

DEPARTMENT OF MINES - TASMANIA
MINERAL INDUSTRY UNPUBLISHED REPORT
DATA SHEET

REPORT NUMBER TCR _____
 CF RF OF

AUTHOR(S): J. P. RANDALL
DATE: 24-9-90
TITLE: ANNUAL REPORT ON EXPLORATION COMPLETED TO 14TH OCTOBER 1990.

COMPANY(S): NORBOLD LTD
SHELL COMPANY OF AUSTRALIA LTD

FORMAT: No. of Volumes: 1 Structure: 7 FIGS 5 APP.

COMPANY REF. (if any): 08.4949

LICENCE / LEASE: EL 29/88

LOCALITY: SK55- 1 2 3 4 5 6 7 8

Map sheet: BURNIE

Geographic: MOUNT MURCHISON
(not in title)

<p>MAPPING - GEOLOGICAL</p> <p><input checked="" type="checkbox"/> Surface - scale :</p> <p><input type="checkbox"/> Mine/Underground</p> <p>DRILLING</p> <p><input type="checkbox"/> Diamond</p> <p><input type="checkbox"/> Percussion</p> <p><input checked="" type="checkbox"/> Auger</p> <p><input type="checkbox"/> Logs</p> <p><input type="checkbox"/> Analysis</p> <p><input type="checkbox"/> Metallic Minerals</p> <p><input type="checkbox"/> Non-metallic Minerals</p>	<p>GEOPHYSICS</p> <p>GND/AIR</p> <p><input type="checkbox"/> Magnetic</p> <p><input type="checkbox"/> Electromagnetic</p> <p><input type="checkbox"/> Radiometric</p> <p><input type="checkbox"/> A.P. <input type="checkbox"/> S.P. <input type="checkbox"/> E.P.</p> <p><input type="checkbox"/> E.I.P./M.I.P <input type="checkbox"/> Resist.</p> <p><input type="checkbox"/> Gravity</p> <p><input type="checkbox"/> Seismic - Refraction</p> <p><input type="checkbox"/> Seismic - Reflection</p> <p><input type="checkbox"/> On-shore <input type="checkbox"/> Off-shore</p> <p><input type="checkbox"/> Well-logging</p>	<p>GEOCHEMISTRY</p> <p><input type="checkbox"/> Stream Sediment</p> <p><input checked="" type="checkbox"/> Soil : _____</p> <p><input checked="" type="checkbox"/> Rock - chip</p> <p><input type="checkbox"/> Gossan</p> <p><input type="checkbox"/> Water : _____</p> <p><input type="checkbox"/> Biogeochemistry</p> <p><input checked="" type="checkbox"/> Cu <input checked="" type="checkbox"/> Pb <input checked="" type="checkbox"/> Zn</p> <p><input type="checkbox"/> Sn <input type="checkbox"/> W <input type="checkbox"/> Mo</p> <p><input type="checkbox"/> Rock: <input type="checkbox"/> Maj. <input type="checkbox"/> Tr.</p>	<p><input type="checkbox"/> PETROLOGY</p> <p><input type="checkbox"/> ORE GENESIS</p> <p><input type="checkbox"/> ORE RESERVES</p> <p><input type="checkbox"/> FEASIBILITY STUDY</p> <p><input type="checkbox"/> MINERAL PROCESSING</p> <p><input type="checkbox"/> MINING</p> <p><input type="checkbox"/> ENVIRONMENT</p> <p><input type="checkbox"/> ENGINEER. GEOLOGY</p> <p><input type="checkbox"/> INDUST. MINERALS</p> <p><input type="checkbox"/> CONSTRUCT. MAT.</p> <p><input type="checkbox"/> FUELS : _____</p>
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MINERALS: Lead Zinc Gold Silver

MINE / DEPOSIT NAME(S): Sterling Valley

OTHER KEY WORDS: Volcanic hiatus, Cambrian, Tyndall Group

ANNOTATION: Geological mapping has identified an horizon indicative of quiescence between volcanic cycles. No EM or consistent surface geochemical anomalies are present. However, lead isotope and selected rock chip sampling indicates that a deep subsurface diamond drill test is warranted.

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- Appendix 5 : Petrological sample descriptions.

1.0 INTRODUCTION

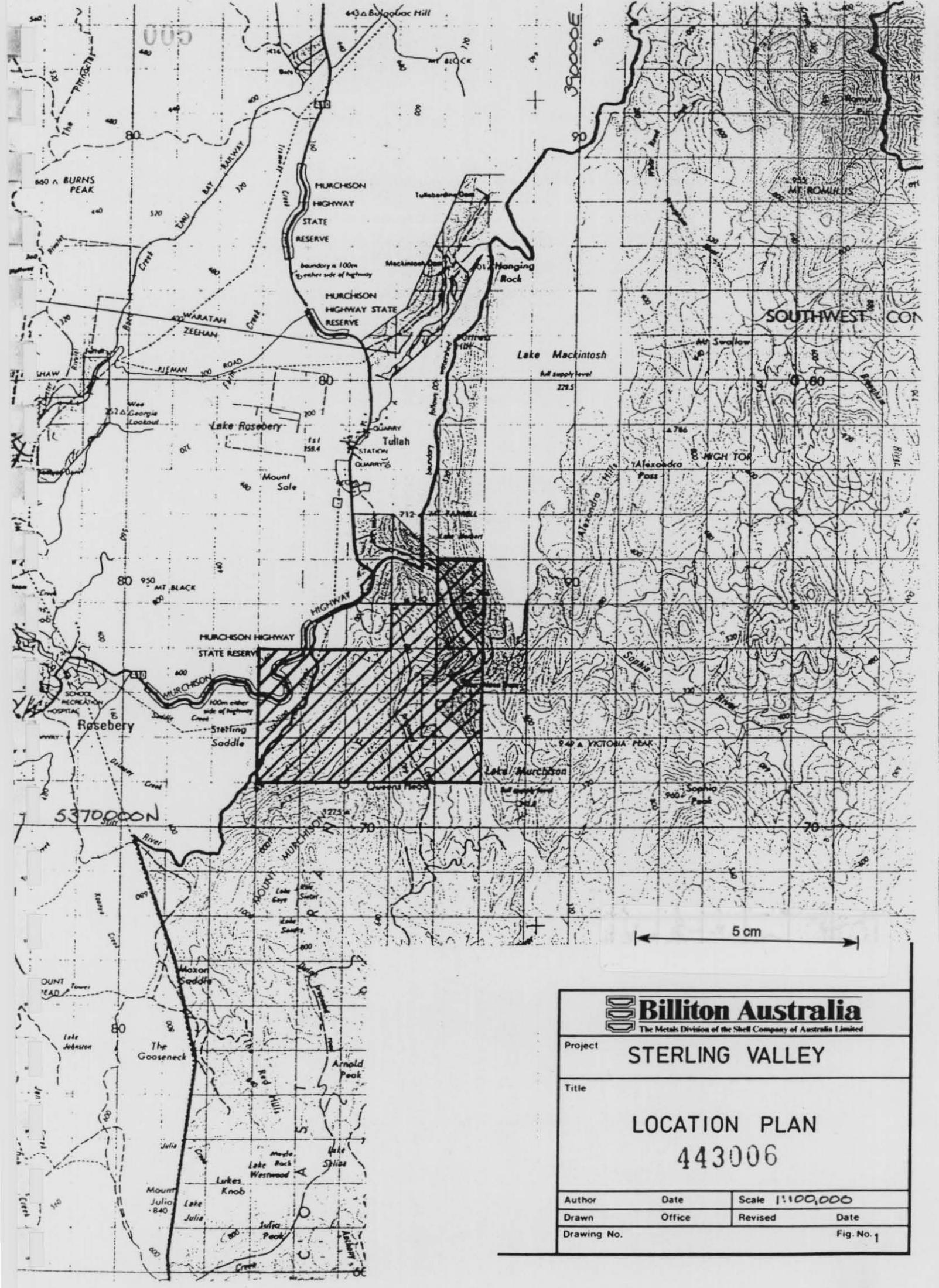
This report details results of exploration carried out by Billiton Australia on behalf of the Sterling Valley Joint Venture during the twelve month period ending 14th October 1990. It is the second annual report pertaining to E.L. 29/88.

2.0 LOCATION

The licence is situated between Rosebery and Tullah on the West Coast of Tasmania and is transected on its north-western edge by the Murchison Highway. (see Fig. 1) Access is gained via the partially sealed Anthony Road and an HEC power line track that traverses the western portion of the licence.

3.0 LAND TENURE

E.L. 29/88, of 17km², was granted to Norgold Limited on the 14th October, 1988 for a period of ten years renewable every 12 months. The licence has been renewed until 14th October 1990 and application for renewal to 1991 has been made. A joint venture agreement is currently in place between Norgold Limited and the Shell Company of Australia Limited whereby Billiton Australia, the Metals Division of the The Shell Company of Australia Limited, manages the joint venture.



 Billiton Australia <small>The Metals Division of the Shell Company of Australia Limited</small>		
Project		
STERLING VALLEY		
Title		
LOCATION PLAN 443006		
Author	Date	Scale 1:100,000
Drawn	Office	Revised Date
Drawing No.	Fig. No. 1	

Norgold and Billiton entered into a joint venture agreement on 12th November 1986 in which E.L. 4/73 was the subject of this agreement. The licence expired on 6th March 1988 but a new exploration licence, namely EL 29/88, was granted to Norgold Limited on behalf of the Sterling Valley Joint Venture (see Fig. 2).

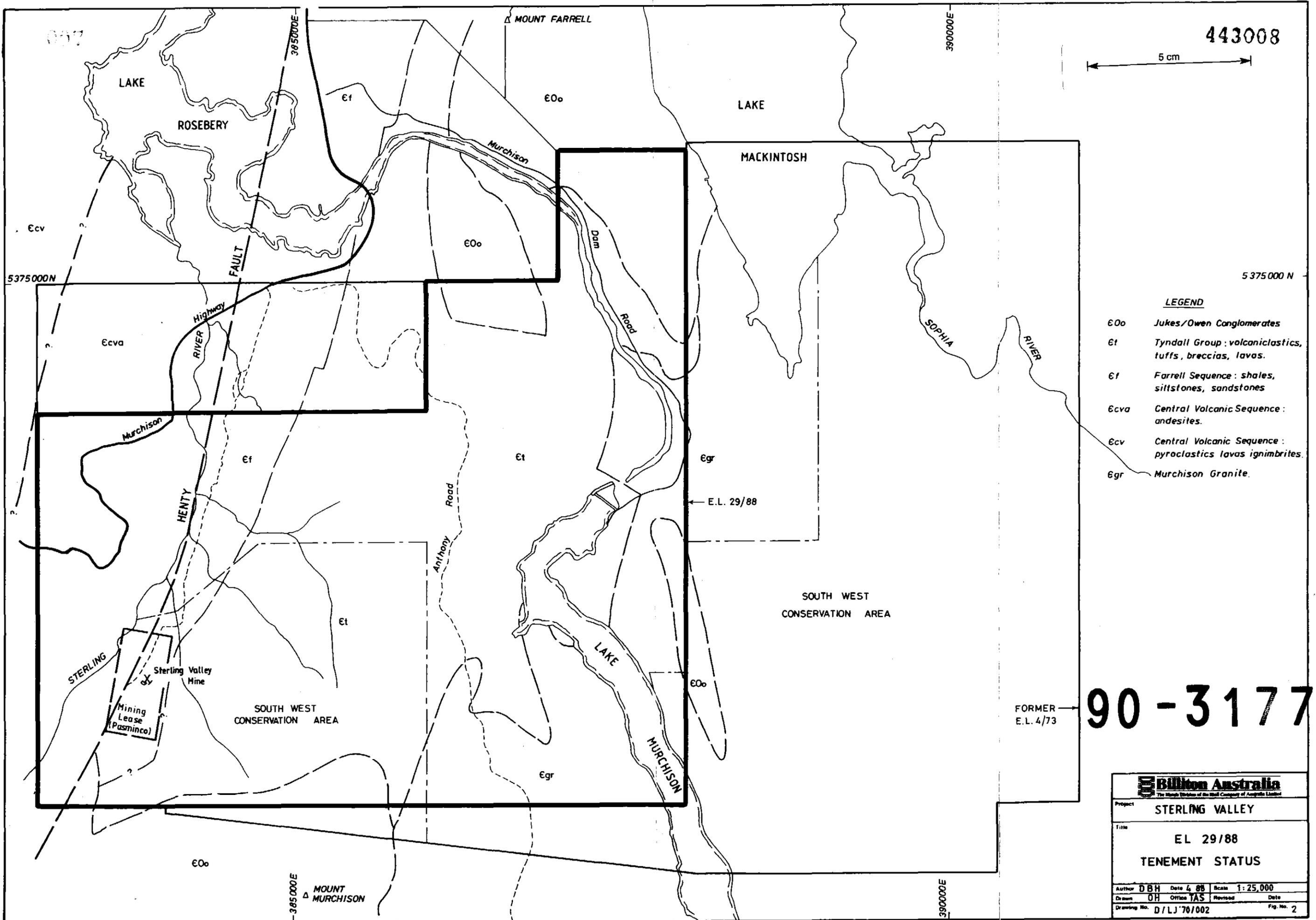
The licence area excludes 0.4km² Murchison Highway State Reserve, 1.5km² Land vested in the HEC and two mining leases (ML's 1M/55, 2M/55) held by Pasminco. In addition, approximately 80% of the licence is contained within the South West Conservation Area.

4.0 PREVIOUS WORK

Previous exploration was carried out under EL 4/73 by Asarco (Aust) Pty Ltd (1973-74), Cominco Aust. Pty Ltd (1975-78) EZ Co (1979-86) and Billiton Australia (1987-88).

A list of important references relating to this work is summarized in a previous report (08.4175) and is not reproduced here.

Billiton continued exploration on behalf of the joint venture within EL 29/88 during 1988-89. A comprehensive program of gridding (54 kms), geological mapping, selected rock chip sampling (78 samples), ground magnetics (50 kms), UTEM surveying (4 loops, 48kms) and diamond drilling (283m) was completed.



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5 cm

LEGEND

- E0o Jukes/Owen Conglomerates
- Et Tyndall Group: volcanics, tuffs, breccias, lavas.
- Ecf Farrell Sequence: shales, siltstones, sandstones
- Ecva Central Volcanic Sequence: andesites.
- Ecv Central Volcanic Sequence: pyroclastics lavas ignimbrites.
- Egr Murchison Granite.

90-3177.

