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BASIN LAKE

TASMANIA

Progress Report for the Year Ending

21st March, 1994

Volume 1 of 1

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Distribution

Aberfoyle - Burnie	(1/4)
Aberfoyle - Hawthorn	(2/4)
Billiton	(3/4)
Department of Mines	**(4/4)**

Internal Report No. Basin Lake 6

930002

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1.0 SUMMARY

The Basin Lake prospect area forms part of a Cambrian intermediate to felsic volcanic centre south of the Henty Fault Zone. Work completed during the 1993-1994 exploration programme included detailed helimagnetics, mapping, petrographic and geochemical investigations. The results of the programme include:

- Recognition of a structural framework, developed largely from helimagnetic data.

- Spatial distribution of the Lower Tyndall Group units and potential for these units to host massive sulphide mineralisation.

- Identification of a number of volcanic centres for the extrusion/intrusion of Anthony Road Andesite masses

Further exploration recommended includes an orientation bedrock geochemistry programme in order to penetrate glacial and alluvial cover. The orientation survey, as a precursor to comprehensive gridded bedrock sampling over the entire LTG units, is aimed to better delineate and classify lithologies currently ascribed to the Lower Tyndall Group as well as locate anomalous bedrock areas via geochemistry.

2.0 INTRODUCTION

Basin Lake E.L. 103/87 north of Queenstown, covers an area of 13 square kilometres in two parts, known as the Lake Selina (5 square kilometres) and Basin Lake (8 square kilometres) blocks (Figure 1).

E.L. 103/87 Basin Lake was granted to the Shell Company of Australia on 21st April, 1988. In June 1991, Aberfoyle Resources Limited entered a joint venture agreement with Billiton whereby Aberfoyle would fund and manage exploration.

In accordance with statutory requirements, E.L. 103/87 was reduced from 26 to 13 square kilometres on the 21st April 1993.

The following report documents exploration by Aberfoyle Resources on E.L. 103/87 Basin Lake for the period March 1993 to March 1994.

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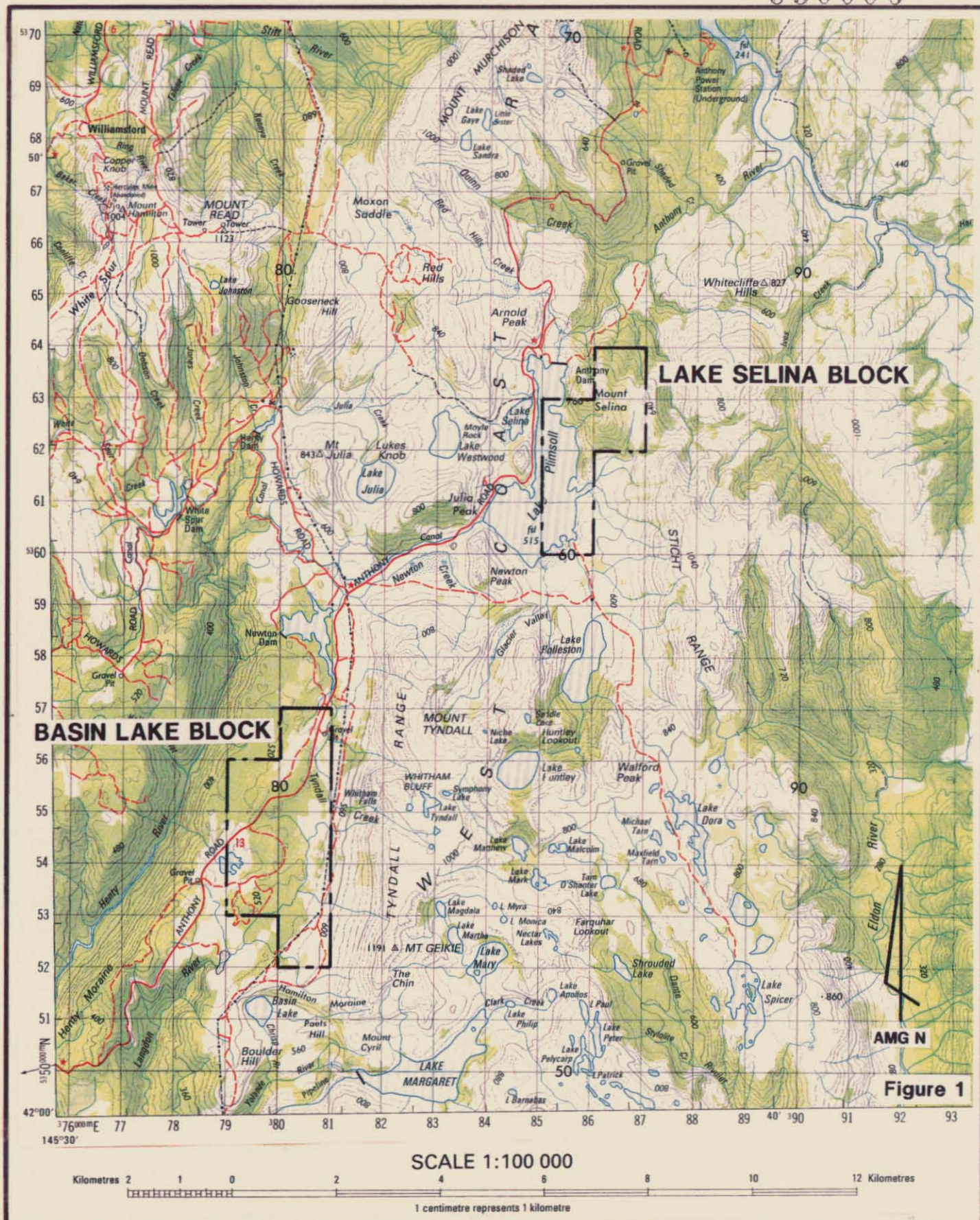

Figure 1

Aberfoyle Resources

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BASIN LAKE E.L.103/87

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3.0 BASIN LAKE PROSPECT

3.1 Introduction

The Basin Lake prospect occurs in an intermediate volcanic centre east of the South Henty Fault and west of the Great Lyell Fault. The 1993-1994 work programme, as part of ongoing mineral exploration, aimed to delineate major Cambrian syndepositional structures, and thereby controls for potential mineralisation sites.

Exploration undertaken included close spaced Helimagnetic and radiometric surveys, in conjunction with mapping and sampling routines. Interpretation of structural, geologic and magnetic data was integrated with geochemical and petrographic investigations.

3.2 Previous Exploration

Modern exploration of the Basin Lake area commenced with Mount Lyell Mining and Railway Company, who conducted IP surveys between 1968 and 1976, culminating in the drilling of diamond hole TYN-1, which intersected graphitic shales. Further IP and magnetic surveys during 1973-74 confirmed several anomalous zones in the north. These were followed up by soil geochemistry and detailed IP surveys, that led to drilling of holes TYN-2 and TYN-3. Both diamond holes intersected pyritic black shales.

In 1978, diamond drill holes BL-1 and BL-2 were drilled by Mount Lyell and both intersected weak base metal mineralisation within altered felsic volcanics.

During the early 1980's further IP, magnetics and soil geochemistry surveys were carried out, resulting in drilling of holes BL-3, BL4 and BL5. Pyritic base metal poor mineralisation was intersected, with a north trending zone of alteration and sulphide mineralisation was indicated. This zone is referred to as the Basin Lake Pyrite Zone.

Goldfields Exploration conducted UTEM and Sirotem surveys over the Basin Lake Pyrite Zone and Leech Hill Pyrite Zones respectively during 1985. After reviewing all available geophysical data, two targets were tested (TYN-4 and TYN-5) with no mineralisation intersected.

In 1985, the Department of Mines drill tested pyrite alteration in the Western Sedimentary Sequence (WSS) closely associated to nearby Anthony Road Andesites (ARA). The hole, drilled to a depth of 504 metres, did not penetrate the stratigraphic top of the Leech Hill alteration zone (Corbett, 1985).

In 1990, Biliton drilled three diamond drill holes BLD 89-1, 89-2 and 89-3 to a total of 858 metres and also completed geological mapping and limited rock chip geochemistry over the prospect area (Creagh, C.J. and Hungerford, N., 1989 and 1990).

Exploration undertaken by Aberfoyle Resources to 1993 includes down hown hole EM on BLD 89-3 and a surface UTEM programme. Surface UTEM was conducted over the entire prospect area in February 1991, as a six loop 59 line kilometre survey. No significant conductors were detected by this survey (Richardson, 1993).

Research completed at Basin Lake includes a study on the structure, stratigraphy and palaeovolcanology of exposure along the Anthony Road as partial fulfilment of an Honours degree at Monash University (D. Hutton, 1989). A study of the geology of Anthony Road exposure along the Anthony Road was also completed by Gibson (1991) at the University of Tasmania.

3.3 Geology

Mapping of outcrop in the Basin Lake area was completed during the 1993-1994 field programme. Mapping data is shown on the 1:10,000 outcrop geology map (Plate BL18B). Areas of outcrop are largely confined to the Anthony Road and exposure proximal to the area surrounding the Leech Hill Road. In large portions of the Basin Lake area, bedrock is obscured by extensive glacial and alluvial deposits.

3.3.1 Petrological Investigation

Twenty one samples from the Basin Lake Prospect were submitted to Dr. A. Crawford at the University of Tasmania for petrographic investigation. Results of the investigation together with petrographic descriptions are attached in Appendix 1.

Of the twenty one samples investigated, nineteen were taken from ARA exposure; the samples include eight titanomagnetite bearing samples (624182, 624353-624355, 624357-624358, 624446 and 624449) and eleven titanomagnetite depleted samples (624207, 624352, 624429-624430, 624433-624434 624436-624437, 624448 and 624183-624184).

Anthony Road Andesite

Two discrete types of Anthony Road Andesite (ARA) can be distinguished based upon the presence or absence of magnetite. Petrographic investigation of ARA exposures aimed to explore differences between rock magnetism and mineralogy and its bearing, if any, on primary composition.

Primary Variability

ARAs are a petrographically and compostionally distinctive lithological unit within the Mount Read Volcanics south of the Henty Fault. It is clear from the petrological investigation that both intrusive and extrusive varieties of these hornblende andesites exist; they cannot be differentiated in hand specimen. These differences are restricted to small changes (coarsening) in the texture of the groundmass, and indicate that the intrusive phases occurred at very shallow levels.

The least evolved ARAs' contain small modal percentages of augite phenocrysts in addition to the ubiquitous plagioclase, hornblende and FeTi oxide phenocrysts. Quartz is present as resorbed phenocrysts in many samples. Hornblende phenocrysts are essentially identical petrographically in every sample, with moderate pleochroism from straw yellow to olive green. Hornblendes are often large and always contain small inclusions of both plagioclase and FeTi oxides, indicating hornblende to be a relatively late crystallising phase.

Plagioclase phenocrysts make up at least 10% modal of every sample investigated. Plagioclase usually forms discrete, single tabular to blocky phenocrysts; commonly rounded and resorbed.

FeTi oxides are present as phenocryst and microphenocryst phases in every sample. They generally make up less than 1% modal of the rock and occur as equant titanomagnetite grains to about 0.2 mm across. Apatite microphenocrysts, with occasional phenocrysts to about 1 mm long, are present in all ARA samples as fresh, slightly smoky crystals occurring as discreet crystals and also as inclusions in hornblende. The high abundance of apatite is indicative of P_2O_5 enrichment.

The groundmass of the hornblende phyric andesites investigated varied from glassy and vitrophyric in extrusive variants, to a microcrystalline to hollocyrstalline sugary quartzo-felspathic intergrowth in intrusive rocks. The groundmasses of the latter varieties are little different to the products of recrystallisation of the devitrified glassy varieties.

Regional Burial and Hydrothermal Alteration Effects

All samples examined were degraded to some degree by effects of regional burial metamorphism. The most usual effect observed was albitisation of plagioclase and sometimes sericite and/or very fine grained epidote products in the albite phenocrysts. Hornblendes generally resisted this alteration, remaining fresh. FeTi oxides show diverse breakdown modes, typically altering to a messy translucent leucoxene, but in a number of the hornblende andesites remaining apparently

unaltered. The effects of regional burial metamorphism on groundmass is the abundance of sericite, fine grained epidote, chlorite and occasionally pumpellyite.

Many of the ARA samples show weak to strong hydrothermal alteration, characterised by the break down of hornblende to chlorite and epidote, plus quartz in some cases. Plagioclase phenocrysts show essentially similar alteration to those in burial metamorphosed rocks. FeTi oxides also show the same style of alteration as in the burial metamorphosed rocks, with either chlorite cores and leucoxenitic rims, or entirely replaced by brown leucoxenitic material.

Hydrothermal assemblages are most recognisable by the style and intensity of the groundmass alteration. In altered varieties, a mesh of sericite ± chlorite pervades the groundmass and frequently a strong chlorite alteration assemblage of calcite ± pyrite occurs throughout the groundmass.

Relationship between Magnetic Susceptibility and Petrography

Petrography aimed to investigate the possible relationship between magnetic susceptibility of the rock and its FeTi oxide abundances and alteration. Essentially all of the samples that show a high magnetic susceptibility contain dominantly fresh FeTi oxides. In cases where FeTi oxides are altered to a leucoxene-chlorite assemblage, the magnetic susceptibility is significantly reduced to values less than 0.5×10^{-5} S.I. units. As a result, it is inferred that the strong magnetic variability observed in the ARAs is due to the presence or absence of FeTi oxides.

High susceptibility due to magnetite as a hydrothermal product was not observed in the set of ARA samples considered but cannot be ruled out, due to magnetite additive alteration recorded further north at Howards Anomaly.

Sample 624209, taken from close to the stratigraphic top of the ARA along the Anthony Road is a plagioclase phyric dacite lava showing weak chloritic hydrothermal alteration. Probable former hornblende phenocrysts, now totally altered to chlorite and granular leucoxenitic material, indicate this sample to be related to the ARA. Sample 624209 may therefore represent a more dacitic fractionate of the ARA type hornblende andesites stratigraphically toward the tip of the pile.

Tyndall Group

A single sample of a Lower Tyndall Group (LTG) unit was examined to investigate the possibility of locally derived debris constituents within the crystal lithic units immediately overlying ARA's along the Anthony Road. Local derivation is suggested by Hutton (1989), who indicated hornblende crystal fragments to be present in crystal rich units overlying massive ARA. Petrology indicates sample 624210 to be an epiclastic sandstone dominated by angular broken quartz and euhedral altered plagioclase phenocrysts in a matrix of totally recrystallised glass. Quartz, which composes up to 20% modal of the rock is notably broken and angular, indicating an origin via explosive probably subaerial eruptions. Detrital FeTi oxide microphenocrysts are not uncommon in this sample and are altered to leucoxene. The matrix is an extremely fine grained quartzo-feldspathic material after vitric ash, heavily overprinted by sericite and probably related to low grade burial metamorphism.

The sample, is not indicative of an andesitic source, but rather derivation from felsic quartz + plagioclase phyric crystal vitric units.

3.4 Geochemistry

3.4.1 Whole Rock Geochemistry

Thirty three samples were submitted to Analabs for whole rock geochemistry. Elements analysed included Cr, Zr, Al_2O_3, SiO_2, TiO_2, Fe_2O_3, MnO, CaO, K_2O, P_2O_5, Na_2O and S. Analytical results are included as Appendix II.

Of the thirty three samples submitted, all are ARA-type lavas with the exception of sample 624209 which is a dacite lava. The investigation aimed to identify immobile element geochemical variations within the ARA as indicators of internal stratigraphic variations or indicators of discrete ARA intrusive/extrusive masses. Amongst the thirty two ARA samples submitted for geochemistry, twelve were magnetite-bearing specimens, whilst the remaining twenty represent magnetite depleted samples.

Titanomagnetite enriched ARA samples include 624208, 624181-624182, 624185 and 624352-624358. Little geochemical variation in immobile or mobile elements is indicated for these samples. Cr levels range between 32 and 69 ppm, Zr levels range between 134 and 173 ppm, Ti/Zr ratios are virtually constant between 17 and 19 and P_2O_5/TiO_2 ratios show values between 0.36 and 0.60. SiO_2 percentages are tightly grouped between 59.8 and 62.3 %.

Non magnetic ARA-type samples show a relatively wider variation in immobile and mobile elements than their magnetic counterparts. Non magnetic samples include 624206-624207, 624426-624437, 624446-624450 and 624183-624184. Cr levels range between 38 and 149 ppm, Zr levels range between 116 and 211 ppm, Ti/Zr ratios range between 17 and 22 and P_2O_5/TiO_2 ratios show values between 0.24 and 0.6. SiO_2 percentages vary between 55.7 and 66.9 %.

Comparison between titanomagnetite enriched ARA samples and titanomagnetite depleted samples indicate that titanomagnetite depleted ARA show a wider variation in both immobile and mobile elements. Petrological investigations suggest the absence of titanomagnetite is a result of magnetite destructive hydrothermal alteration processes. The larger range in abundances of mobile elements may therefore be a result of hydrothermal alteration processes and surficial weathering processes.

Immobile elements, including Cr, Zr, Ti and P, are considered immobile during the style and relatively low intensity of hydrothermal alteration that has affected rocks in this study (refer to Crawford et al., 1992). Such alteration is explanatory for the wider range observed in the abundances of mobile elements, but does not provide adequate explanation for the distribution of immobile elements in more altered ARA samples. What may be inferred is a primary compositional difference between non magnetic and magnetic ARA type units. Further geochemical work together with a spatial analysis of the distribution of samples is required in order to discriminate discrete intrusive/extrusive masses.

Sample 624209 is a dacitic lava with weak chloritic alteration. Petrographically 624209 is a hornblende feldspar phyric lava and possible correlate of the ARA. Geochemically, the Cr level is 42 ppm, the Zr abundance is 191 ppm, Ti/Zr ratio is 20, the P_2O_5/TiO_2 ratio shows a value of 0.41 and SiO_2 abundance is 54.3%. Geochemical data therefore supports the interpretation that this dacite lavas is a fractionate of the Anthony - type andesites.

3.4.2 Rare Earth Element Analyses

Two rock chip samples of hornblende-feldspar phyric ARA from sites at Leech Hill and along the Anthony Road (samples 624356 and 624448 respectively) were submitted for analysis of rare earth elements La, Ce, Pr, Nd, Sm, Eu, Gd, Dy, Er and Yb. Results including rock/chrondrite plots are presented in Appendix III. Sample locations are illustrated on Plate BL18B.

Results indicate near identical chrondrite normalised REE profiles for both samples. It is therefore concluded that the magma source for each sample is similar.

3.4.3 Base Metal Geochemistry

All ARA samples submitted for whole rock analyses were also analysed for elements Cu, Pb, Zn and Ag (refer Appendix II). All of the thirty three samples submitted returned low base metal values. The best sample returned 296 ppm Cu, 8 ppm Pb, 55 ppm Zn and <2 ppm Ag (sample 624206).

3.5 Geophysics

187 line kilometres of magnetic and radiometric data was collected over the Basin Lake prospect area. The survey was flown by Geoterrex in April 1993, with a line spacing of 100 metres and east-west oriented reading lines. Magnetic responses were measured using a Scintrex cesium vapour optical absorption magnetometer. The average sensor terrain clearance was 80 metres. Radiometric data was collected simultaneously using a Nuclear Data gamma ray spectrometer, with windows measuring total count, potassium, uranium and thorium. Comprehensive survey specification details are supplied in Appendix IV. In addition, a digital elevation model (Plate BL30) was produced using GPS navigation data from the helimagnetic survey.

Helimagnetic and radiometric survey data aimed to enhance and refine geological and lithological understandings of the prospect area and provide a means by which a structural framework for the area, as well as potential mineralisation sites, could be developed.

3.5.1 Helimagnetic Data

Magnetic data supplied by Geoterrex includes total magnetic intensity contours (Plates BL22/1 and BL22/2), residual magnetic profiles (Plates BL23/1 and BL23/2) and flight path data with tie line locations (Plates BL22/1 and BL22/2).

Interpretation of helimagnetic data proved useful in the identification of the main structural elements within the prospect area. Structural elements were interpreted at sites where magnetic discontinuities were evident.

The structural interpretation, presented as Plate BL24, was developed largely from helimagnetic data but also integrated with field mapping observations and existing structural dataset compilations (Plate BL20). The resultant interpretive geological summary map is presented as Plate BL31.

Magnetic - Lithological Inferences

Results of the magnetic survey indicate a large variation in magnetic amplitude as a direct response to magnetite abundances in lithological units. Stratigraphy in the area strikes north-south and the magnetite response shows a significant increase in amplitude from background levels in older Western Sedimentary Sequences (WSS) in the west to high amplitude responses of the Tyndall Group in the east. Sections through the Basin Lake Prospect area have been developed, based upon outcrop information, drill hole data and magnetic constraints, and included as Plates BL25A and BL25B.

The WSS outcrops in the west of the prospect area and is composed of feldspathic crystal rich sandstones, black shales and porphyritic rhyolitic intrusives. WSS units show low to background magnetic responses, with an above background response emanating from quartz feldspar phyric rhyolite intrusives.

ARA forms two magnetically discreet groups; ARA with an elevated magnetic response and ARA with a background response. Magnetic ARA, as previoulsy identified from petrology, is the result of abundant primary FeTi oxide phenocrysts (up to 3 % modal) finely dispersed through the groundmass of the lava/breccias.

Non magnetic andesite is the result of magnetite destructive hydrothermal alteration. The presence of two magnetically distinct ARA lavas indicates geochemical differences within the ARA lava pile. These differences are refleced geochemically in immobile elements, but may also reflect permeability differences and thus hydrothermal alteration intensity of the pile. For example magnetic lavas may indicate impermeable masses or volcanic centres that hydrothermal fluids could not penetrate.

Anthony Road Andesites show a variable magnetic signature. The distribution of this magnetic signature broadly increases from low magnetic intensity in the west, to high amplitude magnetic signatures in the east. Discrete masses of ARA are broadly magnetically mappable against the uniformly poorly magnetic WSS. These discrete masses include a large body of andesite at Leech Hill, a moderately magnetic body north of the Anthony Road (AMG coordinates 379000mE, 5355500mN) and ARA stratigraphically below magnetically intense Lower Tyndall Group units. Contacts between ARA and WSS frequently form sharp magnetic breaks interpreted as late stage faulting.

At Basin Lake, Tyndall Group units comprise two units; the Lower Tyndall Group (LTG) and Middle Tyndall Group (MTG). LTG units are described by Hutton (1989) to be locally derived sandstones to breccias containing andesitic to felsic debris.

The LTG is exposed northwards along the Anthony Road and in drill core at Basin Lake to the south of the prospect area. Magnetically, LTG units show elevated magnetic responses interpreted to form two discontinuous lenses: one in the north that extends northwards to EL5/85 Lake Margaret and the second encompassed within the Basin Lake prospect. LTG units include black shale and crystal rich sandstones, with low magnetic susceptibilties.

In comparison, MTG units form a continuous belt of north-south striking magnetically intense volcanic sandstones and breccias. This unit overlys the more discontinuous units of the LTG. The contacts between the ARA/LTG and MTG/LTG are not magnetically distinct, due to the high magnetic intensisties and subsequent poor magnetic contrasts of these units. Epiclastics of the Tyndall Group show a faulted contact with Ordovician sediments in the east by the Great Lyell Fault. Ordovician sediments show low to background magnetic signatures.

Structural Implications

Magnetic data indicates the Basin Lake Prospect to be a structurally complex area. Interpretation of the area is hindered by the lack of exposure due to thick glacial sedimentation. The aim of the magnetic survey was to define a structural framework in which apparent litholigcal variations could be explained in terms of Cambrian syn-depositonal faults. Structural interpretation of magnetic data identified discontinuities or magnetic continuity breaks in the data. The analysis of magnetic map patterns and discrete structural breaks form the structural framework and is presented on plate BL24.

The Great Lyell Fault

The Great Lyell Fault (GLF) is defined on surface as the north-south trending contact between Ordovician sediments and MTG units. The age of the GLF is inferred to be Late Cambrian with Devonian reactivation and forms a basin bounding structure to the Basin Lake area. The GLF dips steeply west and is variably segmented by late Devonian/reactivated Cambrian(?) faults. Magnetically, the GLF is depicted as a sharp magnetic break contrasting magnetically intense MTG units from poorly magnetic Ordovician sequences of the Owen Conglomerate.

Pyrite Corner Fault

The Pyrite Corner Fault is a north west trending structure marked in outcrop by intense sericite+pyrite hydrothermal alteration proximal to the geological contact between altered WSS and non magnetic ARA. The zone is a highly sheared brittley deformed zone up to approximately 100 metres wide with low base metal values. Alteration associated with the Pyrite Corner Alteration zone is thought to be spatially correlated to the Leech Hill Alteration. Alteration is thought to be associated with the intrusion/extrusion of the Leech Hill Andesite body.

Leech Hill Structure

The Leech Hill Structure is a north east trending fault system that forms the southern margin to magnetic andesites exposed along the Anthony Road and the northern margin to LTG units in the south of the prospect area. To the east, the structure offsets the GLF, which may be the result of late stage movement on the Leech Hill Structure.

Due to facies variation and thickness change in units ascribed to the Tyndall Group, the Leech Hill Structure is interpreted to form a likely coactive structure during LTG deposition.

It has not been possible to categorise the remainder of the interpreted array of fault structures into Devonian or Cambrian Fault systems. The magnetic signatures of many of these

faults show shallow magnetic breaks, indicating the faults to have a near surface expression. Structures are typically short lineaments, segregated and offset by late faulting.

3.5.2 Radiometric Data

Radiometric data including Total Count (plate BL29) as well as K, Th and U (plates BL26 to BL28 respectively) have proved of limited use. Pronounced features in the datasets are largely the result of cultural effects; particularly the HECs' Anthony Road. Radiometric differences are broadly evident between ARA and Tyndall Group lithologies, with ARA showing elevated K and Th responses, whilst the Tyndall Group shows low to background levels. For both ARA and Tyndall Group stratigraphies, U levels are sporadic. Further interpretation is however required to evaluate whether these radiometric variations are the result of vegetation changes.

3.5.3 Digital Elevation Model

A digital elevation model (DEM) was produced from GPS navigation data collected during airborne magnetic and radiometric surveys (plate BL30). Interpreted topographic lineaments likely reflect the surface expression of fault structures.

The most pronounced of these structures is the Leech Hill Structure, with the majority of short topographic lineaments likely the result of late stage faulting in the area. Topographic relief within the Basin Lake EL is generally small, except where the exploration licence encroaches the side of the Tyndall Range to the east.

3.6 Geo-Magnetic Summary

The Basin Lake prospect area covers an area of generally low relief dominated by felsic to intermediate volcanics and situated between the South Henty Fault in the west and GLF to the east. Both of these structures show segmentation due to late stage faulting. Basin development at Basin Lake was likely the response of a Cambrian extensional event, during which time volcanic activity commenced, filling the subsided basin. Volcanic activity included the extrusion and shallow level intrusion of ARA, likely from a number of volcanic centres as well as deposition of debris flows derived from both andesitic and felsic volcanic sources. Black shales within the LTG indicate background sedimentation or periods of quiesence.

4.0 CONCLUSIONS AND RECOMMENDATIONS

The Lower Tyndall Group (LTG) units show potential to host massive sulphide mineralisation. Structural and geological controls in the Basin Lake prospect area indicate further bedrock geochemical work is required to better delineate these units and to primarily indicate areas of anomalous bedrock geochemistry.

As a result of widespread glacial cover, prospect scale soil geochemistry has not been undertaken. It is recommended that a bedrock geochemistry programme, using a portable wacker percussion drill, be undertaken over LTG units. Initially proposed is an orientation survey, to indicate if the wacker sampling technique is able to penetrate glacial cover. Sampling of bedrock would also provide more stringent evidence to the distribution of litholigcal units. In the event that the wacker sampling orientation proves unsucessful, a review of the prospectivity and exploration alternatives for the area will be conducted.

A spatial investigation of current geochemical variation and elemental distributions within the ARA is also proposed in conjunction with a structural re-analysis of the prospect area.

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APPENDIX I

SAMPLE NUMBER: 624449

LOCATION: Anthony Basin: Magnetic Susc: 5.24

SUMMARY:

This is a plagioclase+hornblende+quartz+FeTi oxide-phyric andesitic lava, typical of the Anthony Rd - Crown Hill andesites. It shows a low-grade burial metamorphic alteration assemblage.

HAND SPECIMEN:

This is a plagioclase+hornblende-phyric andesitic lava with a few *lithic fragments(?) of hornblende-phyric andesite or diorite.*

THIN SECTION:

This sample is clearly an andesitic lava typical of the Anthony Rd - Crown Hill hornblende andesites. It consists of about 20 modal% of strongly sericite-epidote-altered blocky plagioclase phenocrysts to about 2mm long, about 5-8 modal% of fresh to slightly chloritized hornblende phenocrysts, 3-5 modal% of resorbed quartz phenocrysts, and <1 modal% of altered FeTi oxide phenocrysts. Hornblende phenocrysts contain common albite inclusions and small granular anhedral FeTi oxide inclusions. The FeTi oxide phenocrysts are mainly altered to chlorite with messy brown leucoxene rims. A few are apparently unaltered, or only marginally altered to fuzzy leucoxene.

The groundmass is a fine-grained sugary quartzo-feldspathic intergrowth, possibly after devitrified glass. It contains common very fine-grained chlorite, and disseminated granular epidote.

This was a plagioclase+hornblende-phyric typical Anthony Rd-type hornblende andesite that shows a low-grade burial metamorphic alteration assemblage. The intermediate magnetic susceptibility may reflect the partially altered FeTi oxide phenocrysts and the small FeTi oxide inclusions in hornblende phenocrysts.

SAMPLE NUMBER: 624446

LOCATION: Anthony Basin: Magnetic Susc: 5.4

SUMMARY:

This is a low greenschist facies burial metamorphosed plagioclase+augite+hornblende+FeTi oxide-phyric andesitic lava.

HAND SPECIMEN:

This is a pale grey, rather weathered plagioclase+hornblende-phyric andesitic lava with obviously altered plagioclase and hornblende phenocrysts.

THIN SECTION:

This sample is a rather altered plagioclase+augite+hornblende-phyric andesitic lava. Slightly resorbed and rounded phenocrysts of plagioclase are mainly less than 2mm across, heavily altered to ultra-fine-grained epidote, and make up about 5-8 modal% of the rock. Augite phenocrysts make up around 3 modal% of the rock, and are small, equant fresh crystals mainly less than 1mm long, with occasional chlorite alteration along fractures. Former hornblende phenocrysts make up only a few modal% of the rock, and are quite large (to 4mm long at least). They often contain small plagioclase inclusions, and appear to be altered to very very fine-grained fibrous actinolite. A number of euhedral apatite phenocrysts are also present. FeTi phenocrysts are apparently mainly fresh, with narrow rims of leucoxene.

