963001

Aberfoyle Resources Limited
EXPLORATION DIVISION

LAKE MARGARET EL 5/85

TASMANIA

Technical Progress Report

for the period

September 1992 - September 1993

Located data tape held

Volume 1 of 2

Text and Appendices I - VIII

6 Transparencies held

93-3513 Vol 1/2

Prepared by:

R. Sharpe
GEOLOGIST

Distribution

Aberfoyle - Burnie	(1/4)
Aberfoyle - Hawthorn	(2/4)
Department of Mines	**(3/4)**
CRA Exploration - Canberra	(4/4)

Endorsed by:

D. B. Wallace
REGIONAL EXPLORATION MANAGER

Internal Report No: Lake Margaret 9

963002

LIST OF CONTENTS

FIGURES

PLATES

963004

APPENDICES

1.0 SUMMARY

The Newton Creek Prospect area forms part of a Cambrian intermediate to felsic volcanic basin south of the Henty Fault Zone. Work completed during the 1992-1993 exploration programme include detailed helimagnetics, infill mapping and geochemical investigations. The results of the work programme include:

- Identification of gold rich massive banded barite-sulphide boulders and outcropping gold rich barite stockwork veins in Tyndall Creek. Mineralisation is hosted by Lower Tyndall Group (LTG) volcaniclastics.

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

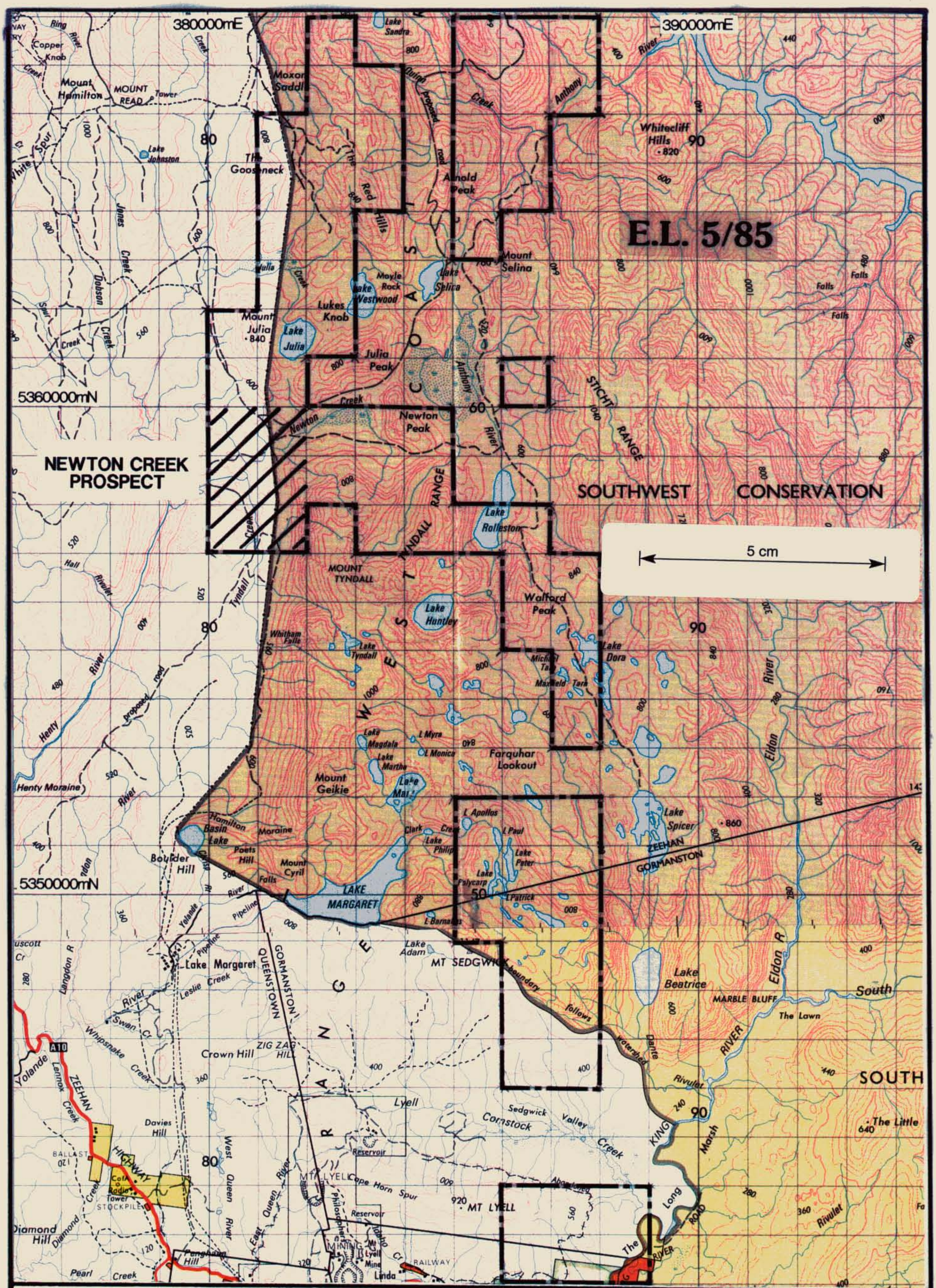
- Identification of three deep seated Cambrian syn-volcanic structures; two of which trend NE and form the structural boundaries to the Newton sub-basin. These two structures separate significant stratigraphic facies variations between north and south, with the sub-basin area filled by LTG units and structurally controlled intrusives.

Further exploration recommended includes deep stratigraphic drilling to test LTG units within the Newton sub-basin and shallow diamond drilling proximal to Tyndall Creek to test outcropping barite-gold mineralisation.

2.0 INTRODUCTION

E.L. 5/85 Lake Margaret was granted to CRA Exploration Pty. Ltd. on the 20th October, 1985. From April 28th 1988, exploration has been conducted by Aberfoyle Resources Limited under terms of the Mount Read Volcanic joint venture with CRA Exploration Pty. Ltd. The licence area was reduced to 73 square kilometres in October 1990 (Figure 1).

The following report documents exploration on E.L. 5/85 Lake Margaret for the period September 1992 to September 1993.



963007 Aberfoyle Resources Limited

EXPLORATION DIVISION

Figure 1.

LAKE MARGARET E.L. 5/85 LOCALITY MAP

Location Code :	Scale : 1:100 000	Date : September 1993	Drawn : JLR
			Plate No. : LMARG 13

3.0 NEWTON CREEK PROSPECT

3.1 Introduction

The Newton Creek prospect occurs in an intermediate to felsic volcanic centre east of the South Henty Fault. Structural and lithological complexities are exemplified by exposure in the Newton Dam Spillway sequences. The 1992-1993 work programme, as part of ongoing mineral exploration, was aimed toward the delineation of major syndepositional Cambrian structures acting as controls for potential mineralisation sites.

An exploration programme that included close spaced helimagnetic and radiometric surveys was completed in conjunction with additional mapping and sampling. Integrated interpretation of structural, geologic and magnetic data was combined with additional geochemical analyses, petrology and isotopic studies.

3.2 Previous Exploration

Previous mineral exploration at Newton Creek has focussed on alteration and mineralisation within Cambrian volcanic sequences that delineate Howards Anomaly. Howards Anomaly forms an elongate alteration centre parallel to a north-south trending stratigraphic contact between Anthony Road Andesite (ARA) and Tyndall Group sequences. The alteration zone with a variable haematite ± carbonate ± chlorite assemblage, is associated with minor Pb, Zn and Ag mineralisation. RGC quit the area in 1985, with the conclusion that mineralisation was sporadic.

Historical aspects and detailed exploration history on the prospect prior to 1986 are documented by Fitzgerald (1987). A total of eight diamond holes have been drilled in the Howards Anomaly area.

Surveys completed over the area have included IP, ground EM, ground magnetics, rock chip and soil geochemical surveys as well as a number of costeans. CRAE acquired the prospect area as E.L.5/85 in 1986 and conducted blanket ground UTEM. EM identified four conductors; each response the result of shallow conductive zones due to black shales from within the Tyndall Group. No significant bedrock conductors attributable to sulphide accumulations were identified by the UTEM survey.

From 1991, exploration by Aberfoyle Resources Limited has included mapping and geochemical programmes (Richardson, 1991; Sharpe, 1992).

A number of massive sulphide clasts hosted within a dacitic volcaniclastic breccia sequence were identified in the HECs' Newton Dam Spillway (Gibson, 1991). These recently discovered sulphide clasts exemplify VHMS accumulation potential in the prospect area.

3.3 Geology

Ground checking of relevant exposures and infill mapping was completed during the 1992-1993 field programme. All additional mapping data has been added to the 1:5000 outcrop geology map (Plate L.MARG.50).

Additional outcrop areas identified include exposure along Tyndall Creek due to low water levels in Newton Dam (AMG GR 381000mE, 5357400mN). Intensely sheared, highly altered and weathered feldspar rich volcaniclastic units of Howards Tuff are exposed. Volcaniclastics are fine to medium grained felspathic-haematitic tuffs. Pervasive hydrothermal alteration shows a variable assemblage of chlorite, sericite and haematite/carbonate, with a severe weathering overprint. Exposure at the junction of Tyndall Creek and Newton Dam, identifies Howards Fault to be a north-south striking, steeply dipping fault with an intensely sheared fabric and sub parallel faulting. Howards Fault forms a major shear zone oriented parallel (347/90° AMG) to the Howards Tuff-Middle Tyndall Group contact (Plates L.MARG.67&65). Sheared fabrics and minor faulting of Howards Tuff unit indicate late (Devonian D2?) sinistral movement on Howards Fault.

North-west of Howards Fault outcrop at AMG GR 380620mE, 5358400mN, dacitic/andesitic breccias of Lower Tyndall Group (LTG) are exposed on the edge of Newton Dam. LTG units show strong cleavage development (016/85°E AMG) with abundant subparallel red jasperoidal veining and jasper breccia zones. Jasperoid fragments have been incorporated into the pale green purple feldspar (±hornblende±quartz) dacitic/andesitic volcaniclastic matrix and form irregularly sized, shaped fragments of variable abundances with long axes elongate to cleavage. Margins of the jasper veins are always sharp with no infringement of alteration into andesitic/dacitic host horizon. The provenance of these LTG breccias and their jasperoidal components are likely derived from underlying volcanics and are further discussed in section 3.3.1.

Mapping of the contact between ARA massive lava/breccias and LTG volcaniclastics was completed. Results have been added to Plate L.MARG.50. An interfingering contact between massive ARA lavas and LTG is observed. From massive ARA exposed along the Anthony Road, the first indication of Tyndall Group Volcanics is that of a feldspar + quartz crystal supported sandstone that grades to a sparsely feldspar rich siltstone. Overlying feldspathic siltstones, is a highly weathered andesitic breccia, which in turn is overlain by fine grained siltstones and sandstones. Conformably deposited over these units is a black shale unit that likely represents pelagic background sedimentation. Black shales are finely laminated and form a broad synclinal structure. A heterogeneous unit of massive grey-cream feldspar + quartz ± hornblende crystal rich lithic volcaniclastics overly black shales. In this unit, lithic clasts are most abundantly black shale lithics and frequent andesitic lithics. Black shale and andesitic lithics as well as occasional hornblende crystal fragments indicate that this unit of the LTG was derived locally from underlying units. The angular shapes and poorly sorted nature of black shale lithics are indicative of rip up clasts from underlying sedimentation. Interbedded fine to well sorted sandstones within this sequence are also observed. Massive textures and diffuse stratification of the LTG volcaniclastics along this portion of the Anthony Road are consistent with high density and concentration turbidity currents as proposed by Hutton (1989). Units are generally east dipping and facing with a pervasive chloritic hydrothermal alteration overprint that increases in intensity toward outcrop in Tyndall Creek.

Tyndall Creek Barite-Sulphide Boulders

A traverse along Tyndall Creek identified a number of banded massive barite-sulphide boulders occurring as float within the active stream system. Barite-sulphide boulder debris, to maximum size of 0.6 metres, can be observed from 100 metres west of the Anthony Road in Tyndall Creek; to outcrop immediately east of the Anthony Road (refer Plate L.MARG.64). Showing an unweathered mineralogy, the ore boulders are composed of a barite-sulphide assemblage that includes abundant visible barite, pyrite, galena and sphalerite. Details of ore boulder mineralogy and petrology are presented in section 3.3.2.

Immediately west of the Anthony Road beside Tyndall Creek, a highly sheared silica altered quartz + feldspar + magnetite + hornblende crystal rich lithic volcaniclastic outcrops. Ascribed to LTG these andesitic/dacitic volcaniclastic units show an intensely sheared nature. Hydrothermal alteration is intense, with a silica ± chlorite ± sericite ± magnetite(?) assemblage. Disseminated pyrite and galena is also observed in outcrop.

East of the Anthony Road beside Tyndall Creek, an outcrop of highly sheared silica + sericite + pyrite altered fine grained volcaniclastics is observed (AMG GR 380940mE, 5357150mN). Anastomosing barite sulphide breccia stockwork veins transecting this outcrop are a likely source to barite-sulphide boulder float, exposed during excavation associated with HEC footing construction of the Anthony Road.

3.3.1 Petrological Investigation

Sixteen samples from the Newton Creek Prospect were submitted to Dr. A. Crawford at the University of Tasmania for petrographic investigation. Results of the investigation together with sample petrographic descriptions are attached in Appendix I. A summary of the results follow.

Anthony Road Andesite

Two discrete types of ARA can be distinguished based upon the presence or absence of magnetite. Petrographic investigation of ARA-type lavas aimed to explore differences between rock magnetism and composition and thereby discriminate between the presence or absence of magnetite and its bearing on primary composition.

The most northern observed occurrence of ARA is at the base of the Newton Dam Spillway (AMG GR 380000mE, 5358350mN). Four samples from this area have been examined. Two of the samples (624444 and 624445), from near the contact with felsic units of the Newton Dam spillway, show relatively unaltered plagioclase + hornblende + quartz phyric mineral assemblages, with a low grade burial metamorphic overprint. Elevated contents of magnetite present as FeTi oxides are observed in both samples. A pink hollocrystalline to vitrophyric groundmass indicates the basal spillway ARA lava forms a distinct intrusive unit. The pink groundmass is ascribed to the presence of interstitial quartzo-felspathic matrix containing tiny FeTi oxides altered to leucoxene. The high modal proportion of FeTi oxides in these samples suggests ARA in this locality to form a relatively fresh impermeable intrusive unit.

Samples 624456 and 624203 are taken from the same mappable ARA unit, with 624456 the southern most identified exposure of the intrusive unit and 624203 from Newton Creek 100 metres below the spillway. Mineralogically similar to the preceding two samples, 624203 forms an evolved dacitic variant of the unit. A high modal proportion of FeTi oxides is also observed.

In summary, these four samples of ARA form a distinct intrusive unit mineralogically identical to other ARA in the prospect area (refer Sharpe, 1992). Hornblende phenocrysts contain small inclusions of plagioclase and FeTi oxides, indicating hornblende to be a late hydrous crystallising phase. Plagioclase (forming up to 10% modal) is totally albitised due to burial metamorphic alteration. Quartz phenocrysts are frequent, forming rounded reacted phenocrysts. Regional burial metamorphism has degraded all ARA to some degree with the effect of albitising plagioclase, producing abundant fine grained sericite and epidote. FeTi oxides are present as a microphenocrysts or phenocryst phases in ARA samples. FeTi oxide phenocrysts generally show diverse breakdown modes, typically altering to a leucoxene variant. FeTi oxides when altered to leucoxene-chlorite show associated lower susceptibilities, indicating localised hydrothermal alteration. A relationship between preservation of primary FeTi oxides and alteration intensity is apparent in ARA.

Lower Tyndall Group - Dacitic/Andesitic Volcaniclastics

Five samples from the LTG andesitic/dacitic volcanic breccia-sandstone units were considered. Samples 624406, 624408 and 624410 were taken from outcrop beside Newton Dam north of Howards Anomaly (AMG GR 380620mE, 5357400mN). Sample 624451 is from outcrop along the southern access road to Newton Dam and 624210 is from ARA-LTG contact zone along the Anthony Road.

Sample 624210 is of a crystal supported unit that represent the first occurrence of LTG from ARA. Consisting of a texturally well preserved epiclastic sandstone, it shows an abundance of angular broken quartz and euhedral altered plagioclase phenocrysts in a matrix of totally recrystallised glass. Detrital FeTi oxide microphenocrysts are not uncommon. The matrix of the rock consists of fine grained quartzo-felspathic material after vitric ash; heavily overprinted by sericite.

624406 is a strongly sheared altered felsic crystal vitric tuff, showing a "false brecciated" texture and extensive development of red jasper. The crystal component consists of angular broken to disaggregated quartz and plagioclase. Alteration includes well developed chlorite and sericite throughout the groundmass with fine grained magnetite altered to leucoxenite. Alteration products are stretched parallel to foliation. Jasperiodal portions of sample 624406 contain relict plagioclase phenocrysts indicating that jasper forms a replacement feature rather than veining. Jasperoid alteration consists of chalcedonic to fine grained intergrowths of silica containing a black haematitic dust and occasional equant euhedral magnetite grains. The jasperoid part of the rock is suggested to be part of the original intermediate to felsic breccia/sandstone that was soaked with Fe-rich silica solutions, forming a haematitic chalcedony gel. Magnetite grains hosted by jasper may therefore be primary FeTi oxides.

624410 is a plagioclase phyric dacite lava containing lithic fragments of ARA. The groundmass has been hydrothermally altered to an intensely developed sericite + epidote + magnetite overprint assemblage. FeTi oxide microphenocrysts and phenocrysts are well preserved. 624410 forms an andesitic example of the andesitic/dacitic LTG breccia. Sample 624451 is a strongly altered glassy plagioclase phyric andesitic breccia, with much of the primary texture overprinted by intense chlorite hydrothermal alteration.

LTG andesites/dacites indicate an ARA to CVC dacitic composition with jasperiod constituent and intense hydrothermal alteration.

CVC -Related Dacites

Seven samples of CVC-related felsic units were examined. Samples included dacite clasts and massive lava samples from the Newton Dam Spillway as well as a nearby rhyolitic porphyry. Samples 624439 and 624442 of dacitic lava clasts in the spillway Upper Breccia Unit. Both samples show near identical petrology as a dark green grey plagioclase phyric lava. FeTi oxide phenocrysts are uncommon and where present altered to leucoxene. Groundmass is devitrified glass strongly overprinted by a weak calcic+sericitic alteration. Samples 624440 and 624441 are from an adjacent massive dacite lava. Both samples are petrographically identical to each other and the previously reported dacite lava clasts 624439 and 624442. Sample 624458, taken from a dacitic lava slice in basal portions of spillway exposure, shows moderately developed hydrothermal calcite+sericite alteration. The sample was formerly a glassy plagioclase phyric dacite lava similar to the previously reported dacites.

3.3.2 Barite-Sulphide Ore Petrology

Eight samples of banded barite-sulphide ore were submitted to Mr. P. Kitto at the University of Tasmania for petrographic examination. Seven of the samples were taken from float boulders identified in Tyndall Creek (Plate L.MARG.64). The remaining sample, 624470, is from anastomosing baritic-sulphide breccia stockwork veining outcropping in Tyndall Creek. A detailed report was provided by Mr. Kitto and presented in Appendix II.

In summary, the mineralogy of all samples was similar consisting of an intensely sheared barite rich groundmass with a sulphide mineralogy of; galena, pyrite, sphalerite, chalcopyrite, tetrahedrite-tennantite, chalcocite and electrum in order of abundance. Barite (forming up to 85% modal) is present as strongly foliated granular to euhedral augens. Brittle deformation and ductile deformation textures are present in barite. Barite augen frequently exhibit offset cleavages, undulose extinction and recrystallised interlocking grain boundaries, with structural textures that include grain rotation and riedel shear fabrics. Dissolution and recrystallisation features in barite are not uncommon.

Sulphide mineralisation is generally contained within deformation bands between more coherent zones of barite. Sulphides are interpreted to be syn-deformational with a paragenesis postdating that of barite. Pyrite (forming up to 40% modal) is present as two distinct phases:

i An early phase of euhedral pyrite, possibly coeval with sphalerite, that has undergone brittle deformation and partial replacement by later sulphide assemblages.

ii Late phase pyrite consisting of an overgrowth of spongy framboidal pyrites around centres of brittle deformed euhedral pyrites. This late overgrowth pyrite appears to be concentrated in zones of low pressure likely deposited as euhedral pyrites deformed.

Euhedral pyrites occur in sphalerite rich zones and contain sphalerite inclusions suggesting coeval precipitation between early phase pyrite and sphalerite. Sphalerite (forming up to 8% modal) is present as anhedral Fe-poor (low temperature) sphalerite along shear planes in barite. Lamellae in sphalerite are highlighted by fine chalcopyrite dustings along cleavage planes (chalcopyrite disease). In places sphalerite displays exsolution textures, appearing to have recrystallised and expelled chalcopyrite to grain margins or in concentrated trails. Deformation has therefore taken place during and after sphalerite deposition. Galena (forming up to 5% modal) occur as anhedral bands along margins of sphalerite and as fracture infill in pyrite. Galena exsolution textures show well developed atoll textures.

Gold, occurring as electrum, is hosted by early euhedral pyrites along fractures frequently associated with galena, chalcopyrite and occasional tetrahedrite-tennantites. Exsolution textures of electrum in pyrite is not uncommon. It is concluded that intense deformation observed in electrum rich samples (624402, 624403, 624404, 624405 and 624470) has been essential in remobilising gold from the early phase of euhedral pyrite. Deformation therefore acted to concentrate gold along fractures and interstitial to annealed pyrite grains. Deformation identified in barite-sulphide ore samples is more intense than that observed in other major Tasmanian VHMS deposits suggesting a structural control to mineralisation (Appendix II). The barite boulders are suggestive of structurally controlled low temperature gold rich mineralising system.

3.4 Geochemistry

3.4.1 Whole Rock Geochemistry

19 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, MgO, P_2O_5, Na_2O and S. analytical results are included as appendix III.

Samples from the Newton Dam Spillway units include dacite lava clasts from the Upper Breccia Sequence and massive lavas adjoining the spillway (specimens 624439 to 624443 inclusive). All samples show low Cr (<11ppm), high Zr (230-310ppm), SiO_2 contents between 60 and 72% and P_2O_5/TiO_2 ratios between 0.15 and 0.29. These results are consistent with CVC/Tyndall Group Suite I felsic lavas as defined by Crawford et al. (1992). Other felsic samples analysed include 624457 and 624458, from a likely southern extension of the dacitic massive lava outcropping adjoining spillway units. Both samples show similar whole rock geochemical characteristics to their likely counterparts 624439 and 624442, with low Cr (<60) and Zr between 170 and 260ppm, SiO_2 levels between 65 to 68% and low P_2O_5/TiO_2 ratios of 0.1 to 0.2. Analyses of a nearby porphyry (624453) shows a rhyolitic composition with low Cr (13ppm) and Zr (100ppm), SiO_2 of 70% and a P_2O_5/TiO_2 ratio of 0.43,. This porphyry sample is classified as Suite 1 CVC with unusually elevated P_2O_5/TiO_2 levels for the Suite I group.

Six samples of ARA were examined for whole rock geochemistry. Two of the samples (624444 and 624445) are from an the intrusive ARA-type unit at the base of the spillway, whilst samples 624203 and 624404 are of the same unit 150 metres west of the spillway in Newton Creek.

All samples of this intrusive unit show consistent whole rock geochemistry with previously analysed ARA. In general, the samples show Cr and Zr levels averaging 49ppm and 120ppm respectively, SiO_2 contents averaging 63% and elevated P_2O_5/TiO_2 ratios between 0.3 and 0.46. The geochemistry of these samples is atypical of Suite II type lavas (Crawford et al., 1992). An additional two samples (624456 and 624459) from ARA-type outcrop 100 metres south of the spillway show similar levels of Cr (21 to 41ppm), Zr (146 to 166ppm) and P_2O_5/TiO_2 ratios (0.37 to 0.54). Geochemical results of the intrusive andesitic unit show consistent levels of immobile elements and silica.

Two samples (624451 and 624452) of a chlorite altered andesitic-dacitic breccia unit sampled along the south road to Newton Dam were analysed. Samples 624451 and 624452 returned P_2O_5/TiO_2 ratios of 0.2 and 0.4 with low Cr (6 to 20ppm) and Zr (190 to 245ppm) respectively. The outcrop is a likely continuation of the Upper Breccia unit ascribed to the LTG in the Newton Dam Spillway with analyses confirming an andesitic to dacitic chemistry.

Three samples from Tyndall Creek area, were submitted in order to ascertain the nature of the host rock lithology to barite stockwork veining. Samples 624464, 624465 and 624466 were sampled on the western side of the Anthony Road beside Tyndall Creek. All samples were volcaniclastic in nature, with sample 624466 showing intense hydrothermal silica alteration overprint of an original volcaniclastic unit. The silica alteration is reflected in whole rock geochemistry with 80% SiO_2 present. Samples 624464 and 624465 contain an average of 23ppm Cr, 138ppm Zr, 1% TiO_2, 60% SiO_2 and low P_2O_5/TiO_2 ratios of 0.14. The elevated TiO_2 contents are reflected in hand specimen by the abundance of magnetite (up to 5% modal) as FeTi oxides.

The origin of FeTi oxides is not clear; they may represent primary magnetite and therefore a detrital component of the feldspar + quartz + lithic LTG volcaniclastic or as a result of magnetite additive hydrothermal alteration. If the former were the case the observed elevated Ti contents and enrichment in FeTi oxides are likely sourced from underlying ARA, which contain elevated proportions of FeTi oxides. Such a conclusion is consistent with observed lithic fragments and hornblende detritus as well as geochemical composition which support an andesitic/dacitic composition to the volcaniclastics in Tyndall Creek

3.4.2 REE Investigation

A total of ten rock chip samples from spillway sequences were submitted to the University of Tasmania for REE analyses. Results of the study, including rock/chrondrite plots and AMG location coordinates are presented in Appendix IV.

Anthony Road Andesite

ARA samples analysed include; 624444 and 624445 from Newton Dam Spillway outcrop and samples 624448 and 624356 from ARA outcrop beside the Anthony Road.

In all four samples ARA REE data show near identical profiles to that data presented by Crawford et al. (1992). Variations of La abundances can be attributed to fractionation processes. REE distributions indicate these ARA samples to be comagmatic.

CVC Dacites

REE investigation of dacitic units from the Newton Dam Spillway aimed to examine genetic links between spillway dacitic lava clasts in the Upper Breccia unit of Gibson (1992) and a dacite lava adjoining spillway outcrop, thereby determining whether dacite clasts were sourced directly from an adjacent dacite lava. Samples 624439 and 624442 are from dacitic lava clasts Upper Breccia unit, whilst 624440 and 624441 are from the CVC massive dacite lava. Whole rock geochemistry (Appendix III) and petrology (Appendix I) indicate samples to be similar.

Results of the REE study indicate that all dacites analysed are unrelated to ARA-type lavas and show typical CVC-type lava REE distributions as defined by Crawford et al. (1992). Dacite dome lava samples exhibit identical profiles but are distinct from dacite clast material. Therefore it can be inferred that the dacite dome and dacite clasts of the spillway are not genetically linked.

Sample 624438 is taken from a basaltic-andesitic clast of the Upper Breccia unit of Newton Dam Spillway. REE patterns show the sample to be typical of mafic CVC-type lava as described by Crawford et al. (1992), generally exhibiting lower levels of heavy REE elements.

3.4.3 Base Metal Geochemistry

Four banded massive barite-sulphide float boulders and eleven variably sulphide and/or barite rich float specimens from Tyndall Creek were submitted for base and precious metal analysis including; Cu, Pb, Zn, Ba, Au and As. Geochemical assay results are presented in Appendix III.

Banded barite-sulphide boulder analyses show elevated levels of base and precious metals. Best assay returned 0.4% Cu, 2.7% Pb, 6.1% Zn, 240ppm Ag, 12.8ppm Au, 0.4% As and 26% Ba (sample 624405). The eleven variable sulphide and/or barite rich float samples showed assay values with comparatively less base and precious metals. The samples took in a widespread occurrence of mineralisation in variably altered host lithologies with visible barite ± galena ± sphalerite disseminated mineralisation. Best assay of these samples returned 0.1% Cu, 0.1% Pb, 0.2% Zn, 77ppm Ag, 1.7ppm Au and 42% Ba. Two continuous chip samples over anastomosing stockwork barite veining (624186) and highly altered volcaniclastics (624187) from Tyndall Creek outcrop were submitted for assay. Barite stockwork veining returned 0.2% Cu, 3.3% Pb, 9.8% Zn, 66ppm Ag, 4.3ppm Au and 29% Ba, whilst volcaniclastics showed relatively low levels of base and precious metals with 9ppm Cu, 0.05% Pb, 0.04% Zn, <2ppm Ag, 0.03ppm Au and 0.6% Ba..

3.4.4 Microprobe Investigation of Electrum

Microprobe analyses of electrum grains in barite-sulphide boulder ore were determined using the Cameca SX50 at the Central Science Laboratory, University of Tasmania. The results are tabulated at the end of the petrographic report presented in Appendix II.

Microprobe results indicate electrum grains to have fineness levels between 550-650, indicative of baritic mineralisation associated with Tasmanian VHMS deposits. Mercury levels within electrum are elevated forming 0.5 to 2.0 wt%. A correlation was observed between increasing mercury levels and increasing silver levels, with decreasing gold levels in these electrum grains analysed. Euhedral pyrites were found to contain up to 0.1 wt% gold and 0.05 wt% silver in their lattice.

Elevated levels of Au in early phase euhedral pyrite would account for visible electrum in those pyrites that have undergone serious deformation, with gold remobilised into fractures and along grain boundaries.

3.4.5 Lead Isotopes

Two Pb isotope analyses were completed by Dr. B. Gemmell through the CODES Key Centre and CSIRO. Sample 623043 from DDH HA007 at 41 metres, consisted of a coarse grained galena, sphalerite and pyrite vein, whilst sample 624043 is from DDH HA008 at 141.7 metres and contains a massive pyrite clast hosted within a quartz crystal rich volcaniclastic. A further four samples were submitted to the CSIRO-Division of Exploration and Mining for Pb isotope analyses. Sample 624201 contains disseminated galena in a dacitic volcaniclastic matrix from the Newton Dam Spillway. Samples 624403 and 624405 are galena bearing barite-sulphide float boulder samples from Tyndall Creek and 624470 is galena from *in situ* barite-sulphide stockwork outcropping in Tyndall Creek. Results and accompanying report are included as Appendix V.

Three of the four CSIRO samples (624403, 624405 and 624470) show an indistinguishable Pb isotopic composition, with an average $^{206}Pb/^{204}Pb$ ratio of 18.388. Sample 623013 with a $^{206}Pb/^{204}Pb$ ratio of 18.396 is more radiogenic than these Tyndall Creek samples. Such isotopic signatures are similar although slightly more radiogenic than the most radiogenic of the Newton Dam Spillway sulphides clasts previously analysed. The relatively homogeneous grouping of Tyndall Creek data together with previously reported Henty Canal and Howards Anomaly data (Sharpe, 1992) indicate that Tyndall Creek data likely represent Cambrian mineralisation with high isotopic homogeneity.

Galena from samples 624201 and 623043 are relatively less radiogenic, with a lower $^{206}Pb/^{204}Pb$ ratio of 18.369 and 18.371 respectively. In comparison to target signatures of Cambrian VHMS mineralisation, 624201 and 624043 plot within the 95% confidence ellipse for Hellyer; whereas previously discussed galenas plot slightly outside of it. The isotopic compositions of 624201 and 623043 are compatible with Hellyer-type Cambrian mineralisation.

3.4.6 Sulphur Isotope Geochemistry

An examination of the sulphur isotopic compositions of sulphate/sulphide species from Tyndall Creek banded barite-sulphide float boulders was undertaken. In addition, sulphide species from *in-situ* anastomosing barite-sulphide veining were also considered. A total of fifteen separates were analysed, including; barite, pyrite and galena. All analytical work was carried out by the CSIRO-Division of Exploration and Mining. Results are included as Appendix VII. Difficultly in obtaining pure mineral separates for sulphur isotopic analyses was experienced due to the fine grained nature of sulphide minerals. As a result, contamination due to sulphide/sulphate phase mixing occurred in the galena separates of samples 624401 and 624403.

Results of the study indicate a complex system active during sulphide and sulphate deposition. A Cambrian age to sulphide/sulphate deposition, supported by Pb isotopic evidence, would imply Middle Cambrian seawater with an estimated $\delta^{34}S$ value near 30‰ (Solomon et al., 1988). Sulphates sourced directly from Cambrian seawater would show $\delta^{34}S$ ratios of 30‰, with codepositional sulphides having a $\delta^{34}S$ ratio of 10‰.

In context, sample 624401 with $\delta^{34}S$ ratios of 32.4‰, 24.5‰ and 12.4‰ for barite, galena and pyrite respectively, indicates sulphur sourced from incompletely reduced seawater sulphate due to mixing between seawater and upwelling reduced magmatic sulphur enriched solutions. This isotopic signature is consistent with sulphur isotope ratios observed within sulphide of the Rosebery baritic zone and the Hellyer barite cap zone. Similar results were obtained for samples 624403 ($\delta^{34}S_{galena}$= 21.5‰), 624405 ($\delta^{34}S_{galena}$= 23.1‰), 624471 ($\delta^{34}S_{galena}$= 12.1‰) and 624201 (δ^{34}pyrite 2.1‰).

Pyrites deposited from completely reduced fluids are observed in a number of the Tyndall Creek samples. Included is pyrite from; 624403 ($\delta^{34}S_{pyrite}$= 2.5‰), 624405 ($\delta^{34}S_{pyrite}$= 3.0‰) and 624470 ($\delta^{34}S_{pyrite}$= 7.1‰). A sulphur isotope signature between 0‰ and 7‰ is typical of Tasmanian VHMS deposits. These results indicate a mixing of rock sulphur and completely reduced seawater sulphate.

Samples 624405 and 624403 show incompatible sulphur isotope ratios between pyrite and galena/barite. For both samples the $\delta^{34}S$ ratios of pyrite indicate pyrite deposited from completely reduced fluids. Galena and barite $\delta^{34}S$ ratios however, indicate sulphur sourced from incompletely reduced seawater sulphate. A duality in isotopic composition may indicate a heterogeneous fluids from which sulphides/sulphates were precipitated or an evolution of the hydrothermal fluid composition with time.

Negative sulphur isotope values are recorded for samples 624201 ($\delta^{34}S_{galena}$= - 1.5‰), 624403 ($\delta^{34}S_{pyrite}$ = -3.7‰) and 624471 ($\delta^{34}S_{pyrite}$ = -1.1‰). Negative sulphur isotopic values indicate sulphur sourced from magmatic fluids. Results indicate magmatic rock sulphur derived fluid from which sulphides precipitated directly or alternatively a late stage resetting of the sulphur isotopic signature.

The latter may be ascribed to intense deformation and subsequent remobilisation during Devonian deformation.

In conclusion, sulphur isotopic values reflect the hydrothermal fluid from which the sulphur present in the sulphide/sulphate precipitating phases was derived. Clearly sulphur isotope signatures indicate a number of sources for sulphur including; incompletely reduced seawater sulphate, completely reduced seawater sulphur with a magmatic component and magmatic related sulphur bearing fluid. A complex history of sulphide/sulphate deposition for the banded barite-sulphide boulders and *in situ* vein mineralisation is concluded.

3.5 Geophysics

3.5.1 EM Survey

A single loop, 3.8 line kilometre Zonge EM survey was completed north of the former Tyndall Mine site (Plate L.MARG.61). The survey was designed to follow up a possible northern extension to a 1986 CRA UTEM anomaly (Sheppard, 1986). Horizontal and vertical component data was collected (Appendix VII).

Results are severely affected by noise associated with the proximity of transmission, but indicate a near surface formational conductor to dominate early time. The conductor location aligns with an inferred lithological boundary between CVC felsic units to the west and rhyolitic Tyndall Group volcanic to the east.

3.5.2 Helimagnetic Survey

153 line kilometres of magnetic and radiometric data was collected over the Newton Creek Prospect area. The survey was flown by Geoterrex in April 1992, 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. Magnetic data supplied by Geoterrex includes total magnetic intensity contours (Plate ANT.B. 7/1), stacked profiles (Plate ANT.B. 10/1) and flight path data with tie line locations (Plate ANT.B. 6/1). Radiometric data was collected simultaneously using a Nuclear Data gamma ray spectrometer, with windows measuring total count, potassium, uranium and thorium. Colour contoured radiometric data supplied by Geoterrex is included as Plates L.MARG.70-73 inclusive. Comprehensive survey specification details are supplied in Appendix VIII. In addition, a digital elevation model (Plate L.MARG.69) was produced using GPS navigation data from the helimagnetic survey.

Helimagnetic and radiometric survey data was aimed to enhance and refine geological and lithological understanding and provide a means by which a structural framework for the area could be developed.

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 magnetic response shows a significant increase in amplitude from background levels in older CVC felsic volcanics in the west to high amplitude responses of the Tyndall Group in the east. Sections through the Newton Creek Prospect have been developed and included as Plates L.MARG.68A &68B.

CVC felsic volcanics are present in western portions of the prospect area. Their magnetic response shows comparatively low to background levels. CVC units in the west are in faulted contact with highly magnetic Henty Fault Wedge tholeiites by the South Henty Fault (SHF). An eastern contact between CVC and ARA units is difficult to identify magnetically. CVC units include a number of small magnetic intrusives proximal to the Newton Dam area. A rhyolitic porphyry is evident at AMG GR 380000mE, 5257700mN and an ARA-type intrusive unit near the Newton Dam Spillway AMG GR 379000mE, 5358600mN. Petrology of the ARA intrusive unit to CVC felsics indicate a high content of FeTi oxides. As a result the unit shows an elevated magnetic response that permits actual mapping of the intrusive unit. Susceptibility measurements of this unit show readings of 30 to 40 cgs. This intrusive body (shown as ϵ_{cvd} Plate L.MARG.67) shows dual peaks and indicates the intrusive has undergone structural modifications.

ARA forms two magnetically discreet groups; ARA with an elevated magnetic response and ARA with a background response. Magnetic ARA, as previously identified from petrology, is the result of abundant primary FeTi oxide phenocrysts (up to 5% modal) and finely dispersed magnetite through the groundmass of the lava/breccias. Non-magnetic andesite is the result of magnetite destructive hydrothermal alteration. The presence of two magnetically distinctive ARA lavas indicate differences exists within the ARA lava pile. These differences are not geochemically reflected in immobile or REE elements, but likely 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.

The contact between magnetic ARA and LTG is difficult to establish from magnetic data. Against this contact, epiclastics of the LTG show a comparable magnetic signature to ARA. Field observations also indicate the contact to be a complex interfingering association and thus is inferred primarily from available outcrop and previous mapping reported in Meares et al. (1981). LTG units, broadly of andesitic to dacitic compositions, show elevated magnetic responses. These responses are the result of abundant magnetite grains in the groundmass. It has not been recognised what proportions of this magnetite are detrital or products of magnetite additive hydrothermal alteration. Also assigned to the LTG are units of Howards Tuff; a highly sheared haematite + chlorite + magnetite altered unit. Howards Fault, a sharp magnetic linear, forms the geological boundary between LTG and Middle Tyndall Group (MTG).

The magnetic response of the MTG shows a high amplitude, short wavelength nature. MTG units show elevated abundances of magnetite and can be magnetically mapped. South of 5359000mN, MTG units show a north-south strike and a faulted contact with Ordovician sediments by the Great Lyell Fault (GLF). North of 5359000mN MTG is absent and CVC units are directly overlain by Upper Tyndall Group (UTG) units. UTG show an elevated magnetic response relative to CVC units but have a comparatively lower magnetic response than its MTG counterpart in the south. Ordovician sediments east of MTG and UTG volcanics show low to background magnetic signatures.

Structural Implications

Magnetic data indicates the Newton Creek Prospect to be a structurally complex area as exemplified in outcrop by structural elements exposed in the Newton Dam Spillway. The aim of the magnetic survey was to define a structural framework in which apparent lithological variations could be explained in the context of

Cambrian syn-depositional faults. Structural interpretation of magnetic data identified discontinuities or magnetic continuity breaks in the data. The analyses of magnetic map patterns and discrete structural breaks form the structural framework and is presented on Plate L.MARG.66. [aside: structures, where applicable, are named according to their western most easting and northing coordinates.]

Three major discrete structural breaks are interpreted. Each form a deep seated structure and show associated broad magnetic gradients. The structures, shown on Plate L.MARG.66. are:

(i) NNE basement Volcanic Fissure:- shows a linear surface expression with an alignment of volcanic centres indicated by a presence of intrusive units at surface.

(ii) 797583 NE South Normal:- associated with a major facies change, separating massive ARA in the south from CVC/LTG volcanics to the north.

(iii) 797583 NE North Normal:- associated with a major facies change, separating CVC/LTG volcanics in the south from CVC/UTG units in the north.

The 797583 North and South Normal Faults are interpreted to have formed a graben type structure with localised sub-basin development during LTG deposition. Between the 797583 North and South Faults a dramatic thickness increase to the LTG is interpreted. This zone between the two syn-depositional faults is the locus of stratigraphic complications that include:

- dramatic facies changes from ARA/LTG in the South to CVC/UTG in the north, reflecting a compositional change from intermediate to felsic domains

- site of abundant intrusive volcanic centres in both CVC and Tyndall Group units

- Flexure in the GLF as indicated by change in fault direction

The NNE Basement Volcanic Fissure intersects the two 797583 Normal Faults close to the site of the Newton Dam Spillway. Geological considerations support the interpretation that these three structures are Cambrian syn-volcanic structures.

The Great Lyell Fault (GLF)

The GLF is defined on surface south of the 797583 South Normal Fault as the faulted contact between Ordovician sediments and MTG. The age of the GLF is inferred to be Late Cambrian with Devonian reactivation and forms a basin bounding structure to the Newton Creek prospect domain. The GLF dips steeply west and is variably segmented by late Devonian/reactivated Cambrian faults. Magnetically, the GLF is depicted by a sharp magnetic break contrasting magnetically intense LTG/MTG from poorly magnetic Ordovician sequences of the Owen Conglomerate.

North of the 797583 South Normal Fault the GLF shows a flexure with a change in orientation from north-south to a more NNW-SSE trend. In this area the GLF does not form the contact between Owen Conglomerate and UTG, but is hosted by Ordovician sediments. In this area Owen Conglomerate sequences rest disconformably over UTG west of the GLF.

South Henty Fault

The South Henty Fault (SHF) forms a magnetically abrupt boundary between Henty Fault Wedge Tholeiites and CVC stratigraphy. The SHF trends north to NNE and is variably segmented by late faulting. Dipping steeply west the SHF is interpreted to form the western basin bounding structure to the Newton prospect basin.

Remainder faulting identified in the area show two preferred orientation patterns

(i) NW trending fault zones e.g. Tyndall Creek Fault, 798574 Fault, 800590 Fault, Canal Fault.

(ii) NE trending fault zones e.g. 789567 Fault, 800567 Fault

It has not been possible to categorise the interpreted array of NW and NE 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. Howards Fault zone forms a pronounced north-south magnetic zone parallel to Tyndall Creek and the Howards Tuff unit. Mineralisation and alteration associated with Howards Tuff is likely the result of preferential alteration due to hydrothermal fluid focussing along a pre-existing structure.

Howards Fault is segmented by short NNW fault lineaments and terminates against the NE trending 797583 North Normal Fault. The structural network of faults observed confirms a complex structural history for the prospect area.

Radiometric Data

Total count radiometric data (plate L.MARG.73) together with U, Th, K (plates L.Marg.70-72) data have proved to be of limited use. Pronounced features in the datasets are largely due to cultural effects particularly the Anthony and Howards Road sites. Radiometric differences are observed between ARA and CVC lithologies, however further interpretation is required to evaluate whether these radiometric variations are the result of vegetation changes.

3.6 Newton Creek Prospect Geo-Magnetic Summary

The Newton Creek Prospect area forms a fault bounded intermediate to felsic Cambrian volcanic basin south of the Henty Fault Zone. Basin bounding structures are the SHF and GLF, each which show segmentation due to late stage faulting. Basin development was likely the response of a Cambrian extensional event, during which time volcanic activity commenced, filling the subsided basin. Volcanic activity included extrusion of ARA and CVC felsic lavas and related debris flows. Well sorted epiclastic sandstones and siltstones of the UTG likely represent the waning of volcanic activity.

During basin development and subsequent volcanic activity, a localised sub-basin developed over the site of the Newton Creek valley, presently filled by the Newton Dam. The Newton sub-basin is fault bounded by the 797583 North and South Normal Faults. The sites of these two faults are inferred from broad magnetic breaks and supported by geological data. Both Normal Faults align with shallow structures that offset the GLF and are likely the result of reactivation along pre-existing structures.

Development of the Newton sub-basin is thought to be the result of a change in the extensional direction from NW-SE to NNW-SSE extensional direction (refer Figure 2). This change in extension direction would also explain the dilational jog or flexure in the GLF from N-S to NNW-SSE at the site where the 797583 North and South Normal Faults intersect the GLF. The proximity of CVC and Tyndall Group intrusives to the two Newton sub-basin bounding structures would indicate magmas were focussed by these structural conduits.

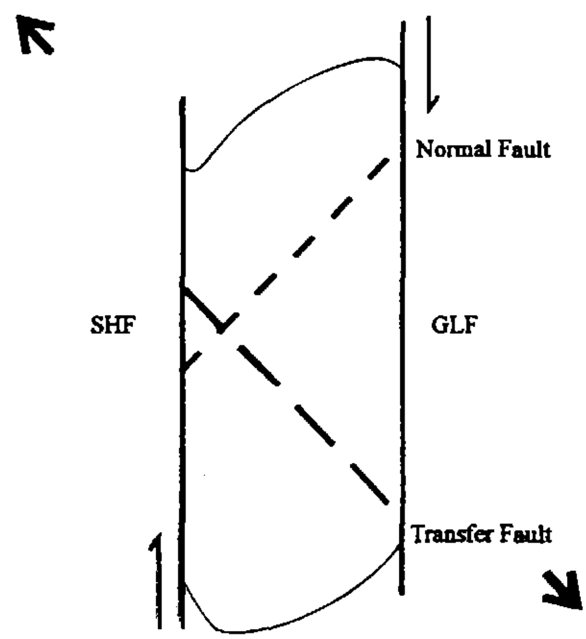
Across the Newton sub-basin, marked changes in geology are observed. The most significant change is that within Tyndall Group Volcanics. UTG epiclastics are only present north of the Newton sub-basin overlying CVC units. South of the Newton sub-basin the Tyndall Group consists of MTG and LTG units overlying ARA. The stratigraphic differences within Tyndall Group Units reflect provenance and geology of source areas. LTG debris flows and volcaniclastics are derived locally from underlying ARA and CVC lavas and interfinger upper portions of both. Deposition of LTG into the Newton sub-basin indicates subsidence of the sub-basin due to the observed thickening of LTG units in this area. Massive sulphide clasts from the Newton Dam Spillway, barite + gold mineralisation in Tyndall Creek and sporadic Pb + Zn + Ag mineralisation at Howards Anomaly occur within LTG units.

At present it is not possible to differentiate an internal stratigraphy of LTG units due to limited exposure. The observed occurrences of mineralisation indicate LTG units show potential as a host horizon for massive sulphide and barite-gold mineralisation.

FIGURE 2 : Rotational Cambrian Extension Field within a Strike-Slip Basin

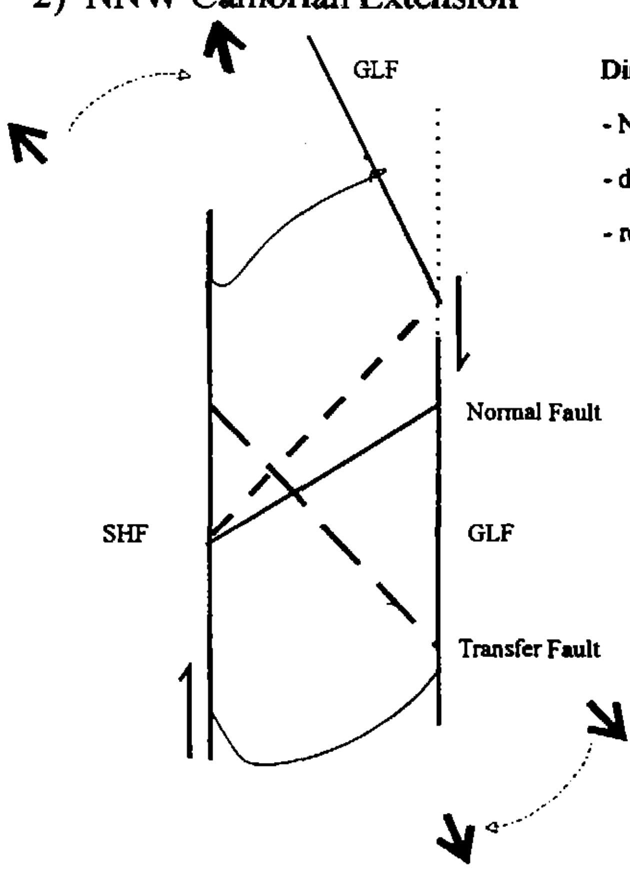
WEST **EAST**

1) NW Cambrian Extension



- North-South Basin Boundary Structures
- NE Normal Faults
- NW Transfer Faults

2) NNW Cambrian Extension



Directional change in extension field (pull-apart basin)

- NNW GLF trend (// to Transfer direction)
- development of ENE Normal faults
- reactivation of existing Transfer orientation

4.0 CONCLUSIONS AND RECOMMENDATIONS

The LTG units show potential to host massive sulphide mineralisation as well as barite-gold mineralisation as indicated by massive sulphide clasts in the Newton Dam Spillway and gold rich barite stockwork in Tyndall Creek respectively. Structural and geological controls present in the Newton sub-basin indicate:

- A Cambrian extension period during which time subsidence of the Newton sub-basin occurred

- Broad thickening of LTG units within the Newton sub-basin

- Structurally focussed intrusive units proximal to basin margins

Potential therefore exists for structurally controlled massive sulphide or barite-gold mineralisation within the LTG stratigraphy or at the LTG contact with ARA/CVC time equivalents. Mineralisation potential within the Newton sub-basin can only be tested by deep stratigraphic drilling.