Bilton Australia <small>The Mining Division of the BHP Company of Australia Limited</small>			
Project	STERLING VALLEY		
Title	EL 29/88 TENEMENT STATUS		
Author	DBH	Date	4/88
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5.0 REGIONAL SETTING

The licence covers a portion of the eastern flank of the Mt. Read Volcanic belt immediately east of Rosebery, (see Fig 3) and includes a range of structural and stratigraphic features.

viz from west to east:

Central Volcanic Sequence (5%) - Mid Cambrian andesitic lavas and volcanoclastics.

Henty Fault Zone - a major NNE trending Cambrian structure that displays Devonian reactivation features.

Farrell Sequence (5%) - Mid to Late Cambrian volcanoclastic sandstones and black shales.

Tyndall Group Volcanics (70%) - Mid to Late Cambrian acid - intermediate lavas and volcanoclastics.

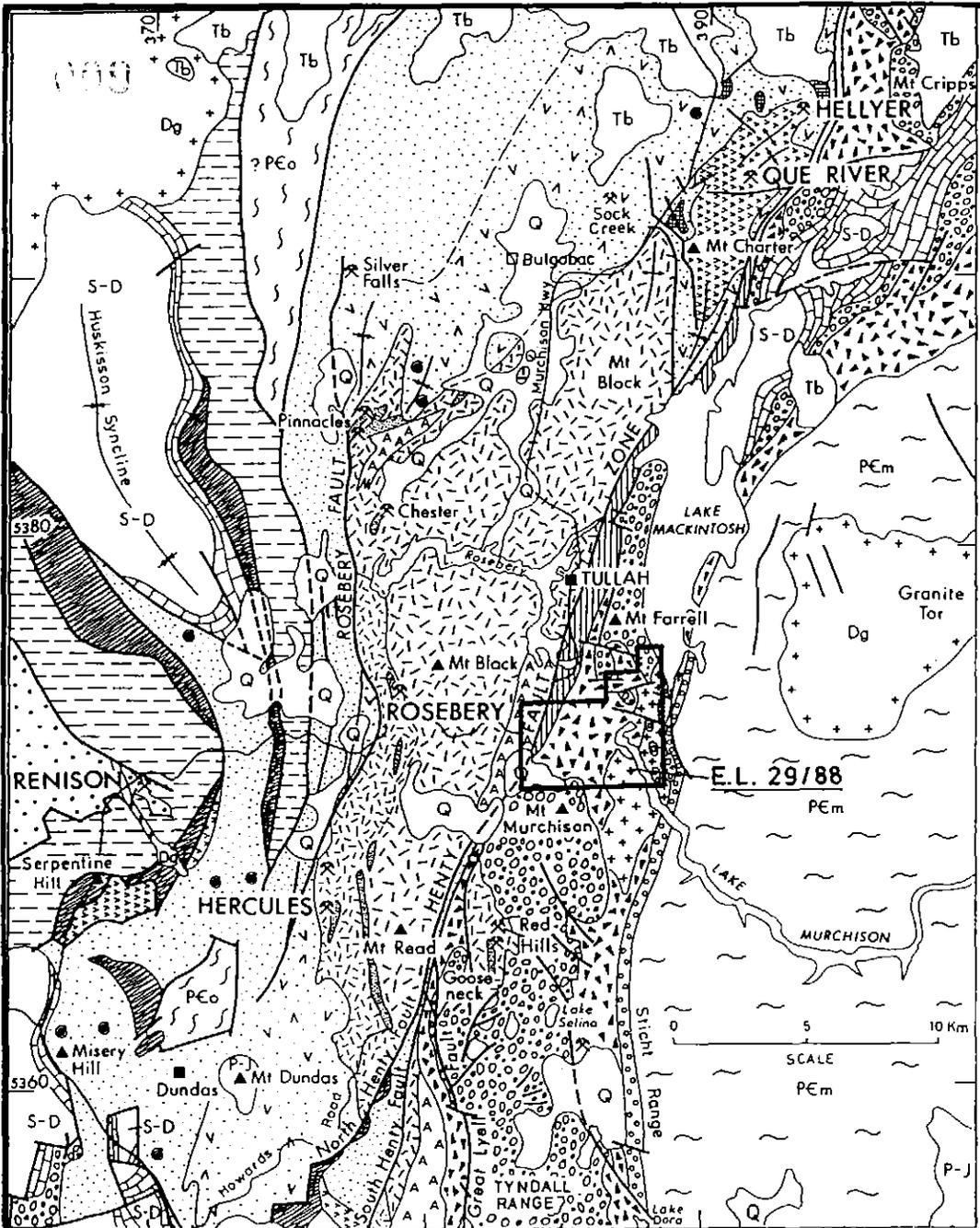
Owen Conglomerate (10%) - Late Cambrian to Ordovician siliciclastic conglomerate.

Granite (10%) - Late Cambrian granitic intrusives adjacent to the PreCambrian Tyennan Block.

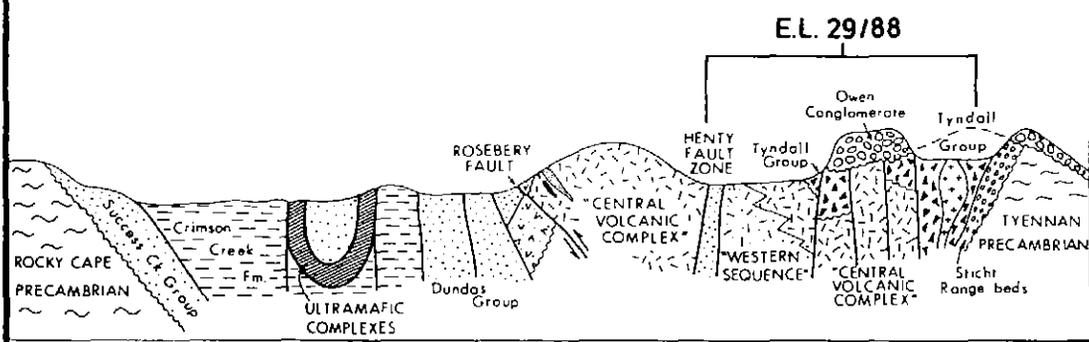
Within the licence area the Tyndall Group Volcanics and Henty Fault Zone have been the main targets for exploration; the former for VMS style base metal mineralization and the latter for structurally controlled gold-arsenic mineralization.

The Tyndall Group suite has historically been considered to be younger than the Central Volcanic Sequence and consisting of dominant quartz phyrlic lavas with lesser volcanoclastics and sediments. The sequence has never been systematically explored using modern exploration techniques, having been considered as a less prospective sequence than the Central

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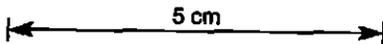


Geology of Northern Portion of Mt. Read Volcanics.



Diagrammatic Cross Section of Dundas Trough

Maps taken from "Geology and Mineral Resources of Tasmania."
G.S.A. Spec. Publ. 15



Project			
STERLING VALLEY			
Title			
REGIONAL SETTING			
Author	JPR	Date	8/89
Scale	1: 250 000		
Drawn	OH	Office	TAS
Revised		Date	
Drawing No.			Fig. No. 3

Volcanics. A major objective in the acquisition of the licence by the Sterling Valley Joint Venture has been to comprehensively evaluate the Tyndall Group as a potential host to VMS style mineralization.

The Henty Fault Zone has received considerable attention recently by RGC at the Henty Prospect and by Billiton - Norgold - Little River Resources at Lakeside. Within this licence area, a small arsenic resource is inferred from limited drilling and low grade gold intercepts have been recorded.

6.0 EXPLORATION COMPLETED

Exploration during 1989-90 has focussed on surface evaluation of the prospective volcanic hiatus identified during the course of detailed geological mapping. This work has included:

1. Lead Isotope Analysis: Six samples containing anomalous lead geochemical values were submitted to the CSIRO with the aim of determining the likely origin of the mineralization in relation to known VMS style mineralization within Tasmania (appendix 1).
2. Lithogeochemical Sampling: Seventy three rock chip samples were collected from three traverses across the Tyndall Group Volcanics. All samples were analysed for total silicates, Zr, Sr, Rb, Y, Nb (appendix 2).

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3. Infill Gridding: A total 4.8 line kms was cut to provide a 100 metre spaced grid from 372900N to 374000N.
4. Auger C Horizon Soil Sampling: A total of 224 samples were collected on 200 metre spaced lines and analysed for Cu, Pb, Zn, Ag, Au, As, Ba. (appendix 3).
5. Geological Mapping: The newly gridded lines were mapped and incorporated into the previous mapping. Rock chip sampling (4 samples, Appendix 4) and petrological work (7 samples, appendix 5) was also completed.

7.0 EXPLORATION RESULTS

7.1 Lead Isotopes

A report contained within Appendix 1 details the major results of this study but a summary is presented below:

<u>Sample</u>	<u>Location</u>	<u>Rock Type</u>	<u>Pb Assay</u>	<u>Isotopic Signature</u>
15263	374375N/ 385690E	Silicified pyritic altered volcanic	0.43%	Devonian-Queen Hill
15921	371800N/ 386000E	Sericitic dacitic lava	0.23%	Cambrian-Rosebery
16091	373200N/ 385595E	Chloritic rhyodacitic with sph-gal-py veinlets	0.51%	Devonian-Queen Hill
16218	374400N/ 385160E	Rhyodacitic volcaniclastic with minor diss. py.	0.16%	Devonian
16226	373000N/ 385105E	Sil vitric ash with 1-2% blebs py sph gal	0.19%	Cambrian-Rosebery
16228	373000N/	Sil ash with qtz vnlets + py	0.11%	Cambrian-Hellyer

Of interest is the conclusion that samples 16226, 16228 contain mineralization of a similar isotopic signature to that of Que River, Hellyer and Rosebery. Both these samples were collected from the mapped volcanic hiatus, indicating that Cambrian mineralizing fluids were present at this stratigraphic level. These results add further weight to the conclusions to be drawn later in this report.

7.2 Lithogeochemistry

A total of 73 samples were collected from three traverses across the volcanic sequence for lithogeochemical study. Many samples are altered strongly (low Na_2O , high K_2O , low Sr) and cannot be reliably used, especially those towards the western contact with the Farrell Sequence.

Figure 5 illustrates the distribution of samples and summarizes the results of the analysis. The intense alteration precludes any definitive statements but it is possible to infer some tentative conclusions:

1. Most volcanic types represented are typical of those within the hanging wall (CH type) of known VMS deposits. This statement does not imply proximity to mineralization however.

2. Examples of footwall volcanics (CL type) are limited to strongly altered samples and therefore the results are less than reliable.

3. There is a suggestion that low Y volcanics occur within the western portion of the sequence. In known mineralized centres this is indicative of proximity to mineralization and therefore some weight should be attached to this analogy. Note however that strong alteration is present.

Overall it is considered that the volcanic types present are more likely to be representative of a hanging wall situation with some evidence to support proximity to mineralization.

7.3 Geological Mapping

Grid based mapping was completed over the infill grid lines in order to more accurately define the volcanic break at "The Cliffs" prospect. Figures 6 and 7 show the fact and interpretative geological maps, respectively.

The mapping indicates that a steep westerly dipping sequence of laminated vitric ash, epiclastic sandstone and siltstone and laminated shale separates two dominantly lava sequences. The epiclastic sequence has been mapped from 372900N (100m width) to 374000N (50m width) but is apparently disrupted in the southernmost area to 373300N. Strong silicification (and

sericite alteration) is typical of much of the epiclastic sequence and pyritic alteration is weakly developed. Base metal anomalism has been previously reported (1989 Annual Report) from the vicinity of 373000N. Cambrian lead isotopic signatures are also present from samples taken from this sequence.

7.4 Auger Sampling

A suite of C horizon soil samples were collected by hand auger at twenty metre intervals on lines 200m apart. The distribution of sample sites is illustrated in Figure 6 whilst the assay results are presented in Appendix 3. Only spot highs were recorded with maximum assays (non-coincident samples) of 180ppm Cu, 1000ppm Pb, 330ppm Zn, 3ppm Ag, 2290ppm As, 3080ppm Ba.

8.0 CONCLUSIONS

Detailed surface exploration within an area known as "The Cliffs" prospect has identified a 50-100m thick sequence of vitric ash, epiclastic siltstone-sandstone and laminated shale that separates two lava dominated sequences of quartz and quartz-feldspar phyric volcanics. Selected rock chip sampling has identified anomalous levels of Pb and Zn in mineralization that has a Cambrian lead isotope signature. Alteration is moderate and expressed as silicification, sericite and chlorite alteration.

UTEM surveying does not suggest the presence of a buried conductor associated with the epiclastic horizon nor has C horizon soil sampling identified any surface geochemical anomalism. Lithogeochemical sampling aimed at fingerprinting the volcanic cycles was inconclusive due to the intense alteration of many of the samples, perhaps as a consequence of Cambrian granite intrusion and later Devonian remobilization.

9.0 RECOMMENDATIONS

It is recommended that the epiclastic sequence be drilled as a stratigraphic test of this horizon. A drill hole of 550 metres down hole length collared at 373000N 384700E would provide continuous geological information pertaining to both the interpreted hanging wall and footwall lithologies. Continuous lithogeochemical sampling and down hole EM surveying is recommended to provide a better understanding of the local geochemical and geophysical setting.

APPENDIX 1

Report to Billiton Australia on the Metallogenic Association
of Exploration Samples from the Sterling Valley Prospect,
Tasmania. CSIRO 4/12/89

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Sirotope



443018

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REPORT TO BILLITON AUSTRALIA

ON THE METALLOGENIC ASSOCIATION

OF EXPLORATION SAMPLES FROM THE

STERLING VALLEY PROSPECT, TASMANIA

REPORT SR 103

JUDITH A. DEAN
GRAHAM R. CARR
4/12/89

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1. AIMS OF STUDY

The aim of this study has been to compare the ratios of high Pb exploration samples from the Sterling Valley prospect in western Tasmania with the known signatures for Cambrian VMS mineralization within the Mt Read Volcanic Belt.

2. SAMPLES

Six samples from the Sterling Valley prospect containing between 1100 and 5100ppm Pb were submitted by Jeff Randell. The prospect is east of the Rosebery deposit and underlain by the Cambrian Murchison Granite. According to Billiton geologists, there is evidence of an alteration overprint both in the late Cambrian and Devonian. In a previous study Carr (1988) presented Pb isotope results for two samples from the Sterling Valley Mine NNE of Rosebery.

3. TARGET Pb ISOTOPIC SIGNATURES

Target Pb isotopic signatures for Cambrian VMS mineralization in western Tasmania are well established (Gulson and Porritt, 1987; SIROTOPE Database) and are shown in Figures 1 and 2 as 95% confidence ellipses for Que River, Hellyer and Rosebery. The ellipses define 2 standard deviations about the mean of the high Pb data for each deposit. The data for these deposits overlap somewhat and Que River and Hellyer show some spread in isotope values (about .25% in the $^{206}\text{Pb}/^{204}\text{Pb}$ ratio).