The groundmass of this sample is a very fine-grained, rather turbid quartzo-feldspathic aggregate riddled with exceptionally fine-grained chlorite. Small spots and patches of chlorite, occasionally containing small actinolite needles are not uncommon through the groundmass.

This is a texturally well-preserved plagioclase+augite+hornblende +FeTi oxide andesite lava, clearly correlated with the Anthony Rd - Crown Hill hornblende andesites. It shows a low greenschist facies burial metamorphic assemblage.

SAMPLE NUMBER: 624358

LOCATION: Anthony Basin: Magnetic Susc. 6.63

SUMMARY:

This is a well-preserved hornblende+plagioclase +quartz+FeTi oxide-phyric andesite with fresh FeTi oxides and largely fresh hornblende.

HAND SPECIMEN:

This is a slightly weathered quite reddish hornblende andesite with abundant large dark hornblende phenocrysts and altered plagioclase phenocrysts

THIN SECTION:

This sample is a texturally well-preserved plagioclase+hornblende +quartz+FeTi oxide-phyric andesitic lava. Hornblende phenocrysts make up around 15-20 modal% of the rock, and are pale yellow to mid-green pleochroic euhedral prisms with about 50% chloritization. They are up to about 5mm long, and commonly contain small altered plagioclase laths and prisms. Albitized plagioclase phenocrysts are tabular euhedra up to at least 3mm long, and are heavily sericitized; they make up about 10-15 modal% of the rock. Quartz phenocrysts are strained and heavily resorbed, and make up about 2-4 modal% of this sample. The FeTi oxide microphenocrysts are almost entirely fresh, occasionally with narrow rims of leucoxenitic alteration where included in altered hornblende crystals.

The groundmass of this rock was glassy, and has devitrified and recrystallized to a relatively coarse-grained, very sugary-textured quartzo-feldspathic intergrowth. Chloritic spots are common, and reddish sericite or oxidized chlorite, clearly a product of surface alteration (weathering) is present throughout the groundmass, and is responsible for the reddish colour.

The FeTi oxide microphenocrysts in this rocks are apparently fresh, and are likely to be responsible for the significantly higher magnetic susceptibility noted above for this sample.

SAMPLE NUMBER: 624357

LOCATION: Anthony Basin: Magnetic Susc: 13.0

SUMMARY:

This is a typical Anthony Rd-type plagioclase+hornblende +quartz+FeTi oxide-phyric andesitic lava with low-grade burial metamorphic alteration, fresh FeTi oxide and high magnetic susceptibility.

HAND SPECIMEN:

This is another very well-preserved plagioclase+hornblende-phyric andesitic lava with a pinkish groundmass, and it is identical to 624355.

THIN SECTION:

This sample is almost identical to 624355, being a plagioclase+ hornblende+quartz+FeTi oxide-phyric andesitic lava. Plagioclase phenocrysts are lightly sericitized albite crystals, hornblende phenocrysts are mainly fresh, and FeTi oxide phenocrysts are quite fresh.

The groundmass of this sample is certainly a bit finer-grained than sample 624355, and it may have been glassy rather than holocrystalline. It is speckled by epidote and chlorite, and contains disseminated tiny equant magnetite grains.

This sample is essentially identical to the previous sample 624355 except that it had a finer-grained, possibly quenched glassy groundmass. It is typical of the Anthony Rd - Crown Hill andesites, and having retained fresh FeTi oxides it has a high magnetic susceptibility.

SAMPLE NUMBER: 624355

930031

LOCATION: Anthony Basin: Magnetic Susc: 14.2

SUMMARY:

This is a well-preserved plagioclase+hornblende+quartz +FeTi oxide-phyric andesitic shallow intrusive rock with fresh FeTi oxides, producing the high magnetic susceptibility.

HAND SPECIMEN:

This is a very well-preserved hornblende+plagioclase-phyric andesite lava with a pinkish groundmass similar to 624358 and 624406, and abundant 1cm-sized hornblende phenocrysts. The sample contains a 2cm diameter fine-grained lithic clast.

THIN SECTION:

This sample is another texturally very well-preserved plagioclase+hornblende+quartz+FeTi oxide-phyric andesitic lava. Plagioclase phenocrysts make up about 15-20 modal% of the rock, and are small (mainly less than 2mm long) tabular prismatic phenocrysts of albite, lightly flecked by sericite. Hornblende phenocrysts make up about 10 modal% of this rock and are essentially identical to those described from the two preceding samples (624352 and 624354), and contain common inclusions of albite and apparently fresh magnetite. Quartz phenocrysts are smaller and less abundant than in the two preceding samples, and are typically strongly resorbed and rounded. FeTi oxide phenocrysts are not uncommon and are apparently completely fresh. A number or prismatic apatite phenocrysts are also present.

The groundmass of this sample is relatively coarse-grained, possibly originally holocrystalline quartzo-feldspathic intergrowth containing common small tabular albite microcrysts. Chlorite and small granular epidote grains are common throughout the groundmass, and tiny equant magnetite grains are quite fresh. This is probably an intrusive variant of the typical Anthony Rd - Crown Hill plagioclase+hornblende andesites. It shows low-grade burial metamorphic degradation. The high magnetic susceptibility of this sample is clearly due to the preservation of the FeTi oxides both as phenocrysts and groundmass.

The lithic fragment in this rock is a plagioclase+hornblende+ quartz+FeTi oxide-phyric andesitic rock probably comagmatic with the host andesite. It has, however, a completely holocrystalline groundmass composed of interlocking plagioclase laths with abundant alteration phases including quartz, epidote, and chlorite. Small FeTi oxide granules throughout the rock are chlorite+leucoxene-altered.

SAMPLE NUMBER: 624354

LOCATION: Anthony Basin: Magnetic Susc: 1.72

SUMMARY:

This is a burial metamorphosed plagioclase+hornblende +quartz+FeTi oxide -phyric andesitic lava, typical of the Anthony Rd -Crown Hill hornblende andesites. It is strikingly similar to 624352.

HAND SPECIMEN:

This is a rather bleached grey hornblende+plagioclase-phyric andesitic lava very similar to the previous sample (624354) except for more Fe-staining and patchy diffuse pink colouration in the groundmass.

THIN SECTION:

This sample was texturally and mineralogically identical to the previous sample 624352; so similar, in fact, that it may have been from the same cooling unit. The only difference now is that this rock is slightly more altered than 624352, with more chlorite-alteration of the hornblende phenocrysts, and epidote is a significant phase growing together with chlorite in altered hornblende. Importantly, the third alteration phase in hornblendes is a rather anhedral granular opaque oxide with a rusty red colour when cut thin enough. This may be hematite. Plagioclase phenocrysts are intensely sericitized, and minor epidote also occurs replacing plagioclase. Former FeTi oxide phenocrysts are replaced by identical chlorite - limonite-leucoxene aggregates as in 624352.

The groundmass of this sample is another sugary-textured, almost microspherulitic quartzo-feldspathic intergrowth after devitrified glass. It contains a very minor percentage of fine-grained equant opaques, possibly hematite.

This is a very similar sample to 624352, being a plagioclase+ hornblende +quartz+FeTi oxide phyric andesitic lava. The significant difference in magnetic susceptibility of this rock and 624352 is likely due to the presence of an opaque Fe oxide in both the groundmass and as one of the replacement phases in altered hornblende.

930033

SAMPLE NUMBER: 624182

LOCATION: Anthony Basin: Magnetic Susc: 3.38

SUMMARY:

This is a low-grade burial metamorphosed plagioclase +hornblende+quartz+FeTi oxide-phyric andesitic shallow intrusive rock, typical of the Anthony Rd-type hornblende andesites. Pumpellyite replaces many plagioclase phenocrysts.

HAND SPECIMEN:

This is another texturally well-preserved plagioclase + hornblende-phyric andesitic lava with a pinkish groundmass and hornblende phenocrysts up to almost 1cm long.

THIN SECTION:

This sample is a plagioclase+hornblende+quartz+FeTi oxide-phyric andesitic lava typical of the Anthony Rd - Crown Hill-type hornblende andesites. Plagioclase phenocrysts (~15 modal%) are slightly more abundant than hornblende phenocrysts (~10 modal%), and are usually less than 2mm long. They are albitized, and commonly contain inclusions of chlorite, pumpellyite and sericite. Hornblende phenocrysts are mainly fresh elongate prisms and contain common small albite and FeTi oxide phenocryst inclusions. In places, they are strongly chlorite-epidote altered. Quartz phenocrysts are rounded and reacted, contain rounded melt inclusions that have crystallized to quartz, feldspar and chlorite, and they make up only one or two modal% of the rock. FeTi oxide phenocrysts vary from quite fresh equant FeTi prisms (<<1 modal% of the rock), to grains that are thoroughly recrystallized to chlorite-leucoxene. Most of the larger FeTi oxide phenocrysts are apparently fresh.

The groundmass of this rock was probably a fine-grained holocrystalline quartz-feldspar intergrowth that is now riddled with chlorite and subordinate epidote. As for the FeTi oxide phenocrysts, some of the groundmass FeTi oxides appear to be fresh granular crystals, whereas others are clearly leucoxenitized.

This may have been a marginal intrusive phase of a hornblende andesite body, or else is from the core of a thick flow. The intermediate magnetic susceptibility value is clearly due to the presence of partially fresh and partially altered FeTi oxide phenocrysts. This is a typical Anthony Rd - Crown Hill-type hornblende andesite. I am not sure that I can see the fine-grained lithics that you ask about; these may be strongly chlorite-altered hornblende phenocrysts with their typical small plagioclase inclusions.

930034

SAMPLE NUMBER: 624352

LOCATION: Anthony Basin: Magnetic Susc: 0.28

SUMMARY:

This is a formerly glassy plagioclase+hornblende +quartz+FeTi oxide-phyric andesitic lava, typical of the burial metamorphosed Anthony Rd - Crown Hill-type hornblende andesites.

HAND SPECIMEN:

This is a grey. bleached hornblende+plagioclase-phyric andesite with large fresh hornblende phenocrysts with plagioclase inclusions, and smaller altered plagioclase phenocrysts.

THIN SECTION:

This sample was originally a 'typical' Anthony Rd-Crown Hill-type hornblende andesite lava, composed of about 10-12 modal% of large euhedral, mainly fresh hornblende phenocrysts, slightly more (~15 modal%) of strongly sericite-altered plagioclase phenocrysts, and much smaller amounts of quartz and altered FeTi oxide phenocrysts. The plagioclase phenocrysts are tabular to blocky prisms to about 2mm across, very strongly pseudomorphed by dense colourless sericite and minor chlorite. The prismatic hornblende phenocrysts are pleochroic from pale yellow to mid-olive green, and are fresh apart from minor chlorite on cleavages. Two or three undoubtedly former hornblende phenocrysts,however, have altered to a yellowish rather high-birefringent chlorite. They always contain small plagioclase inclusions that are usually altered to epidote and sericite. Strongly rounded and resorbed quartz phenocrysts make up about 2 modal% of the rock, and often contain altered melt inclusions. Former FeTi oxide phenocrysts were not common, and have been totally altered to chlorite with messy rims of leucoxene or limonite/goethite.

The groundmass of this sample was originally totally glassy, and is now a fine-grained, sugary-textured intergrowth of quartz and subordinate sericitized feldspar. with not uncommon very fine-grained chlorite. The metamorphic assemblage and texture of the groundmass in this sample is typical of low-grade regional burial metamorphism of this hornblende+plagioclase-phyric formerly glassy lava.

SAMPLE NUMBER: 624448

LOCATION: Anthony Basin: Magnetic Susc: 0.27

SUMMARY:

This is an evolved plagioclase+hornblende-phyric andesitic to dacitic lava, correlated with the Anthony Rd - Crown Hill hornblende andesites, with weak to moderate chloritic hydrothermal alteration.

HAND SPECIMEN:

This is a grey-green, rather altered plagioclase+hornblende-phyric andesitic lava.

THIN SECTION:

This sample is a rather mafic-poor, evolved plagioclase+hornblende-phyric andesitic lava composed of about 5 modal% of albitized plagioclase phenocrysts and around 1 modal% of totally altered hornblende phenocrysts (although a number of the hornblende phenocrysts in the hand specimen are almost certainly fresh) all set in a formerly glassy groundmass. The plagioclase phenocrysts are slightly rounded and resorbed phenocrysts to about 2mm maximum length, which are commonly partially replaced by pale green chlorite. Many have abundant small black inclusion trails and streaks of hematite. The few former hornblende phenocrysts in this rock are totally replaced by chlorite, and contain some quite large FeTi oxide inclusions FeTi oxide phenocrysts are uncommon, and are partially altered to chlorite, with what appears to be disaggregated finer-grained magnetite or hematite. Small apatite phenocrysts are not uncommon.

The groundmass of this sample was vitrophyric, with small albite laths set in devitrified glass that has recrystallized to a murky very fine-grained quartzo-feldspathic intergrowth that is heavily riddled by chlorite. Totally altered small FeTi oxide granules in the groundmass are common, but are replaced by rusty leucoxenitic material.

This is an evolved plagioclase+hornblende-phyric andesite to dacite lava that has suffered weak to moderate hydrothermal alteration that produced abundant chlorite. It differs from sample 624352 in that its hornblende phenocrysts are fresh, and it lacks the chloritic hydrothermal alteration assemblage that characterizes 624352.

SAMPLE NUMBER: 624437

LOCATION: Anthony Basin: Magnetic Susc: 0.45

SUMMARY:

This is a plagioclase+hornblende+FeTi oxide-phyric andesitic lava of the Anthony Rd-type, with a strong epidote-silica hydrothermal alteration.

HAND SPECIMEN:

This is a bleached and weathered plagioclase+hornblende-phyric andesitic lava with altered plagioclase phenocrysts and apparently fresh hornblende phenocrysts.

THIN SECTION:

Yes folks, another Anthony Rd-type plagioclase+hornblende andesite lava. Around 10-15 modal% of this sample consists of intensely altered former plagioclase phenocrysts to about 2mm long that are now composed of a very fine-grained epidote intergrowth. Hornblende phenocryst reach at least 6mm long and are well-formed prismatic crystals that often include small (altered) plagioclase phenocrysts; they are perfectly fresh. There are no quartz phenocrysts in this sample, and all FeTi oxide phenocrysts and microphenocrysts are altered to dirty brown leucoxene.

The groundmass of this sample was glassy, and has altered to a very fine-grained quartz-epidote intergrowth in which patches to almost 1cm across of intense epidote alteration are present. There is virtually no chlorite in this sample, and epidote also occurs as a few narrow veinlets that cut the rock. A few quartzose patches contain acicular long crystals that appear to be actinolite, indicating that this sample achieved basal greenschist facies metamorphic conditions.

This is a plagioclase+hornblende+FeTi oxide-phyric andesite lava of the Anthony Rd-type that shows a lowermost greenschist facies alteration assemblage, probably hydrothermal in origin, dominated by silica and epidote.

SAMPLE NUMBER: 624436

LOCATION: Anthony Basin: Magnetic Susc: 0.31

SUMMARY:

This is an Anthony Rd-type plagioclase+hornblende+quartz +FeTi oxide-phyric andesitic lava with moderate hydrothermal alteration indicated by the assemblage calcite-chlorite-epidote±pyrite.

HAND SPECIMEN:

This is a dark grey rather altered plagioclase+hornblende-phyric andesitic lava with altered plagioclase phenocrysts but apparently fresh hornblende phenocrysts.

THIN SECTION:

This sample is another Anthony Rd - Crown Hill-type plagioclase+ hornblende-phyric andesitic lava. Blocky to tabular albitized plagioclase phenocrysts to about 3mm long make up about 10-15 modal% of this rock and are sometimes slightly rounded and show internally zoned alteration of calcite, sericite and very fine-grained to microcrystalline epidote. Hornblende phenocrysts to almost 1cm long are perfectly fresh, apart from minor chloritic alteration along cleavages, and they make up about 3-5 modal% of the rock. They commonly include small plagioclase crystals and altered FeTi oxide microphenocrysts. A single quartz phenocryst is present in this rock and all the FeTi oxide phenocrysts are altered to brown leucoxenitic aggregates.

The groundmass of this rock is strongly altered and has a texture suggestive of an autobreccia, although this is certainly not obvious from the hand specimen. The formerly glassy groundmass is now a quartzo-feldspathic intergrowth that has been extensive replaced by swirling silica, calcite and ultra-fine-grained epidote, with abundant fine-grained and patchy chlorite. Very minor disseminated pyrite is also present in this sample.

This is a moderately hydrothermally altered plagioclase+hornblende +quartz+FeTi oxide-phyric andesitic lava of the Anthony Rd-Crown Hill-type, with a calcite-epidote-chlorite±pyrite alteration assemblage.

SAMPLE NUMBER: 624435

LOCATION: Anthony Basin: Magnetic Susc. 0.36

SUMMARY:

This is a quite hydrothermally altered (calcite-chlorite-epidote) plagioclase+hornblende-phyric andesitic lava correlated with the Anthony Rd - Crown Hill hornblende andesites.

HAND SPECIMEN:

This is a dark grey, rather altered autobrecciated plagioclase+ mafic-phyric lava with broad zones of paler coloured domains of strong hydrothermal alteration throughout the rock.

THIN SECTION:

This sample is a quite strongly altered plagioclase+sparse mafics-phyric andesitic lava breccia. The least altered lava fragments are composed of about 10-15 modal% of albitized plagioclase phenocrysts to about 2mm long max., and only a few percent of altered mafic phenocrysts in an extremely fine-grained, almost isotropic groundmass. Former mafic phenocrysts were probably hornblende, judging by the rather elongate crystal shapes and alteration to chlorite and calcite. Albitized plagioclase phenocrysts are fairly blocky to tabular euhedra about 2mm long max., and are heavily overprinted by calcite and minor sericite. A few apatite phenocrysts are present, as also are a few small, rounded and resorbed quartz phenocrysts. Occasional small FeTi oxide phenocrysts have exsolved magnetite on octahedral planes, then altered to messy brown leucoxene and chlorite. The alteration assemblage of the formerly glassy to vitrophyric groundmass is calcite-epidote-chlorite-quartz.

Large areas of this section are composed of strongly altered and recrystallized andesite produced during strong hydrothermal fluid passage through the autobrecciated lava. This enhanced the brecciated appearance (producing a texture approaching a 'false brecciated' texture), and has produced widespread very fine-grained almost isotropic epidote, and calcite throughout the altered parts of the rock. The groundmass texture has been obliterated by this hydrothermal alteration.

This is an autobrecciated plagioclase+hornblende andesite lava in which the apparent brecciation has been enhanced by strong calcite-chlorite-epidote-producing hydrothermal alteration.

SAMPLE NUMBER: 624434

LOCATION: Anthony Basin: Magnetic Susc: 0.10

SUMMARY:

This is a formerly highly glassy crystal (plagioclase and quartz) - vitric lithic tuff of rhyolitic composition, which has suffered strong calcite-sericite alteration, and has been cut by a few narrow calcite-pyrite veinlets.

HAND SPECIMEN:

This is a dull, grey massive aphyric felsic tuff or lava.

THIN SECTION:

This sample is a very strongly altered fairly fine-grained crystal vitric tuff containing about 5 modal% of totally sericite+calcite-altered small plagioclase phenocrysts, and a few angular, broken quartz phenocryst fragments. Occasional FeTi oxide phenocrysts are totally altered to messy brown translucent leucoxene. Five or six lithic clasts of mosaic-textured aphyric formerly glassy lavas are present, all being less than 1mm across.

The groundmass of this sample is totally replaced by a fine-grained mixture of sericite, calcite, and very fine-grained equant opaques. Except that the magnetic suceptibility of this sample is close to zero, I would have guessed that these tiny opaques were magnetite. Perhaps they are hematite. The sample is transected by several meandering calcite-pyrite veins less than o.5mm wide, in which occasional small epidote euhedra and chlorite concentrations are also present. Some pyrite crystals are almost 1mm long, although most are much less than this.

This is a strongly calcite+sericite-altered formerly glassy felsic crystal vitric lithic tuff that was cut by pyrite-calcite veinlets late in the alteration history of this sample.

930040

SAMPLE NUMBER: 624433

LOCATION: Anthony Basin: Magnetic Susc: 0.28

SUMMARY:

This is a fairly evolved plagioclase+hornblende+FeTi oxide-phyric Anthony Rd-type andesitic to dacitic lava with moderate chlorite-calcite±pyrite hydrothermal alteration.

HAND SPECIMEN:

This is a grey, altered plagioclase+hornblende-phyric andesitic lava with altered hornblende phenocrysts.

THIN SECTION:

This sample was another plagioclase+hornblende-phyric Anthony Rd-type hornblende andesite, although the relative paucity of hornblende phenocrysts suggests that it may have been more dacitic than andesitic. Albitized plagioclase phenocrysts make up about 15 modal% of the rock, and are rarely larger than 1mm long. They show quite strong sericite and calcite overprinting. Former hornblende phenocrysts probably make up 3-5 modal% of this rock, and were up to at least 4mm long. They are totally replaced by colourless chlorite and calcite, with abundant small leucoxene granules scattered through the hornblende sites. Former FeTi oxide phenocrysts are totally replaced by murky brown leucoxene and are disaggregated in places. A few apatite phenocrysts are also notable.

The groundmass of this rock was probably glassy to vitrophyric. It is now a quite strongly calcite+chlorite-altered fine-grained quartzo-feldspathic intergrowth. It contains disseminated pyrite grains smaller than 0.2mm.

This is a typical Anthony Rd-type plagioclase+hornblende-phyric andesitic to dacitic lava that has suffered moderate hydrothermal alteration producing pervasive calcite+chlorite±pyrite throughout the groundmass. FeTi oxide destruction resulted in magnetic susceptibility being very low.

930041

SAMPLE NUMBER: 624430

LOCATION: Anthony Basin: Magnetic susc. 0.36

SUMMARY:

This is a low-grade burial metamorphosed plagioclase+ hornblende-phyric andesitic lava, typical of the Anthony Rd - Crown Hill hornblende andesites.

HAND SPECIMEN:

This is a dark grey altered, plagioclase+mafic-phyric andesitic lava.

THIN SECTION:

This sample is a hornblende+plagioclase-phyric andesite composed of around 15 modal% altered plagioclase phenocrysts and about 5 modal% of partially altered hornblende phenocrysts in a fine-grained formerly vitrophyric groundmass. Plagioclase phenocrysts are up to 4mm across, and are slightly rounded and resorbed blocky to prismatic crystals that are albitized, and riddled with tiny granular, almost isotropic epidote inclusions, abundant fine-grained sericite and minor chlorite. The hornblende phenocrysts are about half altered to pale green chlorite and not uncommon calcite, and are mainly euhedra less than about 2mm long. A number of 1mm-sized apatite phenocrysts are also present. Uncommon former FeTi oxide phenocrysts are altered to pale green chlorite and leucoxenitic material.

The groundmass of this sample is a messy, rather chloritic quartzo-feldspathic intergrowth after devitrified glass in which are set abundant tiny albite microlites. Spots of chlorite, chlorite-epidote and chlorite-calcite-epidote are common throughout the groundmass, and stylolitic concentrations of altered insoluble oxides are common.

This is a typical Anthony Rd - Crown Hill plagioclase+hornblende-phyric andesitic lava with a low-grade regional burial metamorphic overprint.

SAMPLE NUMBER: 624429

LOCATION: Anthony Basin: Magnetic Susc: 0.30

SUMMARY:

This is a burial metamorphosed or weakly hydrothermally altered Anthony Rd - Crown Hill-type plagioclase+hornblende +FeTi oxide-phyric andesite.

HAND SPECIMEN:

This is a rather altered plagioclase+hornblende (altered)-phyric andesitic lava.

THIN SECTION:

This sample was a plagioclase+hornblende-phyric andesite lava with about 10 modal% of blocky to tabular albitized plagioclase phenocrysts to about 2mm long, with common tiny epidote granules and sericite alteration. Former hornblende phenocrysts were slightly less abundant than plagioclase and have entirely altered to chlorite and epidote. Some crystals were more than 3mm long and included small albite crystals and FeTi oxide microphenocrysts. Former FeTi oxide phenocrysts are totally replaced by murky brown leucoxene. Occasional apatite phenocrysts are present, but quartz phenocrysts are absent from this sample.

The groundmass of this sample is quite altered and rather messy. Almost certainly it was originally glassy to vitrophyric, with tiny plagioclase laths set in glass. The devitrified glass has recrystallized to a very fine-grained quartzo-feldspathic material that is heavily but patchily overprinted by fine-grained epidote and chlorite alteration.

This is a typical Anthony Rd - Crown Hill-type hornblende andesite lava although it lacks the usual few modal% of quartz phenocrysts. It shows a burial metamorphic alteration assemblage, with the total alteration of the FeTi oxide phenocrysts being responsible for the low magnetic susceptibility.

SAMPLE NUMBER: 624207

LOCATION: Anthony Basin Magnetic Susc. 0.43

SUMMARY:

This is a well-preserved plagioclase+hornblende +augite+FeTi oxide-phyric andesitic lava with a low-grade burial metamorphic alteration assemblage.

HAND SPECIMEN:

This is a very fresh-looking hornblende+plagioclase-phyric andesite lava with hornblende phenocrysts up to 1cm long.

THIN SECTION:

This sample is a very well-preserved strongly porphyritic hornblende+plagioclase+augite-phyric andesitic lava. Hornblende phenocrysts up to about 4mm across in thin section make up around 5-8 modal% of the rock. These are almost all perfectly fresh euhedral crystals with pale yellowish to mid-green pleochroism, and abundant inclusions of small tabular plagioclase crystals. Tabular albitized plagioclase phenocrysts are common (perhaps making up 10 modal% of the rock), mainly less than 1mm long, and usually contain small inclusions of chlorite and granular epidote. Augite phenocrysts are colourless, small (<1mm long) euhedral prisms that make up about 5-8 modal% of the rock. There few FeTi oxide phenocrysts or microphenocrysts in this rock are now composed of chlorite with tiny leucoxene granules embedded in it. An interesting feature of this sample is the presence of 4 or 5 small cognate gabbroic inclusions composed of intergrown albitized plagioclase and augite, with some of the augite being replaced by hornblende.

The groundmass of this sample is vitrophyric, composed of unorientated tiny albite microlites and laths set in devitrified glass that has altered to a fine-grained quartzo-feldspathic material. Chlorite is common but not abundant, except in a few gashes through the rock where it occurs intergrown with epidote and occasionally quartz and calcite. Tiny fluffy leucoxene granules after groundmass FeTi oxides.

The fairly uncommon oxide phenocrysts in this sample are altered to chlorite, which contains tiny leucoxene granules. Groundmass FeTi oxides are altered to tiny fluffy leucoxene granules.

This is a well-preserved low-grade burial metamorphosed hornblende+plagioclase+augite+FeTi oxide-phyric andesitic lava.

SAMPLE NUMBER: 624183

LOCATION: Anthony Basin: Magnetic Susc: 0.04

SUMMARY:

This is a hydrothermally chlorite-pyrite-altered formerly plagioclase+hornblende+quartz+FeTi oxide-phyric andesitic lava, typical of the Anthony Rd-type hornblende andesites.

HAND SPECIMEN:

This is a pale grey, hydrothermally-altered plagioclase+ hornblende-phyric andesite with abundant very fine-grained disseminated pyrite and occasional pyrite replacing hornblende phenocrysts.

THIN SECTION:

This sample started life as a typical plagioclase+hornblende +quartz+FeTi oxide-phyric andesitic rock, almost certainly a glassy lava. It has suffered quite strong hydrothermal alteration leading to pervasive alteration of the hornblende phenocrysts and pyrite crystallization. The plagioclase phenocrysts that made up around 15-20 modal% of this rock are blocky to tabular albitized prisms with slight sericite speckling. Hornblende phenocrysts originally made up about 5-8 modal% of this rock and were well-formed prisms up to at least 6mm long, and commonly include albite and FeTi oxide grains. The hornblende has totally altered to almost isotropic chlorite. Quartz phenocrysts are reacted and resorbed, and are rarely bigger than 1mm across. The FeTi oxide phenocrysts and microphenocrysts are also totally altered, in this case to a very fine-grained messy brown leucoxene - chlorite intergrowth. A few apatite microphenocrysts are also present.

The groundmass of this rock is a very fine-grained sugary textured quartzo-feldspathic intergrowth probably after devitrified glass, and contains disseminated minor chlorite. Pyrite occurs throughout the rock, probably making up about 1-2 modal% of this sample. It mainly occurs as idiomorphic crystals to about 1mm maximum dimension, disseminated throughout the rock, occurring in both the groundmass and in former hornblende phenocryst sites. An number of former hornblende phenocrysts contain 8 or 10 pyrite crystals, and they have clearly preferentially nucleated in these sites. There is no petrographically obvious cleavage in this sample, and the pyrite distribution is definitely random.

This is a chlorite-pyrite-altered plagioclase+hornblende+quartz+ FeTi oxide-phyric andesitic lava, typical of the Anthony Rd andesites.

SAMPLE NUMBER: 624184

LOCATION: Anthony Basin: Magnetic Susc: 0.23

SUMMARY:

This is a moderately sericite+chlorite-altered plagioclase+hornblende+quartz+FeTi oxide-phyric andesite lava.

HAND SPECIMEN:

This is a speckled green highly altered hornblende +plagioclase andesitic lava with a weak foliation.

THIN SECTION:

This sample, despite the apparent alteration of the hand specimen, is actually a texturally rather well-preserved plagioclase+hornblende+ quartz+FeTi oxide-phyric andesite lava. Plagioclase and hornblende phenocrysts are about equally abundant, each perhaps making up around 10 modal% of the rock. Plagioclase phenocrysts are albitized, and contain quite abundant sericite, with smaller spots of dark green chlorite. Most are less than 2mm long and are well-formed tabular prisms. Former hornblende phenocrysts vary from 0.5 to at least 4mm long, and all are very well-formed prisms. They are all composed of the same pale green chlorite, with minor sericite, and common but not abundant tiny angular Fe oxide grains. Small plagioclase (albite) prisms are common as inclusions in the hornblende phenocrysts. Quartz phenocrysts make up about 3-5 modal% of this sample and are mainly around 0.5mm long; they are highly rounded and resorbed, with chloritized melt inclusions. FeTi oxide phenocrysts constitute considerably less than 1 modal% of this rock, and all are less than 0.5mm across. They are altered to a translucent mid-brown-tan material (hematite or goethite). A few microphenocrysts of apatite are also present.