A short diamond drilling programme in the vicinity of in situ barite-sulphide anastomosing veining in Tyndall creek is also recommended to test the dip extent, strike length and continuity of the outcropping veining system.

5.0 REFERENCES

Crawford, A.J., Corbett, K.D. and Everard, J.L., 1992. Geochemistry of the Cambrian Volcanic-Hosted Massive Sulphide Rich Mount Read Volcanics, Tasmania, and some Tectonic Implications. *Econ.Geol.*, .89:597-619.

Fitzgerald, F.G., 1987. E.L. 9/66 Tyndall area, Tasmania. Gold Fields Exploration Pty.Ltd. Unpublished Relinquishment Report.

Gibson, R.,P., 1991. The Geology of the Mount Read Volcanics in the Anthony Road - Newton Creek Area, Western Tasmania. Geology Department, University of Tasmania. Unpublished Honours Thesis.

Hutton, D.J., 1989. The structure, stratigraphy and palaeovolcanology of the Cambrian Mount Read Volcanics, Anthony Road Traverse, Queenstown, Tasmania. Dept. Earth Sci., Monash University. Unpublished Honours Thesis.

Meares, R.M.D., Hutton, M.J. and Komyshan, P., 1981. E.L. 9/66 Tasmania. Annual Report for the period 1980-1981. Mount Lyell Mining and Railway Company Limited. Unpublished Report

Richardson, S., 1991. Lake Margaret E.L. 5/85 Tasmania. Technical Progress Report for the period October 1990 to September 1991. Aberfoyle Resources Ltd. Unpublished Report.

Sharpe, R., 1992. Lake Margaret E.L. 5/85 Tasmania. Technical Progress Report for the period October 1991 to September 1992. Aberfoyle Resources Ltd. Unpublished Report.

Sheppard, W.A., 1986. Lake Margaret E.L. 5/85. Progress Report for 12 months to 20" September 1986. CRAE Internal Report No. 14133.

Solomon, M., Eastoe, C.J., Walshe, J.J. and Green, G.R., 1988. Mineral deposits and sulphur isotope abundances in the Mount read Volcanics between Que river and Mt. Darwin, Tasmania. *Econ. Geol.*, 83:1307-1328.

APPENDIX I

SAMPLE NUMBER: 624203

LOCATION: Anthony Basin: Magnetic Susc: 10.5

SUMMARY:

This is a plagioclase+hornblende+quartz+FeTi oxide-phyric dacitic lava comagmatic with the more typically hornblende-rich Anthony Rd hornblende andesites. It shows weak alteration probably of burial metamorphic origin.

HAND SPECIMEN:

This is a dark grey plagioclase+hornblende-phyric andesitic lava strikingly similar to 624456 in hand specimen.

THIN SECTION:

This sample is a rather evolved, probably dacitic variant of the Anthony Rd - Crown Hill hornblende andesite type. Hornblende phenocrysts are less abundant (a few modal%) than in most of the other samples of these hornblende andesites. Albitized plagioclase phenocrysts make up more than 20 modal% of this sample, and are blocky prisms less than 2mm long with light sericite speckling. Three or four large former hornblende phenocrysts with small albite inclusions are totally replaced chlorite, calcite and minor quartz, and streaks of tiny leucoxene-altered opaques. Quartz phenocrysts are rounded and resorbed, and probably make up 1-2 modal% of this rock. The FeTi oxides phenocrysts are almost entirely fresh, although a few crystals appear to have been disaggregated, with chlorite along fractures. Apatite microphenocrysts are not uncommon in this sample.

The groundmass of this sample is very similar to that of 624456. It is a rather heterogeneous mainly fine-grained quartzo-feldspathic intergrowth after devitrified glass, and contains common fine-grained chlorite and tiny apparently fresh magnetite granules. Minor calcite occurs as small patches and streaks overprinting small areas of the groundmass.

This is a low-grade burial metamorphosed plagioclase+hornblende +quartz+FeTi oxide-phyric dacitic lava obviously comagmatic with the slightly more mafic Anthony Rd-type hornblende andesites that dominate this set of rocks. The fresh FeTi oxide phenocrysts and groundmass grains account for the high magnetic susceptibility of the rock. .

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.

SAMPLE NUMBER: 624406

LOCATION: Anthony Basin: Magnetic Susc: 10.4

SUMMARY:

This is a strongly hydrothermally altered felsic crystal vitric tuff with extensive development of red jasper, which is essentially a recrystallized chalcedony-hematite-magnetite replacement of the original rock.

HAND SPECIMEN:

This is a highly altered andesitic(?) lava breccia with several small angular inclusions, and one very large 3cm wide bright red jasperoid inclusion. It is clearly much more magnetic than the other samples described so far from this set.

THIN SECTION:

In the least altered parts of this sample, it is apparently a (still highly altered) crystal vitric tuff with a 'false brecciated' texture. Variable-sized (mainly <0.5mm long) and often broken phenocrysts of albite and subordinate quartz make up about 5 modal% of the rock. The broken plagioclase phenocrysts contain tiny dispersed sericite flakes, and minor chlorite. Quartz phenocrysts are angular, broken and in some instances, disaggregated 'in situ' in the thin section. The groundmass of the rock is very heterogeneous and altered. It was probably glassy, and altered to a very fine-grained quartzo-feldspathic intergrowth that was subsequently strongly overprinted by chlorite and sericite. In places, the chlorite-sericite alteration forms quite a dense meshwork through the rock. There is common fine-grained magnetite through the groundmass, although FeTi oxide phenocrysts are thoroughly altered to leucoxenitic material, and many are stretched and streaked into the weak sericite-chlorite defined foliation.

The jasperoid part of this rock also contains plagioclase phenocrysts in the less altered areas, indicating that it is essentially a replacement feature, rather than an intrusive vein. As the alteration becomes more intense into the jasper, the texture becomes a very unusual ameboid intergrowth of exceptionally fine-grained silica riddled with black hematite dust and occasional equant idiomorphic magnetite crystals that are always <0.1mm across, generally much smaller than this. This strange ameboid quartz-magnetite intergrowth is transected by an intersecting series of very narrow veinlets of very fine-grained polycrystalline silica that are quite free of magnetite or hematite. Interestingly, these veinlets do not extend beyond the margins of the jasper, and stop quite abruptly at the contact with the non-jasperoid part of this rock.

I suggest that this jasperoid part of the rock, which is essentially free of calcite, chlorite and sericite, represents part of the original rock that was soaked with Fe-rich silica solutions, probably becoming a hematitic chalcedony gel. Drying of the gel produced cracks limited to the jasperoid part of the rock, and residual silica solutions drained into the cracks and solidified. I am not sure that the magnetite grains are recrystallized; they may be a primary hydrothermal magnetite.

SAMPLE NUMBER: 624408

LOCATION: Anthony Basin: Magnetic Susc: 0.69

SUMMARY:

This is a plagioclase+hornblende+augite+FeTi oxide-phyric andesitic autobrecciated lava correlated with the Anthony Rd hornblende andesites. It shows a low-grade burial metamorphic alteration assemblage (silica-epidote).

HAND SPECIMEN:

This is a plagioclase+hornblende-phyric andesitic lava with hornblende phenocrysts to almost 1cm long.

THIN SECTION:

This sample is a very distinctive plagioclase+hornblende+augite-phyric andesitic lava breccia rather different from the typical Anthony Rd andesites, although clearly correlated with them. Plagioclase phenocrysts make up some 10 modal% of the sample, and are single, tabular crystals of albite with variable but quite strong replacement by exceptionally fine-grained epidote. Hornblende phenocrysts are much larger and are quite fresh. They make up about 5-7 modal% of this sample and, in contrast with most of the Anthony Rd-type andesites, are rather resorbed and euhedral. Augite phenocrysts are clear, small, equant fresh euhedra to about 0.5mm long that also make up about 3-5 modal% of the sample. They sometimes occur in clusters of 10-20 small crystals that may be small cognate inclusions. Former FeTi oxide phenocrysts were not common and are all altered to a chlorite core with messy brownish black leucoxenitic rims. Apatite occurs only as occasional small microphenocrysts in comparison with the usually significantly much larger crystals in typical Anthony Rd andesites.

This sample is clearly autobrecciated, and the dense dark groundmass of devitrified glass is shattered and pervaded by fractures composed of much lighter coloured material that is dominated by extremely fine-grained silica. Scattered patches of dense ultra fine-grained brownish epidote are common throughout the groundmass.

This autobrecciated andesitic lava probably crystallized at conditions under which hornblende was relatively unstable, as judged by the reacted appearance of the hornblende. It presumably was breaking down and forcing crystallization of small augite crystals just before it was explosively erupted. These conditions to destabilize hornblende may have been heating of the magma in the magma chamber due to emplacement of hotter basalt into the base of the magma chamber. The sample shows a low-grade burial metamorphic alteration assemblage.

SAMPLE NUMBER: 624410

LOCATION: Anthony Basin: Magnetic Susc: 20.7

SUMMARY:

This is a plagioclase-phyric dacitic lava with lithic fragments of Anthony Rd-type hornblende andesites; the rock was very similar originally to 624209, but now shows a strong sericite-magnetite-epidote hydrothermal alteration assemblage.

HAND SPECIMEN:

This is a grey, altered plagioclase-phyric andesitic or dacitic rock with lithic fragments(?) of hematite-altered lava.

THIN SECTION:

This sample is intensely altered to a sericite-epidote assemblage that overprints the entire rock. It was clearly a strongly plagioclase-phyric lava or tuff, with in excess of 25 modal% of plagioclase phenocrysts. Except for occasional cores of albite, these plagioclase phenocrysts have been thoroughly replaced by dense colourless sericite, with occasional small granules of epidote scattered through it. No obvious former mafic phenocrysts are present, although quite a number of darker, hematite-rich lithic fragments composed of small plagioclase phenocrysts in a highly altered matrix are present in the rock, and obvious in hand specimen. I can't convince myself that any of these darker areas were former hornblende phenocrysts, although that possibility cannot be ruled out in a rock as stuffed as this. Interestingly, apatite microphenocrysts are common in the dark 'lithic fragments'. The FeTi oxide microphenocrysts and phenocrysts in this rock are surprisingly well-preserved, and are apparently unaffected by the intense alteration. There is no obvious quartz in this sample.

The groundmass of this rock was probably composed of abundant plagioclase phenocrysts in glass, but has been totally altered to sericite and fine, granular epidote. Abundant disseminated opaques are probably magnetite, and may be secondary, although it is difficult to be certain. This sample is strikingly similar to 624209, although I have no idea whether it is possible that they might come from the same unit. It was probably a dacitic lava which incorporated glassy fragments of Anthony Rd-type hornblende andesite during emplacement. The alteration assemblage, sericite - magnetite - epidote is most unusual, definitely of hydrothermal origin, and is responsible for this highest magnetic susceptibility reading among the samples provided.

SAMPLE NUMBER: 624439

LOCATION: Newton Ck Spillway: Magnetic Susc: 0.21

SUMMARY:

This is a calcite+sericite-altered formerly glassy plagioclase-phyric dacitic lava.

HAND SPECIMEN:

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

THIN SECTION:

This sample is petrographically simple, consisting of around 15 modal% of blocky albitized plagioclase phenocrysts to about 2mm max long, partially altered to calcite and fine-grained sericite. These are almost always gathered in multi-crystal clots of 4 or 5 crystals. There are no mafic phenocrysts in this sample, and occasional small FeTi oxide phenocrysts are partially to completely altered to leucoxene.

The groundmass of this sample was glassy, but has devitrified and then been quite strongly overprinted and recrystallized during weak to moderate hydrothermal alteration that produced abundant very fine-grained chlorite. The groundmass is pervaded by a dense meshwork of sericite.

This is a plagioclase-phyric formerly glassy dacitic lava that has suffered moderate hydrothermal alteration producing an earlier chlorite alteration that has been overprinted by sericite-calcite alteration.

SAMPLE NUMBER: 624440

LOCATION: S Side of the Newton Ck Spillway:
Magnetic Susceptibility: 0.15

SUMMARY:

This is a formerly glassy plagioclase-phyric dacitic lava very similar originally to 624439; it shows moderate hydrothermal chlorite alteration that has been overprinted by weak calcite-sericite alteration.

HAND SPECIMEN:

This is another dark green plagioclase-phyric andesitic lava very similar in hand specimen to 624439.

THIN SECTION:

This sample is petrographically quite similar to the previous sample 624439 in both relic primary characteristics and texture, and style and extent of alteration. It was a glassy plagioclase-phyric dacitic lava in which most of the plagioclase 'phenocrysts' are mainly clusters of more than three subhedral crystals of albite. These show a rather more patchy habit than in 624439, and contain small chloritic inclusions, and many are partially or totally replaced by calcite. A few small totally altered former mafic phenocrysts are present, now replaced by calcite and chlorite; their shapes suggest that they were probably augite. FeTi oxide phenocrysts are not common and are entirely altered to leucoxene.

The glassy groundmass of this sample devitrified and then recrystallized to a patchy mosaic intergrowth of quartz and albite that has been very strongly overprinted by very fine-grained chlorite. Small patches of anhedral quartz occur commonly through the altered groundmass, and a rather diffuse mesh of pale sericite permeates the rock, but is less well-developed than in 624439.

This is another moderately hydrothermally-altered plagioclase-phyric formerly glassy dacitic lava, very similar indeed to 624439.

SAMPLE NUMBER: 624441

LOCATION: Anthony Basin: Magnetic Susc: 0.21

SUMMARY:

This is a weakly chlorite-sericite-altered formerly glassy plagioclase-phyric dacitic lava.

HAND SPECIMEN:

This is a dull grey-green plagioclase-phyric dacitic lava very similar to the previous sample 624440.

THIN SECTION:

This sample is very similar petrographically to the previous sample 624440, except that it contains rather fewer plagioclase phenocrysts. The albitized plagioclase phenocrysts in this rock make up about 5 modal% of the rock and are blocky to tabular euhedral crystals strongly overprinted by fine-grained sericite. A single chlorite-altered small augite phenocryst is present, and all FeTi oxide phenocrysts, which are quite sparse, are altered to dark leucoxenitic material.

The groundmass of this sample, as for the previous rock, is a quartz-feldspar mosaic-textured product of recrystallization of devitrified glass. Abundant small blebs and patches of anhedral quartz have grown from the altered groundmass, and very fine-grained green chlorite is common throughout the groundmass, although not as abundant as in 624439 and 624440. A mesh of fine-grained sericite pervades much of the rock.

This is a weakly hydrothermally altered plagioclase-phyric formerly glassy dacitic lava very similar to 624440.

SAMPLE NUMBER: 624442

LOCATION: Anthony Basin: Magnetic Susc: 0.10

SUMMARY:

This is a formerly glassy plagioclase-phyric dacitic lava with quite weak sericite-chlorite hydrothermal alteration.

HAND SPECIMEN:

This is a mid-green slightly foliated plagioclase-phyric dacitic to andesitic lavas.

THIN SECTION:

Yet another petrographically simple (ie boring) moderately plagioclase-phyric dacitic lava with about 10 modal% of albitized plagioclase phenocrysts that show very patchy alteration to very fine-grained sericite. Most plagioclase phenocrysts occur in multi-crystal clots of 3 or more crystals. There were no former mafic phenocrysts in this rock. Former FeTi oxide phenocrysts are uncommon, and are altered to messy dark brown leucoxene.

The formerly glassy groundmass of this rock is altered to a rather uniform-textured very fine-grained quartzo-feldspathic intergrowth from which abundant small anhedral patches of quartz have crystallized. The groundmass is characterized by local development of wavy, discontinuous chlorite laminae that make the sample appear slightly foliated. Very fine-grained sericite is abundant and forms streaks and a patchily-developed mesh throughout the groundmass.

This is a very weakly hydrothermally-altered (chlorite-sericite) plagioclase-phyric formerly glassy dacitic lava, very similar to the three preceding samples.

SAMPLE NUMBER: 624443

LOCATION: Newton Ck Spillway: Magnetic Susc. 0.14

SUMMARY:

This is a plagioclase-phyric vitric crystal tuff, with weak hydrothermal alteration (silica-chlorite); it is unrelated to the Anthony Rd-type andesites.

HAND SPECIMEN:

This is a dark grey-green, quite altered plagioclase-phyric andesitic lava with a very uneven distribution of phenocrysts.

THIN SECTION:

This sample is not a lava, but a crystal vitric tuff. It contains about 10 modal% maximum of strongly sericite-altered, albitized rather blocky plagioclase phenocrysts in a thoroughly recrystallized formerly vitric ash matrix. The plagioclase phenocrysts are usually less than 2mm long. There are a few small euhedral chlorite pseudomorphs after probable augite, and former FeTi oxide phenocrysts and microphenocrysts are altered to messy brown leucoxene.

The groundmass/matrix of this sample is a rather coarsely recrystallized and heterogeneous-textured quartzo-feldspathic intergrowth after vitric ash. Vitric ash shard shapes are preserved in places, despite their having been replaced by quartz. Chlorite is quite abundant throughout the groundmass, and small spots and aggregates of dark yellowish epidote are also not uncommon. Microshear zones through the groundmass are much finer-grained, and contain abundant sericite.

This is a felsic vitric crystal tuff, most unlikely to be related to the Anthony Rd andesites; it has suffered weak to moderate hydrothermal alteration, producing a silica+chlorite-dominated assemblage.

SAMPLE NUMBER: 624444

LOCATION: Anthony Basin: Magnetic susc. 4.57

SUMMARY:

This is a plagioclase+hornblende+quartz-phyric andesite lava or dyke rock, that shows low-grade burial metamorphic alteration.

HAND SPECIMEN:

This is a reddish strongly porphyritic plagioclase+hornblende-phyric andesitic lava with hornblende phenocrysts to at least 1cm long. It is very similar in hand specimen to 624358.

THIN SECTION:

This sample is a texturally well-preserved plagioclase+hornblende+quartz-phyric andesitic lava. Plagioclase phenocrysts are albitized, and make up around 30 modal% of the rock; they are mainly 1-2mm-sized tabular to blocky euhedra with very slight sericite speckling. Former hornblende phenocrysts are mainly perfectly formed euhedral crystals up to 5mm long in the slide, and they constitute around 10 modal% of this rock. They frequently contain small albite inclusions and are entirely altered to a chlorite with common tiny angular Fe-oxide granules in some crystals. Quartz phenocrysts make up about 2-4 modal% of the rock and are quite rounded and reacted and show strong internal strain features. Former FeTi oxide phenocrysts are mainly apparently fresh opaque grains with some disaggregation around the margins.

The groundmass of this sample is vitrophyric to almost holocrystalline, and is composed of abundant laths of albite with interstitial sugary-textured quartzo-feldspathic material, probably after glassy mesostasis. Abundant apparently fresh tiny FeTi oxide grains are present throughout the pinkish groundmass. Small segregations of polycrystalline quartz and intergrown chlorite are not uncommon.

This is probably from a dyke or from the interior of quite thick flow. It is a low-grade burial metamorphosed plagioclase+hornblende+quartz-phyric andesite

SAMPLE NUMBER: 624445
LOCATION: Anthony Basin: Magnetic Susc: 6.75

SUMMARY:

This is a low-grade burial metamorphosed plagioclase +hornblende+quartz+apatite+FeTi oxide-phyric andesitic lava or shallow intrusive rock correlated with the Anthony Rd andesites.

HAND SPECIMEN:

This is a rather fresh plagioclase+hornblende-phyric andesite lava with hornblende phenocrysts to 1cm long in a dull red-brown groundmass.

THIN SECTION:

This sample is another typical Anthony Rd - Crown Hill hornblende andesite. It contains about 40 modal% of phenocrysts of plagioclase (30%), hornblende (5-8%) and quartz (<3 modal%). The plagioclase phenocrysts are blocky to prismatic, very slightly rounded, and contain chloritized melt inclusions parallel to some crystal faces. They are up to about 5mm long, and show slight to moderate sericite speckling. In this section, hornblende phenocrysts are up to about 3mm long, show pale yellow to mid-green pleochroism, and vary from slightly to totally replaced by bright green chlorite and minor epidote. Most big crystals contain one or more inclusions of albitized plagioclase. Quartz phenocrysts are small (<1mm across) and highly reacted and resorbed, forming strongly embayed and rounded crystals that occasionally contain small chloritized melt inclusions. A few apatite phenocrysts are present, and all the FeTi oxide phenocrysts, which were quite uncommon, are replaced by chlorite and leucoxene.

The groundmass of this sample consists of tiny albite laths and microlites in a pinkish interstitial quartzo-feldspathic matrix after glass. The groundmass contains common tiny FeTi oxides, but these appear to be altered to leucoxene. Chlorite is common throughout the groundmass, although it does not appear to be directly replacing a groundmass mafic phase. A few patches of anhedral secondary quartz intergrown with chlorite are also present, and narrow quartz-epidote veinlets cut the rock.

This is a typical Anthony Rd-type plagioclase+hornblende+quartz +FeTi oxide +apatite-phyric andesitic lava or shallow intrusive rock that shows a low-grade burial metamorphic overprint. I am at a loss to explain the high magnetic susceptibility of this sample. Unlike the other fairly fresh hornblende andesites with high susceptibilities AND FRESH FeTi oxide phenocrysts, the FeTi oxides as phenocrysts and in the groundmass of this sample are thoroughly altered to leucoxene.

SAMPLE NUMBER: 624451

LOCATION: Anthony Basin: Howards Anomaly: Mag. Susc.0.58

SUMMARY:

This is a formerly glassy, strongly hydrothermally chlorite-altered plagioclase-phyric andesitic to dacitic lava or lava breccia.

HAND SPECIMEN:

This is a dark green, intensely chlorite-altered andesitic lava or lava breccia.

THIN SECTION:

This sample is a very strongly altered plagioclase-phyric andesitic lava or lava breccia. Throughout most of the rock, the primary texture has been quite extensively overprinted and almost obliterated in many places. Albitized plagioclase phenocrysts make up about 5-8 modal% of the rock and are fairly small (<1mm long), subhedral, and often appear broken. It is not obvious that any former mafic phenocrysts were present in this rock, although a few strongly chloritized rather prismatic shapes may have been former mafic phenocrysts. Alternatively, they may be lozenge-shaped boudins of chlorite in a strongly chloritized groundmass. Former FeTi oxide microphenocrysts are uncommon, and are altered to dense brown leucoxenitic material.

The groundmass of this sample was probably glassy originally. It has devitrified, and recrystallized to a fine-grained sugary quartzo-feldspathic intergrowth. This has been very strongly fractured and recrystallized again during hydrothermal alteration, which produced extensive chloritic alteration. This is often concentrated in bands up to several mm wide that defines a discontinuous and wavy foliation.

This rock was probably a plagioclase-phyric glassy andesitic to dacitic lava. The lack of apatite phenocrysts, that are resistant to alteration, and other textural details suggest that this sample was probably not an 'Anthony Rd-Crown Hill-type' hornblende andesite. It has suffered strong hydrothermal chlorite alteration.

SAMPLE NUMBER: 624453

LOCATION: Anthony Basin: Magnetic Susc: 1.80

SUMMARY:

This is a formerly glassy plagioclase+quartz-phyric rhyolitic lava with moderate chloritic hydrothermal alteration.

HAND SPECIMEN:

This is a brown, strongly plagioclase+quartz-phyric

THIN SECTION:

This sample is a highly plagioclase+quartz+FeTi oxide-phyric rhyolitic lava. Rounded and reacted quartz phenocrysts are up to 4mm across and are commonly fractured and disaggregated, with extensive subgrain recrystallization along the fractures. These make up around 5 modal% of the rock. Albitized plagioclase phenocrysts are blocky, up to about 2mm across, and slightly sericitized. They make up about 15 modal% of the rock, and often occur as multi-crystal clots. FeTi oxide microphenocrysts are not common, but are almost all apparently fresh. A few have trails of fine-grained magnetite or hematite extending away from the grains where it is transected by foliation planes.

The groundmass of this sample was undoubtedly glassy. It devitrified, and then has recrystallized to a brownish intergrowth composed of exceptionally fine-grained quartzo-feldspathic material riddled with fine chlorite, and containing abundant anhedral small patches of secondary quartz. A wispy web of sericite pervades parts of the section.

This rock is a plagioclase+quartz+FeTi oxide-phyric formerly glassy rhyolitic lava that has suffered weak to moderate hydrothermal alteration, producing pervasive chloritization of the groundmass.

SAMPLE NUMBER: 624456

LOCATION: Anthony Basin: Magnetic Susc: 12.8

SUMMARY:

This is a plagioclase+hornblende+quartz+FeTi oxide-phyric andesitic lava of the Anthony Rd -Crown Hill-type. It shows weak hydrothermal or surficial carbonate alteration that surprisingly has left the FeTi oxides fresh.

HAND SPECIMEN:

This is a quite dark grey plagioclase+hornblende-phyric andesitic lava.

THIN SECTION:

This sample was another plagioclase+hornblende+quartz+FeTi oxide-phyric andesitic lava of the Anthony Rd-type. Former plagioclase phenocrysts are albitized, and make up around 15-20 modal% of the rock, but are strongly replaced by fine-grained chlorite and sericite. They are rarely longer than 2mm. Former hornblende phenocrysts are up to at least 3mm long and make up perhaps 5 modal% of this rock. They are thoroughly replaced by fine-grained chlorite and calcite and often contain inclusions of albitized plagioclase and FeTi oxides. Quartz phenocrysts make up a few modal% of this sample, and are strongly resorbed and rounded. FeTi oxide phenocrysts are equant, apparently fresh crystals never more than 0.5mm across. Apatite phenocrysts are also not uncommon in this sample, some reaching almost 0.5mm long.

The groundmass of this sample is rather darker and more altered than in many of the other hornblende andesites of Anthony Rd - Crown Hill-type. The original groundmass may have been devitrified glass, but it has recrystallized to a messy mainly fine-grained quartzo-feldspathic intergrowth with not uncommon chlorite. Groundmass feldspar is rather sericite-altered, but fine-grained FeTi oxide granules throughout the groundmass are fresh. Spotty calcite overprints about 5-10 modal% of the groundmass.

This typical Anthony Rd-type hornblende andesite shows weak hydrothermal alteration (calcite±chlorite±sericite), but surprisingly, the FeTi oxides are unaffected and apparently fresh. They account for the high magnetic susceptibility of this rock. Possibly this unusual carbonate alteration, not noted in any other samples of this type, may be a near-surface rather low-temperature carbonation, rather than the 'regular' hydrothermal alteration noted in samples such as 624183.

The alteration of this sample is rather similar, although less intense to that of plagioclase-phyric dacite 624458. However, 624458 is unrelated to the hornblende andesites. Samples 624444 and 445 were originally very similar to sample 624456, but they show only weak burial metamorphic alteration, and lack the carbonate alteration that characterizes this rock.

SAMPLE NUMBER: 624458

LOCATION: S of Newton Ck Spillway: Magnetic Susc: 0.23

SUMMARY:

This is a moderately hydrothermally-altered formerly glassy plagioclase-phyric dacitic lava very similar to 624440, with an earlier chlorite alteration overprinted by a sericite-calcite alteration.

HAND SPECIMEN:

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

THIN SECTION:

This sample is a quite strongly chlorite-altered plagioclase-phyric dacite lava that is very similar to samples 624439-624442 described above. It consists of around 5-8 modal% of albitized plagioclase phenocrysts to about 2 mm long that are blocky to tabular prisms more often than not occurring in multi-crystal clots. They are moderately to strongly overprinted by sericite-calcite alteration. There is no sign of former mafic phenocrysts in this rock. Uncommon former FeTi oxide phenocrysts are broken down to dark brown leucoxenitic aggregates.

The formerly glassy groundmass of this lava devitrified, then recrystallized to a patchy mosaic-textured quartzo-feldspathic intergrowth. This has been thoroughly overprinted by strong very fine-grained chloritic alteration that in turn is cut by fairly pervasive sericite-calcite alteration. The sericite forms a fairly continuous mesh through the rock, and is slightly Fe-stained due to surficial weathering. Some late stage fine-grained polycrystalline quartz veinlets cut the sericite mesh.

This is a formerly glassy plagioclase-phyric dacitic lava that is very similar to those described above (samples 624439 - 624442). It is unrelated to the hornblende andesites, and shows moderate hydrothermal alteration, characterized (as for 624440) by an earlier fine-grained but pervasive chlorite alteration of the groundmass, overprinted subsequently by a sericite-calcite alteration.

APPENDIX II

963058

CONSULTANT'S REPORT

TO

ROBINA SHARPE

ABERFOYLE RESOURCES LIMITED

EXPLORATION DIVISION

POLISHED THIN SECTION DESCRIPTIONS

AND MICROPROBE RESULTS

(confidential)

BY

P. A. KITTO

AUGUST 1993

CENTRE FOR ORE DEPOSIT AND EXPLORATION STUDIES

INTRODUCTION

This report provides a detailed description of those set of handspecimens sent by Ms Robina Sharpe of Aberfoyle Resources Limited, Exploration Division to Simon Stephens, Geology Dept., University of Tasmania, in June 1993 for polished thin sectioning.

The sequential order of the suite of samples described below are :

624201	624401	624402	624403
624404	624405	624470	624471

Each sample has been described under the following headings:

(i) Sample number
(ii) Summary
(iii) Handspecimen description
(iv) Textural description (including a photomicrograph x6.5)
(v) Sulfide mineralogy (mineral, volume%, grain size, description)

A number of coloured photomicrographs have also been included to better illustrate the association between gold occurrences, sulfide mineralogy and deformation.

A table of microprobe data detailing the Au : Ag : Hg ratios of a number of electrum grains from three of the polished thin sections has been included as TABLE 1.

Where possible most of the larger electrum grains have been identified by circles marked on the surface of the polished thin sections. The three slides that were probed have their electrum grains circled from the back of the slide because these slides were repolished to remove the carbon coating covering the slide.

At the end of this report is a set of **conclusions** based on the interpretations made while describing this suite of rocks.

SAMPLE NO: 624201

SUMMARY: This handspecimen and polished thin section exhibit relic euhedral feldspar phenocrystic clasts overprinted and replaced by a quartz-carbonate intergrowth subsequently overprinted by a sericite-chlorite alteration associated with disseminated sulfides (galena, pyrite-marcasite, chalcopyrite ± minor sphalerite). No visible free gold was found in this undeformed specimen.

The quartz-carbonate alteration associated with this specimen if related to a VHMS style of mineralisation may be either early or late in the mineral paragenesis and can occur either peripheral to, or central to the main deposit. All of this implies that the actual location of this specimen is ambiguous and very little more can be gained from it's investigation.

HANDSPECIMEN: Porphyritic, feldspathic volcanoclastic rock overprinted by a quartz-carbonate alteration with minor disseminated sulfides. The sulfides consisting of pyrite in the unaltered volcanics and galena in the quartz-carbonate overprint.

TEXTURAL DESCRIPTION: (see accompanying x6.5 photocopy). A weakly foliated volcanoclastic texture emphasised by a chloritic and sericitic overprint. This weakly foliated region grades into an evenly fine grained quartz-carbonate assemblage that overprints and replaces the original porphyritic feldspar nature of the volocanic.

SULFIDE MINERALOGY:

Mineral	%Volume	Size(mm)	Description
Galena	5%	<1.2mm	Anhedral pitted galena occurs as the dominant sulfide within veinlets and as disseminations replacing carbonate (calcite?) within a quartz-carbonate matrix. Galena within the veinlets is intimately intergrown with a minor amount of euhedral pyrite. Outside of the veinlets, galena-sphalerite-chalcopyrite intergrowths occur within fractures, or replacing, relic sedimentary(?) pyrite with supergene marcasite replacement.

963061

Pyrite <5% **0.1mm** Minor euhedral prite <0.1mm occurs intergrown with galena in veinlets. Anhedral detrital sedimentary(?) pyrite upto 1.0mm occurs as minor disseminations in the relic volcanoclastic sections of the slide. Occasional marcasite (supergene) replacement of this pyrite can be observed. Minor galena-sphalerite-chalcopyrite mineralisation can be found in the detrital sedimentary(?) pyrite along fractures and partially replacing this pyrite.

Chalcopyrite Trace <0.05mm Anhedral disseminations of chalcopyrite is visible replacing carbonate and also occurs associated with fractures in detrital sedimentary(?) pyrite.

Sphalerite Trace 0.1mm Minor amounts of Fe-poor anhedral sphalerite with weak chalcopyrite disease is associated with galena that replaces detrital pyrite along fractures.

SAMPLE NO: 624401

SUMMARY: This handspecimen and polished thin section consist of a highly deformed barite with the deformation controlling late sulfide disseminations (sphalerite-pyrite-galena-chalcopyrite-tetrahedrite-tennantite). No visible free gold was observed in the polished thin section. The dissolution-breccia(?) texture in the Fe-poor sphalerite and total lack of deformation in the other sulfides would indicate that the sphalerite was quite early in the sulfide paragenesis and that the framboidal pyrite textures suggest low temperature (<200ºC) deposition for the late stage sulfides.

This sheared barite specimen probably represent the barite cap of a VHMS deposit, and the sphalerite plus pyrite textures could be interpreted to suggest that this specimen was taken from the upper most outward extremity of the original VHMS sulfide mound.

It is worth noting that although this specimen has a strong sense of shear it differs from those specimens that have reported free gold, in that the pyrites in this sample are undeformed. The significance of this point is uncertain but may suggest that either the region from which this specimen was taken was gold deficient or that the nature of the deformation event observed in the gold bearing specimens was important in releasing the micro gold inclusions from their pyritic hosts and concentrating it within fractures in the pyrite or along pyrite grain boundaries.

HANDSPECIMEN: The handspecimen is that of a massive barite, strongly sheared in a dextral sense, with deformation controlling sulfide disseminations (galena and pyrite) along the shear planes.

TEXTURAL DESCRIPTION: (see accompanying x6.5 photocopy) This specimen consists of strongly foliated barite with a dextral sense of displacement associated with sulfide mineralisation. The sulfides themselves are undeformed and therefore are interpreted to be syn-deformation in their paragenesis after barite. Dissolution textures in the sphalerite, that occurs along deformation bands, may suggest that Fe-poor sphalerite deposition may have preceded the other sulfide minerals.

624401
×6.5

963064

SULFIDE MINERALOGY:

Mineral %Volume Size(mm) Description

Barite 85% <10mm The highly deformed barite exhibits well developed augen which indicate a strong sense of dextral displacement. Both brittle and ductile deformation can be seen in the barite. Individual barite crystals exhibit offset cleavages, undulose extinction and recrystallised interlocking grain boundaries. Sulfide mineralisation is always found along the deformation bands between the more coherent zones of barite.

Sphalerite 8% <0.05mm Anhedral Fe-poor sphalerite occurs along shear planes in barite. In plane light the sphalerite can be seen to consist of equant interlocking fragments which in fact may represent the dissolution by fracture controls of originally larger zoned sphalerite crystals. The lamellae observed in sphalerite are highlighted by very fine dusting, along cleavage planes, by chalcopyrite which also occurs as much larger exsolutions along grain boundaries and fractures within individual sphalerite grains, i.e, chacopyrite disease.

Galena 3% <0.1mm Galena occurs as anhedral intergrowths with sphalerite-tetrahedrite-tennantite-chalcopyrite-pyrite and is typically observed along the margins of sphalerite. The galena shows no signs of deformation suggesting that it was post deformation in it's deposition after sphalerite.

Pyrite 2% <0.15mm Euhedral pyrite occurs in sphalerite with minor inclusions of sphalerite within it's crystals suggesting a co-eval stage of precipitation. Where fractures occur in pyrite minor galena infills can be seen. A second form of pyrite occurs as minor disseminations of framboids along the margins of shear planes within sphalerite.

Tetrahedrite-Tennantit1% <0.1mm Anhedral intergrowths of tetrahedrite-tennantite with galena and sphalerite can be seen developed along most major sulfide filled shear planes in barite.

Chalcopyrite <1% <0.05mm Chalcopyrite occurs as exsolutions in sphalerite (chalcopyrite disease) and on grain boundaries between other sulfide minerals.

SAMPLE NO: 624402

SUMMARY: This sample is a rich gold bearing specimen with well over 20 individual grains of electrum identified within a single polished thin section. A number of these electrum grains have been probed and the data analysed in another area of this report.

This strogly sheared specimen was originally a quartz phyric volcanoclastic rock with jasperoidal inclusions which have subsequently undergone deformation and overprinting by a barite and later sulfide (pyrite, sphalerite, galena, tetrahedrite-tennantite, chalcocite, chacopyrite) assemblage. Gold is found in the form of electrum usually within fractures of the earliest formed euhedral pyrites in association with minor amounts of galena and chalcopyrite.

The barite-sulfide-gold assemblage most probably represents a sample from the barite cap of a VHMS deposit.

HANDSPECIMEN: A highly deformed pale grey barite-sulfide (pyrite, sphalerite, galena) rich handspecimen. Rotated barite augen up to 1cm, together with elongate pressure shadow tails highlight the dextral shear sense seen in handspecimen.

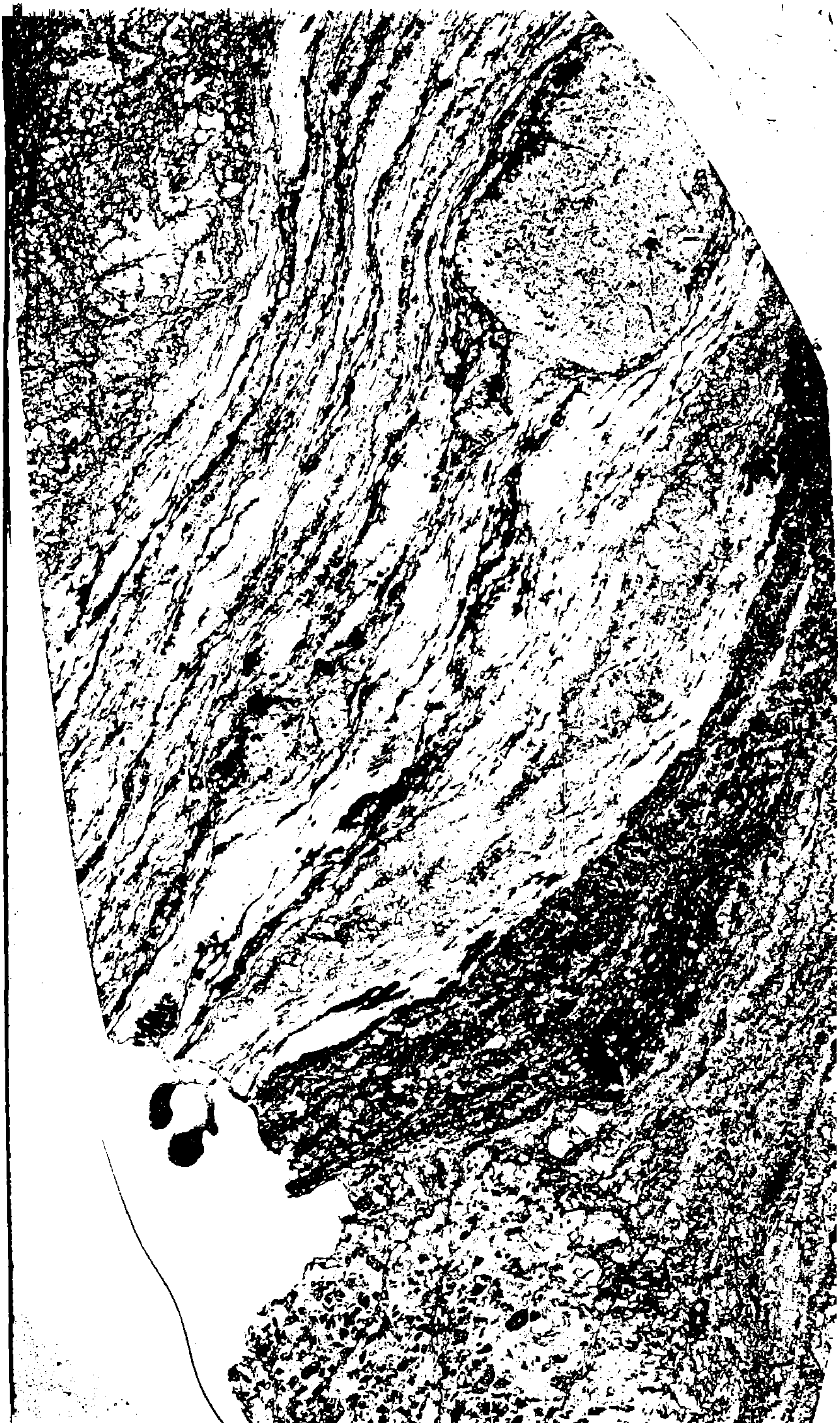
TEXTURAL DESCRIPTION: (see accompanying x6.5 photocopy).
In thin section the strong dextral shear sense of the handspecimen is transposed to a sinistral shear sense highlighted by the ductile deformation behaviour of the barite around the more competent jasperoidal clast and the quartz phyric volcanoclastic fragments. Sulfide assemblages are concentrated in the deformation bands of the barite.

SULFIDE MINERALOGY:

Mineral %Volume Size(mm) Description

Gold Trace <0.05mm Approximately 20 grains of electrum were identified within the early euhedral pyrites, disseminated within the shear planes associated with massive barite. Microprobe analyses indicate that the finess of the electrum ranges from approximately 350 - 950 but average around 650 finess. Grain size of the electrum ranges from 3 - 50 microns and averages 5 microns. The electrum presides within fractures of the early euhedral pyrite with infills of galena, chalcopyrite and rarely

963067



tetrahedrite-tennantite. The highest finess of electrum occurred as a single 3 micron exsolution in pyrite without other sulfides.

Barite 70% 5.0mm The highly deformed barite augen and ground mass exhibit weak undulose extinction and recrystallised grain boundaries. Rotation of the barite cleavage planes within some clasts highlight the shearing sense within the deformation fabric as do the Reidel shears between major shear planes and pressure shadows developed around the more resistant clasts. Sulfide mineralisation has been restricted to those shear planes that have undergone most deformation. Barite has been most deformed around the more resistent jasperoidal clast seen in thin section and around the larger barite augens readily seen in the handspecimen.

Pyrite 5% 0.6mm The earliest stage euhedral pyrite outline the dominant shear planes throughout the barite and along the contact between barite and the quartz phyric volcanoclastic clasts where sericite also highlights the strong deformation foliation. Paragenetically later framboidal pyrite is a minor phase but does develop a spongy pyrite overgrowth on earlier euhedral pyrite. Fracture infills and replacement of the earliest euhedral pyrite by later base metals is associated with the observed electrum seen in this polished thin section.

Sphalerite 3% 0.2mm Anhedral, elongate Fe-poor sphalerite highlight deformation planes within barite together with pyrite. Sphalerite has an apparent brecciated texture due to dissolution features along microfractures that have remobilised chalcopyrite from minor disseminations along cleavage plains to large exsolutions of chalcopyrite along grain boundaries. Sphalerite may be closely coeval with the earliest stage of pyrite precipitation. Tetrahedrite-tennantite, galena and chalcopyrite appear to infill healed fractures within sphalerite and are later paragenetically than the sphalerite.

Galena 1% 0.05mm Anhedral inclusions of galena infill fractures in euhedral pyrite and the sphalerite, occurring typically in association with tetrahedrite-tennantite and chalcopyrite.

Chalcocite <1% 0.05mm Chalcocite occurs as a late colloform overprint on all other sulfide phases but is restricted in extent to one small section of the slide.

Tetrahedrite-tennantite Trace 0.05mm Anhedral tetrahedrite-tennantite intergrowths with galena and chalcopyrite typically occur along fractures in euhedral pyrite and the sphalerite.

Chalcopyrite Trace 0.05mm Anhedral intergrowths of chalcopyrite with galena and tetrahedrite-tennantite typically occur along fractures in euhedral pyrite and the sphalerite.

SAMPLE NO: 624403

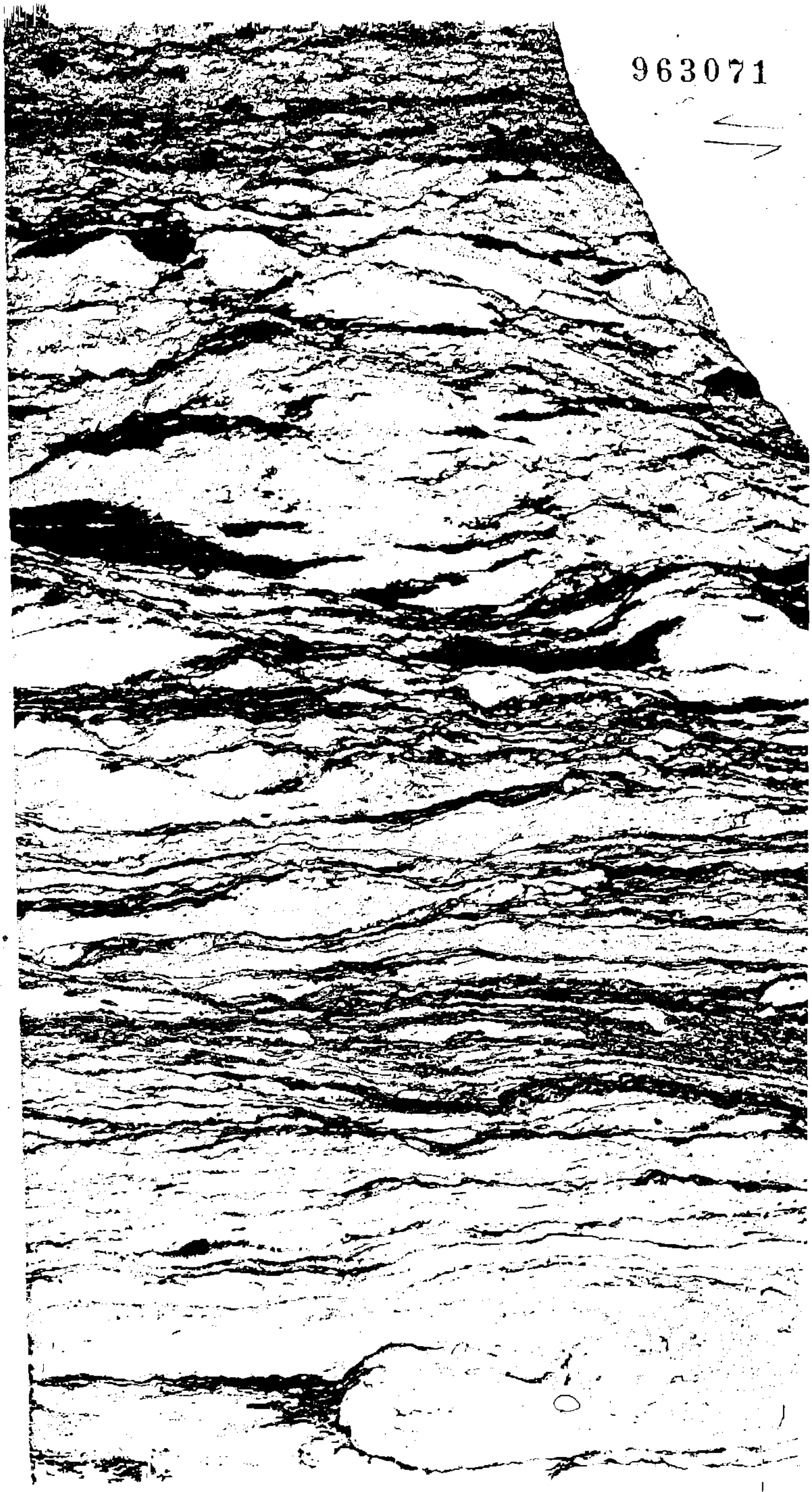
SUMMARY: A rich gold, highly sheared, massive barite-sulfide (sphalerite, pyrite, galena, tetrahedrite-tennantite, chalcopyrite) banded ore with approximately 20+ grains of electrum upto 60 microns in diameter. The average electrum grain size in this specimen is greater than for the rest of the suite of samples which suggests that a higher degree of deformation has played a major role in remobilising and concentration the gold.

The specimen represents a massive, highly deformed barite which has played host to disseminated and elongated sulfide zones within a finely recrystallised barite matrix. Rotated barite augen have beautifully developed elongate pressure shadows with disseminated sulfides that highlight the dextral shear sense in handspecimen. The high strain associated with barite and the sulfide mineralisation imply that the deformation process was active during and post sulfide deposition.

This massive barite specimen with deformation controlled sulfide-gold mineralisation has most probably come from the barite cap of a VHMS deposit. The strong deformation has been significant in remobilising the gold but may have important consequences in terms of the overall location, position and geometry of the original orebody. The deformation observed in this specimen is far greater than that observed at either Hellyer, Que River or Rosebery.

HANDSPECIMEN: This sample is a pale grey, massive barite-sulfide banded ore with a distinct dextrally sheared fabric highlighted by rotation and brecciation of barite augen. The pressure shadows around barite augens contain recrystallised and remobilised sulfides (pyrite, spalerite and galena).

TEXTURAL DESCRIPTION: (see accompanying x6.5 photocopy). A highly sheared massive barite with well developed, and rotated augen that exhibit recrystallised, elongate tails together with disseminated and remobilised sulfides.



