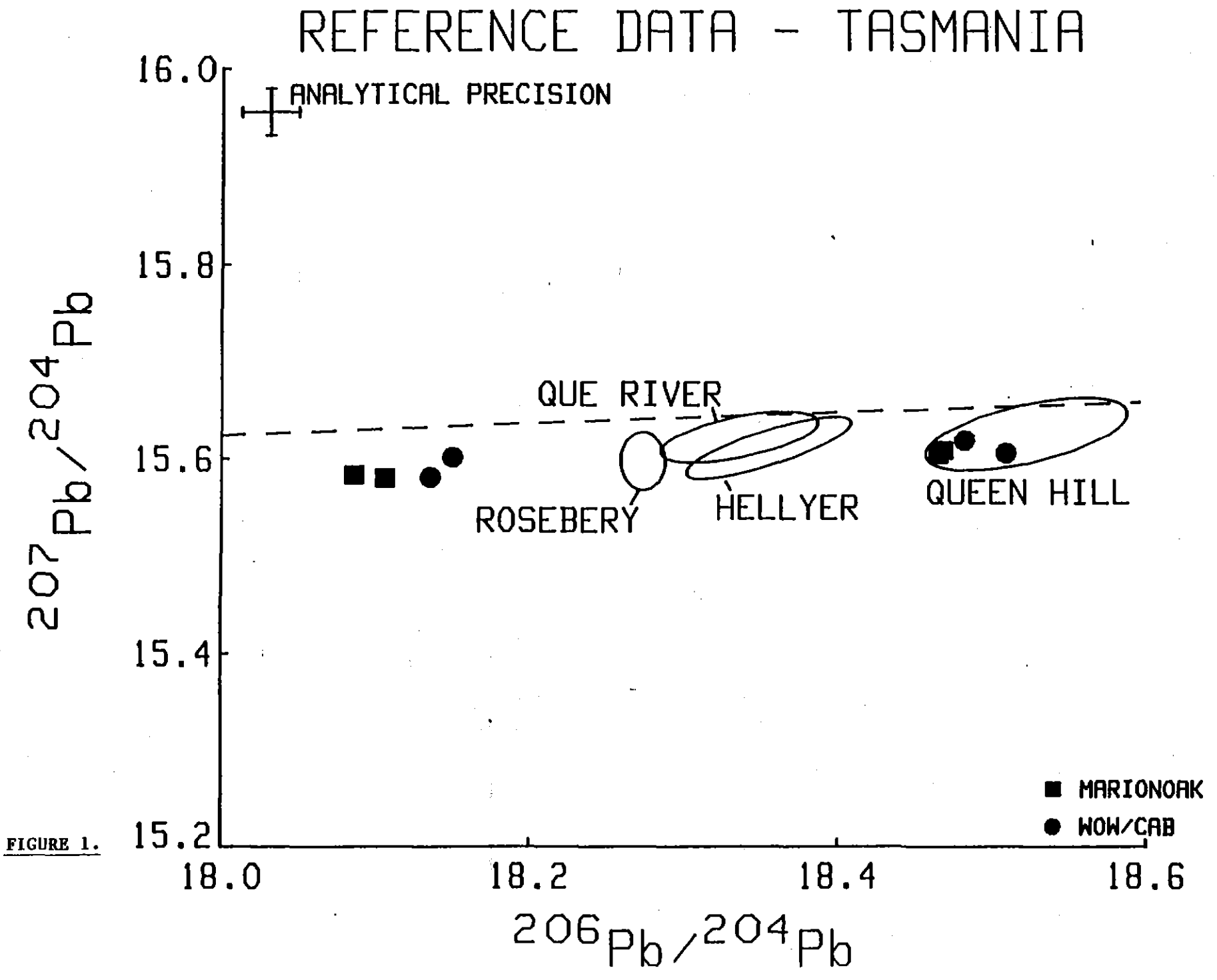


FIGURE 1.

465292

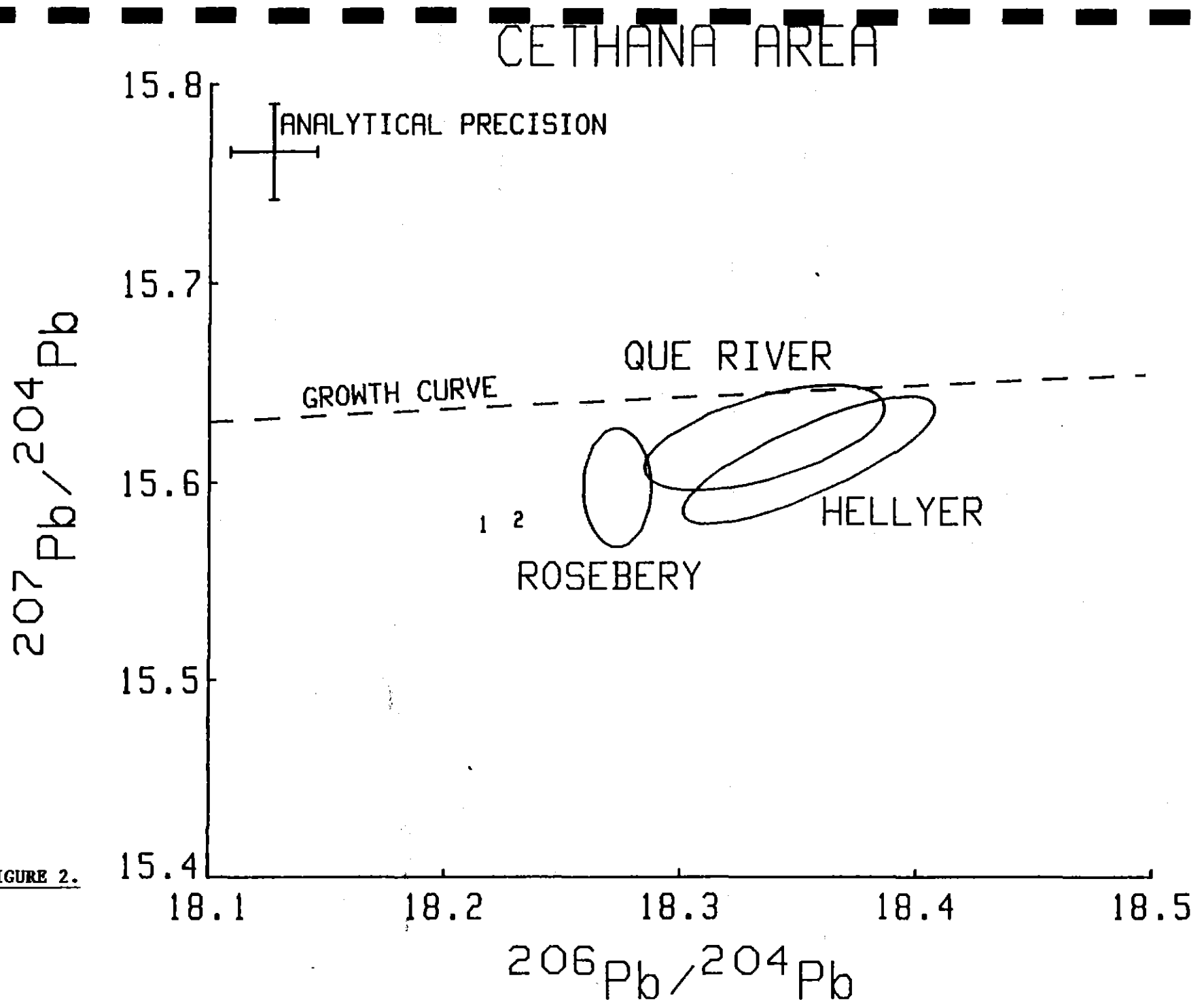


FIGURE 2.

49523

465264

Appendix 5B. (CARR,1989B). Lead Isotope Study

-Gowrie Park

-Mt. Roland

-Beulah Barite.

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465265

Sirotope



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Chief: Dr. B.J.J. Embleton

REPORT TO ABERFOYLE RESOURCES LIMITED

ON THE Pb ISOTOPIC COMPOSITIONS

AND METALLOGENIC ASSOCIATIONS OF ADDITIONAL EXPLORATION SAMPLES

FROM THE GOWRIE PARK LICENCE, NORTHWEST TASMANIA

SR 096

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8/11/89

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254

465266

SUMMARY

Galena or high-Pb rock pulps from Cethana, Mount Roland and an adit in the Beulah Barite deposit were analysed for their Pb isotopic composition to determine their likely metallogenic association.

The isotopic homogeneity of the Cethana samples analysed in this and a previous report, and their isotopic similarity to the Rosebery signature, points to a probable Cambrian origin for the mineralization. Similarly, the Mount Roland samples have a relatively high probability of representing Cambrian mineralization.

The Beulah Barite samples are isotopically similar to samples analysed in a previous report. They are considered to have a low probability of forming in response to the major Cambrian mineralizing event.

1. AIM

The aim of this study has been to:

(i) confirm the probable Cambrian signature for mineralization in the Cethana area which was reported previously (SIROTOPE report 091, 29/8/89);

(ii) to characterise the Pb isotopic compositions of exploration samples from Mount Rowland, and;

(iii) to compare the Pb isotopic composition of samples from an adit on the Beulah Barite prospect with previously analysed material (SIROTOPE report 31/3/88).

2. SAMPLES

Seven samples from the three prospects were provided by Sven Rand. Brief descriptions and locations as provided by Aberfoyle are presented in Table 1.

3. TARGET SIGNATURES

The Pb isotopic signatures of Cambrian and Devonian mineralization have been fully described and discussed in previous reports.

4. METHODS

Galena from the Cethana and Mount Roland prospects was dissolved in concentrated HNO_3 and Pb was purified by micro-electrodeposition techniques. The two pulps from the Beulah Barite prospect were leached in 7N HCl + 7N HNO_3 and Pb was purified by anion exchange in dilute HBr prior to electrodeposition as above. All samples were analysed on a Isomass 54E thermal ionization mass spectrometer run in fully automated mode. Precision estimates for the ratios are depicted as error bars in the upper left hand corner of the ratio plots

and are based on the analyses of over 1000 standards.

5. RESULTS

All results (including the previously analysed samples from the Cethana area) are presented in Table 2 and in Figures 1 to 3.

Cethana area: The 3 samples from the Cethana area (points 3-7) combined with the 2 previous samples (points 1-2) form a homogeneous cluster with similar isotopic compositions to the Beulah Basalt signature (Fig. 1).

Mount Roland: The 2 Mount Roland samples (513693 was analysed in duplicate) have the same isotopic composition which is slightly less radiogenic (lower $^{206}Pb/^{204}$ ratios) than the Cethana data (Fig. 2).

Beulah Barite: The 2 Beulah Barite samples have the same isotopic composition as material previously analysed from this site (Fig. 3).

6. DISCUSSION AND CONCLUSIONS

Cethana area: The isotopic homogeneity of these samples, together with their relatively close similarity to the Beulah Basalt and Rosebery isotopic signatures points to a Cambrian origin for the mineralization. No established Devonian mineralization has isotopic compositions similar to this data. However, we are less confident in ascribing a Cambrian origin to mineralization in the Cethana area than we would be further to the south because of the relative lack of data in the area.

Mount Roland: The isotopic variation between Cethana and Mount Roland is not significant when compared with the measured range in individual deposits (e.g. Que River and Hellyer). Thus the conclusions drawn for Cethana are also valid for Mount Roland. However, as for Cethana, the caveat concerning the

database in the area is also valid.

Beulah Barite: As concluded in the **SIROTOPE** report of 31/3/88, the Pb isotopic similarity of the Beulah Basalt to the Rosebery signature indicates that there is a high probability that this represents the Cambrian signature in this region. The range in isotopic compositions between the Beulah Basalt and the combined Beulah Barite data is about 0.8% (as measured on the $^{206}Pb/^{204}Pb$ ratio) which is slightly greater than the the total range of isotopic compositions measured in over 20 examples of Cambrian mineralization and ore in the region between Hellyer and Mt Lyell. Over small areas, such as encompassed by the Beulah Barite and the Beulah Basalt, the isotopic composition of Cambrian mineralization does not vary by more than about 0.4%. Thus we consider that there is only a low probability that both prospects formed in response to the same Cambrian metallogenic event and based on Pb isotopes the Beulah Barite is given a relatively low priority for further exploration.

465270

TABLE 1 LEAD ISOTOPE SAMPLES

CETHANA-GOWRIE PARK DRILLCORE

Sample	Location	Description
513904	GP C3 37.5m	Galena vein in altered volcanic.
513905	GP 5 81.65m	Prominent galena in quartz-sericite volcanic.
513906	GP 5 86.5m	Minor galena in quartz vein through quartz sericite volcanic.

MOUNT ROLAND ADIT SAMPLES

Sample	Location	Description
513692	Rock pile	Galena vein in altered volcanic.
513693	As above	As above.

BEULAH BARITE ADIT SAMPLES

Sample	Location	Description
513503 (see analysis)	57.8m	Recrystallised and silicified rhyolitic vitric crystal tuff with pyrite, chalcopyrite, and minor galena as disseminations and with calcite veins.
513510 (see analysis)	58.0m	As above but with more intense veining containing sphalerite and barite.

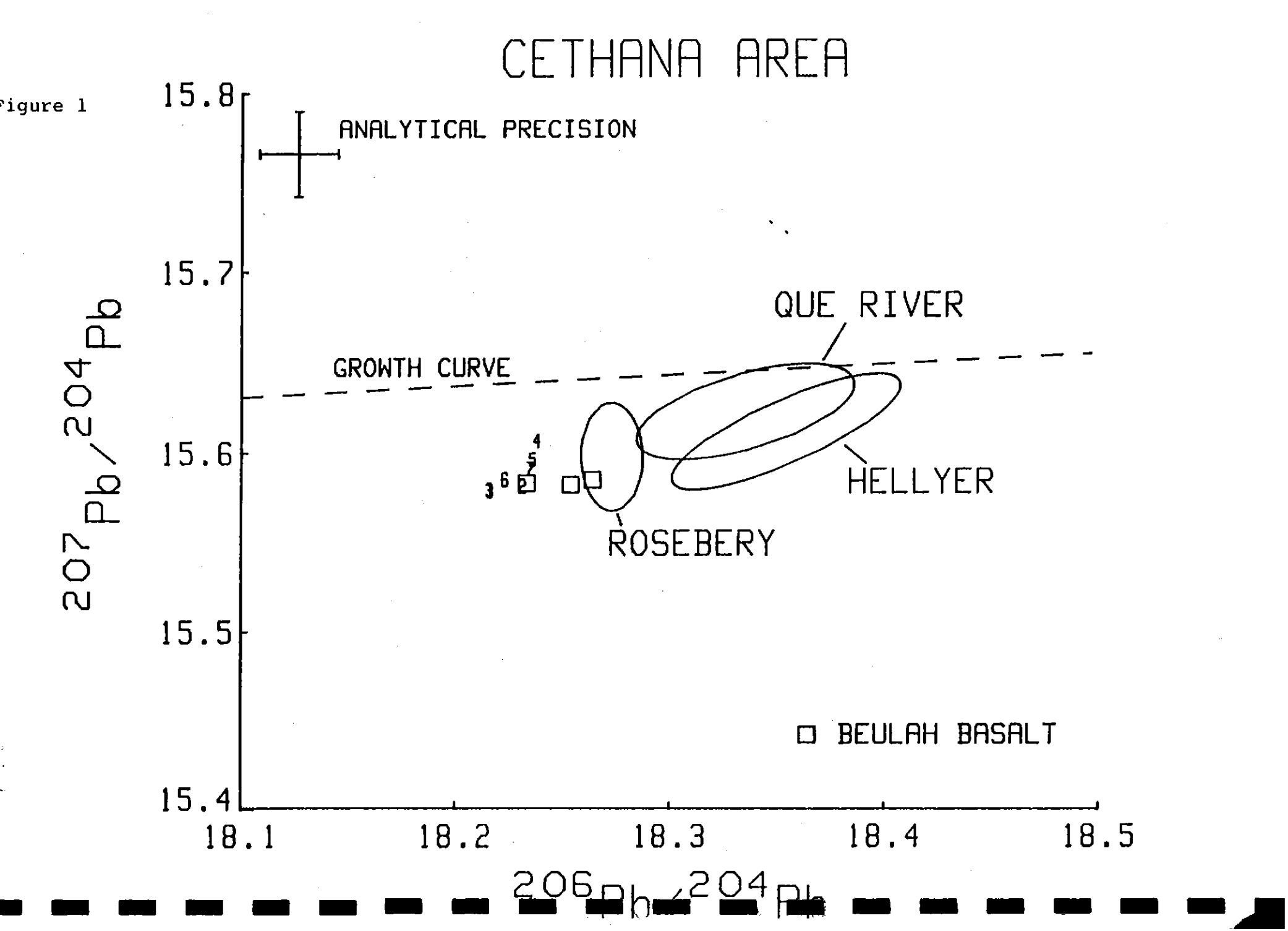
TABLE 2. LEAD ISOTOPE RATIOS OF GOWRIE PARK SAMPLES.

Sample	$\frac{208\ Pb}{206\ Pb}$	$\frac{207\ Pb}{206\ Pb}$	$\frac{206\ Pb}{204\ Pb}$	$\frac{207\ Pb}{204\ Pb}$	$\frac{208\ Pb}{204\ Pb}$	Pb(ppm)
COMBINED CETHANA DATA						
1 428017	2.0871	0.8552	18.216	15.579	38.019	146,300
2 428019	2.0857	0.8547	18.231	15.581	38.026	128,500
3 513904Gl	2.0875	0.8552	18.216	15.579	38.025	
4 513904Gl R	2.0894	0.8557	18.238	15.607	38.107	
5 513905Gl	2.0881	0.8552	18.236	15.596	38.078	
6 513905Gl R	2.0879	0.8552	18.223	15.585	38.048	
7 513906Gl	2.0870	0.8550	18.235	15.591	38.056	
MOUNT ROLAND						
1 513692Gl	2.0870	0.8561	18.198	15.580	37.980	
2 513693GL	2.0867	0.8560	18.202	15.580	37.982	
3 513693GL R	2.0875	0.8562	18.203	15.585	37.997	
BEULAH BARITE - THIS STUDY						
1 513503	2.0900	0.8569	18.184	15.581	38.005	1,020
2 513510	2.0920	0.8576	18.190	15.600	38.053	10,700
3 513510 RC	2.0926	0.8578	18.193	15.605	38.071	10,700

Gl = GALENA
R = Repeat electrodeposition prior to mass spec analysis
RC = Repeat total chemical separation prior to mass spec analysis.

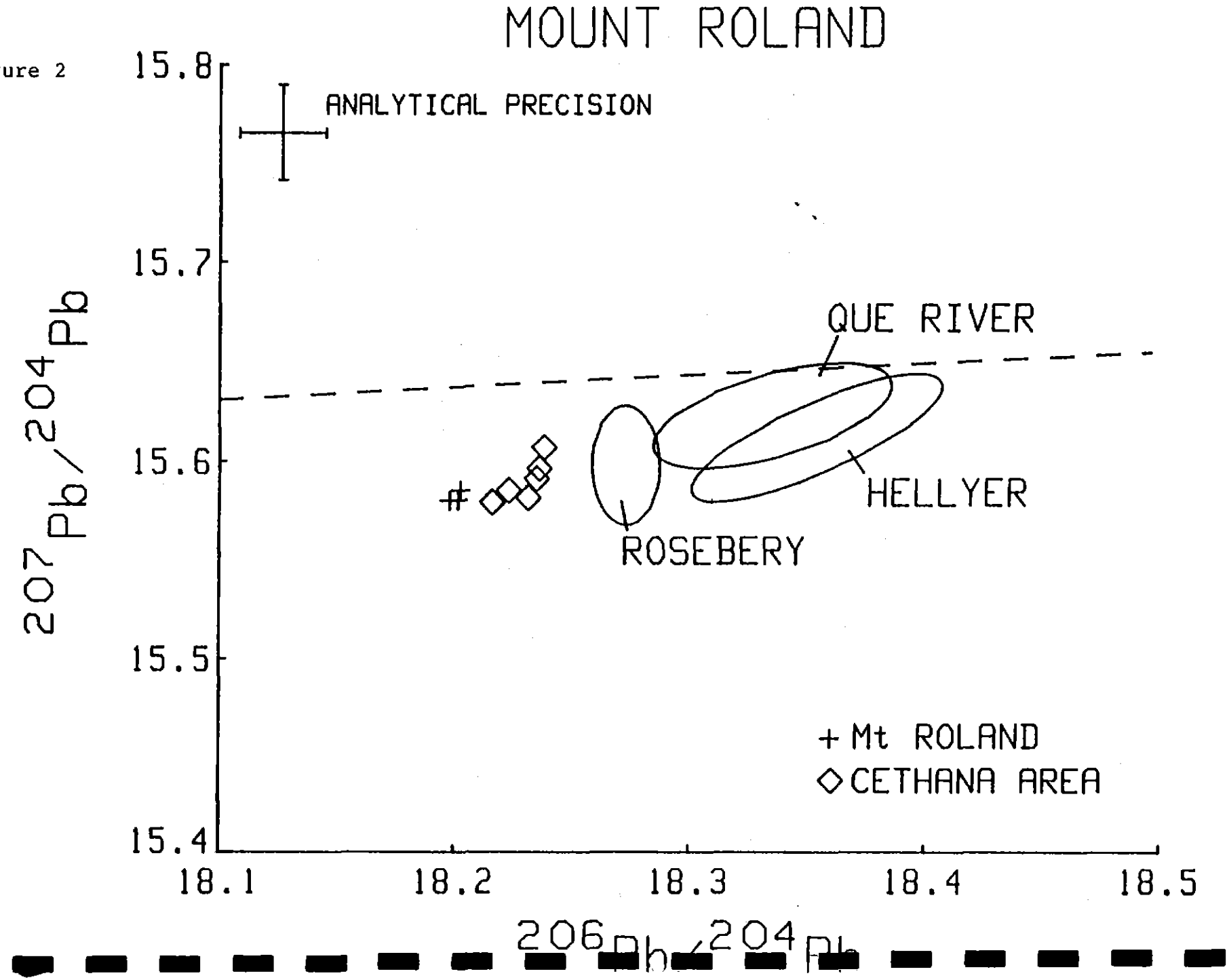
465272

Figure 1



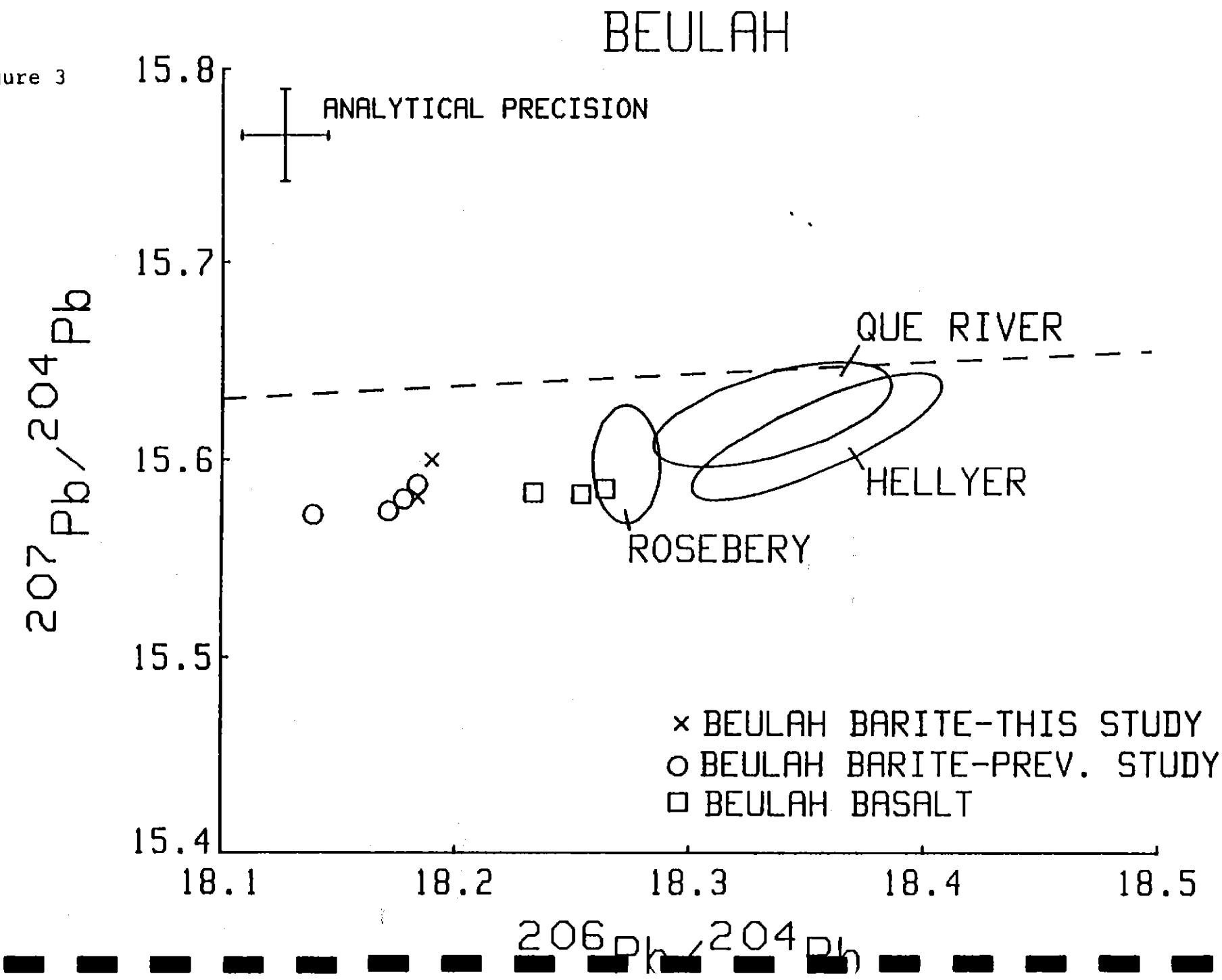
465273

Figure 2



465274

Figure 3



465275

Appendix 6. Amended Log - DDH BB6.