In contrast, mineralization associated with Devonian thermal events has much more variable isotopic compositions and tends to be more radiogenic (i.e. higher $^{206}\text{Pb}/^{204}\text{Pb}$, $^{207}\text{Pb}/^{204}\text{Pb}$ and $^{208}\text{Pb}/^{204}\text{Pb}$ ratios) than the Cambrian VMS target. Minor lodes in the Murchison Gorge area along the Henty Fault Zone, such as Mt Farrell, Murchison Lode, Tullah, Murchison Bridge and Tyndall

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have isotopic compositions which have $^{206}\text{Pb}/^{204}\text{Pb}$ ratios that are generally in the range 18.51 to 18.61 compared with an average value of 18.27 for Rosebery. Galena from the Murchison Lode and a single sample from the Tullah Lode do however have $^{206}\text{Pb}/^{204}\text{Pb}$ ratios which approach the VMS signatures. The Farrell-Tullah-Murchison lodes are most likely associated with the emplacement of the Devonian granitoids. These data and the field for the Devonian Queen Hill mineralization are also shown in Figures 1 and 2.

4. METHODS

About 0.15g of each pulp was digested in a 1:1 mixture of 7N HNO_3 and 7N HCl acids in teflon beakers. Lead was extracted by anion exchange methods in HBr solutions prior to purification by micro-electrodeposition techniques.

Lead isotope ratios were determined on a VG Isomass 54E thermal ionization mass spectrometer run in fully automated mode. Precision estimates of the ratios are shown as error bars in the upper left hand corner of the accompanying diagrams. They represent 2 standard deviations about the mean of over 1000 analyses of international standards and natural samples.

5. RESULTS

Lead isotope results are given in Table 1 and plotted in Figures 3 and 4 in comparison to the Target Signatures discussed above. Data for the two rock chip samples from the previous study are also shown.

Samples 15921 and 16226 have Pb isotopic compositions which are very similar and plot within the target reference fields for Rosebery. Sample 16228 has slightly higher $^{206}\text{Pb}/^{204}\text{Pb}$ values and

plots within the overlapping Que River and Hellyer 95% confidence ellipses. The difference in the $^{206}\text{Pb}/^{204}\text{Pb}$ ratios between the samples is only 0.3%. The 2σ error on this ratio is $\pm 0.1\%$ and data for Que River and Hellyer show a larger than expected variation in $^{206}\text{Pb}/^{204}\text{Pb}$ ratio (also about 0.3%) compared with most other massive sulfide deposits.

Lead isotope results for the other three pulps plot outside the Cambrian VMS fields. Sample 16091 and 16218 are the same within experimental error and have very similar ratios to those reported by Carr (1988) for high Pb rock chip samples (numbers 3036 and 3039) from the Sterling Valley Mine Site. Sample 15263 is the most radiogenic (i.e. has the highest $^{206}\text{Pb}/^{204}\text{Pb}$ and $^{208}\text{Pb}/^{204}\text{Pb}$ ratios; $^{207}\text{Pb}/^{204}\text{Pb}$ values for these five samples are all similar) of the data from this study and plots within the fields for the Farrell-Tullah-Murchison lodes and Queen Hill.

6. DISCUSSION

The isotopic composition of three of the Sterling Valley samples analysed in this study indicates that the mineralization associated with these exploration samples was almost certainly derived from fluids that had a similar origin as those that were responsible for the formation of major Cambrian VMS deposits in the Mt Read Volcanics. The more radiogenic nature of the data for samples 15263, 16091 and 16218 from this study and 3036 and 3039 from a previous study indicates a strong possibility that they are related to Devonian thermal events.

We are not able to assess the likely effect of the underlying Murchison Granite. Research on the Pb isotopic characteristics of Cambrian granites would seem to indicate a different isotopic signature to the Mt Read Volcanics. However

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the results of this research are as yet uncertain.

7. CONCLUSIONS

Lead isotope results for the Sterling Valley samples show evidence of both Cambrian and Devonian mineralizing events. Further exploration should be focussed on samples 15921, 16226 and 16228 since they have Pb isotopic compositions which indicate with a high degree of probability that they formed as part of the Cambrian mineralizing event whereas samples 16091, 16218 and 15263 have a high degree of probability of forming in response to Devonian events.

8. REFERENCES

- Carr, G.R. (1988). Report to Shell Australia on the Pb isotopic compositions of exploration samples from the Mt Read Volcanics northwest Tasmania. SR 21/10/88, 7p.
- Gulson B.L. and Porritt, P.M. (1987). Base metal exploration of the Mt Read Volcanics, western Tasmania: Pt II. Lead isotope signatures and genetic implications. *Econ. Geol.*, 82, pp. 291-307.

TABLE 1. Lead Isotope Data of Samples from the Sterling Valley Prospect

Sample	$\frac{208 \text{ Pb}}{206 \text{ Pb}}$	$\frac{207 \text{ Pb}}{206 \text{ Pb}}$	$\frac{206 \text{ Pb}}{204 \text{ Pb}}$	$\frac{207 \text{ Pb}}{204 \text{ Pb}}$	$\frac{208 \text{ Pb}}{204 \text{ Pb}}$	Pb(ppm)
1 15263	2.0714	0.8410	18.558	15.607	38.442	4,300
2 15921	2.0832	0.8527	18.275	15.583	38.070	2,250
3 16091	2.0767	0.8454	18.461	15.607	38.337	5,100
4 16218	2.0785	0.8472	18.431	15.615	38.308	1,580
5 16226	2.0843	0.8535	18.262	15.586	38.062	1,920
6 16228	2.0812	0.8506	18.323	15.587	38.135	1,100

Sample Number prefixes refer to plotted points Figs 3 and 4.

ISOTOPIC SIGNATURES MT READ VOL

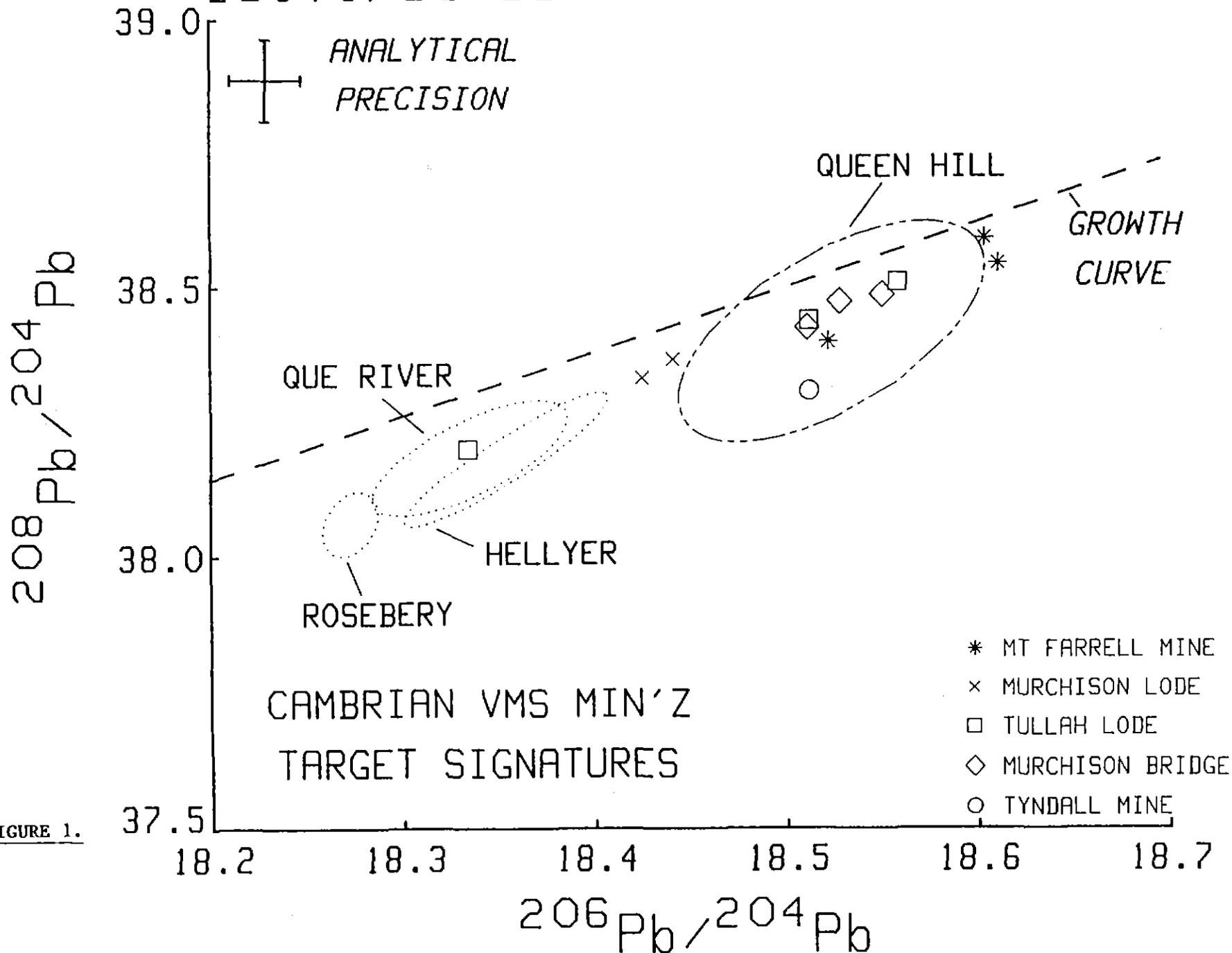


FIGURE 1.

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ISOTOPIC SIGNATURES MT READ VOL

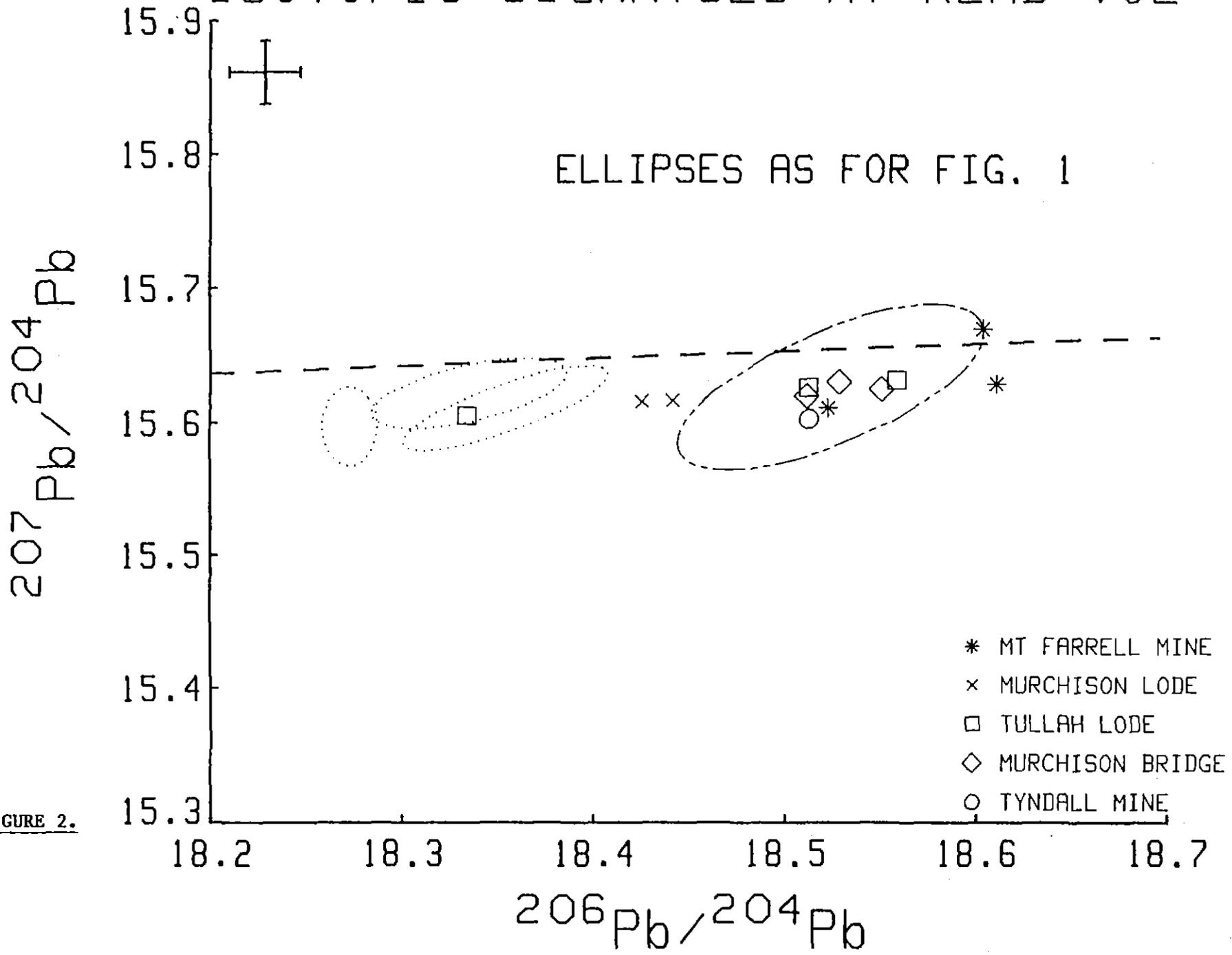


FIGURE 2.