963071

SULFIDE MINERALOGY:

Mineral %Volume Size(mm) Description

Gold Trace 0.05mm Over 20 grains of electrum have been observed in this specimen as fracture infills of early euhedral pyrites. Microprobe analyses indicate a constant finess of the larger (50 micron) electrum grains of between 630 - 700 finess. Grain sizes of the electrum range from <1 to greater than 60 microns with the average sized grain being between 20 and 50 microns. The electrum typically occurs associated with one or other of a number of combinations of the sulfides - chalcopyrite, sphalerite, galena and tetrahedrite-tennantite. Exsolutions of electrum in pyrite, minus other associated sulfide, is not uncommon.

Barite 85% 0.4mm The massive, highly deformed barite exhibits well developed rotated augen with recrystallised pressure shadows and elongate tails along shear planes together with sulfides. Both brittle and ductile deformation can be seen in the barite. Individual barite crystals exhibit offset cleavages, undulose extinction and recrystallised interlocking grain boundaries.The high strain rates associated with the barite have been transferred through to the associated sulfides along shear planes where fracturing, dissolution and recrystallisation features can also be observed.

Sphalerite 7% 2.0mm Anhedral Fe-poor sphalerite occurs along deformation bands in barite. The sphalerite appears to have recrystallised and expelled the chalcopyrite exsolutions to the margins or concentrated it into trails along the centre of the sphalerite mineralisation. Galena, like chalcopyrite, can be seen to accumulate along the margins of sphalerite in association with chalcopyrite. Deformation has obviously taken place during and after sphalerite deposition.

Pyrite 5% 0.3mm An early phase of euhedral pyrite, possibly coeval with sphalerite, has suffered brittle deformation and undergone partial replacement by later sulfide assemblages. This form of early pyrite has suffered most brecciation within sphalerite bands that wrap around barite augen. An overgrowth of spongy pyrite creates a zoned effect around a large percentage of the early pyrite.

Galena 3% 0.05mm Galena occurs as anhedral bands along the margins of sphalerite and as fracture infills in pyrite, usually associated with chalcopyrite, tetrahedrite-tennantite, sphalerite and less commonly electrum.

Tetrahedrite-tennantite <1% 0.05mm Anhedral bands of tetrahedrite-tennantite occur along the margins of sphalerite and as fracture infills in pyrite, associated with chalcopyrite, galena, sphalerite and less commonly electrum.

Chalcopyrite <1% 0.01mm Minor exsolutions of chalcopyrite occur within sphalerite but most has been remobilised to the margins of the sphalerite hosted deformation shear planes or concentrated along sphalerite grain boundaries.

SAMPLE NO: 624404

SUMMARY: A free gold bearing, massive cryptocrystalline quartz-rich volcanic rock with primary elongate red jasperoidal inclusions. Minor sulfide bearing barite veinlets crosscut the bedding(?) foliation and host a single one micron electrum grain of possibly 500 fineness in chalcopyrite. The dominant sulfide is pyrite but this appears to contain no visible free gold. Deformation has been minor and this may be the result of the highly siliceous nature of the sample, relative to the other more barite rich samples described in this suite of samples.

This specimen represents part of the host volcanic stratigraphy to an as yet undiscovered VHMS deposit. The mineralisation represents very minor veining associated with the deposit but it's proximity to the main ore-body is speculative except to say that barite veinlets suggest that this specimen is toward the upper regions of the deposit.

HANDSPECIMEN: A massive grey cryptocrystalline quartz rich volcanic with elongate red jasperoidal inclusions flattened into the bedding plane(?) cleavage. Pyritic veinlets cut the cleavage at approximately 30° and appear to have weakly developed striae on their surfaces. Leaching of the cores from the jasper concretions gives this rock a poxy appearance.

TEXTURAL DESCRIPTION: (see accompanying x6.5 photocopy) The cryptocrystalline quartz volcanic has a weak foliation defined by both jasperoidal concretions and minor chlorite-sericite development which is greatest next to cross-cutting barite and sulfide veins.

SULFIDE MINERALOGY:

Mineral %Volume Size(mm) Description

Gold Trace 0.001mm A single rounded one micron grain of electrum was observed in chalcopyrite associated with tetrahedrite- tennantite in a barite veinlet. The pale nature of the electrum grain suggests that the finess was of the order of 400-600.

963075

Pyrite 15% <0.6mm Pyrite euhedra occur as early phases up to 0.6mm in diameter in barite veinlets. This stage of pyrite has been brecciated and overgrown by a later framboidal-spongy pyrite which dominates the pyrite assemblage. The pyrite assemblage is essential devoid of other sulfides except for minor traces of galena, chalcopyrite and tetrahedrite-tennantite exsolution along possible growth zones in the early euhedral pyrites, giving a few of these pyrite crystals a weak atoll like texture.

One barite-rich veinlet, however, does contain only the earliest euhedral pyrite which is partially replaced by a tetrahedral-tennantite dominated assemblage with minor galena and chalcopyrite. The only observed grain of electrum was associated with this assemblage.

Tetrahedrite-Tennantite<1% <0.6mm Anhedral tetrahedrite-tennantite grains up to 0.6mm in size and restricted to a barite rich veinlet occur associated with the replacement of early formed pyrite rhombohedra. A single grain of electrum associated with minor chalcopyrite in this tetrahedrite-tennantite solid solution was observed. Extremely minor exsolutions of tetrahedrite-tennantite, galena and chalcopytrite within euhedral pyrite outline possible growth zones and produce what appear to be a relic atoll texture within the pyrite.

Chalcopyrite Trace 0.05mm Minor anhedral chalcopyrite intergrowths and fracture infills occur within tetrahedrite-tennantite, as do minor chalcopyrite exsolutions in pyrite which result in atoll like textures.

Galena Trace 0.025mm Minor anhedral galena intergrowths occur with chalcopyrite and tetrahedrite-tennantite within fractures associated with pyrite. Minor galena exsolutions within pyrite also result in atoll like textures.

SAMPLE NO: 624405

SUMMARY: A gold-rich, highly sheared, massive barite-sulphide (pyrite, sphalerite, galena, chalcopyrite, tetrahedrite-tennantite) banded ore with almost 30 grains of electrum, some as large as 75 microns. Like specimen 624403 this sample has electrum with larger than average grains for the suite of specimens, suggesting that the greater degrees of deformation have played significant roles in remobilising and concentrating the gold within fractures in earlier euhedral pyrite.

The specimen represents a sulphide-rich (predominantly pyrite) baritic rock in which the sulphide zone has behaved in a brittle manner and the baritic zone has deformed in a ductile manner around it. Minor sphalerite-galena mineralisation has also accentuated the ductile nature of deformation by providing glide planes that highlight the dextral sense of shear in handspecimen. The high strain associated with the ductile deformation in the sulfide zone imply that the deformation process was active during and after sulfide deposition.

This massive banded pyritic-baritic specimen was probably located within the barite cap of a VHMS deposit. The strong deformation has most likely been responsible for remobilising and concentrating the electrum but may also have important consequences for identifying the location of, and proximity to, the original deposit.

HANDSPECIMEN: The specimen is a massive pale grey and brown banded pyrite-barite ore assemblage with a distinct dextrally sheared fabric highlighted by brittle deformation in the pyrite-rich zones and ductile deformation in the barite-rich zones.

TEXTURAL DESCRIPTION: (see accompanying x6.5 photocopy). The texture is dominated by those features outlined above in the handspecimen description.

SULFIDE MINERALOGY:

Mineral	%Volume	Size(mm)	Description
Gold	Trace	0.075mm	Almost 30 grains of

electrum have been observed in this specimen, as fracture infills of early euhedral pyrites. Microprobe analyses indicate a constant finess of the larger (50 micron) electrum grains of between 470 - 610 finess. The average finess being approximately 550. Grain sizes of the electrum range from <1 to greater than 75 microns with the

963078

average sized grain being between 12 and 25 microns. The electrum typically occurs associated with one or other of a number of combinations of the sulfides - chalcopyrite, sphalerite, galena and tetrahedrite-tennantite.

Pyrite 40% 0.4mm An early phase of euhedral pyrite, possibly coeval with sphalerite, has suffered brittle deformation and undergone partial replacement by later sulfide assemblages. An overgrowth of spongy-framboidal pyrites upon brittly deformed euhedral pyrites has occurred within the low pressure zones of these augens as deformation progressed.

Barite 40% 2.0mm The ductile deformation of barite around pyrite augen has resulted in individual barite crystals exhibiting offset cleavages, undulose extinction and recrystallised interlocking grain boundaries.The high strain rates associated with the barite have been transferred through to the associated sulfides (sphalerite and galena) along shear planes where fracturing, dissolution and recrystallisation features can also be observed.

Sphalerite 5% 0.4mm Anhedral Fe-poor sphalerite occurs within barite shears that deformed in a ductile manner around massive pyrite zones. The sphalerite appears to have recrystallised and expelled chalcopyrite to the margins of the shears or concentrated it along new grain boundaries. Galena, like chalcopyrite, can be seen to accumulate along the margins of sphalerite in association with chalcopyrite. Deformation has probably taken place during and after sphalerite deposition.

Galena 1% 2.0mm Galena occurs as anhedral bands along the margins of sphalerite and as fracture infills in pyrite, usually associated with chalcopyrite, tetrahedrite-tennantite, sphalerite and less commonly electrum.

Tetrahedrite-tennantite Trace 0.05mm Anhedral bands of tetrahedrite-tennantite occur along the margins of sphalerite and as fracture infills in pyrite, associated with chalcopyrite, galena, sphalerite and less commonly electrum.

Chalcopyrite Trace 0.01mm Minor exsolutions of chalcopyrite occur within sphalerite but most has been remobilised to the margins of the sphalerite hosted deformation shear planes or concentrated along sphalerite grain boundaries.

SAMPLE NO: 624470

SUMMARY: A very rich gold bearing specimen with well-over 40 individual grains of electrum identified within a single polished thin section.

The specimen represents a porphyritic, feldspathic volcanoclastic overprinted by a barite assemblage associated with disseminated sulfides (sphalerite, pyrite, galena, tetrahedrite-tennantite, chalcopyrite). Gold is dominantly found in fractures associated with the earliest euhedral pyrite. These fractures are also typically infilled with galena. The gold fineness is estimated from it's colour to range from 450-700.

The barite-sulfide-gold mineralisation most probably represents the barite cap of a VHMS deposit. The in-situ nature of this one specimen and the close association of other gold-rich samples indicates the very close proximity of a potentially high grade VHMS ore deposit.

HANDSPECIMEN: A pale grey barite rich handspecimen with veinlet and disseminated pyrite-sphalerite mineralisation. The volcanoclastic nature of the specimen is identified by faint pink feldspathic porphyritic clasts.

TEXTURAL DESCRIPTION: (see accompanying x6.5 photocopy). Minor feldspathic volcanoclastic fragments veined by fractured massive barite laths and infiltrated by disseminated sulfides.

SULFIDE MINERALOGY:

Mineral %Volume Size(mm) Description

Gold Trace <0.05mm Over 40 grains of electrum were identified within the early euhedral pyrites disseminated throughout this slide. The colour suggests that the finess of the electrum ranges from approximately 450-700. Grain size varies from 1-50 microns with the dominant grain size being between 5 and 15 microns. Electrum predominantly presides within fractures in early pyrite infilled with galena and rarely without galena. It was also seen with galena replacing pyrite, either along margins, or along possible zoned regions within individual pyrite grains. Electrum was rarely observed as isolated exsolutions within pyrite . Single grains of electrum were also identified within tetrahedrite-tennantite and sphalerite.

963081

Barite 80% 4.0mm Individual barite crystals upto 4mm occur and exhibit weak undulose extinctions and recrystallised interlocking grain boundaries in a barite-sericite-sulfide groundmass.

Pyrite 5% 0.4mm An early stage of euhedral pyrite with minor fracture development and galena ± electrum infill is the most common sulfide disseminated throughout this polished thin section. Overprinting this early stage pyrite is a spongy pyrite, typically intergrown with sphalerite, tetrahedrite-tennantite plus minor galena and chalcopyrite.

Sphalerite 5% 1.0mm Anhedral Fe-poor sphalerite is disseminated in the barite-sericite groundmass. The sphalerite is always associated with pyrite but the opposite is not true. In plane polarised light the sphalerite exhibits a weak chalcopyrite disease that defines cleavage and especially outlines grain boundaries. Tetrahedrite
-tennantite and galena appear to infill healed fractures within sphalerite and are later paragenetically than the sphalerite.

Galena 1% 0.25mm Galena occurs as an anhedral interstitial phase within fractures of sphalerite and early pyrite. Galena is most commonly associated with electrum in the fractures of the earliest formed euhedral pyrite.

Tetrahedrite-tennantite Trace 0.2mm Anhedral tetrahedrite-tennantite intergrowths occur with the minerals galena, sphalerite and chalcopyrite.

Chalcopyrite Trace 0.05mm Anhedral intergrowths of chalcopyrite with sphalerite and galena are not uncommon. A weak pervasive chalcopyrite disease within sphalerite can be recognised under high magnification as it highlights cleavage planes and grain boundaries.

SAMPLE NO: 624471

SUMMARY: This handspecimen and polished thin section exhibit feldspar porphyry lava clasts with euhedral plagioclase phenocrysts. The origin of the texture probably resulting from insitu brecciation (autobrecciation?). Irregular barite veining has allowed minor sulfide (pyrite, sphalerite, galena,and tetrahedrite-tennantite) disseminations throughout the lava clast. No visible free gold was observed in this essentially undeformed specimen.

The minor amount of barite veining in handspecimen, associated sulfide mineralogy and accompanying suite of rocks previously described might suggest that this sample is somehow related to the region associated with a VHMS barite cap.

HANDSPECIMEN: The pale creamy-pink feldspar porphyritic handspecimen has been veined and bleached by minor sulfide veinlets containing pyrite, galena and sphalerite.

TEXTURAL DESCRIPTION: (see accompanying x6.5 photocopy). The texture shown in thin section is that of feldspar porphyry lava clasts with euhedral plagioclase phenocrysts that may have undergone insitu brecciation (autobrecciation?) and later veining by a sulfide bearing barite assemblage. Sericitic alteration of the clasts is well developed around the barite veins.

SULFIDE MINERALOGY:

Mineral %Volume Size(mm) Description

Barite 10% 2.0mm Barite veinlets have minor areas of shearing delineated by sphalerite and sericite which occurs on the margins of the volcanoclastic fragments. Pyrite euhedral also occur within this zone but are typically over-shadowed by well developed spongy pyrite over growth.

Pyrite 5% 0.4mm An early minor phase of euhedral pyrite growth is apparent both within barite veins and volcanic clasts. This has subsequently been overprinted by a more substancial precipitation of spongy pyrite. Brecciation and replacement of the pyrite is minor.

Sphalerite 1% 2.0mm Small, 2mm wide veinlets of sphalerite in barite occur irregularly throughout the slide. The sphalerite is Fe-poor with weakly developed chalcopyrite disease.

963084

Galena Trace 0.2mm Occasional anhedral intergrowths of galena with sphalerite, tetrahedrite-tennantite and chalcopyrite can be observed within the barite veins.

Tetrahedrite-tennantite Trace 0.2mm Occasional anhedral intergrowths of tetrahedrite-tennantite with galena, sphalerite and chalcopyrite can be observed within the barite veins.

CONCLUSIONS:

(i) This suite of specimens taken from the MRV succession would appear to be intimately related with VHMS mineralisation. In particular the barite rich samples (624401, 624402, 624403, 624404, 624405, 624470 and 624471) may represent the mineralised barite cap of an as yet undiscovered VHMS deposit.

(ii) The deformation observed in the electrum rich specimens (624402, 624403, 624404, 624405 and 624470) has been essential in remobilising the gold from the early phase of euhedral pyrite and concentrating it in within fractures and along grain boundaries.

(iii) The deformation event responsible for concentrating free gold has a dextral sense of shear in handspecimen and this may assist in helping to relocate the original ore deposit back in the field area from which these float samples were taken.

(iv) The deformation identified in the ore samples is more intense than that observed in other major Tasmanian VHMS deposits such as Hellyer, Que River, Rosebery, Hercules and Mt. Lyell. This suggests that this deposit, if it is a VHMS style deposit, may be sitting along a major fault zone or have been dismembered by such a structure.

(v) The microprobe results indicate that the electrum has an average finess of around 550 - 650. This level of finess is characteristic of the barite zone at South Hercules and other VHMS deposits in western Tasmania. The high mercury levels (0.5-2.0 wt%) associated with the electrum analyses are also characteristic of these styles of VHMS deposits as is Fe-poor sphalerites.

(vi) A good correlation exists between increasing mercury levels and increasing silver levels (with decreasing gold!!!!!) in the electrum microprobe data (see Table 1).

(vii) Qualitative microprobe analyses, not tabled in this report, also indicate that

A. Tetrahedrite-tennantite solid solutions exist in the sulfides and that this assemblage has between 0.6 and 1.7 wt% silver and no gold in it's structure.

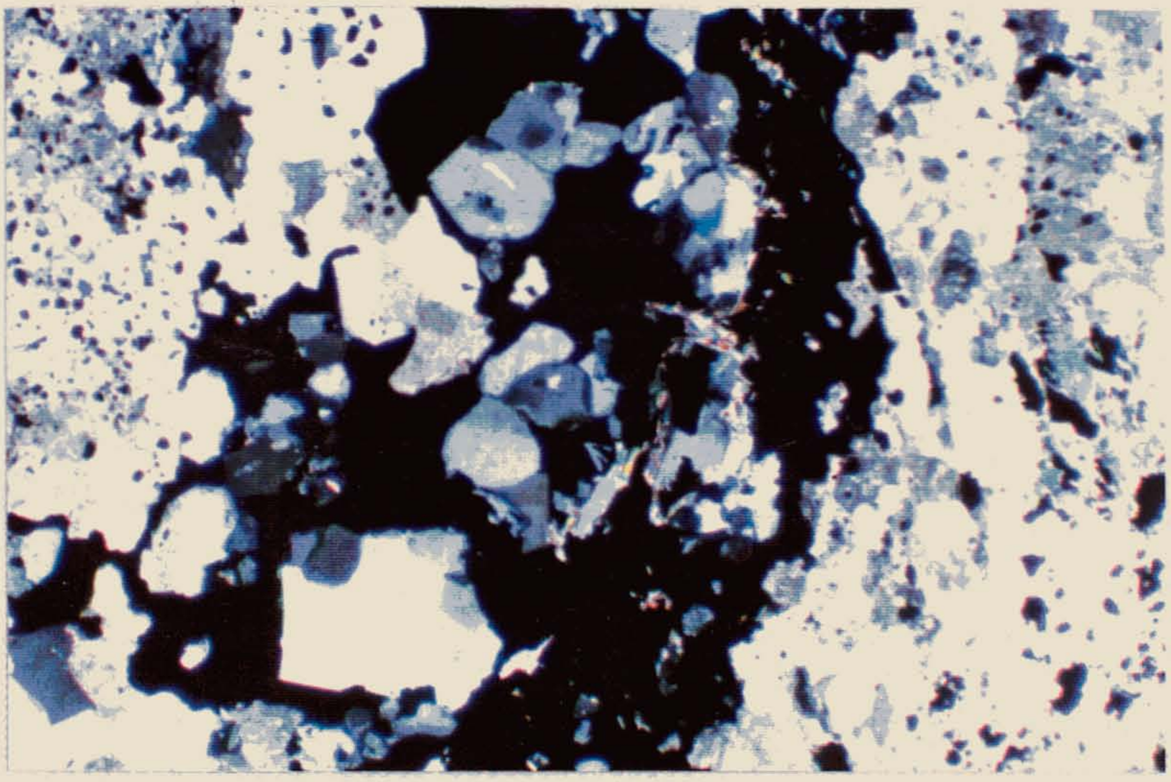
B. Euhedral pyrites have, within their lattice, upto 0.1wt% gold and 0.05wt% siver. This would account for the visible electrum in those euhedral pyrites that have undergone serious deformation.

C In these samples where Au is associated with zinc rich mineralisation (Fe-poor shalerite) rather than copper the gold is carried as thio complexes and directly precipitated in the barite cap of VHMS deposits as micro-inclusions in pyrite owing to the decrease in H_2S activity caused by dilution and oxidation of the hydrothermal fluids at 200° to 300°C, as they mixed with seawater (Huston et. al., 1992).

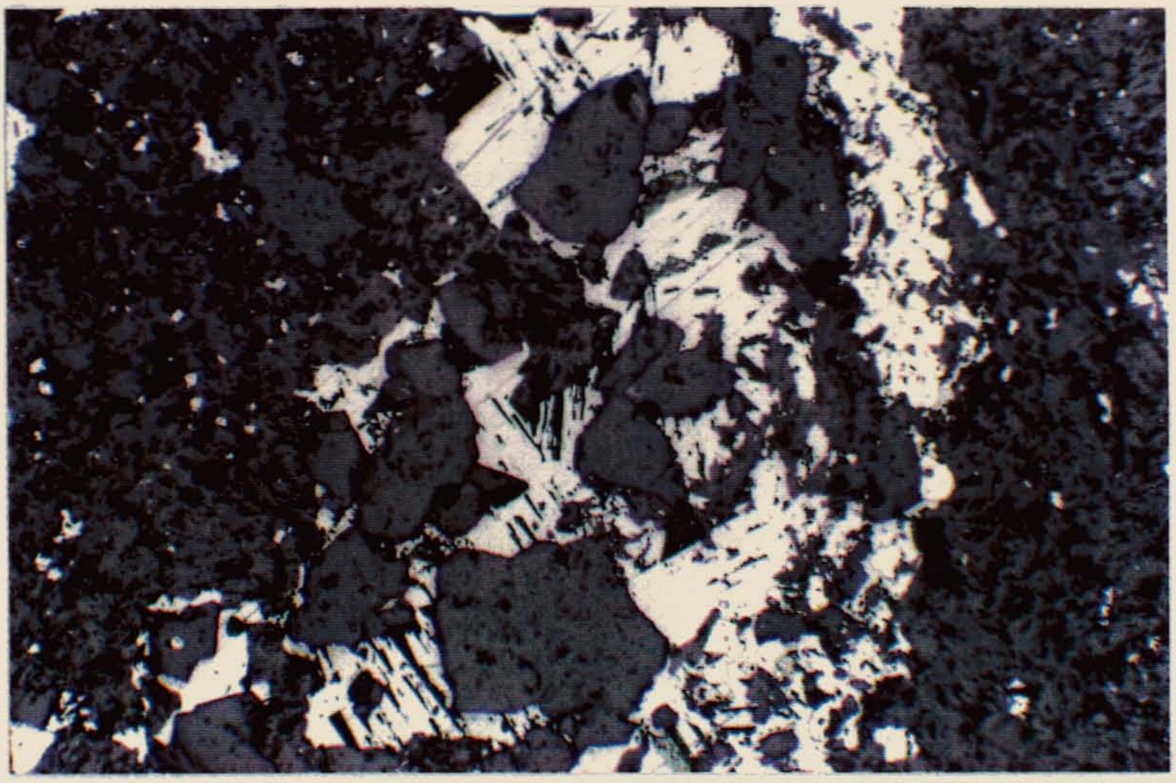
ABERFOYLE AU-PROBE NOS

SAMPLE NO.	Au LOCATION	Ag (wt%)	Au (wt%)	Hg (wt%)	TOTAL
624402	ring 1	40.572	57.266	0.597	98.436
	ring 5	54.116	34.36	2.89	91.366
	ring 6 grain A	3.713	65.278	0.029	69.02
	ring 6 grain B	6.65	69.141	0.172	75.963
	ring 8 grain A	36.472	63.55	0.406	100.428
	ring 8 grain A (repeat)	36.528	63.068	0.407	100.002
	ring 8 grain B	35.514	64.043	0.432	99.989
624403	ring 1	35.933	62.07	0.292	98.295
	ring 3 grain A	32.684	66.195	0.324	99.202
	ring 3 grain B	31.434	67.829	0.329	99.593
	ring 4	28.689	34.168	0.433	63.289
	ring 5	30.205	69.339	0.297	99.841
624405	ring 1	49.42	49.989	1.149	100.558
	ring 2	44.613	45.35	1.202	91.165
	ring 3	39.797	60.287	0.526	100.61
	ring 4 grain A	43.259	56.038	0.737	100.034
	ring 4 grain B	50.453	48.391	1.919	100.763
	ring 4 grain C	49.873	45.5	1.292	96.665
	ring 4 grain D	42.306	57.124	0.58	100.01
	ring 4 grain E	42.764	54.783	0.665	98.211
	ring 5 grain A	38.914	61	0.415	100.33
	ring 5 grain B	39.49	60.39	0.616	100.496
	ring 6 grain A	43.29	53.921	0.671	97.882
	ring 6 grain B	38.787	44.404	0.571	83.762

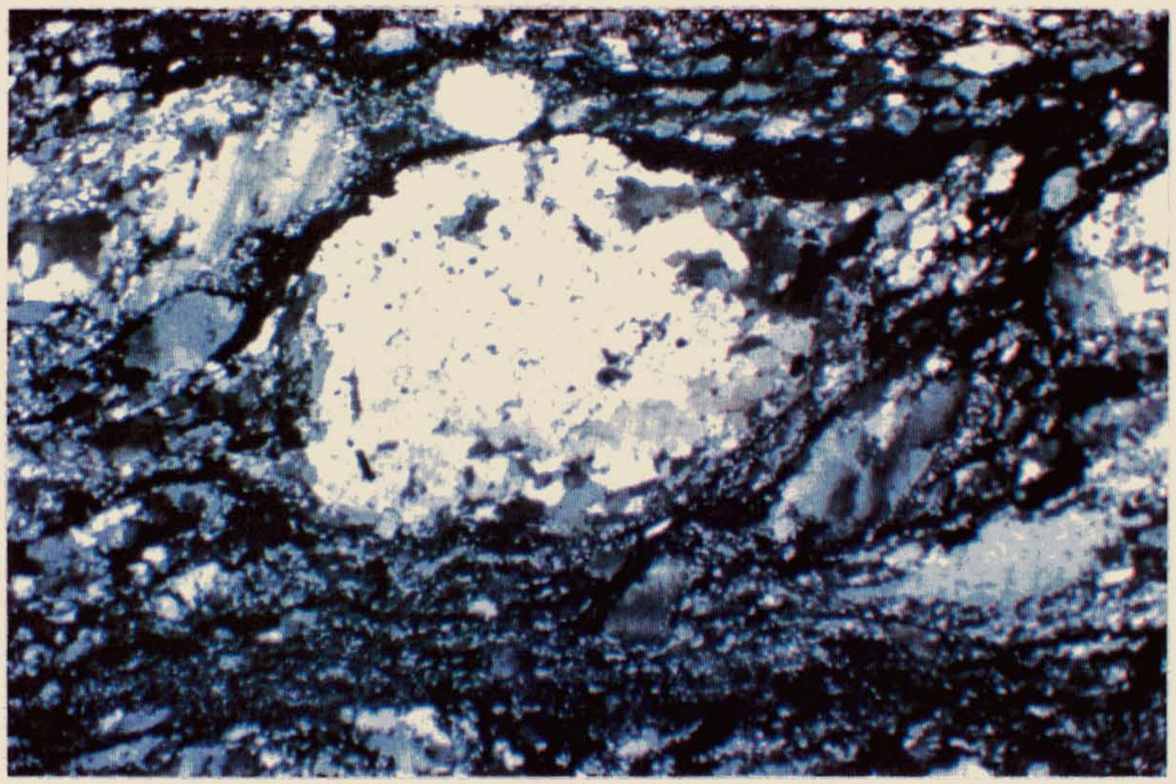
624201 X100 X.N. Qtz-carb. alteration overprinted by gal-sph-py veining with associated chl-ser.



624201 X100 R.L. Qtz-carb. alteration overprinted by gal-sph-py veining with associated chl-ser.

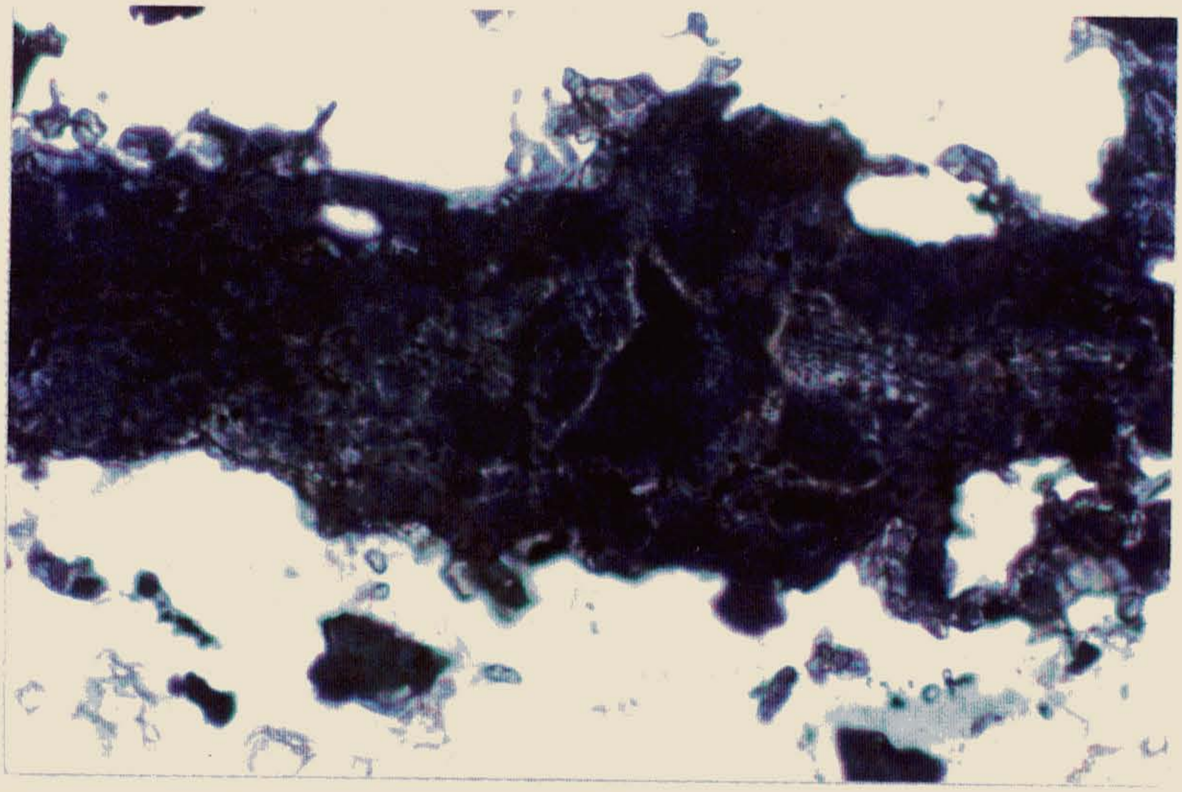


624201 x25 X.N. Barite augen indicating a dextral shear sense.

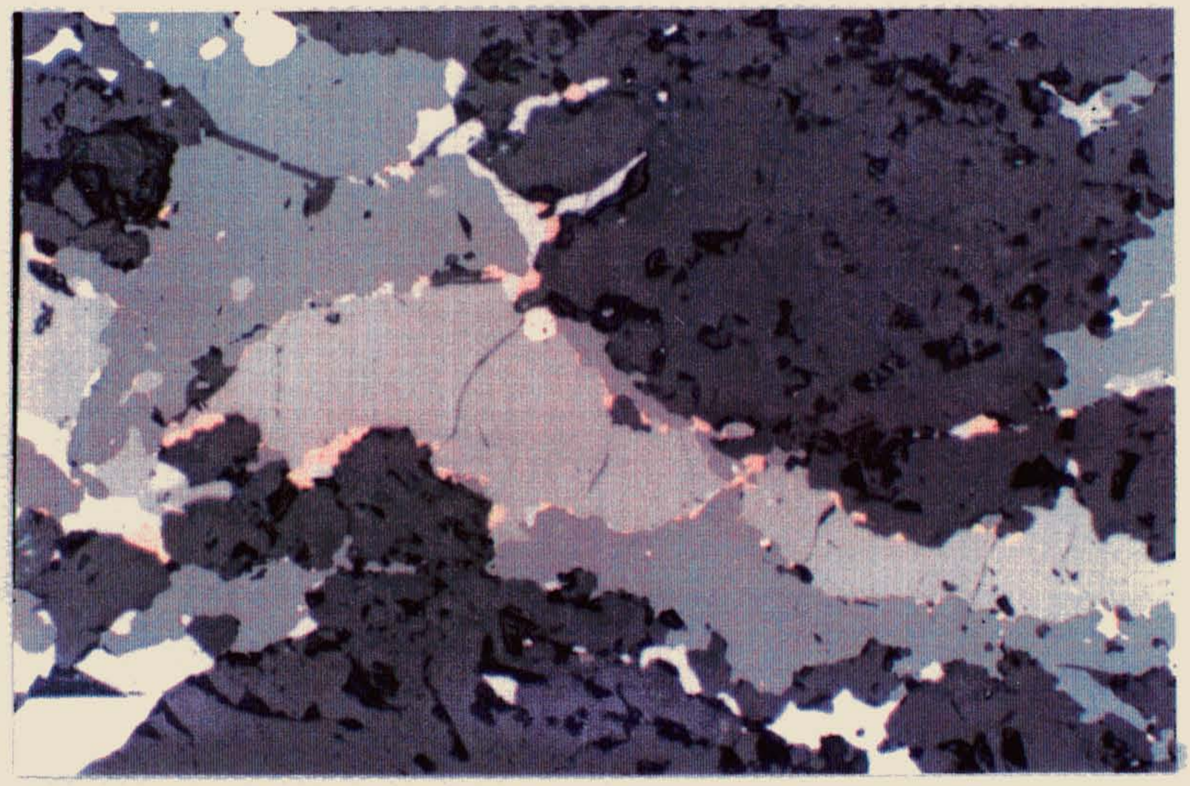


624401 X50 X.N. Barite augen with cleavage exhibiting dextral offsets.

624401 X400 P.P. Fe-poor sphalerite with dissolution (& brecciation?) features, highlighted by cpy exsolution.

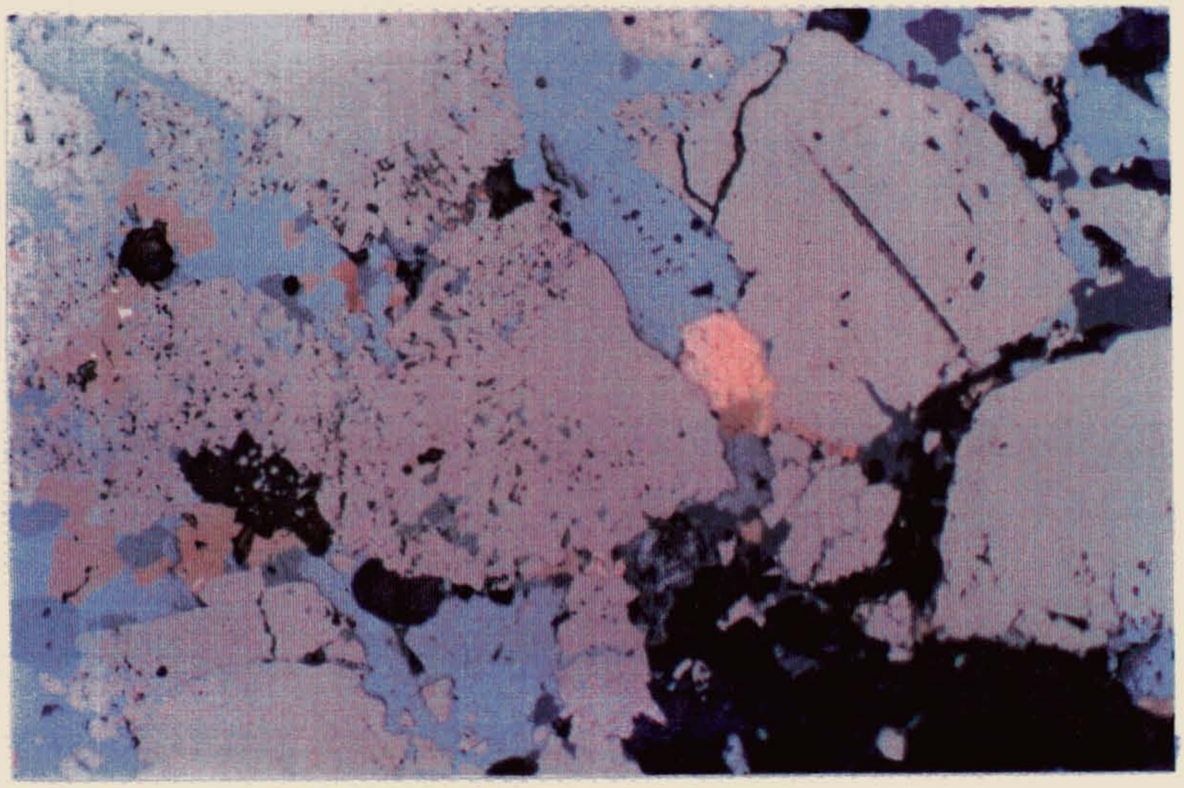


624401 X200 R.L. Sph-gal-tetr-tenn-cpy-py mineralisation along a shear plane in barite.

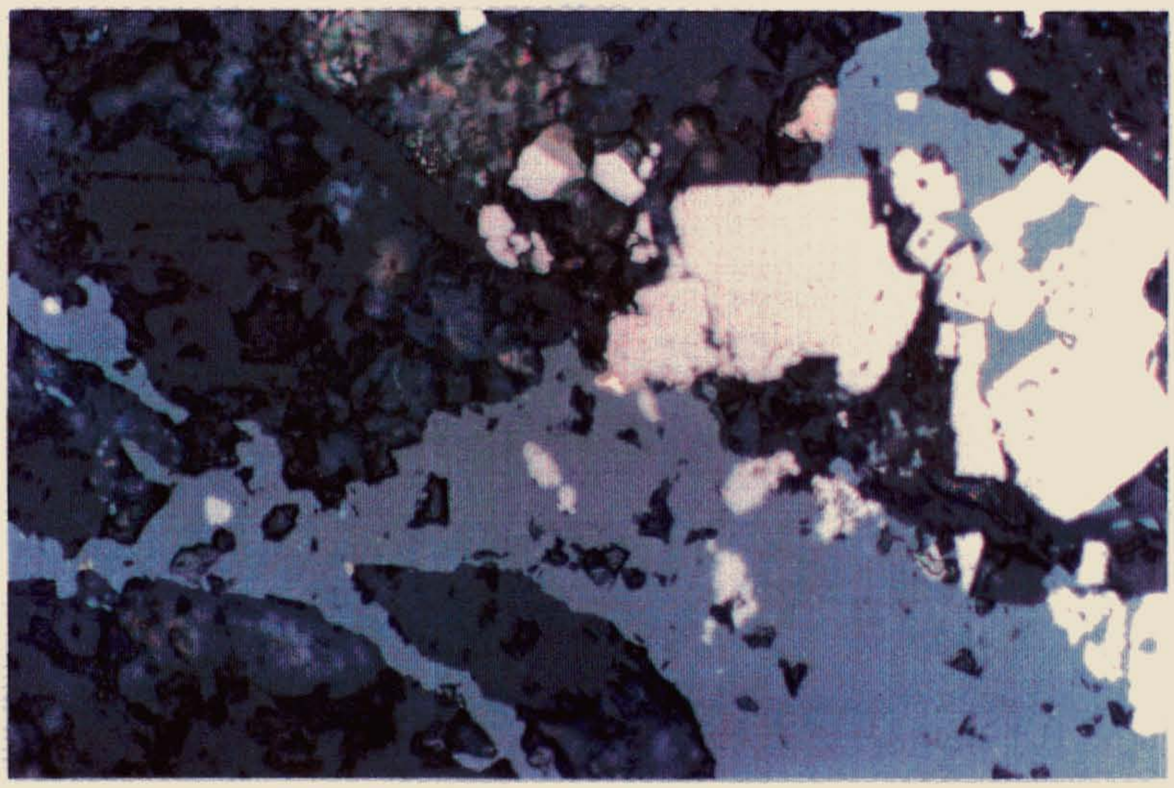


624402 X400 R.L. Two 5 μ electrum grains occurring as exsolution in euhedral pyrite.

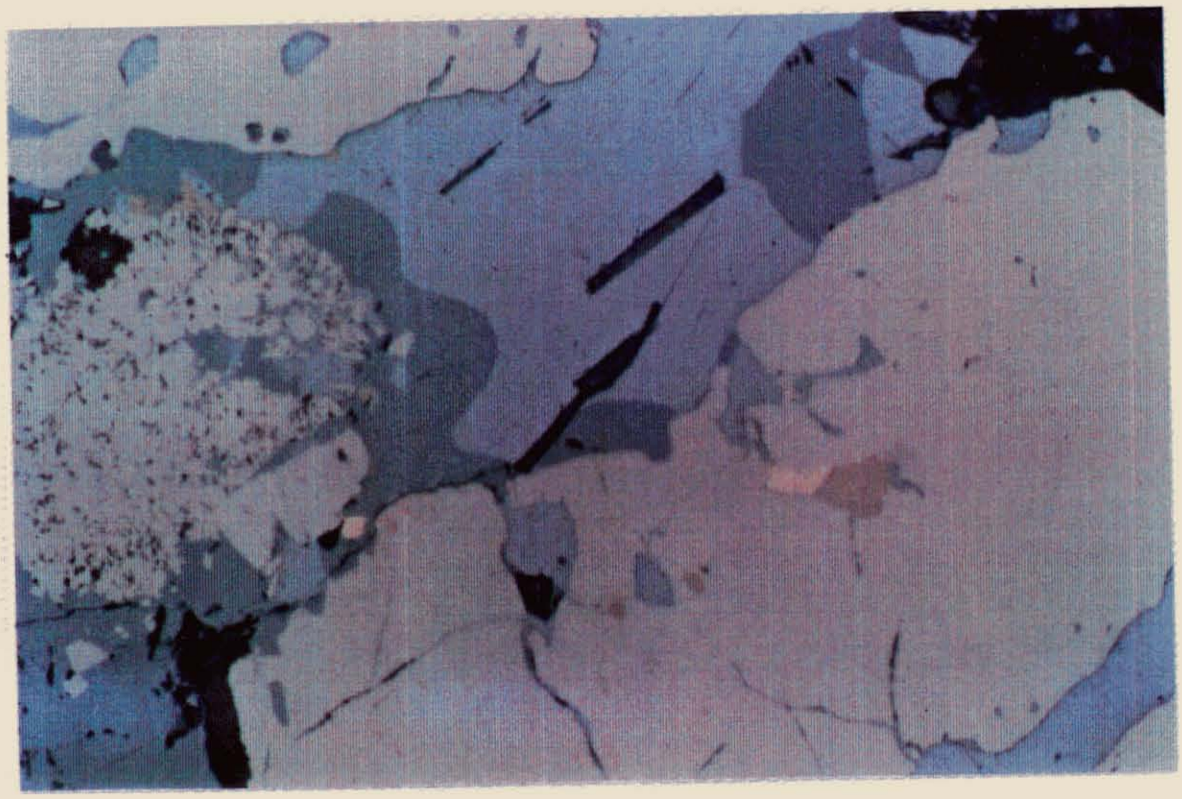
624402 X400 R.L. Several electrum grains (upto 25 μ) in fractured and replaced euhedral pyrites associated with gal-cpy.



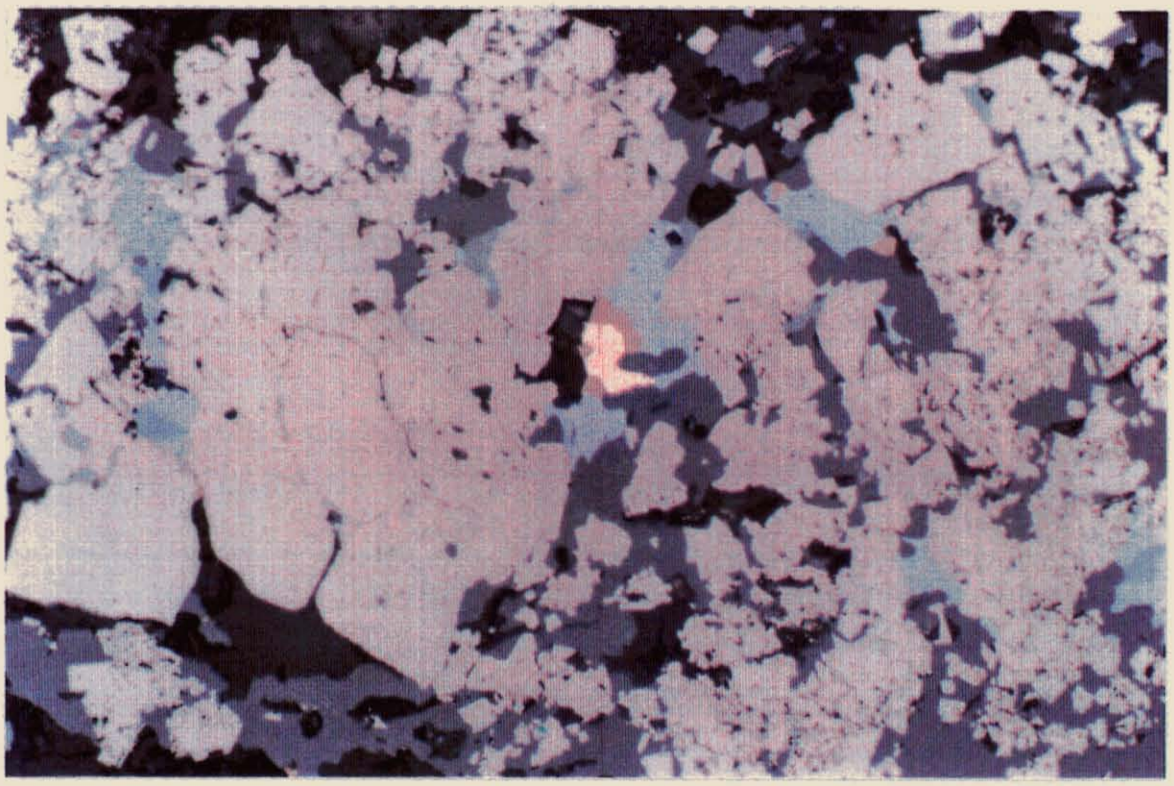
624402 X400 R.L. 7.5 μ electrum grain on edge of euhedral py in cpy-sph and a barite-sericite matrix.



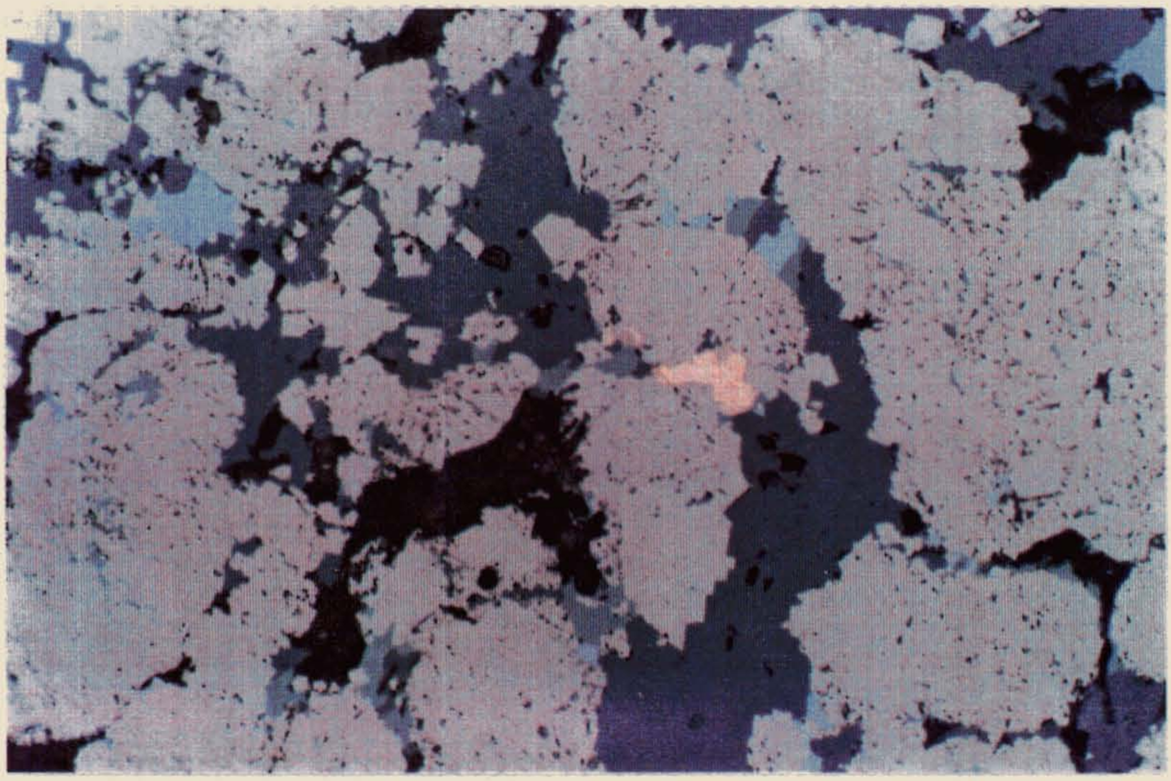
624403 X400 R.L. Two electrum grains. One in a fracture in py with associated cpy-gal. The other in Tenn-tetr-gal. Largest electrum grain is 20μ.