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EXPLORATION DIVISION

DIAMOND DRILL LOG

PROJECT : Gowrie Park
PROSPECT: Beulah Barite

HOLE NO: BB6
PAGE: 1 of 1
LOGGED: SWR
DATE: 30-5-90

DEPTH	DRILL RUNS	CORE LOSS	LITHOLOGY: ROCK NAME	LITHOLOGY: DESCRIPTION	ALTERATION	VEINING	MINERALISATION	STRUCTURE	WEATHERING	VISUAL LOG	REMARKS	DEPTH
2			Weathered orange lapilli Volcaniclastic with angular lava fragments	Medium to coarse grained rock composed of a mixture of red haematite altered grains and white sericite altered grains. Common small black flecks? grains? with brown cores. Occassional large sub-rounded to angular, purple - maroon coloured lava fragments (to 10cm)(generally around 2-3 cm).	very strong weathering producing orange staining and leaching down to ≈ 10m. weak Sericite alt^n weak fuchsite spotting Strong haematite alteration of vesicular lava fragments no calcite.	Very minor orange stained quartz veins aligned in cleavage. Common brown limonite veins in weathered section		well developed cleavage at 10° to core axis			0-19m similar to BB4 34-35 and = 51m. 0-110m is very similar to BB4 142m-EOH.	
19.5m				Sharp contact								
20			Fine-grained felsic lava andesitic.	Pale brown fine grained lava with occassional sub-rounded very fine grained lava fragments (to 4cm). Common weakly aligned round quartz filled vesicles?	moderately Sericitic minor chlorite associated with some quartz veins and in 'wisps' in cleavage. not Haematitic. Calcite altd. rare fuchsite.	minor orange stained quartz veins	none visible	cleavage at ≈10° to core axis. defined by 'wisps' of chlorite.				
32.3m												
34			lapilli Volcaniclastic 35-41m	as for 0-19m but with increased number of stretched lava fragments.	fragments are haematite altered	minor quartz	none	moderate cleavage sub parallel to core				
36			andesitic lava	Pale green-brown lava with occassional quartz filled vesicles and minor rounded fine grained lava fragments	weak chlorite moderate sericite no calcite	very rare barite associated with Common orange quartz veins in cleavage	none	cleavage = 15° c.A.				
42												

46276

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EXPLORATION DIVISION

DIAMOND DRILL LOG

PROJECT : Gourie Park
PROSPECT: Beulah Barite

HOLE NO: BB6
PAGE: 2 of 1
LOGGED: SWR
DATE: 31-5-8[illegible]

DEPTH	DRILL RUNS	CORE LOSS	LITHOLOGY: ROCK NAME	LITHOLOGY: DESCRIPTION	ALTERATION	VEINING	MINERALISATION	STRUCTURE	WEATHERING	VISUAL LOG	REMARKS	DEPTH
44			45.0m									
46			Dark medium grained andesite lava with sub rounded fine grained lava fragments	Dark coloured fine-medium grained lava with common rounded fragments containing possible quartz vesicles. Fragments often have alteration rims.	weak haematite alteration gives purple-maroon coloured matrix. minor streaky chlorite alteration moderate sericite alteration no calcite.	common orange stained Quartz veins to 1cm generally aligned in cleavage with some fine grained chlorite edges	none	cleavage ≈10° to CA.			Probably lava with common fragments as opposed to volcaniclastic. Occasional vesicles suggest lavas.	
48												
50												
52												
54												
56												
58			58.0m lava 59.2m	Pale yellow fine grained lava with minor quartz vesicles	sericite (2) fuchsite spotting minor Cl assoc. ± Q.	none						
60			lava with fragments	as for 45-58m (large frag. at 60.5m)	minor Haematite " sericite	none						
62	61m		lava	light yellow brown aphyric andesite lava.	moderate-Str. Sericite wk. Cl. assoc. ± Quartz rare fuchsite							
64	65.0m											
66			medium grained lava with abundant fragments	dark medium grained rock with red-purple matrix. Common sub rounded to angular fragments (lava) fragments to 5cm. Fragments have altered rims. Possible quartz filled vesicles weakly aligned.	mod sericite Haematite altered matrix and fragments weak chlorite with quartz veins weakly fuchsite spotted. no calcite.	Common irregular orange stained Quartz veins occasionally with minor chlorite edges rare barite in Q/Cl veins.	trace barite in Quartz/chlorite veins	cleavage ≈10° to CA.				
68												
70												
72												
74												
76			76.0 fine grained andesite lava.	fine grained yellow brown massive lava.	weak sericite-pyrite occasional fuchsite rare Chlorite? in fractures? no calcite	minor Q ± rare Barite ± Q/Cl. 81.0m Q vn. ± trace sphalerite + Galena Pyrite	traces of disseminated Pyrite ≤ 1%	78.5 sheared 79.0 fault zone.			76m to 108m all similar yellow brown lava but with intense "crackle" at 92.0-98.5m and weak at 95-97m	
78												
80												
82			82.0 'crackle'	lava as above with intense chlorite brecciation	weak sericite with traces of Pyrite							
84												

46757

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DIAMOND DRILL LOG

PROJECT : Gowrie Park
PROSPECT: Beulah Barite

HOLE NO: BB6
PAGE: 3 of 12
LOGGED: S.WR
DATE: 31-5-89

DEPTH	DRILL RUNS	CORE LOSS	LITHOLOGY: ROCK NAME	LITHOLOGY: DESCRIPTION	ALTERATION	VEINING	MINERALISATION	STRUCTURE	WEATHERING	VISUAL LOG	REMARKS	DEPTH
86			'Crackle'	as above								
88			88.5	88.5								
90			aphyric andesite lava	massive very fine grained yellow brown aphyric lava	wk rare fuchsite rare sericite weakly siliceous? no calcite	93.0-95.0m 1cm wide quartz vein down centre of core	weak rare disseminated pyrite	Vns parallel to core				
92												
94			94.0									
96			weak 'crackle'	weakly crackled lava as above								
98			97.0		strong sericite weak fuchsite weak calcite	minor orange quartz veins	none	clasts stretched and flattened ≈ 30° to C.A.				
100			aphyric andesite lava	as for above but with common fragments								
102												
104											104.5 small patch of pyrite crystals	
106												
108			108 lapilli volcaniclastic 109.5m	red-purple volcaniclastic with red+green altered lava fragments	strong haematite weak calcite	minor orange quartz veins						
110												
112			aphyric andesite lava with common fragments	as for 97-108.0m	strong sericite weak fuchsite very weak calcite	black chlorite? vein	none	111-112m strongly sheared cleavage 10°-CA.				
114								114 as above				
116												
118												
120												
122	1.22		CAVITY	SAND FILLED CAVITY								
124	122.5			Pale red-brown to pale yellow-green lava? with common small fragments of purple	moderate sericite weak chlorite 'wisps'	minor quartz	none	Flow boundaries? or alteration boundaries? or bedding?				
126												

A65278

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DIAMOND DRILL LOG

PROJECT : Gowrie Park
PROSPECT: Beulah Barite

HOLE NO: BB6
PAGE: 4 of [illegible]
LOGGED: S.W.K
DATE: 31-5-85

DEPTH	DRILL RUNS	CORE LOSS	LITHOLOGY: ROCK NAME	LITHOLOGY: DESCRIPTION	ALTERATION	VEINING	MINERALISATION	STRUCTURE	WEATHERING	VISUAL LOG	REMARKS	DEPTH
128				lava (rounded) in fine grained lava matrix.	no calcite			at 32° to CA.			quite common fragments	
130	129.5		aphyric lava	yellow fine grained lava rare frags	mod-str Calcite rare fuchsite wk Hmt	Qz + Cl vns	none	slightly sheared ~ 30° CA.			131–132.6 usim. re 10–19.0m	
132	131		lava	Fine to medium grained lava ± minor frags weakly vesicular	wk Hmt. v.wk Se wk fu.							
134	132.6		lava	green lava as above	wk Chlorite?							
	133.5		lava	Purple lava as above	wk Hmt.							
136	135		Massive lava	very fine grained felsic? lava. Pale yellow brown, common homogenous fragments to 5cm.	wk Se, wk Silica moderate fine grained Pyrite in small veinlets	Small quartz veins with meandering Pyrite veinlets	Pyrite << 1%	chlorite in cleavage? ≈15–20° CA				
138	136											
140			Fragment rich Polymict Volcani-clastic	Volcaniclastic, packed with polymict fragments from 5mm to 5cm. fragments both angular (and sheared) and also sub-rounded. matrix is weakly pyritic fine grained black ash?	v weak Se weak pyrite weak chlorite?	rare quartz veins	Pyrite < 1% disseminated in matrix	moderately to strongly sheared ~25° to CA.			Similar in some ways to HVS.	
142												
144												
146												
148												
150			aphyric andesite lava and lava breccias	Pale yellow brown lava and lava breccia Andesitic variable fragment content from packed with small rounded fragments to massive lava. 148–157 massive lava 157–161.5 lava breccia? 161.5–168 lava 168–171.5 lava breccia 171.5–191 lava	weak Sericite weak Silica Very weak pyrite weak fuchsite no calcite	164 weak 'crackle' with Pyrite 166.5	weak pyrite veinlets				156a reduced to NQ.	
152												
154												
156												
158												
160												
162												
164												
166												
168												

4052279

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EXPLORATION DIVISION

DIAMOND DRILL LOG

PROJECT : Gourie Park
PROSPECT: Beulah Barite

HOLE NO: BB6
PAGE: 5 of
LOGGED: S W K
DATE: 31.5-

DEPTH	DRILL RUNS	CORE LOSS	LITHOLOGY: ROCK NAME	LITHOLOGY: DESCRIPTION	ALTERATION	VEINING	MINERALISATION	STRUCTURE	WEATHERING	VISUAL LOG	REMARKS
170	171.5		lava breccia	as above							
172			massive lava	Pale yellow brown massive lava andesitic	mod-strong Si occassional pyrite reinlets to give weak crackle 176-179m	Occassional large Quartz-Chlorite veins	Small veinlets of Pyrite	massive			Similar to felsic units at Mt Charter?
174											
176											
178											
180	181										
182	182.6		Fault zone?	Sheared and fractured lava.							
184			lava	massive lava with common to abundant fine grained rounded lava fragments	weak silica Weak sericite weak Fuchsite Very weak pyrite	none	trace pyrite	massive			
186											
188											
190											
192			transition zone? from v. show aphyric to Intermediate lavas?	Pale yellow brown to 203m slightly red 203-204m Dark green 204-208m slightly red 208-211 Pale green below 211m rock is variably haematite altered lava with occasional small fragments of lava.	no Sericite? weak silica minor variable haematite 203-204 208-211 rare Fuchsite	minor quartz	none	massive			
194											
196											
198											
200											
202											
204											
206											
208											
210											

465290

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EXPLORATION DIVISION

DIAMOND DRILL LOG

PROJECT : Lawrie Park
PROSPECT: Beulah Barite

HOLE NO: B86
PAGE: 5 of
LOGGED: S.W.K
DATE: 31-5-90

DEPTH	DRILL RUNS	CORE LOSS	LITHOLOGY: ROCK NAME	LITHOLOGY: DESCRIPTION	ALTERATION	VEINING	MINERALISATION	STRUCTURE	WEATHERING	VISUAL LOSS	REMARKS	DEPTH
212			Andesitic to Basaltic lava.	massive fine grained green andesitic to basaltic? lava with variable weak haematite alteration and very rare fragments	minor haematite alteration occurs in patches throughout the matrix (ie not perrasive) no Sericite rare chlorite rare fuchsite moderately to Strongly Calcite altered from 215m→256 Weak calcite alteration from to 287m	some large quartz/chlorite veins (late stage) Some small irregular Hmt/Cc veins	minor haematite disseminated in matrix and in veins (lets) ± calcite.	massive to 229m 229-246m core quite broken 246-249 possible fault core very broken.				
214												
216												
218												
220												
222												
224												
226												
228												
230												
232												
234												
236												
238												
240												
242												
244												
246												
248												
250												
252												

46523 1

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DIAMOND DRILL LOG

PROJECT : Gourie Park
PROSPECT: Beulah Barite

HOLE NO: BD6
PAGE: 7 of
LOGGED: SWE
DATE: 31-5-91

DEPTH	DRILL RUNS	CORE LOSS	LITHOLOGY: ROCK NAME	LITHOLOGY: DESCRIPTION	ALTERATION	VEINING	MINERALISATION	STRUCTURE	WEATHERING	VISUAL LOG	REMARKS	DEPTH
254			Basalt lava	as above	weak Hmt Weak Calcite	Hmt/Cc.	Hmt.					
256			257.6									
258			aphyric andesite lava	massive fine grained andesite lava.	moderately siliceous rare fuchsite no Sericite no Calcite no pyrite	very rare Q. veins	none	massive				
260			261.0m									
262			Andesite to Basalt lava	massive green andesitic or basaltic lava. Slightly felsic? 261 to 276m.	moderately to strongly calcite altered weakly siliceous	minor haematite calcite veins. moderately common large white quartz	minor haematite in calcite veins	weak foliation? at 45°CA. weakly cleaved with small chlorite wisps				
264												
266												
268												
270												
272												
274												
276												
278												
280												
282						Hmt/Cc veining becomes quite common. (2-5mm)						
284												
286												
288					weak calcite no sericite							
290												
292												
294				minor large Basalt lava fragments start to appear.								

45523

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DIAMOND DRILL LOG

PROJECT : Gowrie Park
PROSPECT: Beulah Barite

HOLE NO: BB6
PAGE: 8 of
LOGGED: SWE
DATE: 31-5-9

DEPTH	DRILL RUNS	CORE LOSS	LITHOLOGY: ROCK NAME	LITHOLOGY: DESCRIPTION	ALTERATION	VEINING	MINERALISATION	STRUCTURE	WEATHERING	VISUAL LOG	REMARKS	DEPTH
296			Basalt lava	lava with common lava fragments. Fragment abundance increases down to 323.5m. Fragments range in size from ~1cm to 10 cm. large fragments have reaction rims or 'alteration zones'.	all fragment-rich rock is weakly to moderately haematite altered, with variable Calcite alteration. The more fragmental units are possibly weakly silica altered. Weak pyrite alteration.		traces of very fine grained disseminated Pyrite.				Probable flow margin with common lava fragments.	
298												
300												
302												
304												
306												
308												
310												
312												
314												
316												
318												
320												
322												
323.5												
324			Basalt lava breccia?	Packed fragmental lava breccia, light creamy green.	Very weak calcite weak chlorite no sericite or pyrite	none		chlorite 'wisps' ± 20° C.A.				
326.3												
328			massive andesite lava	massive lava. Slightly lighter in colour than above lava.	weak calcite to 334m Common pyrite in matrix weak hmt. 337.5-343 mod to strong Calcite down to 350.5m.	Calcite/quartz veins with pyrite are quite common	fine grained disseminated Pyrite.	massive				
330												
332												
334												
336												

495233

Aberfoyle Resources Limited
EXPLORATION DIVISION

DIAMOND DRILL LOG

PROJECT : Gowrie Park
PROSPECT: Beulah Barite

HOLE NO: BBG
PAGE: 9 of 10
LOGGED: SUR
DATE: 31-5-80

DEPTH	DRILL RUNS	CORE LOSS	LITHOLOGY: ROCK NAME	LITHOLOGY: DESCRIPTION	ALTERATION	VEINING	MINERALISATION	STRUCTURE	WEATHERING	VISUAL LOG	REMARKS	DEPTH
338			andesite lava		weak Hmt 338-343 moderate-strong Calcite	rare Hmt rich Calcite veins	very fine grained disseminated pyrite visible with fine grained Haematite?	massive				
340												
342												
344												
346												
348												
342				creamy coloured rock as above	common pyrite moderate silica	traces of Py veinlets.						
350												
350.6			Basalt to andesite lava breccia.	light pale green massive lava breccia with common lava fragments	variable Hmt+Cd.alt= Weak calcite minor disseminated pyrite	minor large Q/Ca vns very rare Calcite veining						
352												
354												
356.5												
358			Andesite lava	as above but with no fragments	common pyrite weak silica Very weak calcite rare chlorite	mino-pyrite associated with Quartz and Calcite	Common Pyrite	massive.				
360												
362												
364												
367												
368			Basalt lava	massive fine grained green basalt lava.	moderate calcite variable Hmt weak pyrite			massive				
370												
372												
374												
376												
378			lava breccia									

46523

Aberfoyle Resources Limited
EXPLORATION DIVISION

DIAMOND DRILL LOG

PROJECT : Gowrie Park
PROSPECT: Beulah Barite

HOLE NO: BB6
PAGE: 10 of 10
LOGGED: SWE
DATE: 31-5-80

DEPTH	DRILL RUNS	CORE LOSS	LITHOLOGY: ROCK NAME	LITHOLOGY: DESCRIPTION	ALTERATION	VEINING	MINERALISATION	STRUCTURE	WEATHERING	VISUAL LOG	REMARKS	DEPTH
380			Basalt lava breccia	Sheared chloritic lava with common variably chloritised angular lava fragments with many small rounded fragments	chlorite weak calcite weak pyrite	Q/Cl. calcite ± trace pyrite	common fine grained disseminated pyrite.	sheared ≈10° to CA.				
382			382m Andesitic lava	light brown lava with homogenous lava fragments in a lava matrix. Haematite altered lava with fragments.	weak Hmt Very weak calcite weak to moderate pyrite weak silica Very trace fuchsite	Very rare orange Q2/Cl veins	disseminated pyrite.	massive				
384												
386												
388												
390												
392												
394												
396												
398												
400				E.O.H 400.0 m								

45235

185236

Appendix 7. (Walker,1989). BB6 DHEM Report.

465237

ABERFOYLE RESOURCES LIMITED

EXPLORATION LICENCE 11/88

GOWRIE PARK

DOWNHOLE EM37 SURVEY - DDH BB6

October 1989

TECHNICAL REPORT

DISTRIBUTION

HAWTHORN (1)
BURNIE (1)

PREPARED BY:

G B WALKER
GEOPHYSICIST

ENDORSED BY:

JOVAN SILIC
CHIEF GEOPHYSICIST

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CONTENTS

1. Introduction

2. Downhole EM-37 Survey

3. Conclusions and Recommendations

4. References

FIGURES

GP23 Beulah Barite - Summary Section DDH BB6 1:1000

GP24 Beulah Barite - Cross Section 450600mE, 1:1000

GP28 EL 11/88 Gowrie Park - Location and Geology

GP46 Beulah Barite - BB6 DHEM Loop Location 1:1000

APPENDICES

Appendix 1 Downhole EM-37 Data Section - DDH-BB6

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SUMMARY

The downhole EM-37 survey of drillhole DDH-BB6 was unsuccessful in locating an off-hole conductor.

1. INTRODUCTION

1.1 General

Diamond drillhole DDH-BB6, located on the Gowrie Park licence, was completed on 15th June, 1989. The drillhole aimed at a prospective mixed sediment/lava and lava contact in the vicinity of the Beulah Barite. The hole did not intersect a target footwall position but terminated in hangingwall style altered intermediate lavas (Figure GP23, GP24).

1.2 Geophysics

Electromagnetic methods have made significant contributions to the discovery and delineation of the Que River and Hellyer massive sulphide ore deposits (Webster and Skey, 1979; Silic et al, 1985; Eadie et al, 1985). Following the discovery of the Hellyer orebody, Aberfoyle Resources has rigourously employed the UTEM (University of Toronto Electromagnetic System) method (West, et al, 1984) in the search for new targets.

Drillhole DDH-BB6 was surveyed with downhole EM37 to test a possible off-hole target (Figure 4). The data and results of this survey are also contained in this report.

2. DOWNHOLE EM SURVEY

2.1 Survey Specifications

The downhole EM-37 survey of drillhole DDH-BB6 was conducted by Geoterrex Pty Ltd on 16th October, 1989. The single, 300m X 300m loop survey was carried out at a base frequency of 25Hz using a turn-off time of 0.220ms. Data were recorded at 20m intervals.

2.2 Discussion of Results

The downhole EM-37 data (Appendix 1) do not reflect a target related to sulphide mineralisation. The main features of the data are:

a) Subtle, low amplitude late-time anomalies at first sight depict responses from off-hole conductors, but their absence in early time and intermediate time channels suggests they are products of waveform "clipping" by the EM-37 system.

b) Weak responses from zones of minor pyrite, haematite and calcite alteration (Figure GP23).

3. CONCLUSIONS AND RECOMMENDATIONS

The downhole EM-37 survey of DDH-BB6 failed to locate an off-hole conductor in the vicinity of the drillhole. No further work is recommended for the results of this survey.

4. REFERENCES

Eadie, E. T., Silic, J., and Jack, D. J., (1985), 'The application of geophysics to the discovery of the Hellyer ore deposit, Tasmania', Explor. Geophys. 16, 207-209.

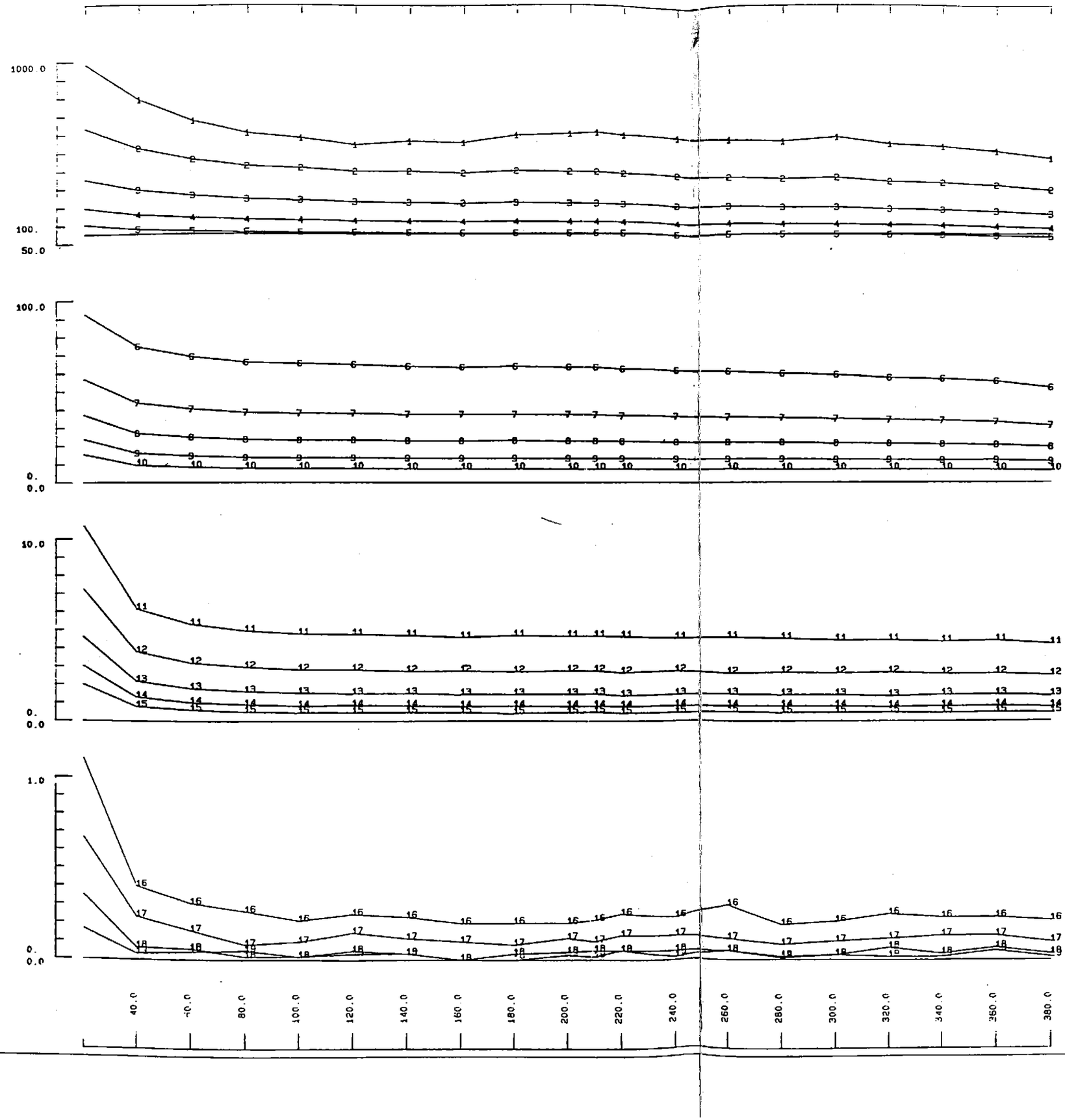
Silic, J., Eadie, E. T., and Jack, D. J., 91985), 'Application of time domain electromagnetic methods in the discovery of the Hellyer ore deposit, Tasmania, Australia', in volume of Extended Abstracts of the 55th SEG meeting, Washington, DC.

Webster, S. S., and Skey, E. H., (1979), 'Geophysical and geochemical case history of the Que River deposit, Tasmania', in Geophysics and Geochemistry in the Search for Metallic Ores; Peter J. Hood, editor, Geological Survey of Canada, Economic Geology report 31, 697-720.

West, G. F., Macnae J. C., and Lamontagne, Y., (1984), 'A time domain EM system measuring the step response of the ground', Geophys., 49, 1010-1026.

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465231



DHEM37 Survey

Lower Beulah

Loop 1

Down-Hole Component

BASE FREQUENCY 25Hz

Aberfoyle Resources Ltd

March 1990

<gbw>

Plot Date : 13/03/90 Horiz

165292

Appendix 8. Mt. Roland Grid Survey Points.

L.C. MACKENZIE & ASSOCIATES

CONSULTING SURVEYORS
LAND, MINING & ENGINEERING
L.C. MACKENZIE (L.S., M.I.S.Aust., B.AppSc. [Surv.])

Wynyard Office: RESERVOIR DRIVE, WYNYARD
Postal Address: P.O. BOX 225, WYNYARD, TAS. 7325

Telephone: Wynyard: (004) 42 3939
After Hours: (004) 42 3939

465293

Aberfoyle Resources Ltd.,
P.O. Box 952,
BURNIE, 7320.

29th November, 1989.

Dear Sir,

Re: Silver Ridge - Gowrie Park.
Co-ordinates of Baseline.

GRID EASTING	GRID NORTHING	AMG EASTING	AMG NORTHING
1200	0000	436913.8	5409629.9
1175	0000	436896.3	5409647.2
1125	0000	436859.8	5409681.4
1075	0000	436823.4	5409715.5

Yours sincerely,

Len Mackenzie,
Registered Surveyor.