The groundmass of this rock was probably glassy, and has altered to a fine-grained mosaic intergrowth of quartz and feldspar that is quite strongly sericitized, and also contains quite common pale green chlorite. This is a burial metamorphic alteration assemblage.

This is a moderately chlorite+sericite-altered plagioclase+ hornblende+quartz+FeTi oxide-phyric andesite lava.

930046

SAMPLE NUMBER: 624210

LOCATION: Anthony Basin: Magnetic Susc: 0.34

SUMMARY:

This is an epiclastic sandstone dominated by angular broken quartz and euhedral altered plagioclase phenocrysts in a matrix of totally recrystallized glass.

HAND SPECIMEN:

This is a detrital plagioclase phenocryst-rich volcaniclastic sandstone with a few large (to several cm) lithic clasts of pale grey siltstone or mudstone.

THIN SECTION:

This sample is a texturally very-well preserved sandstone composed dominantly of detrital angular broken quartz phenocrysts, and altered, more euhedral detrital plagioclase phenocrysts, with a single large lithic clast, all set in a matrix of very fine-grained, recrystallized, vitric ash. The quartz grains make up around 20 modal% of the rock, are mainly around 0.5-1mm long, and are notably broken and angular, clearly indicating an origin via explosive probably subaerial eruptions. Plagioclase phenocrysts are totally altered to almost isotropic sericite and possibly very fine-grained epidote. Detrital FeTi oxide microphenocrysts are not uncommon, and are all similarly altered to dull brown leucoxenitic material with rather shaggy edges. The lithic clast is a mudstone composed of tiny sericite or muscovite crystals and rare, small detrital quartz grains.

The matrix of this rock is an extremely fine-grained quartzo-feldspathic material after vitric ash, and it has been quite patchily but heavily overprinted by sericite. No trace of shard textures is preserved.

This is an epiclastic sandstone derived dominantly from felsic quartz+plagioclase-phyric crystal vitric tuffs. It shows moderate sericite alteration, probably related to low-grade burial metamorphic alteration.

930047

SAMPLE NUMBER: 624209

LOCATION: Anthony Basin: Magnetic Susc: 0.18

SUMMARY:

This is a plagioclase-phyric dacitic lava with weak chloritic hydrothermal alteration. It may be a fractionate of the Anthony Rd type hornblende andesites, although the absence of quartz and apatite phenocrysts suggests that this is unlikely.

HAND SPECIMEN:

This is a grey plagioclase-phyric dacitic to andesitic lava.

THIN SECTION:

This sample is rather difficult to diagnose with confidence. It was probably a dacitic plagioclase-phyric lava, but the unusual groundmass texture makes it difficult to be sure what the protolith was. About 15-20 modal% of the rock is made up of rather blocky albitized plagioclase phenocrysts to about 3mm long, with slight sericite speckling. A few former mafic phenocrysts are made up of chlorite, abundant granular leucoxenitic material and minor quartz, and it is not possible to determine positively whether they were hornblende or augite, although I am fairly certain that they were hornblende. Former FeTi oxides were uncommon, and are totally replaced by messy brown leucoxene and chlorite. There are no apatite phenocrysts or microphenocrysts in this sample.

The groundmass of this sample is heterogeneous and complex. It was probably originally vitrophyric-textured, being composed of plagioclase microphenocrysts and laths in devitrified glass. Crystallization of glass to very fine-grained quartzo-feldspathic material, and pervasive streaking by yellow-green chlorite and a fine sericite mesh throughout the rock make the groundmass look like a tuffaceous rock in places.

This is a dacitic lava with weak to moderate hydrothermal alteration (chlorite-dominated); the probable former hornblende phenocrysts indicate that it may be related to the Anthony Rd hornblende andesites, although groundmass texture, lack of quartz and paucity of apatite phenocrysts all argue against that correlation. Chemical data would be useful to test this question.

PETROGRAPHIC SIGNATURES OF ROCK MAGNETISM
ANTHONY ROAD ANDESITES

A Report for Aberfoyle Exploration (Burnie: attn. Robina Sharpe)

Tony Crawford, 13/7/93

Primary Variability

The Anthony Road - Crown Hill-type hornblende andesites are a petrographically and compositionally distinctive lithological unit within the Mount Read Volcanics south of the Henty Fault. To my knowledge they have no obvious correlates north of the Henty Fault, although their compositions are transitional to the more enriched Hellyer Basalts. It is clear from the twenty six samples of this unit provided for thin section study that both intrusive and extrusive varieties of these hornblende andesites exist, although I cannot differentiate these in hand specimen. The difference is restricted to small changes (coarsening) in the texture of the groundmass, and indicates that the intrusive phase was intrusive at very shallow levels.

The least evolved Anthony Rd-type andesites contain a small modal percentage of augite phenocrysts in addition to the ubiquitous plagioclase, hornblende and FeTi oxide phenocrysts. Quartz is present as resorbed phenocrysts in many samples, although strangely, it is not present in what I judge to be the more evolved dacitic variants of this lithology (on the basis of notably depletion in hornblende phenocrysts). I am fairly certain that the quartz phenocrysts, which are present in most hornblende andesites I have seen from 'arc-type' suites in the world (eg Aolian arc, Andean arc, Fiji, Solomon Islands) are the product of a reaction of the type

augite (+ melt?) = hornblende+ quartz

Hornblende phenocrysts are essentially identical petrographically in every sample I have seen, with moderate pleochroism from straw yellow or almost clear to mid olive green. They are often quite large and always contain small inclusions of both plagioclase and FeTi oxides. This indicates that hornblende is

a relatively late-crystallizing phase, which would be expected if it is a product of reaction between augite and melt. In sample 624408, the hornblende is very reacted and neocrysts of euhedral augite are present, suggesting a back-reaction of the reaction above. This was probably due to heating of the magma in the magma chamber, possibly as a result of input of hotter new magma at the base of the magma chamber.

Plagioclase phenocrysts make up at least 10 modal% of every sample I have seen. They are ususally discrete, single tabular to blocky phenocrysts, commonly very slightly rounded and resorbed, and were originally strongly zoned as indicated by zoned alteration of some crystals. They have been totally albitized during burial metamorphic alteration.

FeTi oxides were present as a phenocryst and microphenocryst phase in every sample of the Anthony Rd-type andesites that I have seen. They always make up probably much less than 1 modal% of the rock and occur as equant titanomagnetite grains to about 0.2mm across maximum. Their variable response to alteration is discussed further on.

Quartz phenocrysts are present in most but not all samples of Anthony Rd-type andesite. They are always rather rounded and reacted-looking, often with deep embayments indicating reaction with host magma. I have suggested above that these quartz phenocrysts result from reaction of augite with a hydrous magma to produce low-Si hornblende plus quartz. Quartz produced in this manner clearly did not stay for very long in equilibrium with the host magma, as indicated by its extensive resorption.

Apatite microphenocrysts and occasional phenocrysts to about 1mm long are present in all Anthony Rd-type andesites as fresh, slightly smoky crystals occurring as discrete crystals and as inclusions in hornblende. The presence of so much (relative to the CVC andesites and dacites) apatite demonstrates that these hornblende andesites are relatively enriched in P_2O_5 (and thus also REE, Sr and Th).

Regional Burial Alteration

All Anthony Rd andesites were degraded to some degree by regional burial metamorphism. This usually had the effect of albitizing all plagioclase, and sometimes producing abundant sericite and/or very fine-grained epidote in the albite phenocrysts. Hornblende by and large resisted this alteation, and remained fresh. FeTi oxide phenocrysts show very diverse breakdown modes, most typically altering to messy translucent leucoxene, sometimes preserving octahedral plates (also altered) of ilmenite due to high-temperature oxidation-exsolution. In quite a number of the hornblende andesites, the FeTi oxides are apparently unaltered.

The groundmass of the hornblende andesites varied from glassy and vitrophyric in extrusive variants, to a microcrystalline to holocrystalline sugary quartzo-feldspathic intergrowth in intrusive rocks. The groundmasses of the latter varieties are little different to the products of recrystallization of the devitrified glassy varieties. Sericite, fine-grained epidote, chlorite, and in one sample pumpellyite, all occur as alteration phases in the groundmass of these lavas.

Hydrothermal Alteration

Many samples of the Anthony Rd-type andesites show weak to strong hydrothermal alteration, characterized by breakdown of hornblende to chlorite and epidote, plus quartz in some cases. Plagioclase phenocrysts show essentially similar alteration to those in burial metamorphosed rocks. FeTi oxides also show the same style of alteration as in the burial metamorphosed rocks, with either chlorite cores and leucoxenitic rims, or entirely replaced by brown messy leucoxenitic material (or both in the one slide).

Hydrothermal assemblages are most notable by the style and intensity of the groundmass alteration. In quite altered varieties, a mesh of sericite or sericite plus chlorite may pervade the groundmass (eg. 624426), or more frequently, strong chlorite alteration ± calcite±pyrite occurs throughout the groundmass (624436, 624433, 624435.

Relationship Between Magnetic Susceptibility and Petrography

The key item I was investigating in this petrographic report was the possible relationships between magnetic susceptibility of the rock and its FeTi oxide abundances and alteration. With a single, inexplicable exception, all rocks that have high magnetic susceptibilites (>4) show FRESH or dominantly fresh FeTi oxides. Where the FeTi oxides are altered to leucoxene-chlorite, the magnetic susceptibility plunges towards values less than 0.5. In a few samples where the FeTi oxides are partially altered (ie. some fresh, some altered), the susceptibility values are in the range 3-6 (eg. samples 624182 and 624449). This is a simple and almost foolproof reason for the strong magnetic variability in the Anthony Rd-tye andesites.

The sole sample which appears to contradict this observation is sample 624445, which has a relatively high susceptibility (6.7) but totally altered FeTi oxides. I can find no fine-grained magnetite in the groundmass to account for this high susceptibility, and have no explanation for it, other than the possibility that the measured susceptibility value was written down wrongly. This should be checked with your own meter.

A single sample (624410) of plagioclase-phyric dacite (unrelated to the Anthony Rd-type hornblende andesites) with abundant magnetite in the strong hydrothermal alteration assemblage shows the highest measured suseptibility of any sample in this set (20.1). This simply shows that high susceptibility may also be due to hydrothermal magnetite, although no example of this was noted in the Anthony Rd hornblende andesites examined.

Implications of this relationship between preservation of primary FeTi oxides and magnetic signature are interesting. Clearly, the highly magnetic hornblende andesites are the least altered, having preserved primary FeTi oxides. Many of these samples look very similar in hand specimen, having a dull pinkish groundmass. It should be checked whether these samples could possibly come from a single, massive, relatively impermeable

intrusive body or lava dome, that did not allow easy access of low-temperature burial metamorphic or hydrothermal fluids.

The second implication is that rock magnetism cannot be used for these hornblende andesites as indicators of pockets or zones of hydrothermal alteration. Both hydrothermal and burial metamorphic alteration produce the same alteration assemblage from FeTi oxides, and both styles of alteration result in a massive decrease in the rock magnetic susceptibility. Therefore mapping from magnetics of highly magnetic zones either indicates zones of almost unaltered andesite, or zones of strong magnetite alteration. I have not observed the latter in the Anthony Rd-type hornblende andesites.

APPENDIX II

BASIN LAKE PROJECT. 9550

[redacted] GEOCHEMICAL SAMPLE LEDGER

PROJECT: ANTHONY BASIN

BSS SIEVE SIZE CODE - MESH NUMBER: A 200 D 80 G 30; B 150 E 60 H 20; C 100 F 40 T = TOTAL

SAMPLE TYPE CODE: OXIDIZED PRODUCTS O; FRESH ROCK R; STREAM SEDIMENTS S; WEATHERED BEDROCK W; SURFACE TRANSPORTED T; RESIDUAL SOIL E; MINE DUMP M

CARD PUNCH: YES ☐ NO ☐ PRINT: YES ☐ NO ☐ VERIFY

DATE: 4/6/93 SHEET: 1/2

EASTINGS	NORTHINGS	SAMPLE NUMBER	DEPTH in CMS	SIZE FRACTION	Sample Type	METAL VALUES PPM	GEOLOGICAL LOG
379357	5335286	624181	BASIN LAKE #2				DkGyPkPpHbPgPhTrPyA-1
379382	5335284	624182	"				DkGyPkHblthicxtalrichA-
379138	5335307	624352	"				PaleGyHbClFdPhA-1
379137	5335302	624353	"				GyGnHbFdA-1
379140	5335301	624354	-				GyBlmgHbPgpoorPhA-1
379184	5335295	624355	(BK ARGILLITE)				PkGycgHbPgPhA-1vesicles?
379219	5335286	624356	"				GyPkHbFdxtalrichA-1
379228	5335285	624357	"				CgFdHbPhA-1
379238	5335283	624358	"				PkBncgHbPgPhA-1
380653	5335629	4446	BSL				SparsleyFdHbPhLgt Gn Gy.
379815	5335518	4447	BSL				GnFdHbPhA-1
379766	5335125	4448	BSL				GnsparselyHbFdPhA-1
379143	5335316	4449	BSL				Lgt GymtxtHbFdPhA-1
379152	5335309	4450	BSL				Lgt GyBlGnHbPhfgA-1

OPERATOR | COMPUTER | CHECK | PLOTTER | DATE

9 30054

[redacted] Exploration — GEOCHEMICAL SAMPLE LEDGER

PROJECT: ANTHONY BASIN

BSS SIEVE SIZE CODE - MESH NUMBER
A 200 D 80 G 30
B 150 E 60 H 20
C 100 F 40 T = TOTAL

SAMPLE TYPE CODE
☐ OXIDIZED PRODUCTS O
☐ FRESH ROCK R
☐ STREAM SEDIMENTS S
☐ WEATHERED BEDROCK W
☐ SURFACE TRANSPORTED T
☐ RESIDUAL SOIL E
☐ MINE DUMP M

CARD PUNCH: YES ☐ NO ☐ PRINT: YES ☐ NO ☐ VERIFY ☐

DATE: 4/6/93

SHEET: 2/2

EASTINGS	NORTHINGS	SAMPLE NUMBER	DEPTH In CMS	SIZE FRACTION	Sample Type	METAL VALUES PPM	GEOLOGICAL LOG
379919	5353457	624183			BSL		GYPSiSeDsfγHbPhA-1
380006	5353369	624184			BSL		GnGyPClSiHbFdPhA-1
379892	5353363	624185			BSL		GYPkHbFdPhA-1

OPERATOR COMPUTER CHECK PLOTTER DATE

9300353

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930056

Phone (004) 316837 | 14 Thirkell St. CODEE TAS 7320 | Fax (004) 318890

ANALYTICAL REPORT No. 100560.60.09550

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

ORDER No.	PROJECT
4457	

DATE RECEIVED	RESULTS REQUIRED
08/04/93	ASAP

No. OF PAGES OF RESULTS	DATE REPORTED	No. OF COPIES	TOTAL No. OF SAMPLES
4	13/07/93	1	26

SAMPLE NUMBERS	SAMPLE DESCRIPTION	ELEMENT/METHOD
24181/185,352/358,439/450,	RC Prep : 6P033	Cu,Pb,Zn,Ag/6A101
63,459		Ba,As,Cr,Zr/6A401
		Whole Rock Analysis/0X408

RESULTS TO
Mr R de Bomford
Aberfoyle Resources Limited
Exploration Division
P.O. Box 952
BURNIE TAS 7320

RESULTS TO

RESULTS TO

REMARKS

N.B. S/0X406 MAY NOT BE ACCURATE FOR SAMPLES CONTAINING SIGNIFICANT LEVELS OF SULPHIDE. METHOD 0M613 SHOULD BE USED TO CHECK SUCH SAMPLES.

EXTRA WORK REQUESTED BY RICHARD DE BOMFORD 30.6.1993 - Cr,Zr/6X401

AUTHORISED OFFICER

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930057

ANALYTICAL DATA

SAMPLE PREFIX	REPORT No.	REPORT DATE	CLIENT ORDER No.	PAGE
	100560.60.09550	13/07/93	4457	5 OF 6

TUBE No.	SAMPLE No.	Na2O	LOI	TOTAL
1	624181	3.79	2.15	100.03
2	624182	3.20	2.65	99.71
3	624183	3.60	4.32	101.17
4	624184	1.96	3.88	99.80
5	624185	5.47	1.88	100.35
6	624352	1.40	4.58	99.63
7	624353	1.88	3.77	99.56
8	624354	2.05	3.47	100.00
9	624355	4.72	2.11	100.23
10	624356	3.48	2.23	99.91
11	624357	4.02	1.93	99.92
12	624358	2.67	4.00	99.62
13				
14				
15				
16				
17				
18				
19				
20	624446	3.32	3.31	100.29
21	624447	3.27	2.92	99.72
22	624448	3.03	2.53	100.31
23	624449	2.86	3.51	99.98
24	624450	2.24	4.29	100.31
25				

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 *Gary Lindberg*

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930058

ANALYTICAL DATA

SAMPLE PREFIX	REPORT No.	REPORT DATE	CLIENT ORDER No.	PAGE
	100560.60.09550	13/07/93	4457	3 OF 6

TUBE No.	SAMPLE No.	SiO2	TiO2	Fe2O3	MnO	CaO	K2O	MgO	P2O5	S
1	624181	60.8	0.42	7.31	0.15	4.43	2.06	3.70	0.175	0.007
2	624182	61.4	0.42	7.38	0.14	3.90	2.37	3.43	0.157	0.012
3	624183	64.6	0.42	5.13	0.03	0.50	1.12	4.48	0.131	1.760
4	624184	64.4	0.44	7.14	0.07	0.26	2.30	3.44	0.184	0.011
5	624185	61.6	0.42	6.94	0.11	2.62	2.36	3.89	0.173	0.010
6	624352	60.8	0.44	6.50	0.08	3.05	3.33	3.31	0.149	0.012
7	624353	60.9	0.44	7.29	0.08	3.32	3.02	3.32	0.168	0.009
8	624354	62.3	0.41	6.93	0.10	2.73	3.00	3.49	0.168	<0.005
9	624355	62.3	0.43	6.70	0.09	3.03	2.20	3.53	0.178	<0.005
10	624356	62.1	0.41	6.73	0.10	2.30	3.68	3.52	0.176	<0.005
11	624357	61.4	0.41	6.81	0.11	3.29	3.25	3.49	0.175	0.011
12	624358	59.8	0.44	7.43	0.09	2.77	3.04	3.25	0.172	0.009
13										
14										
15										
16										
17										
18										
19										
20	624446	57.3	0.52	7.89	0.09	3.86	3.99	3.33	0.313	0.009
21	624447	55.7	0.45	8.30	0.15	7.24	1.46	4.75	0.203	0.031
22	624448	59.2	0.43	7.32	0.13	6.62	1.71	4.52	0.205	0.006
23	624449	61.4	0.44	6.84	0.08	3.74	1.75	3.34	0.184	0.005
24	624450	60.3	0.47	7.34	0.09	4.46	1.73	3.57	0.134	0.012
25										

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 *Gary Lindberg*

930059

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ANALYTICAL DATA

SAMPLE PREFIX	REPORT No.	REPORT DATE	CLIENT ORDER No.	PAGE
	100560.60.09550	13/07/93	4457	1 OF 6

TUBE No.	SAMPLE No.	Cu	Pb	Zn	Ag	Ba	As	Cr	Zr	Al2O3
1	624181	45	29	81	<2	1254	9	44	134	15.06
2	624182	27	91	159	<2	1431	51	58	140	14.69
3	624183	132	6	42	<2	371	31	61	140	15.05
4	624184	27	10	79	<2	1047	4	63	146	15.70
5	624185	16	37	204	<2	1387	<2	51	143	14.88
6	624352	20	6	62	<2	1306	2	55	149	15.96
7	624353	68	<5	35	<2	1077	2	57	151	15.32
8	624354	45	7	167	<2	1156	2	55	138	15.42
9	624355	9	9	153	<2	908	2	51	140	14.95
10	624356	30	23	129	<2	2922	3	47	138	15.24
11	624357	50	75	117	<2	2239	4	46	144	15.01
12	624358	65	33	148	<2	1651	2	53	144	15.91
13										
14										
15										
16										
17										
18										
19										
20	624446	22	<5	85	<2	2256	3	69	173	16.31
21	624447	84	8	79	<2	749	5	72	145	15.29
22	624448	69	19	67	<2	995	8	74	137	14.57
23	624449	43	13	45	<2	608	2	50	150	15.83
24	624450	23	55	213	<2	730	<2	54	151	15.63
25										

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 *Gary Lindberg*

[redacted] Exploration [redacted] GEOCHEMICAL SAMPLE LEDGER

A 39140

PROJECT: ANTHONY BASIN

BSS SIEVE SIZE CODE - MESH NUMBER
A 200 D 80 G 30
B 150 E 60 H 20
C 100 F 40 T = TOTAL

SAMPLE TYPE CODE
☐ OXIDIZED PRODUCTS O
☐ FRESH ROCK R
☐ STREAM SEDIMENTS S
☐ WEATHERED BEDROCK W
☐ SURFACE TRANSPORTED T
☐ RESIDUAL SOIL E
☐ MINE DUMP M

CARD PUNCH PRINT: YES ☐ NO ☐ VERIFY: YES ☐ NO ☐

DATE: 18/5/93

SHEET: 1/2

EASTINGS	NORTHINGS	SAMPLE NUMBER	DEPTH	SIZE FRACTION	Sample Type	METAL VALUES PPM	GEOLOGICAL LOG
379964	5353527	9	62442	06	BSL	BASIN LAKE PROFILE	
380214	5353527	8	62442	07	BSL		
380509	5353567	2	62442	08	BSL		
380608	5353587	8	62442	09	BSL		
379053	5353543	91	62442	6	BSL		
379132	5353548	8	62442	7	"		
379191	5353545	68	62442	8	"		
379286	5353546	39	62442	9	"		
379304	5353546	57	62443	0	"		
379371	5353547	03	62443	1	"		
379409	5353547	34	62443	2	"		
379420	5353547	42	62443	3	"		
379428	5353547	49	62443	4	"		
379445	5353547	60	62443	5	"		
379495	5353547	66	62443	6	"		
379516	5353547	80	62443	7	"		

OPERATOR | COMPUTER | CHECK | PLOTTER | DATE

93006

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930061

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ANALYTICAL REPORT No. 100560.60.09511

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

ORDER No.	PROJECT
4431	BASIN LAKE

DATE RECEIVED	RESULTS REQUIRED
18/05/93	ASAP

No. OF PAGES OF RESULTS	DATE REPORTED	No. OF COPIES	TOTAL No. OF SAMPLES
6	13/07/93	1	26

SAMPLE NUMBERS	SAMPLE DESCRIPTION	ELEMENT/METHOD
A 203/624466 Not Continuous	RC Prep : GP033	Cu,Pb,Zn,Ag/GA101 Ba,As,Cr,Zr/GX401 Whole Rock Analysis/OX408

RESULTS TO
Mr R de Bomford
Aberfoyle Resources Limited
Exploration Division
P.O. Box 952
BURNIE TAS 7320

RESULTS TO

RESULTS TO

REMARKS

EXTRA WORK REQUESTED BY RICHARD DE BOMFORD
30.6.1993 - Cr,Zr/GX401

AUTHORISED OFFICER

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930062

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A.C.N. 004 591 664

ANALYTICAL DATA

SAMPLE PREFIX	REPORT No.	REPORT DATE	CLIENT ORDER No.	PAGE
	100560.60.09511	13/07/93	4431	1 OF 6

TUBE No.	SAMPLE No.	Cu	Pb	Zn	Ag	Ba	As	Cr	Zr	Al203
1										
2										
3	624206	296	8	55	<2	1084	5	82	131	14.26
4	624207	155	22	55	<2	164	8	107	159	15.60
5	624208	27	9	102	<2	590	5	32	173	15.80
6	624209	40	6	92	<2	2693	23	42	191	22.88
7	624426	35	44	533	<2	1733	6	106	145	17.12
8	624427	65	27	160	<2	1142	17	149	211	17.82
9	624428	19	21	147	<2	874	10	40	122	15.10
10	624429	78	88	216	<2	376	56	124	132	14.82
11	624430	84	11	183	<2	341	21	126	132	14.90
12	624431	144	14	65	<2	1635	19	38	173	20.17
13	624432	31	<5	168	<2	1264	8	107	163	16.73
14	624433	52	<5	90	<2	915	13	74	142	14.99
15	624434	65	45	57	<2	1057	23	71	116	13.78
16	624435	23	6	76	<2	904	3	106	126	14.09
17	624436	64	12	71	<2	899	10	99	129	14.11
18	624437	23	44	27	<2	62	21	81	126	12.89
19										
20										
21										
22										
23										
24										
25										

T = element present; but concentration too low to measure
X = element concentration is below detection limit
– = element not determined

AUTHORISED OFFICER *Gary Lindberg*

ANALABS

A Division of Inchcape Testing Services (Australia) Pty. Ltd.
A.C.N. 004 591 664

930063

ANALYTICAL DATA

SAMPLE PREFIX	REPORT No.	REPORT DATE	CLIENT ORDER No.	PAGE
	100560.60.09511	13/07/93	4431	3 OF 6

TUBE No.	SAMPLE No.	SiO2	TiO2	Fe2O3	MnO	CaO	K2O	MgO	P2O5	S
1										
2										
3	624206	60.0	0.44	7.56	0.11	5.54	2.35	4.06	0.200	0.033
4	624207	57.3	0.47	7.36	0.12	6.10	0.32	4.30	0.284	0.072
5	624208	60.4	0.54	7.06	0.13	2.69	1.37	3.66	0.193	0.007
6	624209	54.3	0.63	5.97	0.05	0.36	4.49	1.38	0.260	0.007
7	624426	60.8	0.51	8.33	0.14	0.10	1.76	5.73	0.121	0.008
8	624427	61.9	0.60	6.76	0.08	0.04	2.65	3.70	0.268	<0.005
9	624428	66.9	0.46	6.87	0.11	0.15	2.05	1.89	0.197	0.009
10	624429	61.3	0.48	8.79	0.13	3.06	0.29	3.53	0.196	0.136
11	624430	57.5	0.45	7.80	0.15	5.39	0.34	4.53	0.209	0.095
12	624431	56.1	0.63	6.17	0.10	2.68	4.45	1.65	0.267	0.635
13	624432	60.6	0.49	8.38	0.13	0.79	2.43	4.10	0.266	0.018
14	624433	59.6	0.43	7.29	0.14	3.77	2.13	2.72	0.202	0.316
15	624434	61.9	0.42	7.52	0.09	3.46	2.76	1.57	0.193	2.124
16	624435	54.8	0.44	7.84	0.17	7.24	1.79	4.39	0.203	0.022
17	624436	57.4	0.43	7.43	0.13	6.99	2.20	3.89	0.202	0.136
18	624437	63.7	0.43	8.04	0.11	11.26	0.04	1.20	0.137	0.006
19										
20										
21										
22										
23										
24										
25										

T = element present; but concentration too low to measure
X = element concentration is below detection limit
– = element not determined

AUTHORISED OFFICER Gary Lindberg

ANALABS

A Division of Inchcape Testing Services (Australia) Pty. Ltd.
A.C.N. 004 591 664

930064

ANALYTICAL DATA

SAMPLE PREFIX	REPORT No.	REPORT DATE	CLIENT ORDER No.	PAGE
	100560.60.09511	13/07/93	4431	5 OF 6

TUBE No.	SAMPLE No.	Na2O	LOI	TOTAL
1				
2				
3	624206	3.16	2.16	100.02
4	624207	6.30	1.71	99.98
5	624208	6.73	1.44	100.12
6	624209	5.15	3.97	99.75
7	624426	0.31	5.04	100.14
8	624427	0.22	5.85	100.01
9	624428	2.07	3.80	99.69
10	624429	3.48	3.71	99.96
11	624430	4.06	4.65	100.11
12	624431	1.82	4.85	99.68
13	624432	2.49	3.68	100.19
14	624433	3.04	5.23	99.97
15	624434	2.28	5.00	101.24
16	624435	2.46	6.52	100.08
17	624436	2.37	4.58	99.95
18	624437	0.18	2.09	100.09
19				
20				
21				
22				
23				
24				
25				

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 *Gary Lindberg*

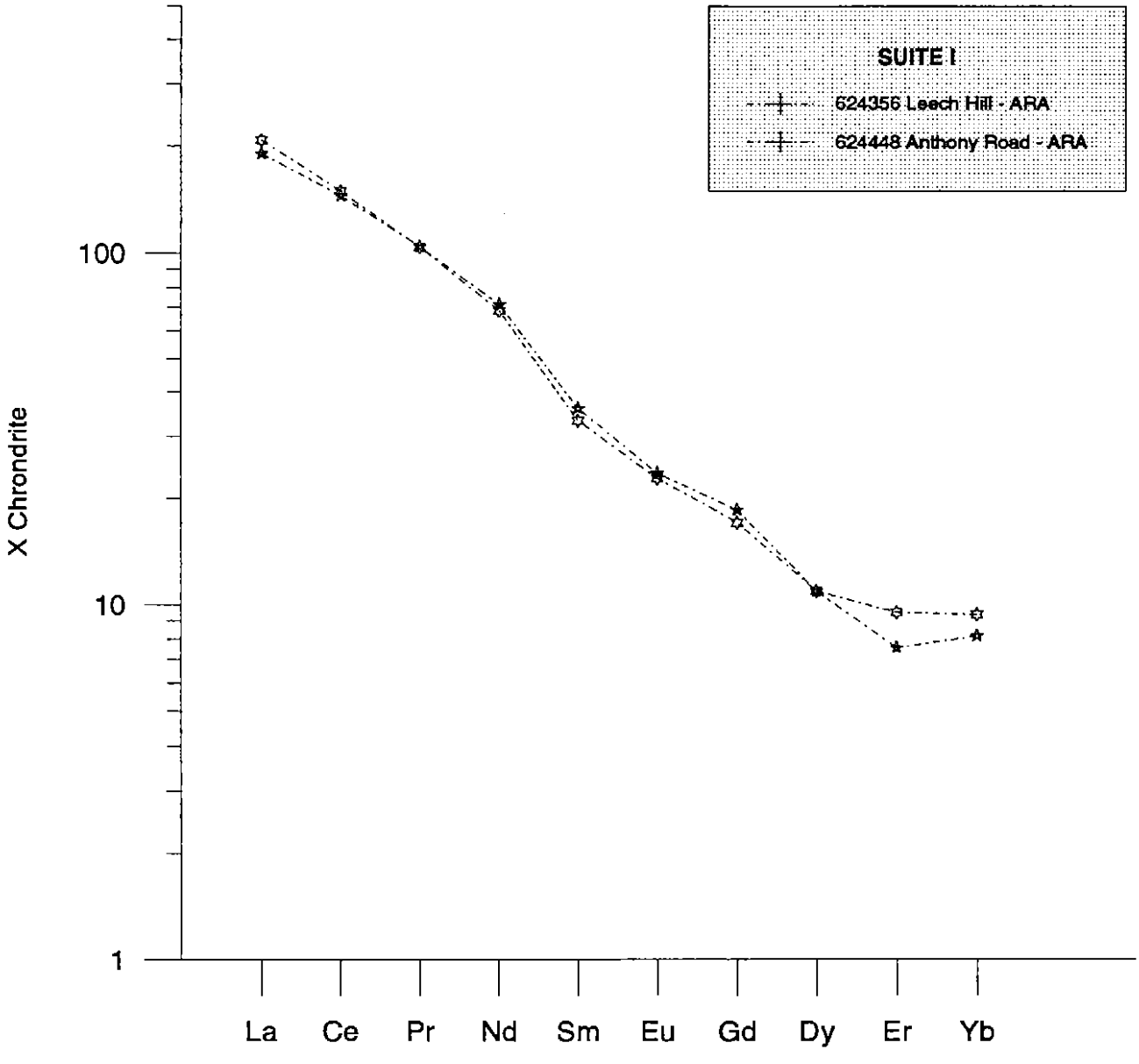
APPENDIX III

	624356	624448
LA ppm	65.6	59.9
CE ppm	121.3	117.8
PR ppm	12.07	12.11
ND ppm	40.9	42.6
SM ppm	6.37	6.93
EU ppm	1.64	1.70
GD ppm	4.42	4.79
TB ppm	0.70	0.62
DY ppm	3.55	3.55
ER ppm	2.02	1.60
YB ppm	1.94	1.69