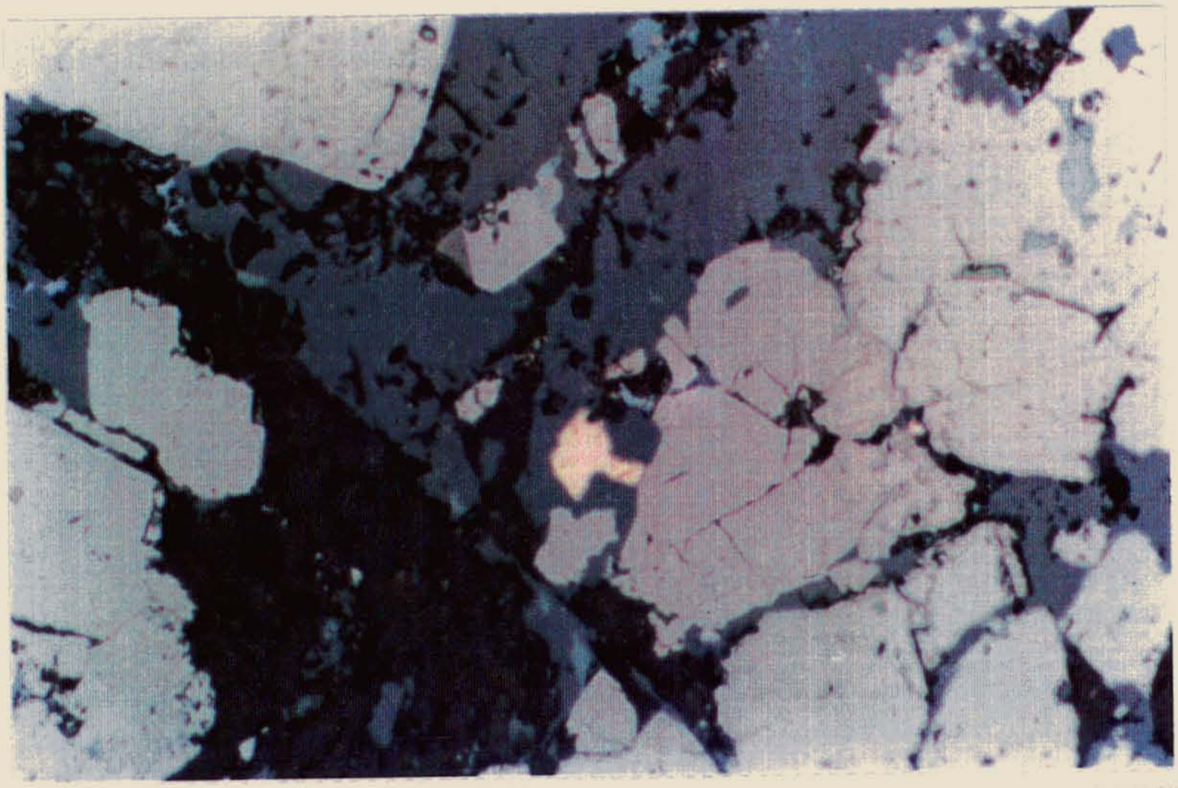
624403 X400 R.L. 25μ electrum grain in a cpy-gal-sph-tetr-tenn. filled fracture within euhedral pyrite and overprinted by spongy pyrite.



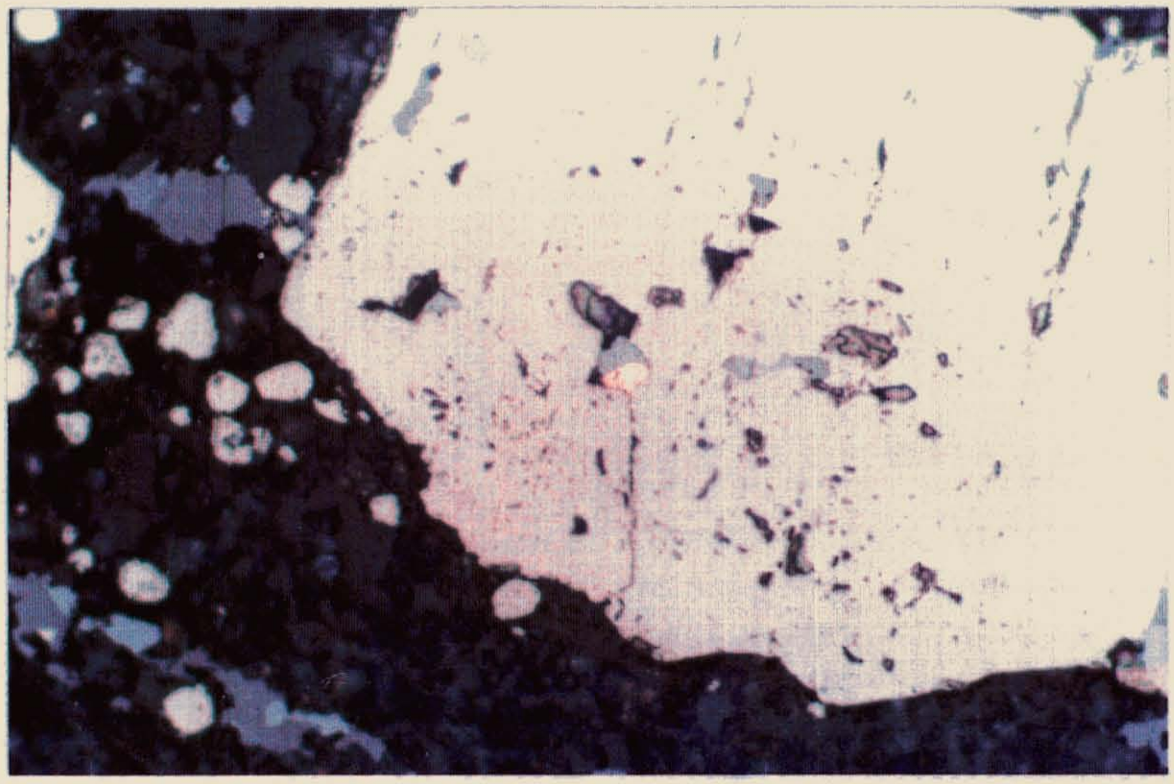
624403 X400 R.L. 35μ electrum grain between euhedral pyrites with a spongy pyrite overgrowth and associated with cpy-gal-sph-tetr-tenn.



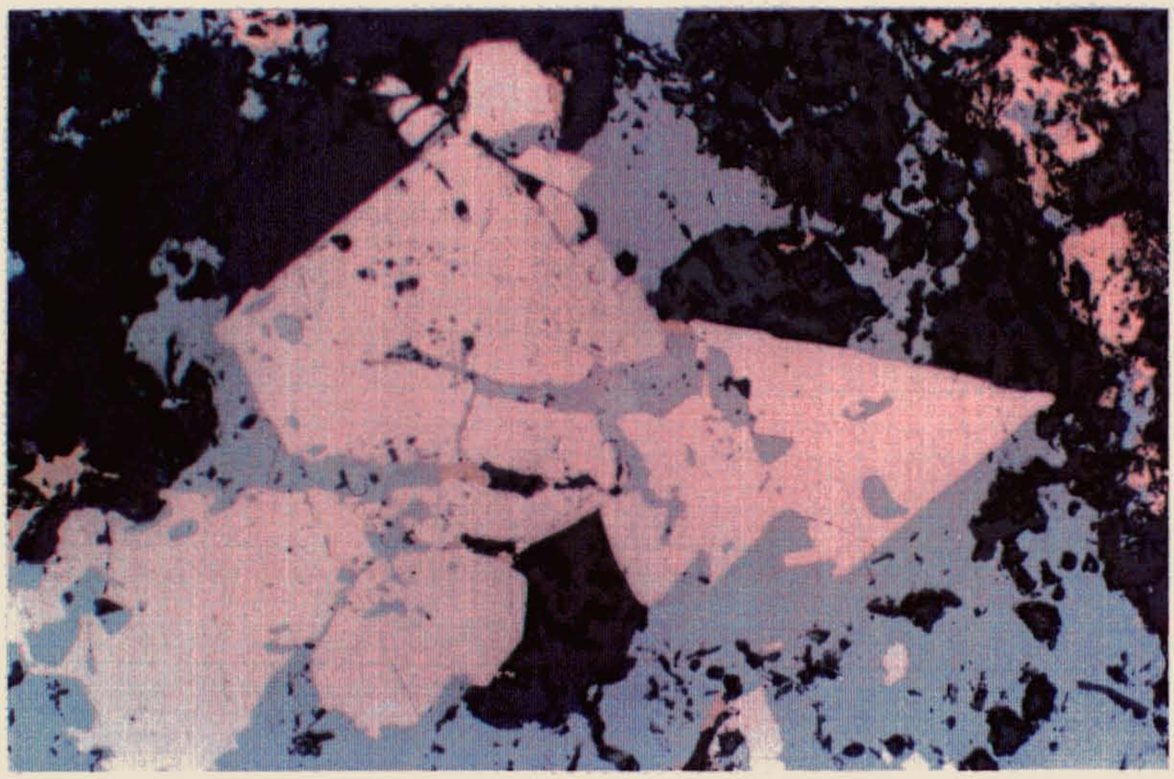
624403 X400 R.L. A 30µ electrum grain within sphalerite after euhedral pyrite. Minor gal-tetr-tenn also seen.



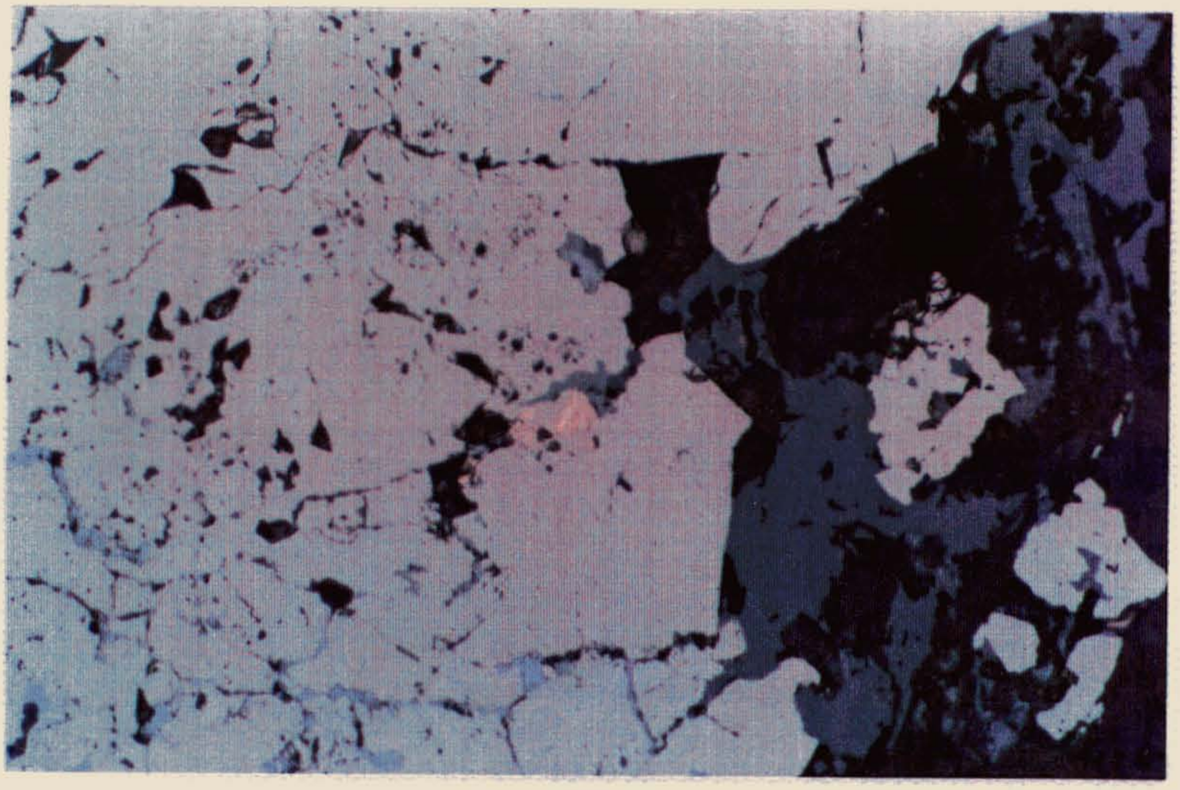
624403 X400 R.L. 12µ electrum grain in healed fracture with gal-tetr-tenn within euhedral pyrite.



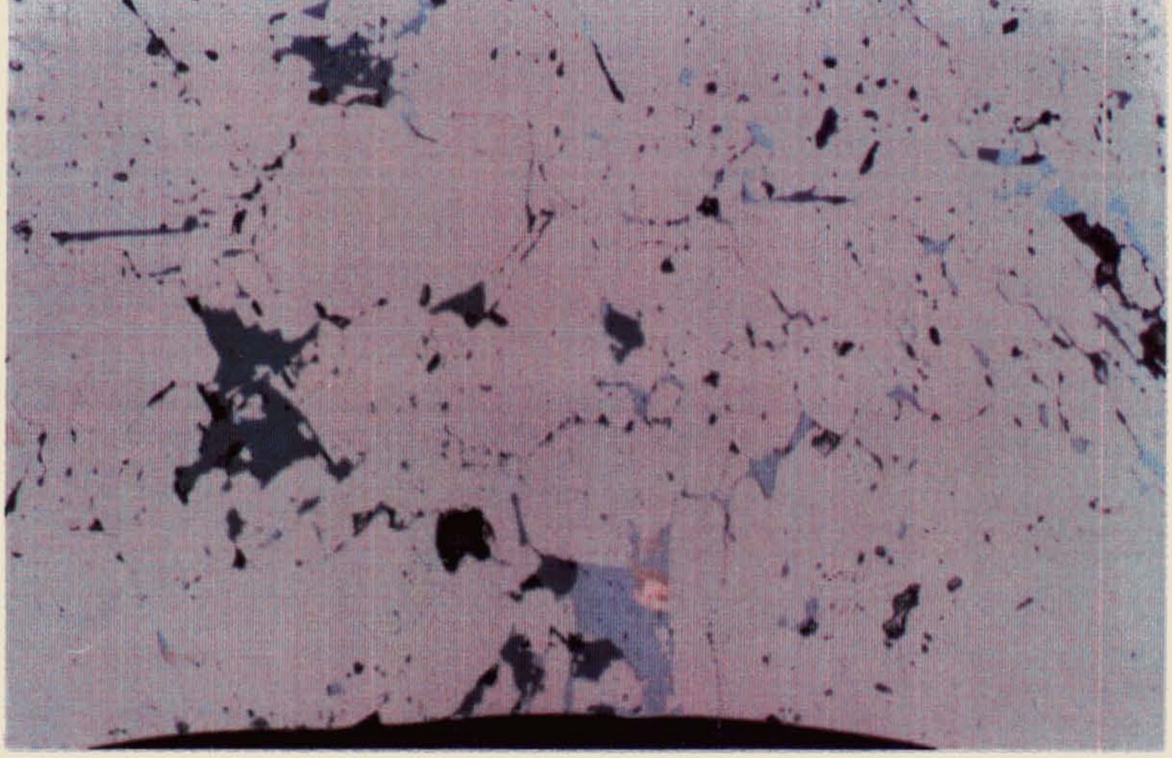
624403 X400 R.L. Rare pyrite rhomdohedra, replaced by tetr-tenn-gal-cpy in barite.



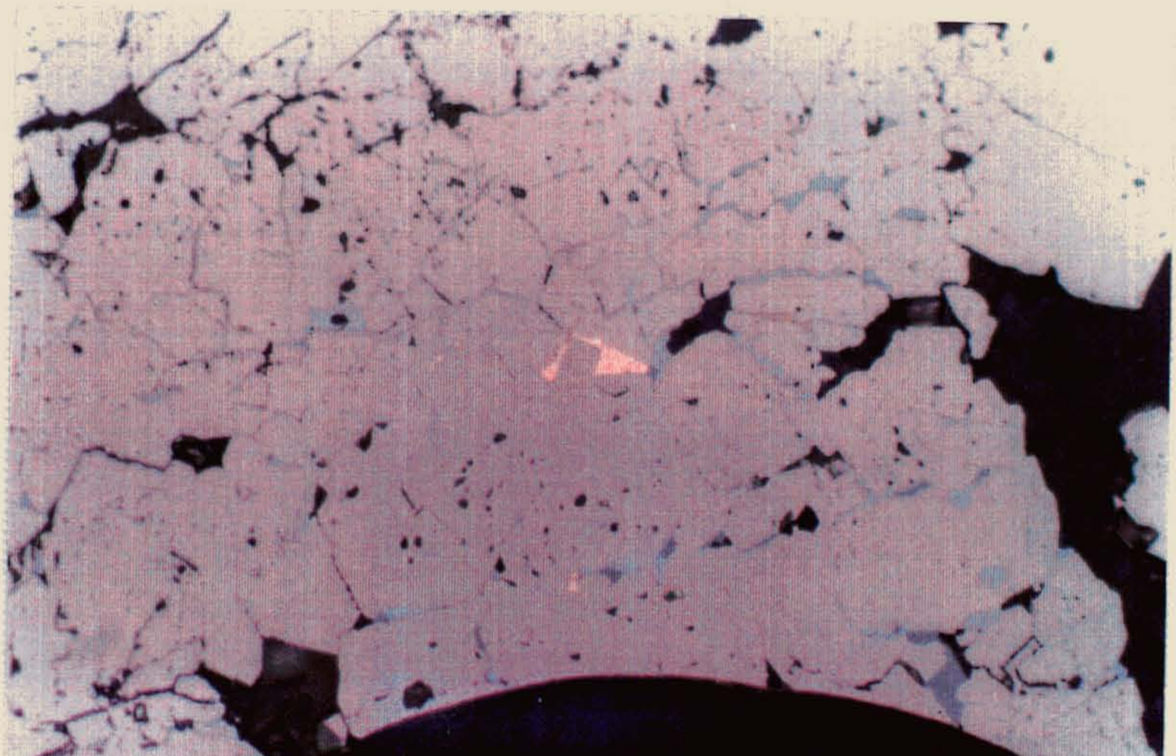
624405 X400 R.L. Fractured euhedral pyrite replaced and infilled by tetr-tenn-gal and electrum (20µ).



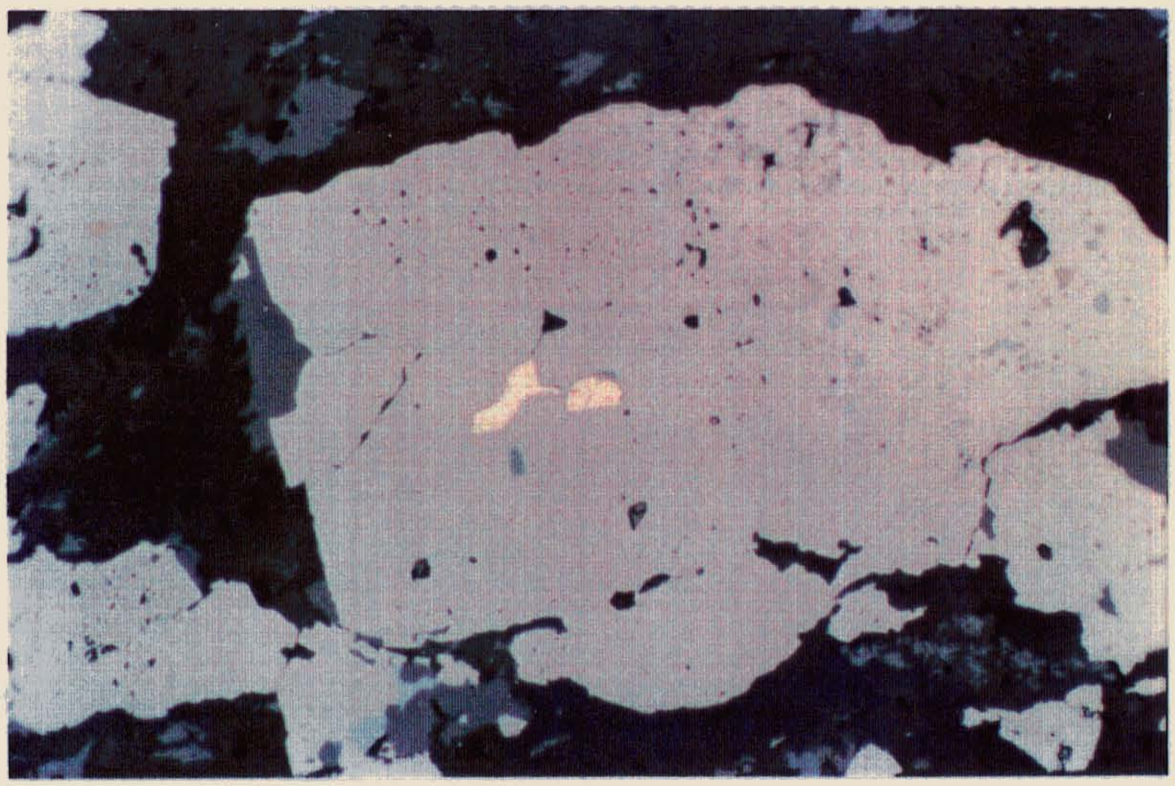
624405 X400 R.L. 10μ electrum grain in fractured euhedral pyrite with an infill of gal-cpy-sph.



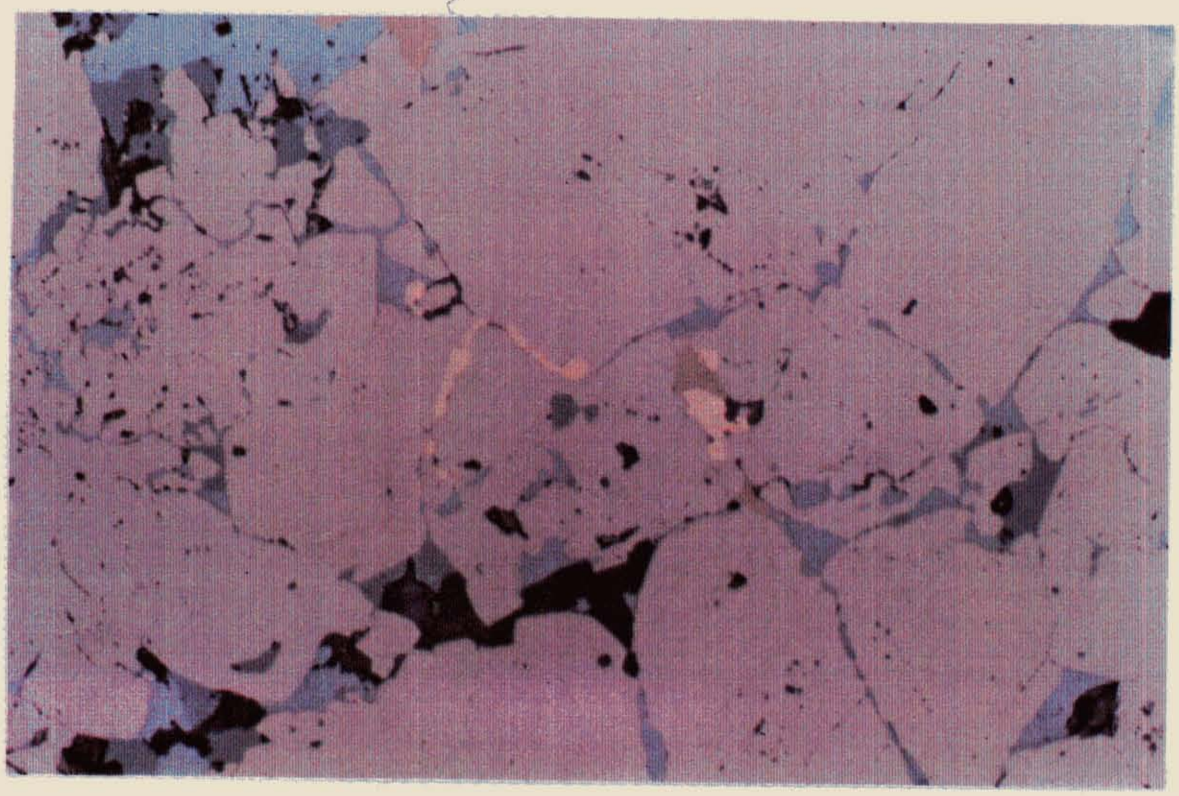
624405 X400 R.L. Electrum (upto 15μ) infilling healed fractures in euhedral pyrite together with cpy-tetr-tenn.



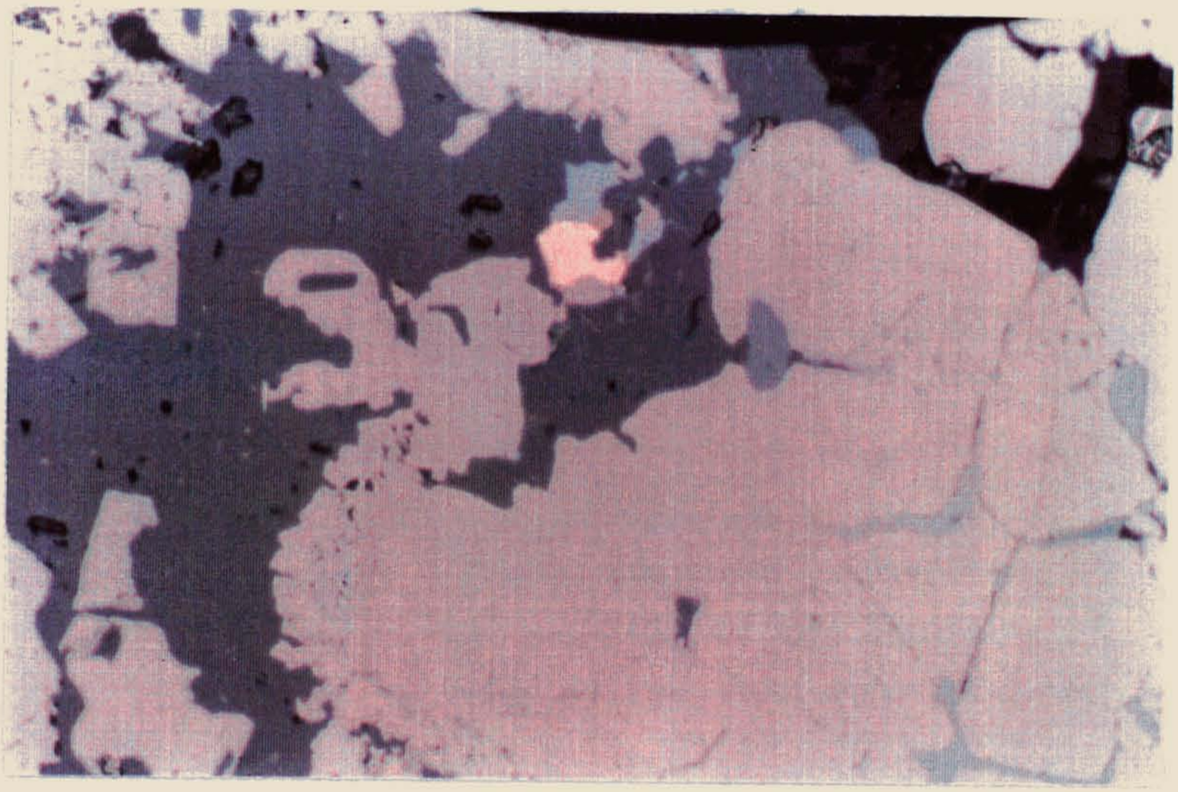
624405 X400 R.L. 15μ and 20μ grains of electrum infilling healed fractures in euhedral pyrite, together with minor amounts of cpy-gal-tetr-tenn.



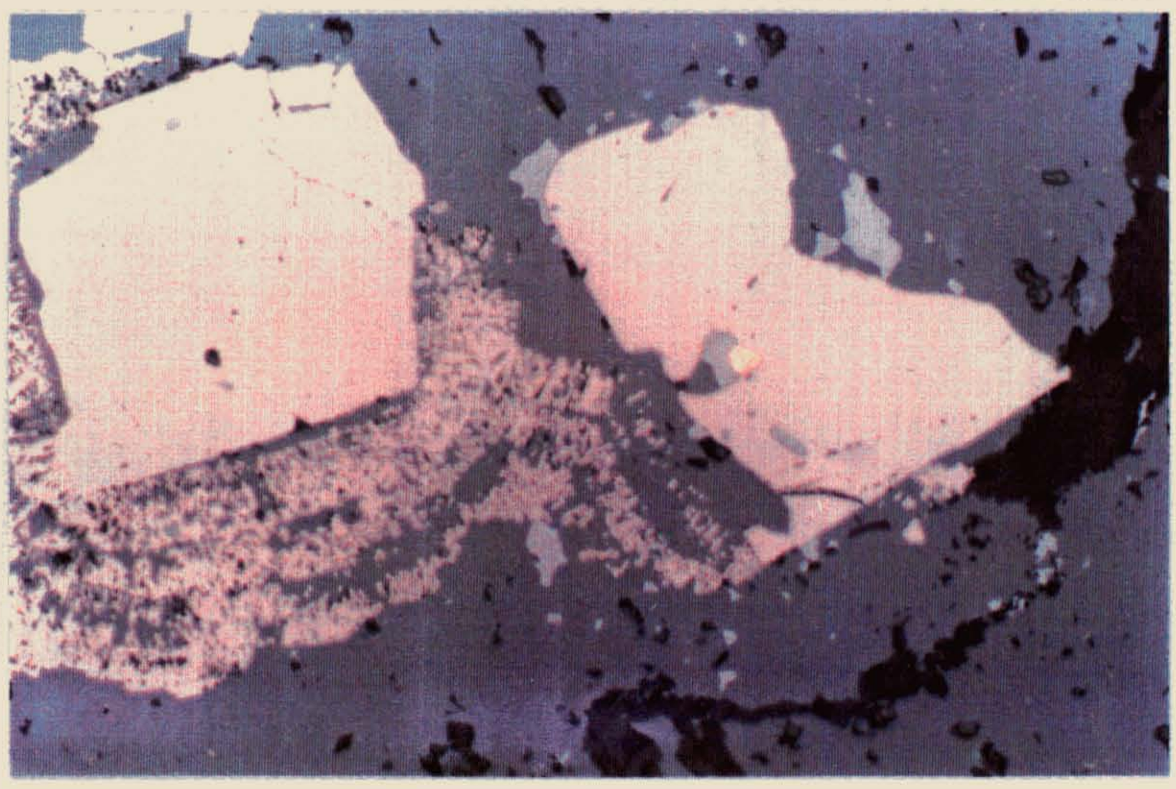
624405 X400 R.L. Numerous 25μ electrum grains filling fractures in pyrite together with cpy-gal-tetr-tenn.



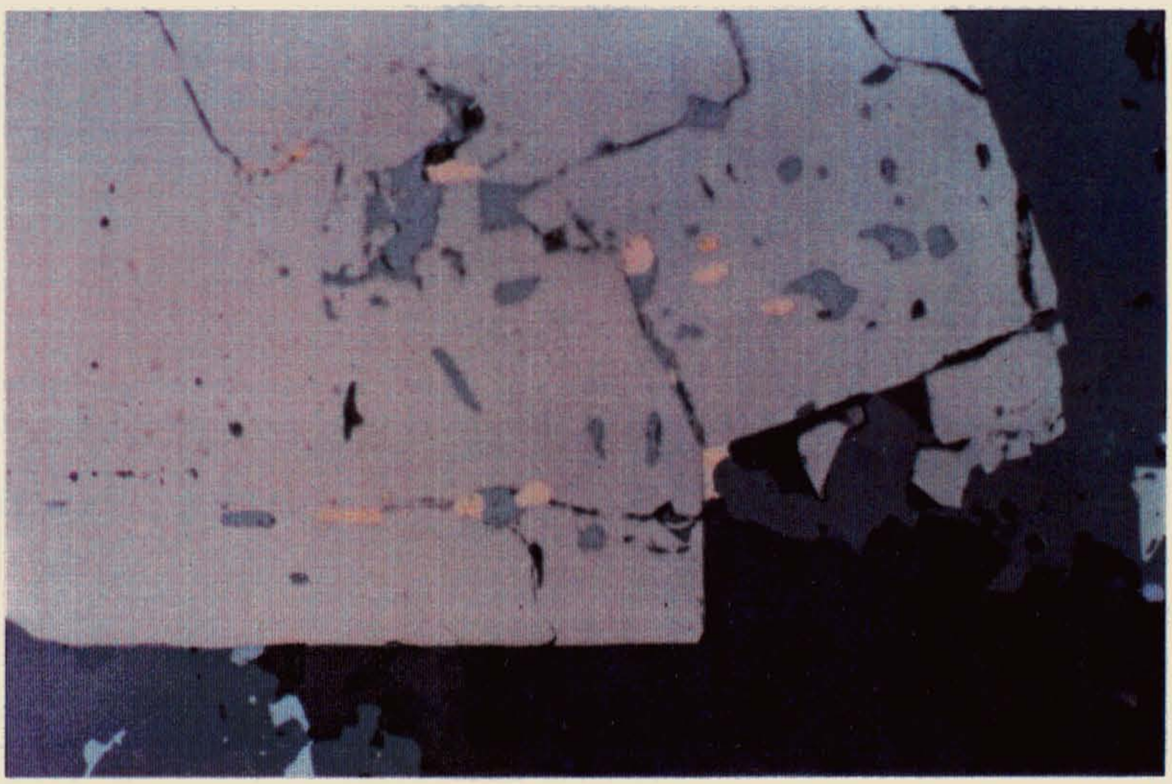
624405 X400 R.L. 30μ electrum grain in a fractured euhedral pyrite with spongy pyrite overgrowth and infilled with sph-gal-cpy.



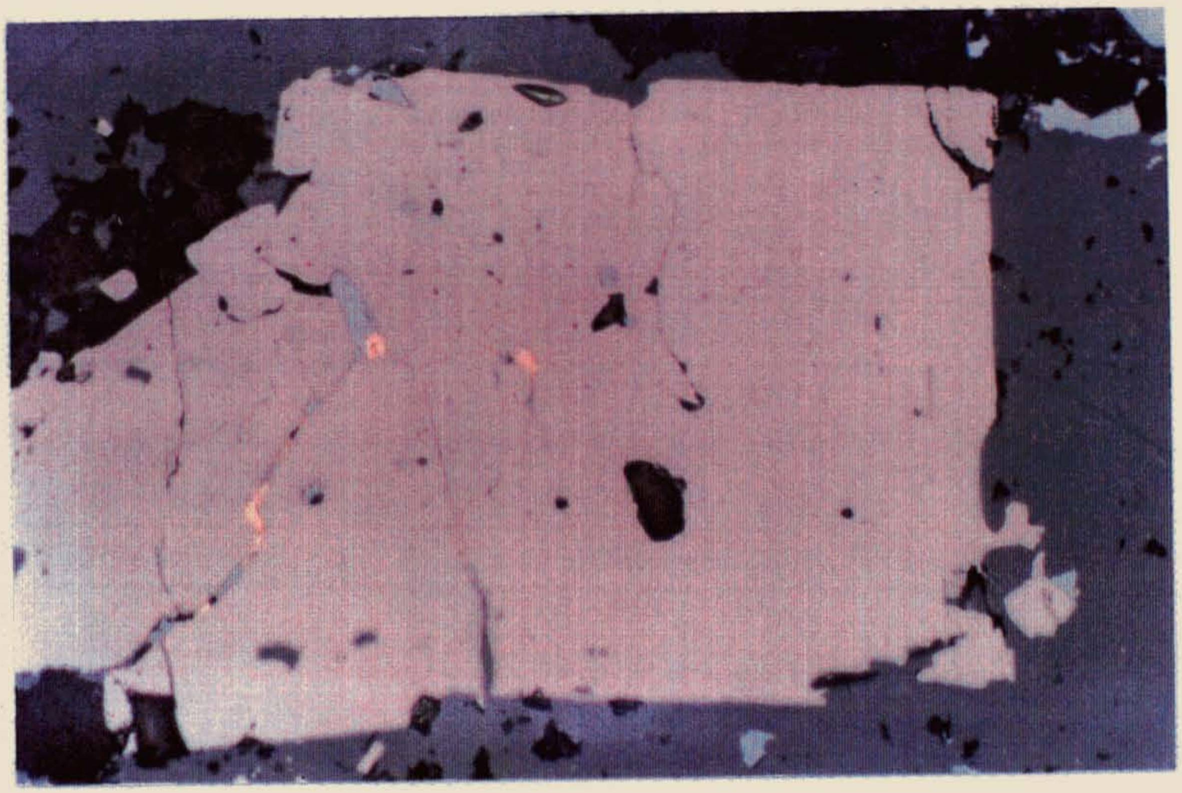
624470 X400 R.L. 7μ electrum grain associated with gal-sph replacement of a euhedral pyrite. Later spongy overgrowth occur on the earlier pyrite.



624470 X400 R.L. 30μ electrum grains and galena along healed fractures in euhedral pyrite.



624470 X400 R.L. 25μ electrum grains and galena along healed fractures in euhedral pyrite.



APPENDIX III

Aberfoyle Exploration GEOCHEMICAL SAMPLE LEDGER

A 35340

PROJECT	BSS SIEVE SIZE CODE - MESH NUMBER	SAMPLE TYPE CODE	CARD PUNCH PRINT / VERIFY	DATE	SHEET
ANTHONY BASIN	A 200, B 150, C 100, D 80, E 60, F 40, G 30, H 20, T = TOTAL	OXIDIZED PRODUCTS O; FRESH ROCK R; STREAM SEDIMENTS S; WEATHERED BEDROCK W; SURFACE TRANSPORTED T; RESIDUAL SOIL E; MINE DUMP M	YES ☐ NO ☐ YES ☐ NO ☐	18/5/93	1/2

EASTINGS (1–7)	NORTHINGS (8–14)	SAMPLE NUMBER (15–20)	DEPTH (21–27) [illegible]	SIZE FRACTION / Sample Type (28–36) [illegible]	METAL VALUES PPM (37–60)	GEOLOGICAL LOG (61–80)
379794	5358209	624203	LMG		ANALYSE FOR	
379716	5358238	624204	LMG			
					Cu, Pb, Zn Ag BY 101	
					Ba, As BY 401	
					WHOLE ROCK BY 408	
					(ANALABS).	
380177	5358406	624451	LMG	NEWTON CK.		
380208	5358406	624452	LMG	"		

OPERATOR COMPUTER CHECK PLOTTER DATE

963102

Aberfoyle Exploration GEOCHEMICAL SAMPLE LEDGER

PROJECT: ANTHONY BASIN

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

SAMPLE TYPE CODE: OXIDIZED PRODUCTS O; FRESH ROCK R (ticked); 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: 2/2

EASTINGS	NORTHINGS	SAMPLE NUMBER	DEPTH in CMS		SIZE FRACTION	Sample Type	METAL VALUES PPM	GEOLOGICAL LOG
380005	5358214	624456	LMG	Newton Ck				
380029	5358196	624457	LMG		"			
380151	5358203	624458	LMG		"			
380938	5357170	624464	LMG		"			
380925	5357163	624465	LMG		"			
380930	5357147	624466	LMG		"			

TOTAL OF 26 ROCK CHIP SAMPLES

OPERATOR COMPUTER CHECK PLOTTER DATE

963103

963104

ANALABS

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

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

ANALYTICAL REPORT No. 100560.60.09511

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

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

ORDER No.	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
624203/624466 Not Continuous	RC Prep : 6P033	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

ANALABS

A Division of Inchcape Testing Services (Australia) Pty. Ltd.
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	Al2O3
1	624203	6	6	207	<2	1581	10	52	139	15.28
2	624204	17	79	72	<2	1122	7	<5	220	14.01
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19	624451	15	19	401	<2	427	3	6	245	15.59
20	624452	32	7	120	<2	2710	<2	27	189	16.16
21	624456	27	11	89	<2	2596	4	47	146	14.56
22	624457	48	29	73	<2	1109	3	63	174	14.85
23	624458	12	16	70	<2	1975	5	<5	261	15.14
24	624464	15	80	165	<2	578	5	24	140	17.14
25	624465	27	28	175	<2	199	5	23	132	16.25

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*

963106

ANALABS

A Division of Inchcape Testing Services (Australia) Pty. Ltd.
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	2 OF 6

TUBE No.	SAMPLE No.	Cu	Pb	Zn	Ag	Ba	As	Cr	Zr	A1203
1	624466	155	917	492	<2	1226	8	20	64	6.79
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23	DETECTION	4	5	4	2	10	2	5	5	0.01
24	UNITS	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%
25	METHOD	GA101	GA101	GA101	GA101	GX401	GX401	GX401	GX401	DX408

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

ANALABS

A Division of Inchcape Testing Services (Australia) Pty. Ltd.
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	3 OF 6

TUBE No.	SAMPLE No.	SiO2	TiO2	Fe2O3	MnO	CaO	K2O	MgO	P2O5	S
1	624203	61.9	0.44	6.84	0.08	1.80	2.44	3.01	0.193	<0.005
2	624204	66.4	0.48	4.88	0.07	2.58	3.64	1.06	0.128	0.404
3										
4										
5										
9										
10										
11										
12										
13										
14										
15										
16										
1										
1										
19	624451	64.4	0.54	9.25	0.17	0.14	1.67	1.96	0.114	0.013
20	624452	66.5	0.42	4.92	0.05	0.07	4.50	1.11	0.100	0.011
21	624456	62.2	0.46	6.99	0.12	1.58	2.77	3.63	0.172	<0.005
22	624457	60.2	0.53	8.91	0.11	2.07	1.65	3.59	0.054	0.008
23	624458	68.2	0.59	5.08	0.08	0.65	3.75	0.53	0.127	<0.005
24	624464	55.1	1.02	9.90	0.13	0.40	0.85	5.55	0.141	0.136
25	624465	62.9	0.95	6.12	0.11	0.27	0.22	3.59	0.133	0.144

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

ANALABS

A Division of Inchcape Testing Services (Australia) Pty. Ltd.
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	4 OF 6

TUBE No.	SAMPLE No.	SiO2	TiO2	Fe2O3	MnO	CaO	K2O	MgO	P2O5	S
1	624466	80.5	0.31	4.17	0.11	0.35	1.17	2.02	0.254	0.380
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23	DETECTION	0.1	0.01	0.01	0.01	0.01	0.01	0.05	0.005	0.005
24	UNITS	%	%	%	%	%	%	%	%	%
25	METHOD	OX408	OX408	OX408	OX408	OX408	OX408	OX408	OX408	OX408

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

AUTHORISED OFFICER Gary Lindberg

ANALABS

A Division of Inchcape Testing Services (Australia) Pty. Ltd.
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	5 OF 6

TUBE No.	SAMPLE No.	Na2O	LOI	TOTAL							
1	624203	4.83	3.05	99.98							
2	624204	2.00	3.90	99.72							
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19	624451	2.48	3.48	99.85							
20	624452	1.91	4.32	100.38							
21	624456	3.68	3.36	99.75							
22	624457	4.73	3.22	100.02							
23	624458	3.22	2.39	99.96							
24	624464	5.86	3.32	99.60							
25	624465	6.91	2.49	100.14							

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

963110

ANALABS

A Division of Inchcape Testing Services (Australia) Pty. Ltd.
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	6 OF 6

TUBE No.	SAMPLE No.	Na2O	LOI	TOTAL						
1	624466	1.93	1.52	99.63						
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23	DETECTION	0.05	0.01	0.01						
24	UNITS	%	%	%						
25	METHOD	OX408	OX408	OX408						

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

AUTHORISED OFFICER Gary Lindberg

BASIN LAKE PROJECT. 9550

Aberfoyle Exploration

GEOCHEMICAL SAMPLE LEDGER

PROJECT	BSS SIEVE SIZE CODE - MESH NUMBER	SAMPLE TYPE CODE	CARD PUNCH PRINT	VERIFY	DATE	SHEET
ANTHONY BASIN	A 200, B 150, C 100, D 80, E 60, F 40, G 30, H 20, T = TOTAL	OXIDIZED PRODUCTS O; FRESH ROCK R; STREAM SEDIMENTS S; WEATHERED BEDROCK W; SURFACE TRANSPORTED T; RESIDUAL SOIL E; MINE DUMP M	YES ☐ NO ☐	YES ☐ NO ☐	4/6/93	1/2

EASTINGS	NORTHINGS	SAMPLE NUMBER	DEPTH in CMS		SIZE FRACTION	Sample Type	METAL VALUES PPM	GEOLOGICAL LOG
								DkGyPkPpHbPgPhTrPyA-1
								DkGyPkHblithicxtal richA-
								PaleGyHbClFdPhA-1
								GyGnHbFdA-1
								GyBlmgHbPg poorPhA-1
								PkGycgHbPgPhA-1vesicles?
								GyPkHbFdxtal richA-1
								CgFdHbPhA-1
								PkBncgHbPgPhA-1
380067	5358353	624439	LMG					DkGyFdPhclvdD-1
380027	5358315	440	"					DkGnFdPhclvdPClaltD-1
380051	5358335	441	"					GyFdPhPsesialtD-1
380037	5358338	442	"					GnGyFdPhD-1
379978	5358303	443	"					DkGyGnFdPhY/D-1
379940	5358281	444	"					DkPkGnHbPgPhClA-1vugs?
379924	5358296	445	"					GnPkFdHbPhc̄roteQzA-1
								sparsleyFdHbPhLgtGn
								GnFdHbPhA-1
								GnsparselyHbFdPhA-1
								LgtGymtxc̄HbFdPhA-1
								LgtGyBlGnHbPhfgA-1
380308	5358279	624459	LMK (new ck.)					GyPPFdQzD/R-1?
380284	5358376	624453	"		"			BhPkQzFd RhyAgglomerate.
		TOTAL OF 26 SAMPLES. (incl. pg. 2)						

OPERATOR | COMPUTER | CHECK | PLOTTER | DATE

963111

ANALABS

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

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

ANALYTICAL REPORT No. 100560.60.09550

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

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

ORDER No.	PROJECT
4457	

DATE RECEIVED	RESULTS REQUIRED
08/06/93	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
624181/185,352/358,439/450, 453,459	RC Prep : 6P033	Cu,Pb,Zn,Ag/GA101 Ba,As,Cr,Zr/GA401 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

N.B. S/OX408 MAY NOT BE ACCURATE FOR SAMPLES CONTAINING SIGNIFICANT LEVELS OF SULPHIDE. METHOD OM613 SHOULD BE USED TO CHECK SUCH SAMPLES.