465294

Appendix 9. (Read,1989). Mt. Roland Grid UTEM Report.

465295

ABERFOYLE RESOURCES LIMITED

EXPLORATION LICENCE 11/88, TASMANIA

GOWRIE PARK

TECHNICAL REPORT

UTEM SURVEY, MT ROLAND GRID, DECEMBER 1989

PREPARED BY:

J J READ
Geophysicist

Distribution

1) Aberfoyle Resources Limited, Burnie
2) Aberfoyle Resources Limited, Hawthorn

ISSUED BY:

J SILIC
Chief Geophysicist

465296

Contents

1. Summary

2. Introduction

3. Aberfoyle UTEM Program

   3.1 Mt Roland Grid UTEM Interpretation

4. Conclusions

5. References

Appendices

Appendix 1 - Mt Roland Grid UTEM Data

Plates

No.	Title	Scale
GP-28	EL 11/88 Gowrie Park Location Plan and Cambrian Geology	As Shown
GWP-37	Gowrie Park El 11/88 Mt Roland Grid December 1989 UTEM Survey Interpretation	1:2500

1. Summary

A two loop surface UTEM survey was conducted at the Mt Roland grid on EL 11/88, Gowrie Park. This survey collected 6.5 line/km of vertical component UTEM data.

No EM responses indicative of massive sulfides occurring at depth were interpreted from the UTEM data. Consequently no further geophysical exploration is required at the Mt Roland grid.

2. Introduction

EL 11/88, Gowrie Park, covers an area of 79 square kilometres, approximately 10km south of Sheffield on the North West Coast of Tasmania. The exploration licence reaches north from the slopes of Mt Roland and Mt Claude, to the Dasher River and extends eastward from Cethana to Lower Beulah (see plate GP-28).

Approximately half the licence is covered with Cambrian Rocks forming part of the northeastern extension of the Mt Read Volcanic Arc (Rand and Noonan, 1989). The Mt Read Volcanic sequence throughout the E.L. is divided into three stratigraphic packages, known as, the Beulah Formation, which is overlain by the Gog Range Greywacke, which in turn is overlain by the Minnow Keratophyre (Jennings, 1979).

The Gowrie Park exploration licence was granted to Aberfoyle Resources Limited on the 1st August 1988, for 10 years with a fifty percent area reduction after five years. Prior to July 1987, EL 11/88 was explored by CRA, as part of their exploration of El 7/73. CRA's previous exploration is described in Rand and Noonan (1989).

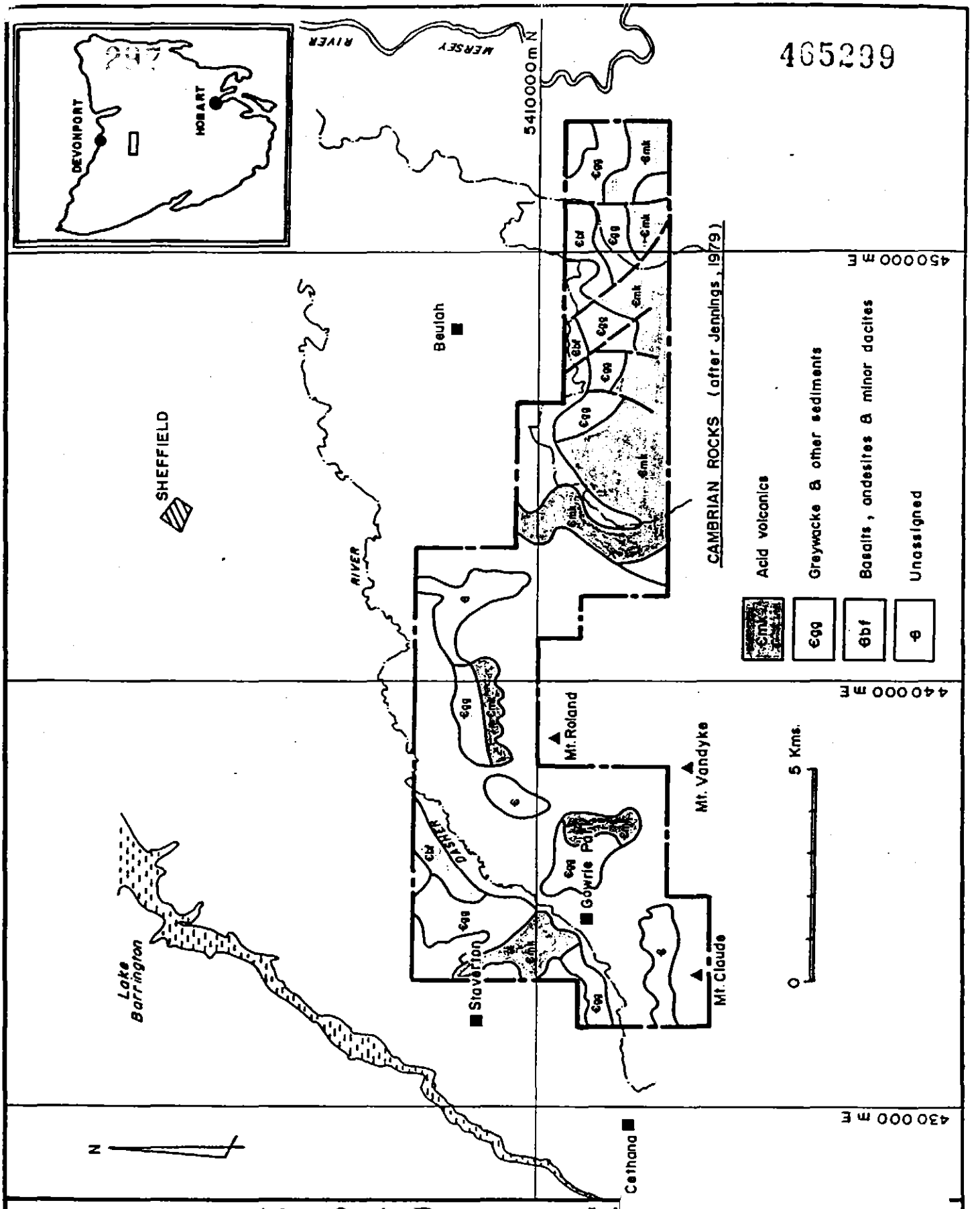
This report describes and documents the results of a two loop UTEM survey that was conducted on the Mt Roland grid, situated at the foothills of Mt Roland. Previous geophysical exploration of EL 11/88 by Aberfoyle, comprised a 30 line/km UTEM survey conducted on the Stonebridge grid (Silic, 1989).

3. Aberfoyle UTEM Program

The Cambrian rocks at the Mt Roland grid were interpreted by Rand and Noonan (1989) to be equivalents of the Tyndall group, which is well developed on the West Coast of Tasmania. Overlying the Tyndall Group equivalents, is a sequence of volcaniclastics which are possible correlates of the Jukes Breccia. This succession was considered prospective for base metal sulfide mineralisation, which was the main exploration target at Mt Roland.

In order to cover the Mt Roland grid with UTEM data, a two loop configuration was used. Loop 1 (see plate GWP-37) covered the area from 0N to 500N and was situated such that steeply to moderately dipping conductive mineralisation would be most efficiently energised. The area from 500N to 1400N was covered from loop 2, whose loop front was moved 500m NE from

465239



Aberfoyle Resources Li

EXPLORATION DIVISION

5 cm

REVISIONS			
Init.	Date	Init.	Date

Location Code :

NORTHERN TASMANIA

E.L. 11/88 GOWRIE PARK
LOCATION PLAN & CAMBRIAN GEOLOGY

Scale : As shown

Date : July, 1989

Compiled :	SWR
Drawn :	SWR, RJE
Traced :	RJE
Checked :	SWR
Plate No. :	GP 28

the loop 1 position. Loop 1 was not used to read the entire Mt Roland grid, as past 500N vortex current generated EM anomalies may have been of too small an amplitude, to be detected. In this region, current gathering processes would dominate the measured secondary EM response. As not all conductors produce current gathering EM anomalies, a conductor may have remained undetected if only loop 1 was used to read the entire Mt Roland grid.

As the Mt Roland grid was not covered with in-loop readings, the possibility of flat lying conductors remaining undetected, can not be totally discounted. Any flat lying conductors occurring 200-300m from the front of either loops 1 and 2 would occur in a null-couple position and may remain undetected.

The contract for the Mt Roland grid UTEM survey was awarded to Lamontagne Geophysics Australia, of Suite 9, 859 Pacific Highway, NSW. The survey was undertaken to the following specifications:

Data- Single Vertical Component, Secondary Magnetic Field UTEM Data
Data Spacing - 50 m (nominal)
Line Spacing - 200 m
Transmitter Frequency - 26.23 HZ
Delay Times - 0.028 - 14.3ms (10 channels)

The survey commenced on the 4/12/89 and was completed on the 6/12/89, with the collection of 6.5 line/km of UTEM data.

3.1 Mt Roland Grid UTEM Survey Interpretation

The interpretation of the Mt Roland grid UTEM data is presented in plate GWP-37. No EM responses were identifiable in the UTEM data that could be attributed to sulfide accumulations occuring at depth.

Several low-amplitude, early delay-time anomalies, were identified in the UTEM data. Using the method of interpretation outlined in Silic (1989), these anomalies were interpreted as due to shallow conductivity variations. These variations maybe reflecting lithological changes, weathering variations or ground water conductivity variations. Such EM responses are termed "formational" and are not prospective.

Two long striking UTEM anomalies are possibly due to poorly conductive faults. This interpretation is based upon the long striking nature of the responses and their

restricted spatial extent. One interpreted fault runs parallel to loop 1 from 1400E to 600E, while the other runs sub-parallel to loop 2 from 1400E to 1000E.

4. Conclusions

The Mt Roland grid UTEM survey did not locate any EM responses that are worthy of further exploration. It can be considered that no significant accumulations of steeply, to moderately dipping conductive mineralisation occurs at the Mt Roland grid, upto a depth of approximately 350m. Two zones, marked on plan GWP-37, were not effectively explored for flat lying conductive mineralisation. Although a possibility, it is unlikely significant mineralisation occurs in these zones.

No further geophysical exploration is recommended for the Mt Roland grid.

5. References

Jennings, I B, 1979, Sheffield Sheet 37, Geological Survey of Tasmania Explanatory Report, Mines Department of Tasmania.

Rand, S W, Noonan, D J, 1989, Exploration Licences 11/88, Gowrie Park Tasmania, Progress Report For the Year Ended July 1, 1989., Aberfoyle Resources Limited Internal Report Gowrie Park 2.

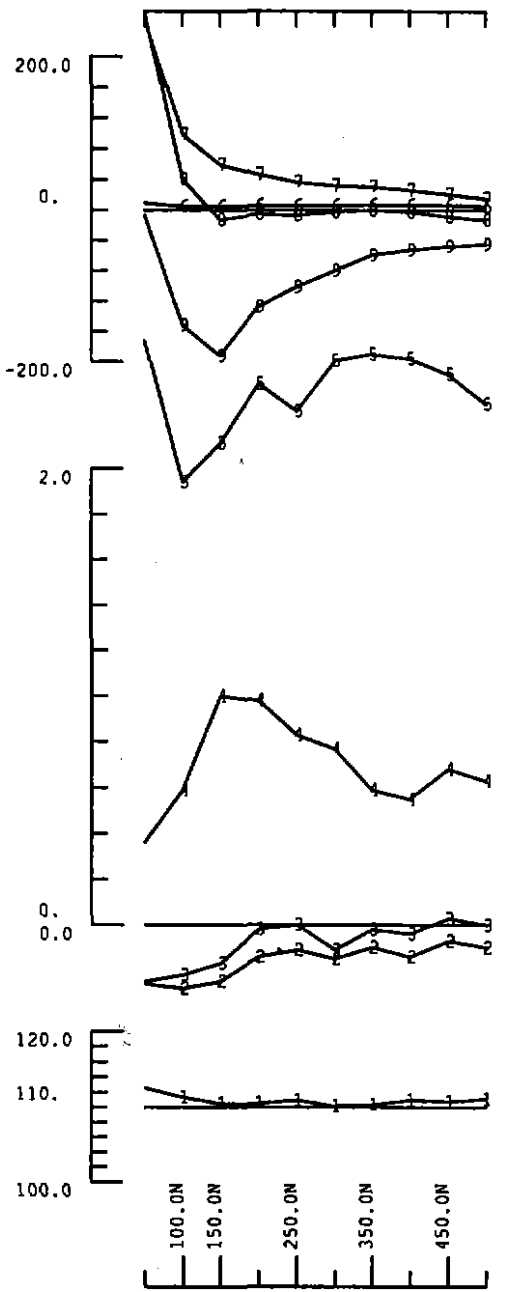
Silic, J, 1989 Interpretation of TDEM Data Using First and Second Spatial Derivatives and Time Decay Analysis, Explor. Geophys., Vol 20, No 1/2, pp 57-64.

465302

Appendix 1

Mt Roland Grid UTEM Data

465303



MT. ROLAND GRID

GOWRIE PARK EL.

LINE 600E LOOP 1

(out of loop data)

Point Normalized

1000E 300N

UTEM Survey Febuary 1990

Secondary Magnetic Field

Hz Component

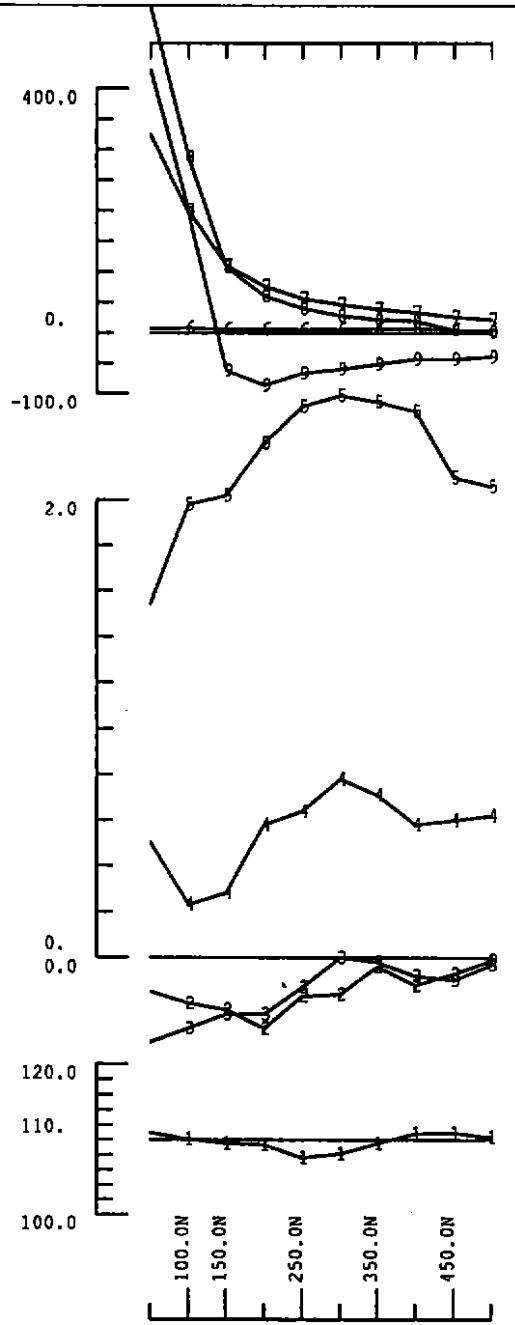
Freq. 26.23Hz

Aberfoyle Resources Ltd

March 1990 <jjr>

Plot Date : 21/03/90 Horiz

455304



MT. ROLAND GRID

GOWRIE PARK EL.

LINE 800E LOOP 1

(out of loop data)

Point Normalized

1000E 300N

UTEM Survey Febuary 1990

Secondary Magnetic Field

Hz Component

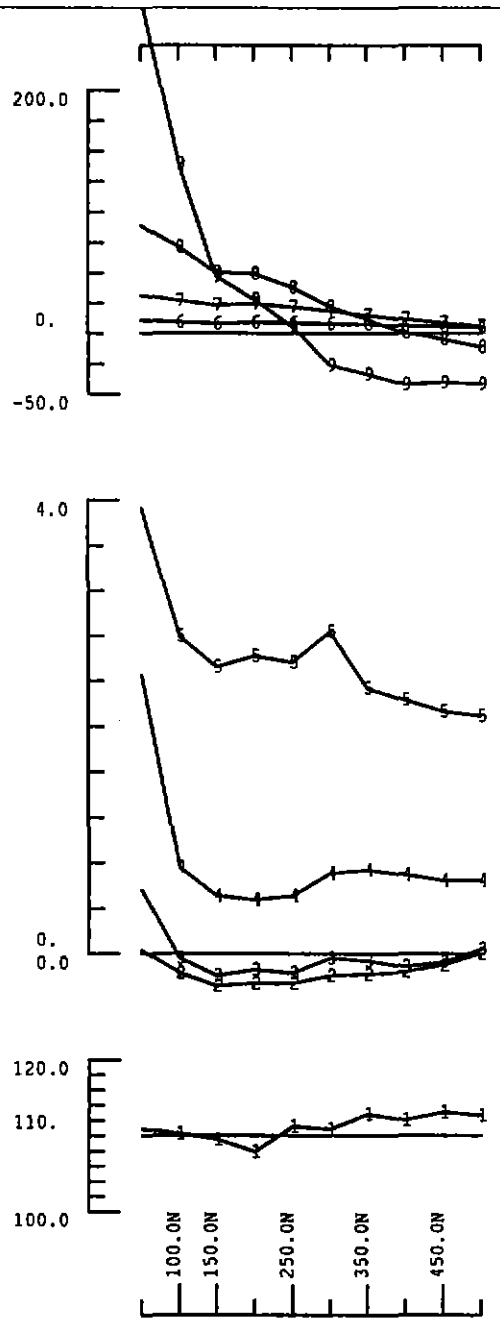
Freq. 26.23Hz

Aberfoyle Resources Ltd

March 1990 <jjr>

Plot Date : 21/03/90 Horiz

465305



MT. ROLAND GRID

GOWRIE PARK EL.

LINE 1000E LOOP 1

(out of loop data)

Point Normalized

1000E 300N

UTEM Survey Febuary 1990

Secondary Magnetic Field

Hz Component

Freq. 26.23Hz

Aberfoyle Resources Ltd

March 1990 <jjr>

Plot Date : 21/03/90 Horiz

465306



MT. ROLAND GRID

GOWRIE PARK EL.

LINE 1200E LOOP 1

(out of loop data)

Point Normalized

1000E 300N

UTEM Survey Febuary 1990

Secondary Magnetic Field

Hz Component

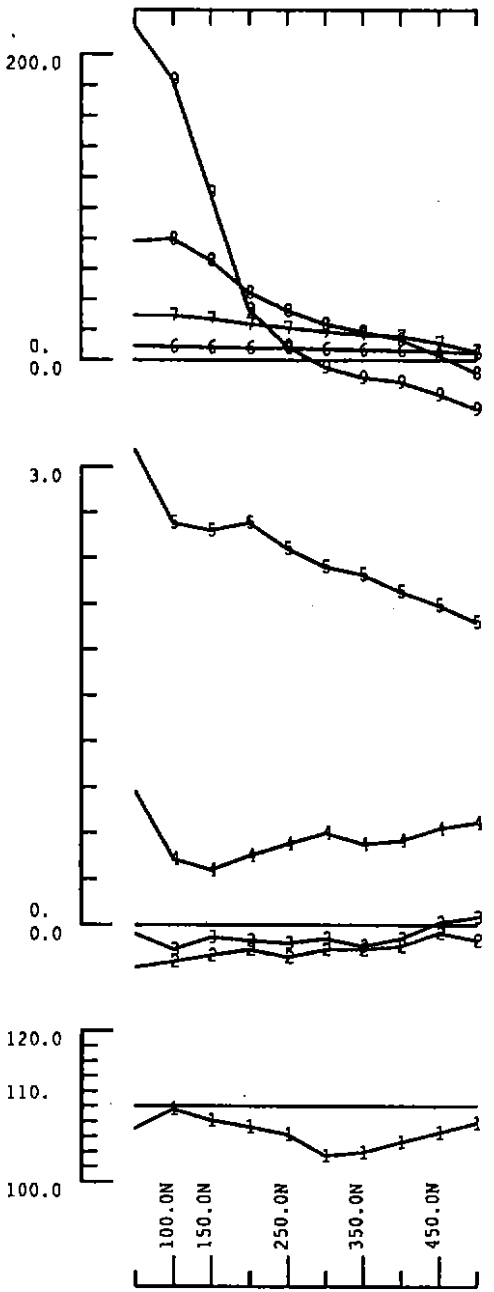
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Aberfoyle Resources Ltd

March 1990 <jjr>

Plot Date : 21/03/90 Horiz

465307



MT. ROLAND GRID

GOWRIE PARK EL.

LINE 1400E LOOP 1

(out of loop data)

Point Normalized

1000E 300N

UTEM Survey Febuary 1990

Secondary Magnetic Field

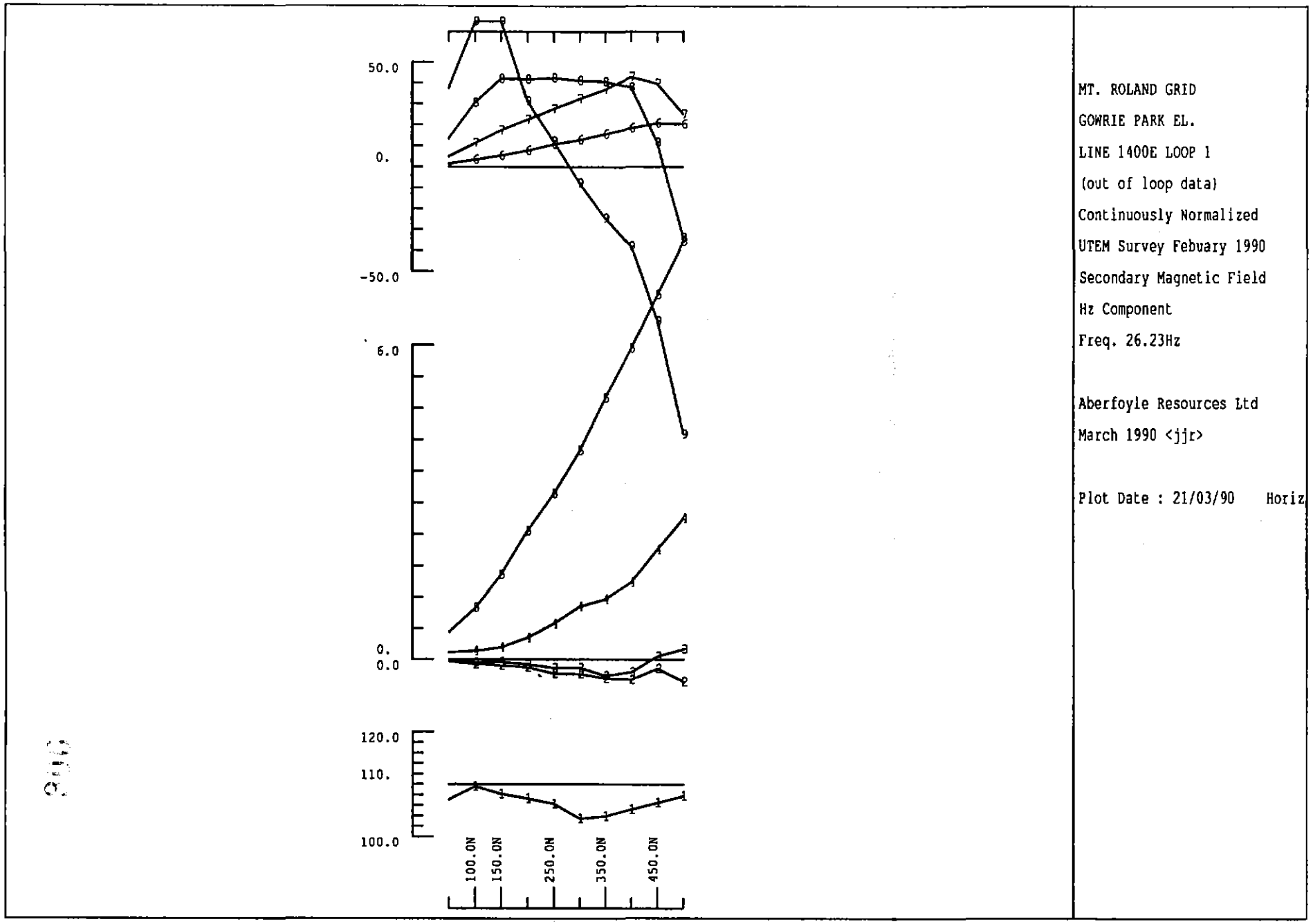
Hz Component

Freq. 26.23Hz

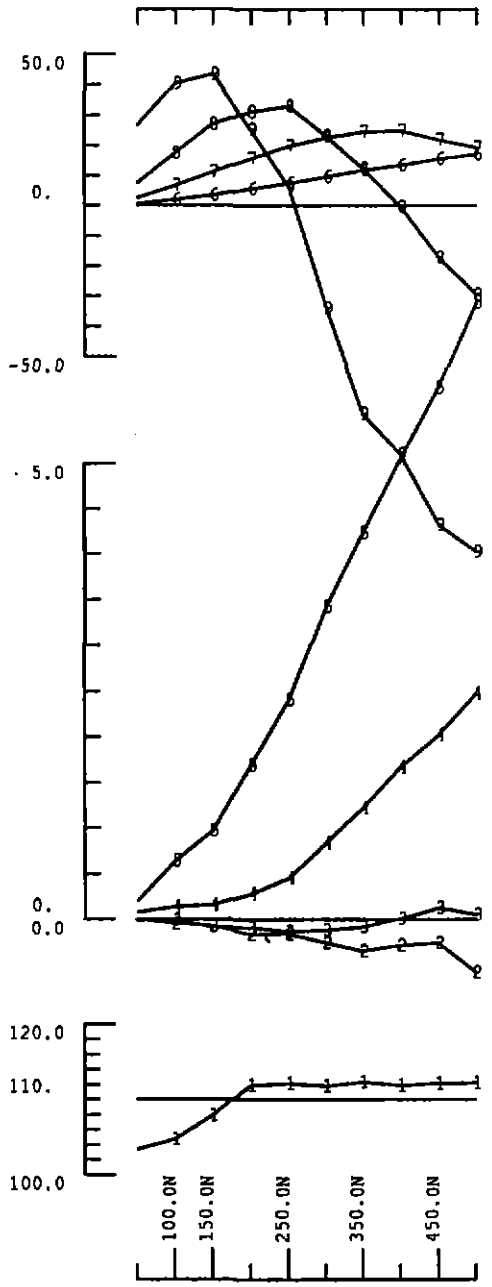
Aberfoyle Resources Ltd

March 1990 <jjr>

Plot Date : 21/03/90 Horiz


50.0
0.
-50.0
6.0
0.
0.0
120.0
110.
100.0
100.0N
150.0N
250.0N
350.0N
450.0N
MT. ROLAND GRID
GOWRIE PARK EL.
LINE 1400E LOOP 1
(out of loop data)
Continuously Normalized
UTEM Survey Febuary 1990
Secondary Magnetic Field
Hz Component
Freq. 26.23Hz
Aberfoyle Resources Ltd
March 1990 <jjr>
Plot Date : 21/03/90
Horiz

465309



MT. ROLAND GRID

GOWRIE PARK EL.