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STERLING VALLEY PROSPECT

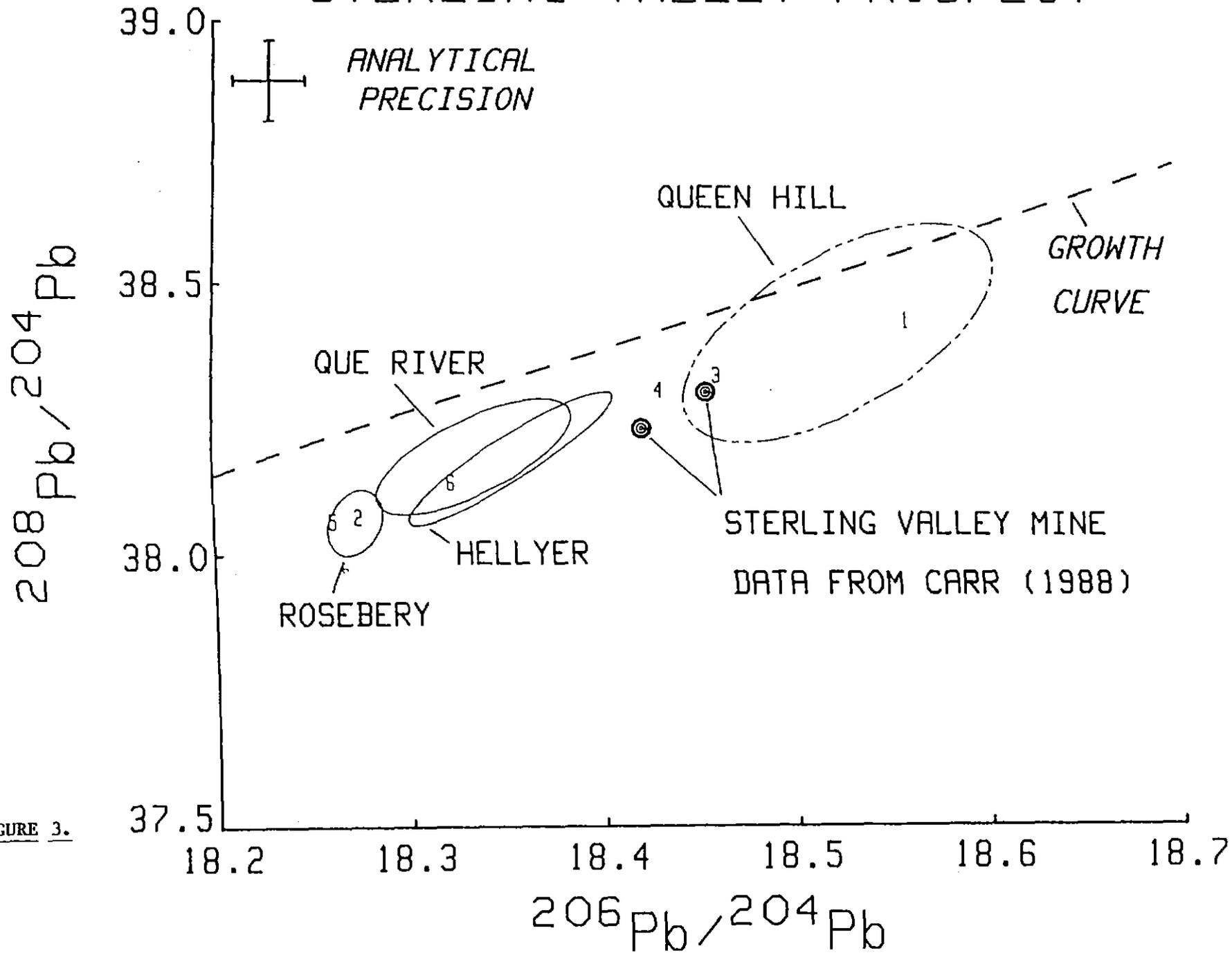


FIGURE 3.

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STERLING VALLEY PROSPECT

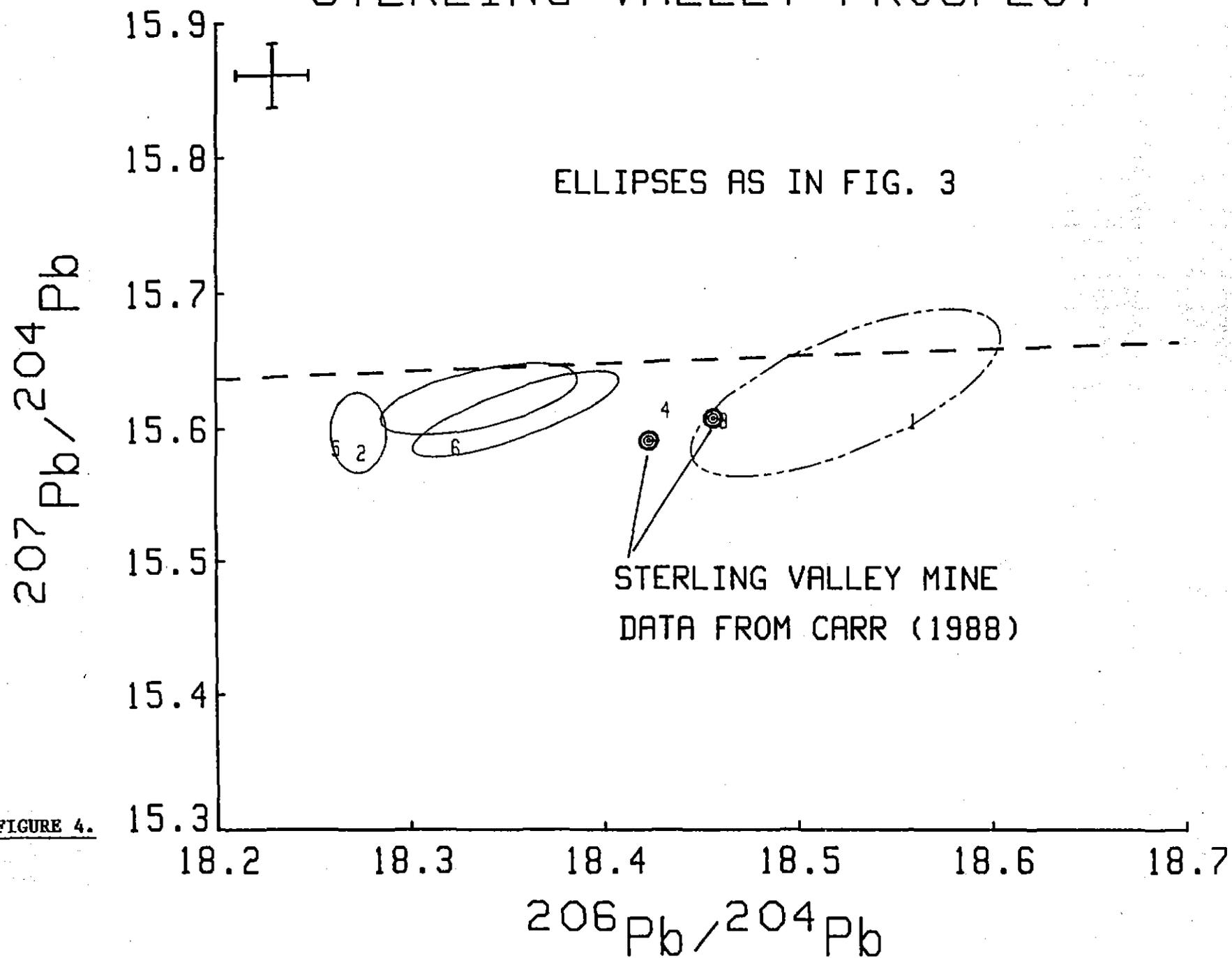


FIGURE 4.

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APPENDIX 2

Lithogeochemical rock chip assays.



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Telephone: (08) 43 5722 Fax: (08) 234 0321 Telex: LABCOM AA89323

443029

Mr. Jeff Randell
Billiton Australia Ltd
PO Box 860
DEVONPORT
TAS 7310

Job Number: 9AD2415

Your Reference: 11704/MT24/JPR
Number of Samples: 75
Extra Samples : 0

1570 - Rox

Date Received: 11-OCT-1989
Date Reported: 08-NOV-1989

This report comprises a cover sheet and pages 1 to 6

This report relates specifically to the samples tested in so far as that the samples as supplied are truly representative of the sample source. Please address any enquiries to Mr. Trevor Francis.

Approved Signature:

for

Dr. John Kikkert
General Manager - Adelaide.

MM Mr Jeff Randell Devonport

Report Analyte Codes:
N.A. - Not Analysed.
L.N.R. - Listed But Not Received.
I.S. - Insufficient Sample for Analysis.

Distribution Codes:
CC - Carbon Copy
EM - Electronic Media
MM - Magnetic Media



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Job: 9AD2415

O/N: 11704/MT24/JPR

ANALYTICAL REPORT

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Sample	SiO2	TiO2	Al2O3	Fe2O3	MnO	MgO	CaO
16236	69.7	0.44	13.6	3.72	0.06	2.08	0.14
16237	72.7	0.33	13.0	2.94	0.06	1.01	0.89
16238	69.0	0.53	13.4	4.88	0.09	2.42	2.04
16239	70.5	0.45	13.0	4.18	0.05	1.81	0.48
16240	72.2	0.40	12.5	4.16	0.05	1.38	0.41
16241	74.2	0.26	12.2	2.24	0.03	0.45	0.05
16242	73.5	0.30	12.7	3.38	0.04	0.66	0.16
16243	75.7	0.29	11.8	2.80	0.02	0.47	0.15
16244	72.0	0.30	13.0	3.88	0.11	1.10	0.09
16245	73.4	0.32	12.8	3.52	0.05	0.81	0.10
16246	71.6	0.25	12.7	4.24	0.05	0.85	0.14
16247	69.7	0.42	12.3	5.25	0.13	1.04	0.10
16248	69.6	0.31	12.0	5.65	0.12	1.18	0.04
16249	69.7	0.42	12.6	4.80	0.03	1.14	0.14
16250	70.5	0.41	11.9	5.10	0.05	1.66	0.16
16251	70.8	0.42	12.9	4.22	0.06	1.21	0.08
16252	70.5	0.39	12.6	3.78	0.07	0.97	0.06
16253	78.4	0.15	10.8	1.12	<0.01	0.29	0.04
16254	67.3	0.36	15.0	5.65	0.05	1.06	0.09
16255	72.8	0.29	12.8	4.16	0.06	0.76	0.05
16256	67.6	0.47	14.3	5.25	0.10	0.88	0.03
16257	70.0	0.44	10.7	10.4	0.19	1.03	0.02
16258	73.2	0.32	11.3	8.10	0.12	1.04	0.03
16259	66.9	0.61	13.4	8.95	0.14	1.78	0.06
16260	68.9	0.64	14.4	5.35	0.12	1.13	0.05
16261	65.3	0.55	14.4	5.80	0.11	1.65	0.38
16262	45.2	0.31	13.9	11.3	0.46	10.7	11.4
16263	75.9	0.17	11.5	2.34	0.03	0.25	0.17
16264	71.4	0.42	13.3	4.42	0.23	2.06	1.42
16265	71.4	0.39	13.1	3.18	0.15	1.10	0.19
16266	73.4	0.22	13.2	2.68	0.17	1.02	0.11
16267	68.3	0.68	12.0	8.00	0.23	2.04	0.26
16268	73.1	0.31	12.7	3.12	0.05	0.44	0.27
16269	73.9	0.35	12.5	2.10	0.04	0.55	0.18
16270	66.5	0.57	14.4	5.05	0.18	1.46	0.84
16271	73.7	0.35	12.3	2.86	0.04	0.48	0.18
16272	74.8	0.36	12.1	2.92	0.05	0.48	0.12
16273	73.5	0.31	12.5	3.56	0.04	0.53	0.16
16274	74.2	0.26	12.4	3.28	0.04	0.60	0.12
16275	74.7	0.25	12.4	2.98	0.04	0.92	0.24
16276	65.1	0.72	15.3	6.00	0.09	0.98	0.16
16277	67.7	0.51	14.0	5.85	0.08	1.62	0.16
16278	70.6	0.41	12.6	5.90	0.10	1.66	0.06
16279	70.3	0.55	12.7	3.98	0.11	1.11	1.89
16280	69.9	0.65	13.0	6.40	0.14	1.53	0.22
16281	72.4	0.27	10.7	7.10	0.07	0.92	0.07
16282	67.3	0.55	12.7	8.35	0.17	1.46	0.12
16283	73.4	0.28	11.9	5.20	0.04	0.74	0.09
16284	72.1	0.29	12.9	3.54	0.04	0.55	0.05
16285	73.3	0.29	13.2	3.70	0.05	0.63	0.07
Units	%	%	%	%	%	%	%
Detn Limit	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Scheme	ICP5	ICP5	ICP5	ICP5	ICP5	ICP5	ICP5



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Job: 9AD2415

O/N: 11704/MT24/JPR

ANALYTICAL REPORT

Sample	SiO2	TiO2	Al2O3	Fe2O3	MnO	MgO	CaO
16286	80.1	0.20	12.0	1.68	0.01	0.39	0.04
16287	73.3	0.42	13.3	3.46	0.07	1.56	0.59
16288	72.8	0.75	12.8	4.26	0.10	1.29	0.55
16289	72.8	0.29	14.0	1.41	0.05	0.58	0.43
16290	75.7	0.20	13.1	2.36	0.08	1.07	0.26
16291	72.1	0.54	13.2	4.74	0.09	1.86	0.85
16292	67.8	1.00	13.4	6.35	0.15	1.96	1.36
16293	68.3	0.73	13.3	6.90	0.15	1.91	1.38
16294	72.2	0.51	12.9	4.36	0.13	1.53	0.51
16295	73.4	0.54	12.6	3.92	0.10	1.53	0.24
16296	74.4	0.39	12.4	3.20	0.06	1.04	0.20
16297	70.2	0.58	13.1	5.30	0.12	1.49	0.20
16298	75.3	0.29	12.6	3.24	0.05	0.52	0.12
16299	73.3	0.25	12.7	4.46	0.06	0.65	0.11
16300	72.2	0.30	12.5	4.90	0.11	1.21	0.15
16608	66.0	0.84	15.9	7.60	0.03	0.38	0.10
16609	83.2	0.05	2.12	11.3	0.27	0.08	0.27
16610	68.9	0.46	13.4	5.65	0.08	1.37	0.49
16611	77.6	0.30	10.6	2.92	0.07	0.68	0.09
16612	74.3	0.31	12.8	4.48	0.11	0.82	0.02
16613	68.5	0.60	14.2	5.20	0.10	1.63	0.13
16614	69.3	0.45	13.6	5.20	0.07	1.18	0.08
16615	71.2	0.42	12.6	5.45	0.12	1.17	0.09
16616	70.4	0.43	12.2	5.85	0.07	1.04	0.08
16617	69.8	0.44	12.6	6.40	0.10	1.08	0.07
Units	%	%	%	%	%	%	%
Detn Limit	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Scheme	ICP5	ICP5	ICP5	ICP5	ICP5	ICP5	ICP5