379219 E
5352867 N

379766 E
5355125 N

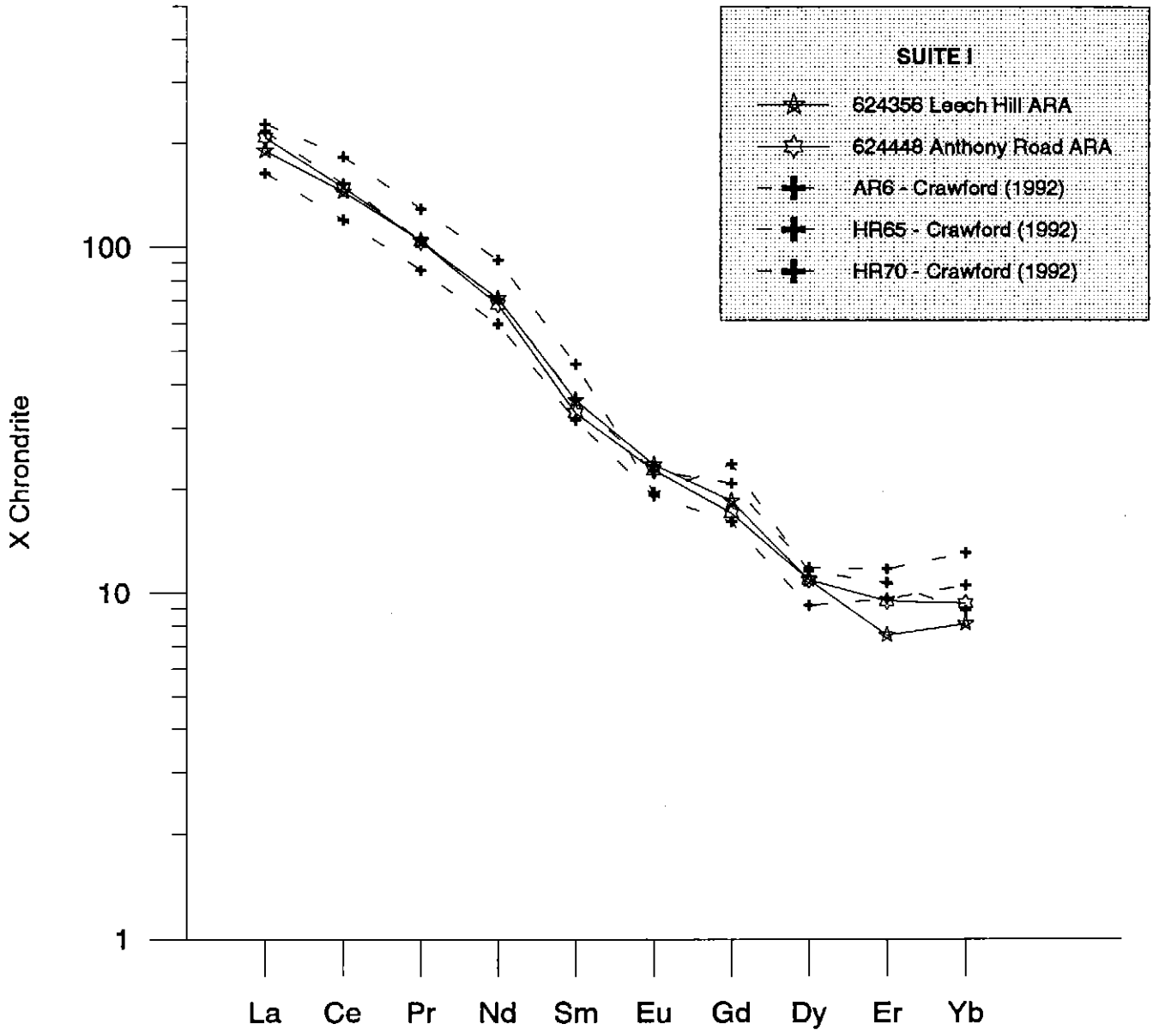
Anthony Basin REE Data
Chrondrite Normalised REE values



RAS 14/03/94
file: /antbasin/graph/ree/bslree.grf

930068

Anthony Road Andesite REE Data
Chrondrite Normalised Values



RAS 14/03/94
file: /antbasin/graph/ree/bslTCree.grf

APPENDIX IV

930070

MACKINTOSH 51

Logistics report for an heliborne magnetic and radiometric survey over MacIntosh, Anthony Basin & Lynchford areas Western Tasmania for Aberfoyle Resources Limited

Job No 3-445

May 1993

Geoterrex Pty Ltd
7-9 George Place
Artarmon NSW 2064

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INTRODUCTION

From 1-25 March 1993, Geoterrex Pty Ltd conducted an heliborne magnetometer and spectrometer survey over three areas on the Franklin and Sophia 1:100,000 sheets in Tasmania (See Appendix D) for Aberfoyle Resources Ltd. This report summarises the logistics, survey parameters, calibration procedures and processing details of the survey.

A total of 1,620 line kilometres were flown over three areas for Aberfoyle Resources:

1) **Mackintosh:** 1,087 line kilometres

2) **Anthony Basin:** 340 line kilometres

3) **Lynchford:** 193 line kilometres

A line spacing of 100 metres was used. Both magnetic and radiometric data was collected by helicopter. Preliminary in-field processing was undertaken with final processing at Geoterrex's processing centre in Sydney.

The bases of operations were Que River Mine and Queenstown, Tasmania.

PART 1
Survey operations summary

Type of survey:	Magnetic and radiometric	
Base of operations:	**Area 1:**	Que River Mine
	Area 2/3:	Queenstown
Aircraft:	Aerospatiale Squirrel 350B	
Survey Area(s) Name:	**Area 1:**	Mackintosh
	Area 2:	Anthony Basin
	Area 3:	Lynchford
Approximate Survey Size:	**Area 1:**	1,087 Line Kilometres
	Area 2:	340 Line Kilometres
	Area 3:	193 Line Kilometres
Flight Line Direction:	**Area 1:**	112° AMG
	Area 2:	90° AMG
	Area 3:	90° AMG
Line Spacing:	100 Metres	
Tie Line Direction:	Orthogonal to traverse lines	
Tie Line Spacing:	1,000 Metres	
Minimum Line Length:	3 Kilometres	
Minimum In-fill Line Length:	3 Kilometres	
Navigation:	DGPS	
Nominal sensor terrain clearance:	80 metres, above tree canopy	
Nominal aircraft speed:	40 metres per second	

Field Personnel:

Pilot:	D Wood
Navigator:	J Sparkman
Electronics Technician:	D Lyus
Project Manager and Data Compiler:	T Donnollan

Table 1: Survey Progress

Date	Flight	Production/ shared days	Progress
26-28 February	-	-	System installation
1 March	-	x	Move to Que River Mine
2 March	-	-	Weather day
3 March	-	x	Installed DGPS beacon
4 March	1	P Area 1	Tie lines
5 March	2	P Area 1	Traverse lines
6 March	3	P Area 1	Traverse lines
7 March	4	P Area 1	Traverse lines
8 March	5/6	x Area 1	Flight 5 lag test
9-20 March	Flights for another survey		
21 March	7	x Area 2	
22 March	8	x Area 2	
23 March	-	-	Weather day
24 March	9	P Area 2 & 3	
25 March	10	x Area 3	

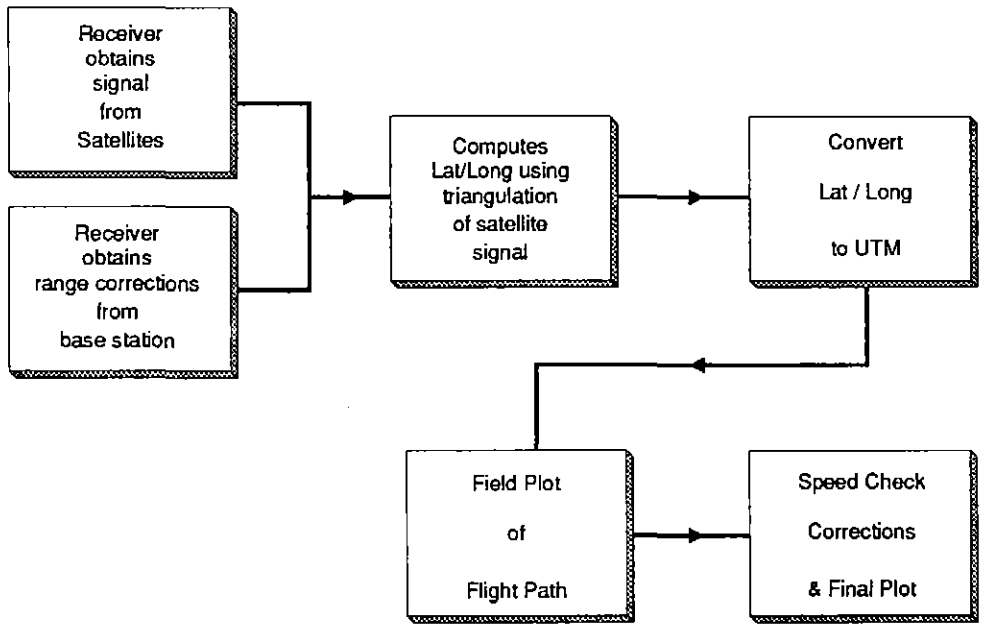
Total number of days:

Production (P): 5
Shared (x): 6

TOTAL: **11**

PART 2
Flight path recovery

DGPS Navigation System Procedures



The DGPS receiver mounted in the aircraft determines which satellites are in operation and receives a signal from them. The base station transmits range corrections to the aircraft receiver, which it applies as it uses 3D triangulation of the satellite response to calculate its position in real time as well as providing the pilots with steering information. The DGPS information is stored digitally as Latitudes and Longitudes (Lat / Longs) and later converted to Universal Transverse Mercator (UTM) co-ordinates.

The DGPS data is read into the field computer and plotted on a daily basis to ensure data quality control and to determine any necessary reflights.

PART 3
Equipment and specifications

3.1) MAGNETOMETER

Model: Scintrex cesium vapour optical absorption magnetometer

Mounting: Towed Bird

Sample Interval: 0.1 seconds

Sensitivity: 0.05 nT

Average noise: The average noise for the survey data is calculated from the fourth difference monitor using the equation:
(Fourth difference noise envelope)/16 = Average Data Noise

System parallax: The system parallax was determined in a test flight (see Section 4 and Appendix A)

3.2) GAMMA RAY SPECTROMETER

Model: Nuclear Data ADC/ND-560

Detectors: 4 Harshaw all viewing 2 pi NaI(Tl) crystals, totalling 16.8 litres.* Crystals, photomultiplier tubes and preamplifiers are all mounted in temperature controlled, insulated compartments.

Sample Interval: 1 second

Number of channels: 256

Synchronisation: The spectrometer sample is allocated to the time recorded at the end of the sample interval.

Window definitions:

Total Count	-	Channel 68 to 255	
Potassium	-	Channel 116 to 133	
Uranium	-	Channel 141 to 158	
Thorium	-	Channel 206 to 240	
Cosmic	-	Channel 0	

Nominal window MeV Ranges:

Total Count	-	0.4 to 3.0 MeV	
Potassium	-	1.35 to 1.57 MeV	(K40, 1.46 MeV)
Uranium	-	1.63 to 1.89 MeV	(Bi214, 1.76 MeV)
Thorium	-	2.42 to 2.82 MeV	(Tl208, 2.615 MeV)
Cosmic	-	3.0 - 6.0 MeV	

* NOTE Due to crystal problems the Macintosh area was flown using a detector crystal volume of 12.6 litres. The other two area were flown with a full crystal volume.

3.3) GROUND MAGNETOMETER BASE STATION

Sensor: Proton Precession
Magnetometer: Geometrics G856
Sample Interval: 5 seconds
Sensitivity: 0.1 nT
Full scale deflection: 50 nT

The base station was used to monitor the diurnal field. The sensor was placed in a suitable position which minimises the effects of high magnetic gradients and man-made interference.

3.4) ALTIMETERS

Radar altimeter

Model: Sperry Stars AA100 radio altimeter system
Sample Interval: 1.0 second
Accuracy: +/- 1.5% (+/- 1m at 60m)
Synchronisation: The average of the output of the altimeter over each second is calculated and assigned to the time recorded at the end of each sample.

Barometric altimeter

Model: Rosemount 840F pressure altimeter
Sample Interval: 1.0 second
Sensitivity: 5 mv per foot

3.5) TRACKING CAMERA

Model: Sony DXC101P Video Camera with a Panasonic video recovery system

The tracking camera is equipped with a 4 mm wide-angle lens. The video tape is synchronised with the geophysical record by a digital fiducial display that increments every second. These fiducials are recorded on the video tape and displayed on the bottom left of the video screen. Times are recorded from the digital information provided by the MADACS system.

3.6) POSITIONING/NAVIGATION SYSTEM

Model: 2 Sercel NR103 mobile DGPS receiver and antennae mounted in aircraft and equipped with pilot steering indicator
Reference station: 1 Sercel NDS100 portable differential station UHF and DGPS antennae
Base station: DGPS base station with lap top data logger

3.7) DATA ACQUISITION SYSTEM

Model: Geoterrex Pty Ltd MADACS

The MADACS is a computer based software system that is used to control and command the operations of all the ancillary equipment. This includes the magnetometer, spectrometer, camera, altimeter, tape drive and analogue chart recorder. The system has the following features.

Communication system

The MADACS uses a lap top operating as a terminal for operator-system communication. Recorded spectrum are monitored via an oscilloscope trace during acquisition.

Software system

Program: MS8

The key feature of this system is that all data collection, verification, buffering, and recording is software-controlled. Therefore, the acquisition system may be economically altered to fit almost any requirement. Critical parameters are automatically monitored during flight, with visual and aural alarms provided for the operator.

Survey parameters are displayed during flight in their correct physical units, simplifying operator analysis. The survey program operates on a request-response basis, with the system pre-empting the operator and rejecting all illegal responses.

Tape Drive

Model: Kennedy 800

The tape drive has a feature which allows checking of the recording process as many times as the particular application permits.

Precision Clock

The system is controlled by a precision clock which allows data to be collected at any multiple of 0.1 seconds. Time is digitally recorded as a six-figure number called a "fiducial". A fiducial number equals the real time in tenths of seconds after midnight, for example, 000000 corresponds to midnight and 360000 corresponds to 10.00am. Fiducials are generated on digital tape, video or film and analogue charts at ten second intervals. The fiducial numbers are calculated from the clock time by the computer.

Computer

Model: Interdata 6/16 mini-computer.

Multiple buffers permit recording, processing and acquisition of data to be carried out simultaneously with no dead time. The computer has the following interfaces:

- **Digital Input/Output Bus** This bus is capable of recording from, writing to, testing and controlling 16 external digital devices.
- **ADC / DAC.** This interface is a caesium analogue to digital converter and a digital to analogue converter.
- **Magnetic Tape Controller** This interface/controller is capable of handling four 9-track NRZI tape transports. Tapes are written in an IBM compatible binary format with full parity, cyclic redundancy and longitudinal check characteristics.
- **Magnetometer Interface** This interface converts the signal from the high sensitivity caesium vapour magnetometer into a format acceptable to the MADACS.
- **Camera Controller** The interface allows the MADACS to control and monitor all aspects of the tracking camera's operation and can synchronise timing and navigation data to the video tape.
- **Operator's Console** This interface provides communication between the operator and the system. While on line during survey, all parameters are continuously displayed on the monitor unless the system senses an abnormal condition in which case a diagnostic message and the time sensed are displayed. The message remains until acknowledged by the operator.

Recorded Digital Data

Each second:
Flight number
Time
Radar Altitude
Barometric Altitude
Positioning data
Spectrometer windows
256 channels of radiometric data
Live time

Each 0.1 seconds: Total magnetic field

Tape formats are documented in Appendix B.

3.8) ANALOGUE CHART RECORDER

Model: RMS GR33 Thermal Dot Matrix Printer
Chart speed: 10 cm/minute; time increases from left to right
Chart width: 30 cm
Event marks: 10 second marks are recorded on both sides of the chart with the associated fiducial numbers being printed at the base of the chart.

Channels recorded & full-scale values:

Total magnetic field:	
Fine scale:	100 nT
Coarse scale:	1000 nT
Magnetic field fourth difference:	+/-20 nT
Terrain clearance:	200 metres
Total Count:	2000 counts/sec
Potassium Count:	250 counts/sec
Uranium Count:	100 counts/sec
Thorium Count:	100 counts/sec
Cosmic Count:	500 counts/sec

All fields increase in value towards the top of the chart.

Zero Positions: These zero positions are annotated on the analogue sample. The zero position of each radiometric channel is calibrated automatically at the start of each line. Between lines each trace resides in its mid-range position.

Synchronisation: No lags occur between traces, other than that which occurs between the magnetic field and its fourth difference.

Compton Effect Corrections: The analogue radiometric channels have been Compton corrected using:

Alpha (Thorium into Uranium)	-	0.443
Beta (Thorium into Potassium)	-	0.424
Gamma (Uranium into Potassium)	-	0.695

The radiometric data recorded on the field tapes has not been corrected.

Cosmic Background correction: The analogue radiometric channels have been corrected in real time, for aircraft and cosmic background using the equations set out in Section 4.

An annotated sample analogue record is shown in Figure 1.

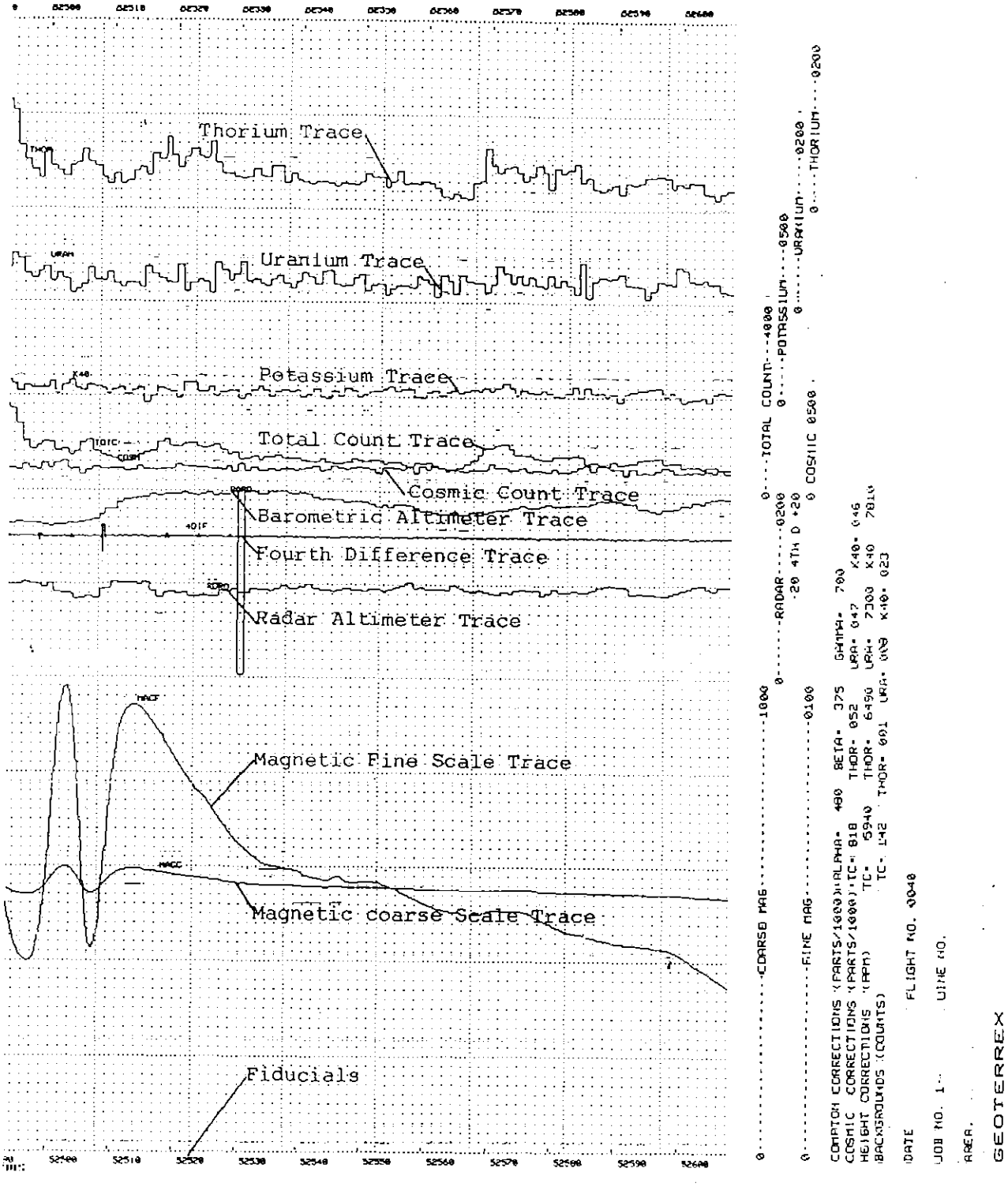


Figure 1 Sample analogue record

PART 4
Calibration procedures and results

4.1) MAGNETOMETER

The following calibration tests were carried out on the magnetometer.

Parallax (also referred to as 'Lag Test')

This test was carried out on 8 March 1993. The aircraft was flown in opposite directions over a sharp magnetic anomaly with the tracking camera and magnetometer operating. The video system records the fiducial (time and X-Y position) of the body which was the source of the sharp magnetic anomaly. When this was compared to the fiducial (time and X-Y position) of the sharp magnetic anomaly recorded on the digital tape a difference of 1.0 seconds was found. Therefore a parallax correction of this magnitude and sense was applied to the magnetic data only.

4.2) SPECTROMETER

The following checks and determinations were carried out for the radiometric data.

Pre and Post-flight Source Check Procedures

- Pre and post-flight U and Th source checks with samples in a standard position relative to the crystals and the aircraft in a standard parking position - recorded for 100 seconds.
- Pre and post-flight test line recorded at survey altitude.

The results of the pre and post-flight uranium and thorium source checks can be found in Appendix A. A sample of the spectra plotted with each uranium and thorium source check is presented in Appendix A, Figure A1.

Compton Stripping Coefficients

These coefficients have been recently determined and adjusted from 23 source checks conducted during the survey in June 1992.

They are:	**Alpha**	-	0.421 +/- 0.015
	Beta	-	0.411 +/- 0.024
	Gamma	-	0.678 +/- 0.038
	Delta	-	0.036 +/- 0.017

Background Determination

This test was carried out on 26 March 1993 to determine the relationship between cosmic events (energies greater than 3.0 MeV) and counts recorded in other channels. The test was flown overland with the spectrometer system correctly calibrated as for survey work. Data was recorded at 2000 foot intervals from 2000 feet to 10000 feet ASL.

The best fit linear equations for these tests are:

Th	background	=	0.056 x Cosmic + 0.88
U	background	=	0.049 x Cosmic + 5.36
K	background	=	0.052 x Cosmic + 9.26
TC	background	=	0.825 x Cosmic + 84.84

where: **cosmic** = counts of energies greater than 3.0 MeV stored in channel 0.
 # background = counts to be subtracted from window #.

Graphs of these equations are presented in Appendix A (Figure A2).

Height Attenuation Coefficients

Since no height attenuation calibrations were required for the temporary helicopter installation, those used for Geoterrex's permanent fixed wing spectrometer system were used. They were determined using the following procedure:

a) An area with "homogeneous" radioactivity, high count rates and relatively flat terrain was selected.

b) An easily repeatable line was flown over this area at eight different altitudes: 200 feet, 250 feet, 300 feet, 400 feet, 500 feet, 600 feet, 700 feet and 800 feet. The spectrometer was correctly calibrated for this test flight.

c) Sections of each line sharing the most constant terrain clearance and count rate were selected for data processing.

d) The altitude data for each line section was corrected using the altitude calibrations recorded on the same flight, and averaged.

e) The radiometric data for each line section was background corrected using a height correction for alpha. The resultant data was averaged.

f) The resulting count rates in each channel were plotted and attenuation coefficients suitable for an air temperature of 21°C were determined.

Graphs of the results can be found in Appendix A (Figures A3).

The coefficients are:	Total count	0.00630 per metre
	Potassium count	0.00768 per metre
	Uranium count	0.00595 per metre
	Thorium count	0.00643 per metre

During all spectrometer tests the data used is the window data recorded on field tapes. The widths of these windows are specified in Section 3.2.

Resolution

The resolution of the spectrometer is defined as the full width of the Thorium peak at its half peak height position, expressed as a percentage of the peak MeV value. The spectrometer resolution was checked before during and after the survey. The results give an average of 5.63%. Appendix A (Figure A4) is a copy of a sample source check.

4.3) ALTIMETER

The Sperry radio altimeter is a high quality instrument whose output is factory calibrated. It is fitted with a test function which checks the calibration of a terrain clearance of 100 feet and altitudes which are multiples of 100 feet. Calibration of the recorded terrain clearance, both analogue and digital, with respect to the altimeter reading is carried out using a potentiometer to vary the reading while recording the altimeter's output.

The results of an altimeter calibration carried out in March 1993 are presented in Table 2. A graph of the results is presented in Figure 3. Regression analysis provides a line of best fit for values less than 500' and another for values greater than 500'. These have been included on the graph, and the equations are:

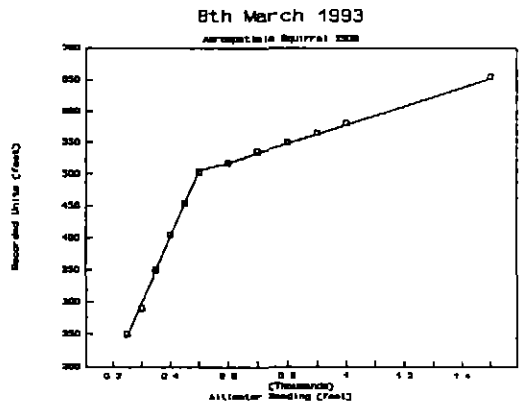
< 500' Recorded Units = 1.04 * Altimeter Reading - 13.4
> 500' Recorded Units = 0.15 * Altimeter Reading + 428

Barometric altitude was also recorded to provide an absolute measure of aircraft altitude rather than aircraft terrain clearance which is measured by the radio altimeter.

Table 2: Altimeter calibration results

Indicated Alt (feet)	**Recorded Radar Alt** (feet)
250	250
300	290
350	350
400	405
450	455
500	503
600	518
700	535
800	550
900	565
1000	580
1500	655

Figure 3: Altimeter calibrations



PART 5
Data processing

5.1) FIELD TAPES

These are recorded in binary format and are compacted and reformatted in binary code. The following information is transferred to a file as the Compacted Field Tape (CFT).

- flight path
- magnetic reading (0.1 nT)
- radiometric data (256 channels)
- radar altimeter (feet)
- barometric altimeter (feet)
- fiducial (time in tenth seconds after midnight)
- DGPS co-ordinates

All channels are checked and edited for single reading spikes and recording gaps, any single reading spikes are removed manually.

5.2) DATA TAPES

Located Data Tape

A levelled located data tape, containing all traverse line, tie line and calibration line data, was recorded in 9-track ASCII code at a density of 6250 bpi in a format described in Appendix B.

Gridded data tape

Gridded data in ER Mapper format with accompanying header files was provided for processed radiometric channels potassium, thorium, uranium and total count and for levelled magnetic data. These files were provided on QIC 150 megabyte cartridge.

5.3) FLIGHT PATH

Processing of the flight path consisted of generating a speed report of the DGPS flight path that was checked for erroneous points by comparing the average aircraft speed between adjacent fixes (being real time values in seconds) and the average speed for the entire line. Significant speed changes over short intervals were noted and the DGPS data was checked for errors and corrected where necessary.

The following convention is used for line number: 101/2N

where the number preceding the decimal is the line number (eg. 101)
the number following the decimal is the part number (eg. the line was the second flight along that line)
the letter represents the flight direction (eg flown to the north)

Lines 101 - 152 are traverse lines for Lynchford. Lines 701 - 704 are tie lines for Lynchford
Lines 201 - 292 are traverse lines for Anthony Basin. Lines 711 - 714 are tie lines for Anthony Basin
Lines 301 - 505 are traverse lines for Macintosh. Lines 721 - 732 are tie lines for Macintosh

5.4) MAGNETIC DATA

a) Corrections

Levelling

The aeromagnetic data is levelled by diurnal subtraction. The base station data is edited and checked for level shifts. This data is then synchronised to the airborne data for subtraction.