LINE 1200E LOOP 1

(out of loop data)

Continuously Normalized

UTEM Survey Febuary 1990

Secondary Magnetic Field

Hz Component

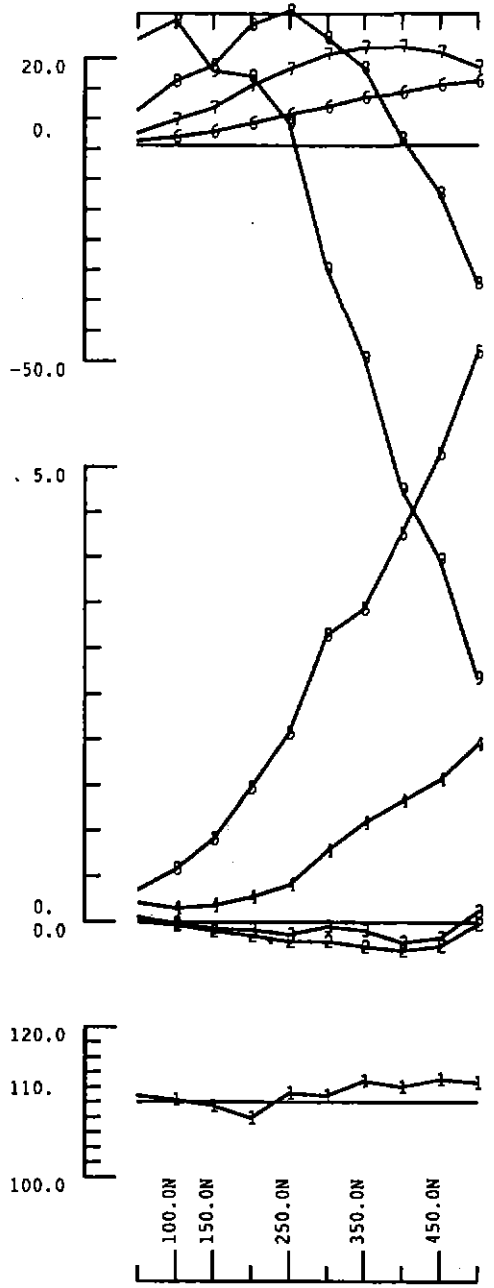
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Aberfoyle Resources Ltd

March 1990 <jjr>

Plot Date : 21/03/90 Horiz

465310



MT. ROLAND GRID

GOWRIE PARK EL.

LINE 1000E LOOP 1

(out of loop data)

Continuously Normalized

UTEM Survey Febuary 1990

Secondary Magnetic Field

Hz Component

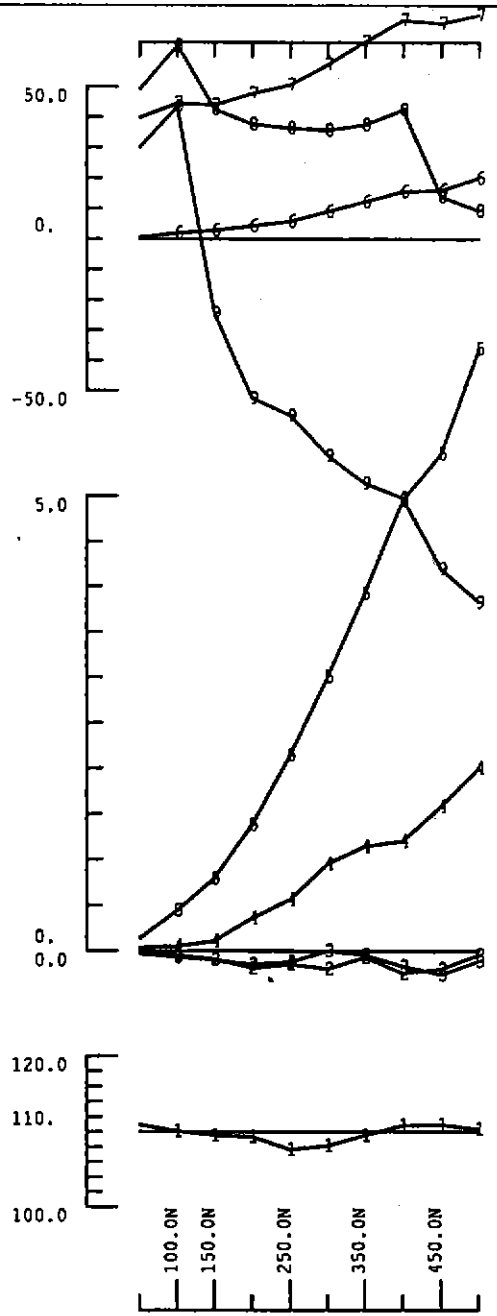
Freq. 26.23Hz

Aberfoyle Resources Ltd

March 1990 <jjr>

Plot Date : 21/03/90 Horiz

465311



MT. ROLAND GRID

GOWRIE PARK EL.

LINE 800E LOOP 1

(out of loop data)

Continuously Normalized

UTEM Survey Febuary 1990

Secondary Magnetic Field

Hz Component

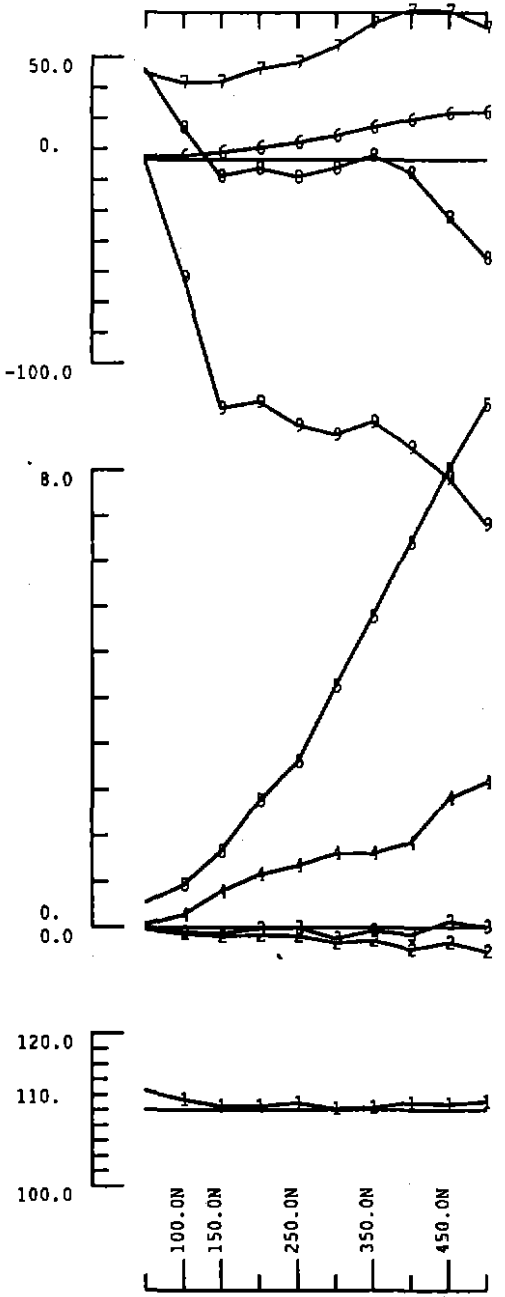
Freq. 26.23Hz

Aberfoyle Resources Ltd

March 1990 <jjr>

Plot Date : 21/03/90 Horiz.

455312



MT. ROLAND GRID

GOWRIE PARK EL.

LINE 600E LOOP 1

(out of loop data)

Continuously Normalized

UTEM Survey Febuary 1990

Secondary Magnetic Field

Hz Component

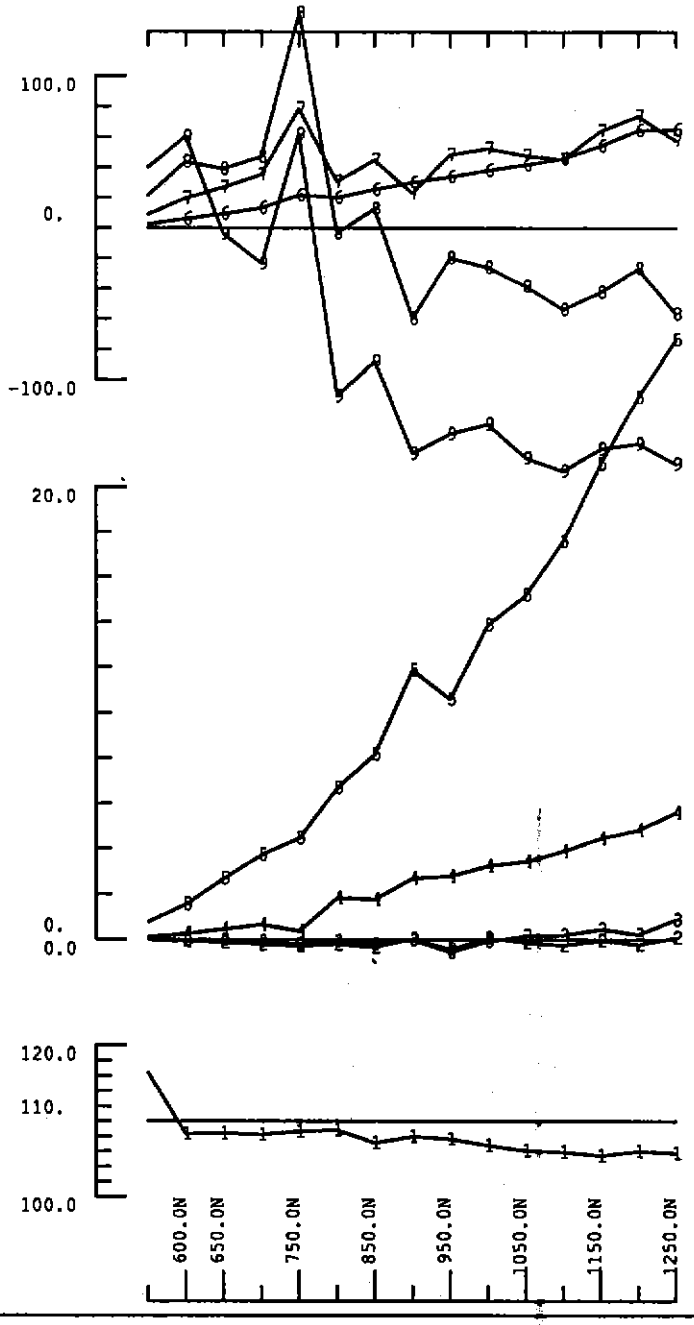
Freq. 26.23Hz

Aberfoyle Resources Ltd

March 1990 <jjr>

Plot Date : 21/03/90 Horiz

465313



MT. ROLAND GRID

GOWRIE PARK EL.

LINE 600E LOOP 2

(out of loop data)

Continuously Normalized

UTEM Survey Febuary 1990

Secondary Magnetic Field

Hz Component

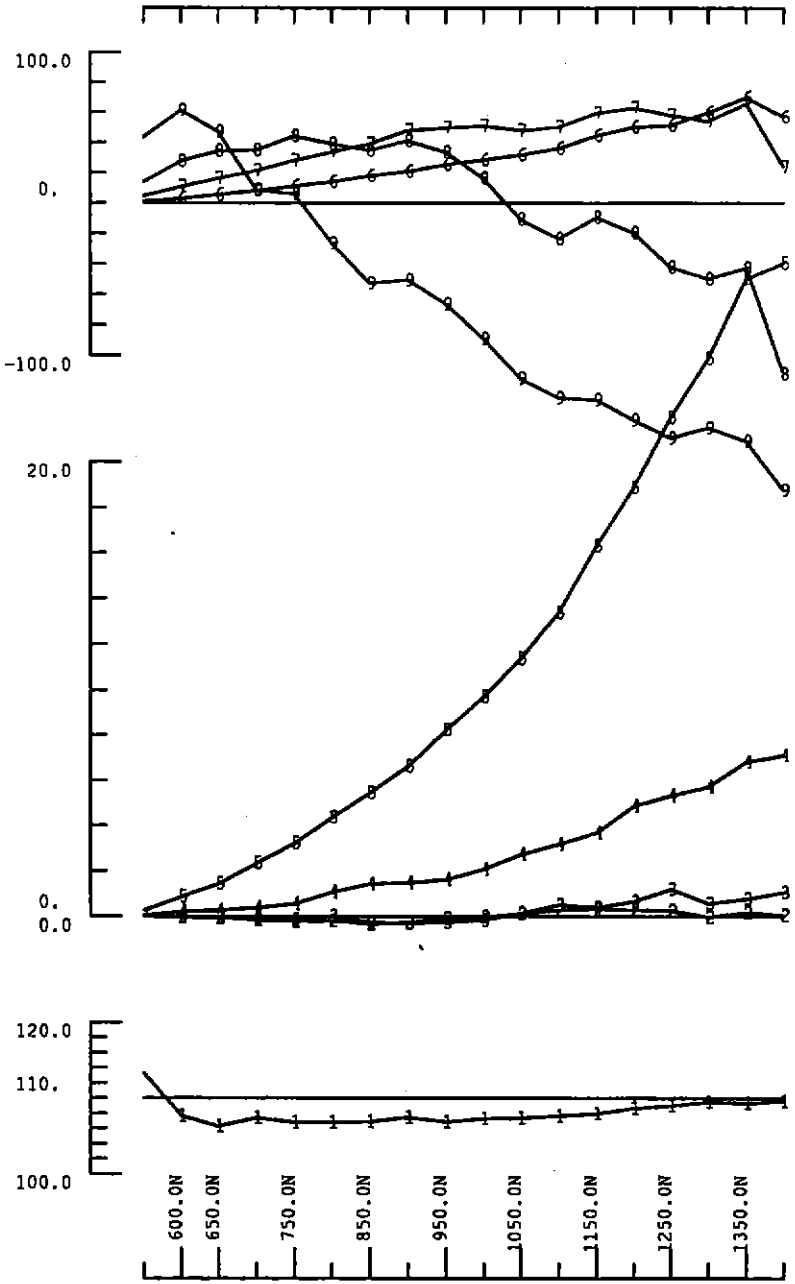
Freq. 26.23Hz

Aberfoyle Resources Ltd

March 1990 <jjr>

Plot Date : 21/03/90 Horiz

409314



MT. ROLAND GRID

GOWRIE PARK EL.

LINE 800E LOOP 2

(out of loop data)

Continuously Normalized

UTEM Survey Febuary 1990

Secondary Magnetic Field

Hz Component

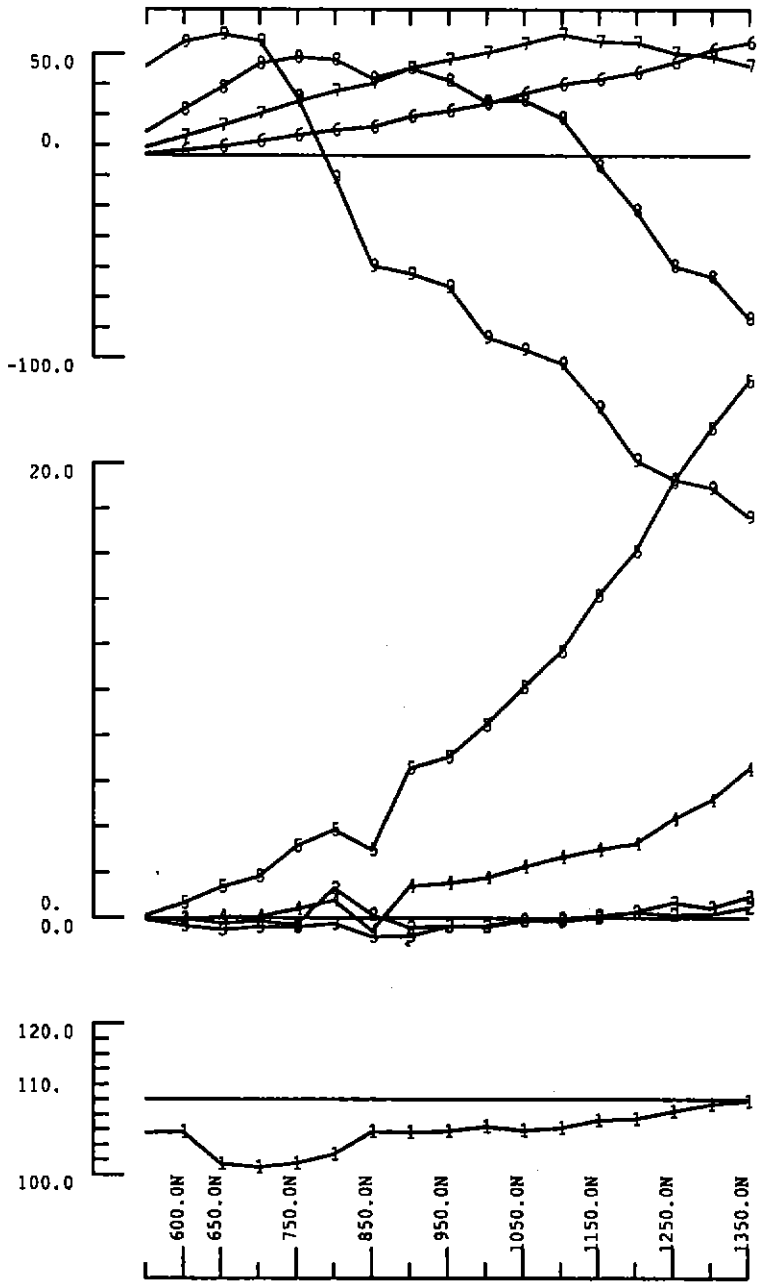
Freq. 26.23Hz

Aberfoyle Resources Ltd

March 1990 <jjr>

Plot Date : 21/03/90 Horiz

465315



MT. ROLAND GRID

GOWRIE PARK EL.

LINE 1000E LOOP 2

(out of loop data)

Continuously Normalized

UTEM Survey Febuary 1990

Secondary Magnetic Field

Hz Component

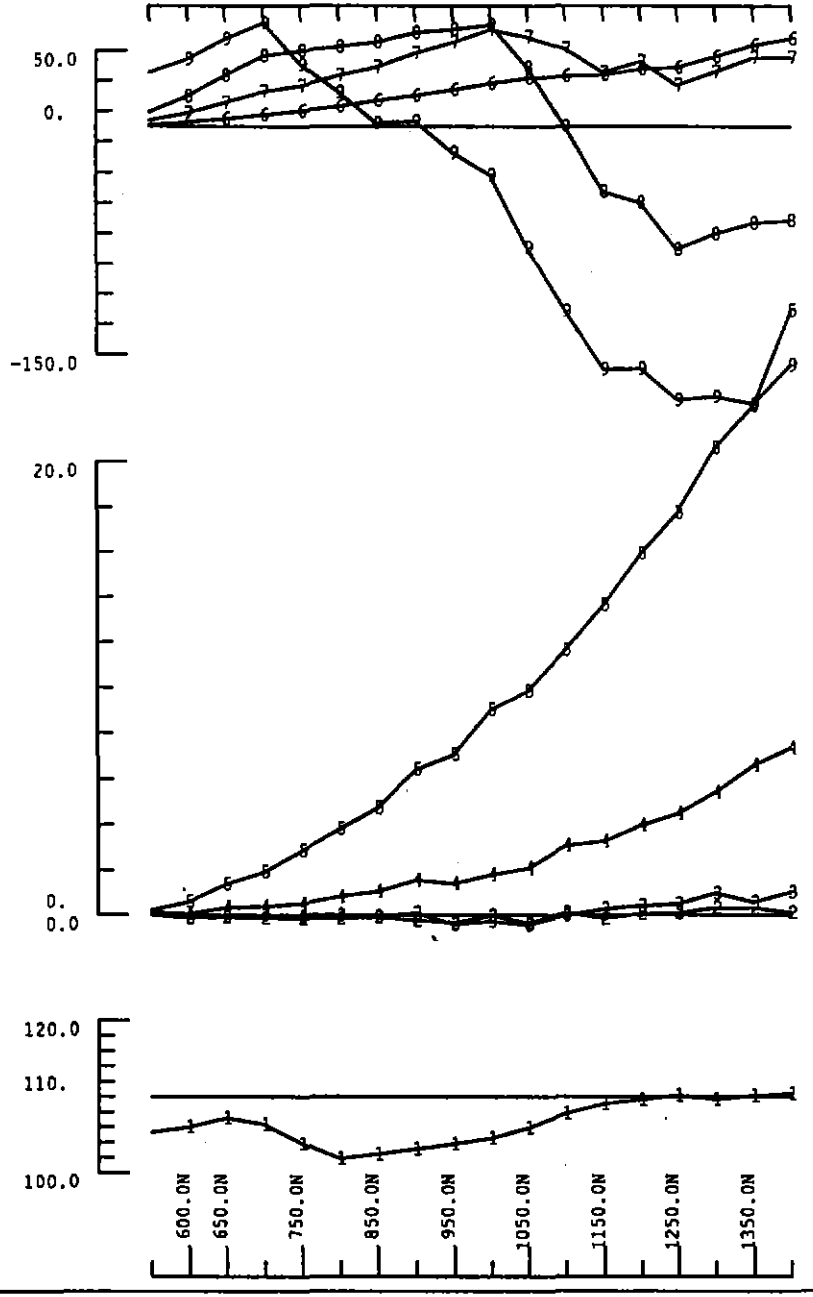
Freq. 26.23Hz

Aberfoyle Resources Ltd

March 1990 <jjr>

Plot Date : 21/03/90 Horiz

453316



MT. ROLAND GRID

GOWRIE PARK EL.

LINE 1200E LOOP 2

(out of loop data)

Continuously Normalized

UTEM Survey Febuary 1990

Secondary Magnetic Field

Hz Component

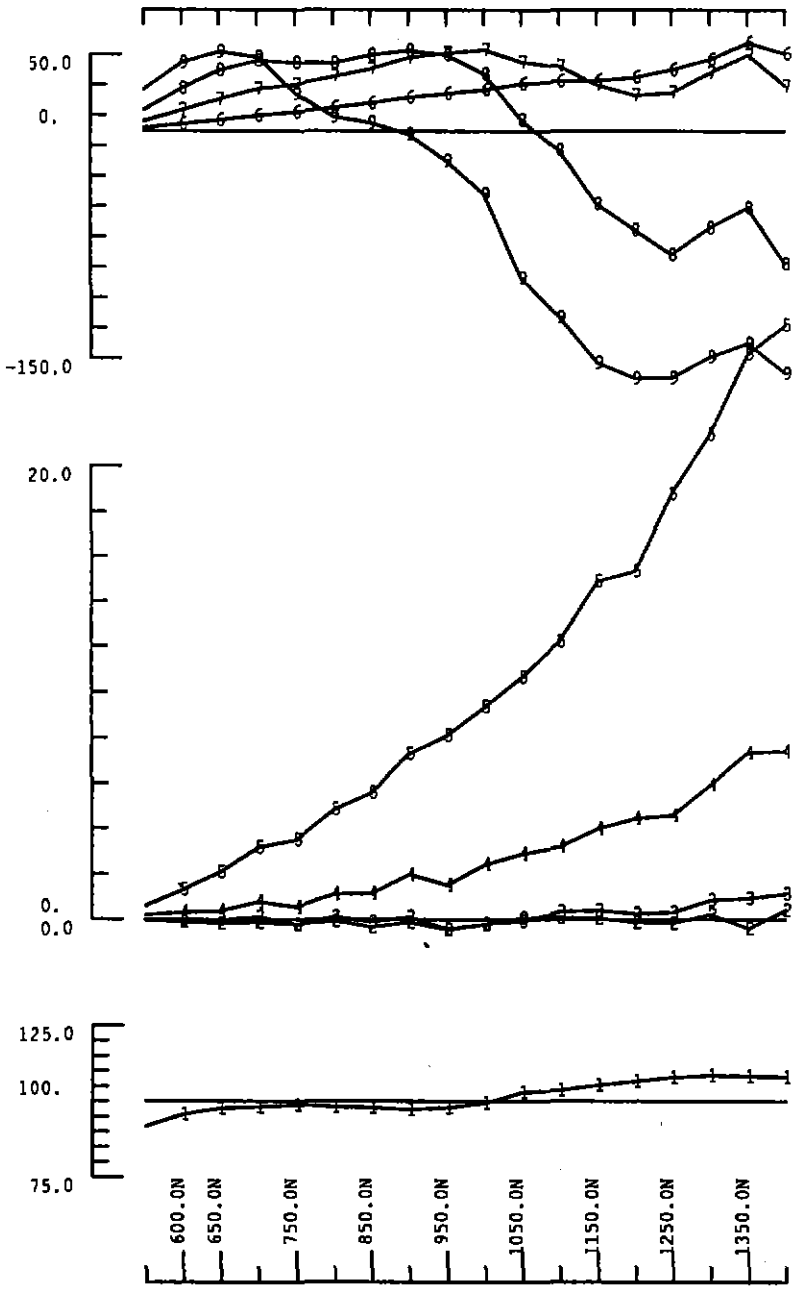
Freq. 26.23Hz

Aberfoyle Resources Ltd

March 1990 <jjr>

Plot Date : 21/03/90 Horiz

435317



MT. ROLAND GRID

GOWRIE PARK EL.