443031



03E

ANALYTICAL REPORT

443032

372000N

372200N

Sample	Na2O	K2O	P2O5	LOI	Total
16236	0.79	6.70	0.07	2.28	99.6
16237	2.40	4.76	0.03	1.63	99.7
16238	2.84	3.22	0.06	1.80	100.3
16239	2.06	5.25	0.05	1.75	99.6
16240	2.26	4.32	0.05	1.53	99.2
16241	0.23	9.35	0.02	0.88	99.9
16242	3.44	4.28	0.02	1.04	99.5
16243	3.26	4.30	0.01	1.06	99.9
16244	2.30	4.84	0.03	1.04	98.7
16245	2.04	4.90	0.03	1.90	99.8
16246	0.24	7.70	0.07	1.63	99.5
16247	0.09	8.40	0.05	1.65	99.2
16248	0.09	7.45	0.04	1.87	98.3
16249	0.14	7.45	0.05	1.55	98.0
16250	0.13	7.65	0.07	1.49	99.1
16251	1.18	6.40	0.05	1.79	99.1
16252	0.13	9.15	0.05	1.24	98.9
16253	0.51	6.70	<0.01	1.01	99.0
16254	0.09	6.95	0.05	2.56	99.2
16255	0.13	6.80	0.04	1.98	99.9
16256	0.12	8.80	0.04	2.28	99.9
16257	<0.01	2.80	0.07	3.82	99.4
16258	<0.01	2.94	0.02	2.68	99.7
16259	0.02	3.54	0.06	3.62	99.1
16260	0.02	4.66	0.03	3.68	99.0
16261	2.60	5.75	0.09	2.08	98.7
16262	0.89	1.23	0.06	3.46	98.9
16263	2.02	6.25	<0.01	0.84	99.4
16264	2.92	1.63	0.08	2.22	100.1
16265	1.46	6.25	0.06	1.88	99.2
16266	3.36	2.78	<0.01	2.18	99.1
16267	0.94	4.18	0.11	2.90	99.6
16268	2.98	5.15	0.05	0.94	99.1
16269	2.14	5.30	0.07	1.13	98.2
16270	3.66	3.38	0.12	2.26	98.4
16271	2.72	4.70	0.05	1.19	98.6
16272	1.77	5.05	0.05	1.38	99.1
16273	3.30	3.94	0.04	1.20	99.1
16274	2.24	4.58	0.03	1.61	99.4
16275	0.58	5.60	0.03	2.12	99.9
16276	0.31	10.1	0.11	2.08	101.0
16277	2.10	5.80	0.09	1.83	99.7
16278	0.74	5.95	0.06	2.04	100.1
16279	2.08	5.15	0.11	2.68	100.6
16280	1.92	4.32	0.09	2.18	100.3
16281	0.09	7.15	0.06	1.86	100.7
16282	0.28	7.65	0.10	1.99	100.7
16283	0.51	7.40	0.05	1.15	100.8
16284	1.41	5.50	0.04	1.89	98.3
16285	1.85	6.35	0.04	1.37	100.8

Units	%	%	%	%	%
Detn Limit	0.01	0.01	0.01	0.01	0.01
Scheme	ICP5	ICP5	ICP5	ICP5	ICP5



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Job: 9AD2415

O/N: 11704/MT24/JPR

032

ANALYTICAL REPORT

Sample	Na2O	K2O	P2O5	LOI	Total
16286	1.41	3.46	0.03	1.58	100.9
16287	2.10	4.26	0.09	1.80	100.9
16288	1.93	3.46	0.17	2.36	100.4
16289	4.38	2.74	0.07	1.23	98.0
16290	3.50	3.46	0.03	1.31	101.0
16291	3.16	2.10	0.08	2.28	101.0
16292	2.04	4.54	0.09	1.97	100.6
16293	2.40	3.60	0.09	2.08	100.8
16294	3.72	2.80	0.04	1.94	100.6
16295	2.24	4.24	0.03	2.02	100.8
16296	2.22	4.46	0.02	1.73	100.1
16297	0.51	7.20	0.07	1.97	100.8
16298	2.90	4.54	0.02	1.24	100.8
16299	2.08	5.65	0.02	1.43	100.7
16300	1.29	4.30	0.03	2.36	99.3
16608	0.12	4.52	0.23	4.60	100.3
16609	0.02	0.30	0.23	2.10	99.9
16610	2.12	7.00	0.08	1.41	100.9
16611	0.89	6.20	0.03	1.24	100.6
16612	0.02	5.30	<0.01	2.56	100.7
16613	0.82	6.75	0.05	2.78	100.7
16614	1.33	7.85	0.03	1.86	101.0
16615	1.03	6.70	0.01	1.99	100.8
16616	0.18	8.90	0.06	1.54	100.7
16617	0.09	7.60	0.04	2.46	100.7
Units	%	%	%	%	%
Detn Limit	0.01	0.01	0.01	0.01	0.01
Scheme	ICP5	ICP5	ICP5	ICP5	ICP5

372200N

443033

373000N



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Job: 9AD2415

O/N: 11704/MT24/JPR

ANALYTICAL REPORT

Sample	Zr	Sr	Rb	Y	Nb
16236	160	88	300	24	17
16237	200	110	210	25	13
16238	260	175	155	34	14
16239	240	92	185	22	16
16240	230	94	150	34	15
16241	170	115	250	20	15
16242	280	105	105	30	16
16243	260	94	96	26	15
16244	270	74	210	28	15
16245	290	60	180	34	15
16246	230	80	210	20	11
16247	240	78	240	22	15
16248	130	64	240	15	12
16249	230	65	185	15	17
16250	230	54	170	48	14
16251	240	46	220	30	18
16252	210	50	250	34	16
16253	105	36	220	22	14
16254	300	40	260	42	17
16255	260	68	220	22	14
16256	240	86	320	22	18
16257	175	7	165	22	15
16258	210	4	145	28	17
16259	210	8	180	26	14
16260	170	38	320	24	17
16261	280	160	240	24	26
16262	12	400	26	10	4
16263	190	125	180	32	20
16264	240	165	98	38	16
16265	220	105	170	30	17
16266	190	78	115	25	16
16267	340	58	145	20	16
16268	270	135	140	44	16
16269	300	105	155	22	16
16270	310	135	130	42	18
16271	300	98	140	30	16
16272	300	76	195	36	18
16273	260	110	100	32	15
16274	260	78	150	32	15
16275	200	78	210	22	17
16276	270	98	260	34	14
16277	290	82	185	26	18
16278	220	72	150	34	16
16279	330	68	180	35	18
16280	350	70	135	26	18
16281	240	62	140	24	13
16282	290	64	240	20	17
16283	250	56	170	25	11
16284	185	52	220	20	17
16285	180	82	170	20	17
Units	ppm	ppm	ppm	ppm	ppm
Detn Limit	4	2	2	4	2
Scheme	XRF1	XRF1	XRF1	XRF1	XRF1

443034



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Job: 9AD2415

O/N: 11704/MT24/JPR

ANALYTICAL REPORT

034

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Sample	Zr	Sr	Rb	Y	Nb
16286	130	16	180	25	16
16287	230	86	165	28	15
16288	330	95	135	18	16
16289	240	105	135	25	15
16290	100	105	130	30	18
16291	240	105	130	28	15
16292	340	135	185	35	16
16293	350	115	185	38	16
16294	240	86	110	28	14
16295	230	84	140	26	15
16296	230	96	140	15	15
16297	350	100	280	30	19
16298	280	76	130	30	15
16299	270	86	190	28	14
16300	260	56	180	22	14
16608	155	12	195	18	14
16609	<4	20	4	<4	3
16610	200	110	200	22	14
16611	165	48	180	15	15
16612	200	17	300	18	16
16613	320	50	185	22	17
16614	270	60	165	24	17
16615	240	64	155	20	16
16616	250	56	210	22	16
16617	250	62	200	16	17
Units	ppm	ppm	ppm	ppm	ppm
Detn Limit	4	2	2	4	2
Scheme	XRF1	XRF1	XRF1	XRF1	XRF1

035

443036

APPENDIX 3

Auger C horizon soil sample assays

ANALABS

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

Phone (09) 458 7999

52 Murray Road, Welshpool, W.A. 6106

Telex AA92560

ANALYTICAL REPORT No.

204.0.08.06890

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

036

The Shell Company of Australia
Metals Division
P.O. Box 860
Devonport Tasmania 7310

ORDER No.	PROJECT
11719	LJ70
DATE RECEIVED	RESULTS REQUIRED
90/02/26	ASAP

No. OF PAGES OF RESULTS	DATE REPORTED	No. OF COPIES	TOTAL No. OF SAMPLES
10	21/03/90	1	224

STATE OF SAMPLES	REF. ETC.	SAMPLE NUMBERS	PRE-TREATMENT						ANALYSIS			
			DRY	CRUSH	SPLIT	PUL-VERISE	SIEVE	OTHER SEE REMARKS	NONE	REFER TO ANALYSIS SECTION	PREPARATION	METHOD
		The Shell Company of Australia Metals Division P.O. Box 860 Devonport Tasmania 7310										

RESULTS TO	
RESULTS TO	

REMARKS

AUGER SAMPLES.

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

AUTHORISED OFFICER *G Jenkins*

443037

ANALABS

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

ANALYTICAL DATA

SAMPLE PREFIX

REPORT NUMBER

REPORT DATE

CLIENT ORDER No.

PAGE

037

204.0.08.06890

21/03/90

11719

1 OF 10

UBE No.	SAMPLE No.		Cu	Pb	Zn	Ag	Au	AuChk	As	Ba
1	373100N 384620 E		5	60	100	0.5	<0.008	<0.008	11	403
2	373100N 384640 E		<5	50	50	<0.5	<0.008	-	5	145
3	373100N 384660 E		5	80	110	0.5	<0.008	-	10	800
4	373100N 384680 E		35	440	220	1.0	<0.008	-	12	900
5	373100N 384700 E		<5	30	35	<0.5	<0.008	-	6	654
6	373100N 384720 E		<5	15	40	<0.5	<0.008	-	<2	396
7	373100N 384740 E		5	75	60	<0.5	<0.008	-	9	569
8	373100N 384760 E		125	250	170	1.5	<0.008	-	24	661
9	373100N 384780 E		20	250	330	1.5	<0.008	-	27	840
10	373100N 384800 E		5	110	80	<0.5	<0.008	-	28	503
11	373100N 384820 E		5	85	70	0.5	<0.008	-	12	722
12	373100N 384840 E		<5	30	45	<0.5	<0.008	-	<2	1920
13	373100N 384860 E		10	415	160	1.0	<0.008	-	<2	910
14	373100N 384880 E		5	90	225	<0.5	<0.008	-	<2	2360
15	373100N 384900 E		5	210	175	2.0	<0.008	-	5	691
16	373100N 384920 E		60	370	170	3.0	<0.008	<0.008	9	326
17	373100N 384940 E		10	190	105	1.0	<0.008	-	8	611
18	373100N 384960 E		45	1000	280	1.5	<0.008	-	<2	550
19	373100N 384980 E		<5	20	20	<0.5	<0.008	<0.008	<2	202
20	373100N 385000 E		<5	95	50	<0.5	<0.008	-	4	527
21	373100N 385020 E		15	130	325	<0.5	<0.008	-	27	323
22	373100N 385040 E		<5	50	60	<0.5	<0.008	-	<2	344
23	373100N 385060 E		55	345	110	1.0	<0.008	-	23	459
24	373100N 385080 E		20	115	160	<0.5	<0.008	-	<2	1110
25	373100N 385100 E		75	160	170	<0.5	<0.008	-	21	1040

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

Jenkins

443038

ANALABS

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

ANALYTICAL DATA

SAMPLE PREFIX

REPORT NUMBER

REPORT DATE

CLIENT ORDER No.

PAGE

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204.0.08.06890

21/03/90

11719

3 OF 10

UBE No.	SAMPLE No.		Cu	Pb	Zn	Ag	Au	AuChk	As	Ba
1	373300N 384760 E		10	60	70	<0.5	<0.008	-	2	1260
2	373300N 384780 E		85	80	130	<0.5	<0.008	-	4	1230
3	373300N 384800 E		60	90	90	<0.5	<0.008	-	9	611
4	373300N 384820 E		50	115	90	<0.5	<0.008	-	7	1690
5	373300N 384840 E		85	155	120	<0.5	<0.008	-	10	1660
6	373300N 384860 E		10	55	120	<0.5	<0.008	-	<2	2210
7	373300N 385120 E		5	65	125	<0.5	<0.008	-	5	1800
8	373300N 385140 E		5	630	130	<0.5	<0.008	-	2	2300
9	373300N 385160 E		10	<5	155	<0.5	<0.008	-	<2	1550
10	373300N 385180 E		5	10	25	<0.5	<0.008	-	2	206
11	373300N 385200 E		20	250	125	<0.5	<0.008	-	<2	1530
12	373300N 385220 E		5	10	65	<0.5	<0.008	-	5	1130
13	373300N 385240 E		5	60	120	<0.5	<0.008	-	2	799
14	373300N 385260 E		15	<5	90	<0.5	<0.008	-	3	1020
15	373300N 385280 E		40	5	180	<0.5	<0.008	-	6	1230
16	373300N 385300 E		15	65	90	0.5	<0.008	<0.008	11	358
17	373300N 385320 E		20	150	185	<0.5	<0.008	<0.008	<2	1750
18	373300N 385340 E		20	<5	150	0.5	<0.008	-	10	2980
19	373300N 385360 E		5	30	100	<0.5	<0.008	-	<2	2360
20	373300N 385400 E		<5	<5	15	<0.5	<0.008	<0.008	2	43
21	373300N 385420 E		5	40	20	<0.5	<0.008	-	6	123
22	373300N 385440 E		5	10	40	<0.5	0.009	-	<2	322
23	373300N 385460 E		5	15	30	<0.5	0.014	-	3	300
24	373300N 385480 E		5	35	25	<0.5	0.015	-	2	189
25	373300N 385500 E		5	15	30	<0.5	0.010	-	3	171

Results in ppm unless otherwise specified.

T = element present; but concentration too low to measure

X = element concentration is below detection limit

- = element not determined

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ANALYTICAL DATA

SAMPLE PREFIX

REPORT NUMBER

REPORT DATE

CLIENT ORDER No.

PAGE

039

204.0.08.06890

21/03/90

11719

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TUBE No.	SAMPLE No.		Cu	Pb	Zn	Ag	Au	AuChk	As	Ba
1	373500N 385240 E		<5	30	20	<0.5	<0.008	-	4	232
2	373500N 385260 E		<5	100	25	<0.5	<0.008	-	<2	251
3	373500N 385280 E		<5	40	25	<0.5	<0.008	-	5	434
4	373500N 385300 E		<5	30	170	<0.5	<0.008	-	4	1540
5	373500N 385320 E		<5	15	110	<0.5	<0.008	-	<2	1500
6	373500N 385340 E		<5	15	95	<0.5	<0.008	-	<2	1580
7	373500N 385360 E		<5	10	75	<0.5	<0.008	-	2	1110
8	373500N 385380 E		<5	10	5	<0.5	<0.008	-	<2	132
9	373500N 385400 E		10	180	140	<0.5	<0.008	-	3	1160
10	373500N 385420 E		<5	20	10	<0.5	<0.008	-	2	185
11	373500N 385440 E		<5	15	15	<0.5	<0.008	<0.008	2	577
12	373500N 385460 E		<5	40	70	<0.5	<0.008	-	<2	862
13	373500N 385480 E		<5	20	20	<0.5	<0.008	<0.008	5	381
14	373500N 385500 E		<5	20	10	<0.5	<0.008	-	<2	73
15	373700N 384780 E		35	65	60	<0.5	<0.008	-	43	1040
16	373700N 384800 E		90	75	95	<0.5	<0.008	-	52	891
17	373700N 384820 E		140	60	95	<0.5	0.014	0.012	45	409
18	373700N 384840 E		45	40	50	<0.5	<0.008	-	14	666
19	373700N 384860 E		<5	15	55	<0.5	0.011	-	6	1380
20	373700N 384880 E		25	80	50	0.5	0.042	-	11	680
21	373700N 384900 E		5	95	40	<0.5	0.013	-	13	466
22	373700N 384920 E		15	55	30	0.5	<0.008	<0.008	21	844
23	373700N 384940 E		135	150	110	0.5	<0.008	-	23	1390
24	373700N 384960 E		45	155	70	<0.5	<0.008	-	56	1500
25	373700N 384980 E		<5	25	35	<0.5	<0.008	-	2	2640

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

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ANALYTICAL DATA

SAMPLE PREFIX

REPORT NUMBER

REPORT DATE

CLIENT ORDER No.