International Geomagnetic Reference Field

The International Geomagnetic Reference Field known as IGRF (1990) is subtracted from the data and a datum of 2000 nanoteslas is then added to ensure that there are no negative magnetic values before contouring.

b) Product Specifications

Gridding and Contouring

Grid mesh size:	25 x 25 metres			
Grid filter:	None			
Contour maps:	Horizontal scale	-	1:10,000	
	Contour interval	-	**Area 1:**	2, 20, 200 nT
			Area 2:	2, 20, 200 nT
			Area 3:	2, 20, 200 nT
Stacked magnetic profile maps:	Horizontal scale	-	1:10,000	
	Vertical scales	-	**Area 1:**	5,50 nT/cm*
			Area 2:	50 nT/cm
			Area 3:	50 nT/cm

* The three northern sheets plotted with a vertical scale of 5 nT/cm
The three southern sheets plotted with a vertical scale of 50 nT/cm

5.5) RADIOMETRIC DATA

a) Corrections

The radiometric data was corrected for:

i) Spectrometer dead time

"Dead time" is the fraction of 1 second when the spectrometer is actually counting the energy levels and not registering the incoming counts. A typical "dead time" is 15 msecs in a 1 second sample period.

ii) Cosmic effect and aircraft background

Through test flying outlined in Section 4, Geoterrex Pty Ltd has established the coefficients for the linear relationship between the incoming cosmic counts (energies greater than 3 MeV) and their contribution to the background in each window.

iii) Changes in ambient air temperatures

The effects of changing air temperature are incorporated in the notion of a temperature corrected altitude that will be used in other calculations. The field operator records the outside temperature at regular intervals throughout each flight while at survey altitudes.

iv) Compton scattering

After testing the Compton stripping coefficients determined from the calibration procedures outlined in Section 4, new values were chosen to minimise over compensation for the actual interchannel relationships on each survey line which were found to be less than the ideal relationship measured on the ground during calibration. The values used were:

Alpha	-	0.421
Beta	-	0.411
Gamma	-	0.678
Delta	-	0.036

It should be noted that alpha coefficient is height dependent under the linear relation:

true alpha = ground + 0.02 + 0.00025 x height

v) Height attenuation

To minimise the possibility of over correcting the data for height variations, an altitude tapering function was applied. The data was attenuated to approximately the mean survey terrain clearance minus one standard deviation (110 metres). Tapering began at 175 metres and finished at 200 metres, so for altitudes greater than 200 metres the data was corrected as if it had been collected at 200 metres.

Attenuation constants:

Total count	-	0.00630
Potassium	-	0.00768
Uranium	-	0.00595
Thorium	-	0.00643
Alpha	-	0.00076

b) Production specifications

Gridding and contouring

Grid mesh size: 25 x 25 metres
Grid filter: None
Full colour map for each radiometric channel
Map scale: **Area 1:** 25,000
Area 2: 25,000
Area 3: 10,000

PART 6
Items delivered

- Logistics Report

- Final Flight Path Maps on film at 1:10,000 scale
  Final Residual Magnetic Contour Maps on film at 1:10,000 scale
  Final Residual Magnetic Profile Maps on film at 1:10,000 scale
  Laminated radiometric colour maps for each channel at appropriate scale

- Binders containing Analogue Charts
  Diurnal charts

- Located Data Tape
  Gridded Data in ER Mapper Format on QIC 150 Mb cartridge

- Flight Logs and Index
  Mileage listing
  Recovered Line Listing
  Tracking videos

APPENDIX A: SPECTROMETER CALIBRATION DATA

Flight		Pre Flight		Post Flight	
		U Source	Th Source	U Source	TH Source
1	U count	8374	7295	8211	6735
	Th count	412	16059	304	15956
	K count	6115	7144	5772	7913
	Total count	89414	206206	88502	206468
2	U count	8715	7021	8224	6723
	Th count	392	16222	203	15949
	K count	6124	7692	6124	7861
	Total count	88942	206891	89292	205350
3	U count	8369	7425	8477	6927
	Th count	348	16070	344	15927
	K count	6071	7211	6278	7663
	Total count	88300	205838	89090	206174
4	U count	8636	7187	8500	7093
	Th count	486	16162	450	15941
	K count	6190	7408	6243	7485
	Total count	89618	205940	89404	206762
8	U count	10755	8800	10741	9248
	Th count	528	20006	316	19927
	K count	7755	9564	7594	9197
	Total count	110265	254740	111763	255522
9	U count	11051	9031	11008	9388
	Th count	248	19905	423	19227
	K count	7822	9336	7593	8885
	Total count	112759	254150	111954	255755

FIGURE A1(i) - SAMPLE SOURCE CHECK - URANIUM SOURCE

FIGURE A1(ii) - SOURCE CHECK - THORIUM SOURCE

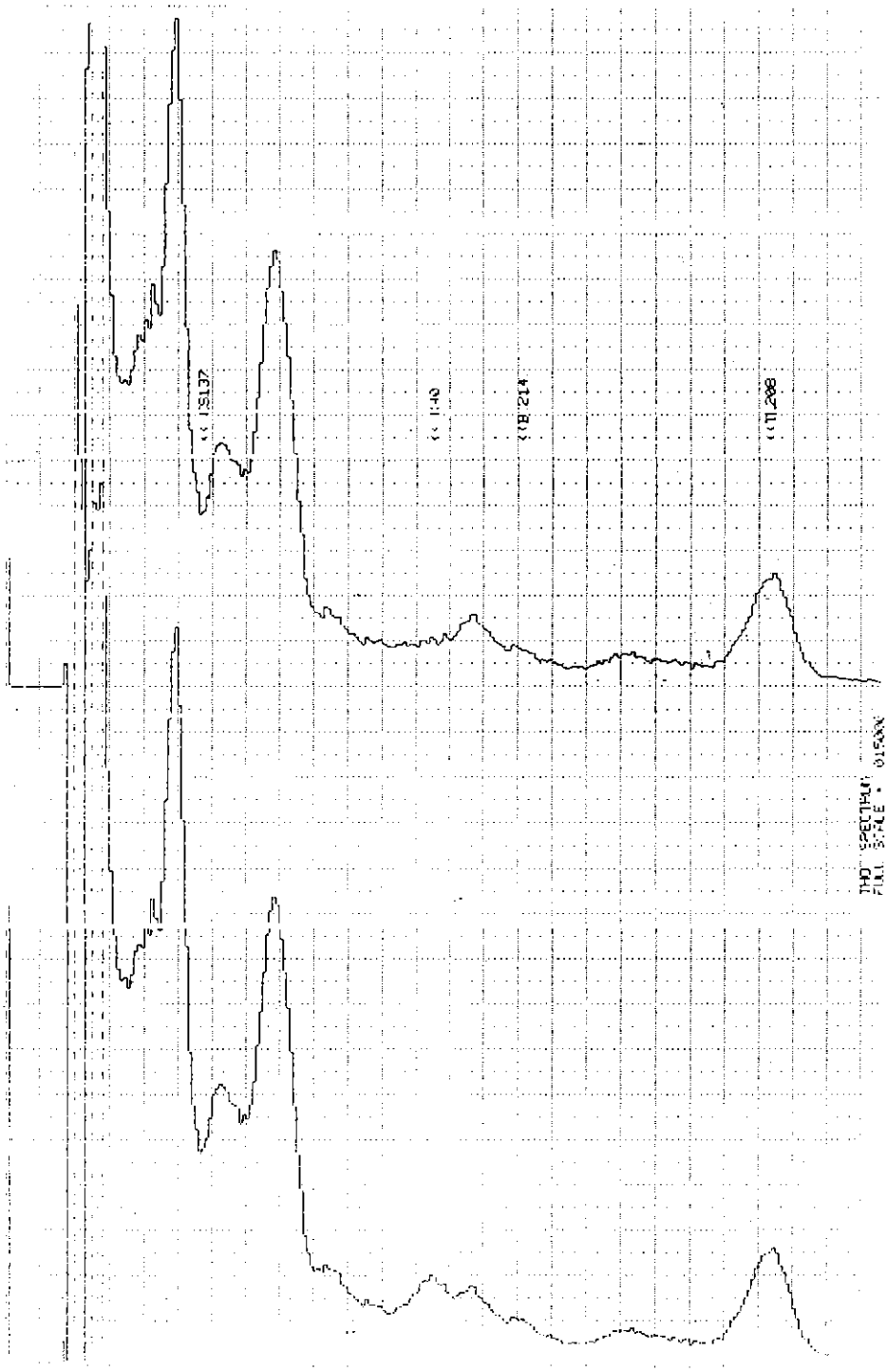


FIGURE A2 COSMIC BACKGROUND TESTS

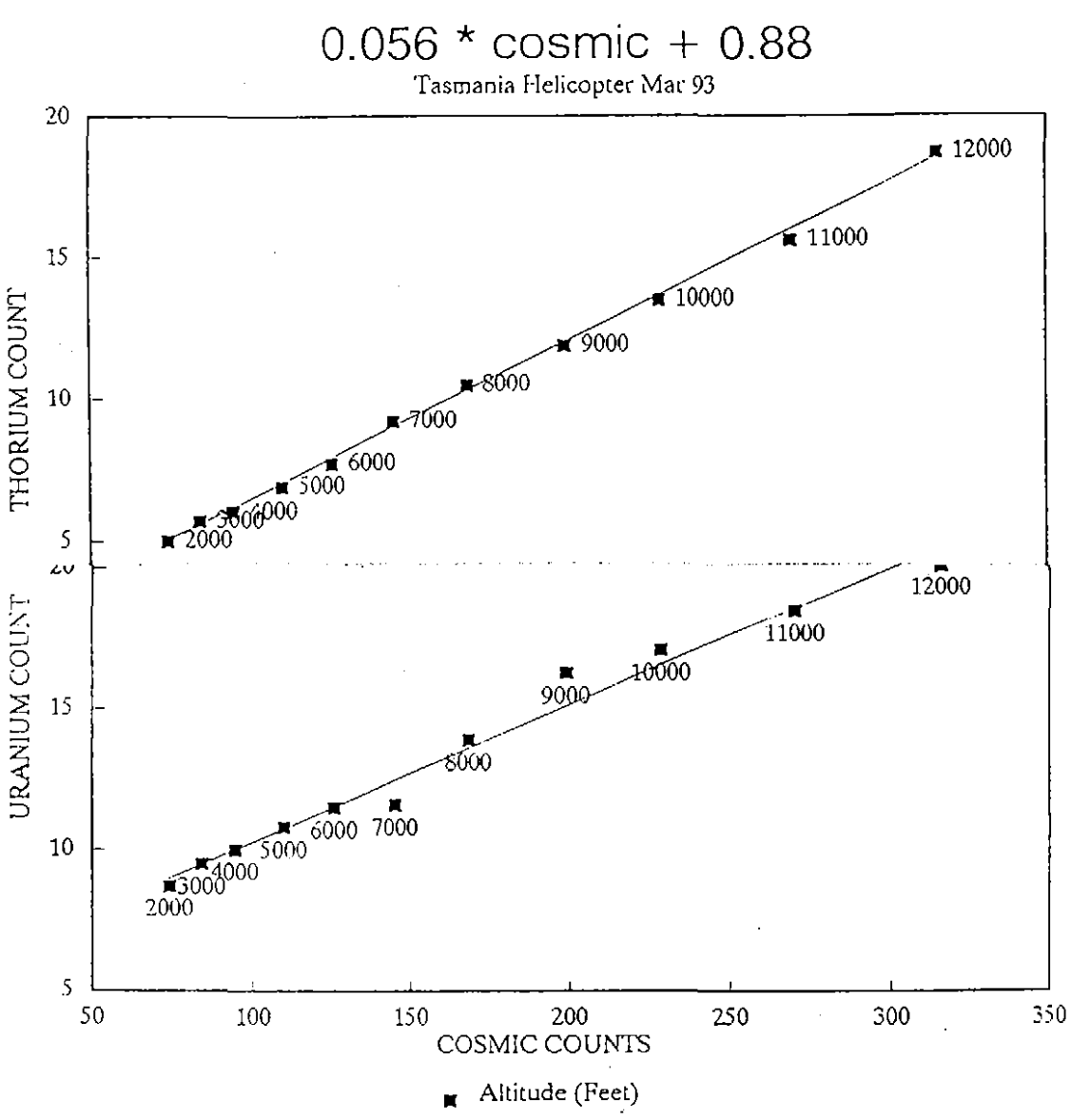
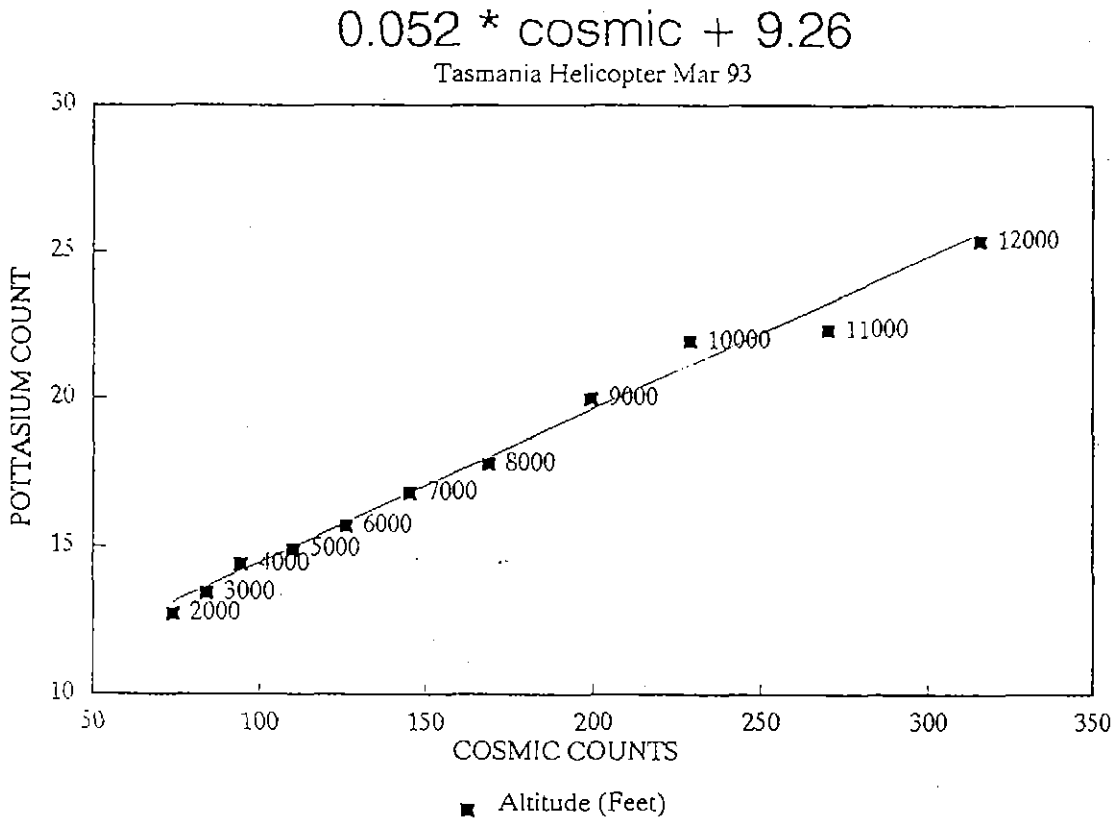


FIGURE A2 COSMIC BACKGROUND TESTS



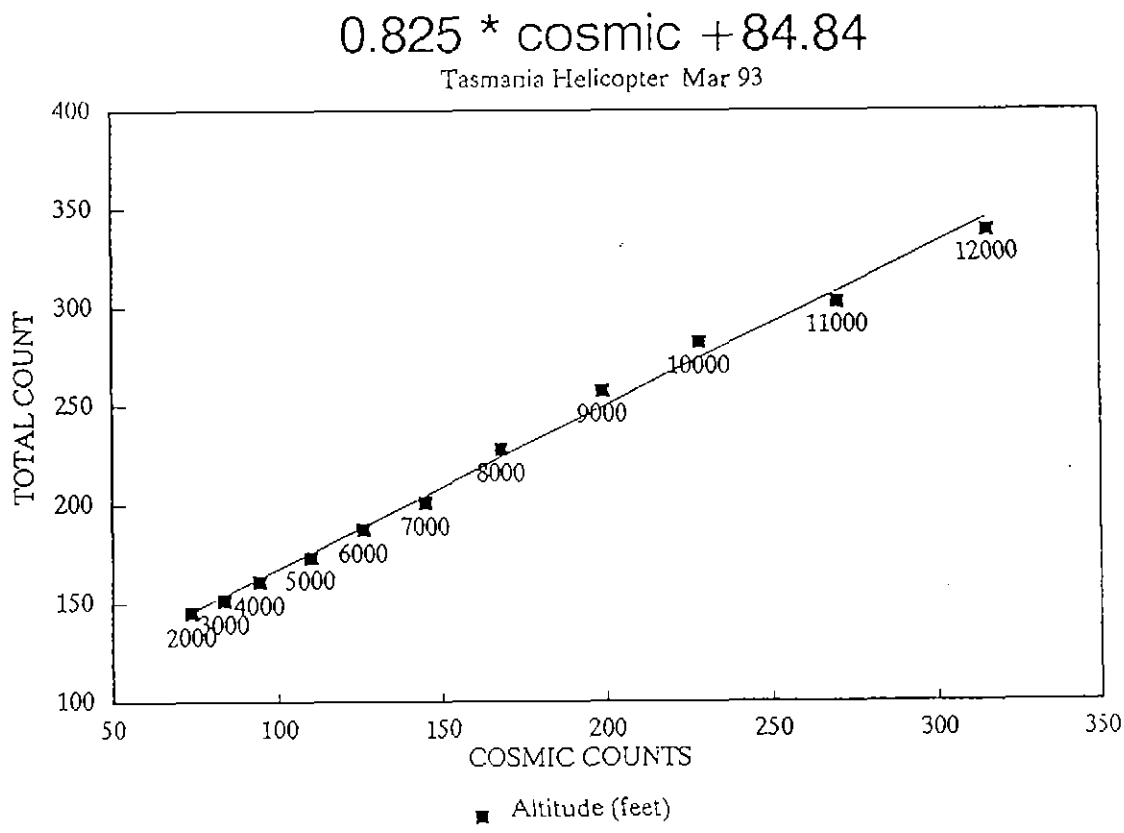
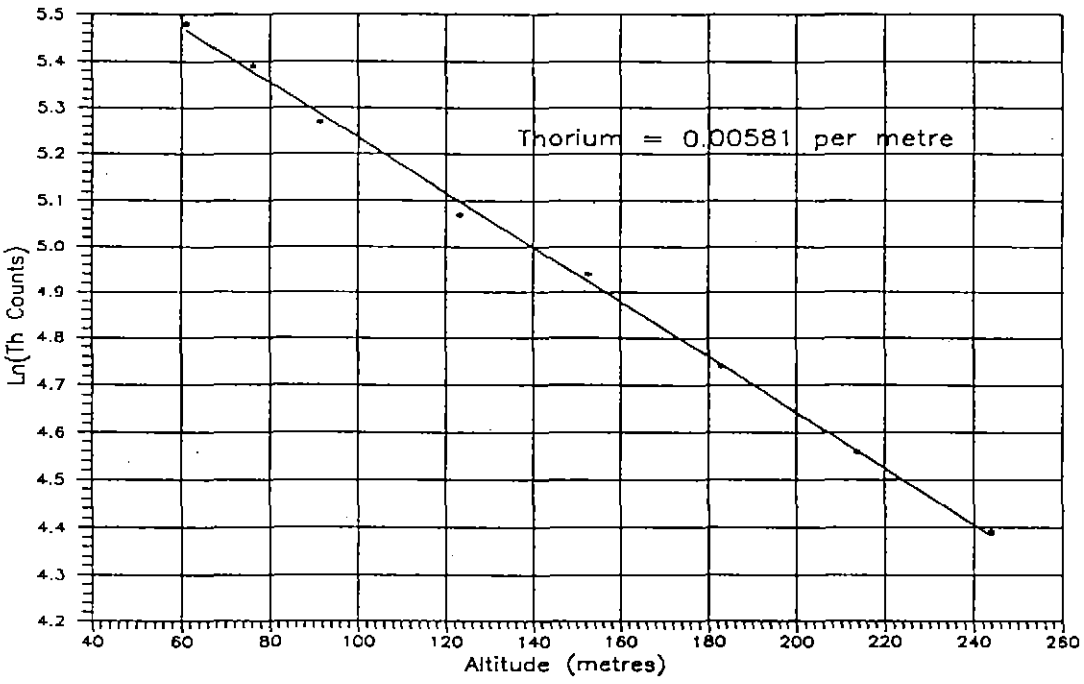


FIGURE A3: HEIGHT ATTENUATION TESTS



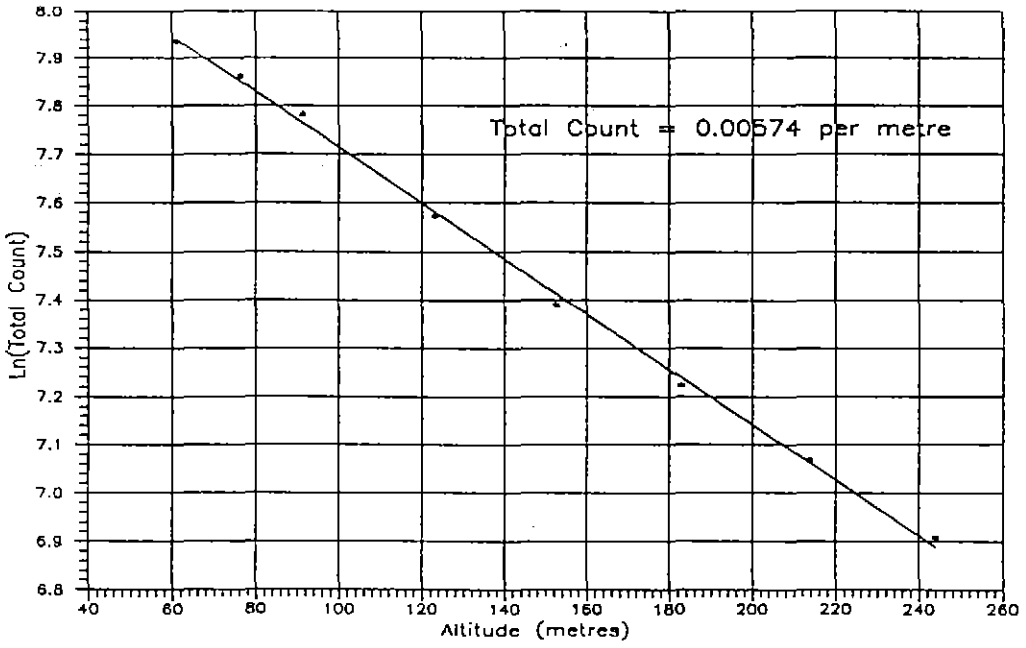
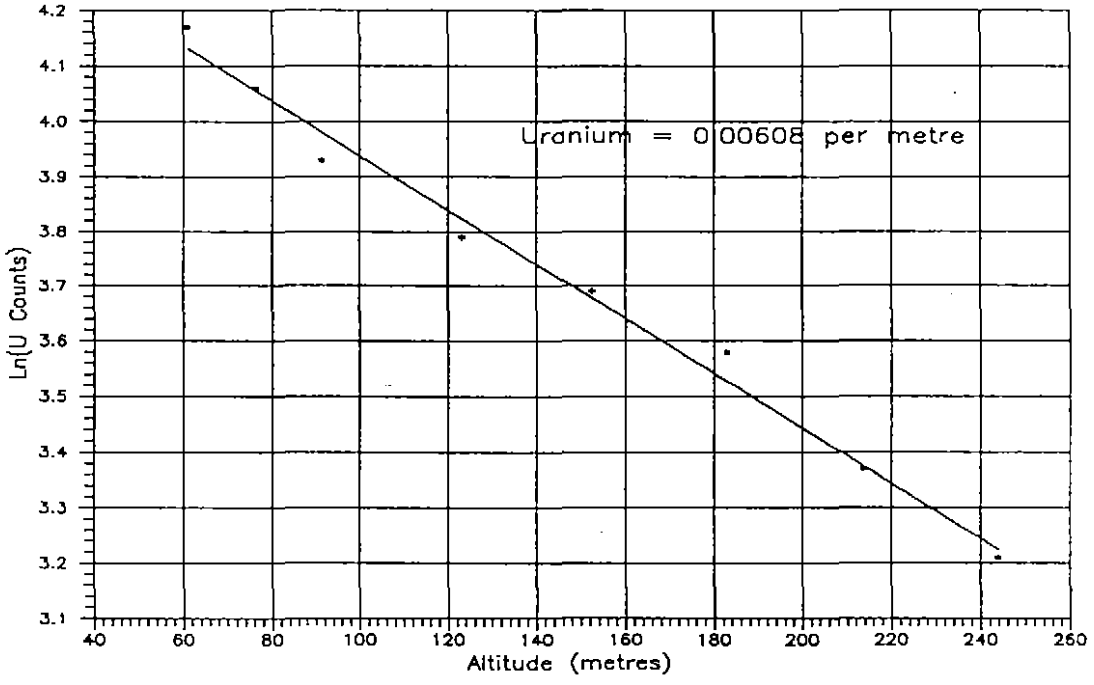


FIGURE A3: HEIGHT ATTENUATION TESTS



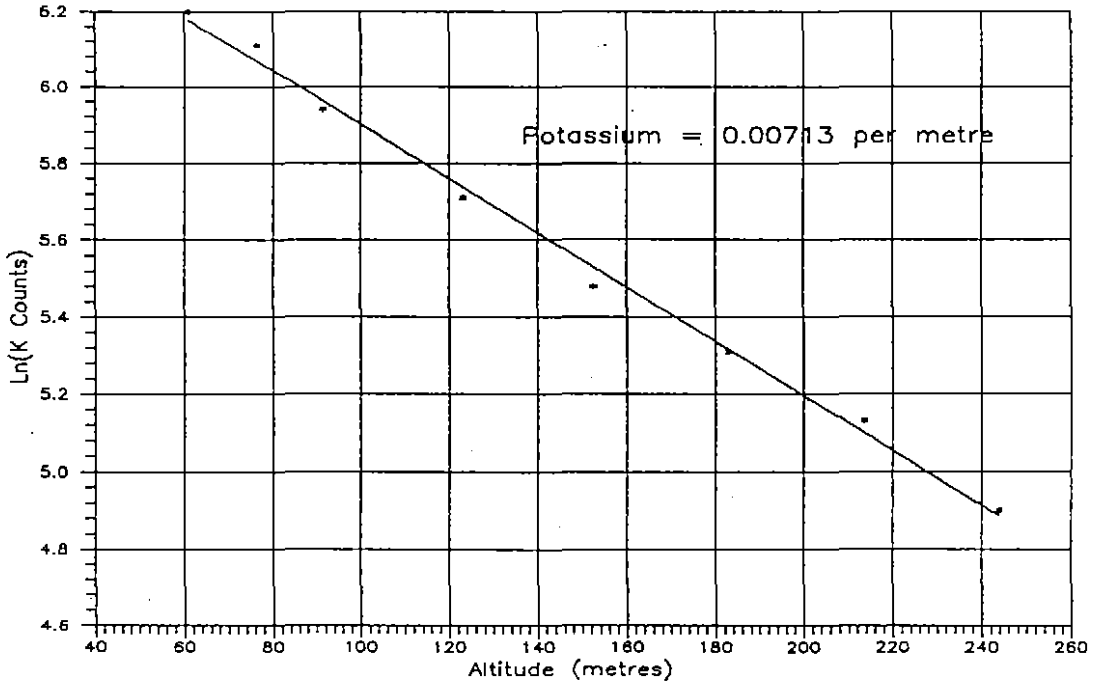
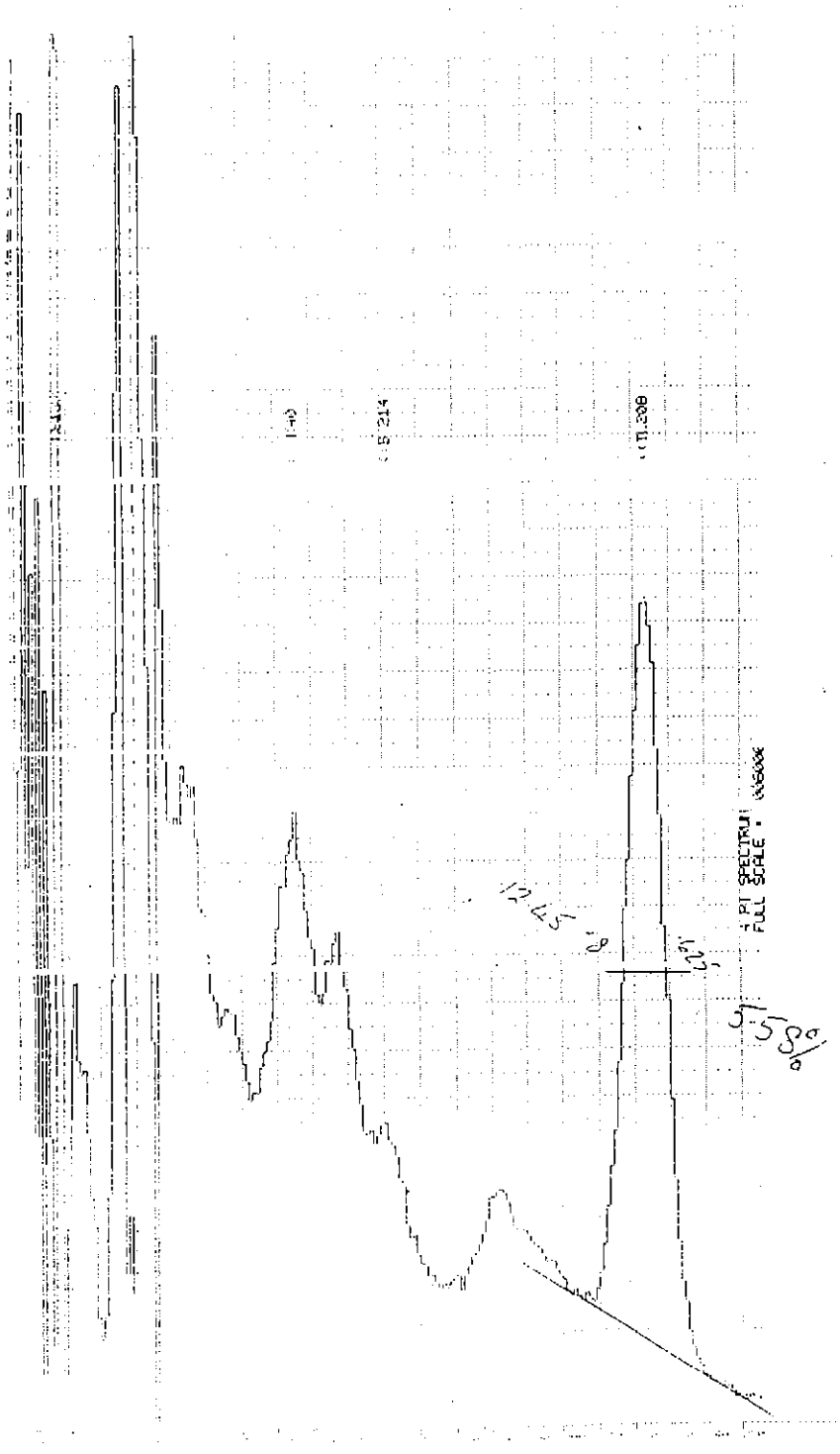


FIGURE A4 (i) - SPECTROMETER RESOLUTION CHECK

March 1993



APPENDIX B: MAGNETIC DATA TAPE FORMATS

TABLE B1: LOCATED DATA TAPE FORMAT

Column	Located Data Tape Format Description
1 - 8	Flight
9 - 16	Line
17 - 24	Fiducial
25 - 32	Eastings
33 - 40	Northings
41 - 48	Date (DDMMYY)
49 - 56	Levelled Magnetic Value
57 - 64	Raw Magnetic Value
65 - 72	Diurnal
73 - 80	Uncorrected Total Count
81 - 88	Uncorrected Potassium Count
89 - 96	Uncorrected Uranium Count
103 - 104	Uncorrected Thorium Count
105 - 112	Cosmic Count
113 - 120	Corrected Total Count
121 - 128	Corrected Potassium Count
129 - 136	Corrected Uranium Count
137 - 144	Corrected Thorium Count
145 - 152	Radar Altimeter
153 - 160	GPS ASL

Record Length	160 Bytes
Block Size	10240 Bytes
Density	6250 Bpi
Recording Mode	ASCII

APPENDIX C: RMS THERMAL PAPER STORAGE INSTRUCTIONS

PAPER STORAGE AND HANDLING, RMS 2030 THERMAL PAPER

STORAGE:

Ambient Temperature:	Less than 25°C
Relative Humidity:	Less than 65%
Storage Location:	In darkness before and after exposure.