LINE 1400E LOOP 2

(out of loop data)

Continuously Normalized

UTEM Survey Febuary 1990

Secondary Magnetic Field

Hz Component

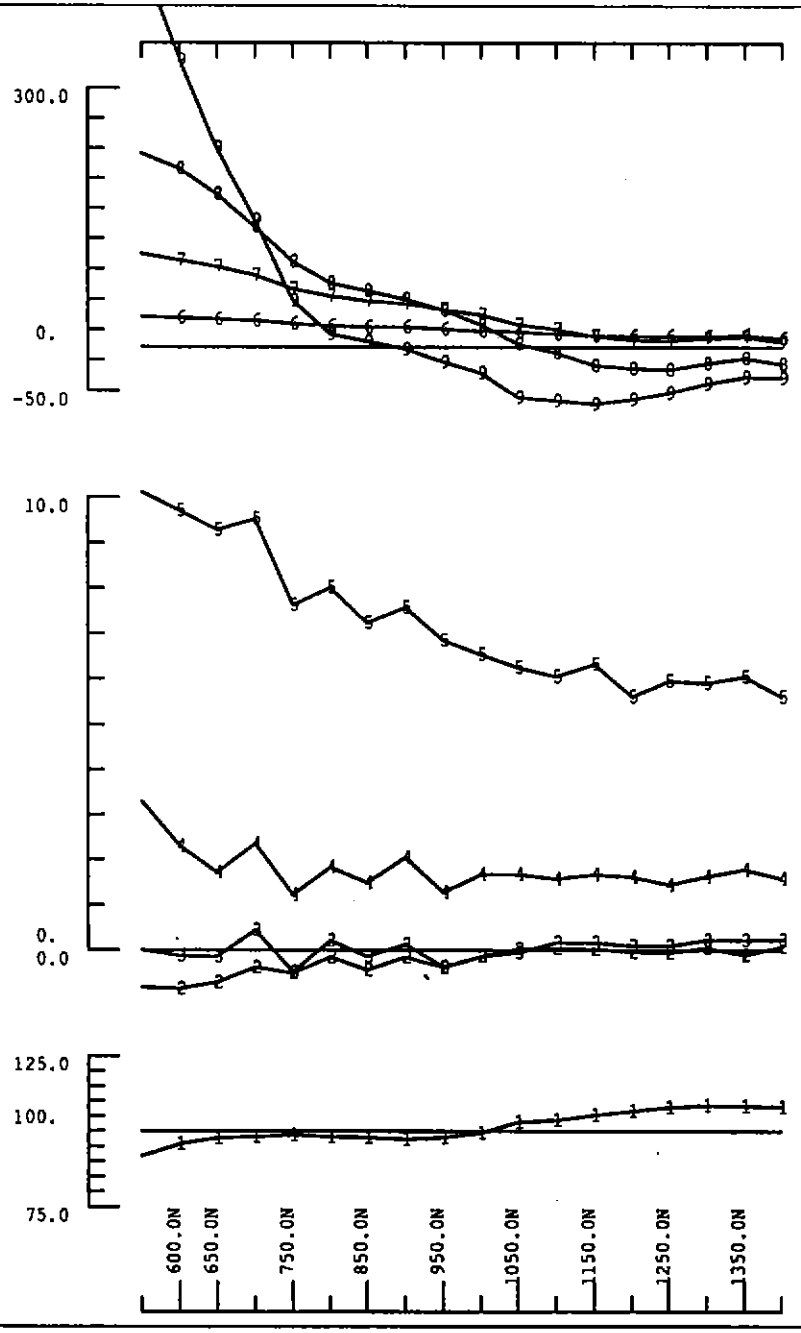
Freq. 26.23Hz

Aberfoyle Resources Ltd

March 1990 <jjr>

Plot Date : 21/03/90 Horiz

165318



MT. ROLAND GRID

GOWRIE PARK EL.

LINE 1400E LOOP 2

(out of loop data)

Point Normalized

1000E 1000N

UTEM Survey Febuary 1990

Secondary Magnetic Field

Hz Component

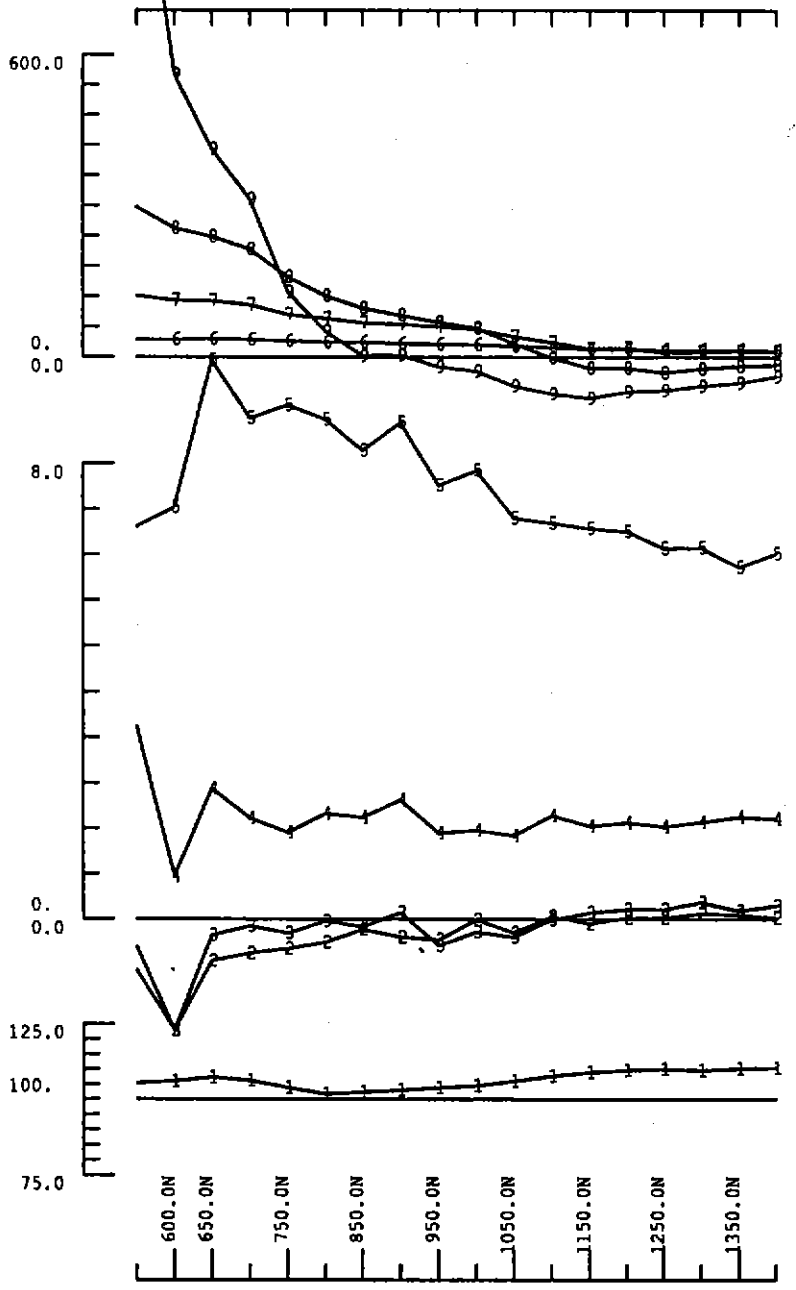
Freq. 26.23Hz

Aberfoyle Resources Ltd

March 1990 <jjr>

Plot Date : 21/03/90 Horiz

405319



MT. ROLAND GRID

GOWRIE PARK EL.

LINE 1200E LOOP 2

(out of loop data)

Point Normalized

1000E 1000N

UTEM Survey Febuary 1990

Secondary Magnetic Field

Hz Component

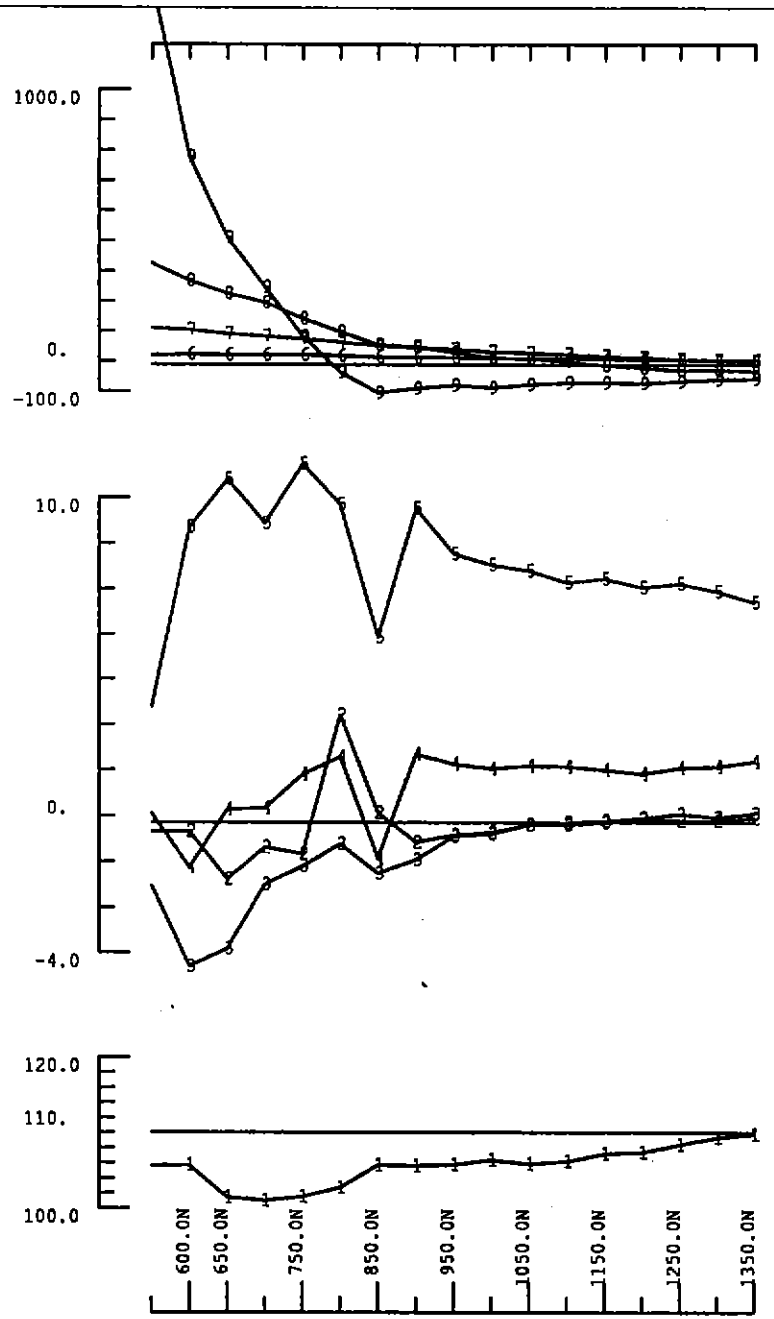
Freq. 26.23Hz

Aberfoyle Resources Ltd

March 1990 <jjr>

Plot Date : 21/03/90 Horiz

435320



MT. ROLAND GRID

GOWRIE PARK EL.

LINE 1000E LOOP 2

(out of loop data)

Point Normalized

1000E 1000N

UTEM Survey Febuary 1990

Secondary Magnetic Field

Hz Component

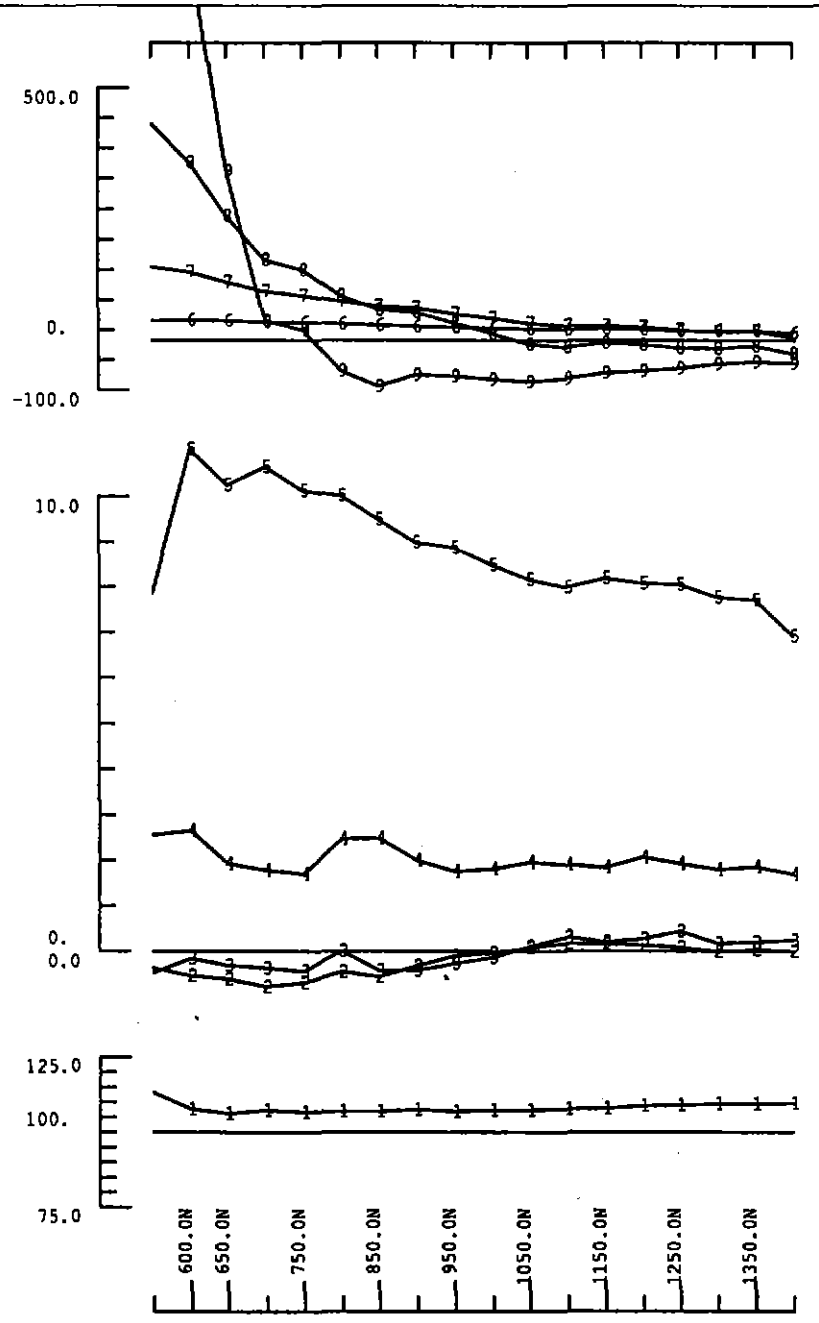
Freq. 26.23Hz

Aberfoyle Resources Ltd

March 1990 <jjr>

Plot Date : 21/03/90 Horiz

435321



MT. ROLAND GRID

GOWRIE PARK EL.

LINE 800E LOOP 2

(out of loop data)

Point Normalized

1000E 1000N

UTEM Survey Febuary 1990

Secondary Magnetic Field

Hz Component

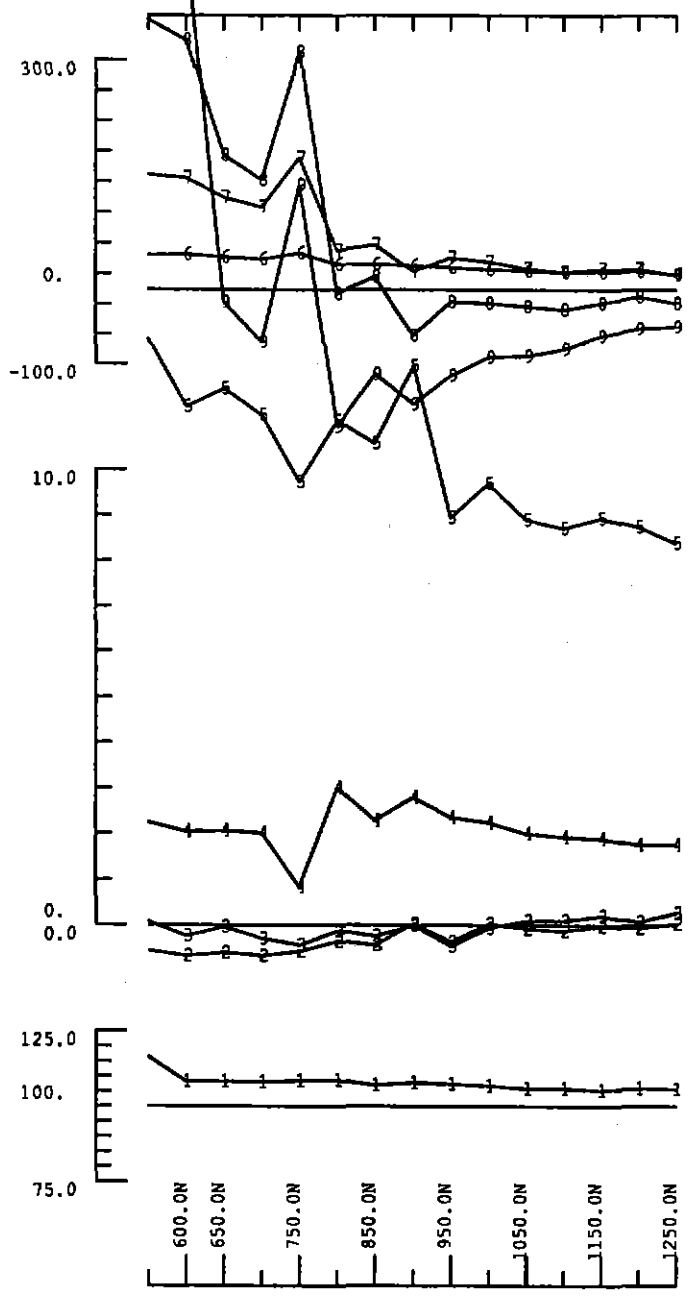
Freq. 26.23Hz

Aberfoyle Resources Ltd

March 1990 <jjr>

Plot Date : 21/03/90 Horiz

435322



MT. ROLAND GRID

GOWRIE PARK EL.

LINE 600E LOOP 2

(out of loop data)

Point Normalized

1000E 1000N

UTEM Survey Febuary 1990

Secondary Magnetic Field

Hz Component

Freq. 26.23Hz

Aberfoyle Resources Ltd

March 1990 <jjr>

Plot Date : 21/03/90 Horiz

465323

Aberfoyle Resources Limited

EXPLORATION DIVISION

EXPLORATION LICENCE 11/88

GOWRIE PARK

TASMANIA

Progress Report for the Year

Ended 1 July, 1990.

Volume 2

Plates

MINES
File Ref.
27 JUL 1990
Doc. Ref.
Action Officer | Initials
Refer to
Comms dated
24.7.90.
Resubmit to | Date

OPEN FILE

90-3153.
VOL 2/2

3358

York Creek

Cheeks Creek

RIVER DASHER

Clouds Road

Tea Tree Road

Sprint Track

STATE FOREST

Mt. ROLAND PROTECTED AREA

Gravel Pit
qz pebble Cg Scree

RD 84 MR 2
007° to 180°
0-9m scree
9-43m wh. vtc?
43-100m var. CN A.I. (tr dis. Py, Mt)

5 410 000mN

434 000mE

435 000mE

540 520 500 480 460 440 420 400 380 360 340 320 300 280 260 240 220 200

5cm

SHEET LAYOUT

G H I J K L M N O P Q R
1 2 3 4 5 6
EL 43/85
EL 11/88

Aberfoyle Resources Limited			
EXPLORATION DIVISION			
REVISIONS	NORTH WEST TASMANIA	Compiled : SWR	
Init Date Init Date	GOWRIE PARK E.L. 11/88	Drawn : RJE	
GWR/je 7.9.90	OUTCROP GEOLOGY	Traced : RJE	
	465324	Checked : SWR	
Location Code	Scale 1 : 2 500 Date May, 1990	Plate No GP35/H4	

9550

436 000 mE

437 000 mE

438 000 mE

5 410 000 mN

GOWRIE PARK EL 11/88

Mt. ROLAND PROTECTED AREA

TEERS ROAD

625 N 100E (CRA)

(AMG 436913·8E 5409629·9N)

90-3153.

SHEET LAYOUT

G H I J K L M N O P Q R

1 2 3 4 5 6

EL 43/85

EL 11/88

5cm

465325

Aberfoyle Resources Limited
EXPLORATION DIVISION

REVISIONS				
Init.	Date	Init.	Date
SWR/JK	26-3-90		
SWR/JK	26-3-90		

NORTH WEST TASMANIA
GOWRIE PARK E.L. 11/88
MT. ROLAND GRID
OUTCROP GEOLOGY

Compiled : SWR
Drawn :
Traced : JMS
Checked :

Location Code :

Scale : 1 : 2500

Date : February 1990

Plate No : GP 35/14

5597

434 000mE

435 000mE

5 412 000mN

5 411 000mN

TRANSMISSION LINE

STATE FOREST

Febeys Road

DASHER RIVER

5cm

560 540 520 500 480 460 440 420 400 380 360 340 320 300 280 260 240

mas gr m-f Pl + Y ith lv + minor Qz/Ep vn +wk fp A-B1 (magnetic)

wk mod gr fp —

br m-cg qz + Y ith (to 1cm) lv

mod-st gr vnd qz Y ith vlc st

dk gy wk hmn dft fp + mafic phyric A-B ft. E fragments to 3cm ch fg wk Ch, dft A ith

qz + Y im lv

mas Q/Ep vnd qz ith lv.

qz + Y im lv weakly magnetic

Y ith vkd st qz pebbles + 5mm

lge blds mas bt B1 E mnr. qz + cc filled ves + rare Py, magnetic rare qz/Ep qtn. grid pos 15 E chert + qz infill (pillows ?)

f-mg br-gn mafic phyric ves. B1 + m-cg fg-f ith lv.

cly 150°/vert

(562072 P.G.) gd mg ith fp A lb fragments to 10 cm, ch fg mtx wk Cc (esp. between frags) magnetic

mmas fg pp+gn A ith. lv

(562071 P.G.) vfg dft (wk hmr dft) mas + mg vkl E mod calc fg A1 fragments + Ch, mafic? phenocrysts (wk Ch, dft) fg A ith lv, v wk Cc, dft magnetic

wk hmr dft vc, vfc ith, dft fg (<1mm) ; ? mnr Ep spt A-1 ?

fg sp gn A ith. lv, wk cly 150°/vert

qz fp (mnr) br A ith lv, F rkvn Ep + mnt dft mg mtx, tr mnr Ch1 por.

(562073 P.G.) mas br fg wx fg + wk Ch1 dft mafic A1? mnr Ch1 F/c dft magnetic

mas br fg wx fg ith (<1mm) lv.

(562074 P.G.) vfg gy tx vlc Sh finely bedded ; (<1mm) mnc Py (right way up) bedding 035°/69°E cly 165°/vert

fg bedded Gv

fg gy-br finely bedded vlc Sh

br fg vcvt vlc Sh

bedding 355°/58°E

(562075 P.G.) mic-mg pp sm fp wk ENE dft mafic phyric weakly foliated fp + HQ A1 (or A, to ?) + pyrite, wk Qz dft wk, cly 150°/vert

vf y fg sl-gy finely bedded vlc Sh dd mg (immunised) vlc st bedding) 000/45E dip 160°/80°N

gr m-cg qz +Y ith lv, v fg Gr bedded qz

br-sl br fg vlc Sh dd cg sm st

vfg lt br Gv

(562076 P.G.) mas br mg qz fp mod qz phyric Y ith lv, com A1-1 frags weakly magnetic

mas gy gr vf cly 335/85°E

bedding 025/63°E

wk gn fg lt grey mnr L bedding cly 160/70E

mg dk gn wk qz + fp Y ith lv, F com small Ch dft Pl frags wk Gr dft wk cly 160/65°E

mas fg qz + fp Y im dkb wk ch

wk shd lbf/Ch vn

fg sv ? vf Sh

sp wk hmt dft Y ith (inc qz pebble) vlcd st, str magnetic

lge blds mas br B1 F mnr. qz + cc filled ves + rare Py, magnetic rare qz/Ep qtn. grid pos 15 E chert + qz infill (pillows ?)

f-mg br-gn mafic phyric ves. B1 + m-cg fg-f ith lv.

wth. br f-mg fg Y ith lv.

T B + vfg br m.

mic fg qz + fp Y im. dkb wk ch.

T B

wk shd lbf/Ch vn

fg sv ? vf Sh

T B

sp wk hmt dft Y ith (inc qz pebble) vlcd st, str magnetic

5 fg br-gy qz + mnr Cg lg x lv + com wh vn, rt

wh vf - st (40cm; e-w)

yw bn fg qv

wk Fe st mg qz x ith lv

mg dft fp x lv

fg x Pu lv.

mod st qz phyric (to 2mm) vert wh vf st

con TB

T B

or tr mg fp x ith lv.

4 + mg dk gn fg + mnr Ch1 dft Pu ? (or brn.) fg x ith lv stc cly 125° vert

lge bld mic fg wk qz phyric x lv

lt gy mic Sh ? (qv ?) 5 mnr wh ith + rare fg

562040 P.G. gr bn fg mic qz bdd lv im Sh, bedding 230°/55°E mod cly 150°/dft fg (Cr + 30% opm, T1/3Zr ? 19)

lt gy qv bedding 260°/060°S (lightway up)

gr qz vnd qz lv sp vns w 0.4m 150°vert

wk Fe st fg mic lv

wk Fe st fg fp ith lv wk qz phyric (<1mm)

st clv mg fg + o ith lv, cly 125° vert

dpn, blds wh wm st Fe st, Qz/Ch vns

cg vfcl Cg (pebbles to 10 cm)

fg gn gy Sh ; bd ? m-cg Y ith lv & mnr Mt + Py clasts 562044 P.G. (+ sm 562043) T1/Zr 127°

gn-bl mg qz+lp+mnr Ch1 dft Pu qz fp x Pu lv, str clv 110°/vert mod str Cc dft

562043 P.G. gn m-cg Y ith (5% fg) lv Pu Y, ? E com dk gn Ch1 dft Pu + tr Py ith lv ax Cc dft, st clv 117/80°N T1/Zr ? 59 ?

dk br mg mod qz phyric qz fp x Y ith lv vert fractures of this Sh

STATE FOREST

lt wm st clv qz phyric or fg mtx, mod com qz x lv, clv 125° vert.

lt br gn mg qz fp x ith lv, clv 125° vert (ith 1c < imm)

y-lt bn mod qz phyric (to 3mm) R qz x lv, E mnr bx lithq (as for 562042)

wk clv 120°/ vert

wk Fe st mg qz ith lv lbd fg Sh (cont sed dst)

wk clv qtz lv, clv 125°/vert

vfcl pebble Cg

lt gn wk rded qz phyric vfc, F mnr gn Se + Chl dft assps (other Pu ?)

lt gn qz phyric vfc mnr dk patch, rare Fg (f. cts for 562039)

R qtz lv

lt bn sparsely qz phyric qz x lv, wk clv 150°/vert

lt bn wk qz phyric (to 2mm) qz x lv, wk clv. 130/80°N

mas wk clv, lt gn wk qz phyric R qz x lv, cly 115°/vert

v-r qz phyric ex fp R qz x lv.