PAGE

040

204.0.08.06890

21/03/90

11719

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TUBE No.	SAMPLE No.	Cu	Pb	Zn	Ag	Au	AuChk	As	Ba
1	373700N 385000 E	<5	15	50	<0.5	<0.008	-	<2	2990
2	373700N 385020 E	<5	30	45	<0.5	<0.008	-	<2	1960
3	373700N 385040 E	10	170	25	<0.5	<0.008	-	53	1280
4	373700N 385060 E	20	90	40	0.5	0.010	-	58	1500
5	373700N 385080 E	10	40	35	<0.5	0.010	-	68	1680
6	373700N 385100 E	10	35	30	0.5	<0.008	-	3	2090
7	373700N 385120 E	60	35	50	<0.5	<0.008	-	4	2040
8	373700N 385140 E	15	35	40	<0.5	<0.008	<0.008	6	1230
9	373700N 385160 E	25	35	45	<0.5	<0.008	<0.008	3	2250
10	373700N 385180 E	<5	30	50	<0.5	<0.008	-	3	2420
11	373700N 385200 E	<5	25	35	<0.5	<0.008	-	<2	2540
12	373700N 385220 E	100	105	45	<0.5	0.023	-	<2	2650
13	373700N 385240 E	30	15	40	<0.5	<0.008	-	2	2450
14	373700N 385260 E	<5	10	200	<0.5	<0.008	-	2	2430
15	373700N 385280 E	<5	120	265	<0.5	<0.008	-	<2	2110
16	373700N 385300 E	<5	5	20	<0.5	<0.008	-	4	949
17	373700N 385320 E	10	55	170	<0.5	<0.008	<0.008	5	2560
18	373700N 385340 E	10	55	145	<0.5	<0.008	-	<2	3080
19	373700N 385360 E	<5	20	40	<0.5	<0.008	-	7	373
20	373700N 385380 E	<5	10	85	<0.5	<0.008	-	<2	2180
21	373700N 385400 E	<5	15	35	<0.5	<0.008	-	5	269
22	373700N 385420 E	<5	5	10	0.5	<0.008	-	<2	405
23	373700N 385440 E	<5	10	15	<0.5	<0.008	-	<2	202
24	373700N 385460 E	<5	10	65	<0.5	<0.008	-	<2	1120
25	373700N 385480 E	<5	20	85	<0.5	<0.008	-	8	664

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

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ANALYTICAL DATA

SAMPLE PREFIX			REPORT NUMBER			REPORT DATE		CLIENT ORDER No.		PAGE	
041			204.0.08.06890			21/03/90		11719		7 OF 10	
TUBE No.	SAMPLE No.		Cu	Pb	Zn	Ag	Au	AuChk	As	Ba	
1	373700N 385500 E		<5	15	65	<0.5	<0.008	-	<2	1200	
2	373700N 385520 E		<5	15	85	<0.5	0.011	<0.008	<2	1680	
3	373700N 385540 E		<5	10	90	<0.5	<0.008	-	5	1680	
4	373900N 384820 E		60	200	200	<0.5	0.011	-	196	816	
5	373900N 384840 E		50	85	145	<0.5	<0.008	-	156	1030	
6	373900N 384860 E		55	165	220	<0.5	0.014	-	267	1230	
7	373900N 384880 E		50	110	205	1.0	0.011	-	121	1460	
8	373900N 384900 E		35	90	145	1.5	<0.008	-	164	953	
9	373900N 384920 E		10	90	75	<0.5	<0.008	-	137	1530	
10	373900N 384940 E		30	35	125	<0.5	<0.008	<0.008	<2	2760	
11	373900N 384960 E		25	75	85	<0.5	<0.008	-	136	1380	
12	373900N 384980 E		15	75	60	<0.5	<0.008	<0.008	97	1500	
13	373900N 385000 E		10	75	85	<0.5	<0.008	-	269	1610	
14	373900N 385020 E		30	260	55	2.0	<0.008	<0.008	2290	1760	
15	373900N 385040 E		<5	25	135	<0.5	<0.008	-	23	2540	
16	373900N 385060 E		55	20	75	<0.5	<0.008	-	13	2910	
17	373900N 385080 E		<5	30	410	<0.5	<0.008	-	<2	2360	
18	373900N 385240 E		5	25	105	<0.5	<0.008	-	<2	2190	
19	373900N 385260 E		<5	20	25	<0.5	<0.008	<0.008	<2	476	
20	373900N 385280 E		5	25	195	<0.5	<0.008	-	5	2850	
21	373900N 385300 E		<5	30	145	<0.5	<0.008	<0.008	3	2440	
22	373900N 385320 E		20	40	110	0.5	<0.008	-	18	1320	
23	373900N 385340 E		<5	20	25	<0.5	0.013	-	<2	173	
24	373900N 385360 E		<5	15	15	<0.5	<0.008	-	<2	178	
25	373900N 385380 E		<5	20	50	<0.5	<0.008	-	<2	1120	

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

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ANALYTICAL DATA

SAMPLE PREFIX

REPORT NUMBER

REPORT DATE

CLIENT ORDER No.

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042

204.0.08.06890

21/03/90

11719

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TUBE No.	SAMPLE No.		Cu	Pb	Zn	Ag	Au	AuChk	As	Ba
1	373900N 385400 E		<5	20	30	<0.5	<0.008	-	<2	230
2	373900N 385420 E		5	20	80	<0.5	<0.008	-	<2	1140
3	373900N 385440 E		<5	35	80	<0.5	<0.008	<0.008	<2	972
4	373900N 385460 E		<5	20	70	<0.5	<0.008	-	<2	1580
5	373900N 385480 E		<5	25	100	<0.5	<0.008	<0.008	2	1330
6	373900N 385500 E		<5	30	75	<0.5	<0.008	-	<2	529
7	372900N 384620 E		40	50	90	<0.5	<0.008	-	22	208
8	372900N 384640 E		35	40	90	<0.5	<0.008	-	12	626
9	372900N 384660 E		5	25	20	<0.5	<0.008	-	<2	200
10	372900N 384680 E		180	120	55	<0.5	0.036	-	34	906
11	372900N 384700 E		25	80	40	<0.5	0.035	-	<2	900
12	372900N 384740 E		5	35	45	<0.5	<0.008	-	3	1140
13	372900N 384760 E		10	30	70	<0.5	<0.008	-	<2	2220
14	372900N 384780 E		<5	30	145	<0.5	<0.008	-	<2	2370
15	372900N 384800 E		<5	25	105	<0.5	<0.008	-	<2	2540
16	372900N 384820 E		<5	25	125	<0.5	<0.008	-	<2	1550
17	372900N 384840 E		5	45	60	<0.5	<0.008	-	14	385
18	372900N 384860 E		5	75	120	<0.5	<0.008	-	9	500
19	372900N 384880 E		5	180	165	<0.5	<0.008	-	8	770
20	372900N 384900 E		5	200	220	<0.5	<0.008	-	11	779
21	372900N 384920 E		5	280	200	<0.5	<0.008	-	10	712
22	372900N 384940 E		5	80	155	<0.5	<0.008	-	<2	648
23	372900N 384960 E		5	70	150	<0.5	<0.008	-	8	575
24	372900N 384980 E		<5	45	100	<0.5	<0.008	-	<2	873
25	372900N 385000 E		<5	35	70	<0.5	<0.008	-	3	603

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

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ANALYTICAL DATA

SAMPLE PREFIX			REPORT NUMBER			REPORT DATE		CLIENT ORDER No.		PAGE	
043			204.0.08.06890			21/03/90		11719		9 OF 10	
TUBE No.	SAMPLE No.		Cu	Pb	Zn	Ag	Au	AuChk	As	Ba	
1	372900N 385020 E		<5	30	75	<0.5	<0.008	-	<2	773	
2	372900N 385040 E		<5	30	65	<0.5	<0.008	-	<2	756	
3	372900N 385060 E		<5	40	90	<0.5	<0.008	-	7	704	
4	372900N 385080 E		<5	30	130	<0.5	<0.008	-	<2	1790	
5	372900N 385100 E		<5	30	120	<0.5	<0.008	-	<2	1950	
6	372900N 385120 E		<5	25	145	<0.5	<0.008	-	<2	2160	
7	372900N 385160 E		5	30	95	<0.5	<0.008	-	<2	1870	
8	372900N 385180 E		<5	80	65	<0.5	<0.008	-	<2	493	
9	372900N 385200 E		<5	15	40	<0.5	<0.008	-	<2	980	
10	372900N 385220 E		10	30	90	<0.5	<0.008	-	<2	404	
11	372900N 385240 E		20	315	225	<0.5	<0.008	-	11	623	
12	372900N 385260 E		15	30	210	<0.5	<0.008	-	<2	993	
13	372900N 385280 E		5	75	120	<0.5	<0.008	-	<2	456	
14	372900N 385300 E		10	110	285	<0.5	<0.008	0.009	<2	449	
15	372900N 385320 E		<5	45	80	<0.5	<0.008	-	<2	1750	
16	372900N 385340 E		<5	20	170	<0.5	<0.008	-	<2	1930	
17	372900N 385360 E		<5	25	30	<0.5	<0.008	-	<2	426	
18	372900N 385380 E		5	20	75	<0.5	0.039	-	<2	1280	
19	372900N 385400 E		<5	25	50	<0.5	<0.008	<0.008	2	320	
20	372900N 385420 E		<5	25	60	<0.5	<0.008	-	<2	663	
21	372900N 385440 E		<5	30	45	<0.5	<0.008	<0.008	<2	504	
22	372900N 385460 E		<5	65	60	<0.5	<0.008	-	<2	622	
23	372900N 385480 E		5	135	210	<0.5	<0.008	-	3	596	
24	372900N 385500 E		<5	85	120	<0.5	<0.008	-	4	695	
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

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ANALYTICAL DATA

SAMPLE PREFIX	REPORT NUMBER	REPORT DATE	CLIENT ORDER No.	PAGE					
044	204.0.08.06890	21/03/90	11719	10 OF 10					
TUBE No.	SAMPLE No.	Cu	Pb	Zn	Ag	Au	AuChk	As	Ba
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21	SNR = Sample not received								
22	DETECTION	5	5	5	0.5	0.008	0.008	2	10
23	UNITS	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
24	METHOD	101	101	101	101	309	309	401	401
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

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443045

045

443046

APPENDIX 4

Rock chip sample assays.

CLASSIC LABORATORIES LTD

443047

Job: OAD1119
O/N: 11722/LD58/JPR

ANALYTICAL REPORT

030

Sample	Au Avg	Au Au Rpl	Au SSi	Cu	Zn	Ag
16921	0.01	0.01	--	115	98	<1
16922	<0.01	<0.01	--	4	13	<1
16924	<0.01	<0.01	--	10	155	<1
16929	<0.01	<0.01	--	9	125	<1
16932	<0.01	<0.01	--	14	10	<1

Units	ppm	ppm	ppm	ppm	ppm	ppm
Detn Limit	0.01	0.01	0.01	0.01	2	1
Scheme	FA1	FA1	FA1	FA1	AAS2	AAS2

443048

CLASSIC LABORATORIES LTD

Job: OAD1119
O/N: 11722/LD58/JPR

ANALYTICAL REPORT

Sample	Pb	As	Ba
✓ 16921	310	54	190
✓ 16922	13	2	420
✓ 16924	850	<2	310
✓ 16929	140	<2	1140
16932	14	11	1700

Units	ppm	ppm	ppm
Detn Limit	2	2	10
Scheme	XRF1	XRF1	XRF1

(1)

SAMPLE	NORTHING	EASTING	SAMPLE	NORTHING	EASTING
16236	374000	386310	16268	372200 N	385540
37		386100	69		385480
38		385960	70		385440
39		385860	71		385380
40		385820	72		385330
41		385760	73		385260
42		385720	74		385140
43		385660	75		385100
44		385630	76		385050
45		385520	77		384930
46		385390	78		384840
47		385300	79		384780
48		385240	80		384680
49		385160	81		384590
50		385120	82		384530
51		385080	83		384440
52		385040	84		384380
53		384850	85		384300
54		386680	86	372200 N	384160
55		386720	87	373000 N	386200
56		387000	88		386140
57		387110	89		386110
58		387170	90		386060
59	374000 N	387220	91		385980
60	372200 N	386300	92		385860
61		386020	93		385800
62		385970	94		385750
63		385930	95		385680
64		385780	96		385560
65		385720	97		385480
66		385660	98		385440
16267		385600	16299		385400
			16300		385360

048

APPENDIX 5

Petrological sample descriptions.

Dear Jeff:

Attached are faxed copies of your samples from W Mt Murchison. As is evident from the descriptions, they are a fairly variable lot, and include definite formerly glassy rhyolite lava (16923), a probable former glassy rhyolite lava or vitric tuff. The remainder of the samples are detrital sediments from shale to fine sandstone, all epiclastic, with variable amounts of altered vitric ash, quartz and feldspar crystal detritus, and significantly, a notable component derived from pelitic metamorphics or Precambrian granite (detrital muscovite flakes, polycrystalline quartz and tourmaline, plus some quite large zircons).

Important alteration features are the common silicification, and in two samples (16926 and 16929), a strong granular quartz-Kspar alteration typical of the banded pink Tyndall Group felsic rocks in the hydrothermal alteration aureole of the Murchison Granite (where I have seen it in the vicinity of the old Lake Selina prospect). Foliation, brecciation and variable sericite development may have preceded silicification in some samples, and there seems to have been a weak episode of chlorite+quartz±calcite fracturing and veining after silicification and KSPAR-Qtz alteration in some samples.