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

AUTHORISED OFFICER

963119

963113

ANALABS

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

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
13	624439	15	<5	125	<2	679	9	11	291	18.20
14	624440	21	6	76	<2	716	4	6	239	15.47
15	624441	33	<5	73	<2	802	5	9	247	15.56
16	624442	12	<5	86	<2	480	4	5	235	15.26
17	624443	9	16	49	<2	942	2	6	310	13.89
18	624444	19	56	192	<2	1224	2	45	142	15.84
19	624445	60	23	93	<2	2234	<2	49	152	16.46
20										
21										
22										
23										
24										
25	624453	20	<5	105	<2	2134	2	13	146	14.79

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*

ANALABS

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

ANALYTICAL DATA

SAMPLE PREFIX	REPORT No.	REPORT DATE	CLIENT ORDER No.	PAGE
	100560.60.09550	13/07/93	4457	2 OF 6

TUBE No.	SAMPLE No.	Cu	Pb	Zn	Ag	Ba	As	Cr	Zr	Al2O3
1	624459	7	9	178	<2	2059	7	21	166	15.09
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23	DETECTION	4	5	4	2	10	2	5	5	0.01
24	UNITS	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%
25	METHOD	GA101	GA101	GA101	GA101	GX401	GX401	GX401	GX401	OX408

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

AUTHORISED OFFICER *Gary Lindberg*

ANALABS

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

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
13	624439	60.6	0.57	8.67	0.09	0.28	2.70	1.55	0.151	0.034
14	624440	66.2	0.53	5.74	0.07	1.50	2.36	0.88	0.142	<0.005
15	624441	68.5	0.52	6.12	0.05	0.45	2.60	0.89	0.145	<0.005
16	624442	69.4	0.44	5.49	0.06	0.22	1.94	1.11	0.126	<0.005
17	624443	72.4	0.35	3.96	0.08	1.09	2.63	0.79	0.051	0.006
18	624444	62.7	0.44	6.28	0.06	0.44	2.55	3.80	0.202	<0.005
19	624445	61.5	0.45	6.42	0.11	1.50	3.24	3.59	0.210	0.005
2										
2										
25	624453	69.1	0.34	4.47	0.06	0.19	3.14	1.19	0.146	0.017

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*

963116

ANALABS

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

ANALYTICAL DATA

SAMPLE PREFIX	REPORT No.	REPORT DATE	CLIENT ORDER No.	PAGE
	100560.60.09550	13/07/93	4457	4 OF 6

TUBE No.	SAMPLE No.	SiO2	TiO2	Fe2O3	MnO	CaO	K2O	MgO	P2O5	S
1	624459	66.9	0.34	4.86	0.12	0.50	2.70	2.14	0.185	0.009
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23	DETECTION	0.1	0.01	0.01	0.01	0.01	0.01	0.05	0.005	0.005
24	UNITS	%	%	%	%	%	%	%	%	%
25	METHOD	OX408	OX408	OX408	OX408	OX408	OX408	OX408	OX408	OX408

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

AUTHORISED OFFICER Gary Lindbe

963117

ANALABS

A Division of Inchcape Testing Services (Australia) Pty. Ltd.
A.C.N. 004 591 684

ANALYTICAL DATA

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

		Na_2O	LOI	TOTAL						
13	624439	4.03	2.83	99.66						
14	624440	3.84	2.93	99.65						
15	624441	3.12	2.42	100.38						
16	624442	3.70	2.10	99.83						
17	624443	3.18	1.39	99.87						
18	624444	4.63	2.64	99.58						
1										
2										
22										
23										
24										
25	624453	4.19	2.30	99.93						

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

963118

ANALABS

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

ANALYTICAL DATA

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

TUBE No.	SAMPLE No.	Na2O	LOI	TOTAL						
1	624459	5.17	1.84	99.83						
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23	DETECTION	0.05	0.01	0.01						
24	UNITS	%	%	%						
25	METHOD	OX408	OX408	OX408						

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

AUTHORISED OFFICER Gary Lindberg

0571

Aberfoyle Exploration — GEOCHEMICAL SAMPLE LEDGER

A 39340

PROJECT	BSS SIEVE SIZE CODE - MESH NUMBER	SAMPLE TYPE CODE		CARD PUNCH PRINT	VERIFY	DATE	SHEET
ANTHONY BASIN	A 200, B 150, C 100, D 80, E 60, F 40, G 30, H 20, T = TOTAL	☐ OXIDIZED PRODUCTS O; ☐ FRESH ROCK R; ☐ STREAM SEDIMENTS S	☒ WEATHERED BEDROCK W; ☐ SURFACE TRANSPORTED T; ☐ RESIDUAL SOIL E; ☐ MINE DUMP M	YES ☐ NO ☐	YES ☐ NO ☐	16 - 6	1/1

EASTINGS	NORTHINGS	SAMPLE NUMBER	DEPTH / LICENCE	SIZE FRACTION	Sample Type	METAL VALUES PPM	GEOLOGICAL LOG
380965	5357284	624401	LMG			Cu Pb Zn Ba As Ag Au	Float Ba/sulphide from tyndall ck
380972	5357296	624402	LMG			* Expect high Ba/Pb values	
380978	5357308	624403	LMG				
380984	5357317	624405	LMG				

OPERATOR COMPUTER CHECK PLOTTER DATE

963119

963120

ANALABS

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

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

ANALYTICAL REPORT No. 100560.60.09571

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

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

ORDER No.	PROJECT
4468	LMG

DATE RECEIVED	RESULTS REQUIRED
17/06/93	ASAP

No. OF PAGES OF RESULTS	DATE REPORTED	No. OF COPIES	TOTAL No. OF SAMPLES
1	09/07/93	1	4

SAMPLE NUMBERS	SAMPLE DESCRIPTION	ELEMENT/METHOD
624401/03,624405	RO Prep : GP033	Cu,Pb,Pb:1,Zn,Zn:1,Ag/GA104 Au/GG309 As/GX401,Ba/GX404

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

RESULTS TO

RESULTS TO

REMARKS

Anthony Basin

AUTHORISED OFFICER

ANALABS

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

ANALYTICAL DATA

SAMPLE PREFIX	REPORT No.	REPORT DATE	CLIENT ORDER No.	PAGE
	100560.60.09571	09/07/93	4468	1 OF 1

TUBE No.	SAMPLE No.	Cu	Pb	Pb:1	Zn	Zn:1	Ag	Au	As	Ba
1	624401	2475	2.41	–	–	5.84	452	1.250	771	41.40
2	624402	7900	–	2.60	3.20	–	107	8.780	846	37.50
3	624403	2764	–	2.60	–	6.09	105	8.680	976	40.30
4	624405	3699	–	2.73	–	6.12	240	12.800	3534	26.00
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23	DETECTION	20	0.01	0.01	0.01	0.01	10	0.008	2	0.01
24	UNITS	ppm	%	%	%	%	ppm	ppm	ppm	%
25	METHOD	GA104	GA104	GA104	GA104	GA104	GA104	GG309	GX401	GX404

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

NEWTON / ... L, ... MARGARET

Abertoyle Exploration

GEOCHEMICAL SAMPLE LEDGER

PROJECT: ANTHONY BASIN

BSS SIEVE SIZE CODE: A 200, B 150, C 100, D 80, E 60, F 40, G 30, H 20, I 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: 3/6/93

SHEET: 1/1

EASTINGS	NORTHINGS	SAMPLE NUMBER	LICENCE	SIZE FRACTION	Sample Type	METAL VALUES PPM	GEOLOGICAL
380043	5358340	624438	LMG		R	Phil Robinson	VesGnB/A
380067	5358353	624439	LMG		R	University of Tasmania	FdrichDkGyClvdD-1clast.
380027	5358315	624440	LMG		R	REE Analysis.	GyGnFdPhD-1domesth
380051	5358335	624441	LMG		R	La, Ce, Pr, Nd, Sm, Eu	GyGnFdPhD-1domeupper
380037	5358338	624442	LMG		R	Gd, Dy, Er, Yb	FdPhD-1clastbaseunit
379978	5358303	624443	LMG		R		D/YFdPx-1slicebaseway
379940	5358281	624444	LMG		R		HbFdPhA-1basedam
379924	5358296	624445	LMG		R		HbFdPhA-1NewtonCk.
		624356	BSL		R		MagFdHbA-1sthrd.todam
		624448	BSL		R		NmagFdHbPhA-1AntRd.

TOTAL OF 10 SAMPLES

9631 22

CO-ORDINATOR — COMPUTER — CHECK — PLOTTER — DATE

963123

ANALABS

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

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

ANALYTICAL REPORT No. 100560.60.09659

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

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

ORDER No.	PROJECT
4500	

DATE RECEIVED	RESULTS REQUIRED
02/08/93	ASAP

No. OF PAGES OF RESULTS	DATE REPORTED	No. OF COPIES	TOTAL No. OF SAMPLES
2	18/08/93	1	13

SAMPLE NUMBERS	SAMPLE DESCRIPTION	ELEMENT/METHOD
624186/187,388/397,399	RC Prep : GP033(A)	Au,Au(R),Au(S)/GG309 Cu,Pb,Zn,Ag/GA101 Pb,Pb:1,Zn,Zn:1,Ag/GA104 Ba,As/GX401, Ba/GX404

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

RESULTS TO

RESULTS TO

REMARKS

TYNDALL ck.

N.B. Pb:1
Zn:1
merged by hand.

AUTHORISED OFFICER

963124

ANALABS

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

ANALYTICAL DATA

SAMPLE PREFIX	REPORT No.	REPORT DATE	CLIENT ORDER No.	PAGE
	100560.60.09659	18/08/93	4500	1 OF 2

TUBE No.	SAMPLE No.	Cu	Pb	Pb	Pb:1	Zn	Zn	Zn:1	Ag	Ag
1	624186	1541	-	-	3.25	-	-	9.76	-	66
2	624187	9	528	-	-	357	-	-	<2	-
3	624388	8	54	-	-	280	-	-	<2	-
4	624389	1807	-	1.81	-	1686	-	-	14	-
5	624390	279	-	-	2.83	-	1.17	-	-	81
6	624391	338	-	1.42	-	103	-	-	14	-
7	624392	4284	-	-	4.94	725	-	-	-	75
8	624393	458	4360	-	-	-	0.74	-	-	70
9	624394	71	817	-	-	1558	-	-	-	77
10	624395	243	334	-	-	3715	-	-	-	35
11	624396	944	-	0.66	-	-	1.51	-	-	146
12	624397	3601	-	-	3.89	394	-	-	-	94
13	624399	186	2011	-	-	7421	-	-	15	-
14										
15										
16										
17										
18										
19										
20										
21										
22										
23	DETECTION	4	5	0.01	0.01	4	0.01	0.01	2	10
24	UNITS	ppm	ppm	%	%	ppm	%	%	ppm	ppm
25	METHOD	GA101	GA101	GA104	GA104	GA101	GA104	GA104	GA101	GA104

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

ANALABS

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

ANALYTICAL DATA

SAMPLE PREFIX	REPORT No.	REPORT DATE	CLIENT ORDER No.	PAGE
	100560.60.09659	18/08/93	4500	2 OF 2

TUBE No.	SAMPLE No.	Au	Au(R)	Au(S)	Ba	Ba	As			
1	624186	4.510	4.370	-	-	28.97	1316			
2	624187	0.025	-	-	-	0.63	79			
3	624388	<0.008	-	-	1033	-	154			
4	624389	0.070	-	-	-	6.06	23			
5	624390	<0.008	-	-	-	8.82	129			
6	624391	<0.008	-	-	-	1.52	62			
7	624392	<0.008	-	-	-	3.34	334			
8	624393	0.060	-	-	1182	-	768			
9	624394	1.170	1.100	-	-	41.95	734			
10	624395	0.401	0.381	-	-	4.48	701			
11	624396	0.016	-	-	-	5.95	273			
12	624397	<0.008	0.008	0.009	-	4.48	1006			
13	624399	0.588	0.620	-	-	7.10	258			
14										
15										
16										
18										
19										
20										
21										
22										
23	DETECTION	0.008	0.008	0.008	10	0.01	2			
24	UNITS	ppm	ppm	ppm	ppm	%	ppm			
25	METHOD	GG309	GG309	GG309	GX401	GX404	GX401			

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

AUTHORISED OFFICER

APPENDIX IV

NEWTON CK LAKE MARGARET

Abertoyle Exploration

GEOCHEMICAL SAMPLE LEDGER

PROJECT: ANTHONY BASIN

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

SAMPLE TYPE CODE: [ ] OXIDIZED PRODUCTS O; [x] 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: 3/6/93

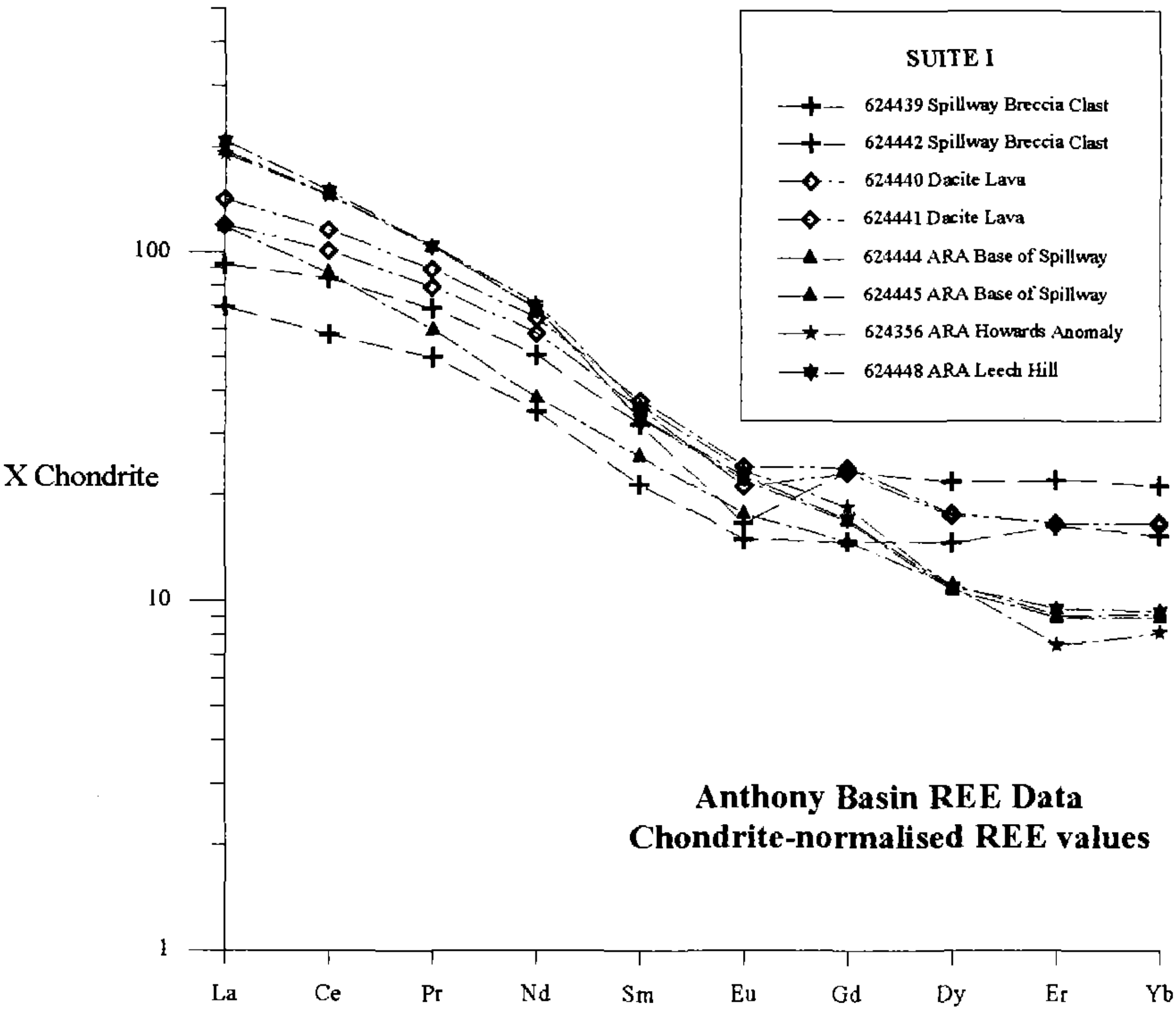
SHEET: 1/1

EASTINGS	NORTHINGS	SAMPLE NUMBER	LICENCE	SIZE FRACTION	Sample Type	METAL VALUES PPM	GEOLOGICAL LOG
		624438	LMG		R	Phil Robinson University of Tasmania	VesGnB/A
		624439	LMG		R	REE Analysis	FdrichDkGyClvdD-1clast.
		624440	LMG		R	La, Ce, Pr, Nd, Sm, Eu	GyGnFdPhD-1domesth
		624441	LMG		R	Gd, Dy, Er, Yb	GyGnFdPhD-1domeupper
		624442	LMG		R		FdPhD-1clastbaseunit
		624443	LMG		R		D/YFdPx-1slicebasesway
		624444	LMG		R		HbFdPhA-1basedam
		624445	LMG		R		HbFdPhA-1NewtonCk.
		624356	BSL		R		MagFdHbA-1sthrdtodam
		624448	BSL		R		NmagFdHbPhA-1AntRd.

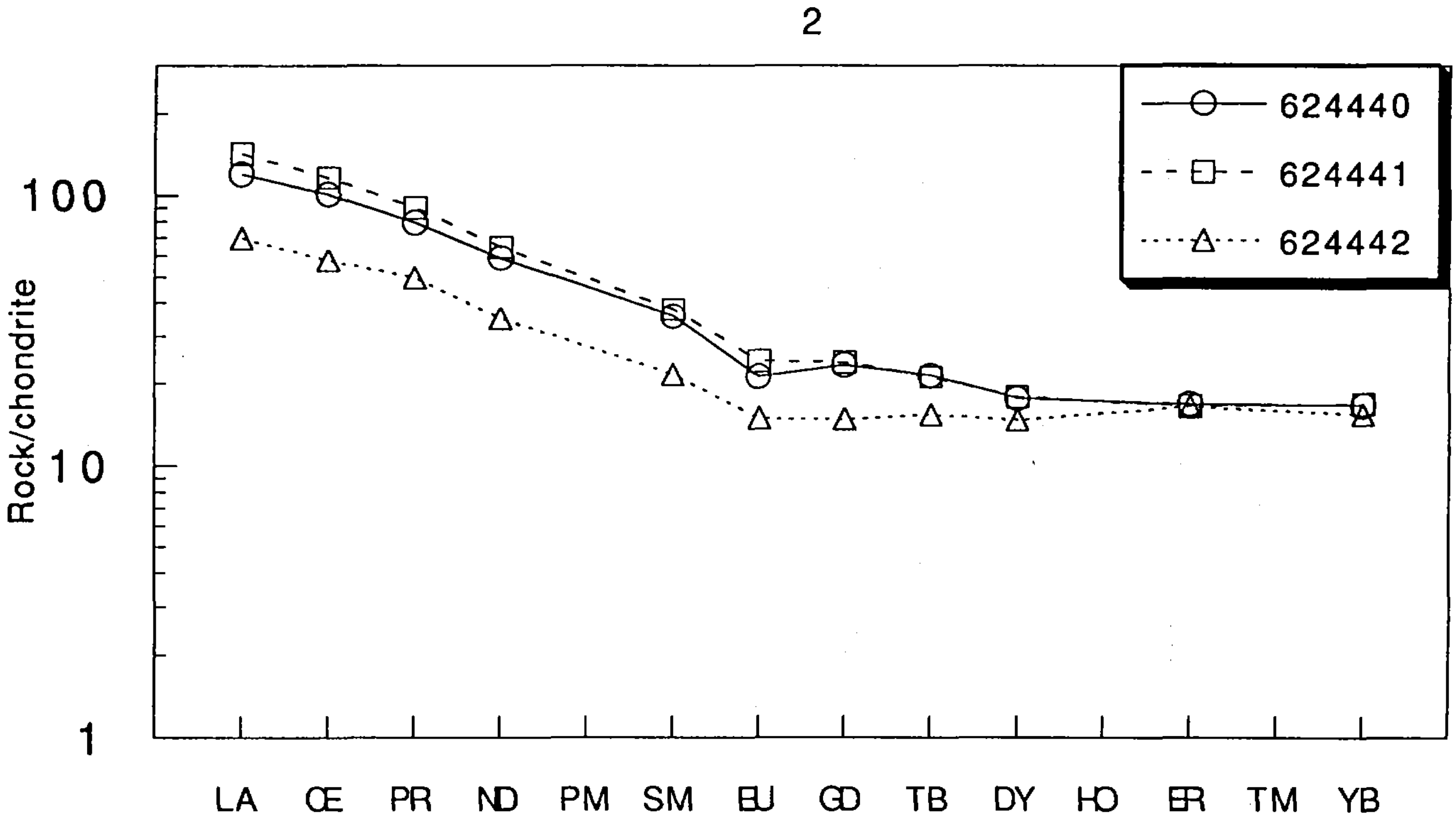
TOTAL OF 10 SAMPLES

963127

OPERATOR COMPUTER CHECK PLOTTER DATE


SUITE I
624439 Spillway Breccia Clast
624442 Spillway Breccia Clast
624440 Dacite Lava
624441 Dacite Lava
624444 ARA Base of Spillway
624445 ARA Base of Spillway
624356 ARA Howards Anomaly
624448 ARA Leech Hill
X Chondrite
100
10
1
La
Ce
Pr
Nd
Sm
Eu
Gd
Dy
Er
Yb
Anthony Basin REE Data
Chondrite-normalised REE values

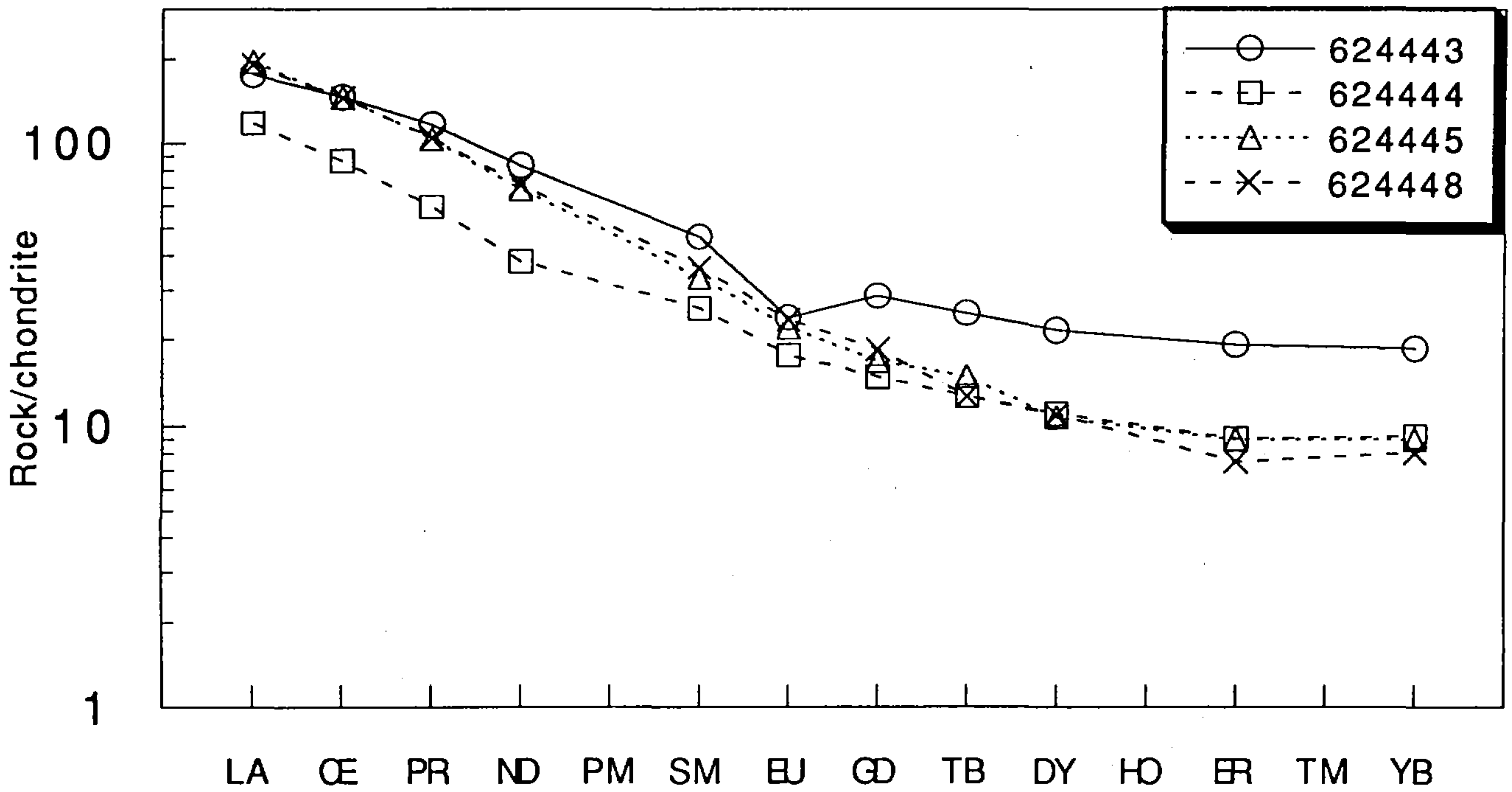
	624356	624438	624439	624440	624441
LA ppm	65.6	26.4	29.0	37.6	44.6
CE ppm	121.3	42.8	68.3	81.8	94.4
PR ppm	12.07	6.54	7.99	9.18	10.45
ND ppm	40.9	24.9	30.3	34.9	38.5
SM ppm	6.37	4.68	6.13	6.80	7.22
EU ppm	1.64	1.59	1.20	1.53	1.75
GD ppm	4.42	3.93	6.08	6.03	6.22
TB ppm	0.70	0.58	1.11	1.05	1.04
DY ppm	3.55	3.68	7.12	5.70	5.79
ER ppm	2.02	2.30	4.70	3.57	3.54
YB ppm	1.94	2.09	4.46	3.44	3.49
	624442	624443	624444	624445	624448
LA ppm	21.9	55.1	37.1	61.4	59.9
CE ppm	46.8	118.4	70.6	118.3	117.8
PR ppm	5.75	13.48	6.91	12.04	12.11
ND ppm	20.8	49.7	22.7	41.1	42.6
SM ppm	4.14	8.89	4.95	6.37	6.93
EU ppm	1.08	1.73	1.28	1.60	1.70
GD ppm	3.82	7.39	3.84	4.35	4.79
TB ppm	0.75	1.22	0.62	0.73	0.62
DY ppm	4.77	7.00	3.59	3.48	3.55
ER ppm	3.49	4.10	1.93	1.91	1.60
YB ppm	3.20	3.88	1.92	1.87	1.69

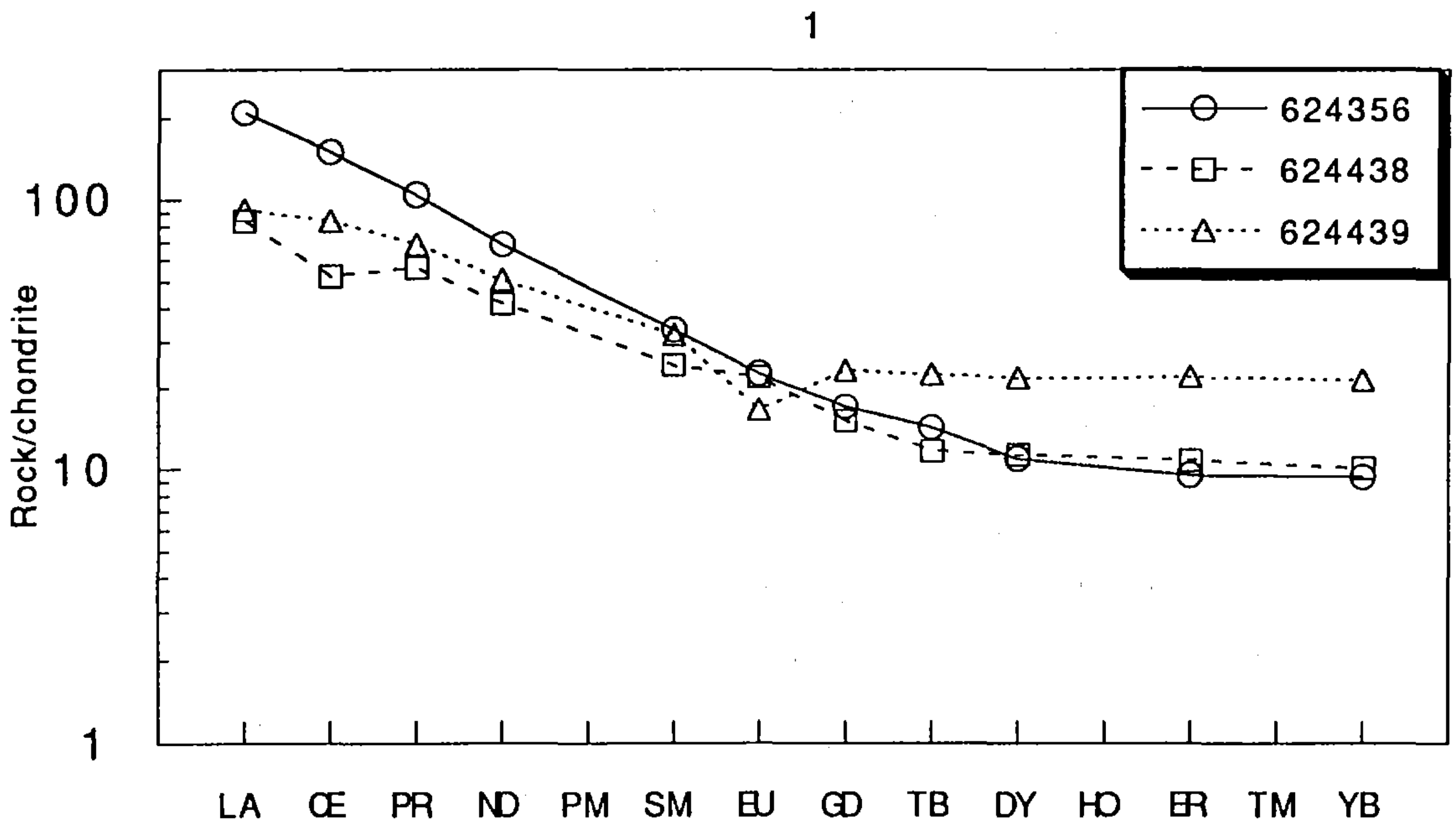


2
624440
624441
624442
Rock/chondrite
100
10
1
LA
CE
PR
ND
PM
SM
EU
GD
TB
DY
HO
ER
TM
YB

963130

3


624443
624444
624445
624448
Rock/chondrite
100
10
1
LA
CE
PR
ND
PM
SM
EU
GD
TB
DY
HO
ER
TM
YB


1
624356
624438
624439
100
10
1
Rock/chondrite
LA
CE
PR
ND
PM
SM
EU
GD
TB
DY
HO
ER
TM
YB

963132

APPENDIX V

002-207662 CODES CENTRE UNI.TAS 117 P01 SEP 09 '93 16:36

963134

CODES fax sheet

to ROB SHARPE
ABERFOYLE EXPLORATION

from J. BRUCE GEMMELL

date 9/9/93

fax no. 004 316896

no. of pages 1

ROB,

HERE ARE THE Pb ISOTOPE #'S

	6/4	7/4	8/4	
HA 8 141.7m	18.396	15.607	38.199	623013
HA 7 41m	18.371	15.604	38.171	623043

HOPE THESE SOLVE ALL YOUR PROBLEMS!

Bruce

Centre for Ore Deposit and Exploration Studies
Geology Department, University of Tasmania, GPO Box 252C, Hobart, Australia 7001
Fax: Aust. 002 207662, Intl 61 02 207662. Phone: Aust. 002 202472, Intl 61 02 202472

963135

Division of Exploration and Mining Institute of Minerals, Energy and Construction

CSIRO
AUSTRALIA

Mineral Research Laboratories
51 Delhi Road,
North Ryde, NSW 2113
Sydney Australia

Postal address:
PO Box 136 North Ryde, NSW 2113
Telephone: (02)887 8666
Facsimile: (02)887 8921
Telex: 25817

Sirotope

REPORT TO ABERFOYLE RESOURCES LIMITED ON A Pb ISOTOPE STUDY OF FURTHER SAMPLES FROM THE NEWTON CREEK PROSPECT, LAKE MARGARET E.L., WESTERN TASMANIA, WITH AN APPENDIX OF S ISOTOPE DATA

SIROTOPE REPORT SR 271

JUDITH A. DEAN

29/09/93

Perth
Floreat Park Laboratories
Private Bag, Wembley
WA 6014
Telephone: (09) 387 0200
Facsimile: (09) 387 8642
Telex: 92178

Melbourne
Syndal Laboratories
PO Box 54, Mount Waverley
VIC 3149
Telephone: (03) 881 1355
Facsimile: (03) 803 2052

Brisbane
Queensland Centre for Advanced Technologies
PO Box 883, Kenmore
QLD 4069
Telephone: (07) 212 4444
Facsimile: (07) 212 4455

Perth
Rock Mechanics Research Centre
PO Box 437, Nedlands
WA 6009
Telephone: (09) 389 8421
Facsimile: (09) 389 1906

1. INTRODUCTION

This report details the results of a continuing Pb isotope study of exploration samples from the Newton Creek area within Aberfoyle's Lake Margaret E.L. north of Queenstown. Comparisons are drawn between the data for these samples and revised signatures for Cambrian volcanic-hosted massive sulfide (VHMS) mineralization hosted by the Mount Read Volcanics as outlined in Dean (1992) and Gemmell et al. (1992) and also to previous analyses from the Tyndall mine and Henty Fault Zone. Other data from the Newton Creek region, Lake Margaret E.L. and probable post-Cambrian mineralization in the Murchison Gorge area are also compared.

According to Carr (1992), a preliminary investigation of Pb isotope ratios of Cambrian mineralization in the Mount Read Volcanic Belt indicates a correlation of data with respect to the stratigraphy of the host lithologies. VHMS deposits in the Central Volcanic Complex have a range of ratios from the Rosebery through to the Hellyer values whereas deposits in the Dundas and Tyndall Groups only have the Que River or Hellyer signatures. Devonian-related mineralization has in contrast higher $^{206}Pb/^{204}Pb$ ratios of greater than about 18.44. There are however a limited number of occurrences with $^{206}Pb/^{204}Pb$ ratios intermediate between Hellyer and the Devonian field (e.g., Lynchford E.L., Carr and Dean, 1989). With isotopic compositions in this range, it is less certain as to whether the mineralization represents a Cambrian or Devonian metallogenic event.

This report also includes an appendix of S isotope data from the Newton Creek prospect.

2. SAMPLES AND METHODS

Four samples were provided by Robina Sharpe as detailed below:

624201 Disseminated galena in a dacitic matrix indicating possible replacement. This sample is from stratigraphically higher in the Newton Creek spillway breccia than sulfide clasts previously identified.

624470, 624403 and 624405 Galena bearing samples from barite-sulfide veining in Tyndall Creek south of the spillway and east of Howards Anomaly. The host rocks are mapped as Tyndall Group.

Galena was hand picked from each sample and dissolved in concentrated HNO_3. Lead was purified by micro-electrodeposition onto Pt electrodes. Isotope ratios were determined on a VG ISOMASS 54E thermal ionization mass spectrometer run in fully automated mode. Data have been normalized to the accepted values of international standard NBS SRM 981 by applying a correction factor of +0.08% per atomic mass unit. Precision estimates, based on over 1300 analyses of international standards and natural samples, are shown as error bars (mean ± 2σ) in the upper left hand corner of the accompanying diagrams. Also shown are the 95% confidence ellipses for these standard data.

3. RESULTS

Lead isotope ratios are given in the Table and plotted in Figure 1 with reference to the average crustal Pb evolution curve, or growth curve, of Cumming and Richards (1975), and the revised target signatures for VHMS mineralization in the Dundas and Tyndall Groups, exemplified by Que River and Hellyer, and in the Central Volcanic Complex which generally has the Rosebery signature but which may also have compositions which fall within the Que River and Hellyer fields.

Three of the four galenas are indistinguishable in Pb isotopic composition with an average $^{206}Pb/^{204}Pb$ ratios of 18.388. These samples represent mineralization which is probably in the Tyndall Group. Galena *624201* (point 1) from the Central Volcanic Complex is slightly less radiogenic (i.e., lower $^{206}Pb/^{204}Pb$ ratio). In comparison to the target signatures for Cambrian VHMS mineralization, *624201* plots within the 95% confidence ellipse for Hellyer whereas the other three galenas plot slightly outside it.

4. COMPARISON WITH OTHER DATA FROM THE REGION

In Figure 2, data from this study are compared to previous analyses from the Newton Creek prospect reported by Dean (1992), the Lake Margaret EL (Carr and Dean, 1990) and the Anthony Road spillway (Carr, 1992). In those reports, attention was drawn to the fact that some of these samples had isotopic compositions which probably indicated a radiogenic component due to their relatively low-Pb contents and the *in situ* radioactive decay of U and Th to Pb since the Lower Palaeozoic. Samples analysed in this study are however all galenas and thus represent initial ratios (i.e., no post-depositional change in isotope ratios has occurred). For the Hellyer deposit which has an average $^{206}Pb/^{204}Pb$ ratio of 18.355 ± 26 (2σ, based on 58 analyses from Gulson and Porritt, 1987, and Gemmell et al., 1992), pyrites with <200 ppm Pb have $^{206}Pb/^{204}Pb$ ratios >18.42 (i.e., indicating a post-depositional radiogenic component). For this reason, Lake Margaret EL and Newton Creek samples with <250 ppm are not considered to have initial ratios and are not plotted in the Figures nor included in following discussions.

Thus considering only the high-Pb data, the isotopic composition of *624201* is compatible with it being from Cambrian mineralization. It is similar, although slightly more radiogenic, than the most radiogenic of the Anthony Road sulfide clasts previously analysed. The Tyndall Creek galenas are data are however less straightforward to interpret. The Henty Canal and Howards Anomaly samples analysed by Dean (1992) are from Tyndall Group rocks and, with the

Tyndall Creek galenas, plot in a fairly restricted field which overlaps the Hellyer field but which is, on average, slightly more radiogenic. The Henty Canal samples are from alteration zones and have moderate Pb contents (530 to 680 ppm); thus a minor radiogenic component cannot be ruled out.

Figure 3 shows the data compared to examples of probable Devonian mineralization from the Murchison Gorge area (Gulson and Porritt, 1987). In particular, it should be noted that the Tyndall Mine located in the Newton Creek prospect area and hosted within the Central Volcanic Sequence but of probable Devonian metallogenesis (M. Solomon, pers. commun., quoted in Gulson and Porritt. 1987), is significantly more radiogenic than the Tyndall Creek galenas analysed in this study. However, the Murchison Lode samples which are also coonsidered to represent Devonian mineralization plot between the Tyndall Creek galenas and the Tyndall Mine samples.

5. INTERPRETATION

Based on some reservations, the following conclusions can be made as to the metallogenic association of these samples:

1) Galena *624201* has a Pb isotopic composition which indicates that it has probably deposited from hydrothermal fluids associated with the major Cambrian metallogenic event.

2) The *Tyndall Creek* galenas plot just outside established Cambrian VHMS fields but are significantly different from the nearby Tyndall Mine of probable Devonian age. The relatively homogeneous grouping of data from Henty Canal, Howards Anomaly and Tyndall Creek may justify an expansion of the Cambrian metallogenic signature in the Tyndall Group hitherto considered to have an isotopic composition corresponding to the Que River and Hellyer fields. Generally, VHMS mineralization within a particular metallogenic province displays a high level of isotopic homogeneity; however, there is evidence in the Mount Read Volcanic Belt of relatively larger range of $^{206}Pb/^{204}Pb$ ratios (e.g., from the Elliott Bay to the Hellyer target fields).

6. REFERENCES

Carr, G.R. (1992). Report on a Pb isotope study of sulfide and altered wallrock clasts from a volcanic breccia in the Central Volcanic Complex, western Tasmania. ***SIROTOPE Report SR 165,*** 25/05/92, 11p.

Carr, G.R. and Dean (1989). Report to Aberfoyle Resources Limited on the lead isotopic compositions and metallogenic association of exploration samples from the Lynchford E.L., western Tasmania. ***SIROTOPE Report SR 093,*** 29/08/89, 8p.

Carr, G.R. and Dean, J.A. (1990). Report to Aberfoyle Resources Ltd on the probable metallogenic association of exploration samples from the Lake Margaret E.L., western Tasmania. ***SIROTOPE Report SR 118,*** 22/06/90, 11p.

Cumming, G.L. and Richards, J.R., 1975. Ore lead isotope ratios in a continuously changing Earth. *Earth Planet. Sci. Letts, 28,* pp. 155-171.

Dean, J.A. (1992). Report to Aberfoyle Resources Limited on a Pb isotope study of samples from the Newton Creek prospect, Lake Margaret E.L., western Tasmania. ***SIROTOPE Report SR 233,*** 3/09/92, 11p.

Gemmell, J.B., Carr, G.R. and Dean, J.A. (1992). Pb isotope research: Hellyer deposit, Elliott Bay prospects, Mackintosh district prospects and VHMS source-rock study. *Annual Report to Aberfoyle Resources Ltd., Overview of progress to December 1992,* 35p.

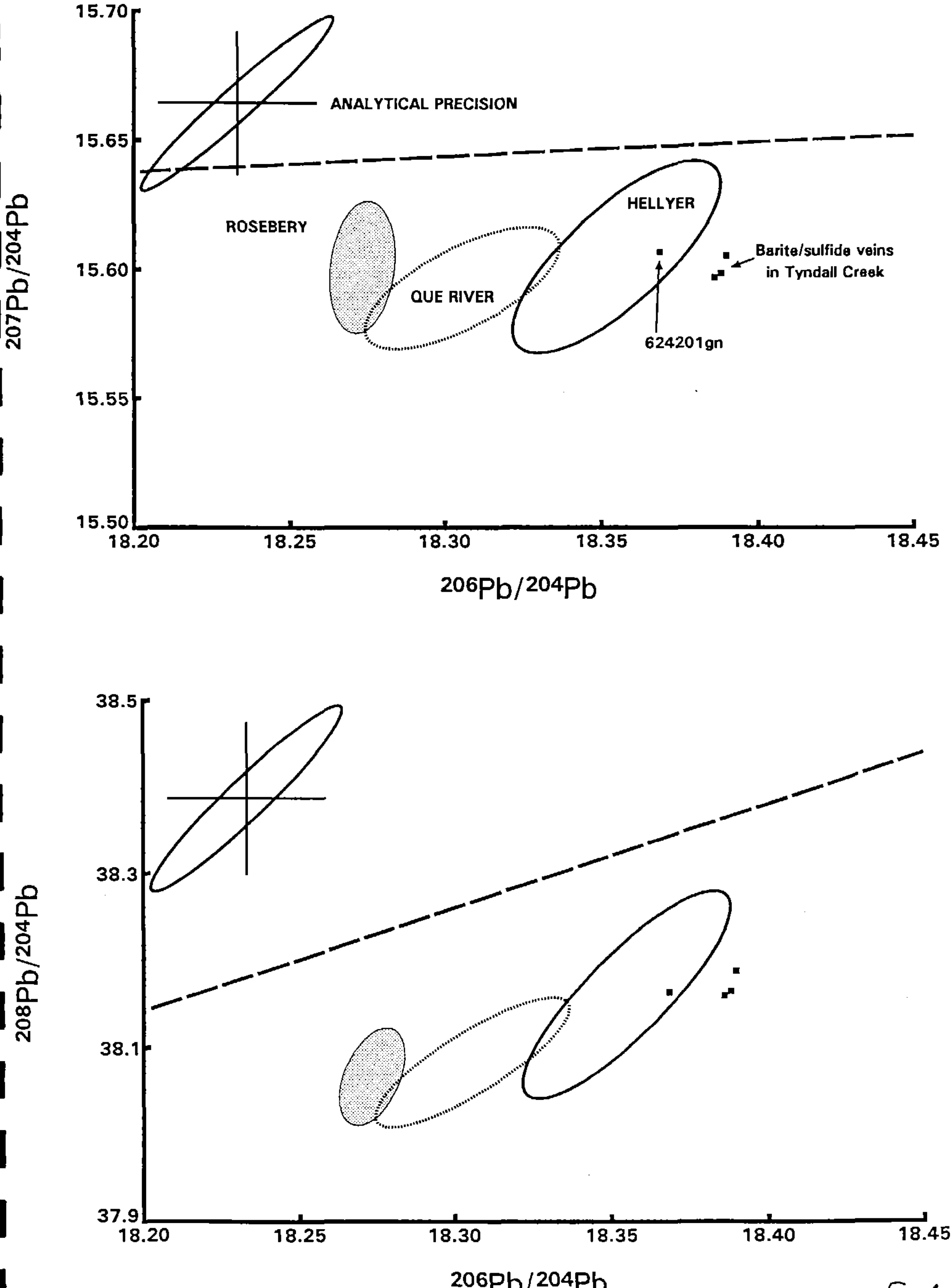
Gulson B.L. and Porritt, P.M., 1987. Base metal exploration of the Mount Read Volcanics, Western Tasmania: Pt. II. Lead isotope signatures and genetic implications. *Econ. Geol., 82,* pp. 308-327.

TABLE 1. LEAD ISOTOPE DATA FOR GALENAS FROM THE NEWTON CREEK PROSPECT

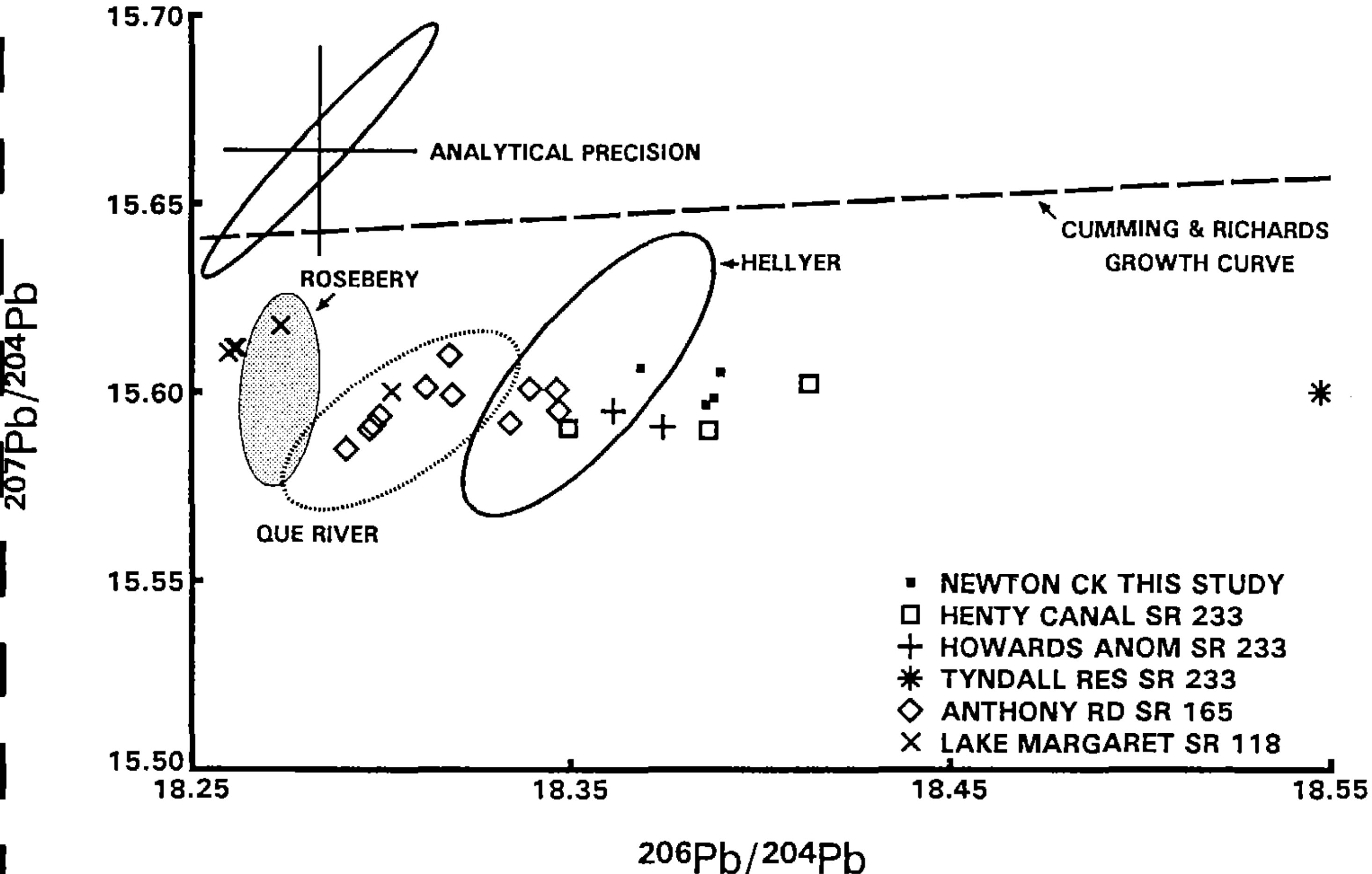
Sample	$\frac{^{208}Pb}{^{206}Pb}$	$\frac{^{207}Pb}{^{206}Pb}$	$\frac{^{206}Pb}{^{204}Pb}$	$\frac{^{207}Pb}{^{204}Pb}$	$\frac{^{208}Pb}{^{204}Pb}$
LAKE MARGARET EL, NEWTON CREEK PROSPECT					
1 624201	2.0776	0.8496	18.369	15.607	38.164
2 624470	2.0755	0.8483	18.388	15.598	38.165
3 624403	2.0766	0.8486	18.390	15.605	38.188
4 624405	2.0755	0.8483	18.386	15.597	38.160

ALL SAMPLES GALENAS
SAMPLE NUMBER PREFIXES REFER TO PLOTTED POINTS FIGURE 1

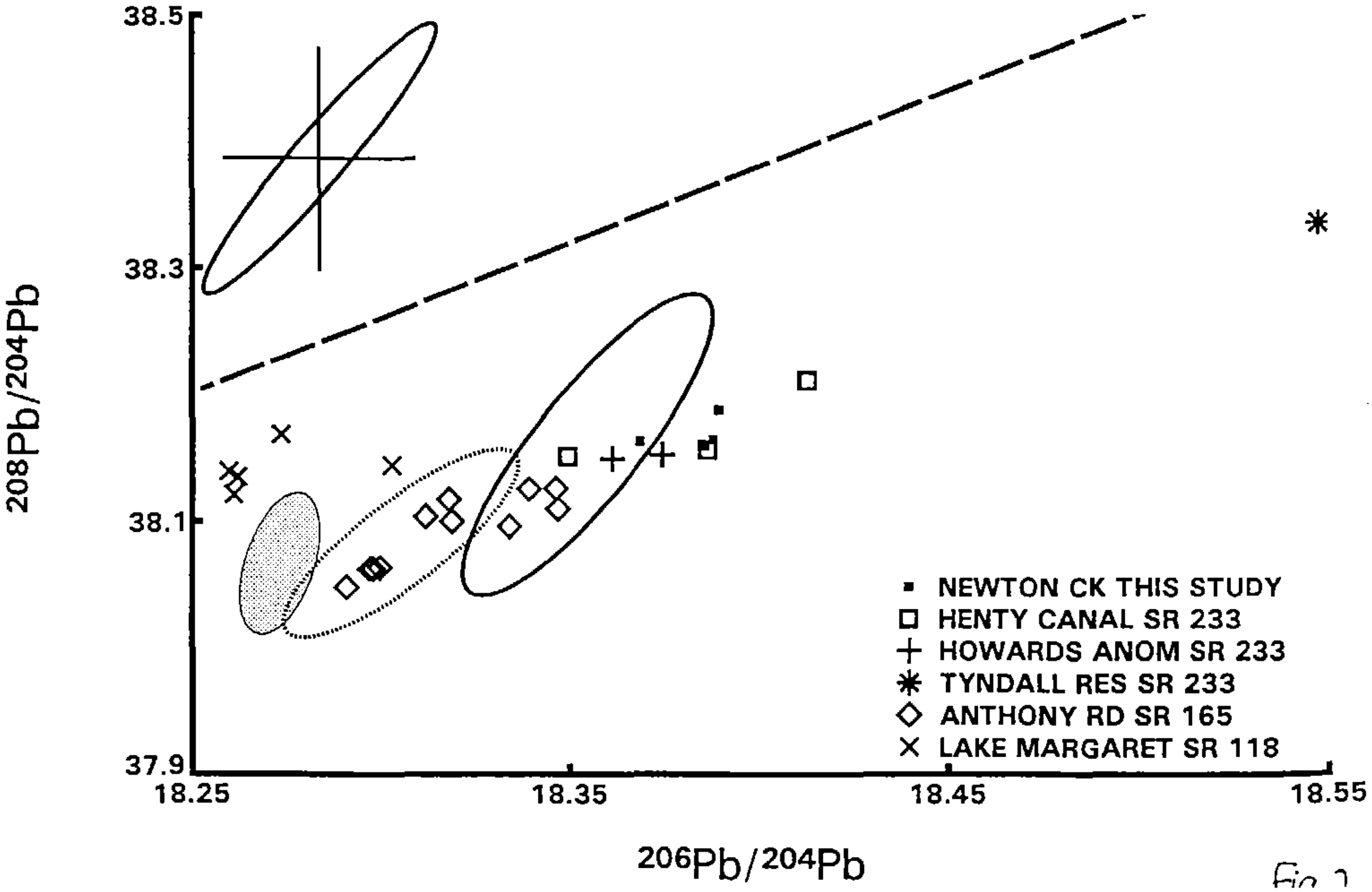
DATA THIS STUDY



963142



15.70
15.65
15.60
15.55
15.50
207Pb/204Pb
18.25
18.35
18.45
18.55
206Pb/204Pb
ANALYTICAL PRECISION
CUMMING & RICHARDS
GROWTH CURVE
HELLYER
ROSEBERY
QUE RIVER
NEWTON CK THIS STUDY
HENTY CANAL SR 233
HOWARDS ANOM SR 233
TYNDALL RES SR 233
ANTHONY RD SR 165
LAKE MARGARET SR 118



38.5
38.3
38.1
37.9
208Pb/204Pb
18.25
18.35
18.45
18.55
206Pb/204Pb
NEWTON CK THIS STUDY
HENTY CANAL SR 233
HOWARDS ANOM SR 233
TYNDALL RES SR 233
ANTHONY RD SR 165
LAKE MARGARET SR 118

Fig 2

COMPARISON WITH DEVONIAN MINZ

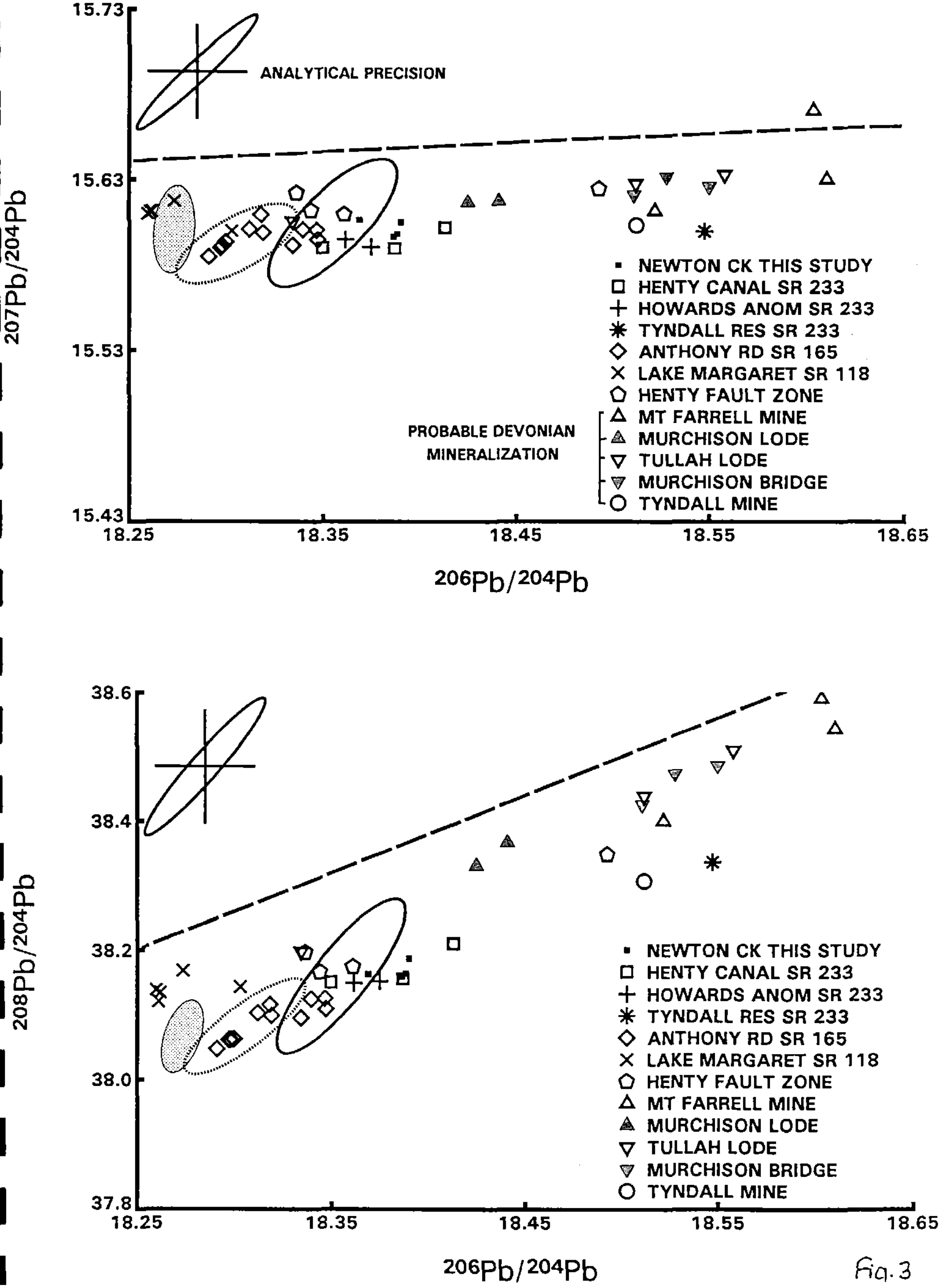


Fig. 3

APPENDIX VI

APPENDIX OF SULFUR ISOTOPE RESULTS

Sulfur isotope analyses were undertaken on eight samples as detailed below in Table A1 from the Newton Creek prospect, Lake Margaret EL in western Tasmania. Also given are the analysed phases. Table A2 lists the sulfur isotope data.