562039 G mas lt gn lt gy qz phyric vfc F fg mrx, mod com Fe st dk bn wisps ? T1/Zr ? 3

v-r qz phyric fg mrx, wk clv, qtz lv (identical to 562042)

clv 135°/vert

lt clv wk qz phyric mcg, lt gn qz x lv clv 135°/90°N

com fr wh qz lv.

no sys

qz x lv.

gr with mg qtz fp lv.

wth. qv qz x Pu lv C mud com ; lt gn Ishme wx-v wth ; with hairlines & occ fg chert 0 5% qvein

SHEET LAYOUT

G H I J K L M N O P Q R

1 2 3 4 5 6

EL 43/85

EL 11/88

465326

Aberfoyle Resources Limited
EXPLORATION DIVISION

NORTH WEST TASMANIA

GOWRIE PARK E.L. 11/88

OUTCROP GEOLOGY

REVISIONS			
Init	Date	Init	Date
SWR/JE	18-6-90		
SWR/JE	6-7-90		
Location Code			

Scale 1 : 2500 Date June, 1990

Compiled : SWR
Drawn : RJE
Traced :
Checked :
Plate No : GP35/H3

E.L.43/85 BEULAH

E.L.11/88 GOWRIE PARK

Index to sheets

A	B
A	B
C	D

Beaulah 34

Gowrie Park 42

5410000 m N

5409000 m N

451000 m E

452000 m E

453000 m E

5400 E

5600 E

5800 E

5000 E

5200 E

5400 E

5600 E

5800 E

5000 E

5200 E

ST4

ST5

ST6

ST5A

BB1 (CRA)

BB2 (CRA)

BB3 (CRA)

BB4 (CRA)

BB5 (CRA)

BB6 (ABERFOYLE)

GE1 (CRA)

Dynans Bridge Road

For details in this area see
BEULAH BARITE PROSPECT
1:1000 Plate GP15

Cbfl

Cbfaa

CbfRvlcl

Cgg

5 cm

90-3153.

Aberfoyle Resources Limited
EXPLORATION DIVISION

465327

NORTHERN TASMANIA

GOWRIE PARK E.L.11/88 - BEULAH E.L.43/85

GARDEN OF EDEN GRID

INTERPRETIVE GEOLOGY

REVISIONS			
Init	Date	Init	Date
Location Code			

Compiled: DJJ, SWR

Drawn: RJE

Traced: JMS

Checked: SWR

Plate No: GP42 B

Scale: 1:2500

Date: APRIL 1990

324

5410000mN

449000mE

450000mE

5409000mN

E.L. 43/85

E.L. 11/88

Ess. ℰ large ang. Q. fr. & mnr. fd. phn.

mas. gn. br clay alter B?

5153446 mas. gn. fp. A. B.I.

Ess. float

€bfDvlcl

€bfl

5153435 mas. fg. gn. wk. fp. B.I. wk. fd /Si alt ?

com. wth. B.I. float

fg. wk. Hmt. /Cc alt. B.I.

fg. fp. B?! wk Cc

5153342 P.G. mg. gn-br. str. fp + Px phn. wk. ves. A. B.I. wk. Ep./Cc alt.

m-cg. fp + Cl alt. Px phn. ves. A. B.I. ℰ mnr. Cc

fg. bl. B. I.

st. fp. B. A.I. wk Hmt alt.

5153341 P.G. str. Hmt /Cc alt ves. B.I. ℰ Cc+Cl ? in filling

5153340 P.G. mas. fg. gn. A?! ° + v.wk. Cc. alt. x. mnr. rd. ≠ ≠ Hm. vns ?

mas. dk. br. fg. alt. B?!

some sections strongly cleaved vertical /.063°m (Hem. alt.)

5153339 P.G. fg. pale. gn. sel. alt. fp. vtr. Tf occ. fg. spt. mnr. or. wth. ves ?

5153346 P.G. dk. br. Hb. + fd. phn. rich A. (ant. plug ?) ℰ str. ser./ chl. alt.

com. str. fp. A ?! ? ℰ mod. perv. mnt rare fg. yw. Epidosite

Hmt. alt. B. I.

com. qz. rubble in paddock

Dowkins Road

200

RIVER

Ooze

TRACK

com. or. Gw ℰ v.mnr. str. Hmt./ fp. vlc.

or. Gw

or. sed

fp. vlcl ℰ com. pk. rded. fd. and mnr. rded. Q

or. Gw. + Sh.

145°m 70°/340m or. bd. Sh & Gw

FLAGGING 9600N

5153591 P.G. mg. vlcl. ℰ Q + fd. phn. frags. ℰ mnr. D.I. frags. in gn. fg. mtx + Gw. frag ℰ. vlc + mer. inpot

cg. vlcl.

€bfDvlcl

€gg

mg. vlcl. Ess.

str. wth. vlcl. ? rded. Q.

FLAGGING 9500N

fg. vlcl. ℰ mnr. fd + Q phn. (sil. rded.) ℰ in o. gn. mtx.

f-mg. vlcl ? ℰ com. fd. phn. mnr. D.I. frags ? in gn. mtx. ℰ occ. str. Hmt. alt

fr. vlcl.

FLAGGING 9450N

fr. mic. BSh

Q. mic. Sst. mod. com. wh. reef Q. float

Hmt. alt. wk. fp. B.I.

mg. str. fp. br. vlc. B ? ℰ mod. pat. Hmt. alt. mtx.

5153580 mnr. float of y-or f-mg. D ? occ. Q + fg. phn ℰ mnr. Q + hmt. vn. + tr. Py ? (v. similar to 5153521)

5153579 gn. f-mg. A - B.I. ℰ bk. mafic phn. rare fp. wk. Cc. alt. + fr. dissem. Py. com. Cl + Ep / Q

v. fg. wk. mafic phn. str. fp (wth. surface) B?! ℰ mod. perv. Hmt alt. wk. mod. Cc (similar to 5153541)

vfg. bl. gn. mas. B? ℰ mnr. Hmt. alt. mtx.

fg. mafic phn? B.I. + fp. A.B.I.

str. fp. mg. dk. gn. A. B. I. v. wk. Hmt. mtx.

str. fp. A - B.I. (vis. on wthd. surface) mod. perv. Hmt + wk. Cc. (5153694 G.)

or - br - gn. wth. B.I.

vfg. alt. Bl. Fe rich Py? + mnr. y-or. alt. B?! ℰ Q + com. bk. spt. Cl? ves? Epid ?

vfg. alt. B.I. ℰ wk - mod. pat. Hmt. alt. mtx.

mas. B.I. ℰ abn. mafic. phn ? no obv. fd. mnr. Q + Cc in ves

5153549 mas. vfg. pp - rd - dk. br. vlc. I. ℰ int. Cl com. str. Hmt. alt. and occ. abn. spec. Hmt. / mag.

5153556 P.G. dk. gn. Bl. ℰ com. fd. phn. com. Cl alt. mafic. phn. com. dissem. Py & mnr. ds. ? Hmt. mnr. Cc. alt.

float pred. B.I.

int. Fe (Hmt ?) stn. ves. B.I.

5153355 P.G. mas. wk. Hmt. alt (v. fg. dk. gn. rock ℰ com. Cc ves. ? B?)

y-br. Q rich. vlc. ℰ mnr. Q vn. (similar to 5153521)

Fe st. Hmt ? rich. Gossanous mx ℰ alt. B?D? lava frags ?

5153353 P.G. Highly Cl/Si. alt gossanous glassy felsic lava ℰ common Hmt. vn.

bd. Sh.

5153463 G spec. Hmt. + Q rock

spec. hsem. magnetite rock

5153351 P.G. mas. br. with. wk. fp. wk. Hmt ? alt. A - D.I. ℰ mnr. Py.

rd + bk. Mn. rich B

4280346 rd. wh. + br. wth. B

rd + bk. Mn. rich. B

mas. rd - br. mod. str. Hmt ? Mn. stn. wk. ves. alt. B.I. ℰ or. with. ves + float as for

428035 P.G. dk. gy. unalt. str. fp. A or B.I. ℰ abn. mafic. phn.

or. mic. + Q. sst.

FLAGGING 9400N

mas. bl - gn. fp. + Hb phyric lava ?

5153678 P.G.

or. sh.

Qa

€gg

or. wth. sed. cg. Gw ? vlcl ? mnr. wh. Q. rubble cg. mm. Sst. ℰ com. rded. Q. & mnr. Sh. frags.

hard. vlcl. ℰ mnr. Q. + fp. Ess.

Dlcl. ℰ abn. Q. D. Ess.

mnr. wh. reef. Q.

mg. rdep. to packed E.?

€bfDvlcl

or. br. wth. fg. B.I. ℰ occ. Px. of Hb phn. and. wk. Hmt. alt. mtx. or. fg. vlcl ?

v. str. Hmt. alt. vlc.

fg. B.I.

fg. B. Sh

wk. Hmt. B.I.

5153680 P.G. fg. bl. B.I.

wk. Hmt. alt. B. I.

Br. with. fg. fp. vlc.

lt. br. mas. wth. fgr. vlc. ℰ mnr. or. fp ? B.I.

FLAGGING 9300N mas. br - gn. fg. wk. fp. + mafic. phn. B.I. ℰ v. fc. py. 5153681 P.G.

200

B.I.

FLAGGING 9250N

B.I. float

MINNOW

FLAGGING 9200N vlcl

mg. gy. mic. tuff

mas. fp. + mafic. vlc. 513679 P.G. (sim. 5153678 P.G.)

mg. mic. Gw.

fg. mic. B.Sh

45°

mg. mic. Sh. (sim. to SM 1 & 2)

90° seeding ?

fg. B. Sh

mas. rd. soil ℰ com. rded. qz. frags. Gw

ST 28 490005E

ST 29 492005E

ST 12 D

ST 11

ST 10

ST 13

ST W

ST 12 A

484005E

486005E

488005E

494005E

496005E

498005E

500005E

502005E

504005E

5153349 P.G. float v. fg. dk. gn. of A. lb. ℰ mnr. dk. frags. mod. Cc. alt. (frags. show wk. int. foliation)

rd. mg. Sst/Gw

5153348 P.G.

5153349 P.G. mas. mg. fd + Cl. alt. Px phn. A. B.I. ℰ local epidosite development

ST 12 E

ST 12 F

ST 1

ST 2

mas. rd. soil ℰ com. rded. pebbles Gw

y. or. soil ℰ occ. rnded pebbles Gw

mas. rd. soil other B.P.

"LOWER BEULAH"

Lower Dynons Road

Bridge Road

mas. wthd. B?!

428038 P.G. mas. dk. gy - gn. A. lb. ℰ mnr. D - RD vlc. lh. frags. wk. Cc.

5153350 P.G. mas. pale y-br. v.wk. Hmt. alt. D. xtf. or lava ℰ mnr. Fu. spt. mnr. Fe rich (Hmt ?) vns.

5153485 spec. Hmt. vnt.

mas. pale y-br. v. wk. Hmt. alt. ? lava

mas. uncit. B. I.

428037 P br. wth. Y. lh. A. D. xt. ℰ. gn. mtx. wk. foln.

shd. Hmt. fp. B ?

mas. fp. shd. B. ℰ mnr. lge. Q. vn.

5153405 Bldy. Q + spec. Hmt.

428048 P.G. gy - blk. fd + Px. phn. B.I. ℰ mnr. Hmt.

5153418 P.G. Bldy. Q + mas. stky. + be. Cl. vn. or. frac. filling.

€bfaa

€bfl

€bfal

€bfRvlcl

€gg

SM2 (CRA)

SM1 (CRA)

159m

179m

bd. Hmt. alt. Gw.

gy. Sh/lava ms.

Shd. mudstone. vf.

Gw+ mudstone vf

bd. mudstone — vf

br. Gw — vf

or. pk. leached Gw vf

mudstone — vf

Gw vf

Gw. q. vn. vf

bd. Sh ()

mas. gy. lava (v. f. ? ? 5153417

bd. Gw

Gw ? vf. ?

D/ mudstone ?

fg. vn.

Gw ?

Bsh

Gw ?

gy. sh.

Gw + sh.

Gw/mnr. hoem.

Gw/hoem. 5

br. Sh/Gw

Gw/hoem. 3

br. Gw + mudstone

Gw

Gw. q. sh. vf

bd. Sh ()

D ?!

dom. B.I. float occ. D?!. float.

dom. B.I. float ℰ occ. D?!. float.

float comprises mixture unalt. B.I. & fg. y-br. lava. ℰ com. Q/Ep 5153352 P.G. Epidosite (similar to 5153350 ?)

ST 1

ST 2

50000E

50200E

50400E

mas. rd. soil

wth. B

B fp./hoem

and. prom. fp. lx., partly Y

wth. rd or ye. blr. lava

wth. rd/hoem. spec. hoem

wth. rd. fp. lava/hoem

wh. Si ?, Se ?, spec. hoem.

wth. / hoem. (lava ?) D ? / spec. hoem.

/ hoem. 5

/ Si, hoem. vns.

/ hoem. 4 - spec. hoem. 5

wh. small fp. lavt

gy. D. patchy wh. 5

shd. hoem. lava lx.

/ hoem. 5

/ spec. hoem. 4

wth. lava

/ hoem. 5

rd. gn. Y lx. / Si., spec. hoem / hoem. 5

rd. bk + wth. wth. lava

/ hoem. 5

5153414 P mar. gy. str. Se + Si. alt. A. & lb.

shd. lava / hoem. spec. hoem.

shd / Se

— Ge / hoem. spec. hoem.

lava ? / hoem.

5153412 P gr. str. wth. trachytic. Afp. A. l. ℰ mnr. Fu. spt.

wh. apoline Si. Mn. spec. hoem. 5

/ Si. 5 - 5 ? 5153411

schists / highly Se (5)

wth. lt. gn. shd. q. Se rich. lava gn. lava / hoem. spec. hoem. patches

5153436 Hmt + Si. alt. lch. rock

5153560 P.G. 5153561 P.G.

gr. wh. bd. Gw. gn. fgn. bd. sh.

/ hoem. 5

dk. gn. sh.

maroon unalt. gr. mr. por. B (Beulah B.)

For Details in this area see BEULAH BARITE PROSPECT 1:1000 Plate GP 15

graphic gn. B.

lava / hoem. spec. hoem

bd. sh. Gw

Index to sheets

A	B	Beaulah 34
A	B	Gowrie Park 42
C	D	

Gregory's Road

Aberfoyle Resources Limited
EXPLORATION DIVISION

465328

NORTHERN TASMANIA

GOWRIE PARK E.L. 11/88 - BEULAH E.L. 43/85

GARDEN OF EDEN GRID

INTERPRETIVE GEOLOGY

REVISIONS			
Init.	Date	Init.	Date
SWR/JMS	1/8/90		
SWR/JMS	10-10-90		

Location Code

Scale 1:2500

Date APRIL 1990

Compiled SWR

Drawn RJE

Traced JMS

Checked SWR

Plate No GP42A

9532

450300 m E
450400 m E
450500 m E
450600 m E
450700 m E
450800 m E
450900 m E
451000 m E
451100 m E

5408900 m N
5408800 m N
5408700 m N
5408600 m N
5408500 m N
5408400 m N

GN MN

For Detailed geology refer Plate GP 27 (1:200)

- LOCALITY MAP -

BEULAH E.L. 43/85

BEULAH

SHEET COVERAGE

GOWRIE PARK E.L. 11/88

0 1 2 Kms

P0684B83(CRA)
76m
RD 882 (CRA)
99m
400m (RL-175)
DDH BB6(Aberfoyle)
DD84 BB5(CRA)
DDBB 4 (CRA)
PDB3 BB1 (CRA)
MAIN SHAFT
Creek
Sweetwater
≈ 75°

Cbfl
Cbfaa
Cbfal
CbfRvlcl
Cgg

5 cm

0 50 100 metres

90-3153.

Aberfoyle Resources Limited
EXPLORATION DIVISION
465329

NORTH WEST TASMANIA
GOWRIE PARK E.L. 11/88
BEULAH BARITE AREA
INTERPRETIVE GEOLOGY

REVISIONS			
Init	Date	Init	Date
SWR/JE	6.9.89		
SWR/JE	4.3.90		

Location Code

Scale : 1 : 1000
Date APRIL 1990

Compiled : SWR
Drawn : RJE
Traced : JMS
Checked :
Plate No : GP 41

9599

GOWRIE PARK

Mt. ROLAND PROTECTED AREA

Rodeo Ground

Sprint Track

SAWMILL

Gravel Pits

DASHER RIVER

Clauds Road

O'Neills Road

O'Neills Creek

Power line

CRA 5000N Baseline

CRA Cut Line

Track

Ridge

434 000 mE

435 000 mE

5 409 000 mN

5 408 000 mN

(562391 P.G.) Gg gr-gn.q.fp.x.ith. E.Sil. com. felsic. frags. mor. Hb.Al. and pre-€ frags. Ti/Zr = 17·2

fg.lv.lbd., wk. q.+fp.xlv. civ.080°/85°S

Cg bl.qz.x.ith.lv. frags of wh. Se alt.i.x. mnr block Sh.

yr-gn. mg.qz. phyric lv. mnr Se alt.

gr-wh. fg.v. wk.qz phyric mod. chl-cr wth. fp. vic. wn. Se alt., wk. pink mnr.alt.

wh. Qz + fp volc. trace dk. flecks (Py ?)

or. wh. qz. vlcl (qz. frags to 4 mm)

wk.shd.sil. wth. qz. vlc.

or. wh. qz. vlcl

wh.peg

Qz pebble Cg only

com. fin. of Qz pebble Cg

peg 4900E 4700N

peg 5000N 4900E

DDH RDB4 GP4 60°/360°/84m

Qz pebble Cg

flagging 5000N 5000E

dseg 5100E, 4950N

5000E 4900N

red flagging 1900E ? 1000S

white flagging 5000E, 4775N

4950N ? 4400E

4425E

4450E

grid line

grid line ?

ige Q Cg blds.

4900E, 4900N

4900E, 4800N

4800N

white flagging

gridline ?

Q vlcl.

mg.Q.phyric vlc. (↑?)

mod.civ.ext. Q + fp rich mg. vlcl.

Sat. wk. ener. alt. civ. 115°/80°N

mg. Q. vlcl. st. civ. 110°/80°S

fg.gn.felsic. vlc. (↑?) no vis. Q

mg. Q. vlcl.

Q rich xtl. vlcl. mod. hmat. alt.

Cg-Q xtl. fg. vlcl. gn. Se. mtx.

QCg

Q Cg

QCg mg Q+ fp R.↑

or. flagging (CRA S/Sed ?)

blue flagged cut line (CRAE ?)

(562380 P.G.) mas. y-or. str. wthd. volc. str. fp. + mnr. Q p-ps. in gn. mrx. fp. Q.A.i. Ti/Zr = 20

Q Cg

QCg (562311 P.) mg. Se. hmt. alt. fp. + Hb. A. x. vlcl. lbd., fg. fp. Slt. Ti/Zr = 18

com., abn. fit. of qz. + mnr. fp. l. R.↑

(562312 P.G.) fg. gr. gn. x.ith. vlcl. ± mnr. Hb.l. A.i. & Q.R.↑. fr. Ti/Zr = 2

Dam

(562313 P.G.) pp. mne. alt. A.–D. x.ith. vlcl. com. stubby fd ± mnr. gn. Chl. flecks no obv. Q. mnr. Epidosite fr. Ti/Zr = 20

fp.l.

mic Set

no o/c abn. Q Cg float

no outcrop abn. Q Cg float.

no outcrop abn. Q Cg float

no o/c

mas. o/c (562321 P.G.) or.-br. fp. x. vlcl. ± mnr. Q. & + Gl. Mt. alt. Ti/Zr = 21

SHEET LAYOUT

G H I J K L M N O P Q R

1 2 3 4 5 6

EL 43/85

EL 11/88

Aberfoyle Resources Limited
EXPLORATION DIVISION

465330

NORTH WEST TASMANIA

GOWRIE PARK E.L. 11/88
OUTCROP GEOLOGY

REVISIONS			
Init.	Date	Init.	Date
SWR	Jan. 8-1-90		
SWR	Jy. 6-7-90		

Location Code :

Compiled : SWR
Drawn : RJE
Traced :
Checked : SWR

Scale : 1 : 2 500
Date : March , 1990
Plate No : GP 35/ H5

9595

5 409 000 mN

5 408 000 mN

432 000 mE

433 000 mE

Claude Road

DASHER RIVER

Power line

Pole 18

grid line

cross line

grid peg

drill line

CRA? line

dozer track

500 480 460 440 420 400 380 360 340 320 300 280

(562035 P.G.) Ti/Zr : 32·9
m-cg & x fp. lm. E St comprised of q + lithic + mnr. Pre-E lms. mod. str. Chl. alt. mnr.

(562037 P.G.) Ti/Zr : 10·2
fg bl. wx. and qz + fp + mnr. Chl. lithic. lv. str. Gc alt.

(562036 P.G.)
mas. fg. bl. fp + mafic TP ( ) x's (?)

(562034 P.G.) Ti/Zr : 18·9
mas. mg. gn. or fp + q x. lth. R lv. & mnr. lms. S→NE x. rdx. str. Chl. alt. mnr. (v. sim. to 562396 & 562032)

(562033 P.G. cg E St comprised of D-R qx. lith-cs + rare Δ. lths + rare Pre-E. lms. v. str. lmnr. alt (some frags not others fresh) Ti/Zr : 25·4

(562032 P.G.) Ti/Zr : 18·9
f-mg br-gn qz. phyric vlc & mnr. dk. mafics ? & mod. com. or-br. qz. phyric lava frags (to 8mm) q x. lth. lv.
(v. similar to 562034 & 562396)

(562030 G.) f-mg mas. gn-br R! Ti/Zr : 5·6
gn-gn cg qz + or with fp. vlc & mnr. fg. qz. phyric frags.

(562029 P.G.) gy-bn fg + mafic phyric Δ (holocrystalline dyke ? or centre of thick flow ?) Ti/Zr : 5·6 ?

(562028 P.G.) Ti/Zr : 29·3
mas. mod. st. Fe st. pp. lmnr. alt fg + mafic porphyritic Δ (f-vgr. S-?) wk. rbn

(562027 P.G.) Ti/Zr : 8·8
ext. massive or-br qz. fp. R x. lv. ? com. dft. vlvns. mod. com. qz. vns. & v. mnr. dyke intrusion in rock (R!) (v. simil. to 562396)

(562398 P.G.) mas. pp. (lmnr. alt) strongly porphyritic (fg to 1cm) (+gn S!?) & Δ ! per. lmnr. ironoching. Q. qtz. lith. lv. v. sm. Se alt. Ti/Zr : 14·7
as for 562398 but E st. gn. wk. dft. alt. mtx. mnr. fragments Δ ?! Q.

(562399 P.G. Ti/Zr : 17·2
mas. vpr. lmnt. pp (from mnr. variety to per.) gn. fg. (& occ. dk. flecks (mafics) fg. Δ ! ?

(562394 P.G.) Ti/Zr : 8·5
ext. mas. br. qz + fp phyric R.! mnr. block flecks of Chl. in mtx. no s-g. alt

(562395 P.G.) mas. dk. gn. wk. Se alt. str. Chl. Gc. alt. E St. q + fp + felsic. lths. lv. lam. (similar to 562396) Ti/Zr : 11·8

(562400 P.G.) mod. Se alt. fg. wk. qz. phyric R? fg & gn. mtx. str. cleaved. v. st. Gc alt. + mnr. Chl. alt. (to frags of R? ++ Δ. !?) Ti/Zr : 11·0

(562392 P.G.) fg. gn. mas. (mnr. block. mafic phenocrysts ?) + mafic porphyrite Δ ! mnr. qz / Ep vns. cut by qz. vnlts. Ti/Zr : 37·2

(562393 P.G.) fg. gn. mas. (identical to 562394)

(562397 P.G.) ext. massive mg. q + fp. E vlc. str. q + fp + felsic lth. frags in gn. str. mtx. str. Chl. wk. Se alt Ti/Zr : 11·6

(562395 P.G.) mas. dk. gn. wk. Se alt. str. Chl. Gc. alt. E St. q + fp + felsic. lths. lv. lam. (similar to 562396) Ti/Zr : 11·8

(562394 P.G.) Ti/Zr : 8·5
ext. mas. br. qz + fp phyric R.! mnr. block flecks of Chl. in mtx. no s-g. alt

(562393 P.G.) fg. gn. mas. (identical to 562394)

(562392 P.G.) fg. gn. mas. (mnr. block. mafic phenocrysts ?) + mafic porphyrite Δ ! mnr. qz / Ep vns. cut by qz. vnlts. Ti/Zr : 37·2

(562400 P.G.) mod. Se alt. fg. wk. qz. phyric R? fg & gn. mtx. str. cleaved. v. st. Gc alt. + mnr. Chl. alt. (to frags of R? ++ Δ. !?) Ti/Zr : 11·0

(562398 P.G.) mas. pp. (lmnr. alt) strongly porphyritic (fg to 1cm) (+gn S!?) & Δ ! per. lmnr. ironoching. Q. qtz. lith. lv. v. sm. Se alt. Ti/Zr : 14·7
as for 562398 but E st. gn. wk. dft. alt. mtx. mnr. fragments Δ ?! Q.

(562399 P.G. Ti/Zr : 17·2
mas. vpr. lmnt. pp (from mnr. variety to per.) gn. fg. (& occ. dk. flecks (mafics) fg. Δ ! ?