So, in answer to the questions you posed, yes there are lavas and laminated ashes, but most are detrital fine-grained and silicified epiclastic sediments (probably with a significant vitric ash component). I wouldn't call the alteration extreme, although it is significant and characteristic of the granite-related Kspar-quartz, or silicification, common in the area around the Murchison and Darwin granitoids. The laminated units almost certainly do represent bedding. From the eight samples I looked at, if they are at all representative of the stratigraphic section sampled, I would agree that they indicate a period of volcanic quiescence. However, I am not convinced that the Tyndall Group represent a period of intense active volcanism (although I haven't looked at much Tyndall material). Rocks such as many you sent me in this batch might be reasonably mapped in the field as banded tuffs and silicified lavas, but they are clearly detrital epiclastic sediments. How true this is of the entire Tyndall Group I am not sure. Ring for any other queries.

Best wishes,

PS Rocks and sections, and originals of these descriptions are returning to you presently Ansett Air freight.

SAMPLE NUMBER: 16923 ✓

SUMMARY:

This is a banded quartz+feldspar-phyric formerly glassy rhyolitic lava with banding due to variable devitrification being enhanced by selective sericitization and pressure solution of less recrystallized bands.

HAND SPECIMEN:

This is a pale grey-cream banded vitric tuff or devitrified rhyolitic lava containing common small quartz, clay-altered plagioclase phenocrysts.

THIN SECTION:

At first glance, this sample in thin section appears to be a devitrified felsic crystal-vitric tuff. However careful examination of the phenocrysts and the groundmass texture suggests that it is, in fact, a devitrified rhyolitic lava. The sample consists of subequal amounts (around 3 modal% each) of perfectly euhedral quartz and former feldspar phenocrysts, most less than 0.5mm across, in an altered, formerly glassy groundmass. The quartz phenocrysts are entire euhedra, but often show slight rounding and resorption. Feldspar phenocrysts were originally albitized plagioclase euhedra, but have been almost totally replaced by low-birefringent clayey aggregates.

The groundmass of the sample is banded, due to variably intense sericite alteration. Originally, I think the groundmass of this sample would have been homogeneous, non-vesicular massive glass (obsidian?). This has devitrified to a complex, fine-grained mosaic intergrowth of quartz, albite, minor Kspar and sericite. Sericite makes up about 15-20 modal% of the lighter coloured bands in the sample. The darker coloured bands are sericite-rich, composed of up to 80 modal% sericite that shows a weak foliation, and is somewhat more yellowish when concentrated in this manner (giving the darker bands). In the sericite-rich bands, groundmass feldspars have been obliterated, and only dispersed quartz grains occur. The quartz phenocrysts in the sericite-rich bands show slight strain and irregular extinction, suggesting that the darker bands in the rock represent slightly higher strain zones along which pressure solution of groundmass, and growth of abundant sericite took place.

The rock was almost certainly a glassy quartz+feldspar-phyric rhyolitic lava, possibly originally weakly banded due to devitrification. Low grade alteration and weak pressure solution along less crystalline bands may have enhanced the banding with strong sericite growth. In this

case, the banding may be taken as an indicator of the primary banding, and be useful structural information. The typical broken and more abundant phenocrysts in felsic crystal tuffs, and the homogeneous texture of the groundmass away from sericitic zones, all rule against this sample having been a crystal tuff

SAMPLE NUMBER: 16924 ✓

SUMMARY:

This is a banded, foliated epiclastic siltstone or reworked vitric tuff containing felsic volcanic detritus, much of it originally glassy, and occasional detrital metamorphic muscovite.

HAND SPECIMEN:

This is a fractured, weakly banded and possibly foliated, mottled pale pink and cream felsic lava or vitric tuff that has been silicified.

THIN SECTION:

This sample is very difficult to diagnose with certainty. It is composed of a strongly foliated and very fine-grained quartz-sericite \pm minor chlorite intergrowth, possibly after glassy material such as vitric ash. Angular quartz crystal fragments and grains, mainly less than 0.1mm across make up about 10 modal% of the sample and are set in a strongly foliated sericite-rich matrix in which small clay-altered feldspar grains are not uncommon. Crystal faces are not uncommonly preserved on many small detrital quartz grains. A notable feature of the rock is the presence of occasional well-formed, relatively coarse, probably detrital muscovite grains. Tiny patches and streaks of yellowish green chlorite are also not uncommon, but make up less than 10 modal% of the rock, and late-stage chlorite veining, albeit minor, is present. It is interesting and surprising that the sample shows much less silicification in thin section than I might have expected from the hand specimen.

Although the strong foliation precludes definitive assignment, I think the lack of quartz phenocrysts (which generally survive in similarly schistose rhyolitic lavas), and the presence of detrital muscovite grains suggest that this was a fairly fine-grained epiclastic sediment, sourced dominantly from the local felsic volcanic/tuff pile, but including a minor component (muscovite, and by implication quartz and maybe feldspar) from adjacent pelitic metamorphics. This sample is unlike the previous sample, which was clearly a lava; it could easily, however, be an epiclastic sediment accumulating in the same basin/area as the previous lava.

SAMPLE NUMBER: 16925 ✓

SUMMARY:

This is an epiclastic siltstone derived largely from felsic volcanic ash and quartz-feldspar phenocryst detritus; it does however, contain a minor component derived from pelitic metamorphics, and is probably a good candidate for what the previous sample looked like before it was deformed and foliated.

HAND SPECIMEN:

This is a rather porous, pale green, weakly banded felsic or intermediate tuff or epiclastic siltstone; the few lighter coloured bands are less than 5mm thick.

THIN SECTION:

In thin section, this is clearly a fine-grained epiclastic sediment, probably a volcanogenic siltstone-greywacke. It is not framework supported, the detrital grains making up only about 30 modal% of the sample. The rock consists of around 30 modal% of small angular quartz and less abundant albite grains, and rare detrital muscovite, set in a non-foliated matrix of almost opaque, exceptionally fine-grained quartz-sericite-chlorite; much of this material may represent altered formerly glassy detritus and ash, although it cannot be proven on the basis of thin section alone. The detrital quartz and feldspar occur in occasional coarser bands and laminae that clearly define bedding, and detrital zircon and several green tourmaline grains are concentrated significantly at the base of one of the coarser bands, along with some altered Fe oxides.

This sample is a probable likely protolith for the significantly more foliated and sericitic previous sample, and bears the same implications for provenance; the presence of detrital tourmaline further supports the suggestion that some detrital component from the Precambrian metamorphics is included in this (and the previous) sample.

SAMPLE NUMBER: 16926 ✓

SUMMARY:

This is a banded pink quartz-Kspar rock generated by hydrothermal recrystallization of a crystal-poor vitric ash or rhyolite in the vicinity of the Murchison Granite.

HAND SPECIMEN:

This is an unusual silicified, banded felsic tuff with pink bands from 1mm to 2cm thick alternating with darker grey-green chloritic(?) bands up to 1cm thick. The bands are rather irregular, and in some cases discontinuous.

THIN SECTION:

This sample was originally probably an almost crystal-free banded felsic vitric tuff or obsidian, composed of variably devitrified rhyolitic glass. Only two or three albite crystal fragments are present in the sample, and these are less than 0.5mm long. The coarser-grained pink bands in this sample have the characteristic sugary, very fine-grained aplitic texture, composed of intimately intergrown anhedral quartz and Kspar and minor pale green chlorite spots, typical of the banded and massive pink Tyndall correlates in the Murchison granite aureole, for example around Lake Selina. Darker bands in this sample appear to be very much finer grained, rather than more chloritic or sericitic, although several angular fracture fillings and patches of green chlorite are present in the rock.

This sample was probably an almost crystal-free, banded rhyolitic vitric tuff or obsidian that recrystallized thoroughly to quartz-Kspar (\pm minor chlorite) in the hydrothermal aureole of the Murchison Granite.

SAMPLE NUMBER: 16927 ✓

SUMMARY:

This is a silicified and brecciated epiclastic sandstone derived from both a felsic volcanic and a pelitic metamorphic terrain. It is quite similar to 16925, and may represent a brecciated and silicified version of essentially the same rock.

HAND SPECIMEN:

This is a strongly silicified, very hard dark grey green brecciated lithic tuff or epiclastic fine sandstone.

THIN SECTION:

This sample, despite the brecciation and silicification, is clearly a volcanogenic greywacke. It is not framework supported, but consists of around 50-60 modal% of framework grains of dominantly quartz and minor albite, in a very fine-grained silicified quartz-feldspar matrix that may be partly or largely after formerly glassy ash. Tiny patches of sericite and green chlorite are not uncommon through the rock. The quartz grains are mainly less than 0.3mm across, and include probably volcanic quartz with even extinction and occasional crystal faces, and polycrystalline quartz with uneven extinction, probably derived from pelitic metamorphics. Detrital zircon, and especially strongly pleochroic green tourmaline, are quite common in the slide, the latter certainly derived from pelitic metamorphics or Precambrian granitic rocks. Late calcite-chlorite veins cut the rock, and appear to post-date silicification, since discrete small calcite prisms are not uncommon overprinting the silicified groundmass of the sample.

Although this sample has more framework grains than 16925, the detrital assemblage is essentially identical, and if they were from the same unit I wouldn't be surprised.

SAMPLE NUMBER: 16928 ✓

SUMMARY:

This is a silicified laminated siltstone-shale with post-silicification chlorite veining. It is probably a finer-grained equivalent of the previous sample.

HAND SPECIMEN:

This is a dark grey, silicified laminated shale.

THIN SECTION:

This sample is a fine-grained detrital sediment, including poorly defined interbedded shale and siltstone layers. In the 'coarser' layers, angular detrital quartz grains make up about 5 modal% of the sample, although it is not possible to determine with any certainty whether they are metamorphic or volcanic quartz. The remainder of the rock is composed of exceptionally fine-grained quartz and feldspar intergrown with minor streaky and filamentous pale green chlorite that is often aligned subparallel with bedding. Fractures often have limonite-goethite concentrations along their length, and narrow zones of microbrecciation have abundant green chlorite along the fractures, post-dating silicification.

This sample is likely to be simply a much finer grained version of the preceding sample, with the same implications. Boring.....

056
SAMPLE NUMBER: 16929 ✓

SUMMARY:

This is a former siltstone, possibly epiclastic and similar to the previous sample, that suffered brecciation and localized sericitization-foliation, followed by quartz-Kspar-chlorite recrystallization and veining, probably related to Murchison Granite emplacement.

HAND SPECIMEN:

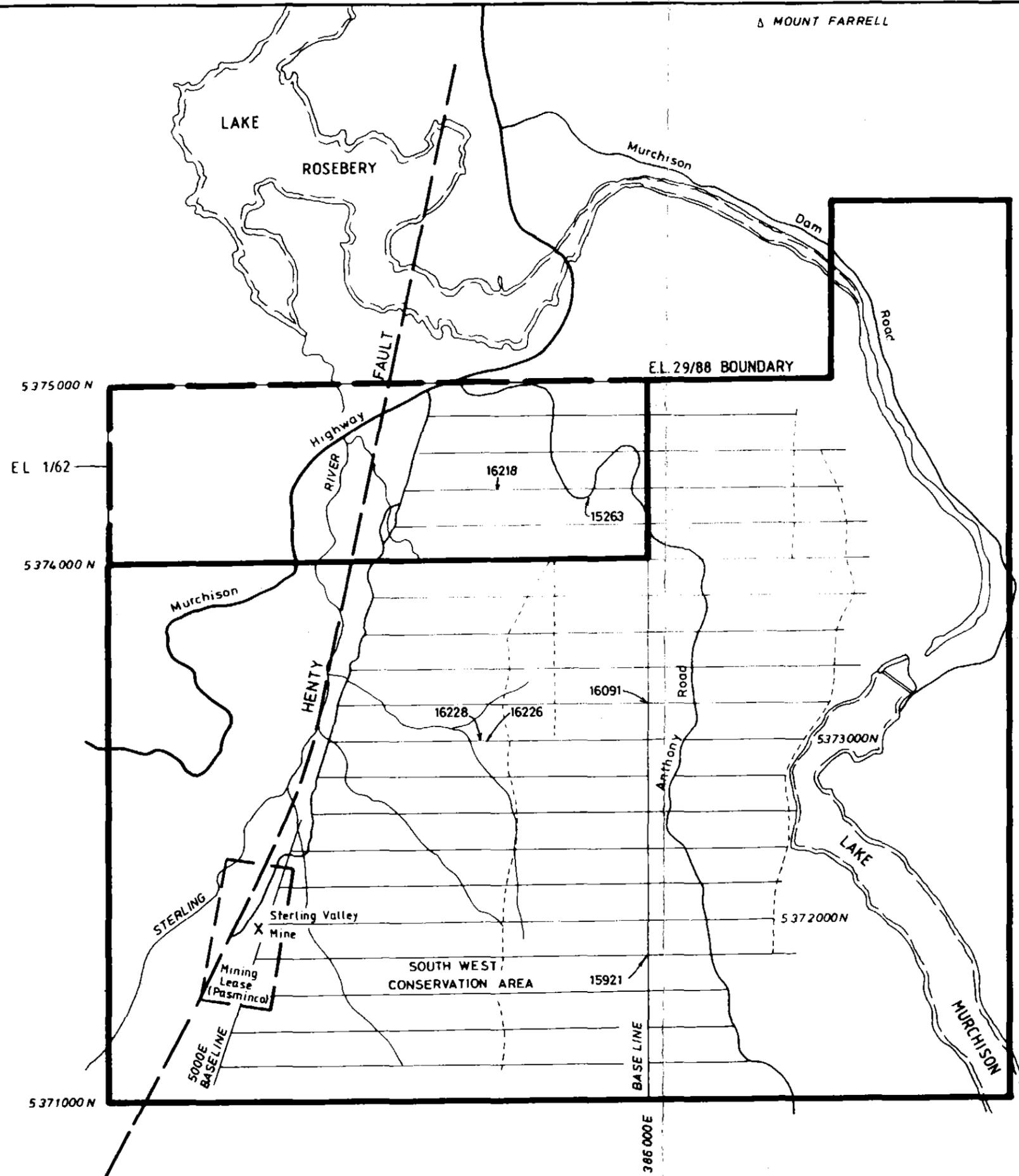
This is an unusual brown strongly foliated and brecciated siltstone or shale that may also be silicified.

THIN SECTION:

The least altered and disturbed parts of this section show that the rock was a siltstone very similar to the preceding sample, with minor angular detrital quartz of uncertain derivation. However, the matrix of this sample was strongly sericitized and foliated in irregular discrete bands, and locally brecciated. Quartz-chlorite veinlets meander through the sample haphazardly, and in many places, the matrix appears to have recrystallized to (or been replaced by) patchy and irregular quartz-Kspar-yellowgreen chlorite assemblages, in places up to 2mm grainsize.