Under these conditions, the paper should retain its characteristics and the printed images will remain legible for at least 5 years, although in the case of blue image paper, there may be some slight fading.

TO ELIMINATE PREMATURE PAPER DEVELOPMENT:

- Colour development begins at temperatures between 70 to 100°C, and reaches saturation density between 80 and 120°C. Premature development of the paper may occur at lower temperatures, and particularly if the humidity is greater than 65%.
  eg. If the paper is stored for 24 hours at a temperature of 60°C, some development may occur. Or if the paper is stored for 24 hours at a temperature of 45°C when the relative humidity is 90%, development may also occur.

- Avoid use of solvent-type adhesives. Adhesives containing volatile organic solvents such as alcohol, ester, ketone, etc causes colour formation and therefore rubber-type adhesives etc should not be used. Starch, PVA and CMC type adhesives are recommended.

- Frictional heat generated by rubbing a finger nail or sharp object over the surface will cause images to develop.

- Thermal paper will develop colour if brought into contact with freshly processed Diazo copying paper.

TO ELIMINATE PAPER FADING:

- Thermal paper will turn yellow, and blue printed images will tend to fade if exposed to direct sunlight or to fluorescent lighting for long periods. File exposed paper in the dark immediately after exposure. Do not store paper near windows.

- Prolonged contact with PVC film containing plasticisers such as ester phthalate will reduce the image forming ability of the paper and cause printed images to fade. We recommend that files made of polyethylene, polypropylene, polyester, etc be used.

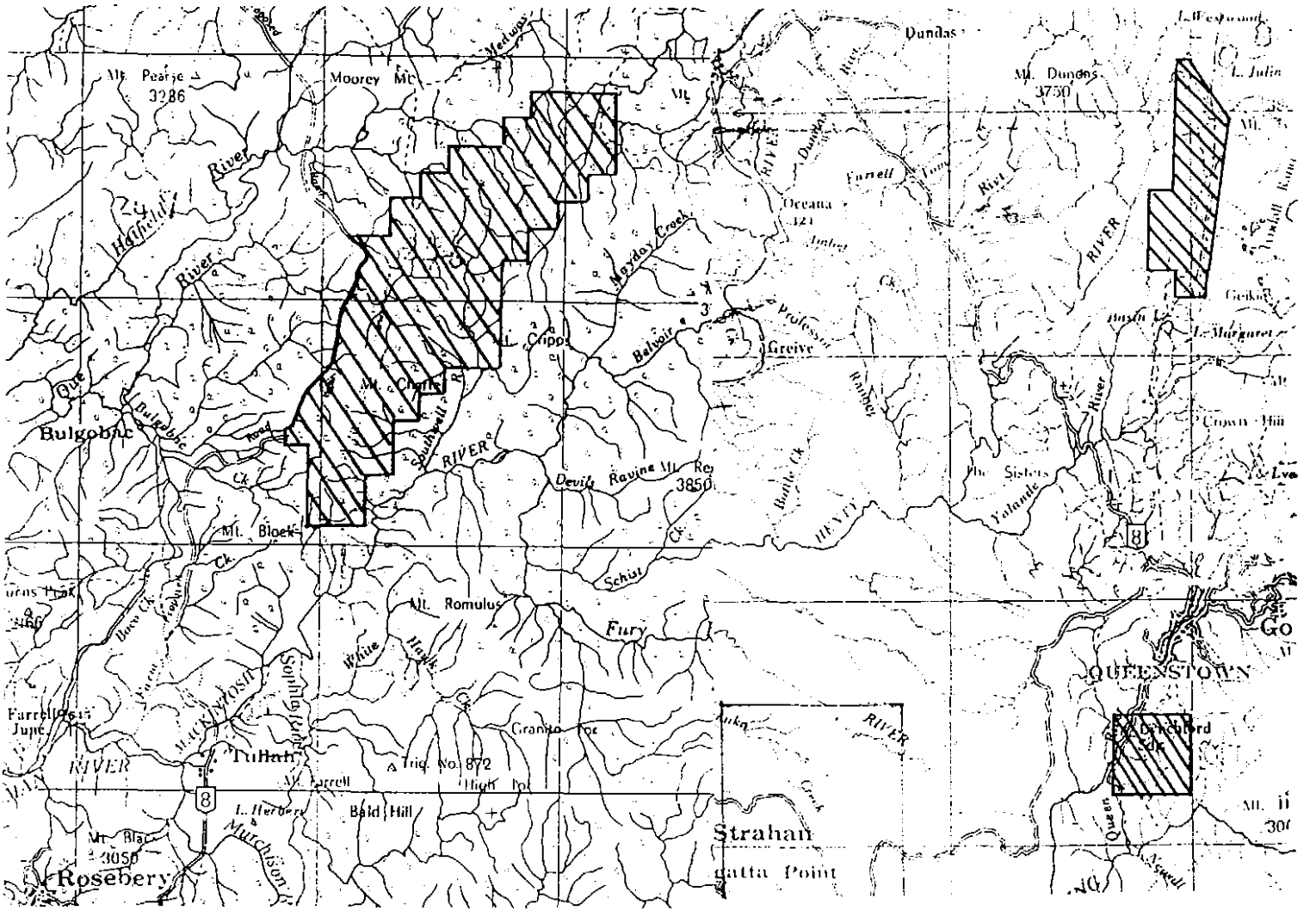
- Self-adhesive cellophane tapes containing an alcohol type plasticiser will cause the image to fade. Double-sided adhesive tape is recommended for use instead of paste.

- Handling thermal paper with dirty or sweaty fingers might cause images to fade.

- Do not store developed paper with the sensitised surfaces touching as images might be transferred from one sheet to another.

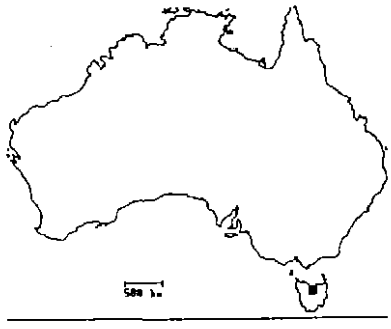
APPENDIX D: LOCATION MAP

LOCATION MAP Scale: 1:250,000

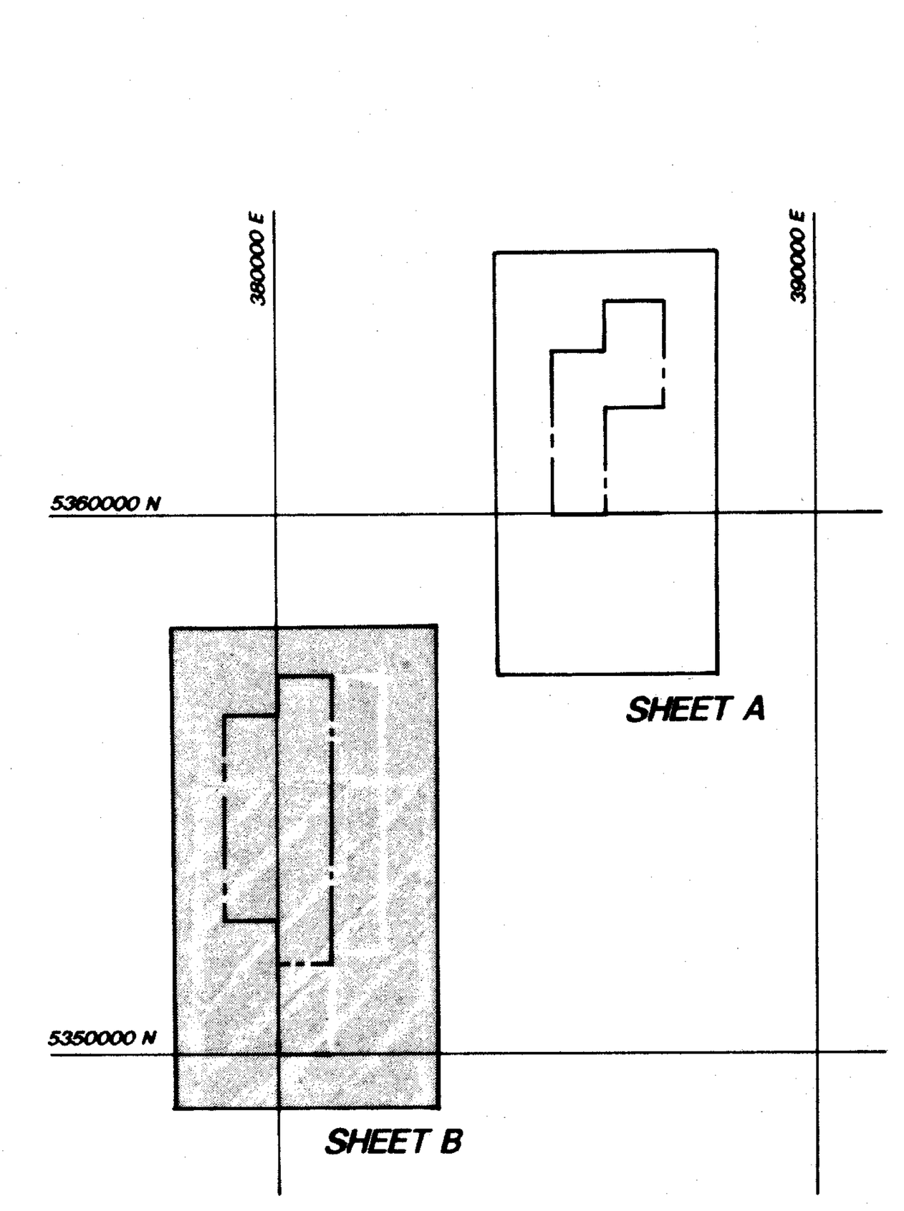


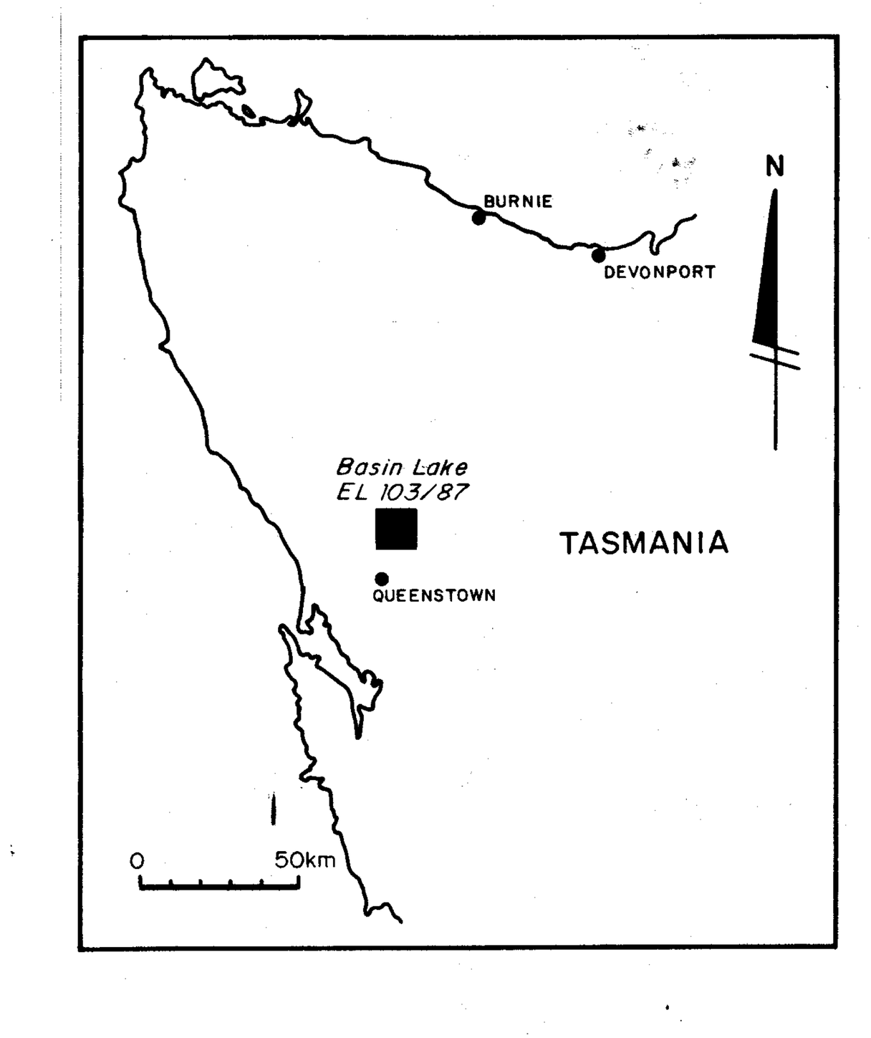
BERNIE 1:250,000

QUEENSTOWN 1:250,000



INDEX TO SHEETS





930101

5 cm

0 1km

94-3552

Aberfoyle Resources Limited
EXPLORATION DIVISION

REVISIONS			
Init.	Date	Init.	Date
J.M.S.	14-4-93		
MAR	8-6-93		

NORTH WEST TASMANIA
BASIN LAKE EL 103/87
OUTCROP GEOLOGY

Compiled : RAS
Drawn :
Traced : NB
Checked : RAS
Plate No : BL 18B

Location Code :
Scale : 1:10 000
Date : MAY 1993

378000 mE

145°32'

145°33'

145°34'

145°35'

383000 mE

5361000 mN

41°54'

41°55'

41°56'

41°57'

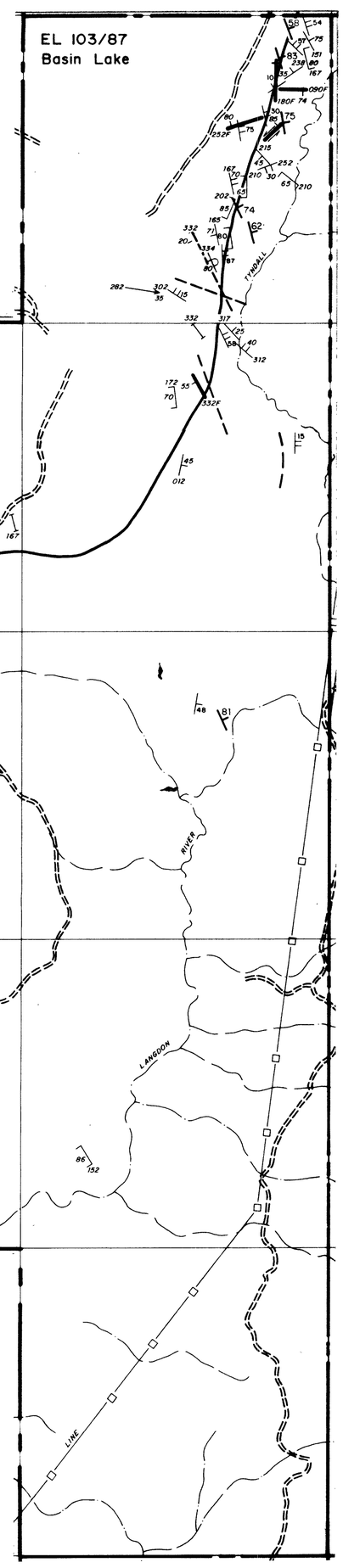
41°58'

5352000 mN

79 80 81 82

59 58 57 56 55 54 53

EL 103/87
Basin Lake



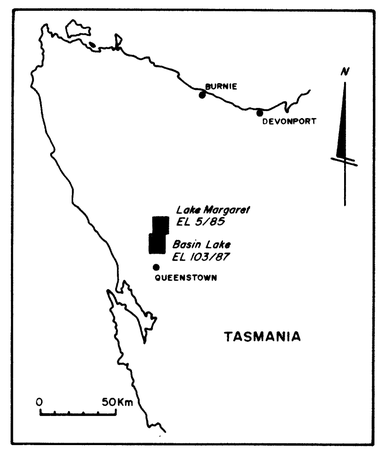
GN MN
12°

LEGEND

- Fault
- Geological contact
- Anticline
- Syncline
- Fold plunge

Strike & Dip of bedding:

- Facing known
- Facing unknown
- Overturned
- Vertical
- Strike & Dip of cleavage
- Vertical cleavage
- Aberfoyle data
- Mines Dept. data
- Robert Gibson (1991 Hons. Tas. Uni.)
- David Hutton (1990 Hons. Monash Uni.)



930102

5 cm

0 1 Km

94-3552

Aberfoyle Resources Limited
EXPLORATION DIVISION

REVISIONS			
Init.	Date	Init.	Date
RSJma	14-11-93		

NORTH WEST TASMANIA
ANTHONY BASIN
STRUCTURAL DATA COMPILATION

Location Code K55/5 | Scale 1:10 000 | Date: August 1993

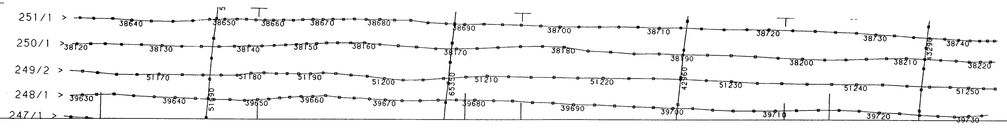
Compiled: RAS
Drawn: RAS
Traced: MAR
Checked:
Plate No: BL20

376000E 377000E 378000E 379000E 380000E 381000E 382000E

41°53'00"S
41°54'00"S
41°55'00"S
41°56'00"S

5362000N
5361000N
5360000N
5359000N
5358000N
5357000N

145°30'00"E 145°31'00"E 145°32'00"E 145°33'00"E 145°34'00"E 145°35'00"E



AIRBORNE SURVEY SPECIFICATIONS

MAGNETOMETER :	SCINTREX cesium vapour optical absorbtion mounted on a bird Sensitivity : 0.05 nT
RECORDING INTERVAL :	0.1 sec
SPECTROMETER :	Nuclear Data 256 channel ADC Volume : 16.8 litres
TOTAL COUNT WINDOW :	0.4 - 3.00 MeV
POTASSIUM WINDOW :	1.35 - 1.57 MeV
URANIUM WINDOW :	1.63 - 1.89 MeV
THORIUM WINDOW :	2.42 - 2.82 MeV
RECORDING INTERVAL :	1.0 sec
DATA RECORDING :	Geoterrex MADACS acquisition system Digital to magnetic tape
NOMINAL TERRAIN CLEARANCE :	spectrometer in aircraft at 115 m magnetometer mounted on a towed bird
NOMINAL LINE SPACING :	Traverse lines 100 m Tie lines 1.0 km
FLIGHT PATH NAVIGATION :	SERCEL NR103 GPS and SERCEL NDS100 UHF DGPS navigationn system
FLIGHT PATH RECORD :	real time from UHF DGPS system corrected for selected availability

FLIGHT PATH

Grid notation refers to Australian Map Grid Zone 55
Navigation fix 32768

MAP INDEX
145°30'00"E 145°35'00"E
41°53'00"S
1
2
41°59'00"S
41°59'00"S 145°30'00"E 145°35'00"E

GN
TN
MN

5cm

Grid Convergence = 0.98°
Declination = 13.30°

SCALE 1:10000

200 0 200 400 600 800 m

94-3552

JOB NO : 3-445
Surveyed by GEOTERREX PTY LTD : March 1993
Compiled by GEOTERREX PTY LTD. SYDNEY
Processed by GEOTERREX PTY LTD. SYDNEY

930103

ABERFOYLE RESOURCES LTD

ANTHONY BASIN
FLIGHT PATH
BURNIE SK55-3
SHEET 1 OF 2

DRAWING NO: BL21/1 | DATE : 27-APR-1993

376000E 377000E 378000E 379000E 380000E 381000E 382000E

41°56'00"S
41°57'00"S
41°58'00"S
41°59'00"S

5356000N
5355000N
5354000N
5353000N
5352000N
5351000N

145°30'00"E 145°31'00"E 145°32'00"E 145°33'00"E 145°34'00"E 145°35'00"E

< 711/1 < 712/1 < 713/1 < 714/1

247/1 > 246/1 > 245/1 > 244/1 > 243/1 > 242/1 > 241/1 >

< 240/1 < 239/1 < 238/1 < 237/1 < 236/1

235/1 > 234/1 > 233/1 > 232/2 >

< 231/1 < 230/1

229/1 > 228/1 > 227/2 > 226/2 > 225/1 >

< 224/1 < 223/1 < 222/1 < 221/1 < 220/1

219/1 > 218/1 > 217/1 > 216/1 > 215/1 >

< 214/1 < 213/1 < 212/1 < 211/1 < 210/1

209/1 > 208/1 > 207/1 > 206/1 >

< 205/1 < 204/1 < 203/1 < 202/1

201/1 >

AIRBORNE SURVEY SPECIFICATIONS

MAGNETOMETER :	SCINTREX cesium vapour optical absorbtion mounted on a bird Sensitivity : 0.05 nT
RECORDING INTERVAL :	0.1 sec
SPECTROMETER :	Nuclear Data 256 channel ADC Volume : 16.8 litres
TOTAL COUNT WINDOW :	0.4 - 3.00 MeV
POTASSIUM WINDOW :	1.35 - 1.57 MeV
URANIUM WINDOW :	1.63 - 1.89 MeV
THORIUM WINDOW :	2.42 - 2.82 MeV
RECORDING INTERVAL :	1.0 sec
DATA RECORDING :	Geoterrex MADACS acquisition system
NOMINAL TERRAIN CLEARANCE :	Digital to magnetic tape spectrometer in aircraft at 115 m magnetometer mounted on a towed bird
NOMINAL LINE SPACING :	Traverse lines 100 m Tie lines 1.0 km
FLIGHT PATH NAVIGATION :	SERCEL NR103 GPS and SERCEL NDS100 UHF DGPS navigation system
FLIGHT PATH RECORD :	real time from UHF DGPS system corrected for selected availability

FLIGHT PATH

Grid notation refers to Australian Map Grid Zone 55
Navigation fix 32768

MAP INDEX
145°30'00"E 145°35'00"E
41°58'00"S
1
2
41°59'00"S

GN
TN
MN
5 cm

Grid Convergence = 0.97°
Declination = 13.30°

SCALE 1:10000

200 0 200 400 600 800 m

94-3552

JOB NO : 3-445
Surveyed by GEOTERREX PTY LTD : March 1993
Compiled by GEOTERREX PTY LTD. SYDNEY
Processed by GEOTERREX PTY LTD. SYDNEY
930104

ABERFOYLE RESOURCES LTD

ANTHONY BASIN
FLIGHT PATH
BURNIE SK55-3
SHEET 2 OF 2

DRAWING NO: BL21/2 | DATE : 27-APR-1993

376000E 377000E 378000E 379000E 380000E 381000E 382000E

41°53'00"S
41°54'00"S
41°55'00"S
41°56'00"S

5362000N
5361000N
5360000N
5359000N
5358000N
5357000N

145°30'00"E 145°31'00"E 145°32'00"E 145°33'00"E 145°34'00"E 145°35'00"E

AIRBORNE SURVEY SPECIFICATIONS

MAGNETOMETER :	SCINTREX cesium vapour optical absorbtion mounted on a bird
Sensitivity :	0.05 nT
RECORDING INTERVAL :	0.1 sec
SPECTROMETER :	Nuclear Data 256 channel ADC
Volume :	16.8 litres
TOTAL COUNT WINDOW :	0.4 - 3.00 MeV
POTASSIUM WINDOW :	1.35 - 1.57 MeV
URANIUM WINDOW :	1.63 - 1.89 MeV
THORIUM WINDOW :	2.42 - 2.82 MeV
RECORDING INTERVAL :	1.0 sec
DATA RECORDING :	Geoterrex MADACS acquisition system Digital to magnetic tape
NOMINAL TERRAIN CLEARANCE :	spectrometer in aircraft at 115 m magnetometer mounted on a towed bird
NOMINAL LINE SPACING :	Traverse lines 100 m Tie lines 1.0 km
FLIGHT PATH NAVICATION :	SERCEL NR103 GPS and SERCEL NDS100
FLIGHT PATH RECORD :	UHF DGPS navigationm system real time from UHF DGPS system corrected for selected availability

RESIDUAL MAGNETIC CONTOURS

Grid notation refers to Australian Map Grid Zone 55

Magnetics :	Diurnals removed
IGRF :	1990 model (updated for secular variation to March 1993) removed. datum 2000 nT added
Total Field :	62285 nT (at 4157005, 1453200E)
Inclination :	72 degrees S
Declination :	13.3 degrees E
Grid mesh size :	25 x 25 metres
Grid filter :	None
Contour interval :	2, 20 and 200 nT

MAP INDEX

145°30'00"E 145°35'00"E
41°53'00"S
1
2
41°59'00"S
145°30'00"E 145°35'00"E

PRELIMINARY COPY

GN
TN
MN

5cm

Grid Convergence = 0.98°
Declination = 13.30°

SCALE 1:10000

200 0 200 400 600 800 m

94-3552

JOB NO : 3-445
Surveyed by GEOTERREX PTY LTD : March 1993
Compiled by GEOTERREX PTY LTD. SYDNEY
Processed by GEOTERREX PTY LTD. SYDNEY

930165

ABERFOYLE RESOURCES LTD

ANTHONY BASIN
RESIDUAL MAGNETIC CONTOURS
BURNIE SK55-3
SHEET 1 OF 2

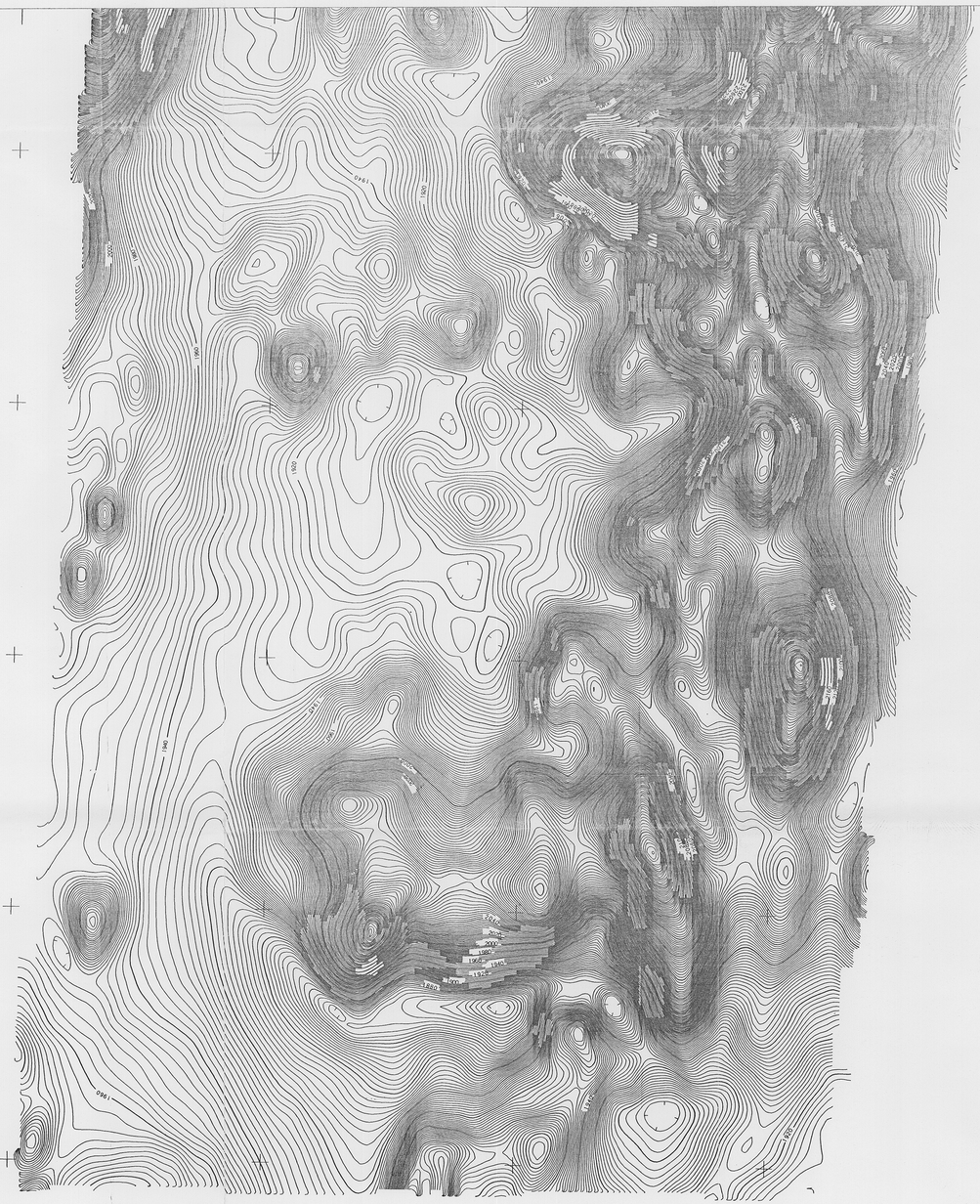
DRAWING NO: BL22/1 DATE : 27-APR-1993

376000E 377000E 378000E 379000E 380000E 381000E 382000E

41°56'00"S
41°57'00"S
41°58'00"S
41°59'00"S

5356000N
5355000N
5354000N
5353000N
5352000N
5351000N

145°30'00"E 145°31'00"E 145°32'00"E 145°33'00"E 145°34'00"E 145°35'00"E



AIRBORNE SURVEY SPECIFICATIONS

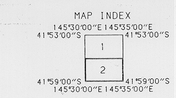
MAGNETOMETER :	SCINTREX cesium vapour optical absorbtion mounted on a bird
	Sensitivity : 0.05 nT
RECORDING INTERVAL :	0.1 sec
SPECTROMETER :	Nuclear Data 256 channel ADC
	Volume : 16.8 litres
TOTAL COUNT WINDOW :	0.4 - 3.00 MeV
POTASSIUM WINDOW :	1.35 - 1.57 MeV
URANIUM WINDOW :	1.63 - 1.89 MeV
THORIUM WINDOW :	2.42 - 2.82 MeV
RECORDING INTERVAL :	1.0 sec
DATA RECORDING :	Geoterrex MADACS acquisition system
	Digital to magnetic tape
NOMINAL TERRAIN CLEARANCE :	spectrometer in aircraft at 115 m
	magnetometer mounted on a towed bird
NOMINAL LINE SPACING :	Traverse lines 100 m
	Tie lines 1.0 km
FLIGHT PATH NAVIGATION :	SERCEL NR103 GPS and SERCEL NDS100
	UHF DGPS navigationnn system
FLIGHT PATH RECORD :	real time from UHF DGPS system
	corrected for selected availability