(562396 P.G.) Ti/Zr : 8·8
ext. massive or-br qz. fp. R x. lv. ? com. dft. vlvns. mod. com. qz. vns. & v. mnr. dyke intrusion in rock (R!) (v. simil. to 562395)

(562397 P.G.) ext. massive mg. q + fp. E vlc. str. q + fp + felsic. lth. frags in gn. str. mtx. str. Chl. wk. Se alt Ti/Zr : 11·6

(562398 P.G.) mas. pp. (lmnr. alt) strongly porphyritic (fg to 1cm) (+gn S!?) & Δ ! per. lmnr. ironoching. Q. qtz. lith. lv. v. sm. Se alt. Ti/Zr : 14·7
as for 562398 but E st. gn. wk. dft. alt. mtx. mnr. fragments Δ ?! Q.

(562399 P.G. Ti/Zr : 17·2
mas. vpr. lmnt. pp (from mnr. variety to per.) gn. fg. (& occ. dk. flecks (mafics) fg. Δ ! ?

(562394 P.G.) Ti/Zr : 8·5
ext. mas. br. qz + fp phyric R.! mnr. block flecks of Chl. in mtx. no s-g. alt

(562395 P.G.) mas. dk. gn. wk. Se alt. str. Chl. Gc. alt. E St. q + fp + felsic. lths. lv. lam. (similar to 562396) Ti/Zr : 11·8

(562393 P.G.) fg. gn. mas. (identical to 562394)

(562392 P.G.) fg. gn. mas. (mnr. block. mafic phenocrysts ?) + mafic porphyrite Δ ! mnr. qz / Ep vns. cut by qz. vnlts. Ti/Zr : 37·2

(562400 P.G.) mod. Se alt. fg. wk. qz. phyric R? fg & gn. mtx. str. cleaved. v. st. Gc alt. + mnr. Chl. alt. (to frags of R? ++ Δ. !?) Ti/Zr : 11·0

SHEET LAYOUT

G H I J K L M N O P Q R
1 2 3 4 5 6
EL 43/85
EL 11/88

5cm

Aberfoyle Resources Limited 465331
EXPLORATION DIVISION

REVISIONS			
Init.	Date	Init.	Date
SWR/je	9·7·90		

NORTH WEST TASMANIA

GOWRIE PARK E.L. 11/88

OUTCROP GEOLOGY

Compiled : SWR
Drawn : RJE
Traced :
Checked :

Location Code :
Scale : 1 : 2500
Date : June, 1990
Plate No. GP35/G5

6593

STATE FOREST

E.L. 11/88

E.L.10/88 NORANDA

STAVERTON

Davies Creek

Kells Creek

Staverton Road

Bullocks Road

TRANSMISSION LINE

5412000mN

5411000mN

432000mE

600

SHEET LAYOUT

G H I J K L M N O P Q R

1 2 3 4 5 6

EL 43/85

EL 11/88

5cm

Aberfoyle Resources Limited 465332

EXPLORATION DIVISION

REVISIONS			
Init.	Date	Init.	Date
DMR/ie	6.7.90		

NORTH WEST TASMANIA

GOWRIE PARK E.L 11/88

OUTCROP GEOLOGY

Compiled : SWR

Drawn : RJE

Traced :

Checked :

Location Code

Scale : 1 : 2500

Date : June, 1990

Plate No : GP 35 / G3

958

E.L.11/88

E.L.10/88 NORANDA

STATE FOREST

Jarmans Creek

Staverton Road

TRANSMISSION LINE

HEC TRANSMISSION LINE

Cheeks Creek

432000 m E

5410 000 m N

600

500

400

5 cm

SHEET LAYOUT

G H I J K L M N O P Q R

1 2 3 4 5 6

EL 43/85

EL 11/88

Aberfoyle Resources Limited 465333

EXPLORATION DIVISION

NORTH WEST TASMANIA

GOWRIE PARK E.L. 11/88

OUTCROP GEOLOGY

REVISIONS			
Init	Date	Init.	Date
DMR/rje	6.7.90		

Location Code

Scale : 1:2500 Date : May , 1990

Compiled : SWR

Drawn : RJE

Traced : RJE

Checked : SWR

Plate No : GP 35/G4

9596

st. wth. fg y-grn ± ? tr Hmt. (after Py)

mg. wk. qz. phyric vic. ± tr. Py + mod. Hmt. alt. (not Sch.)

st. qz. vnd. + Fe st. vicl.

fg vic (no vis. q.) Sr. wths. D-RD.).

st. qz. vnd. st. qz. phyric vic. (to 2mm) q.v. lv ?

st. qz. phyric vic. (to 4mm) com. Se alt. pebbles in mtrx. mtr. dk. black flecks (sulphide ?) (562020 P.G.) well bedded civd Sh com. Musc. x-g. (v. blk-QRS) Ti/Zr ±13 ?

mg. vicl.

fg lt. gr. wk. qz. phyric lv. ? ± mod. Si alt. stnd. wk. Hmr. alt. occ. qz. vns.

Q. Cg

(562021 G) str. br. dth. Fe st. + lim. (after Py) ? vic. ± mtr. qz. vns ? (qu = Q 68%, Ti/Zr ±15 ?)

fg. lt. gn. vic. ± rare qz. phenocrysts v. wky. schistose, wk. Se alt. patches in mtrx. wk. per. Hmr. R.I. ?

wk. civ. grk. (Hmr. alt.) fg vic. rare qz. pks.

pit ?

st. Hmr. (with surface) st. Si alt. wk. Si-Py vnd. fg. vic. mnr. Q phenocrysts

085° wk. civ. 105°/85°N

metal peg 2/2956

(562022 P.G.) st. civ. fg. wk. qz. phyric x. lm. lv. mnr. felsic. lths. v. str. Se alt. mnr. Py ? Ti/Zr ± 17-2

c. civ. 110°/ vert.

gn. Se + Gn ?. alt. mtx. qz. x. lv.

wk. Hmr. alt. x. lm. lv.

qz. phyric x. lth. lv. v. mnr. Sh. frags. to 1 cm. civ. 110°/ vert.

ext. qz. phyric vic. ± wk. Se alt. mtx. ○ Se Sch.

v. st. Si. alt. mod. qz. phyric wk. Se alt. vic. ?

seg. 100E, 4575 N

v. st. Si. alt. st. qz. phyric vic. mnr. qz. vns.

wk. Si-wk. Ls. alt. st. phyric vic.

ext. Si. alt. qz. phyric vic. ? mnr. qz. vns.

clv. 110°/ vert.

Si. alt. qz. phyric wk. fp. porphyry R.I. ?

85° ○ ext. Si. alt. fg. vic. mod. civ. 125°/85 N

v. st. Si. alt. fg. br. vic. mnr. qz. phenocrysts, rare qz. vns.

wk. civ. 115°/ vert.

(562023 P.G.)

fg. gy-grn. Si. alt. vic. mnr. qz. phenocrysts and Se alt. fp. mnr. vns. of Py ? - Gn ?

100E, 4375 N

st. Si. alt. qz. phyric vic.

ext. Si. alt. vic. st. clv. 125°/ vert.

ext. Si. alt. wk. Se alt. wk. alt. qz. phyric R.I. ?

lge Q. Cg. blds.

Q. Cg.

100E, 4300 N

100E, 4275 N

Olivers Road

TOWER

5 407 000 mN

5 406 000 mN

432 000 mE

wk. Qz pebble Cg

v. st. Si. alt. fg. y-br. qz. phyric vic

v. st. Si. alt. mod. Se alt. strongly quartz phyric lge. green vic.

y-br. v. st. Si. alt. mod. Se alt. qz. phyric vic., qz. vns. com.

GPC 3
509°/180°/94·1m

435 000 mE

Q. Cg

com. wk. st. + str. Se alt. st. Q. phyric vic

com. Se alt. Q. vic.

Se alt. Q. vic. tr. Hmr.

st. Si. int. Se alt. Q. phyric vic. mod. Q. vns. (tr Py ?)

wk. Se alt. str. Q. phyric vic. wk. Q. vns. (compe. MCI)

st. Se alt. wk. Si. alt. Q + fp. vic. ± mod. Q. vns. ± mnr. Hmt. flks.

Se alt. vic. wk. clv. vert / 120°

Se alt. Q. vic. clv. vert / 120°

4800 N

st. Si. Se alt. st. Q. phyric vcl. ± mod. com. sm. / mtrl. vns. (after Py ?)

Si. Se alt. Q. vic. tr. Py ?

4700 N

st. Se alt. Q. Schist

st. Se alt. wk. Si. alt. Qz. rich vicl ?

85 GP 5

wk. Py. st. Se alt. Q. vic. schist

4650 N

mod. clv. st. Se alt. Q. vicl.

4600 N

wk. Py, Si, Se alt. ○ Q. vic.

mod. Si. Se alt. st. Q. phyric vic. ± lge. shaby Q. xstals.

com. Q. Cg

? lge. Q. Cg. blds.

? ext. Se alt. Si. alt. vic

wk. Si. st. Se alt. Q. phyric vic. tr. Py ?

(562024 P.G.) sm. ext. Si. + Se alt. qz. + fp. R.I. Ti/Zr ± 16

77GPC 2
45°/180°/112·75m

a-red flagging tape

(562377 P.G.) pale bn. qtz fp Q R.I. wk. Si. + Chl. alt. v. str. Se alt. Ti/Zr + 8-0

sl. Se alt. Q. vic. (poss. vicl ?)

bn. vic. rubble int. Se alt.

ext. Se alt. Q. phyric ext. Si. alt. wk. Se alt. vic. (as for 562024) ?

wk. Se alt. vic.

v. st. Si. alt. wk. Se ○ Hmr. vfg. vicl

st. clv. st. Hmr. Se alt. vic. clv. 125°/ 70°N

Q. pebble Cg ?

qz. pebble Cg

qz. pebble Cg

qz. pebble Cg

qz. pebble Cg

MT. CLAUDE △

5 406 000 mN

433 000 mE

5 cm

SHEET LAYOUT

G H I J K L M N O P Q R

1 2 3 4 5 6

EL 43/85

EL 11/88

Aberfoyle Resources Limited 465334
EXPLORATION DIVISION

REVISIONS			
Init	Date	Init	Date
SWR	6-7-90		

Location Code

NORTH WEST TASMANIA
GOWRIE PARK E.L. 11/88
OUTCROP GEOLOGY

Scale : 1 : 2 500 | Date : May, 1990

Compiled : SWR
Drawn : RJE
Traced : RJE
Checked : SWR
Plate No : GP 35 / 66

56"1

436 000mE

437 000mE

5 409 000mN

5 408 000mN

clearing

gn Q + fp Rl.

bn. ext. Q rich. l.

(562320 P.G.) fr. dk. bn. Q Rl. wk. Gc. Ti/Zr. + 9

mg. vicl. Sst. (frags. to lcm) lbd. fg. bdd. Sh.

st. cv. (or bd.?) fg. mc. vicl. Slst. str. Cl. 80–010°

Se. qtf. qz + fp. vicl. ?

mos. Q Rl.

Qz. fp Rl.

Q + fp Rl.

Qz. fp. vicl.

fp. vicl. Sst. , bdd. fg. gy Sh. cv. 80° — 085° , cv. 80° — 225°

fg. bd. vicl. , lbd. gy Sh.

gy Sh. , bd. mg. vicl. Sst. , wedge. bdds. bd. 55 — 170° (opp. way up)

503

500

480

460

440

420

400

380

O'Neills Road

Roland Track

Walking Track

(562330 P.G.) fp. wk. fp. wk. Q. phyric Q. A. or D. l. Ti/Zr. + 19

(562307 P.G. fg., fp. Hb. l. A. l. str. shr. Ti/Zr + 31

(562319 P.G.) gn. Q phyric l. ? Hb. l. A. lb. str. Cp. Cl. alt. (similar to 562314) Ti/Zr. + 18

wk. Se. str. gn. Q + fp. Rl. wk. Cc.

com. fldr. of

fg. gn. Sh.

(562258 P.G. gr. wth. v. str. fp. A. l. no vis. Q. A ? tr. Py Ti/Zr. + 27

gy Sh. bd. 30 - 290° cly. 80 - 180°

fg. gy. Sh.

mg. qz. + fp. vicl. Sst.

sur. vey. peg.

mg. qz + fp. vicl. Sst.

Mnt.

563015 P.G. mg. Q + fp. v. vfc. vis. 562316 P.G. fg. l m. vis. Slt. + Mnt. l. mnr. musc. Ti/Zr. + 10

562317 P.G. mg. qz + fp. vicl. Sst. & felsic vic. fr. + pelitic meta. fr. mod. cv. 80° — 065° Ti/Zr. + 68

Q Cg.

sur. vey peg.

Qz Cg.

Q Cg. + mnr. pp. , mc. Sst.

for. Incl. (Lamb. Sand.?)

Q Cg.

Q Cg. mnr. Q vic. l ?

mnr. pp. (Hmt. qz ?) st. fp. mnr. Q. l. wk. Gc.

Q Cg.

for. wth. fp + Q. A. l.

for. wth. st. fp. + Q. A. l. wk. Hmt. dlt.

(562314 P.G.) mod. gn. pp. wk. Hmt. str. Cl + Cc. dlt. fp. + mnr. Q. Hb. A. lb. Ti/Zr. + 20

cv. 80 to 225°

Mt. ROLAND PROTECTED AREA

mg. ect. q + fp. rich. vfr. lth. vicl.

qz. + fp. lth. vicl.

(562330 P.G.) fp. + q. phyric lth. vicl. Sst. & com. D – R. fr. + mnr. A. l. fr. Ti/Zr. + 15

Hmt + chl. dlt.

(562322 P.G) fg. pp. br. Hmt. dlt. Q + fp. + vicl. Mt. + Hmt. dlt. Ti/Zr + 26

QCg

O'Neills Creek

(562323 P.G.) Hmt. str. Q + fp x. vicl ? com. chl. patches and mnr. q. vnts. mnr. Mt. + Cc. Ti/Zr + 22

mos. st. fp. + wk. Q phyric vicl.

(562324 P.G.) pp. wk. Hmt. dlt. fd. rch. mnr. q. x. vfr. (ET) vicl.

Ti/Zr + 59

vclc. wk. Hmt. dlt. vicl. (as for 562323) wk. cly. ? 80 - 205° (Mt ??)

mos. pp. (Hmt. dlt.) wkly. dif. phyric fp. l.

(562326 P.G.) pp. (wk. Hmt. dlt.) Q + fp. + chl. alt. mafic (lbx. ?) blt. por. Rl. l. Ti/Zr + 14

(as for 562326)

mos. Rl. l. (as 562326)

(562325 P.G.) fr. gn. Se. alt. qz + fd. lithic vicl. Sst. & mod. mnr. + str. Q. + Ep. alt. Ti/Zr + 35

(562326 P.G.) pp. Hmt. alt. fd + q + mafic lb. ? F. G. Se. Bth. fr. Ti/Zr + 18

mos. Q. fp. mafic por. Rl. mnr. Cc. vns.

Q. Cg.

cgn. mos. Q. + Cg. bldrs.

(562327 P.G.)

Ti/Zr + 14

Q. fp. rich x. lth. vicl. & com. D – Rl. fr.

vf. fp. vicl.

pp. Hmt. alt. fp. + Q. por. vicl.

pg. Hmt. alt. Q + fp. por. vicl.

QCg. bldrs.

Ti/Zr + 19

(562329 P.G.) mos. bl. br. Q + fp. + mafic & mnr. Hmt. vns. fp. Q. Hb. A. l.

562328 br. fp. vic. & mnr. Hmt. vns. core Chl. & Q. vns. mod. Cc. alt. fp. + Hb. A. l. Ti/Zr + 22

mos. QCg. bldrs.

QCg. bldrs.

fg. pp. l.

GOWRIE PARK EL 11/88

90-3153.

5 cm

SHEET LAYOUT

G H I J K L M N O P Q R

1 2 3 4 5 6

EL 43/85

EL 11/88

Aberfoyle Resources Limited

EXPLORATION DIVISION

465335

NORTH WEST TASMANIA

GOWRIE PARK E.L. 11/88

OUTCROP GEOLOGY

REVISIONS			
Init.	Date	Init.	Date
SWR	6-5-90		

Location Code :

Scale : 1 : 2 500

Date : March , 1990

Compiled : SWR

Drawn : RJE

Traced :

Checked : SWR

Plate No : GP 35 / 15

5600

434 000 mE

435 000 mE

5 407 000 mN

5 406 000 mN

lost line

very old logging road.

st wth. st. clv.

gn wk. Se alt. v.fg vicl. Sh
+ mg. fg + q. vnl.

wk Hmt. alt. or. fp. vicl
& 5 mm py. qz. vns. (562025 G)
Bri = 0·36 Ta, Tu/Zr = 13·6

st. clv. st. fp. mnr. q. mg vicl
wk. Hmt. clv. 090°/70° S

pp. mod. Hmt. alt. st. fp. mg. x. lth. lv.
st. clv. 105°/vert

pp. Hmt. vicl
st. Si. q~ br. ext. Si. wk. Py ? vlc

st. clv. ext. Si. wk. Hmt. fg vic. clv. 090°/70° S

ADIT (562027 P.G.) T./Zr = 17·6
Mos. Qz. st. clv. 100°/80° N
St. Si. 1 CC Se alt. v. fg. y-br. cv. ? or Sh

wh. st. Si. Se alt. fg. vlc. tr. Py. r

Corner of UTEM Loop

y~br. mos. qz. phyric vicl ?

(562026 P.G.) pp. bh. str. foliated
fp + lb + apatite. A.91 str. Se Hmt
Co. alt. T./Zr = 8·8

mos. wk. Si. wk. Hmt. alt.
qz. phyric. vicl.

mod. st. Se alt. vlc.

st wth. mod. Se alt.
sy. vicl. Sh. ?

mod. Se alt. qy. vicl. Stst.

mnr. fth. Qz. pebble Cg

mod. wth. mod. Se alt. st. gn. fp
+ mnr. broken qz. stfj. vicl.

fresh Cg. gn. vlc. qz. phyric
stf. lth. vicl.

gn. fg. vicl. mnr. qz. vns.

peg. 4900N 1600 E.
fg. wk. Se alt. fg. gn. vicl.
mnr. frags. to loam

peg. 1600E 4875N ?

str. Si. alt. or. vlc.

abn. Q. fg. wth. wh. Q. vn.

mod. Hmt. patches. in fg
wk. Se alt. Qz. phyric vlc.

comm. fth. wk. CN. spt., Hmt. spt.
Se alt. Q. phyric. vic. (↑F)
mnr. q. vns. (wk. shd.)

wk. shd. wk. Si. Se alt.
mos. vic. 1 com. q. vns.
as for 562024

wk. CN. spt. wk. Si + Se alt. vcl. ?

v. large qz. Cg. blds.

wk. CN. spt. mod. Se alt. qz. phyric
vicl. ↑ mnr. Hmt. spts.

77 GPC 1
40°/180°/107·1m
st. Si. Se alt. fg. vic. (↑)
wk. qz. phyric

com. qz. Cg. blds.

wk. CN. Spt. st. Se
Qz. phyric vicl.

mod. CN. Si. Se alt.
vlc.

gravel Si. alt.

str. CN. spt. st. Hmt. alt.
or. qz. phyric vlc.

wk. Si. wk. Hmt. wk. Se alt. fg. vlc.

st. Q. phyric wk. Hmt. alt. wk. Se alt. vicl.

wk. shd. Hmt + Se alt. vlc.
(no obvious Q.)

ridge top

st. wth. or. vlc

pp. ext. Hmt. alt. mod. Si.
fg. vicl. Stst. & q. vns.

qz. pebble Cg

qz. Cg

qz. Cg

qz. pebble Cg

qz. pebble Cg

qz. pebble Cg

Q. Cg.

st. Q. phyric vlc.

mod. Se. alt.
Q. phyric vicl. ?

mod. Si. alt. Si. Fe. st. (after Py ?)
Q. phyric vicl. ± fn. Py ?

30°/ st. wthd. Si. clv. mod. Se. alt.
st. st. Co. alt. vicl. ± com. diss.
st. qz. at. rim. + ?
clv. 150° dip. 30° S

Q. pebble Cg. mnr. fg. Q
Sst. bed ? 055° dip. 30° S

Q. Cg.

mos. cliff of Q. Cg

Q. Cg.

Q. Cg.

Q. Cg.

9602

90-3153.

Interpretation based on :

1. Aberfoyle mapping
2. Bamford & Green 1988. MRV metallic mineral deposits map Sheet 8114 IV – 8115 III CETHANA
3. Jennings, I.B., 1959. SHEFFIELD Geology sheet

Index to Sheets

A	B	C

0 500 1000 metres

5 cm

TASMANIA

N

BURNIE (WYNYARD)

LAUNCESTON

Gowrie Park E.L. 11/88

QUEENSTOWN

HOBART

0 100 Km

Aberfoyle Resources Limited EXPLORATION DIVISION				465337
REVISIONS: Init / Date / Init / Date — SWR/re 20-9-89; SWR/re 6-10-89; RJE 20-6-90; SWR/rje 2-7-90	NORTHERN TASMANIA			Compiled : SWR
	GOWRIE PARK E.L. 11/88			Drawn : SWR RJE
	INTERPRETIVE GEOLOGY			Traced : RJE
				Checked :
Location Code : K55/3	Scale : 1 : 10,000	Date : April, 1990		Plate No : GP 43

2589

436 000mE
437 000mE
438 000mE
5 412 000mN
5 411 000mN

380
360
340
320
300
280
260
240
240
260
280
300
320
340
360
380
400
420
440
460
480

219m

DASHER RIVER

Pattawalonga Road

Road

Claude Road

Febeys Road

Rysley Road

Mt. ROLAND PROTECTED AREA

1200N 1600E
8.0 Cs.

1200N
no outcrop

1100N
no outcrop

Section 1500E
N 35° to 45° Hnbl. (dip?)
8.0 Cs.

Strong qtz. stockwork, A, B ?, C ?

Strong qtz. stockwork, A, B ?, C ?

1000E

5 cm

SHEET LAYOUT

G H I J K L M N O P Q R
1 2 3 4 5 6

EL 43/85
EL 11/88

Aberfoyle Resources Limited
EXPLORATION DIVISION
465338

REVISIONS

Init.	Date	Init.	Date

Location Code :

NORTH WEST TASMANIA
GOWRIE PARK E.L. 11/88
MT. ROLAND GRID
OUTCROP GEOLOGY

Scale : 1 : 2 500
Date : February 1990

Compiled : SWR
Drawn :
Traced : JMS
Checked :
Plate No : GP 35/13

436 000mE

437 000mE

438 000m E

5 410 000mN

5 410 000 m N

Qt

Qt

Qt

Qt

€a

€a

€a

Θcg

Θcg

SeSi

SePy

Cc

Cc

SeSi

SiSe

SiCc

Ba

Si

SiSe

PyCcSe

CcSe

CcPy

Cc

Py

SiSe

SeCc

Cc

SiSePy

SeSi

PySe

SePyCc

PySe

?

?

?

?

- LEGEND -

Qt	Quaternary talus — Ordovician conglomerate rubble
Θcg	Ordovician - quartz pebble conglomerate (Roland Conglomerate)
€a	Cambrian Volcanics — Hornblende + Augite + feldspar ± quartz ± apatite phyric andesite lava
Si	Variable silica alteration — weak silicification of matrix to intense silicification of wholerock
Cc	Moderate to intense calcite alteration of wholerock
Py	Weak to moderate pyrite alteration producing disseminations and veins of pyrite
Ba	Anomalous Ba in rock chip (0·39% Ba)
⚒	Adit ∂ Sph, Gn minor Cpy + Py veins in str. Si Cc Py altered rock

436 000mE

437 000 mE

438 000m E

90-3153.

5 cm

Aberfoyle Resources Limited
EXPLORATION DIVISION

465339

REVISIONS			
Init.	Date	Init.	Date

Location Code :

NORTH WEST TASMANIA

GOWRIE PARK E.L.11/88

MT. ROLAND GRID

OVERLAY TO OUTCROP GEOLOGY

Scale : 1 2500

Date : March, 1990

Compiled : SWR

Drawn : SWR

Traced : RJE

Checked :

Plate No : GP35/14/A

9503

450300 m E | 450400 m E | 450500 m E | 450600 m E | 450700 m E | 450800 m E | 450900 m E | 451000 m E | 451100 m E

5408900 m N | 5408800 m N | 5408700 m N | 5408600 m N | 5408500 m N | 5408400 m N

GN MN

For Detailed geology refer Plate GP.27 (1:200)

PD84 BB3 (CRA)

RD BB2 (CRA)

DDH BB6 (Aberfoyle)

DD84 BB5 (CRA)

DDBB4 (CRA)

PD83 BB1 (CRA)

MAIN SHAFT

Adit

AB 4500E | AB 4506E | AB 4507E | AB 4508E

CRA SW 400W ?

Cut Line ?

Sweetwater Creek

- LOCALITY MAP -

BEULAH E.L. 43/85

BEULAH

SHEET COVERAGE

GOWRIE PARK E.L. 11/88

0 1 2 Kms

5 cm

90-3153.

0 50 100 metres

Aberfoyle Resources Limited 465340

EXPLORATION DIVISION

REVISIONS			
Init.	Date	Init.	Date
SWR/JR	15.9.89		
SWR/JR	16.3.90		

Location Code :

NORTH WEST TASMANIA

GOWRIE PARK E.L. 11/88

BEULAH BARITE AREA

OUTCROP GEOLOGY

Scale : 1:1000 | Date : June, 1989

Compiled : SWR

Drawn : RJE

Traced : JLR

Checked :

Plate No : GP 15

322

5410 000m N

449000mE

450000mE

5410000 m N

E.L 43/85

E.L. 11/88

Dawkins Road

RIVER

200

200

200

MINNOW

Gregory's Road

Lower Dynans Bridge Road

"LOWER BEULAH"

5409000mN

5409000 m N

448200 E

448400E

448600E

448800E

449000E

449200E

449400E

449600E

449800E

450000E

450200E

450400E

450600E

450800E

ST 13

ST 12

ST 12A

ST 28

ST 11

ST 10

ST 29

ST 12 D

ST 12E

STAR

ST 12F

ST 1

ST 2

SM 1 (CRA)

SM 2 (CRA)

or, mic + Q sst.