The alteration style of this siltstone, especially the recrystallization patches of quartz-Kspar, and the localized sericitic banding, are reminiscent of the alteration in the vicinity of the Murchison Granite, as I have seen in the area around Lake Selina.

8576



90-3177.

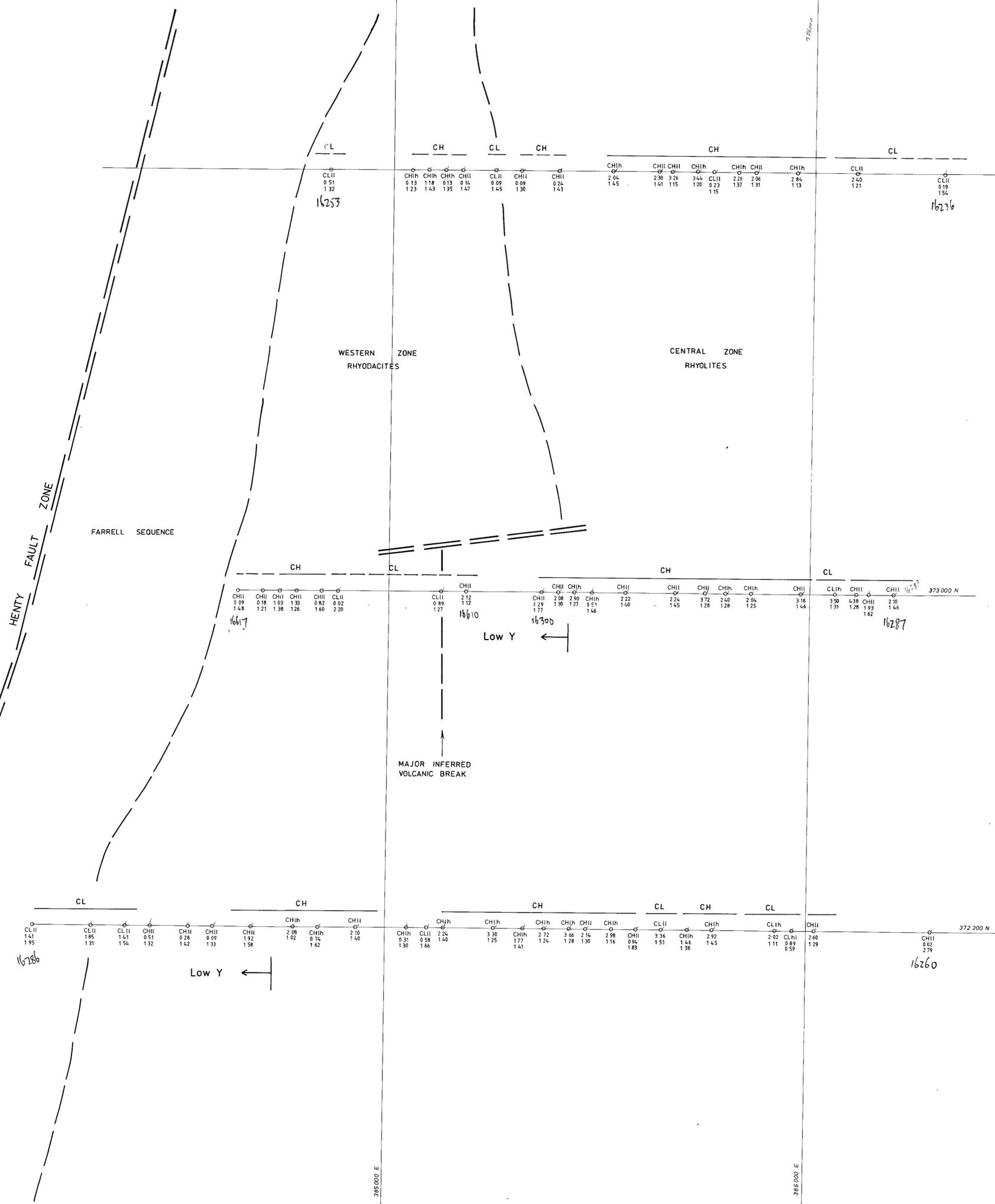
 Walking track (Loop access)
 Grid Line

 The Metals Division of the BHP Company of Australia Limited			
Project		STERLING VALLEY J.V.	
Title		LOCATION OF LEAD ISOTOPE SAMPLES	
Author	JPR	Date	8/89
Scale	1:25000		
Drawn	OH	Office	TAS
Revised		Date	
Drawing No.		Fig. No.	4

443059

5 cm

Δ MOUNT MURCHISON



LEGEND

- Non Altered (AH Index <17, Na₂O >2%)
- Sample point
- Altered (AH Index >17, Na₂O <2%)
- CH High Ti / Zr
- CL Low Ti / Zr
- 1st suffix h = High Sr
- l = Low Sr
- 2nd suffix h = High Y
- l = Low Y
-
- CH
- x = Na₂O value %
- y = Alteration Index

5 cm

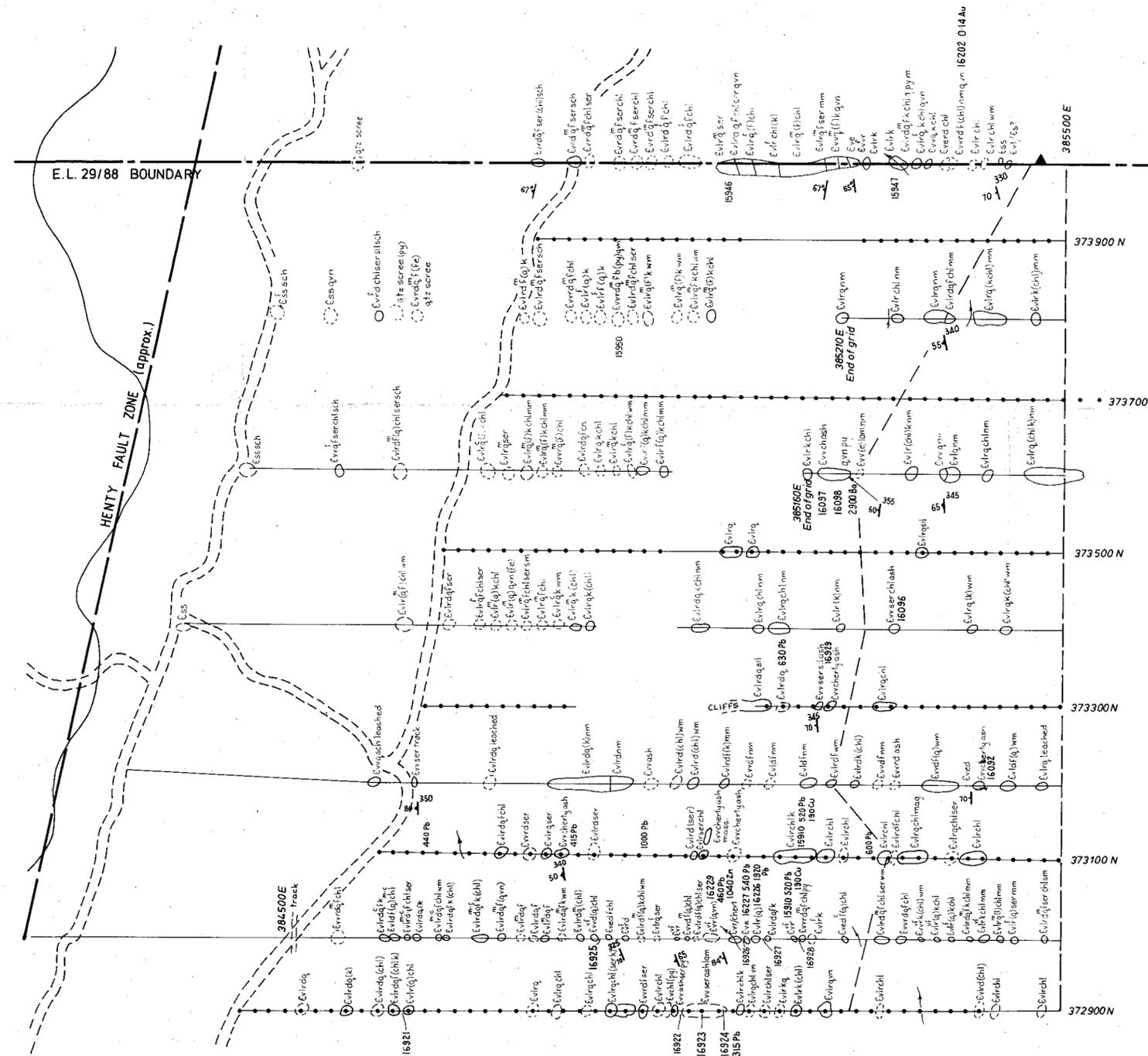
90-3177.

Billiton Australia
The Metals Division of the Shell Company of Australia Limited

Project: **STERLING VALLEY**

Title: **LITHOGEOCHEMICAL SAMPLING MAP 443060**

Author	JPR	Dept.	TAS	Scale	1:5000
Drawn	OH	Date	9/90	Revised	Date
Checked	Date	S'ced	Date		
Sheet No.	FIG 5	Drawing No.			



5 cm

90-3177.

EARLY ORDOVICIAN	θsc	OWEN CONGLOMERATE	Pebble to boulder conglomerate of quartzite, often hematitic and k-feldspar altered.
	θss	?NEWTON CK. SANDSTONE	Dirty medium grained quartzite.
LATE CAMBRIAN - EARLY ORDOVICIAN	cdc	DORA CONGLOMERATE JUKES BRECCIA	Strongly hematitic and silicified pebble conglomerate of predominantly volcanic detritus.
LATE CAMBRIAN	Egr	MURCHISON GRANITE	Coarse grained epigranular quartz feldspar biotite ± chlorite. Often strongly altered k-spar, chlorite, pyrite.
	Ess/sbs	FARRELL SEQUENCE	Fine laminated black shales and massive sandstone. Some volcanoclastic character.
MID CAMBRIAN	Evr	TYNDALL GROUP VOLCANICS	Rhyolite Lava Massive siliceous, may be quartz phytic, fine to coarse phenocrysts.
	Evrld		Rhyodacitic Lava Quartz feldspar phytic often foliated may be sericitized.
	Evrld		Dacitic Lava Feldspar phytic often chloritized.

TYNDALL GROUP VOLCANICLASTICS (EPICLASTICS)		Evrld	Rhyodacitic Volcaniclastic	Fine grained quartz-feldspar phytic often sericitized, layered, pumiceous.	
		Evd	Dacitic Volcaniclastic	Dominantly feldspar phytic chloritized fine to medium grained pumiceous.	
		Evv	Undiff. Volcaniclastic	Fine grained strongly altered undetermined composition.	
		Everd	Rhyodacitic Epiclastic	Medium to coarse lithics in sericitized matrix. Often quartz phytic.	
		Eved	Dacitic Epiclastic	Chloritic coarse lithic component, strongly altered.	
INTRUSIVE		Ebi	Basaltic Dyke	Fine grained chloritic massive.	
ALTERATION					
Chl	Chlorite	lq	Weakly quartz phytic	f	Super script over phytic
K	K-feldspar	q	Strong quartz phytic	c	Component as grain size
Ser	Sericite	(f)	Weakly feldspar phytic		
Py	Pyrite	f	Strong feldspar phytic		
Q-vn	Quartz vein				

- Outcrop
- Subcrop
- Float
- ↗ Strike/Dip Bedding
- ↘ Strike/Dip Cleavage
- Access Line
- ~ Creek
- Road
- Track

443061

Billiton Australia
The Metals Division of the Shell Company of Australia Limited

Project: **STERLING VALLEY**

Title: **THE CLIFFS GEOLOGICAL FACT MAP**

Author	JPR	Dept.	TAS	Scale	1:5000
Drawn	OH	Date	4/90	Revised	Date
Checked		Date		S'ceded	Date
Sheet No.	FIG 6	Drawing No.	D/LJ 70/017		

PETROLOGICAL DESCRIPTIONS

SAMPLE NUMBER 16923

SUMMARY
This is a banded quartz-feldspar phyric formerly glassy rhyolitic tuff with banding due to variable devitrification being enhanced by selective sericitization and pressure solution of less recrystallized bands

SAMPLE NUMBER 16924

SUMMARY
This is a banded, foliated epiclastic siltstone with worked vitric tuff containing felsic volcanic detritus. It does not contain originally glassy, and occasional detrital metamorphic muscovite

SAMPLE NUMBER 16925

SUMMARY
This is an epiclastic siltstone derived largely from felsic volcanic ash and quartz-feldspar phenocryst detritus, it does however contain a minor component derived from pelitic metamorphics, and is probably a good candidate for what the previous sample looked like before it was deformed and foliated

SAMPLE NUMBER 16926

SUMMARY
This is a banded pink quartz-feldspar rock generated by hydrothermal recrystallization of a crystal-poor vitric ash or rhyolite in the vicinity of the Murchison Granite

SAMPLE NUMBER 16927

SUMMARY
This is a silicified and brecciated epiclastic sandstone derived from both a felsic volcanic and a pelitic metamorphic terrain. It is quite similar to 16925 and may represent a brecciated and silicified version of essentially the same rock

SAMPLE NUMBER 16928

SUMMARY
This is a silicified lamellar siltstone shale with post-silicification chlorite veining. It is probably a finer grained equivalent of the previous sample

SAMPLE NUMBER 16929

SUMMARY
This is a former siltstone, possibly epiclastic and similar to the previous sample, that suffered brecciation and localized sericitization-foliation, followed by quartz-feldspar-chlorite recrystallization and veining, probably related to Murchison Granite emplacement



LEGEND

- LAVAS**
 - △△ Rhyolite massive siliceous ± quartz phyric, often flow banded
 - △_{RD} Rhyodacite often foliated and sericitised, quartz + feldspar phyric
 - ▽▽ Dacite chloritic feldspar ± quartz phyric
- VOLCANIC-CLASTICS**
 - ▽|▽| Crystal Tuff quartz + feldspar phyric, sericitised, pumiceous
 - Crystal Lithic Tuff quartz ± feldspar epiclastic with lithics of and lava
 - ▨▨ Cherty Ash often laminated, silicified, very fine grained

5 cm

90-3177.

443062

Billiton Australia <small>The Metals Division of the Shell Company of Australia Limited</small>			
Project		EL 29/88 STERLING VALLEY JV	
Title			
THE CLIFFS PROSPECT GEOLOGICAL INTERPRETATION			
Author	JPR	Date	5/90
Scale	1:5000		
Drawn	OH	Office	TAS
Revised	Date		
Drawing No	D/LJ 70/018		Fig No 7