Table A1.

Sulphur isotope analysis of samples from Lake Margaret EL 5/85 Newton Creek Prospect.

Sample	Mineral	Location
624401	Ga, Py, Barite	Float: Tyndall Creek
624403	Ga, Py, Barite	Float: Tyndall Creek
624404	Py	Float: Tyndall Creek
624405	Py, Ga	Float: Tyndall Creek
624201	Ga, Py	Mass sulphide Newton Ck spillway
624470	Py	Sth. side Tyndall Creek: vein
624471	Ga, Py	Sth. side Tyndall Creek: vein style
624183	Py	Leech Hill Alteration in Andesite

Table A2. Sulfur isotope results with an indication of the purity of the mineral phase.

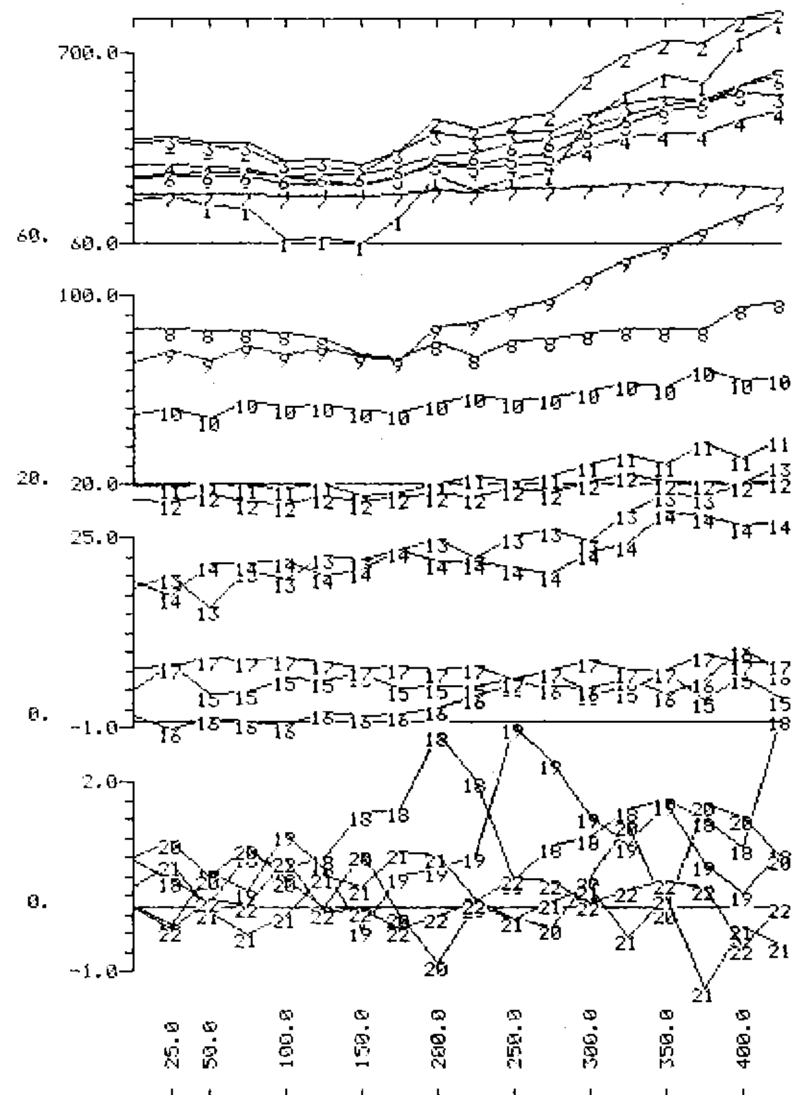
Sample	Mineral phase analysed	$\delta^{34}S$	Purity of mineral phase
624401	galena	+24.5	significant contamination with gangue
624401	pyrite	+12.4	minor contamination with gangue
624401	barite	+32.4	almost pure, minor pyrite
624403	galena	+21.5	possible contamination with barite
624403	pyrite	+2.5	probably pure
624403	pyrite	+2.7	
624403	barite	+35.1	minor sulfide contamination
624404	pyrite	-3.7	
624405	pyrite	+3.0	pure
624405	galena	+23.1	<10% pyrite
624201	galena	-1.5	almost pure
624201	pyrite	+22.1	pure
624470	pyrite	+7.1	
624471	galena	+12.2	very minor pyrite
624471	pyrite	-1.1	pure
624183	pyrite	+5.6	

Sulfides and sulfates were drilled out using a dental drill. Sulfides were combusted with Cu2O to produce SO2 and analysed at CSIRO, North Ryde using a Finnigan MAT 252 mass spectrometer. Standards used were two CSIRO Ag2S standards (Ag2S /2, δ34S = +0.2‰ and Narrabeen Seawater,δ34S +20.8‰). The overall precision of preparation and analysis is ± 2‰. The isotopic results are reported relative to the meteoritic Canyon Diablo Troilite (CDT) standard in the per mille notation.

Sulphur Isotope Results

east	north	sample	Mineral	del34S
380978	5357308	624201	Galena	-1.5
380978	5357308	624201	Pyrite	22.1
380965	5357284	624401	Barite	32.4
380965	5357284	624401	Galena	24.5
380965	5357284	624401	Pyrite	12.4
380978	5357308	624403	Barite	35.1
380978	5357308	624403	Galena	21.5
380978	5357308	624403	Pyrite	2.5
380978	5357308	624403	Pyrite	2.5
380972	5357296	624404	Pyrite	-3.7
380984	5357317	624405	Galena	23.1
380984	5357317	624405	Pyrite	3.0
381000	5357120	624470	Pyrite	7.1
381000	5357120	624471	Galena	12.2
381000	5357120	624471	Pyrite	-1.1

APPENDIX VII



NEWTON CREEK EM SURVEY

SURVEY DATE 4/12/92

LOOP 1 LINE 60000

READ BY RS

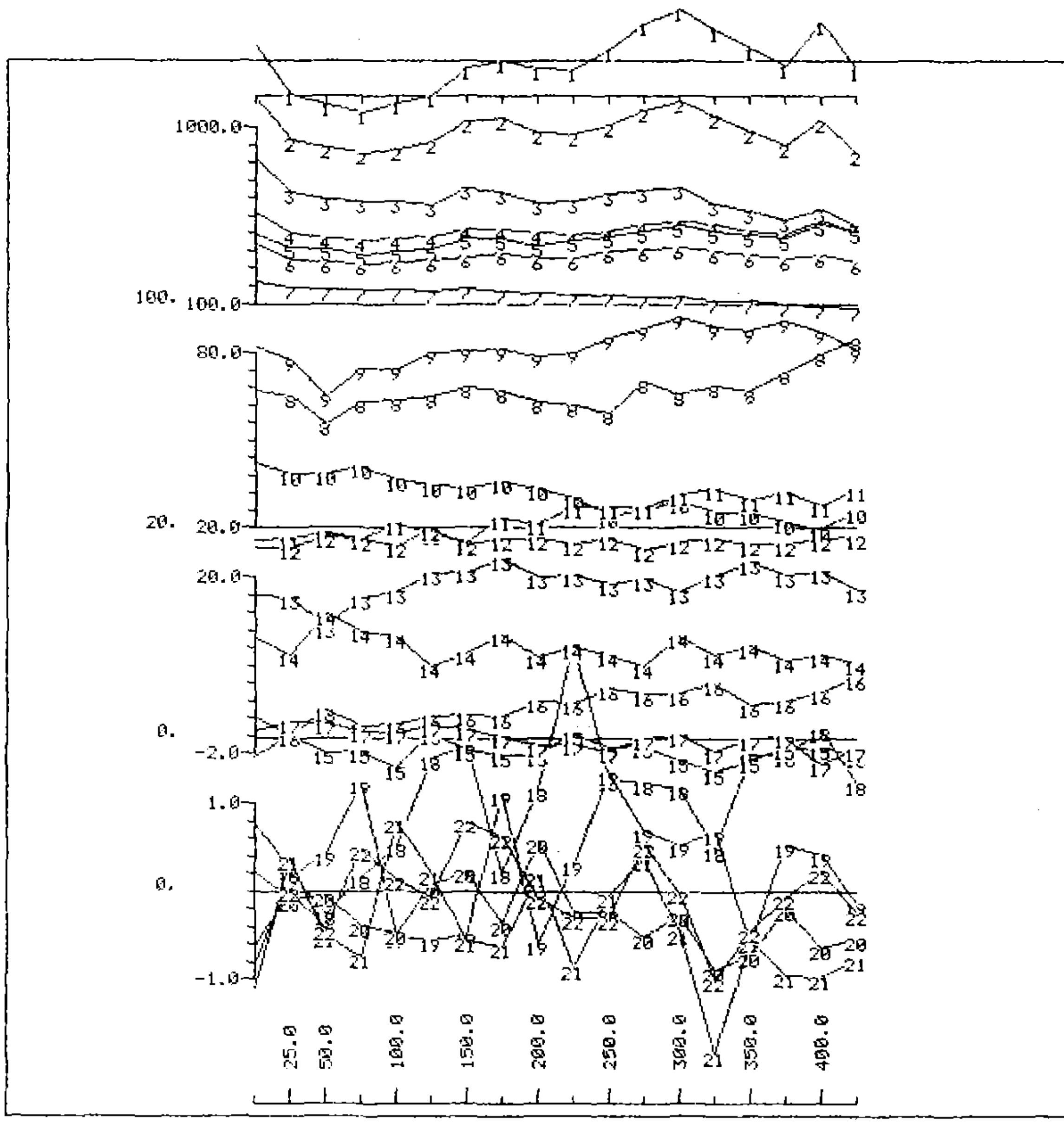
PLOTTED BY RS

Hz COMPONENT

ZONGE GDP-16

Horiz scale Plot number : 1

963149



NEWTON CREEK EM SURVEY

SURVEY DATE 4/12/92

LOOP 1 LINE 60000

READ BY RS

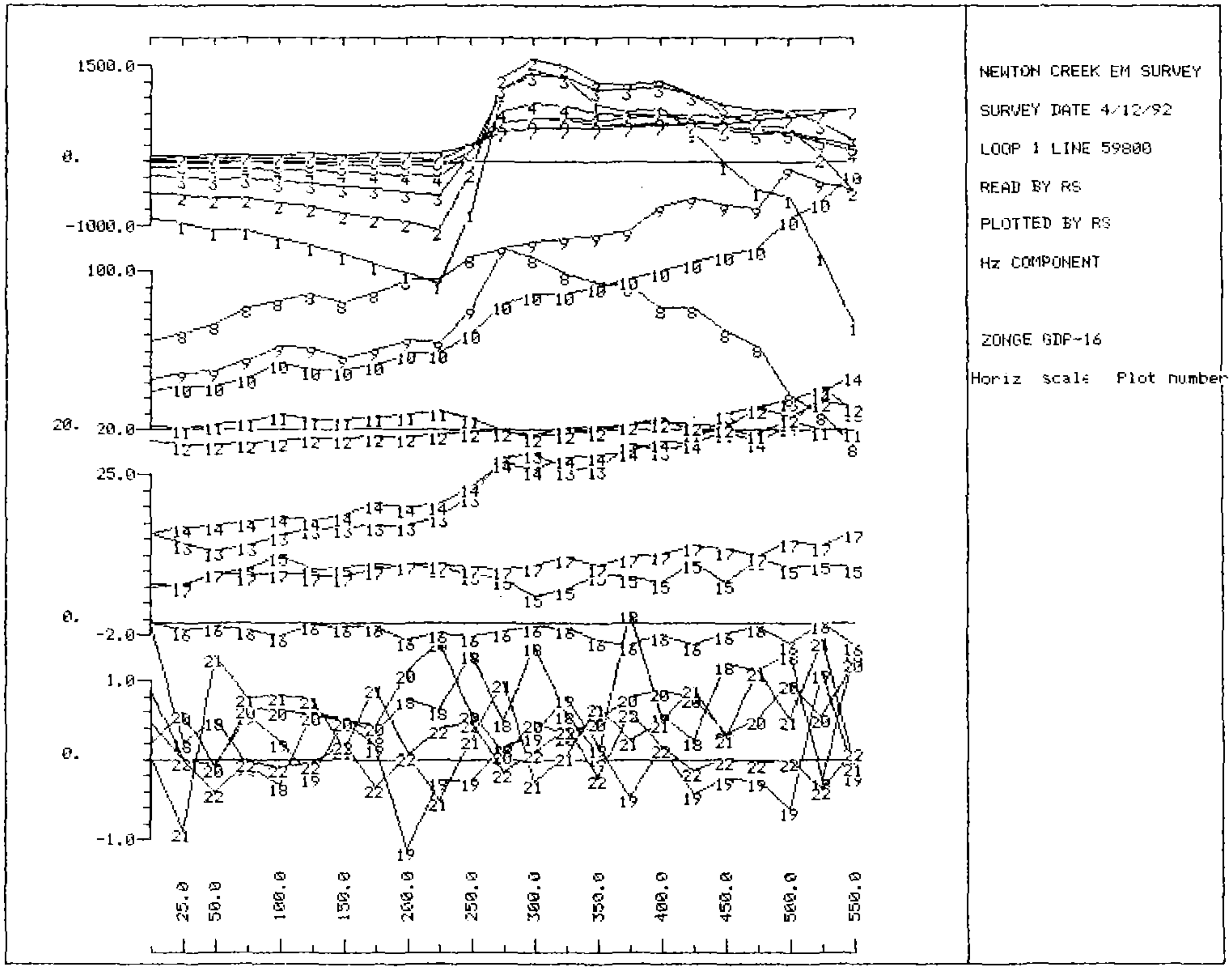
PLOTTED BY RS

Hx COMPONENT

ZONGE GDP-16

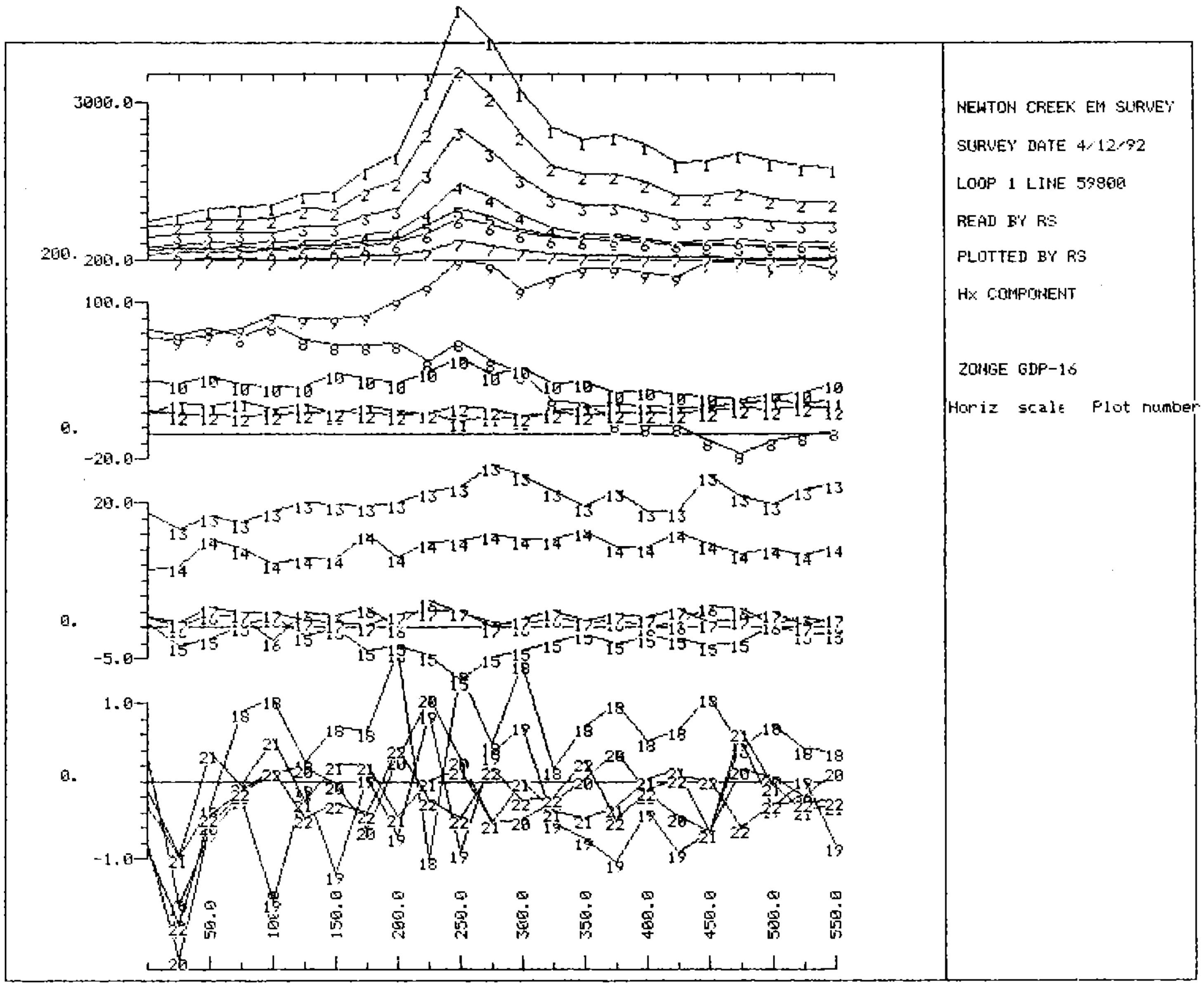
Horiz scale Plot number : 1

963150



NEWTON CREEK EM SURVEY
SURVEY DATE 4/12/92
LOOP 1 LINE 59800
READ BY RS
PLOTTED BY RS
Hz COMPONENT
ZONGE GDP-16
Horiz scale Plot number : 1
1500.0
0.
-1000.0
100.0
20.
20.0
25.0
0.
-2.0
1.0
0.
-1.0
25.0
50.0
100.0
150.0
200.0
250.0
300.0
350.0
400.0
450.0
500.0
550.0

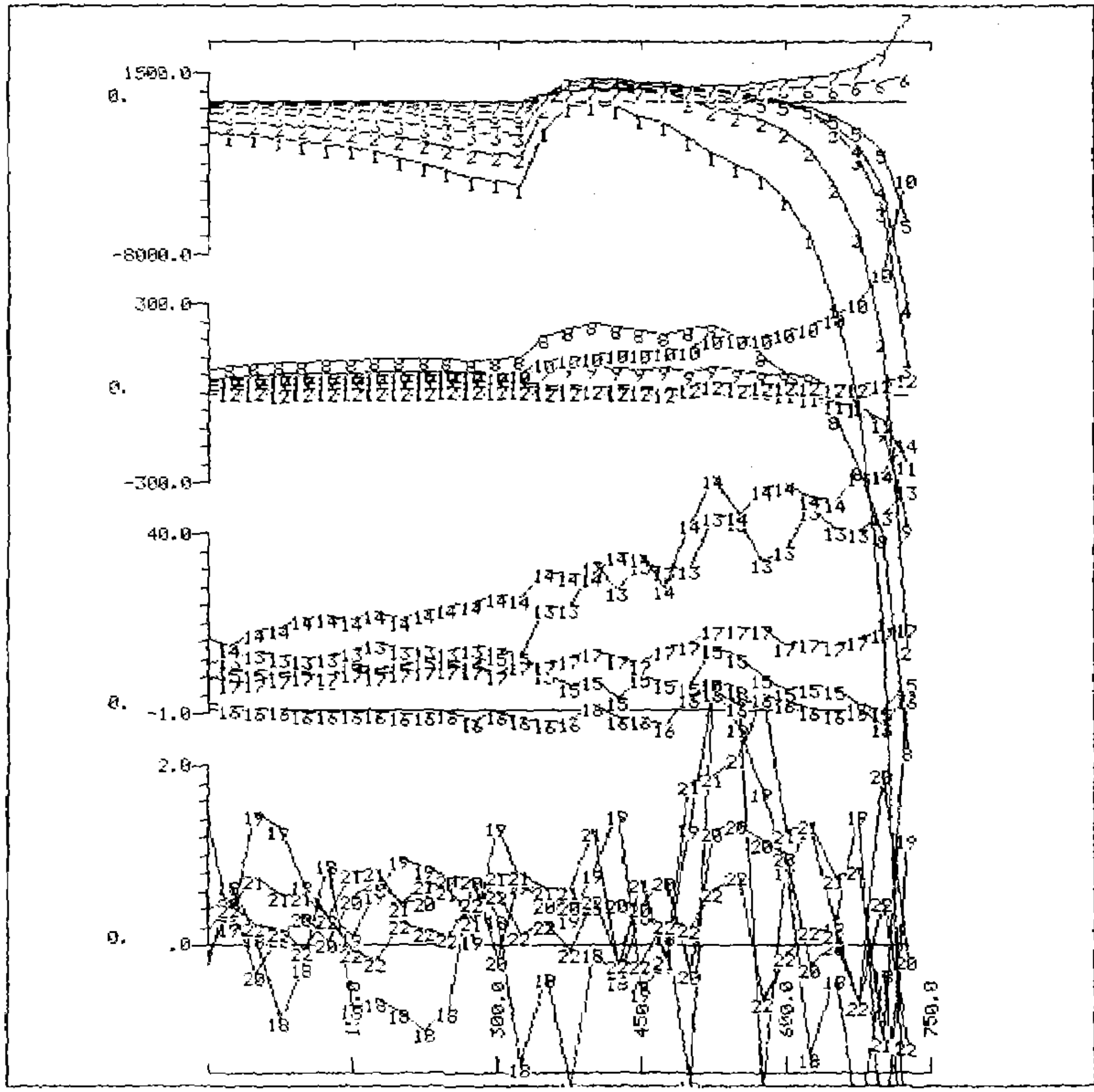
963151



NEWTON CREEK EM SURVEY
SURVEY DATE 4/12/92
LOOP 1 LINE 59800
READ BY RS
PLOTTED BY RS
Hx COMPONENT
ZONGE GDP-16
Horiz scale Plot number : 1
3000.0
200.
200.0
100.0
0.
-20.0
20.0
0.
-5.0
1.0
0.
-1.0
50.0
100.0
150.0
200.0
250.0
300.0
350.0
400.0
450.0
500.0
550.0

963152

→ HEC Revegetation



NENTON CREEK EM SURVEY

SURVEY DATE 3/12/92

LOOP 1 LINE 59600

READ BY RS

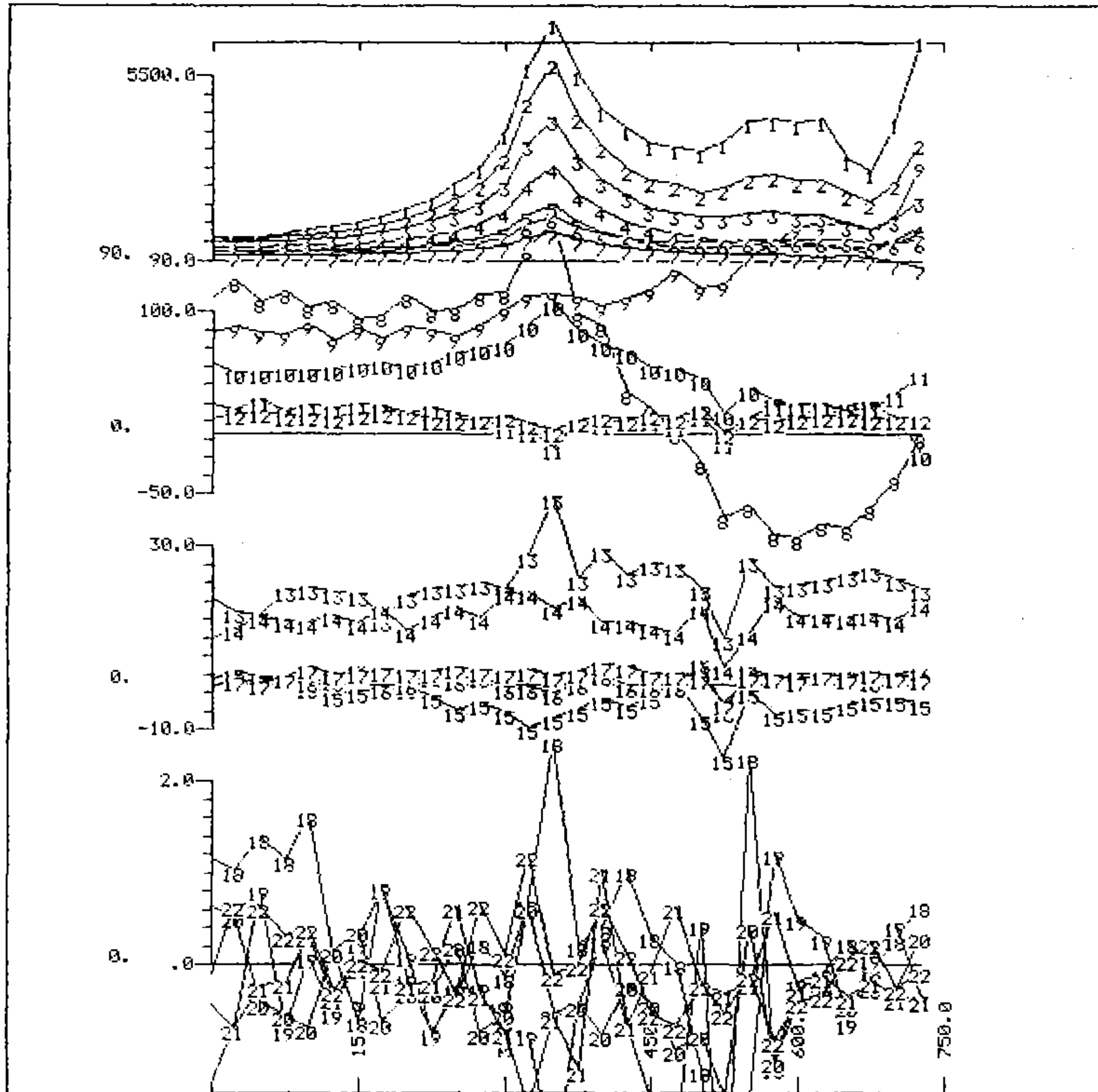
PLOTTED BY RS

Hz COMPONENT

ZONGE GDP-16

Horiz scale Plot number : 1

963153



NEWTON CREEK EM SURVEY

SURVEY DATE 3/12/92

LOOP 1 LINE 59600

READ BY RS

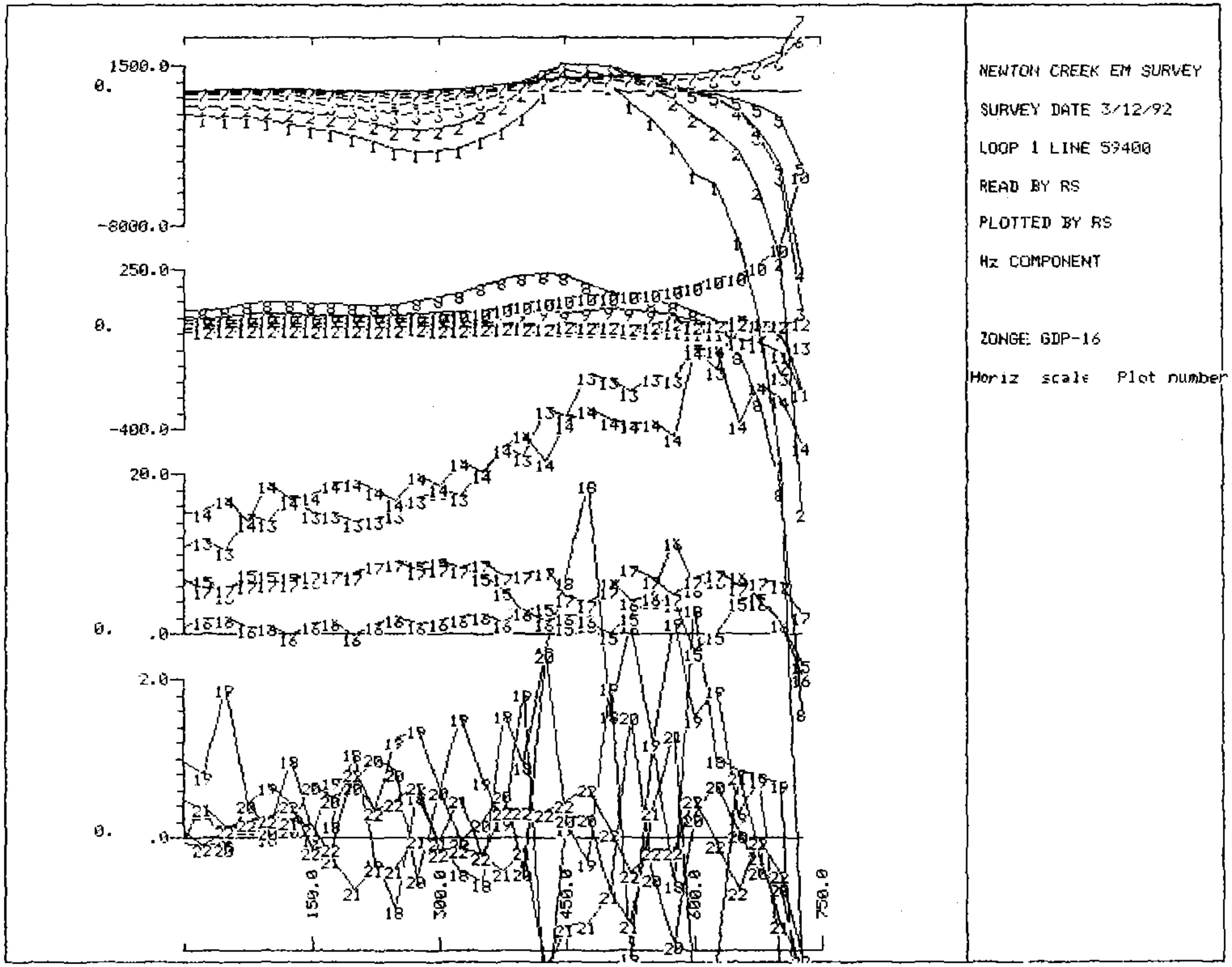
PLOTTED BY RS

Hx COMPONENT

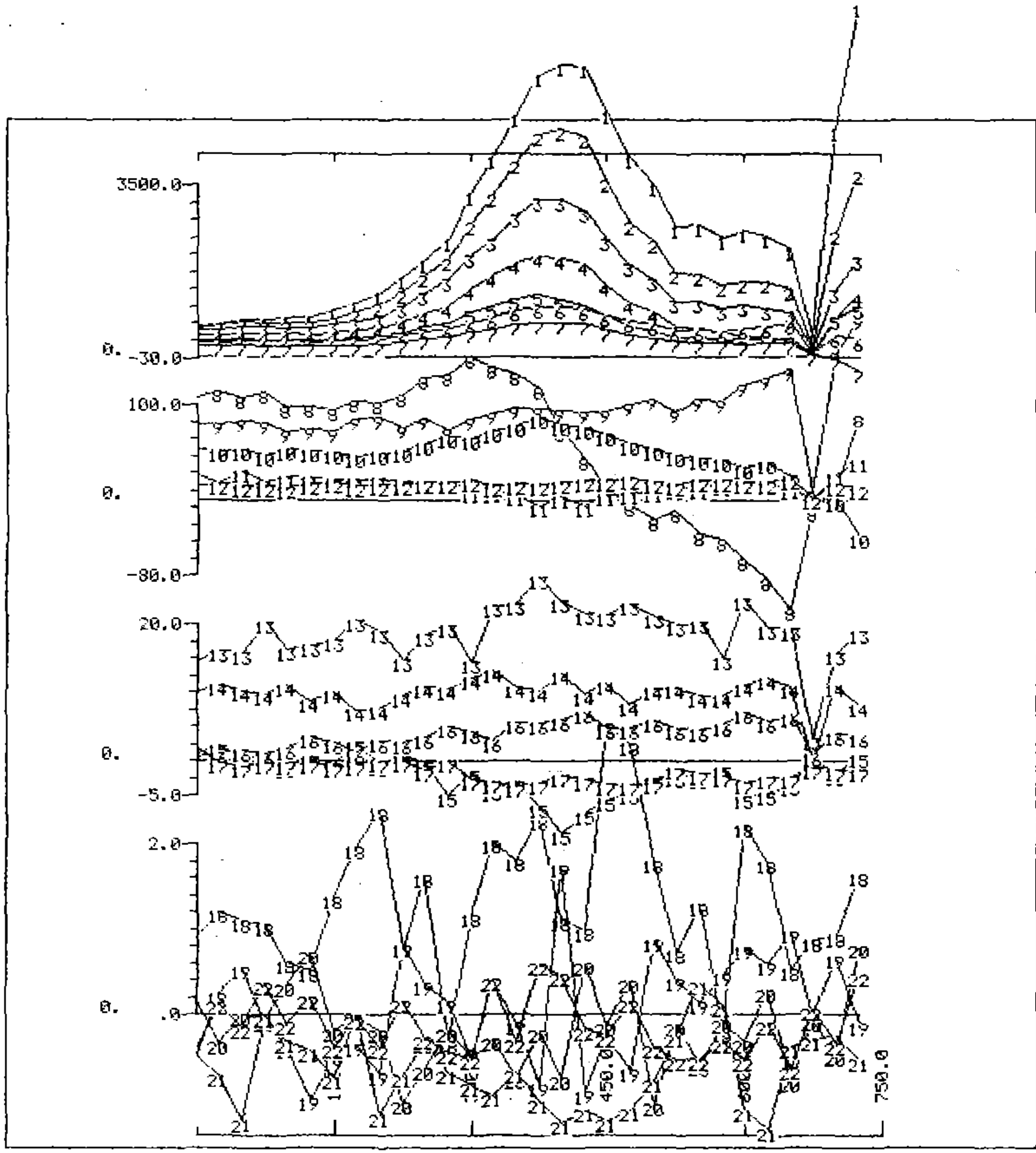
ZONGE GDP-16

Horiz scale Plot number :

963154


NEWTON CREEK EM SURVEY
SURVEY DATE 3/12/92
LOOP 1 LINE 59400
READ BY RS
PLOTTED BY RS
Hz COMPONENT
ZONGE GDP-16
Horiz scale Plot number : 1
1500.0
0.
-8000.0
250.0
0.
-400.0
20.0
0.
.0
2.0
0.
.0
150.0
300.0
450.0
600.0
750.0

963155



NEWTON CREEK EM SURVEY

SURVEY DATE 3/12/92

LOOP 1 LINE 59400

READ BY RS

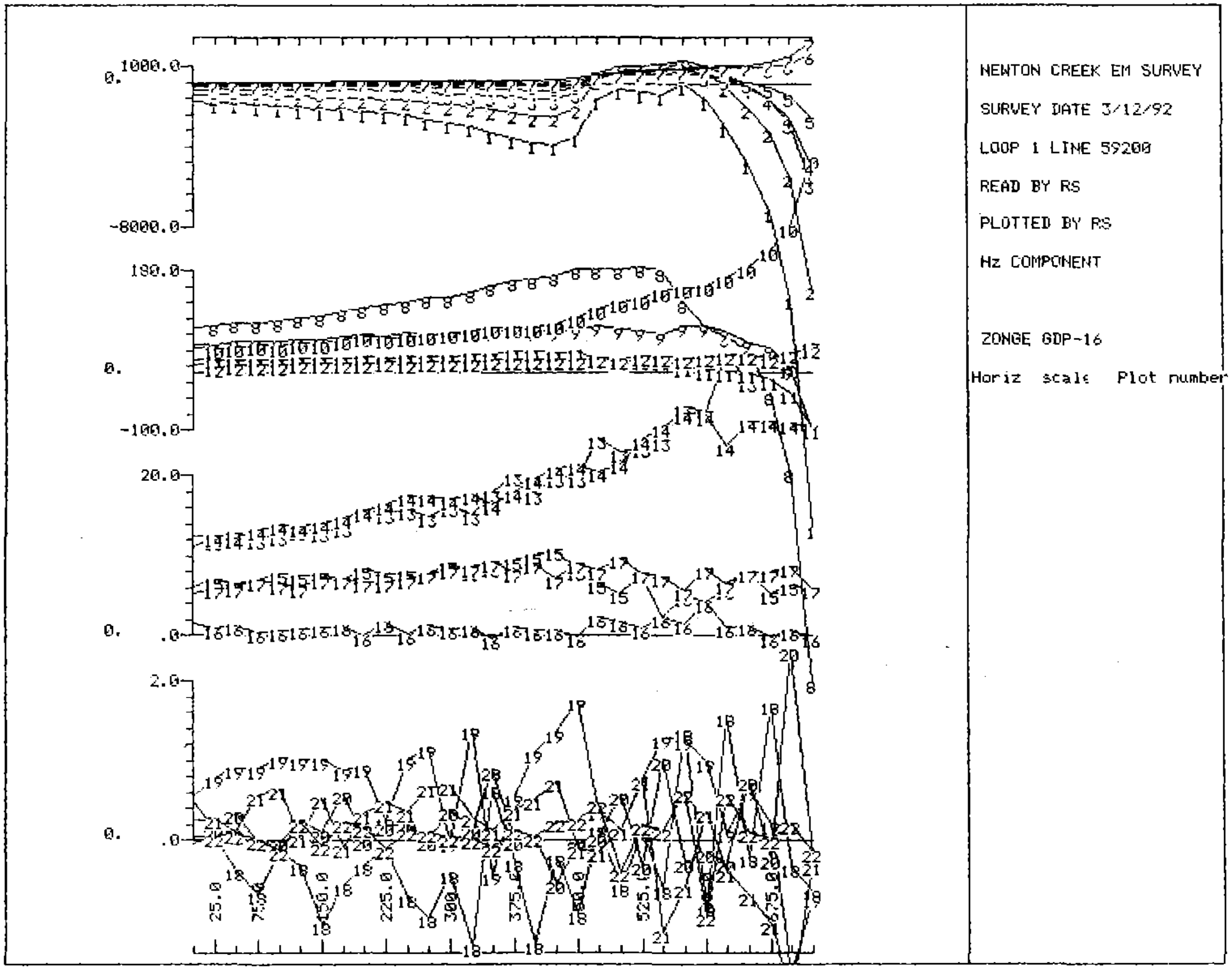
PLOTTED BY RS

Hx COMPONENT

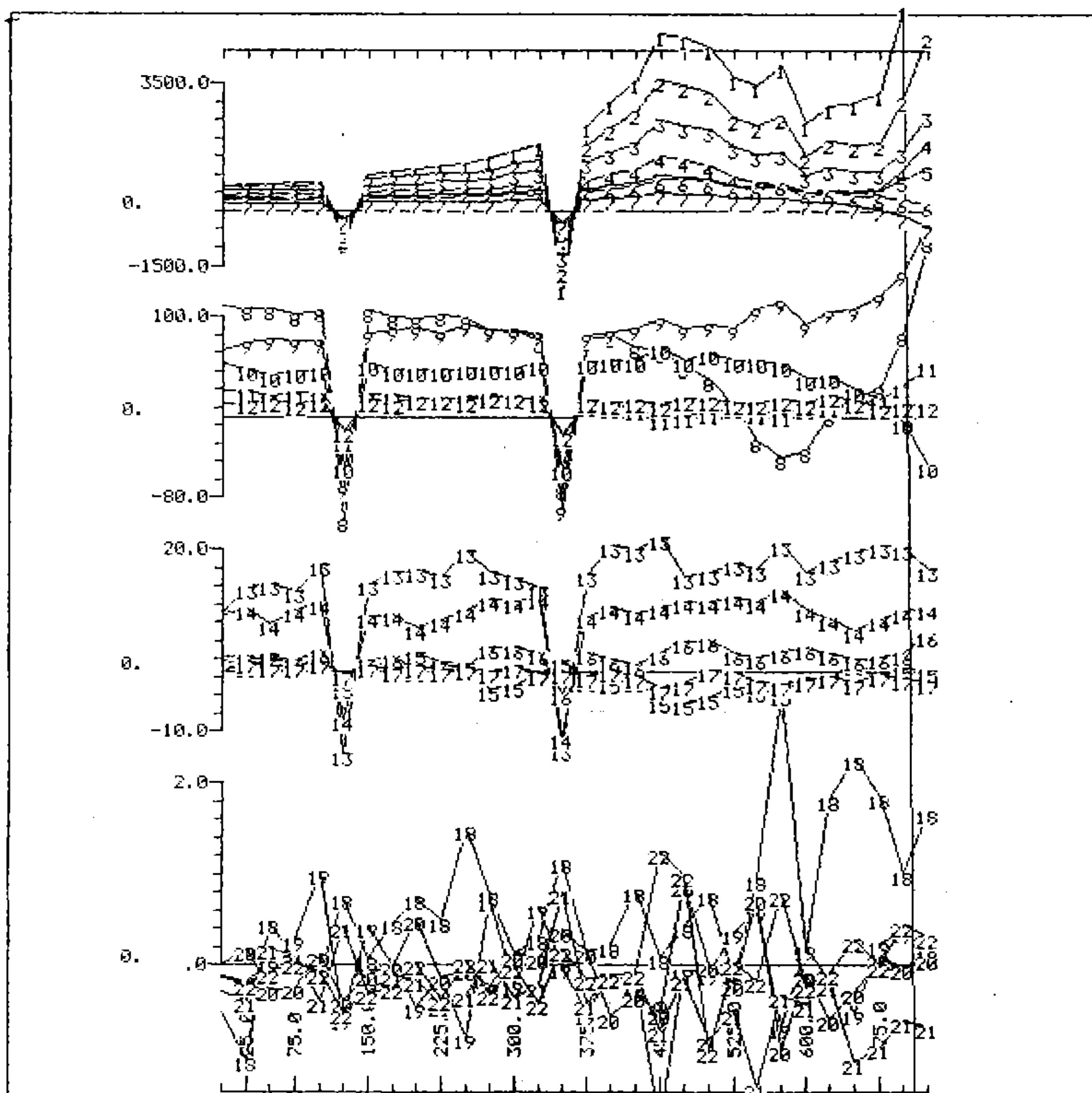
ZONGE GDP-16

Horiz scale Plot number : 1

963156


NEWTON CREEK EM SURVEY
SURVEY DATE 3/12/92
LOOP 1 LINE 59200
READ BY RS
PLOTTED BY RS
Hz COMPONENT
ZONGE GDP-16
Horiz scale Plot number : 1

963157



NEWTON CREEK EM SURVEY

SURVEY DATE 3/12/92

LOOP 1 LINE 59200

READ BY RS

PLOTTED BY RS

Hx COMPONENT

ZONGE GDP-16

Horiz scale Plot number : 1

963158

APPENDIX VIII

MACKINTOSH 51

963160

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

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

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

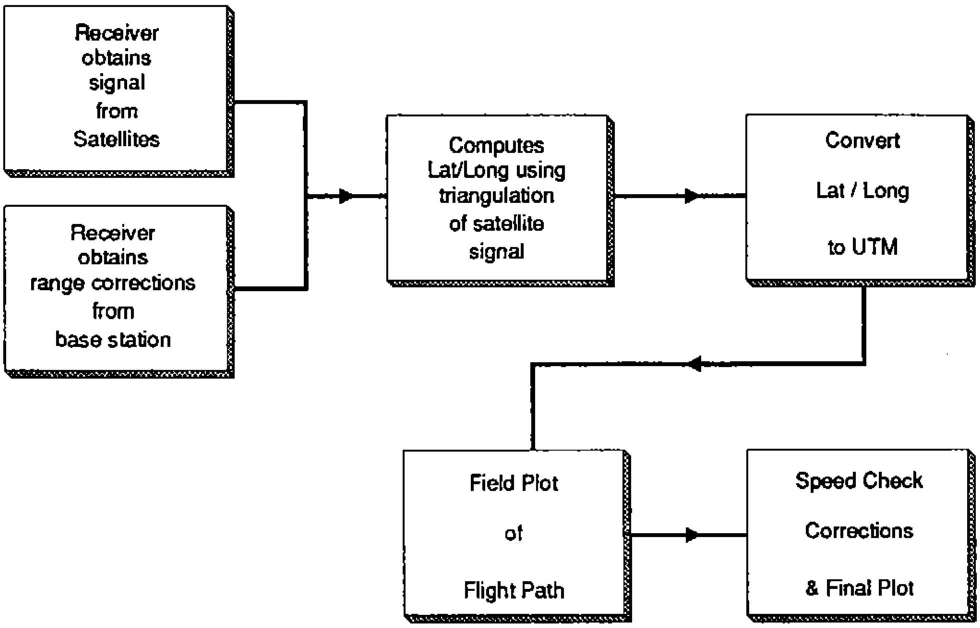
Date	Flight	Production/ shared days	Progress
26-28 February	-	-	System installation
1 March	-	x	Move to Que River Mine
2 March	-	-	Weather day
3 March	-	x	Installed DGPS beacon
4 March	1	P Area 1	Tie lines
5 March	2	P Area 1	Traverse lines
6 March	3	P Area 1	Traverse lines
7 March	4	P Area 1	Traverse 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.