FLAGGING 9400N

513678 P.G.

mas. bl-gn fp + Hb phyric lava?

or sh.

Qa

for wth. sed. cg. Gw? vlcl?

mnr. wh Q rubble

cg. mm Sst + ξ comm. rded Q and mnr Sh frags

hard vlcl ξ mnr qz + fp Ess

Dlcl ξ abn Q

D. Ess

mnr. wh. reef . Q

fg. B. Sh

v.str. Hmt. alt. vlc.

mg. rded fp. packed ξ?

or-br. wth. fg. B.I. ξ occ. Px of Hb phn. and wk Hmt alt. mtx. or fg. vlcl?

br. wth. fg. fp. vlc.

wk Hmt. alt. B.I

fg. B.I.

wk Hmt. B.I.

513680 P.G.

fg. br. B.I.

FLAGGING 8600N

vlcl.

vlcl.

mng gy mic. Gw

mas. fp+ mafic vlc 513679 P.G. (sim. 513678)

fg. mic. B Sh

mg. mic Gw

mg. mic Sh (sim. to SM1 & 2)

fg. B Sh

145° 090° bedding?

ST 28 49000E

70°/090°m or bd. Gw

float mix of fg or sed B. f-mg. gn. v. wk ves. 513347 P.G. br-gy fp(?)

ST 11

ST 10

513348 P.G.

float v. fg. dk. gn. or.ú. lb. ξ mnr. dk. frags mod. Cc alt. (frags show wk. int. riature)

rd. mg. Sst/Gw

ST 29

513349 P.G.

mas. mg. fd + Cl. alt. Px phn. A, B.I. ξ local epidosite development

ST 12 D

mas. rd. soil ξ com. rded qz frags. Gw

49400E

ST 12E

y. or. soil ξ dan. rnded pebbles Gw.

lt bn Slt/ Gw

lt bn Slt. Gw

78°/147°m

80/125°m

town. bd. Slt

60°/129°m

prom. bd. Sh.

f- mg. mic Gw ξ mnr gy Sh.

85/185°m

bd. tn gn. rd. Sh. Slt. Ss

85°/273°m

FLAGGING 9300N

mas. bl-gn fg. wk fp + mafic phn B.I. ξ v. fr. py

513681 P.G.

lt. br. mas. wth. fgr. vlc ξ mnr or fp ? B.I.

FLAGGING 9250N

B.I.

B.I. float.

y-br. Q rich vlc. ξ mnr. Q vn. (similar to 513352)

Fe st. Hmt ? rich Gossanous rock ξ alt. B ? D ? lava frags ?

513353 P.G. Highly Cl/Si alt. gossanous glassy felsic lava ξ common Hmt. vn.

dom. B.I. float occ. D?I. float

D?I.

dom. B.I. float ξ occ D?I. float.

float comprises mixture unalt. B.I. & fg. y-br. lava ξ com. Q/Ep

513352 P.G. Epidosite (similar to 513350 ?)

mas. unalt B.I.

428037 P

br. wth. Y. lh A. D. H. ξ gn. mtx. wk. foln.

513465 G

spec. Hmt + Q rock

spec. hoem. magnetite rock

513351 P.G.

mas. br. wth. wk. fp. wk Hmt ? alt. A = D.I. ξ mnr. Py

bd. Sh

rd + bk Mn rich B

428034 S

rd. wh + br. wth. B

rd + bk Mn rich B

Q?

mas rd-br. mod str. Hmt ? Mn stn. wk ves. alt. B.I. ξ or. wth. ves + float as for

428035 P.G.

dk. gy. unalt. str. fp. A or B.I. ξ abn. mafic phn.

shd. Hmt fp. B ?

mas fp shd. B ξ mnr lge Q vn.

428037 P

br. wth. Y. lh A. D. H. ξ gn. mtx. wk. foln.

513428 P.G.

Blody Q + mas. stky. bk Cl vn. or frac. filling.

513410G

Blody Q + spec. Hmt.

428048 P.G.

gy-bk fd + Px. phn. B.I. ξ mnr. Hmt.

mas. rd. soil after B ?

mas. whtd. B ? I.

mas. pale y-br. v. wk. Hmt. alt. ? lava

mas. pale y-br. v. wk. Hmt alt. Q xtf. or lava ξ mnr. Fu spt. mnr. Fe rich (Hmt ?) vns.

513418G

spec. Hmt. vnt

highly wth. hoem. volc.

wh. alt. lava ξ occ. Hmt. stn.

br - lt. gn. lava / Fs 4 hoem. 4

wth. rd. fp. volc.

wth. small fp. lava

gn. lava / v.

wth. rd. fp. lava

wth. lava

wth. B

B fp / hoem

shd. prom. fp. lv., porrly. Y

wth. rd. or. ye. br. lava

Si, hoem. vns.

hoem. 5

wth. / hoem. (lava ?)

D ? / hoem.

grn. D ? / spec. hoem. vn

gy D patchy wh. 5

rd. fp. lava / hoem.

/ hoem. 4 / spec. hoem. 5

fg. B. / hoem. 4

/ hoem

/ wh. Si ?, Se ?, spec. hoem.

shd. hoem. lava l.v.

/ spec. hoem. 5

wth. lava

rd. gn. Y. l.v. / Si., spec. hoem. / hoem. 5

rd. bk + wh. wth. lava

/ hoem. 5

513414 P

mor. gy. str. Se + Si alt. A. B. lb.

wkd. lava / hoem. spec. hoem.

/ wkd / Se

Gw / hoem., spec. hoem.

lava ? / hoem.

513412 P

y. or. str. wth. trachytic Afp. A. l. ξ mnr. Fu spt.

mas. gy. lava Q + ? / 513417

bd. Gw

gy Sh / lava mas

179m

159m

bd. Hmt. alt. Gw

Shd. mudstone vi

Gw+ mudstone

bd. mudstone

br. Gw

or. pk. leached Gw

mudstone

Gw

Gw q. vn. vi

bd. Sh. ()

Gw ?

Bsh

Gw ?

gy sh.

Gw + sh

Gw / mnr. hoem.

gy sh

Gw + sh

Gw

Gw ?

/ hoem. 5

br. Sh / Gw

Gw / hoem. 3

br. Gw + mudstone

schists / highly Se (5)

or. wth. bd. Gw

gn. tan bd. sh.

rded / hoem. 5

dk. gn. sh.

513436

Hmt + Si alt. lch. rock

513440

Hmt ? Mn stn. wk ves. alt. B.I. ξ or. wth. ves + float as for

maroon. unalt. gr. fm. por. B (Beulah B.)

wh. spotted Si. Mn spec. hoem. q

7.5 Si - Se ? 513411

wth. spotted Si. Mn spec. hoem. q

gn. lava / hoem. spec. hoem. patches

513430 P.G.

dk. gy. unalt. str. fp. A or B.I. ξ abn. mafic phn.

513428 P.G.

Blody Q + mas. stky. bk Cl vn. or frac. filling.

513410G

Blody Q + spec. Hmt.

513416G

spec. Hmt. + Q rock

513351 P.G.

mas. br. wth. wk. fp. wk Hmt. ? alt. A = D.I. ξ mnr. Py

428034 S

rd. wh. + br. wth. B

rd + bk Mn rich B

428035 P.G.

dk. gy. unalt. str. fp. A or B.I. ξ abn. mafic phn.

mas rd-br. mod str. Hmt ? Mn stn. wk ves. alt. B.I. ξ or. wth. ves + float as for

428048 P.G.

gy-bk fd + Px. phn. B.I. ξ mnr. Hmt.

513436

Hmt + Si alt. lch. rock

505360 P.G.

505361 P.G.

bd. Sh. Gw

5 cm

For Details in this area see BEULAH BARITE PROSPECT 1:1000 Plate GP 15

Index to sheets

A	B	Beaulah 16
C	D	Gowrie Park 25

Aberfoyle Resources Limited 465341

EXPLORATION DIVISION

NORTHERN TASMANIA

GOWRIE PARK E.L. 11/88 - BEULAH E.L. 43/85

GARDEN OF EDEN GRID

OUTCROP GEOLOGY & SAMPLE LOCATIONS

REVISIONS			
Init.	Date	Init.	Date
SWR/rje	1/8/89		
SWR/rje	20/9/89		

Location Code :

Scale : 1 : 2500 Date : June , 1989

Compiled : SWR

Drawn : RJE

Traced : RJE

Checked : SWR

Plate No : GP 25 A

323

5410000 mN

451000 mE

452000 mE

453000 mE

E.L.43/85 BEULAH

E.L.11/88 GOWRIE PARK

Index to sheets

A	B
A	B
C	D

Beaulah 16

Gowrie Park 25

5409000 mN

ST4

506000E

508000E

510000E

512000E

514000E

516000E

518000E

520000E

522000E

524000E

526000E

528000E

ST5

ST6 2045-6

ST5A 5240E

Dynans Bridge Road

200

For details in this area see
BEULAH BARITE PROSPECT
1:1000 Plate GP15

BB1 (CRA)

BB2 (CRA)

BB3 (CRA)

BB4 (CRA)

BB5 (CRA)

BB6 (ABERFOYLE)

GE1 (CRA)

House

fence

5cm

Aberfoyle Resources Limited	465342
EXPLORATION DIVISION	

REVISIONS			
Init.	Date	Init.	Date
Location Code :			

NORTHERN TASMANIA
GOWRIE PARK E.L.11/88 - BEULAH E.L.43/85
GARDEN OF EDEN GRID
OUTCROP GEOLOGY & SAMPLE LOCATIONS

Scale : 1:2500 | Date : June , 1989

Compiled : DJJ, SWR
Drawn : RJE
Traced : RJE
Checked : SWR
Plate No : GP25 B

9584

450400 mE

450500 mE

5408700 mN

5408600 mN

AMG Magnetic North

12°

Mineralisation/Comments	Lithology		Structure/Veining	Alteration/Comments
	f.g. av.?	121 m		
	m-cg.vicl.b.frags to1cm		513508PG wkly.Cc Se alt. lth.Tf	Ti/Zr = 40
				wk.Hmt.wk.Cc.Fu.alt.wk.Se Py
	mas.D.lb.?or.lv.			
				var.mod.str.Hmt.mod.str.Cc.Fu alt.mod.Si Se alth.
v.str.Cc.development on walls			513507PG	
	m-cg.vicl.b.(frags to1cm)		int.Cc alt.plag.-augphyric A.I. Contact 270M/55S	Ti/Zr = 31
		100 m	Cleavage 265M/75S	str.Hmt.alt.wk.Si,Cc+Py
distinct increase in Cc on walls	mas.wh.vicl.D?			
mnr.diss.Py+tr.Gn.				
			Q/Cc.vn. F 105M/50S	Si alt.+Cc alt.Fu spt.
	f.g.vicl.?& mnr.mas vicl.units?		South side up?	Cc on outside of vn.& Q inside
			str.clv.	513509G Fe stalactite
walls become considerably drier & less Fe stn. less min.				513506PG str.cc alt.felsic lth.Tf&mnr.Py Ti/Zr = 35
	com.-abn.Q/Cl.vns			
				str.Si wk.Se Py alt.& com.Fu spt.
	com.Fe.Mn?stalactites			513505PG str.Cc alt.plag-aug phyric Alb.&mnr.Py Ti/Zr = 37
		75 m		
	f.g.av.unit?			str.Hmt.alt.
	mas.wh.vicl.& mnr.bk.Cl? flecks x vns to give 'crackle' appearance		Cleavage 250M/75S	
			Cleavage 050M/80S	
			Cleavage 045M/75S	
	com.to abn.Py as dis or as vns.& mnr. Sp. Gn.			
	com.lge Fe Mn? stalactites			
walls of adit very wet & 'slimy' & abn. or Fe+Cc coating	mas.fg.bk.vicl?& com.abn.Py.vn. +dis.Py			Si alt.Py alt.
				513510PG Se Si v.str.alt.felsic l.?porxv.& abn. Sph+Py vnlt+diss.mnr.Ba Gn Ti/Zr = 5
				513504PG fg Sh & Se Cc vnlt Ti/Zr = 8
	f.g.mic.Py.Bsh.& mnr.mas Fd.xv.?			513503PG rexd Si alt. Rxvl.?& Cl.Se.Cc vnlts & Py Cp y mnr.Gn Ti/Zr = 5
walls of adit have mnr.or.Fe+Cc coating			str.Cleaved 274M/84S	
				Si alt Py
			F 120M/55S	513502PG gy.v.fg thinly bdd Slt & R. f Cc Ser mnr.Cl mtx.
		50 m	Cleavage 085M/78S	
			Qvn 285M/75S	
tr.diss.Py visible	wh.v.fg.vicl.(Df)& mnr.bk.flecks (diss.min?)		mod.str.clv.	
			Contact 270M/85N	mod.Si alt.
			str.clv.	
	or-bk.mic.Gw+Sh & occ.mnr.Q/ Hmt.vns.		Bedding 065M/75S	
			Cleavage 105M/85N	
			mnr.Q/Hmt.vn.	
	m.g-cg.sed.& bk.mtx			
	m.g.Gw.+mnr.Bsh.			
	f.p A.I. (int?)			
		25 m	mnr.Q/Hmt.vn.	var.mod.-str.Hmt.alt.
	Bsh.& mnr.ibd.or.Gw			
			mod.-str.clv.	
			Bedding 296M/75S	
	gn.str.Fd.p.A.I.(int.)			513501PG Ti/Zr = 54 plag Hb phyric A.int.contacting wk.Se alt.Gw & pelitic & felsic volc.frags.
	f.g.Bsh.			
	gn.str.Fd.p.A.I.(int)		Contact 230M/67N	
	f.g.bk.Sh.& mnr.or.Gw.ibd.		mnr.Fault 060M/45S	
	gn.str.Fd.p.A.I.(int.)		mod.str.clv.	
	f.g.Bsh.(beds to1cm) ibd.& mnr. or mg.Gw.		Bedding 266M/85S Cleavage parallel to bed	
		0 m	F 115M/62S South side up	Fault movement indicated by dragged bedding

5 cm

90-3153.

Aberfoyle Resources Limited EXPLORATION DIVISION				465343
REVISIONS				NORTH WEST TASMANIA
Init.	Date	Init.	Date	GOWRIE PARK E.L.11/88
				BEULAH BARITE ADIT
Location Code :				Scale : 1:200
				Date : July, 1989
				Compiled : SWR
				Drawn : SWR
				Traced : JLR
				Checked :
				Plate No : GP 27

BB2 (CRA) 450643E 5408715N 226 RL

BB6 450780E 5408647N 200RL (-180m)

BB4 450390E 5408476N 196.3RL (+11m)

200 RL

100

0

-100

E.O.H. 99m

MAROON LAVAS & LAVA BRECCIAS

50(-165)

Se.Fu.occ Hmt.

Se.Fu.Py.alt.

100(-149)

mxd. lavas with com. lava fr. & mnr. vicl. units

F

wk.Se Py

150 (-131)

Vlv.

aphyric A.l. & lb.

wk.Fu Se Si Py

F

200(-112)

wk. Hmt.

transition zone aphyric andesites Co porphyritic andesite/basalts

var. Fu Co

mas.gn.Bl.

250(-95)

wk. Si.Fu

D.l.

wk. Co

300(-77)

mas.gn.Bl. & com.fr. increasing to 327m

wk.mod.Hmt./Co & mnr.Si Py

packed Bl.lb.

350(-60)

com Py

mix of mas.gn. A/Bl.lb.

wk. Co. Hmt. ± Py

E.O.H. 400m (-42)

PREDOMINANTLY BASALTIC/ ANDESITIC LAVAS & LAVA BRECCIAS

?

?

Bavn.

Costeans

Bavn.

Sweet Water Creek

5408600N

5408500N

Highly mod. fu-se-air

E.O.H. 218.8m (-38)

Hmt. alt.

200(-3)

gn.lava/ crackle

Se.Fu. Co Hmt. lava

150(+2)

Pred. s.g. lavas & mnr. lava b.

Bavn. in Sh.

100(+3)

mxd. zone of lk. Sh. & lavas

90(+9)

lg. lk. Sh.

MIXED SEDIMENT/LAVAS

GOG RANGE SEDIMENTS

PREDOMINANTLY APHYRIC ANDESITIC LAVAS WITH MINOR PORPHYRITIC LAVAS AND VOLCANICLASTICS

POSSIBLE TARGET

BOTTOM RIGHT

BACK SCANNED FICHE No. 8

Aberfoyle Resources Limited

EXPLORATION DIVISION

465344

5 cm

REVISIONS			
Init.	Date	Init.	Date
SWR je	10-10-89		

Location Code :

NORTH WEST TASMANIA

GOWRIE PARK E.L. 11/88

BEULAH BARITE-GARDEN OF EDEN PROSPECT

CROSS SECTION 450600mE

Scale : 1:1000

Date : July, 1989

Compiled : SWR

Drawn :

Traced : JLR

Checked :

Plate No. : GP 24

(9557

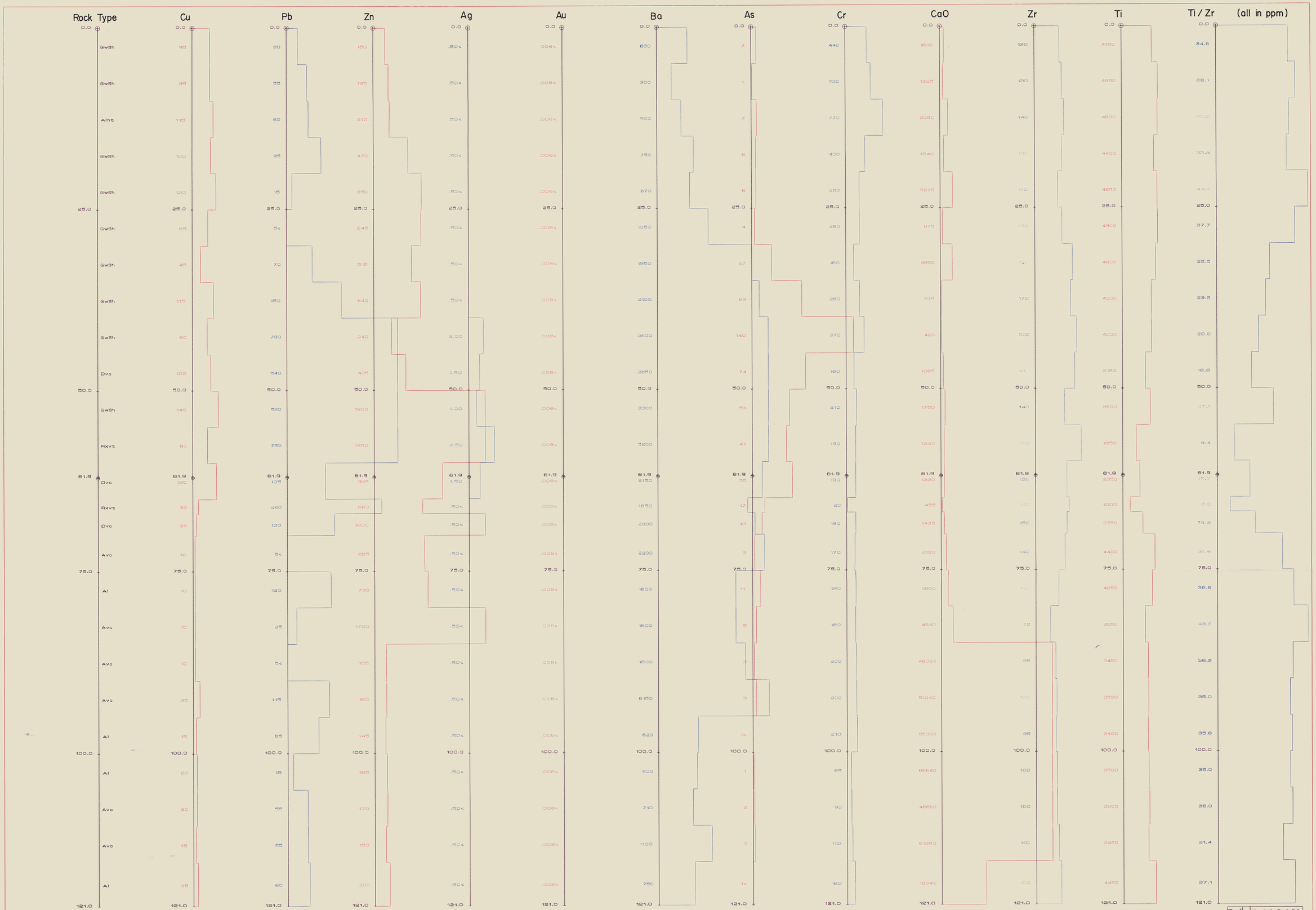


Plate GP 30

90-3153.
465345

9593

450300mE
450400mE
450500mE
450600mE
450700mE
450800mE
450900mE
451000mE
451100mE

5408900mN
5408800mN
5408700mN
5408600mN
5408500mN
5408400mN

PD84 BB3 (CRA)

RD BB2 (CRA)

DDH BB6 (Aberfoyle)

DD BB4 (CRA)

DD84 BB5 (CRA)

?

?

?

?

PYRITE-SERICITE-SILICA ALTERATION
(FOOTWALL STYLE?)

VARIABLE CALCITE-FUCHSITE-HAEMATITE-SERICITE ALTERATION
(HANGINGWALL STYLE?)

5 cm

90-3153.

Aberfoyle Resources Limited
EXPLORATION DIVISION

465346

REVISIONS			
Init.	Date	Init.	Date
Location Code :			

NORTH WEST TASMANIA
GOWRIE PARK E.L.11/88
BEULAH BARITE AREA
ALTERATION

Scale : 1:1000
Date : April, 1990

Compiled : SWR
Drawn : SWR
Traced : RJE
Checked :
Plate No : GP 40

A

450700E

DDH BB6
450780E
5408647N, 200RL

450800E

B

RL 200 m

100 m

00 m

-100 m

mixed zone of aphyric andesitic lavas & common lava fragments, & minor volcaniclastic units.

Se Fu altered with occassional strong heamatite alteration

513653 P G str Cc. Hmt alt A l (foliated)

513654 P G str Cc. Se alt aphyric A l.

513655 P G v str Se. Cc mnr Hmt (after Py) alt A lth vlcl

50

sericite - fuchsite - pyrite altered tr dissem Py

100

513656 P G v str Se Cc alt aphyric A l. with mnr Cc - Ba - Py vns

sericite - fuchsite occ weak heamatite alteration

F

polymict volcaniclastic

mixed yellow - brown aphyric lavas and lava breccias

150

weakly sericite - pyrite altered

513657 P G str Se Cc alt A lth vlcl

common small pyrite veinlets

transition zone from aphyric to porphyritic basaltic lavas with minor lava fragments

F

very weakly fuchsite - sericite altered with minor silica and occ pyrite alteration

513658 P G str Cc Se alt Px + fp A l

200

weak heamatite alteration

massive green basalt lava with rare lava fragments, minor heamatite / Cc veining

variable fuchsite - calcite alteration

513659 P G Px. + fp A to B l com Cl, Cc Hmt alt

fg yellow - brown aphyric lava

250

Weakly silica - fuchsite altered

green basalt lava with rare fragments

weak calcite alteration

513660 P G str Cc. Se alt Px + fp B l

basalt lava with fragment abundance increasing to 323.5m

300

513661 P G int Cc Se Hmt alt Px + fp B lb

Flow margin ?

packed basalt lava breccia

weak - moderate heamatite / calcite alteration occassionally with silica / pyrite alteration

513662 P G str Se. Cc Hmt alt fp B lb

mixture of massive green andesite / basalt lavas and lava breccias

moderate - strong calcite alteration and variable heamatite / pyrite alteration

common pyrite

350

513663 P G str Cc alt Px + fp A l with com Py Cl Cc vn / + s

weak calcite alteration with weak heamatite and / or pyrite alteration

513664 P G str Cc alt Px + fp A lb mnr dis Py.

EOH. 400m
RL - 173.26m

5 cm

0 50 metres

TOP LEFT

FIG 3

Aberfoyle Resources Limited

EXPLORATION DIVISION

465347

REVISIONS			
Init	Date	Init	Date
SWR js	10 10 89		

Location Code

NORTH WEST TASMANIA

GOWRIE PARK E L 11/88

BEULAH BARITE PROSPECT

SUMMARY SECTION DDH BB 6

Scale As shown

Date June, 1989

Compiled	SWR
Drawn	SWR
Traced	RJE
Checked	
Plate No	GP 23

9592



90-3153.

Aberfoyle Resources Limited EXPLORATION DIVISION					465348
REVISIONS				North West Tasmania	Compiled : JJR
Init.	Date	Init.	Date	GOWRIE PARK E.L. 11/88	Drawn : JJR
				MT. Roland Grid	Traced : RKW
				December 1989 UTEM Survey Interpretation	Checked : JJR
Location Code :				Scale : 1:25000 Date : MARCH 1990	Plate No : GWP 37

9558

450300 m E
450400 m E
450500 m E
450600 m E
450700 m E
450800 m E
450900 m E
451000 m E
451100 m E
5408900 m N
5408800 m N
5408700 m N
5408600 m N
5408500 m N
5408400 m N

GN MN

DDH84 BB3 (CRA)
RD BB2 (CRA)
DDH BB6 (Aberfoyle)
DD84 BB5 (CRA)
DDBB4 (CRA)
PD83 BB1 (CRA)
MAIN SHAFT
AB 450400 E
AB 450500 E
AB 450600 E
AB 450700 E
AB 450800 E
400m (RL-175)
Sweetwater
CRA

For Detailed geology refer Plate GP 27 (1:200)

— LOCALITY MAP —

BEULAH E.L. 43/85
BEULAH
SHEET COVERAGE
GOWRIE PARK E.L. 11/88
0 1 2 Kms

90-3153.

0 50 100 metres

5 cm

Aberfoyle Resources Limited
EXPLORATION DIVISION
465349

NORTH WEST TASMANIA
GOWRIE PARK E.L. 11/88
BEULAH BARITE AREA
BB6 DHEM37 LOOP LOCATION

REVISIONS			
Init.	Date	Init.	Date
SWR	5.9.89		
SWR	16.3.90		

Location Code :

Scale : 1 : 1000
Date : July 1990

Compiled : SWR
Drawn : RJE
Traced :
Checked :
Plate No : GP46