RESIDUAL MAGNETIC CONTOURS

Grid notation refers to Australian Map Grid Zone 55

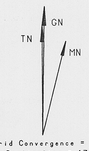
Magnetics :	Diurnals removed
IGRF :	1990 model (updated for secular variation to March 1993) removed. datum 2000 nT added
Total Field :	62285 nT (at 415700S, 1453200E)
Inclination :	72 degrees S
Declination :	13.3 degrees E
Grid mesh size :	25 x 25 metres
Grid filter :	None
Contour interval :	2, 20 and 200 nT

MAP INDEX



PRELIMINARY COPY

5 cm



Grid Convergence = 0.97°
Declination = 13.30°

SCALE 1:10000

200 0 200 400 600 800 m

94-3552

JOB NO : 3-445
Surveyed by GEOTERREX PTY LTD : March 1993
Compiled by GEOTERREX PTY LTD, SYDNEY
Processed by GEOTERREX PTY LTD, SYDNEY 930106

ABERFOYLE RESOURCES LTD

ANTHONY BASIN
RESIDUAL MAGNETIC CONTOURS
BURNIE SK55-3
SHEET 2 OF 2

DRAWING NO: BL22/2 | DATE : 27-APR-1993

376000E 377000E 378000E 379000E 380000E 381000E 382000E

41°53'00"S
41°54'00"S
41°55'00"S
41°56'00"S

5362000N
5361000N
5360000N
5359000N
5358000N
5357000N

145°30'00"E 145°31'00"E 145°32'00"E 145°33'00"E 145°34'00"E 145°35'00"E

251/1
250/1
249/2
248/1
247/1

AIRBORNE SURVEY SPECIFICATIONS

MAGNETOMETER :	SCINTREX cesium vapour optical absorption mounted on a bird
	Sensitivity : 0.05 nT
RECORDING INTERVAL :	0.1 sec
SPECTROMETER :	Nuclear Data 256 channel ADC
	Volume : 16.8 litres
TOTAL COUNT WINDOW :	0.4 - 3.00 MeV
POTASSIUM WINDOW :	1.35 - 1.57 MeV
URANIUM WINDOW :	1.63 - 1.89 MeV
THORIUM WINDOW :	2.42 - 2.82 MeV
RECORDING INTERVAL :	1.0 sec
DATA RECORDING :	Geoterrex MADAGS acquisition system Digital to magnetic tape
NOMINAL TERRAIN CLEARANCE :	spectrometer in aircraft at 115 m magnetometer mounted on a towed bird
NOMINAL LINE SPACING :	Traverse lines 100 m Tie lines 1.0 km
FLIGHT PATH NAVIGATION :	SERCEL NR103 DPS and SERCEL NDS100 UHF DGPS navigation system
FLIGHT PATH RECORD :	real time from UHF DGPS system corrected for selected availability

RESIDUAL MAGNETIC PROFILES

Grid notation refers to Australian Map Grid Zone 55

Magnetics :	Diurnal removed
IGRF :	1990 model (updated for secular variation to March 1993) removed. datum 2000 nT added
Total Field :	62285 nT (at 415700S, 1453200E)
Inclination :	72 degrees S
Declination :	13.3 degrees E
Vertical Scale :	50 nT/cm
Base Value :	2000 nT

MAP INDEX

145°30'00"E 145°35'00"E
41°53'00"S
1
2
41°59'00"S
145°30'00"E 145°55'00"E

5cm

TN GN MN

Grid Convergence = 0.98°
Declination = 13.30°

SCALE 1:10000

200 0 200 400 600 800 m

94-3552

JOB NO : 3-445
Surveyed by GEOTERREX PTY LTD : March 1993
Compiled by GEOTERREX PTY LTD. SYDNEY
Processed by GEOTERREX PTY LTD. SYDNEY

930107

ABERFOYLE RESOURCES LTD

ANTHONY BASIN
RESIDUAL MAGNETIC PROFILES
BURNIE SK55-3
SHEET 1 OF 2

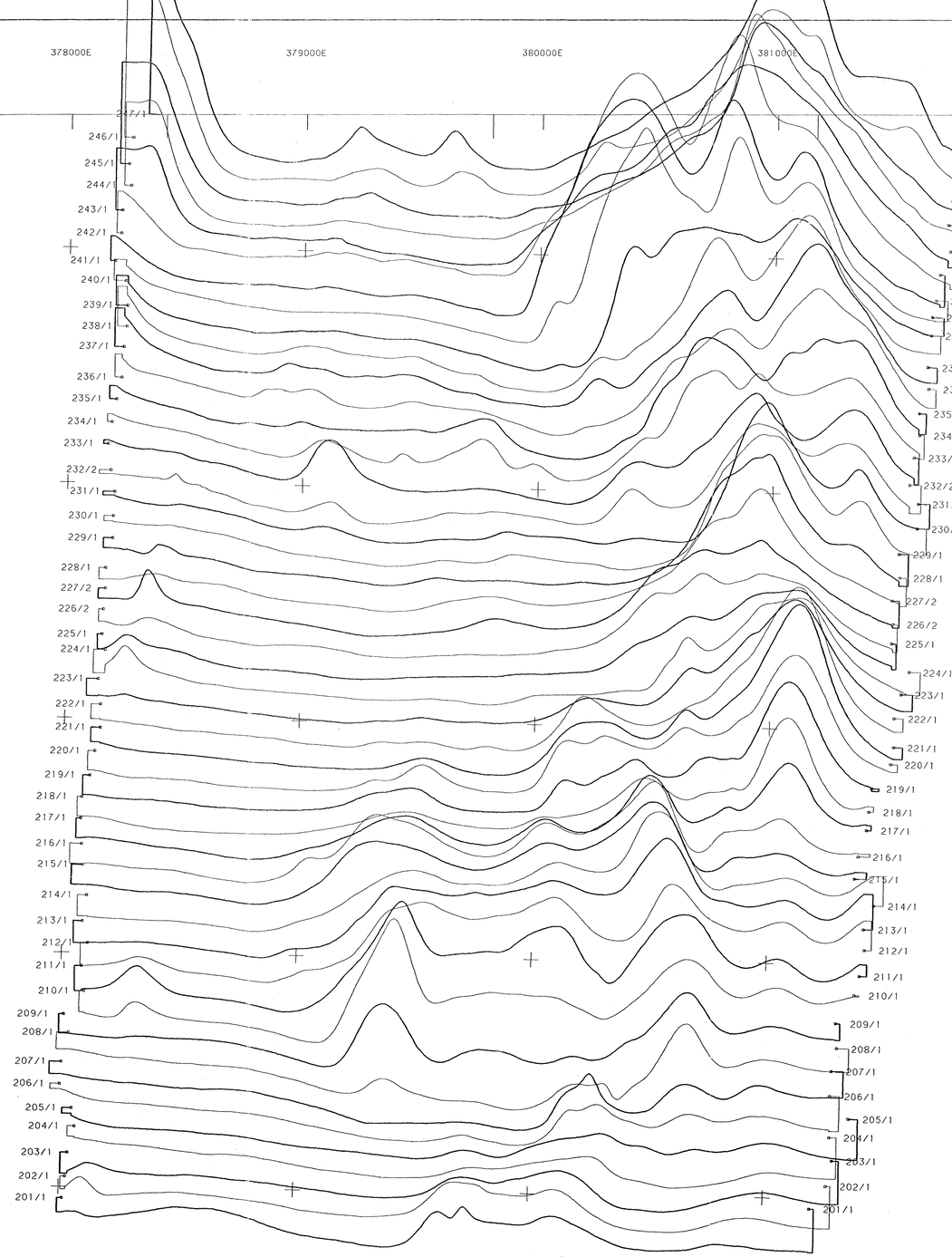
DRAWING NO: BL23/1 | DATE : 30-APR-1993

376000E 377000E 378000E 379000E 380000E 381000E 382000E

41°56'00"S
41°57'00"S
41°58'00"S
41°59'00"S

5356000N
5355000N
5354000N
5353000N
5352000N
5351000N

145°30'00"E 145°31'00"E 145°32'00"E 145°33'00"E 145°34'00"E 145°35'00"E



AIRBORNE SURVEY SPECIFICATIONS

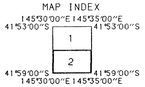
MAGNETOMETER :	SCINTREX cesium vapour optical absorption mounted on a bird Sensitivity : 0.05 nT
RECORDING INTERVAL :	0.1 sec
SPECTROMETER :	Nuclear Data 256 channel ADC Volume : 16.8 litres
TOTAL COUNT WINDOW :	0.4 - 3.00 MeV
POTASSIUM WINDOW :	1.35 - 1.57 MeV
URANIUM WINDOW :	1.63 - 1.89 MeV
THORIUM WINDOW :	2.42 - 2.82 MeV
RECORDING INTERVAL :	1.0 sec
DATA RECORDING :	Geoterrex MADACS acquisition system Digital to magnetic tape
NOMINAL TERRAIN CLEARANCE :	spectrometer in aircraft at 115 m magnetometer mounted on a towed bird
NOMINAL LINE SPACING :	Traverse lines 100 m Tie lines 1.0 km
FLIGHT PATH NAVIGATION :	SERCEL NR103 GPS and SERCEL NDS100 UHF DGPS navigation system
FLIGHT PATH RECORD :	real time from UHF DGPS system corrected for selected availability

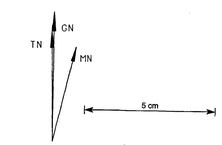
RESIDUAL MAGNETIC PROFILES

Grid notation refers to Australian Map Grid Zone 55

Magnetics :	Diurnal removed
IGRF :	1990 model (updated for secular variation to March 1993) removed. datum 2000 nT added.
Total Field :	62285 nT (at 41°700S, 145°200E)
Inclination :	72 degrees S
Declination :	13.3 degrees E
Vertical Scale :	50 nT/cm
Base Value :	2000 nT

MAP INDEX





Grid Convergence = 0.97°
Declination = 13.30°

SCALE 1:10000

200 0 200 400 600 800 m

94-3552

JOB NO : 3-445
Surveyed by GEOTERREX PTY LTD : March 1993
Compiled by GEOTERREX PTY LTD. SYDNEY
Processed by GEOTERREX PTY LTD. SYDNEY

930107A

ABERFOYLE RESOURCES LTD

ANTHONY BASIN
RESIDUAL MAGNETIC PROFILES
BURNIE SK55-3
SHEET 2 OF 2

DRAWING NO: BL23/2 | DATE : 30-APR-1993

378000 mE

145°32'

145°33'

80

81

145°34'

82

145°35'

385000 mE

5361000 mN

41°54'

60

59

41°55'

58

57

41°56'

56

55

41°57'

54

53

41°58'

5352000 mN

EL 103/87
Basin Lake

787550

T2

T1

FAULT

TYNDALL

LEECH HILL STRUCTURE

PYRITE CORNER FAULT

RIVER

LANDON

FAULT

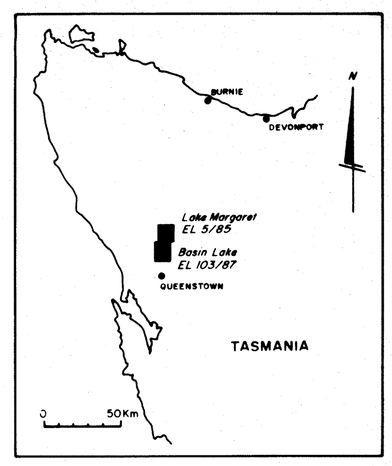
FAULT

LINE

802519

LEGEND

- HELIMAGNETIC INFERRED STRUCTURAL ELEMENT
- REGIONAL AEROMAGNETIC LINEAR
- HELIMAGNETIC INFERRED MAJOR LITHOLOGICAL BOUNDARY
- OLD WORKINGS
- ALTERATION ZONE
- DEM / MAGNETIC INFERRED STRUCTURAL ZONES



5 cm

0 1 Km

94-3552

930108

Aberfoyle Resources Limited
EXPLORATION DIVISION

REVISIONS			
Init	Date	Init	Date
RSJma	6·9·93		
RSJma	19·11·93		

NORTH WEST TASMANIA

ANTHONY BASIN

STRUCTURAL ELEMENT OVERLAY

Compiled :
Drawn :
Traced : NB
Checked :

Location Code K55/5 | Scale 1:10 000 | Date AUGUST 1993 | Plate No : BL24

379000E 380000E 381000E 382000E

W (Henty River)

SECTION 5356500N

E (Tyndall Range)

379000E 380000E 381000E 382000E

€Oc Owen Conglomerate

TYNDALL GROUP

€tss Upper Tyndall Group: Interbedded sandstone/siltstone volcaniclastics with minor rhyolitic breccia volcaniclastics.

€t Middle Tyndall Group: Rhyolitic/Dacitic volcanic debris flow units with interbedded crystal rich sandstones and occasional rhyolite intrusion.

€tm Middle Tyndall Group: Magnetically distinct unit consisting of interbedded, volcaniclastic breccias/sandstones of rhyolitic-dacitic composition with distinctive banded nature.

€tad Lower Tyndall Group: Polymitic lithic volcanic debris flow breccias with interbedded finer grained crystal rich volcaniclastics. Dacitic to Andesitic in composition.

€tsh Black laminated shale.

€tx Feldspathic - Quartz Crystal Supported Unit

€tct Howards Tuff or Comstock Tuff equivalent. Banded carbonate hematite altered ash units.

€trl Tyndall Group Intrusive
Massive pink grey quartz feldspar rhyolite lava.

ANTHONY ROAD ANDESITE (ARA)

€cvam Massive green to pink hornblende feldspar phyric andesitic-lava with distinct magnetite. Minor andesitic shallow level intrusives.

€cvan Green grey feldspar phyric ± hornblende lava/breccia with interbedded epiclastics. Absence of magnetite.

€cvd Intrusive(?) hornblende feldspar phyric pink columnar jointed massive dacite/andesite. Magnetically discrete unit.

CENTRAL VOLCANIC COMPLEX (CVC)

€cfl Undifferentiated rhyolite/dacite lavas and volcaniclastics.

€cd Grey green feldspar phyric dacite lava.

WESTERN SEDIMENTARY SEQUENCE (WSS)

€wss Sandstones/siltstones and crystal rich lithic breccias with interbedded shales.

CVC/WSS INTRUSIVES

€xp Cream feldspar quartz rhyolitic porphyry

—— Bedding

– – – – Mapped Geological Contact

——— Mapped Fault

0 500 1000 metres

94-3552

930108A.

Aberfoyle Resources Limited
EXPLORATION DIVISION

REVISIONS			
Init	Date	Init.	Date

NORTH WEST TASMANIA
ANTHONY BASIN
INTERPRETIVE CROSS SECTIONS
SHEET B

Location Code :

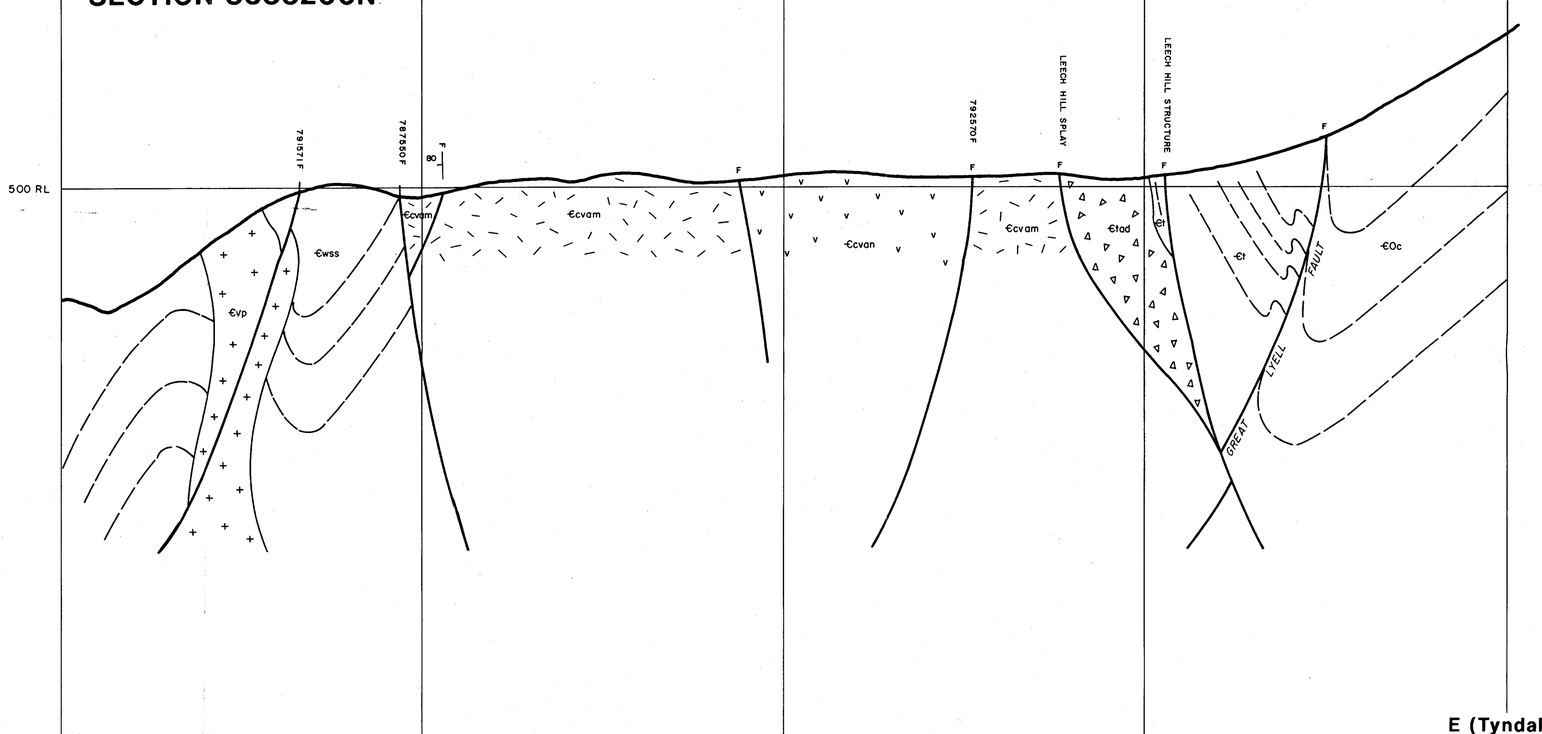
Scale : 1 : 10000 | Date : AUGUST 1993

Compiled : RS
Drawn : RS
Traced : RJE
Checked :
Plate No : BL25A

W (Henty River)

SECTION 5355200N

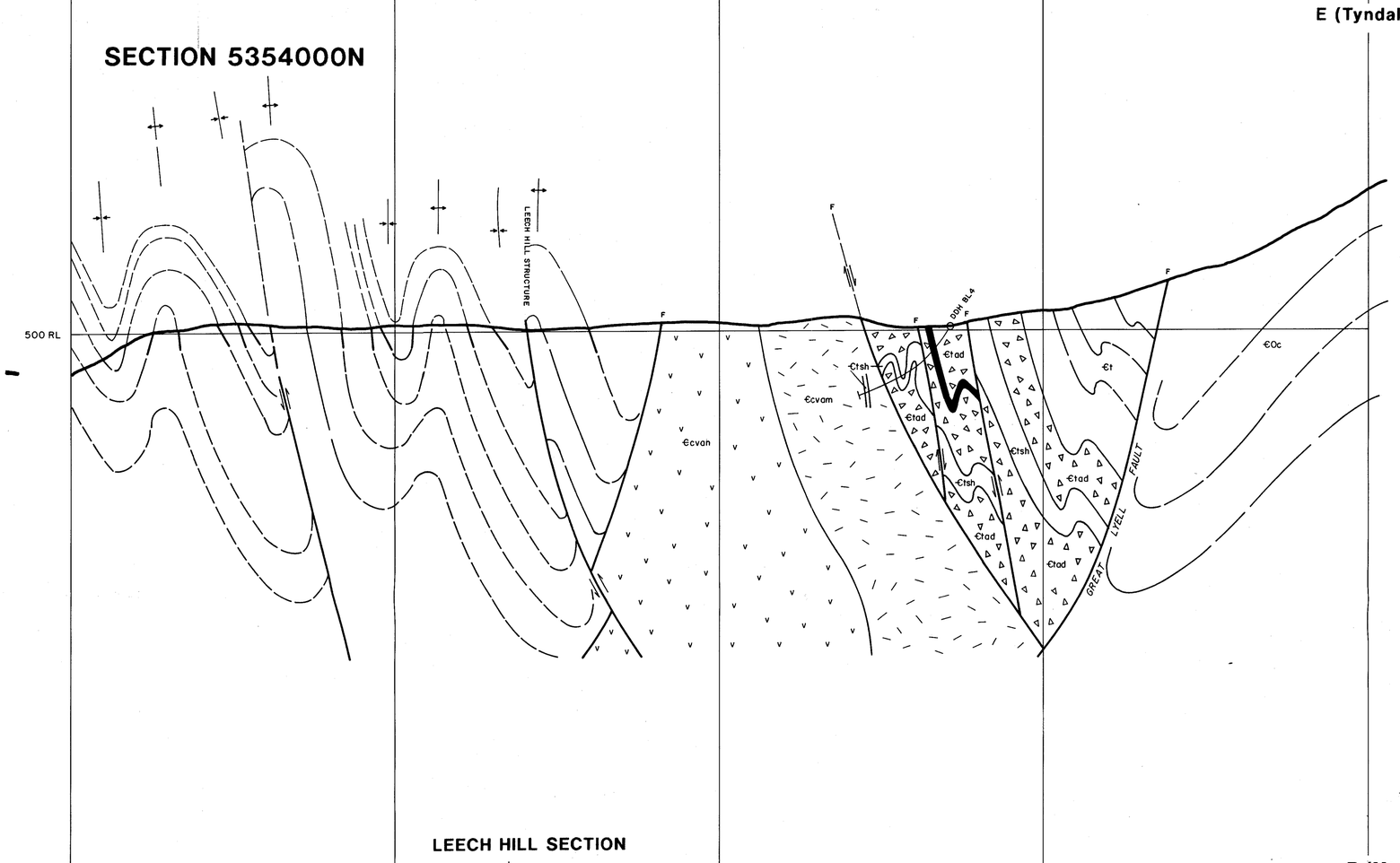
E (Tyndall Range)



W (Henty River)

SECTION 5354000N

E (Tyndall Range)

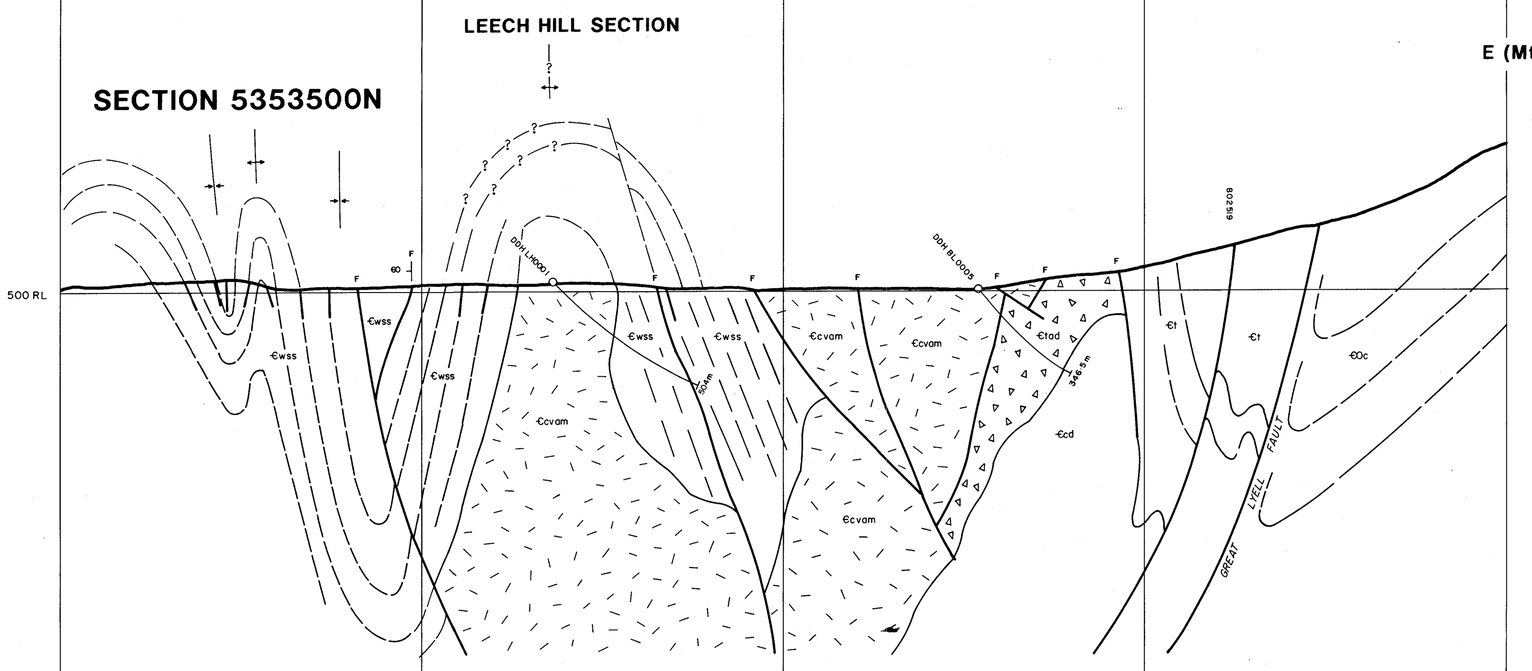


W (Henty)

LEECH HILL SECTION

SECTION 5353500N

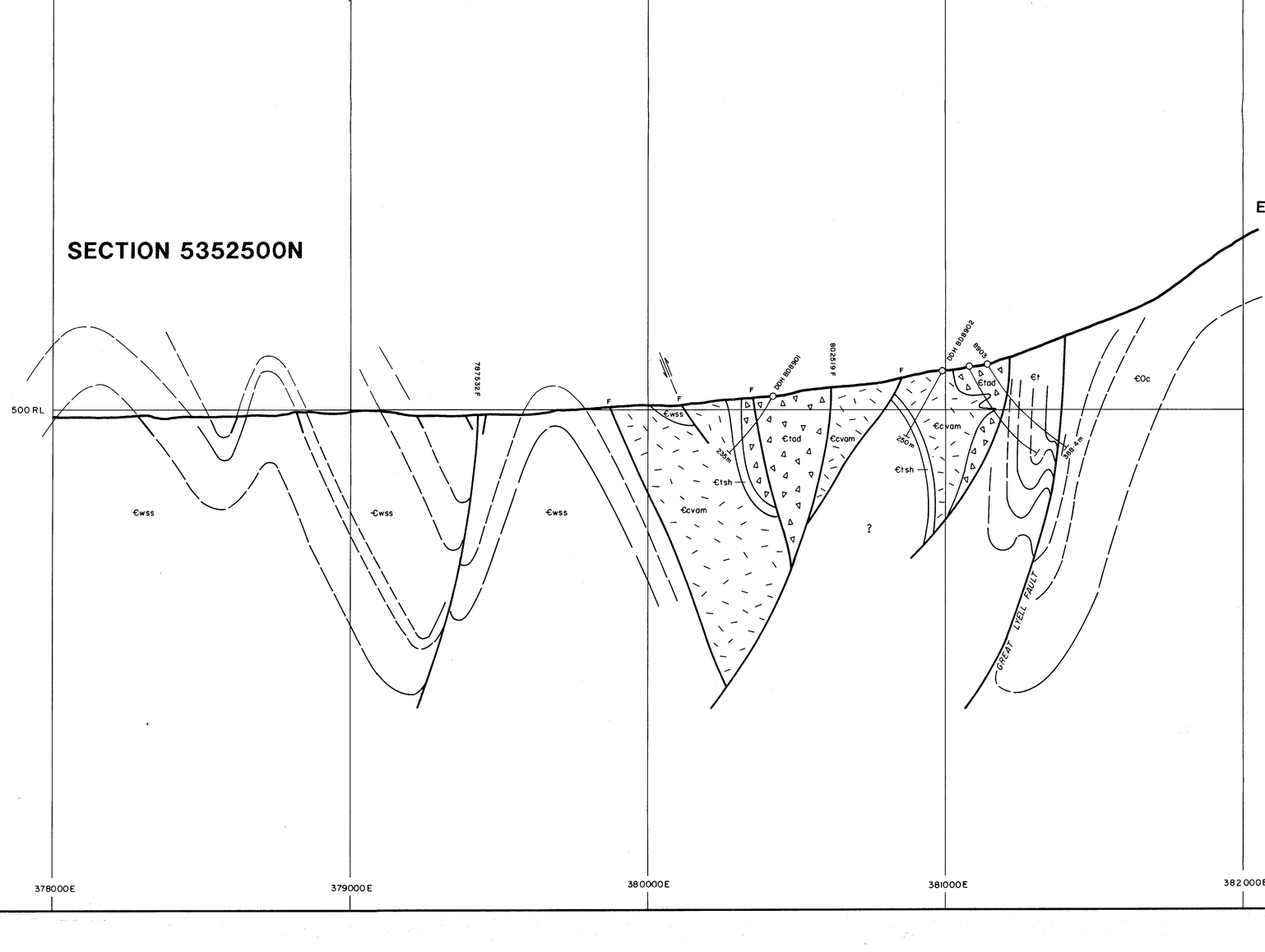
E (Mt.Geikie)



W (Henty)

SECTION 5352500N

E (Mt.Geikie)



€Oc — Owen Conglomerate

TYNDALL GROUP

€tss — Upper Tyndall Group: Interbedded sandstone/siltstone volcaniclastics with minor rhyolitic breccia volcaniclastics.