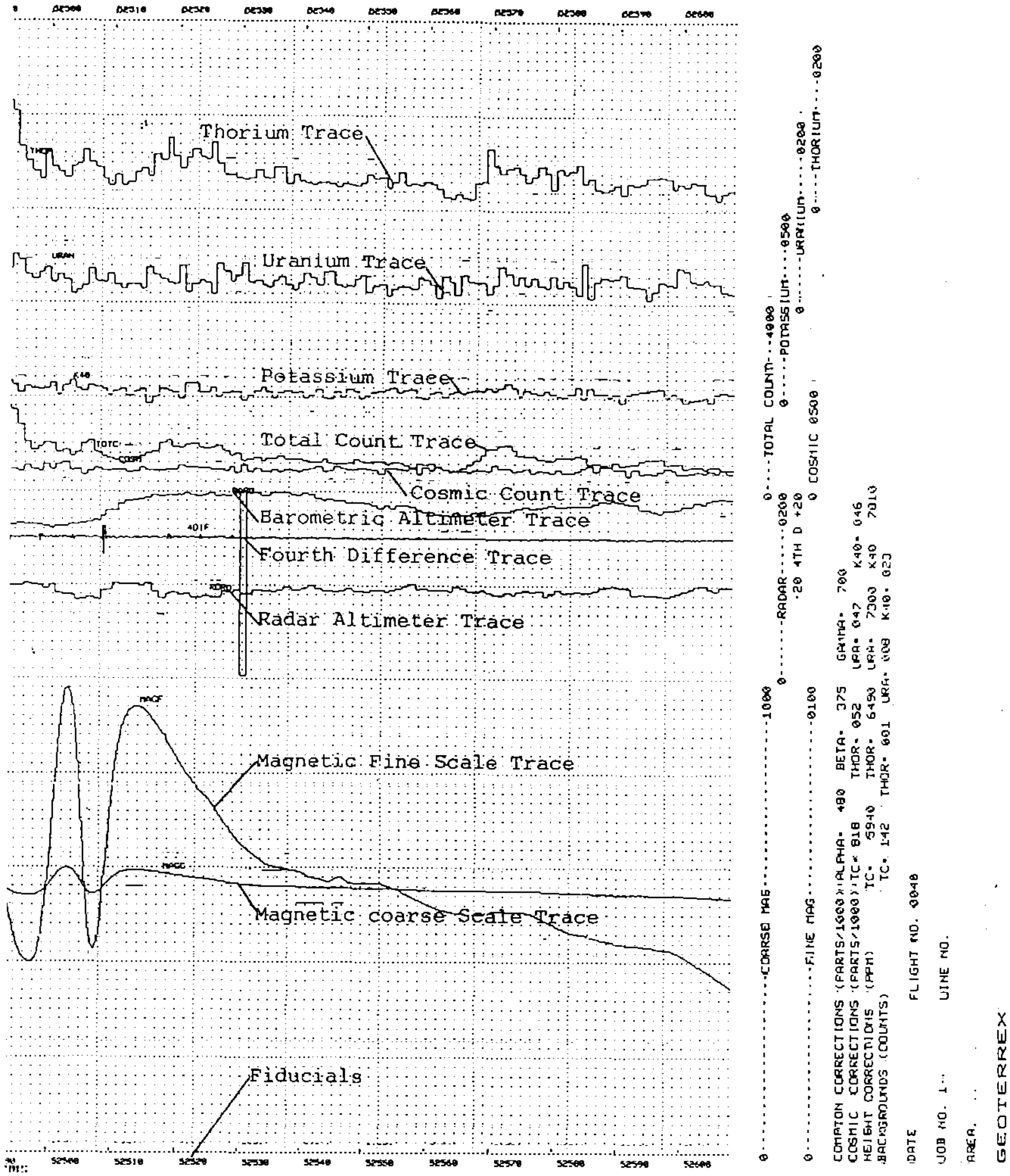


Figure 1 Sample analogue record

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:

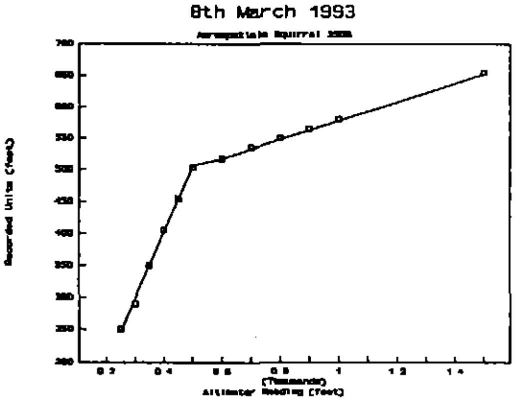
< 500' Recorded Units = 1.04 * Altimeter Reading - 13.4
> 500' Recorded Units = 0.15 * Altimeter Reading + 428

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

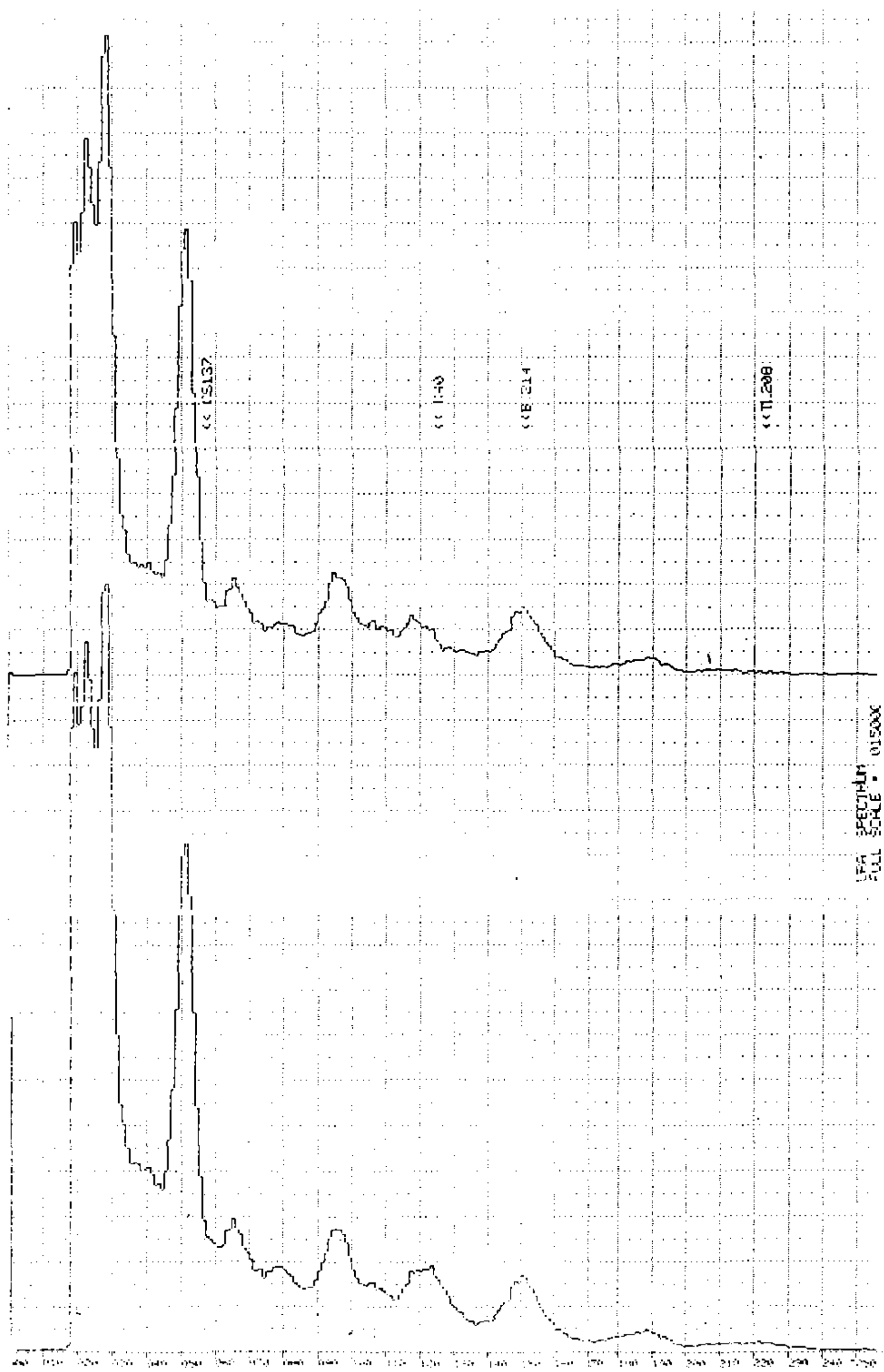


FIGURE A1(ii) - SOURCE CHECK - THORIUM SOURCE

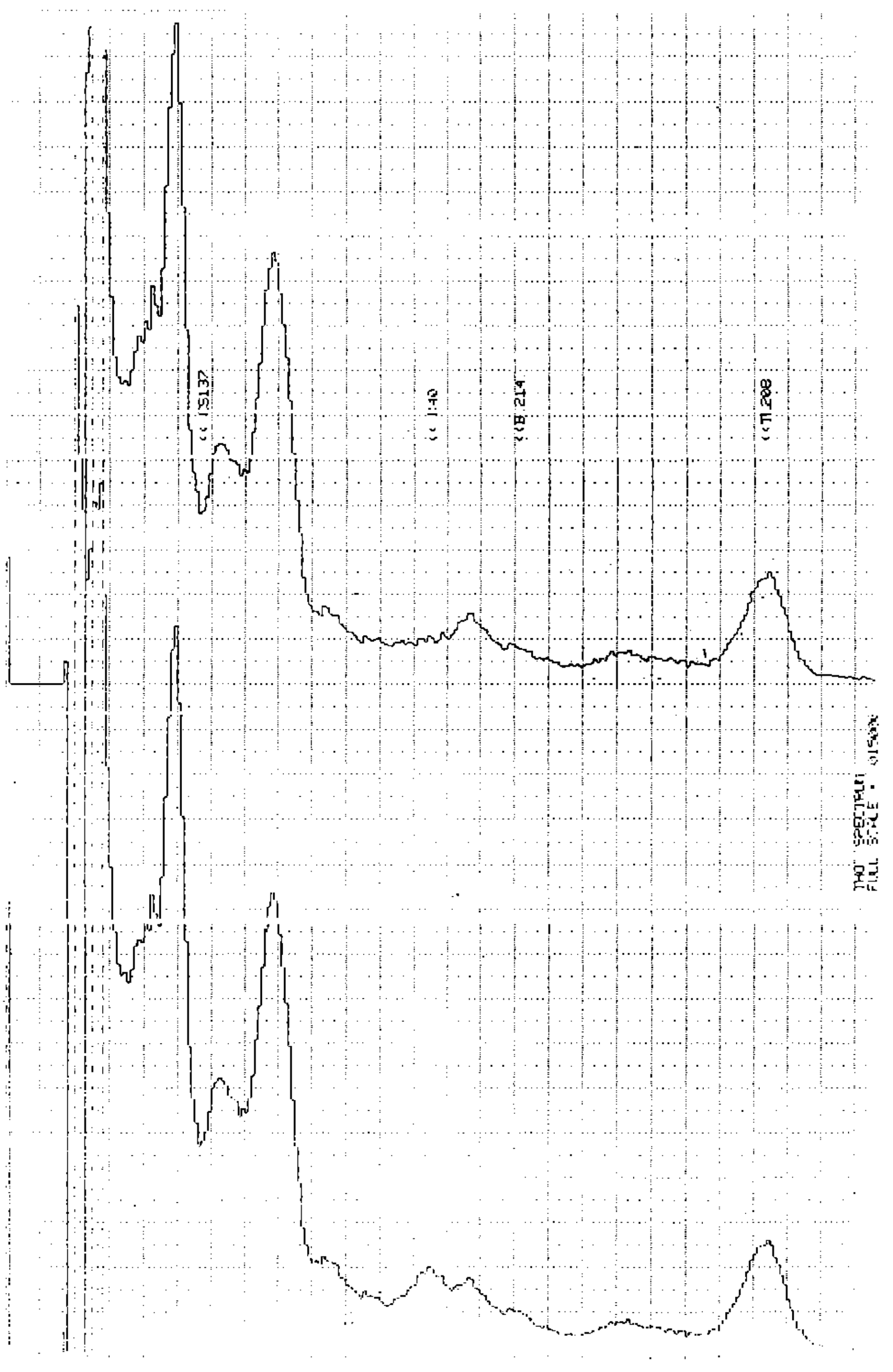


FIGURE A2 COSMIC BACKGROUND TESTS

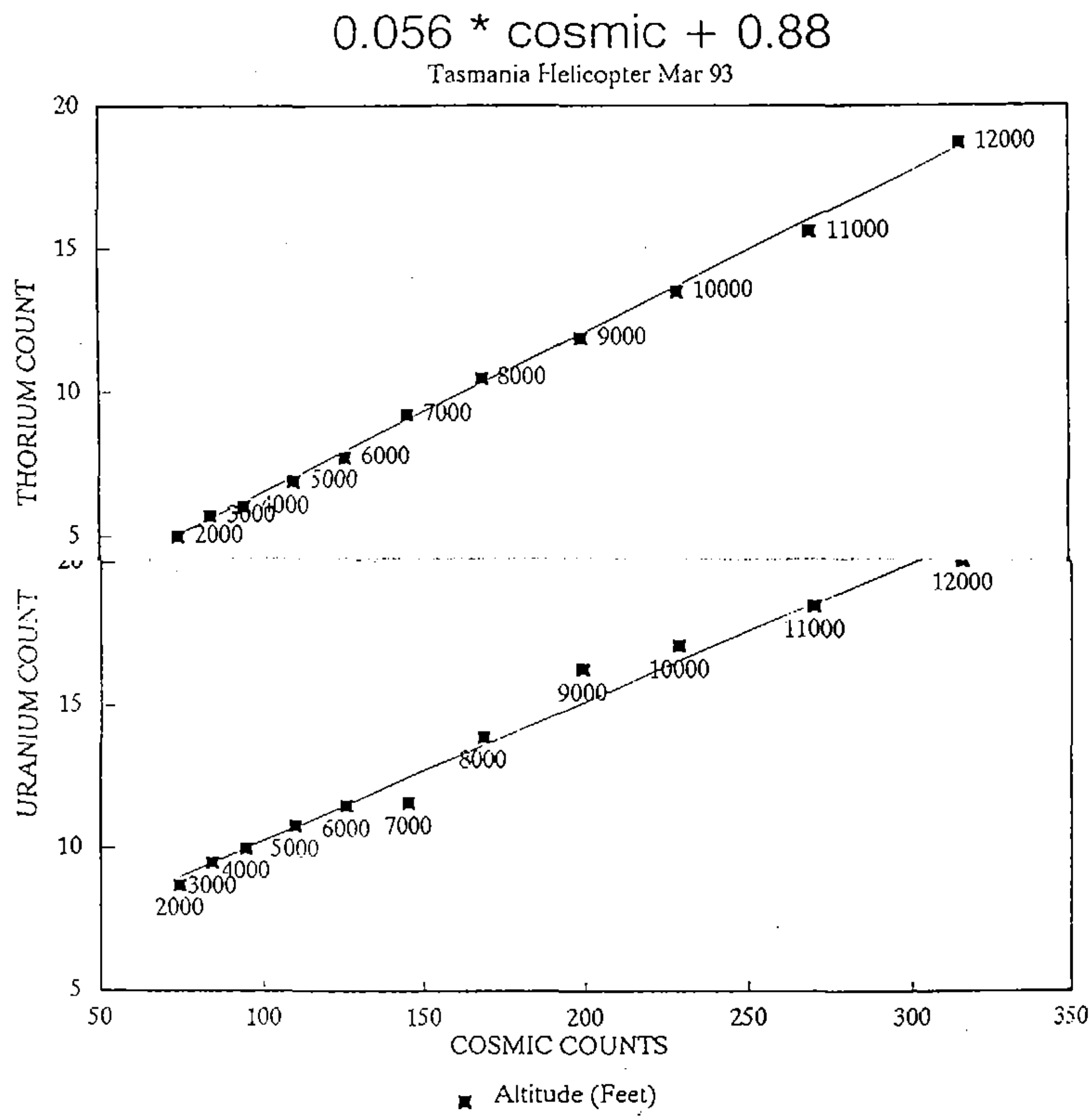
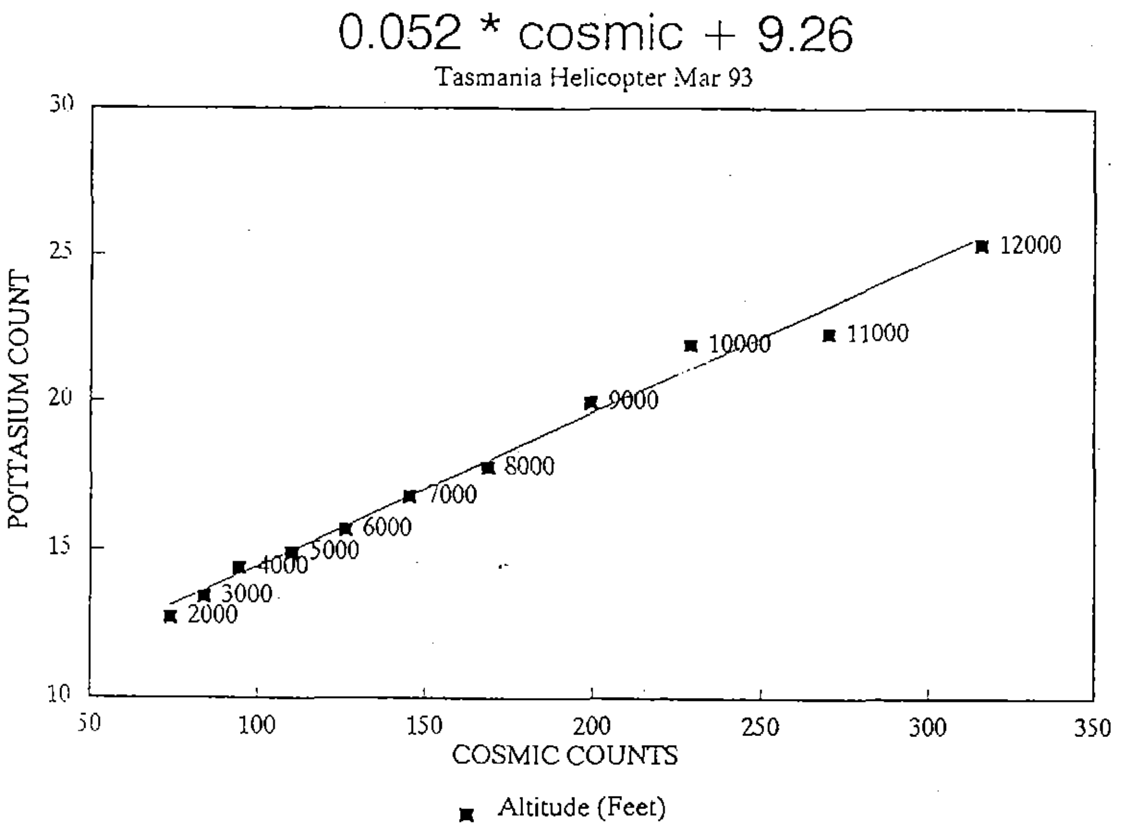


FIGURE A2 COSMIC BACKGROUND TESTS



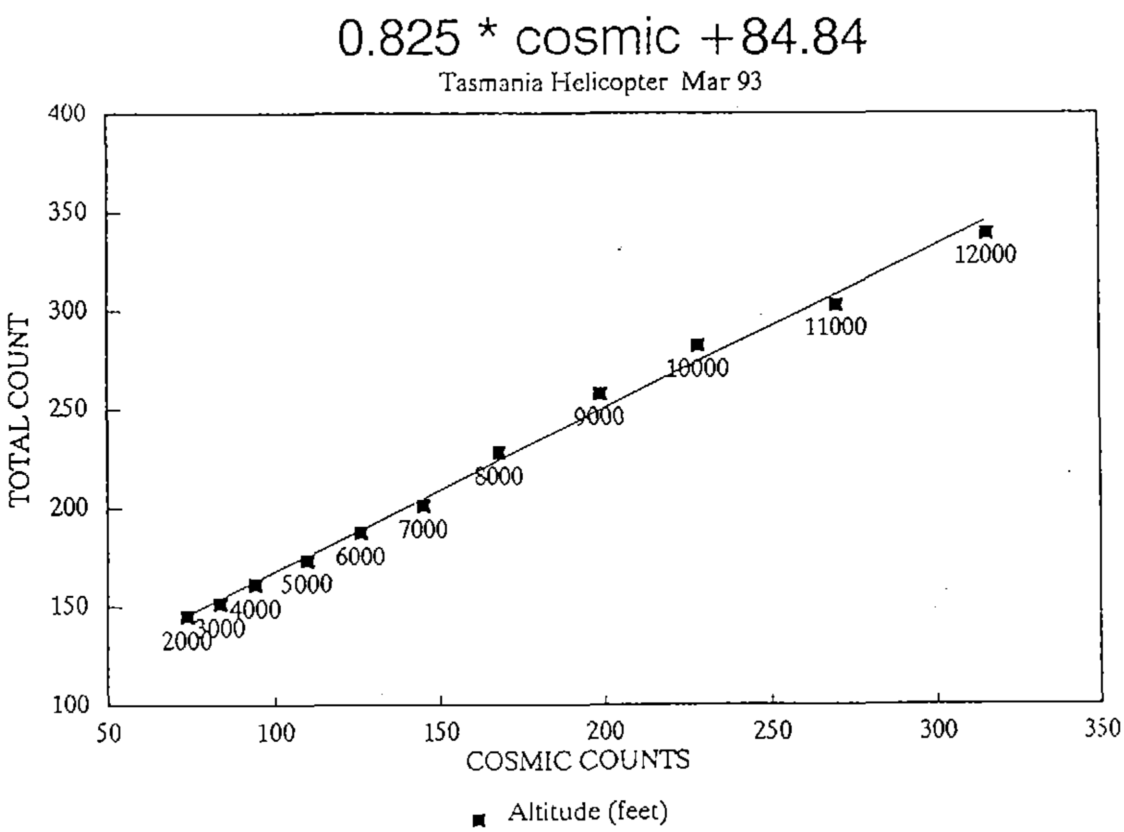
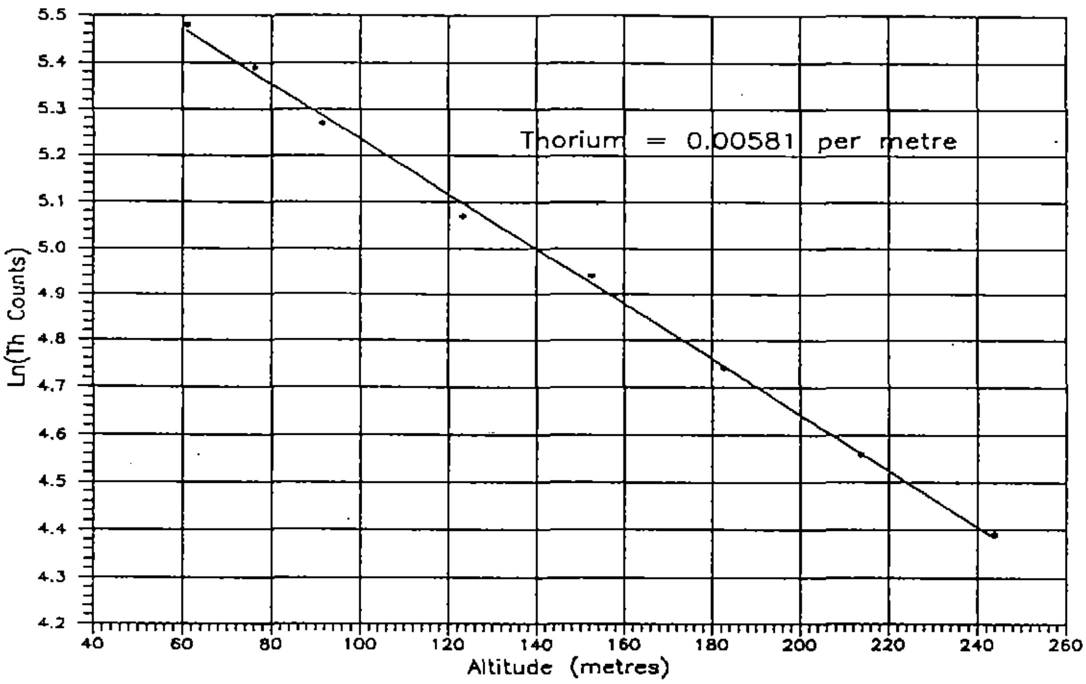


FIGURE A3: HEIGHT ATTENUATION TESTS



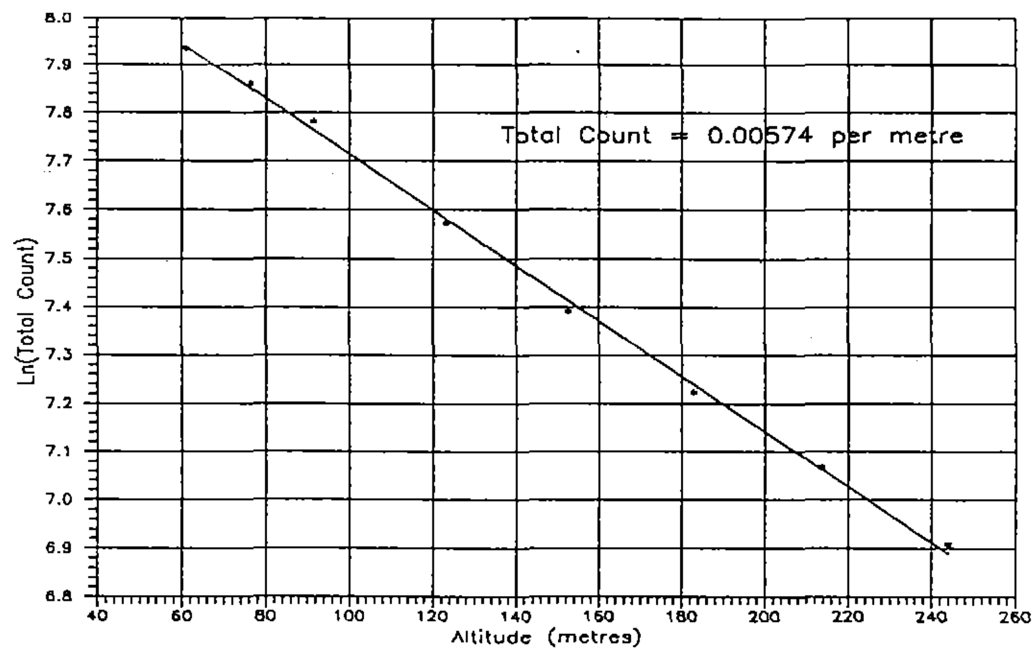
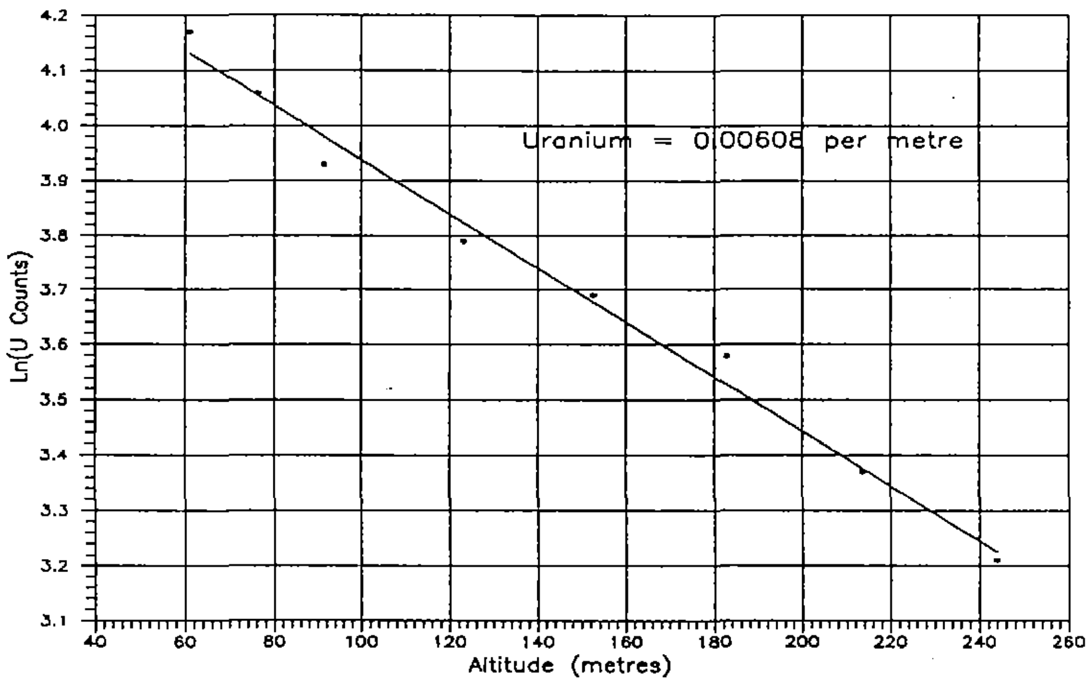


FIGURE A3: HEIGHT ATTENUATION TESTS



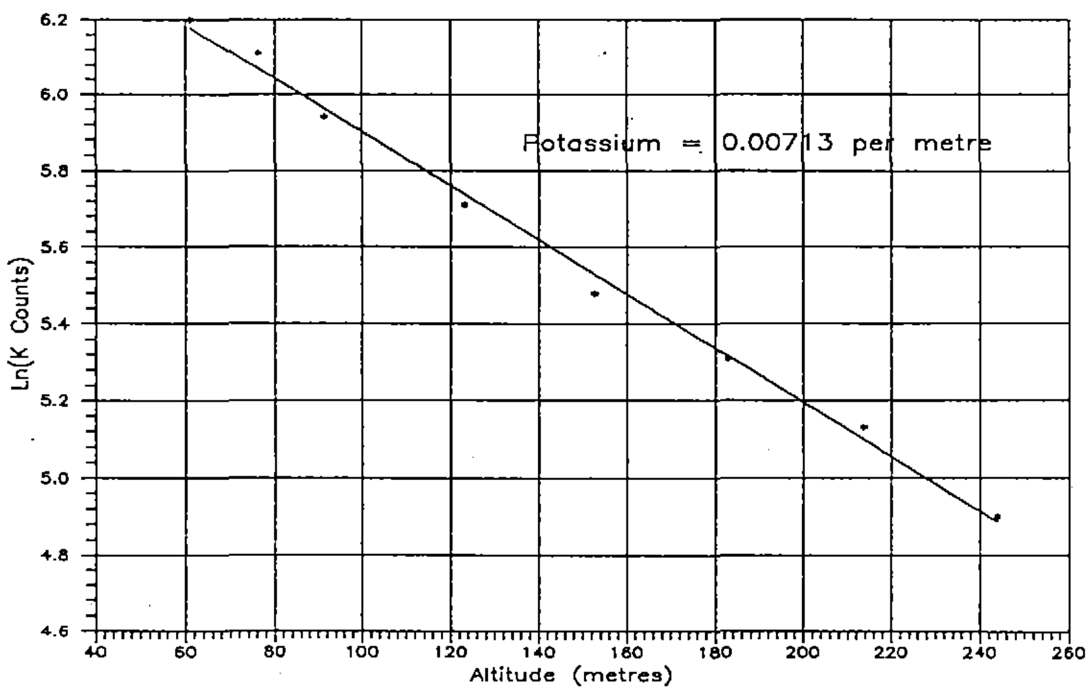
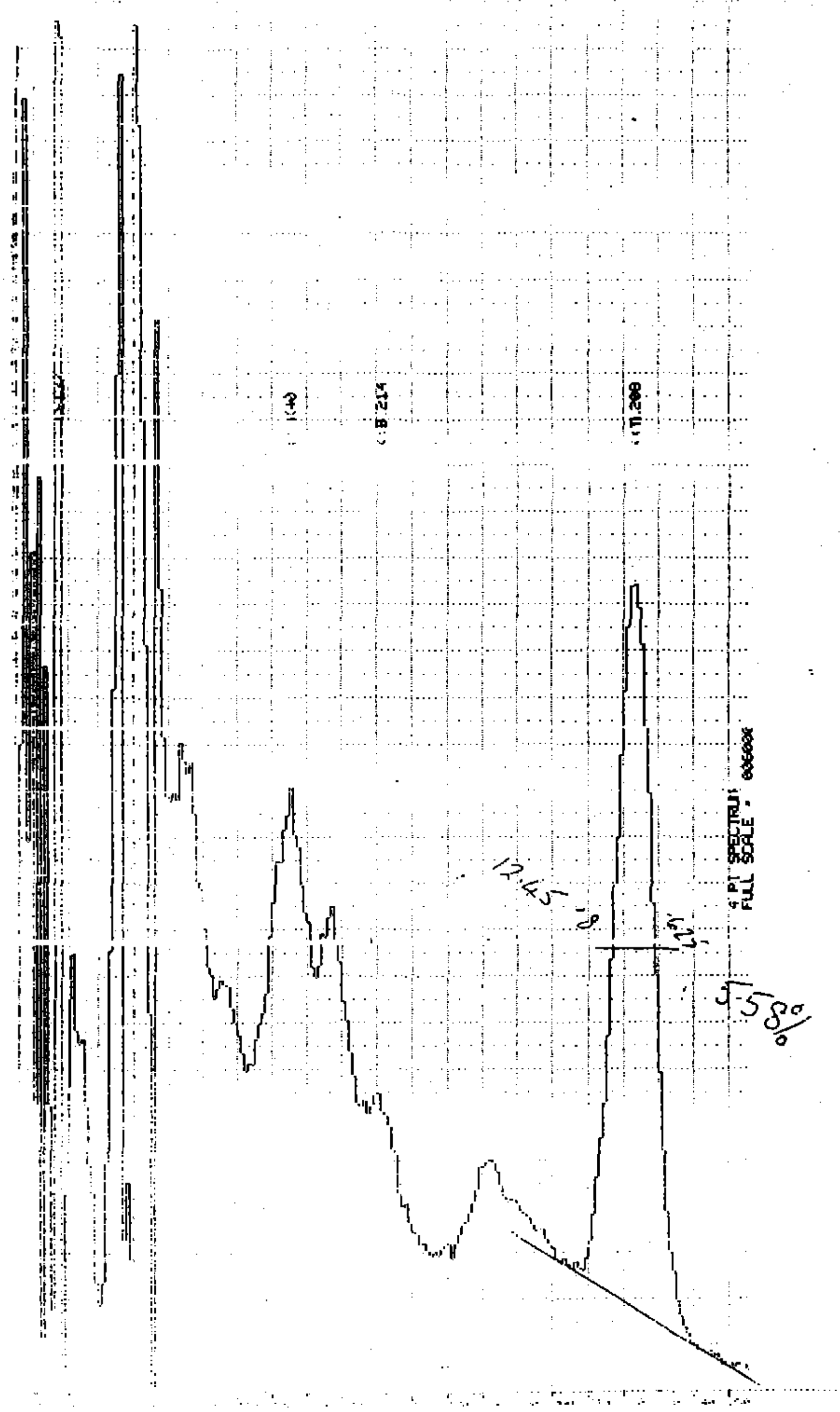


FIGURE A4 (i) - SPECTROMETER RESOLUTION CHECK

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.

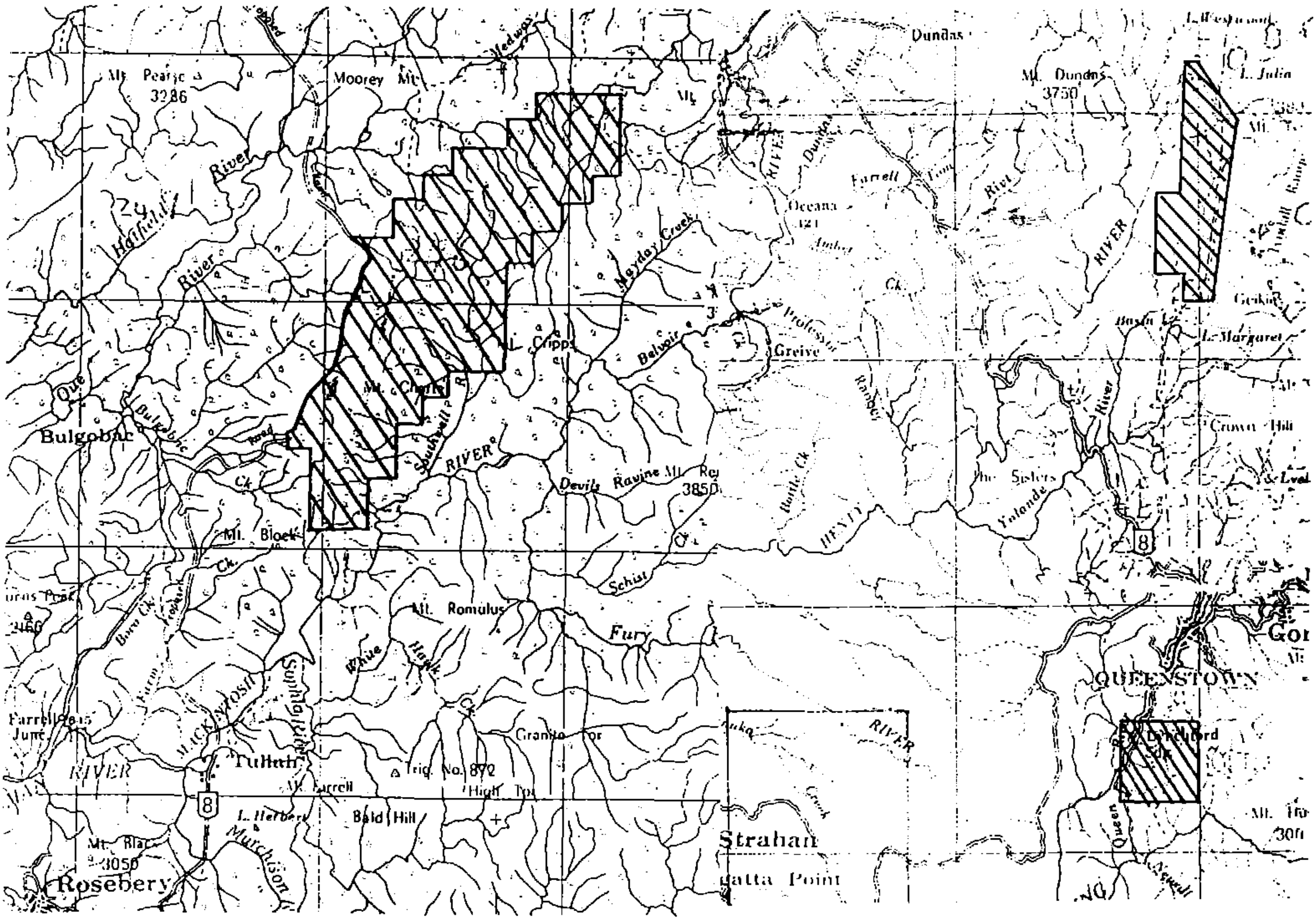
- Self-adhesive cellophane tapes containing an alcohol type plasticiser will cause the image to fade. Double-sided adhesive tape is recommended for use instead of paste.

- 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.

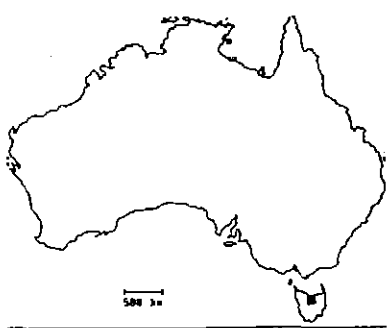
APPENDIX D: LOCATION MAP

LOCATION MAP Scale: 1:250,000



BERNIE 1:250,000 QUEENSTOWN 1:250,000

5 cm



Aberfoyle Resourc imited
EXPLORATION DIVI

LAKE MARGARET EL 5/85

TASMANIA

Technical Progress Report

for the period

September 1992 - September 1993

Volume 2 of 2

Plates

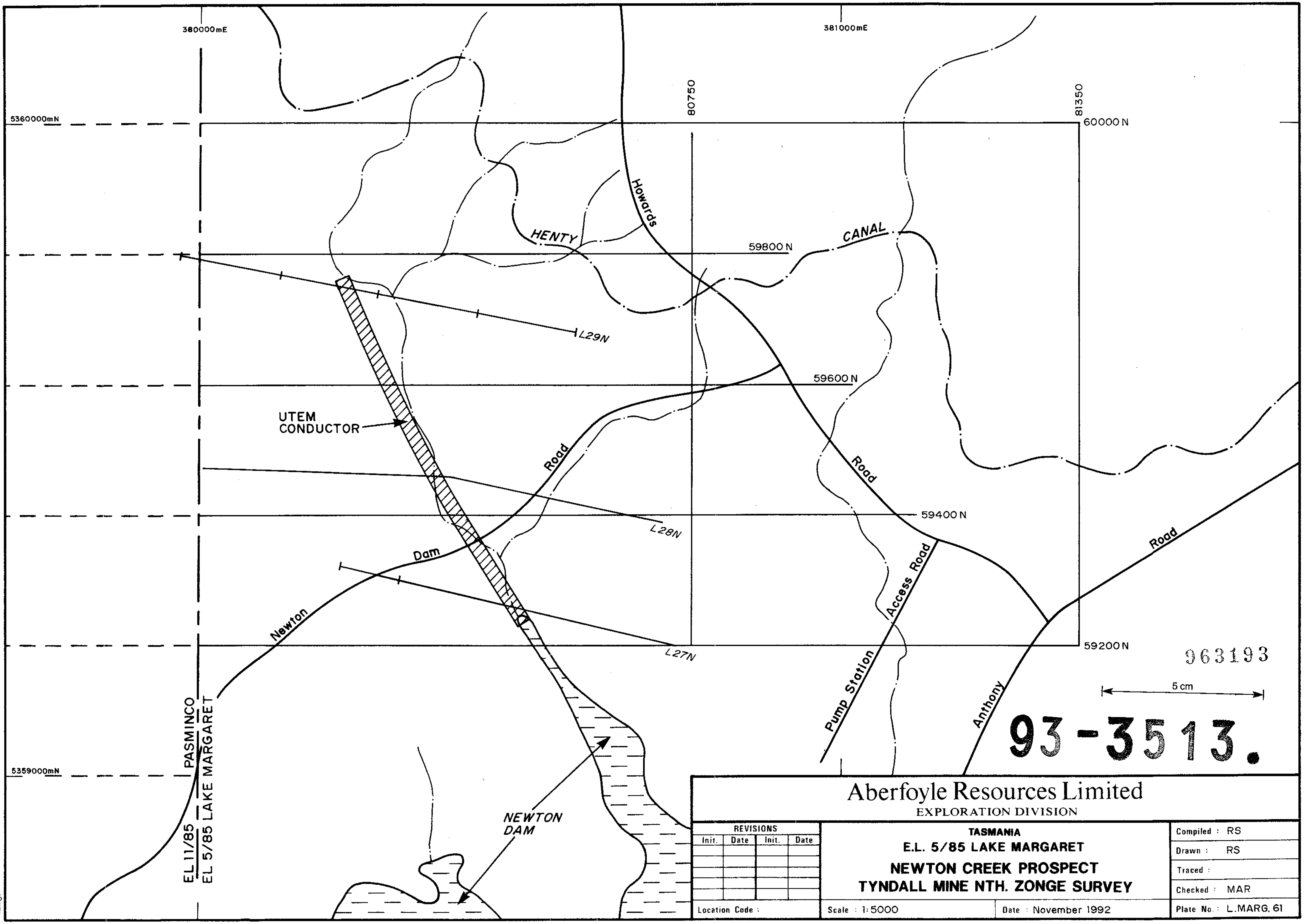
6 transparencies + 1 located data tape Reld

Distribution

Aberfoyle - Burnie	(1/4)
Aberfoyle - Hawthorn	(2/4)
Department of Mines	**(3/4)**
CRA Exploration - Canberra	(4/4)

Internal Report No: Lake Margaret 9


LAKE JULIA
619m
HENTY CANAL ALTERATION - PLAN PROJECTION OF NORTHERN BANK
SCALE 1:500
CONTINUOUS ROCK CHIP SAMPLES
REFER TO PLAN PROJECTION
SECTION 1
SCALE 1:200
CONTINUOUS ROCKCHIP SAMPLES
REFER TO SECTION 1
HENTY
CANAL
NEWTON
CREEK
ROAD
ANTHONY
ACCESS
H.E.C.
NEWTON DAM SUB STATION
PUMP STATION
NEWTON DAM
HA 008
HA 007
HA 003
HA 006
HA 004
HA 001
HA 002
HA 005
TYN3
TYN 5
E.L. 5/85
LAKE MARGARET
E.L. 103/87
BASIN LAKE
PLAN
SCALE 1:100
93-3513.
SOUTHWEST
CONSERVATION
AREA
SCALE 1:5000
metres 0 100 200 300 400 500 metres
5361 000mN
5360 000mN
5359 000mN
5358 000mN
5357 000mN
61 000 N
60 800 N
60 600 N
60 400 N
60 200 N
60 000 N
59 800 N
59 600 N
59 400 N
59 200 N
58 600 N
58 400 N
58 200 N
57 600 N
57 400 N
57 200 N
57 000 N
56 800 N
56 600 N
380000mE
381000mE
382000mE
Aberfoyle Resources Limited
EXPLORATION DIVISION
963192
REVISIONS
Init. Date Init. Date
HECjms 11 5 92
RS jms 25·1·93
RS nb 1·6·93
RS jms 6·9·93
WESTERN TASMANIA
LAKE MARGARET E.L.5/85
NEWTON CREEK AREA
OUTCROP GEOLOGY
Compiled : RS
Drawn : JMS
Traced :
Checked : RS
Location Code :
Scale : 1 5000
Date : MAY 1992
Plate No : L. MARG 50
5 cm



963193

93-3513.

Aberfoyle Resources Limited
EXPLORATION DIVISION

REVISIONS			
Init.	Date	Init.	Date

Location Code :

TASMANIA
E.L. 5/85 LAKE MARGARET
NEWTON CREEK PROSPECT
TYNDALL MINE NTH. ZONGE SURVEY

Scale : 1:5000
Date : November 1992

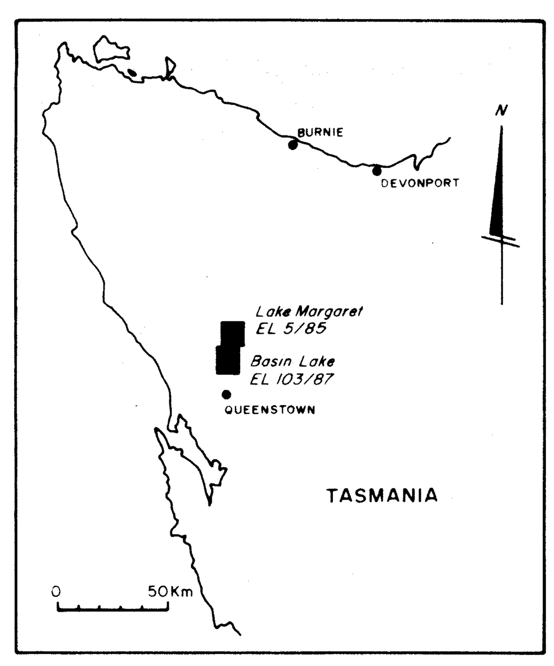
Compiled : RS
Drawn : RS
Traced :
Checked : MAR
Plate No. : L.MARG. 61

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.)



5 cm

0 5Km

93-3513.

963194

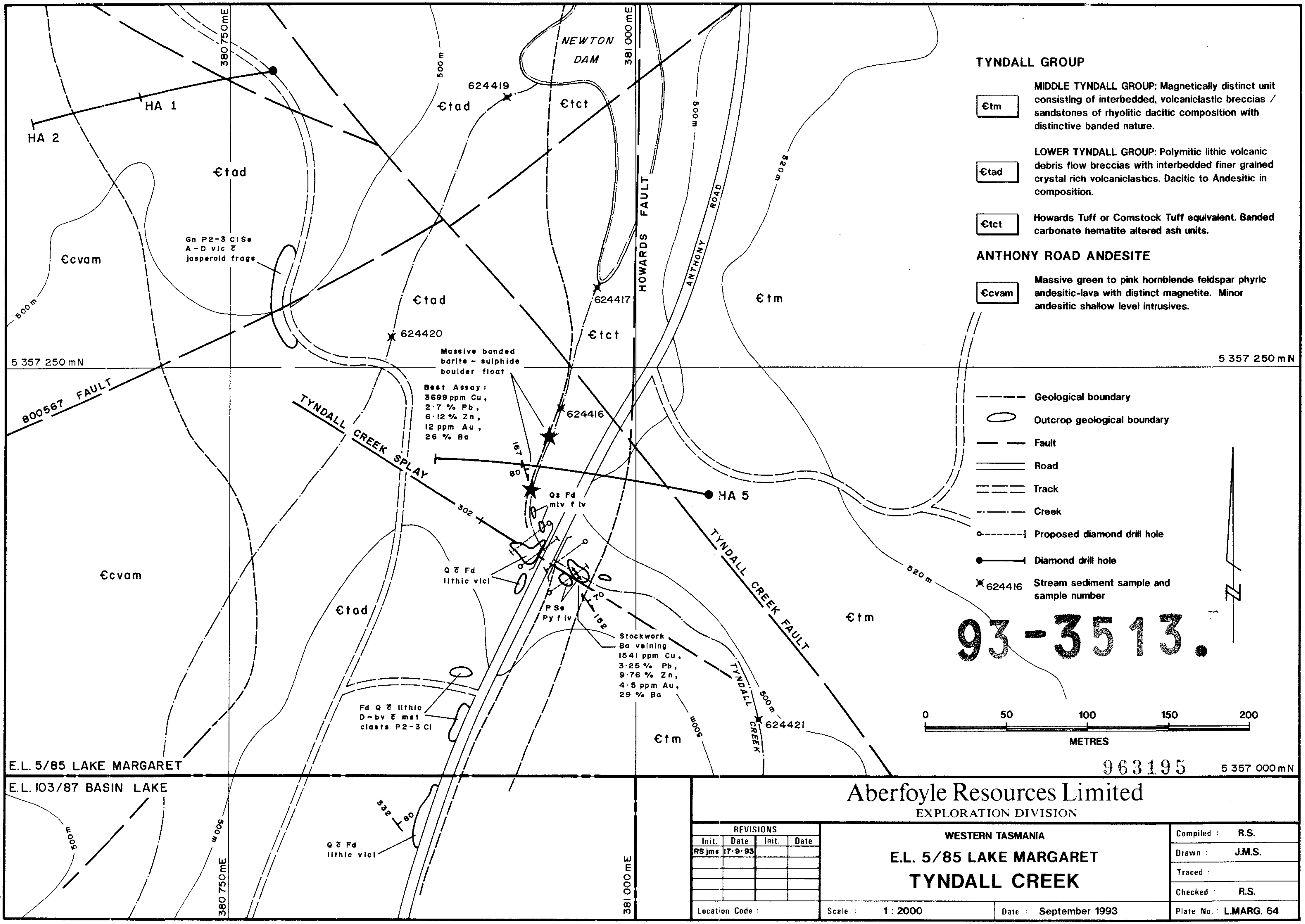
Aberfoyle Resources Limited
EXPLORATION DIVISION

NORTH WEST TASMANIA
ANTHONY BASIN
STRUCTURAL DATA COMPILATION

REVISIONS			
Init	Date	Init	Date

Compiled : RAS
Drawn : RAS
Traced : MAR
Checked :

Location Code K55/5 | Scale 1:10 000 | Date : August 1993 | Plate No : LMARG 65



Aberfoyle Resources Limited
EXPLORATION DIVISION

REVISIONS			
Init.	Date	Init.	Date
RS jms	17.9.93		

WESTERN TASMANIA
E.L. 5/85 LAKE MARGARET
TYNDALL CREEK

Compiled : R.S.
Drawn : J.M.S.
Traced :
Checked : R.S.
Location Code :
Scale : 1 : 2000
Date : September 1993
Plate No. : L.MARG. 64

€Oc 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.

€tad 27 — Lower Tyndall Group: Polymitic lithic volcanic debris flow breccias with interbedded finer grained crystal rich volcaniclastics. Dacitic to Andesitic in composition.

€tsh 68 — Black laminated shale.

€tx 28 — Feldspathic - Quartz Crystal Supported Unit

€tct 25 — Howards Tuff or Comstock Tuff equivalent. Banded carbonate hematite altered ash units.

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

ANTHONY ROAD ANDESITE (ARA)

€cvam 46 — Massive green to 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)

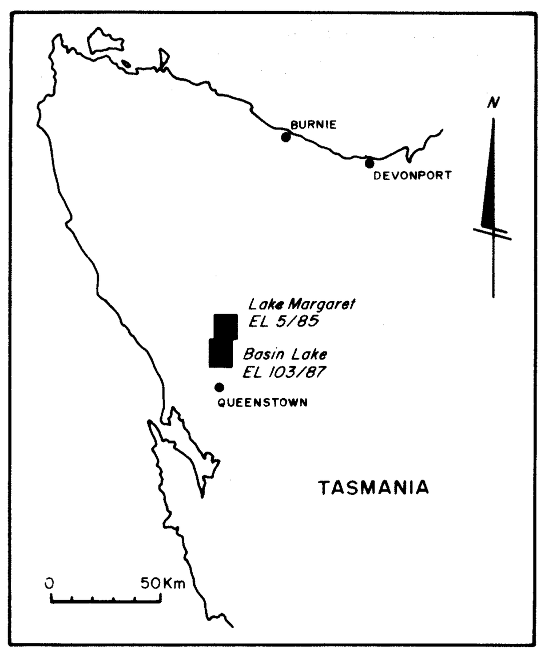
€wss 69 — Sandstones/siltstones and crystal rich lithic breccias with interbedded shales.

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.



93-3513.

0 5Km

5 cm

Aberfoyle Resources Limited

EXPLORATION DIVISION

963196

REVISIONS			
Init	Date	Init	Date
RS jms	8·9·93		

NORTHWEST TASMANIA

ANTHONY BASIN

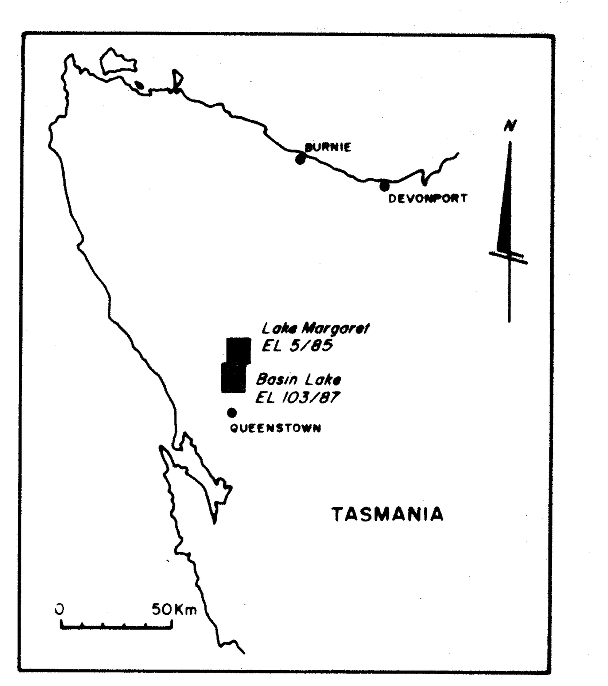
GEOMAGNETIC INTERPRETATION

Compiled : RS
Drawn : RS
Traced : NB
Checked :

Location Code K55/5 | Scale : 1:10 000 | Date : AUGUST 1993 | Plate No : LMARG 67

LEGEND

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



93-3513.

0 — 5Km

5 cm

Aberfoyle Resources Limited
EXPLORATION DIVISION

963197

REVISIONS			
Init	Date	Init	Date
RSjms	6·9·93		

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 : LMARG 66

€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.
€tod	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

93-3513.

0 500 1000 metres

5 cm

Aberfoyle Resources Limited
EXPLORATION DIVISION

963198

REVISIONS			
Init.	Date	Init.	Date

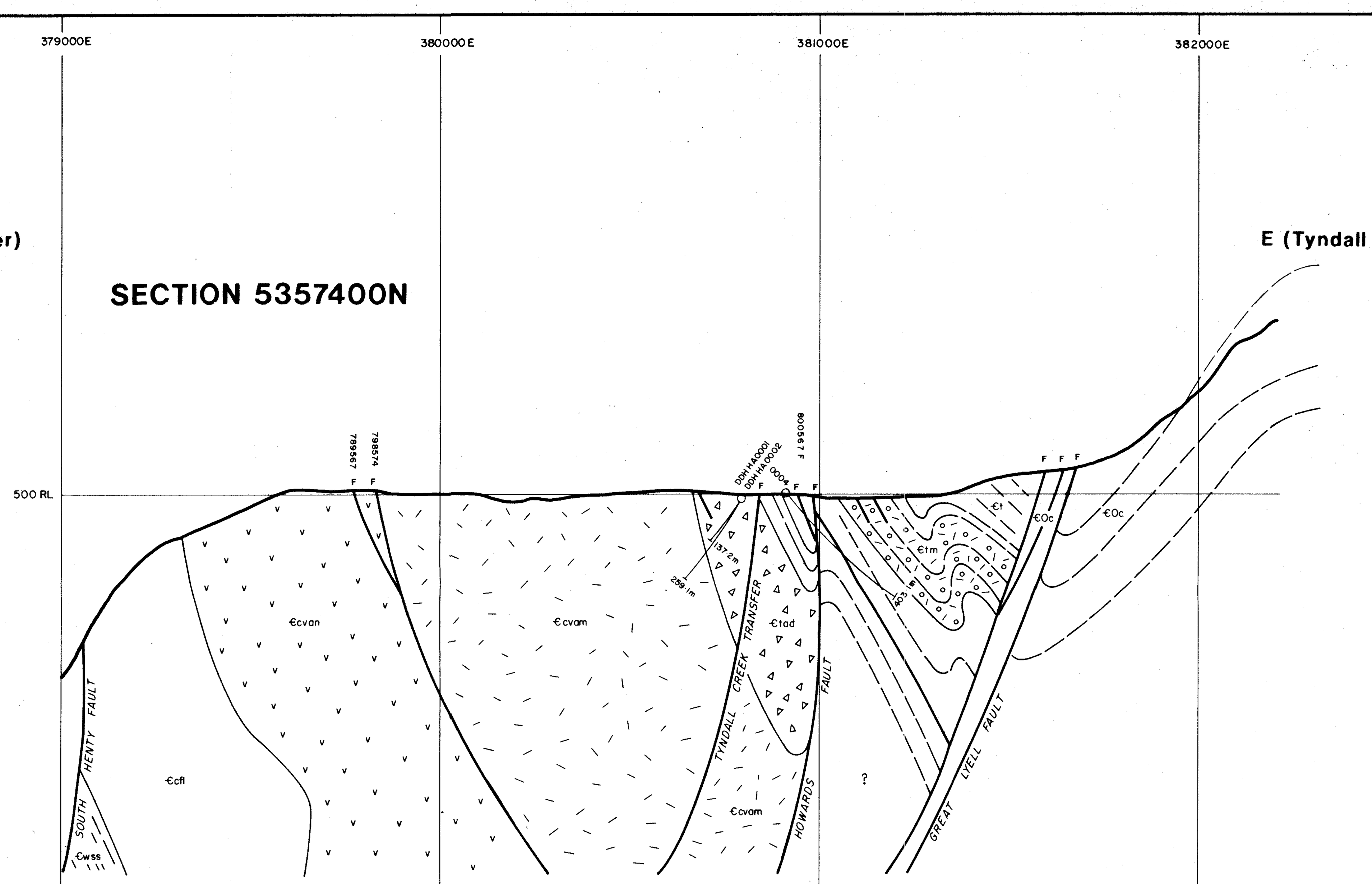
NORTH WEST TASMANIA
ANTHONY BASIN
INTERPRETIVE CROSS SECTIONS
SHEET A

Compiled : RS
Drawn : RS
Traced : RJE
Checked :

Location Code :
Scale : 1 : 10000
Date : AUGUST 1993
Plate No : LMARG 68A

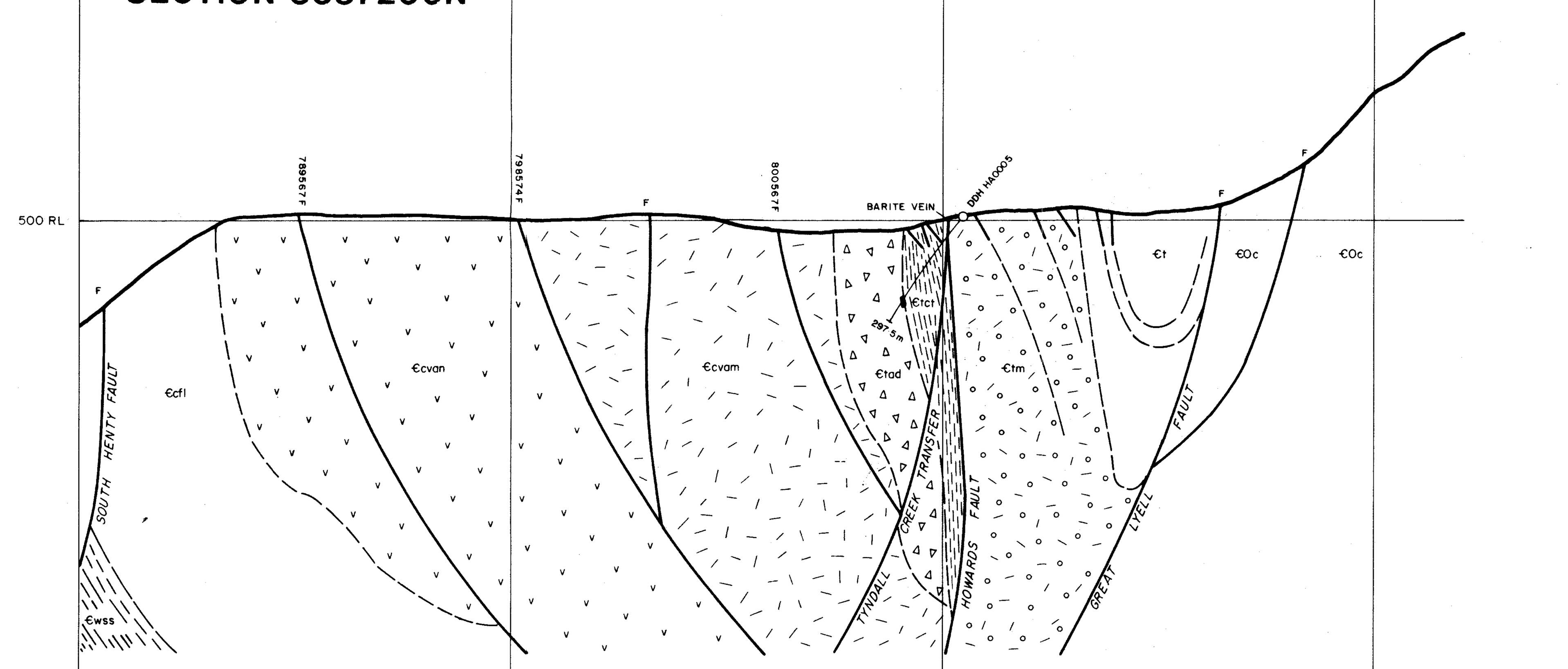
W (Henty River) E (Tyndall Range)

SECTION 5357400N



W (Henty River) E (Tyndall Range)

SECTION 5357200N



N.B. DDH HA5 : minor Pb/Zn < 1700 ppm b/w 58-100 m dh depth
Ag < 18 ppm b/w 66-82m
No Au assay

€Oc Owen Conglomerate

TYNDALL GROUP

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

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

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

€tad <u>Lower Tyndall Group</u>: 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 <u>Tyndall Group Intrusive</u>
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

93-3513.

0 500 1000 metres

5 cm

Aberfoyle Resources Limited
EXPLORATION DIVISION

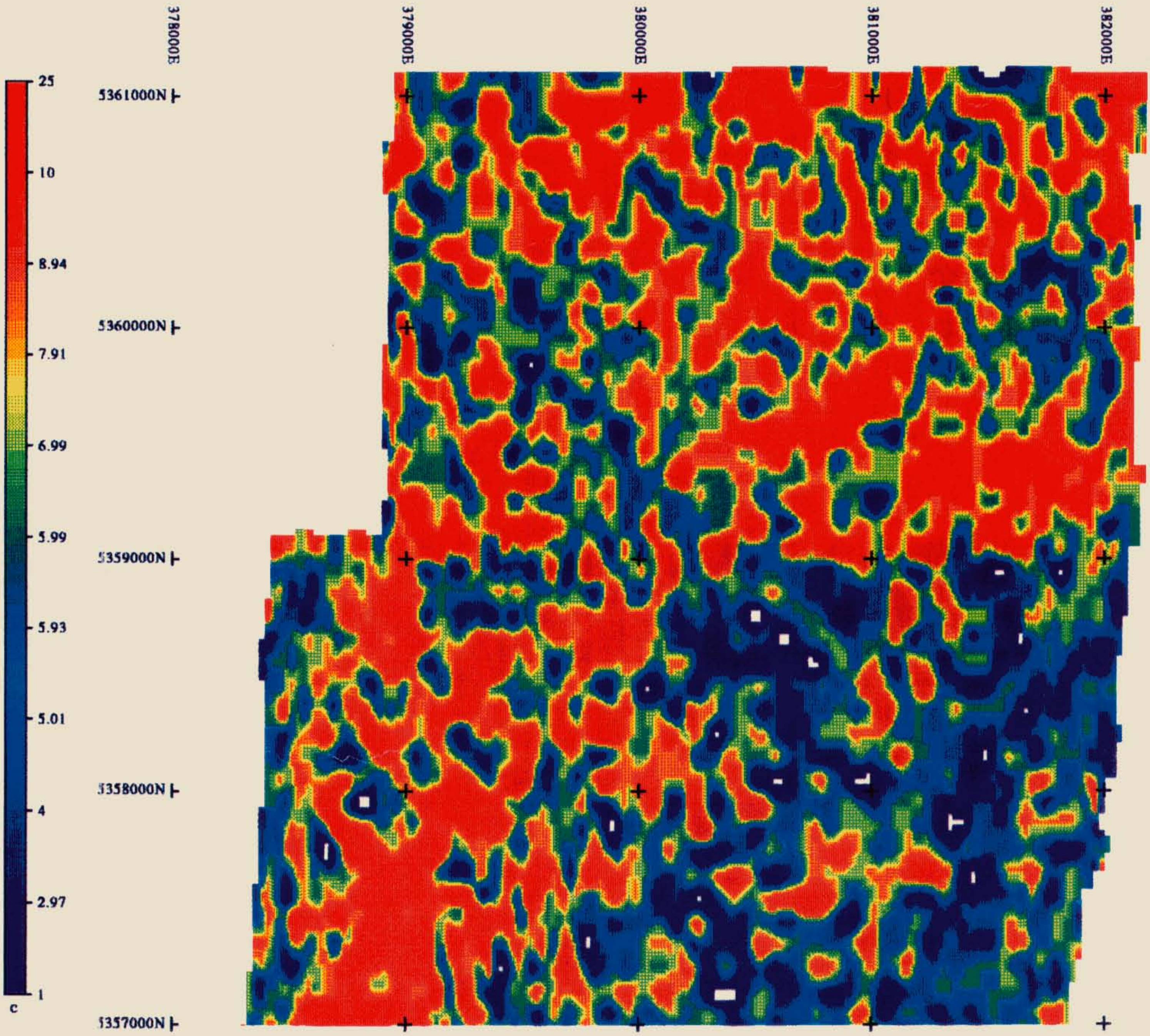
963199

REVISIONS			
Init.	Date	Init.	Date

NORTH WEST TASMANIA
ANTHONY BASIN
INTERPRETIVE CROSS SECTIONS
SHEET B

Compiled : RS
Drawn : RS
Traced : RJE
Checked :

Location Code :
Scale : 1: 10000
Date : AUGUST 1993
Plate No : LMARG 68B



963200

ABERFOYLE RESOURCES LIMITED

EXPLORATION DIVISION

REVISIONS			
Init.	Date	Init.	Date

Map Projection: TMAMG
Geodetic Datum: AGD66
Location Code:

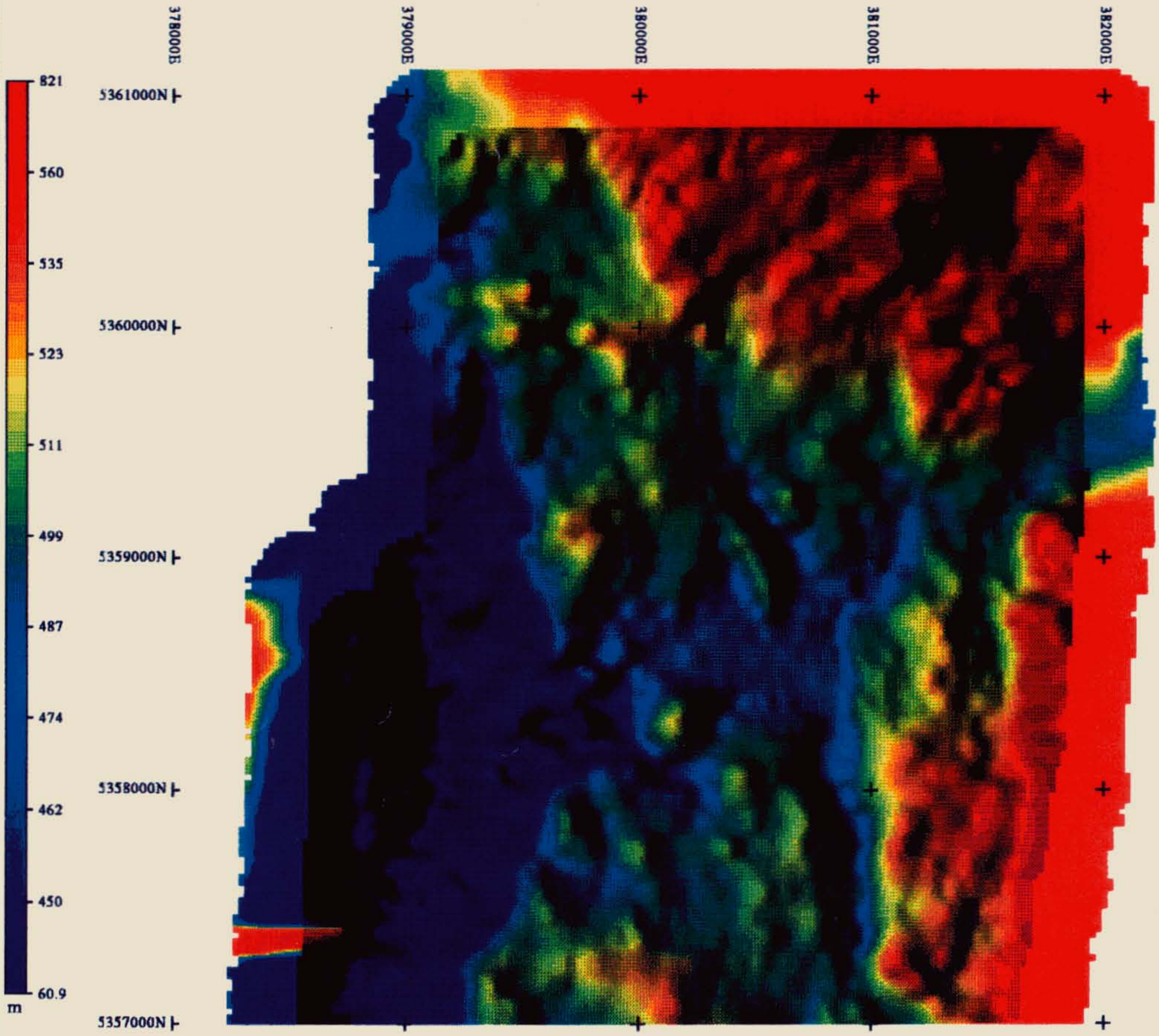
TASMANIA
EL 5/85 Lake Margaret
Anthony Basin
Radiometrics - U
Algorithm: AntB_rad_U(AnnRep)

Scale: 1:25000
Date: September 1993

Compiled: RHL
Printed: JX-730
Traced:
Checked:
Plate No. LMARG.70

5 cm

93-3513.



ABERFOYLE RESOURCES LIMITED

EXPLORATION DIVISION

REVISIONS			
Init.	Date	Init.	Date

Map Projection: TMAMG
Geodetic Datum: AGD66

TASMANIA
EL 5/85 Lake Margaret
Anthony Basin
Digital Elevation Model RTS 45.270
Algorithm: AntB_DEM_3(AnnRep_MLev)

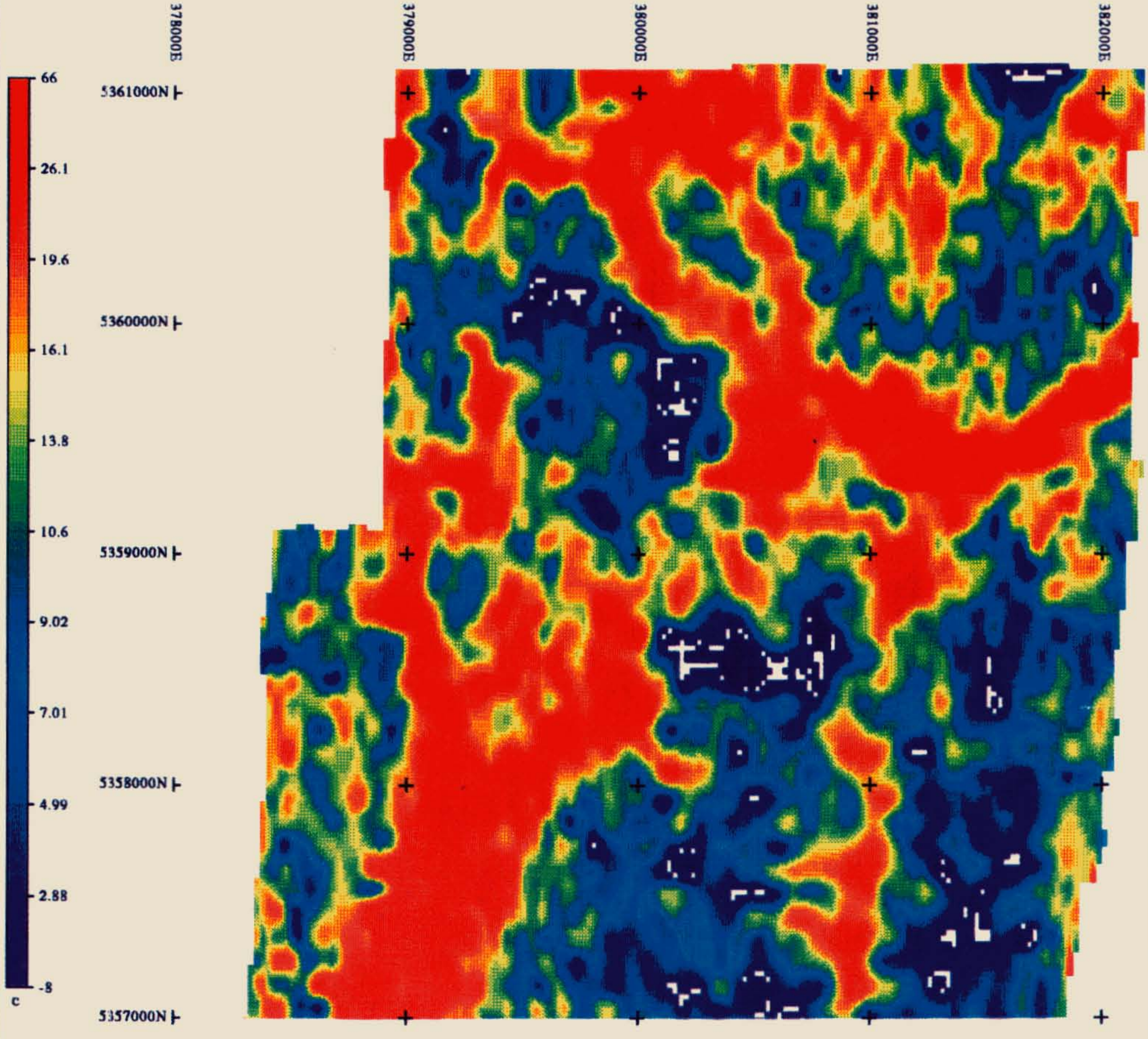
Compiled: RHL
Printed: JX-730
Traced:
Checked:

Location Code:	Scale: 1:25000	Date: September 1993	Plate No. LMARG.69

93-3513

5 cm

963201



ABERFOYLE RESOURCES LIMITED

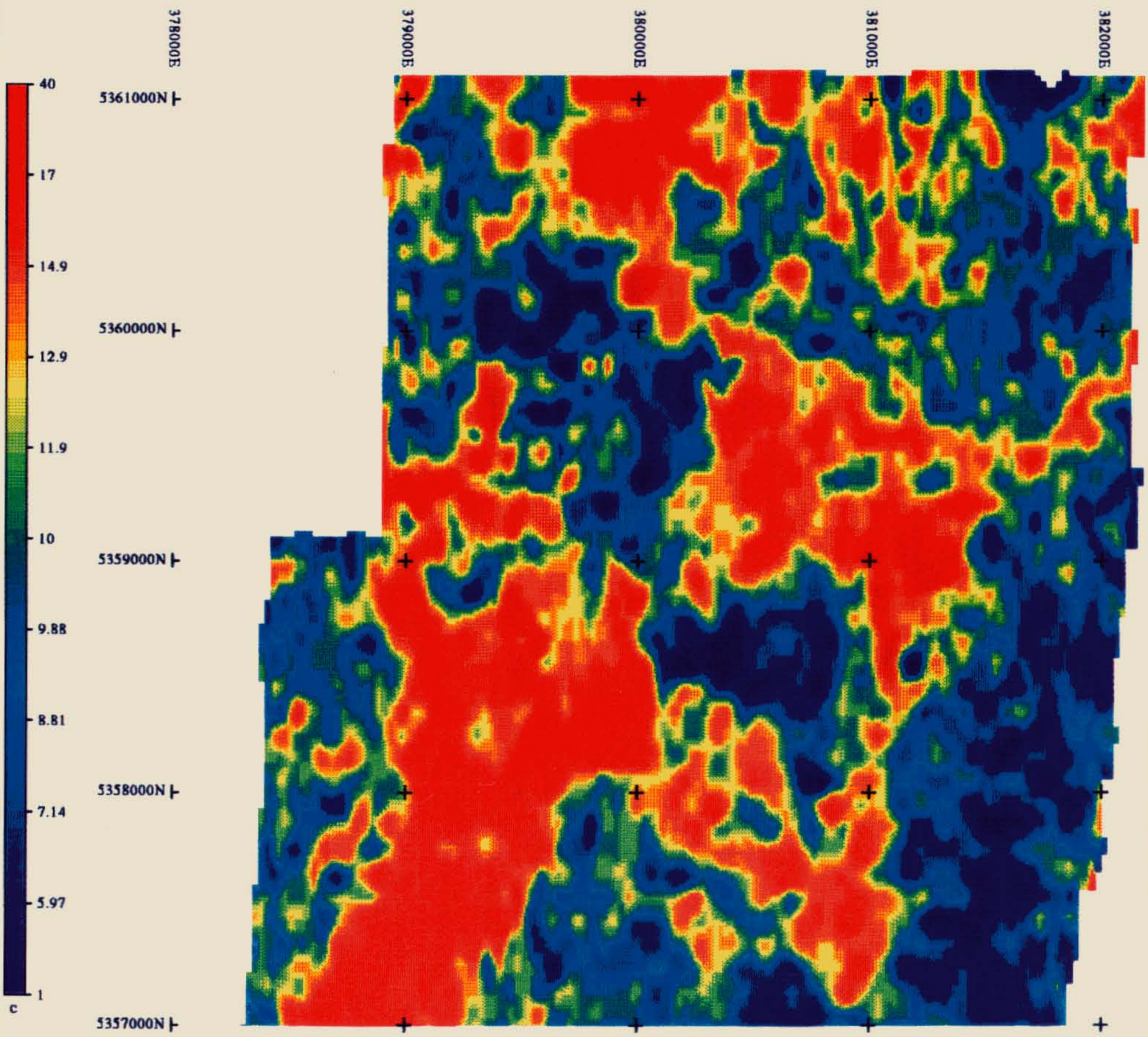
EXPLORATION DIVISION

REVISIONS				TASMANIA		Compiled: RHL
Init.	Date	Init.	Date	EL 5/85 Lake Margaret		Printed: JX-730
				Anthony Basin		Traced:
Map Projection: TMAMG				**Radiometrics - K**		Checked:
Geodetic Datum: AGD66				Algorithm: AntB_rad_K(AnnRep)		
Location Code:				Scale: 1:25000	Date: September 1993	Plate No. LMARG.72

93-3513.

5 cm

963202

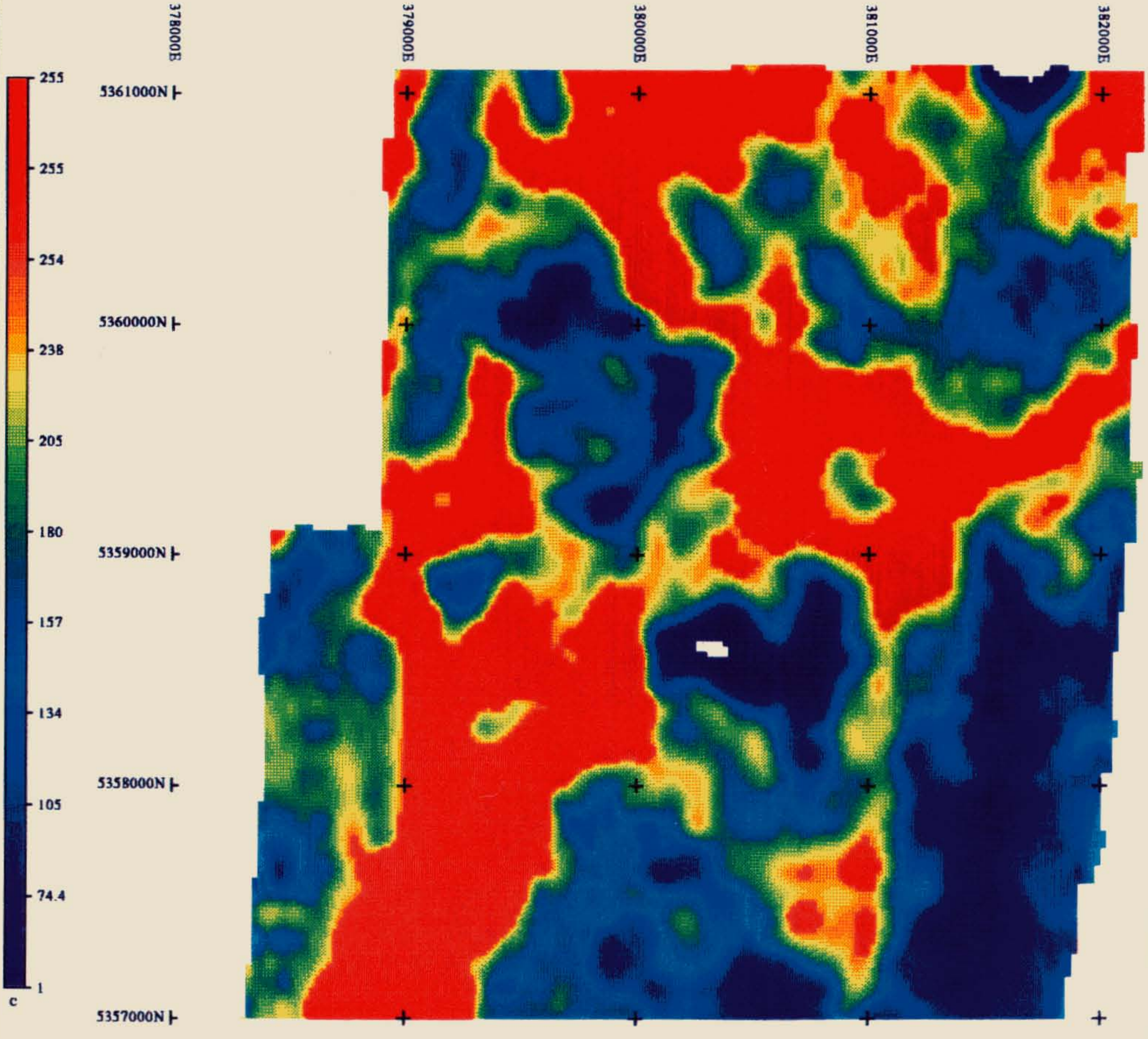


ABERFOYLE RESOURCES LIMITED
EXPLORATION DIVISION

REVISIONS				TASMANIA		Compiled: RHL
Init.	Date	Init.	Date	EL 5/85 Lake Margaret		Printed: JX-730
				Anthony Basin		Traced:
Map Projection: TMAMG				Radiometrics - Th		Checked:
Geodetic Datum: AGD66				Algorithm: AntB_rad_Th(AnnRep)		
Location Code:				Scale: 1:25000	Date: September 1993	Plate No. LMARG.71

93-3513.

963203



ABERFOYLE RESOURCES LIMITED

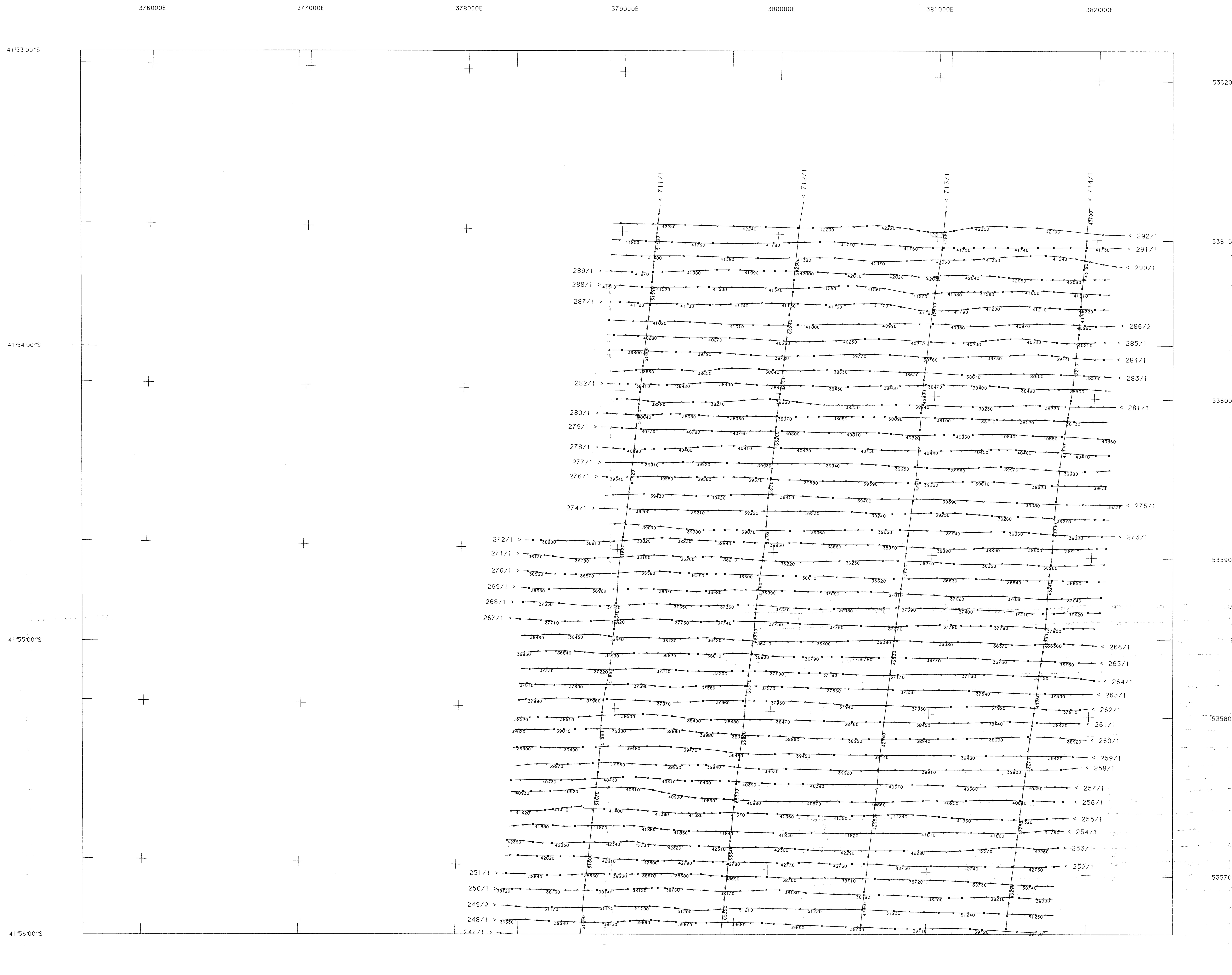
EXPLORATION DIVISION

REVISIONS				TASMANIA	Compiled: RHL
Init.	Date	Init.	Date	EL 5/85 Lake Margaret	Printed: JX-730
				Anthony Basin	Traced:
				Radiometrics - Total Count	
Map Projection: TMAMG					Checked:
Geodetic Datum: AGD66				Algorithm: AntB_rad_TC(AnnRep)	
Location Code:				Scale: 1:25000 — Date: September 1993	Plate No. LMARG.73

963204

93-3513.

5 cm



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

TN GN MN

Grid Convergence = 0.98°
Declination = 13.30°

SCALE 1:10000

200 0 200 400 600 800 m

5 cm

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

963205

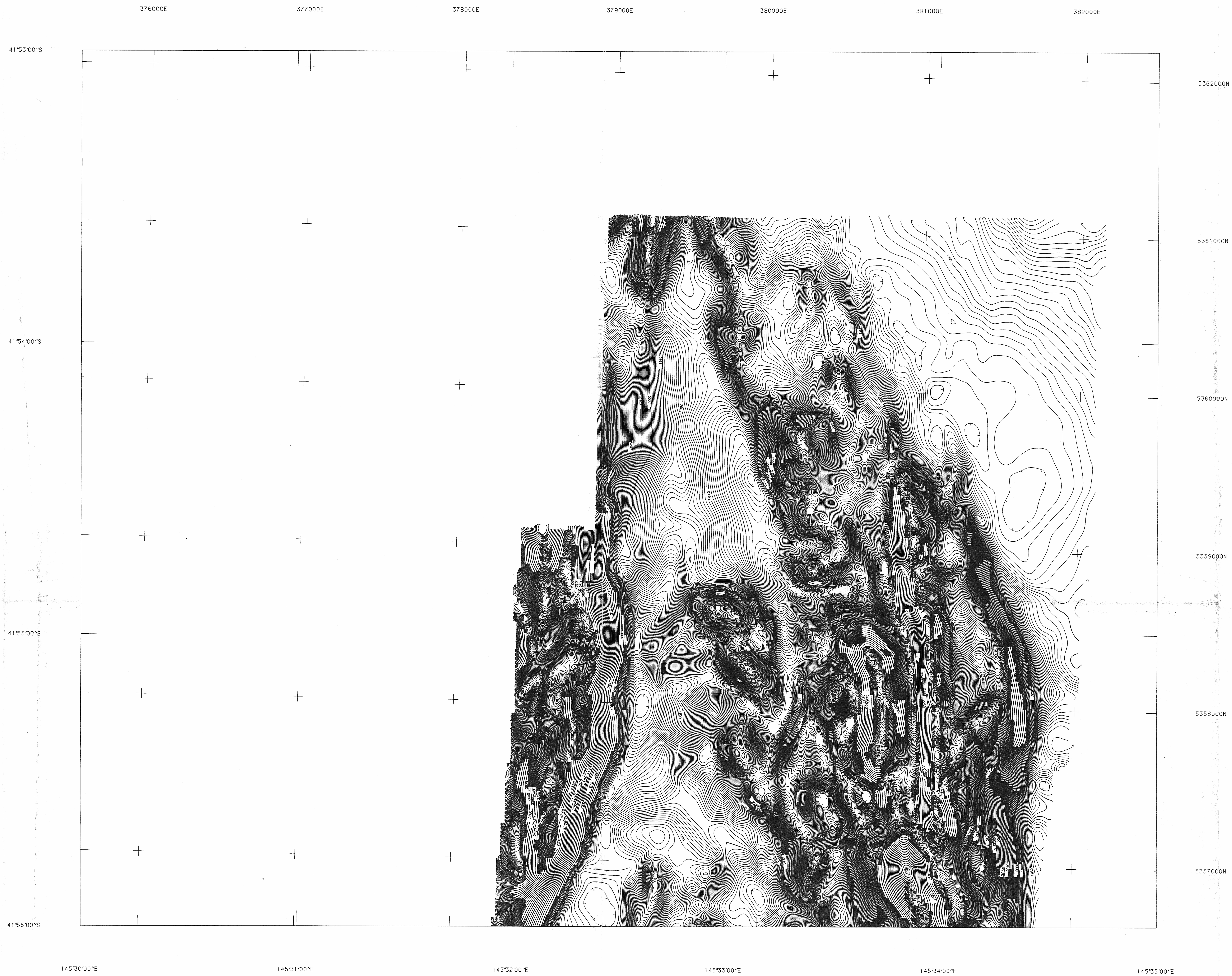
ABERFOYLE RESOURCES LTD

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

DRAWING NO: ANTB 6/1 | DATE : 27-APR-1993

ANTB 6/1

93-3513.



AIRBORNE SURVEY SPECIFICATIONS

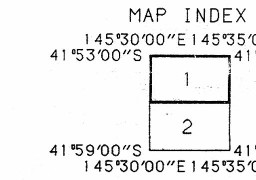
MAGNETOMETER :	SCINTREX cesium vapour optical absorbtion mounted on a bird Sensitivity : 0.05 nT
RECORDING INTERVAL :	0.1 sec
SPECTROMETER :	Nuclear Data 256 channel ADC Volume : 16.8 litres
TOTAL COUNT WINDOW :	0.4 - 3.00 MeV
POTASSIUM WINDOW :	1.35 - 1.57 MeV
URANIUM WINDOW :	1.63 - 1.89 MeV
THORIUM 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 navigationm system
FLIGHT PATH RECORD :	real time from UHF DGPS system corrected for selected availability

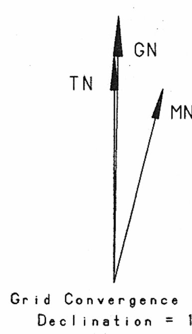
RESIDUAL MAGNETIC CONTOURS

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





Grid Convergence = 0.98°
Declination = 13.30°

SCALE 1:10000

200 0 200 400 600 800 m

5 cm

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

963206

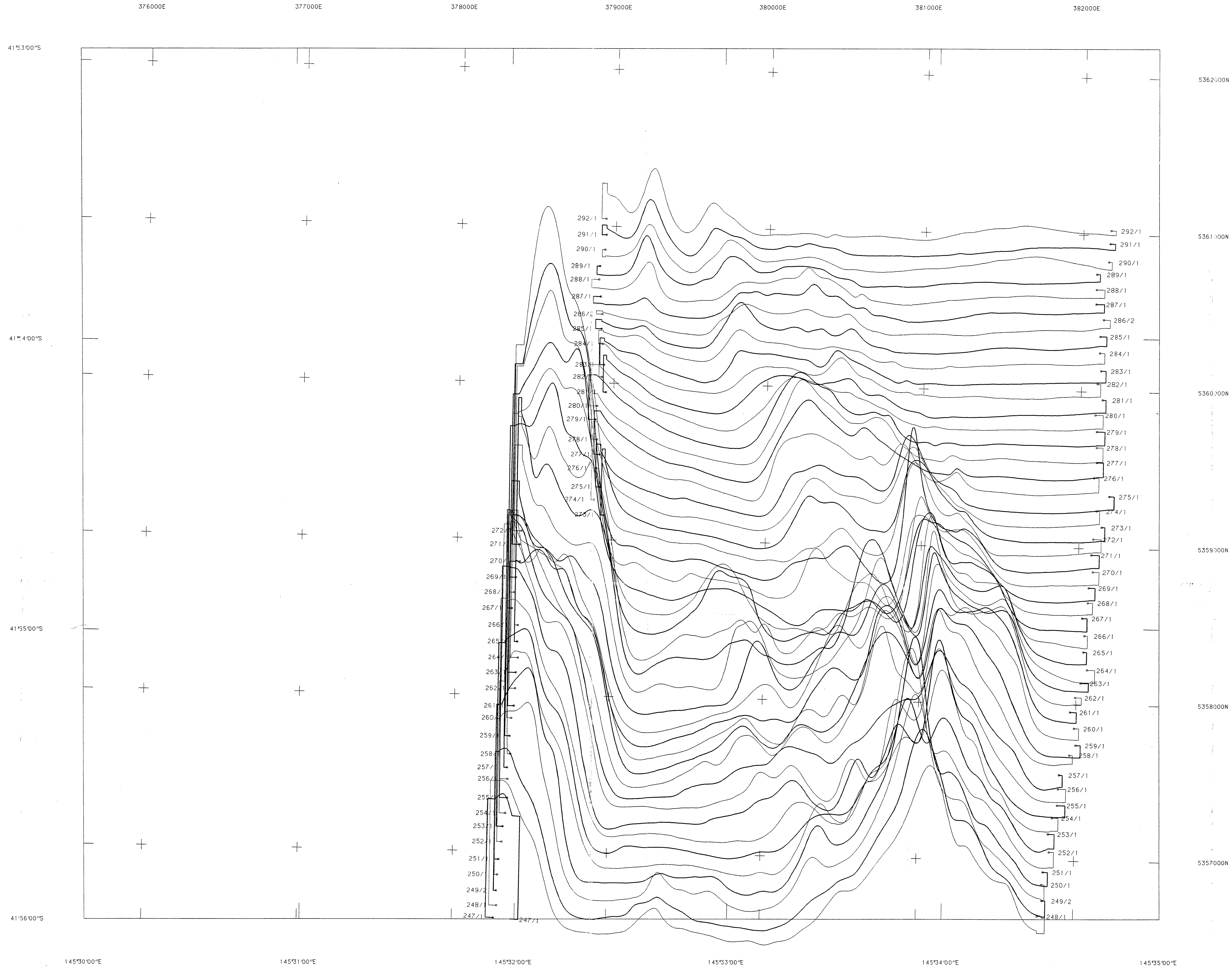
ABERFOYLE RESOURCES LTD

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

DRAWING NO: ANTB 7/1 | DATE : 27-APR-1993

ANTB 7/1

93-3513



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

TN GN MN

Grid Convergence = 0.98°
Declination = 13.30°

SCALE 1:10000

200 0 200 400 600 800 m

5 cm

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

963207

ABERFOYLE RESOURCES LTD

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

DRAWING NO: ANTB 10/1 | DATE : 30-APR-1993

ANTB 10/1

93-3513.