€t — Middle Tyndall Group: Rhyolitic/Dacitic volcanic debris flow units with interbedded crystal rich sandstones and occasional rhyolite intrusion.

€tm — Middle Tyndall Group: Magnetically distinct unit consisting of interbedded, volcaniclastic breccias/sandstones of rhyolitic-dacitic composition with distinctive banded nature.

€tad — Lower Tyndall Group: Polymitic lithic volcanic debris flow breccias with interbedded finer grained crystal rich volcaniclastics. Dacitic to Andesitic in composition.

€tsh — Black laminated shale.

€tx — Feldspathic - Quartz Crystal Supported Unit

€tct — Howards Tuff or Comstock Tuff equivalent. Banded carbonate hematite altered ash units.

€trl — Tyndall Group Intrusive
Massive pink grey quartz feldspar rhyolite lava.

ANTHONY ROAD ANDESITE (ARA)

€cvam — Massive green to pink hornblende feldspar phyric andesitic-lava with distinct magnetite. Minor andesitic shallow level intrusives.

€cvan — Green grey feldspar phyric ± hornblende lava/breccia with interbedded epiclastics. Absence of magnetite.

€cvd — Intrusive(?) hornblende feldspar phyric pink columnar jointed massive dacite/andesite. Magnetically discrete unit.

CENTRAL VOLCANIC COMPLEX (CVC)

€cfl — Undifferentiated rhyolite/dacite lavas and volcaniclastics.

€cd — Grey green feldspar phyric dacite lava.

WESTERN SEDIMENTARY SEQUENCE (WSS)

€wss — Sandstones/siltstones and crystal rich lithic breccias with interbedded shales.

CVC/WSS INTRUSIVES

€vp — Cream feldspar quartz rhyolitic porphyry

—— Bedding

– – – – Mapped Geological Contact

——— Mapped Fault

930109

5 cm

0 500 1000 metres

94-3552

Aberfoyle Resources Limited
EXPLORATION DIVISION

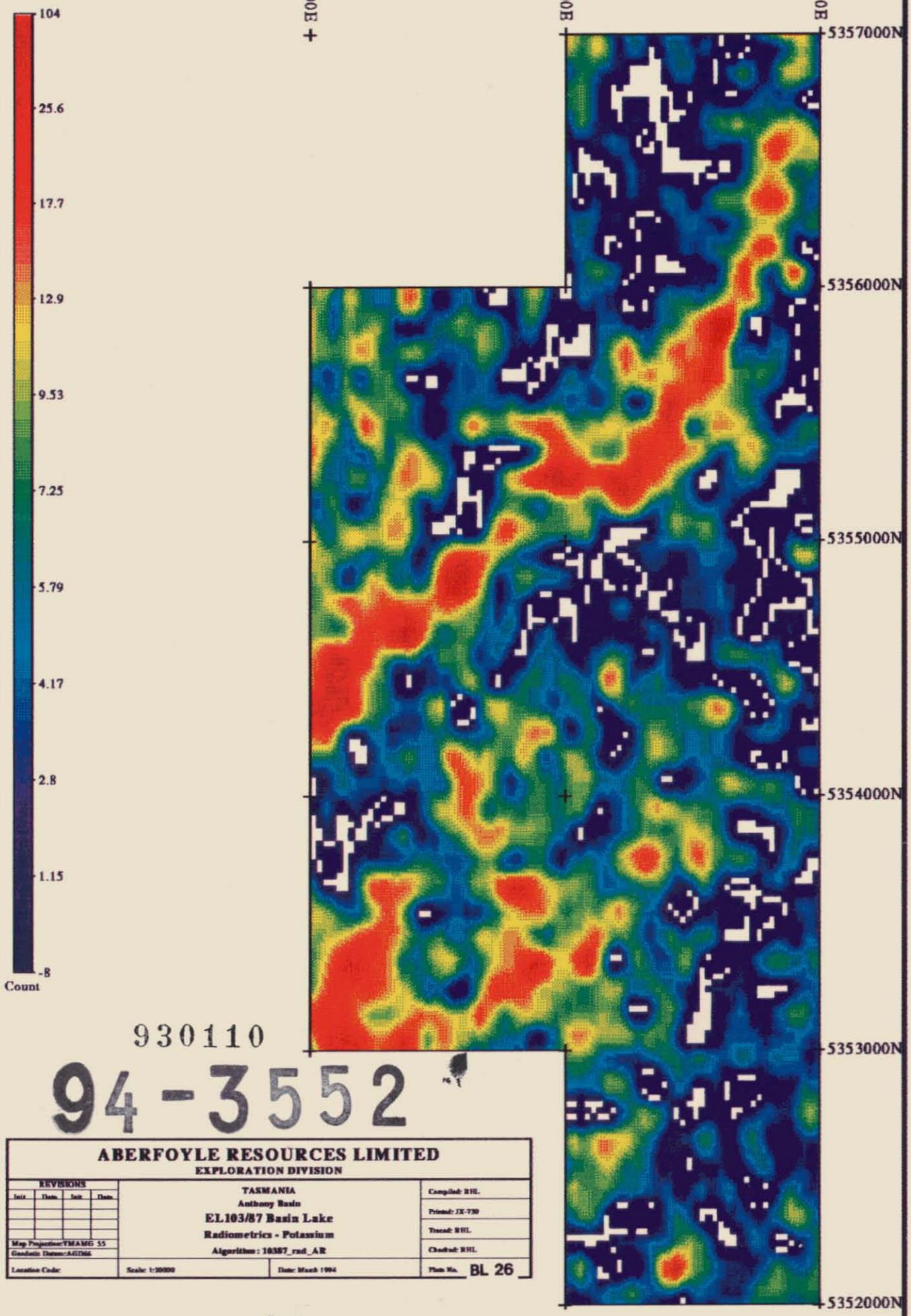
REVISIONS			
Init.	Date	Init.	Date

NORTH WEST TASMANIA
ANTHONY BASIN
INTERPRETIVE CROSS SECTIONS
SHEET C

Location Code :

Scale : 1 : 10000 | Date : AUGUST 1993

Compiled : RS
Drawn : RS
Traced : RJE
Checked :
Plate No : BL25B



930110

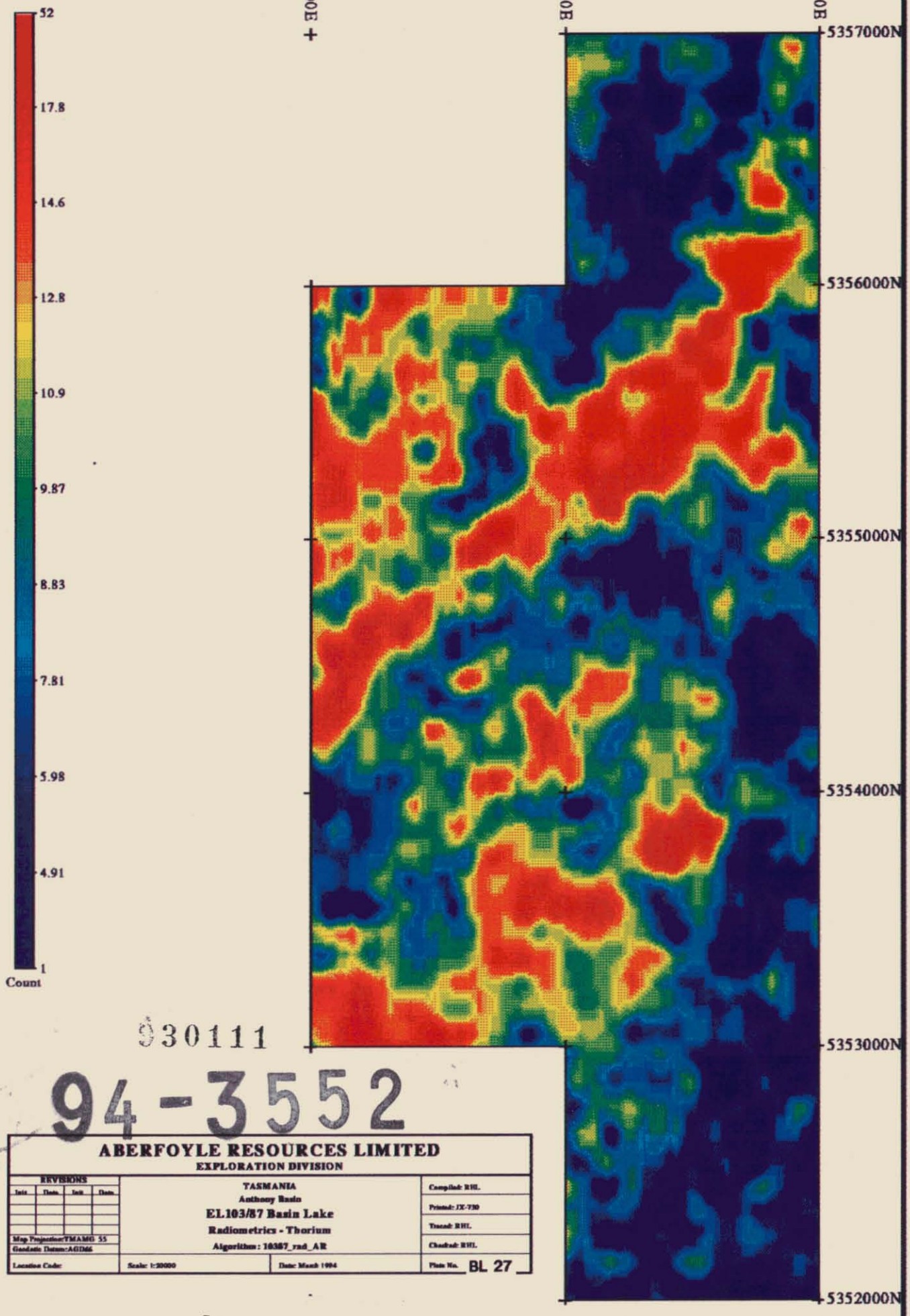
94-3552

ABERFOYLE RESOURCES LIMITED
EXPLORATION DIVISION

REVISIONS				TASMANIA Anthony Basin EL103/87 Basin Lake Radiometrics - Potassium Algorithm : 10387_rad_AR	Compiled: RHL Printed: JX-730 Traced: RHL Checked: RHL
Init.	Date	Init.	Date		
Map Projection: TMAMG 55 Geodetic Datum: AGD66					
Location Code:				Scale: 1:20000	Date: March 1994

Plate No. BL 26

5 cm



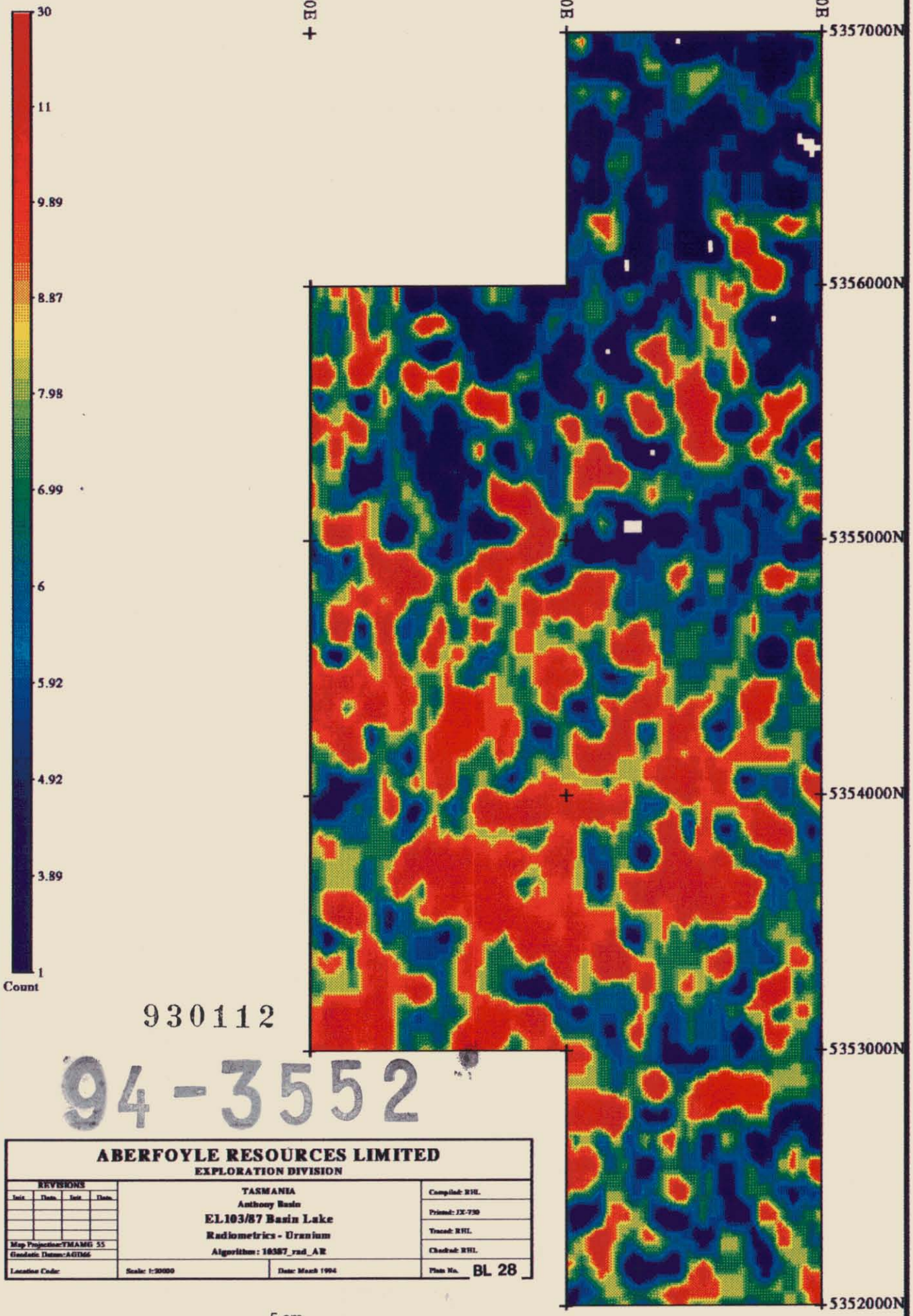
930111

94-3552

ABERFOYLE RESOURCES LIMITED
EXPLORATION DIVISION

REVISIONS				TASMANIA	Compiled: RHL.
Init.	Date.	Init.	Date.	Anthony Basin	Printed: JX-730
				EL103/87 Basin Lake	Traced: RHL.
				Radiometrics - Thorium	Checked: RHL.
Map Projection: TMAMG 55				Algorithm: 10387_rad_AR	
Geodetic Datum: AGD66					
Location Code:				Scale: 1:20000 Date: March 1994	Plate No. BL 27

5 cm



930112

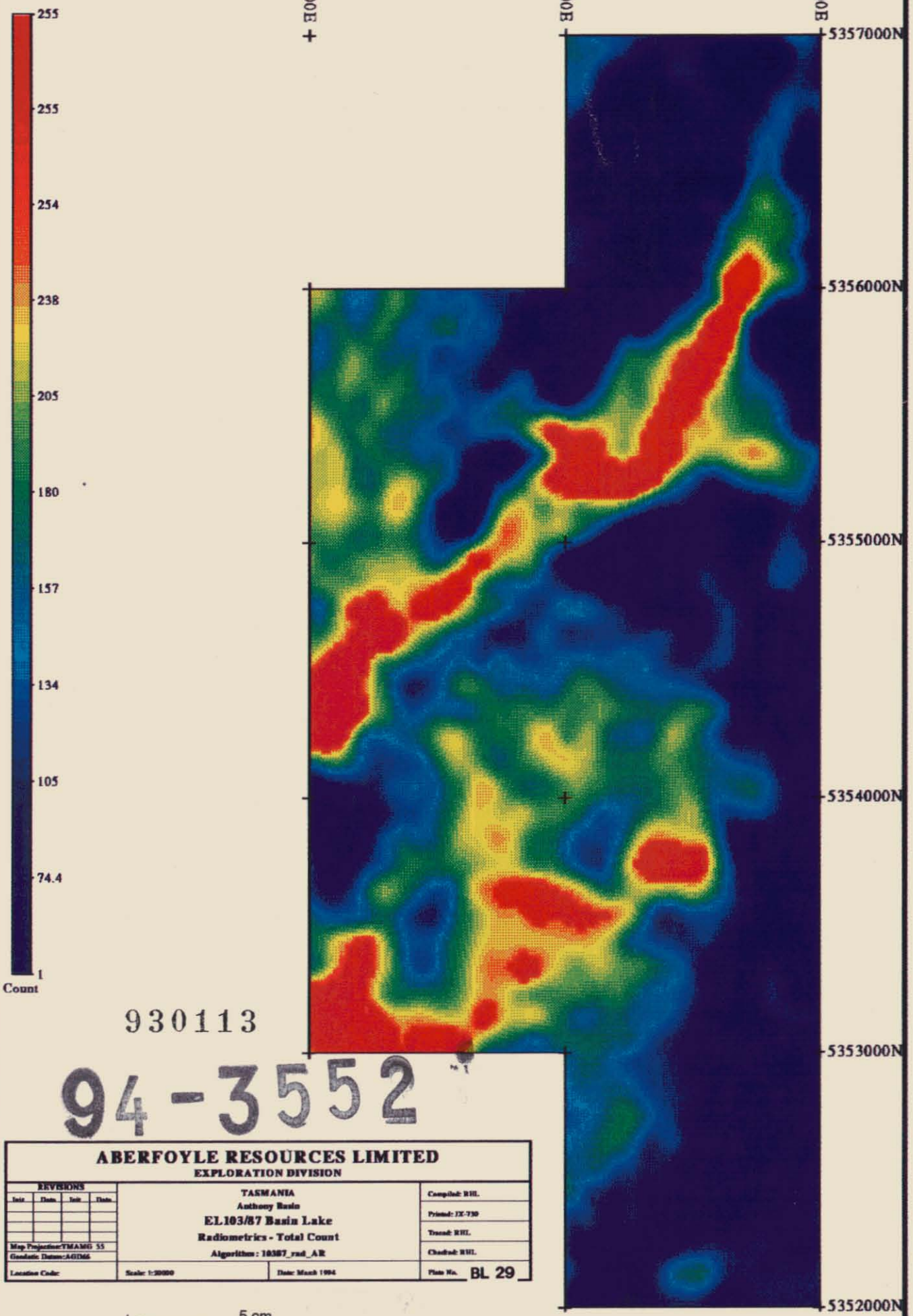
94-3552

ABERFOYLE RESOURCES LIMITED
EXPLORATION DIVISION

REVISIONS				TASMANIA Anthony Basin EL103/87 Basin Lake Radiometrics - Uranium Algorithm : 10387_rad_AR	Compiled: RHL Printed: JX-730 Traced: RHL Checked: RHL
Init	Date	Init	Date		
Map Projection: TMAMG 55 Geodetic Datum: AGD66					
Location Code:				Scale: 1:20000	Date: March 1994

Plan No. BL 28

5 cm



930113

94-3552

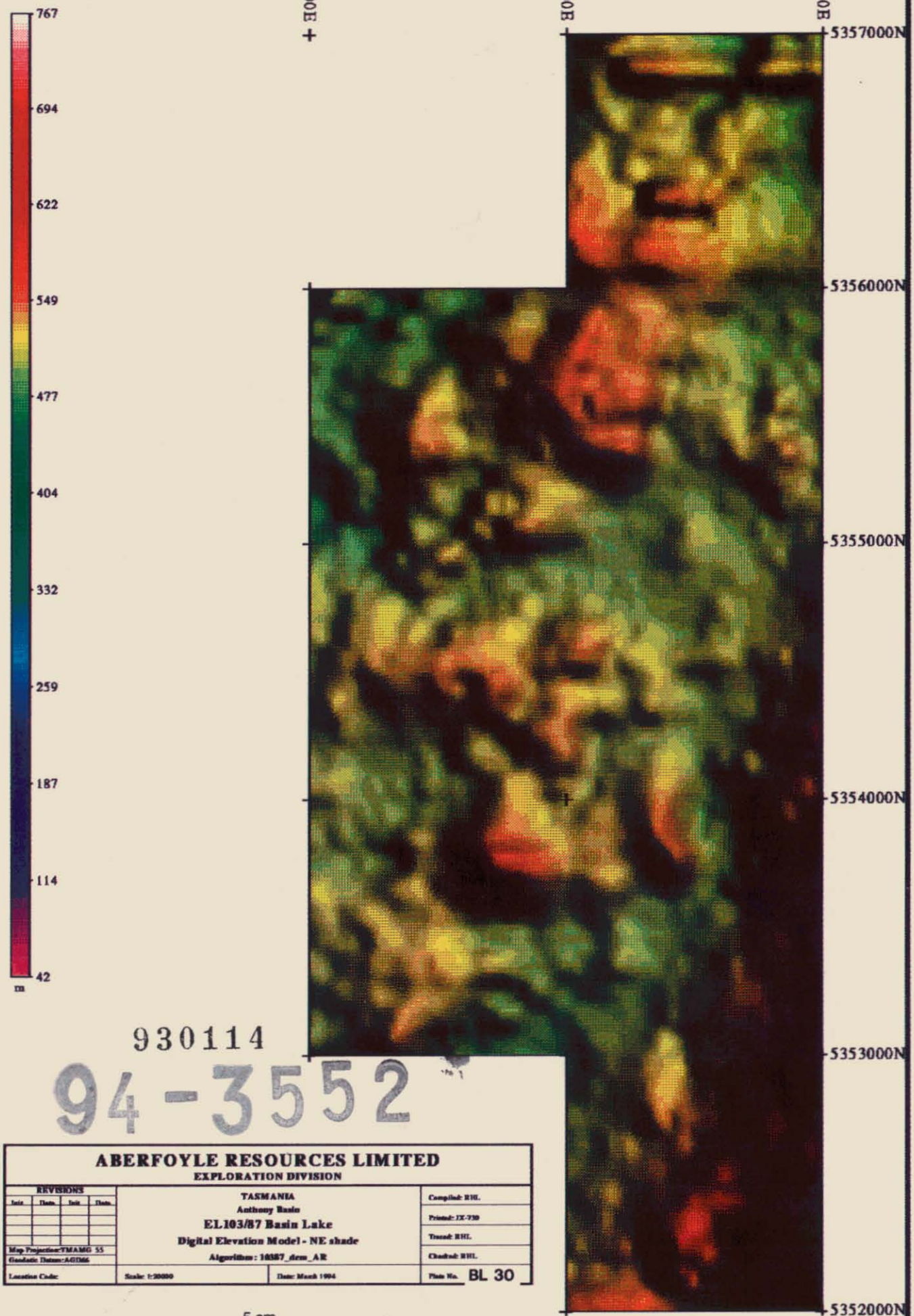
ABERFOYLE RESOURCES LIMITED
EXPLORATION DIVISION

REVISIONS					
Init	Date	Init	Date		
Map Projection: TMAMG 55					
Geodetic Datum: AGD66					
Location Code:				Scale: 1:20000	Date: March 1994

TASMANIA
Anthony Basin
EL103/87 Basin Lake
Radiometrics - Total Count
Algorithm: 10387_rad_AR

Compiled: RHL
Printed: JX-730
Traced: RHL
Checked: RHL
Plate No. BL 29

5 cm



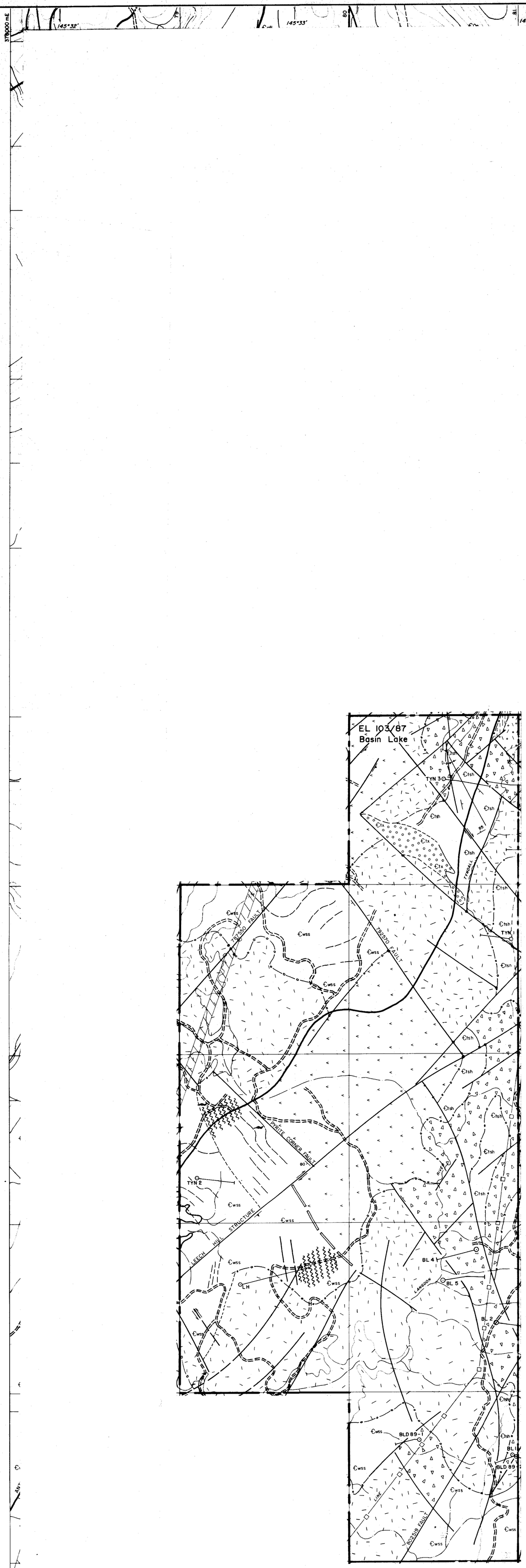
930114

94-3552

ABERFOYLE RESOURCES LIMITED
EXPLORATION DIVISION

REVISIONS				TASMANIA	Compiled: RHL
Init.	Date	Init.	Date	Anthony Basin	Printed: IX-730
				EL103/87 Basin Lake	Traced: RHL
				Digital Elevation Model - NE shade	Checked: RHL
Map Projection: TMAMG 55				Algorithm: 10387_dem_AR	
Geodetic Datum: AGD66					
Location Code:				Scale: 1:20000 Date: March 1994	Plate No. BL 30

5 cm



€0c 17 — Owen Conglomerate

TYNDALL GROUP

€tss 30 — Upper Tyndall Group: Interbedded sandstone/siltstone volcaniclastics with minor rhyolitic breccia volcaniclastics.

€t 22 — Middle Tyndall Group: Rhyolitic/Dacitic volcanic debris flow units with interbedded crystal rich sandstones and occasional rhyolite intrusion.

€tm 24 — Middle Tyndall Group: Magnetically distinct unit consisting of interbedded, volcaniclastic breccias/sandstones of rhyolitic-dacitic composition with distinctive banded nature.

€tct 25 — Lower Tyndall Group: Howards Tuff or Comstock Tuff equivalent. Banded carbonate haematite altered ash units.

€tsh 68 / 27 / €tad / €tx 28 — Lower Tyndall Group: €tad Polymitic lithic volcanic debris flow breccias with interbedded finer grained crystal rich volcaniclastics. Dacitic to Andesitic in composition. : €tsh Black laminated shale. : €tx Feldspathic - Quartz Crystal Supported Unit.

€trl 26 — Tyndall Group Intrusive: Massive pink grey quartz feldspar rhyolite lava.

ANTHONY ROAD ANDESITE (ARA)

€cvam 46 — Massive green pink hornblende feldspar phyric andesitic-lava with distinct magnetite. Minor andesitic shallow level intrusives.

€cvan 48 — Green grey feldspar phyric ± hornblende lava/breccia with interbedded epiclastics. Absence of magnetite.

€cvd 51 — Intrusive (?) hornblende feldspar phyric pink columnar jointed massive dacite/andesite. Magnetically discrete unit.

CENTRAL VOLCANIC COMPLEX (CVC)

€cfl 52 — Undifferentiated rhyolite/dacite lavas and volcaniclastics.

€cd 62 — Grey green feldspar phyric dacite lava.

WESTERN SEDIMENTARY SEQUENCE (WSS)

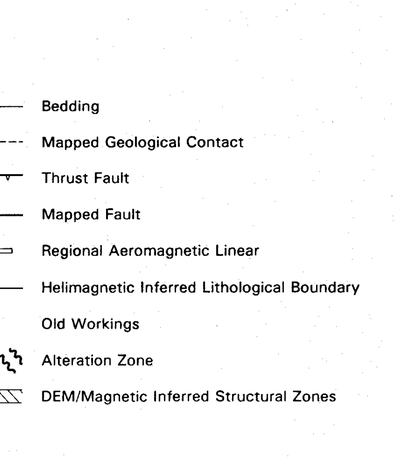
€wss 69 — Sandstones/siltstones and crystal rich lithic breccias with interbedded shales.

CVC/WSS INTRUSIVES

€vp 58 — Cream feldspar quartz rhyolitic porphyry.

6 — Local hydrothermal alteration.

- Bedding
- Mapped Geological Contact
- Thrust Fault
- Mapped Fault
- Regional Aeromagnetic Linear
- Helimagnetic Inferred Lithological Boundary
- Old Workings
- Alteration Zone
- DEM/Magnetic Inferred Structural Zones



5 cm

0 1Km

930115

94-3552

Aberfoyle Resources Limited
EXPLORATION DIVISION

REVISIONS			
Init	Date	Init	Date
RS jms	8-9-93		
RS jms	2-11-93		
RS jms	6-11-93		

NORTHWEST TASMANIA
ANTHONY BASIN
GEOMAGNETIC INTERPRETATION

Location Code : K55/5 | Scale : 1:10 000 | Date : AUGUST 1993

Compiled : RS
Drawn : RS
Traced : NB
Checked :
Plate No : BL31