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EXPLORATION LICENCE 29/87
STRAHAN, N.W. TASMANIA
INTERIM REPORT, DECEMBER 1989

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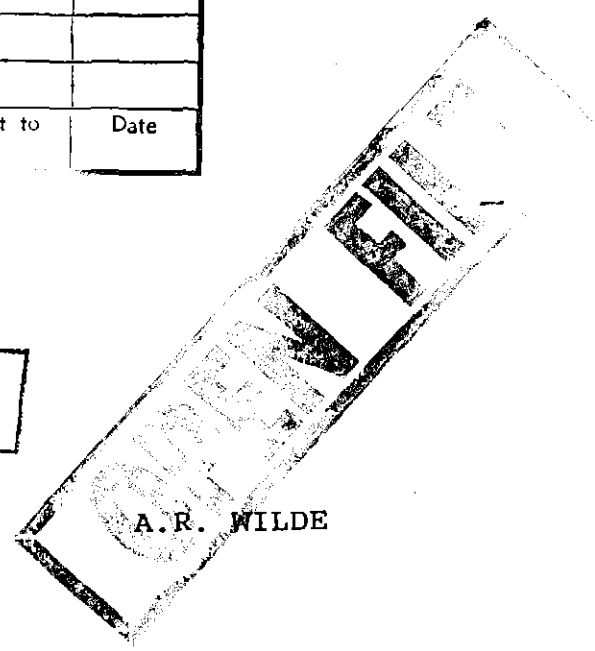

A.R. WILDE

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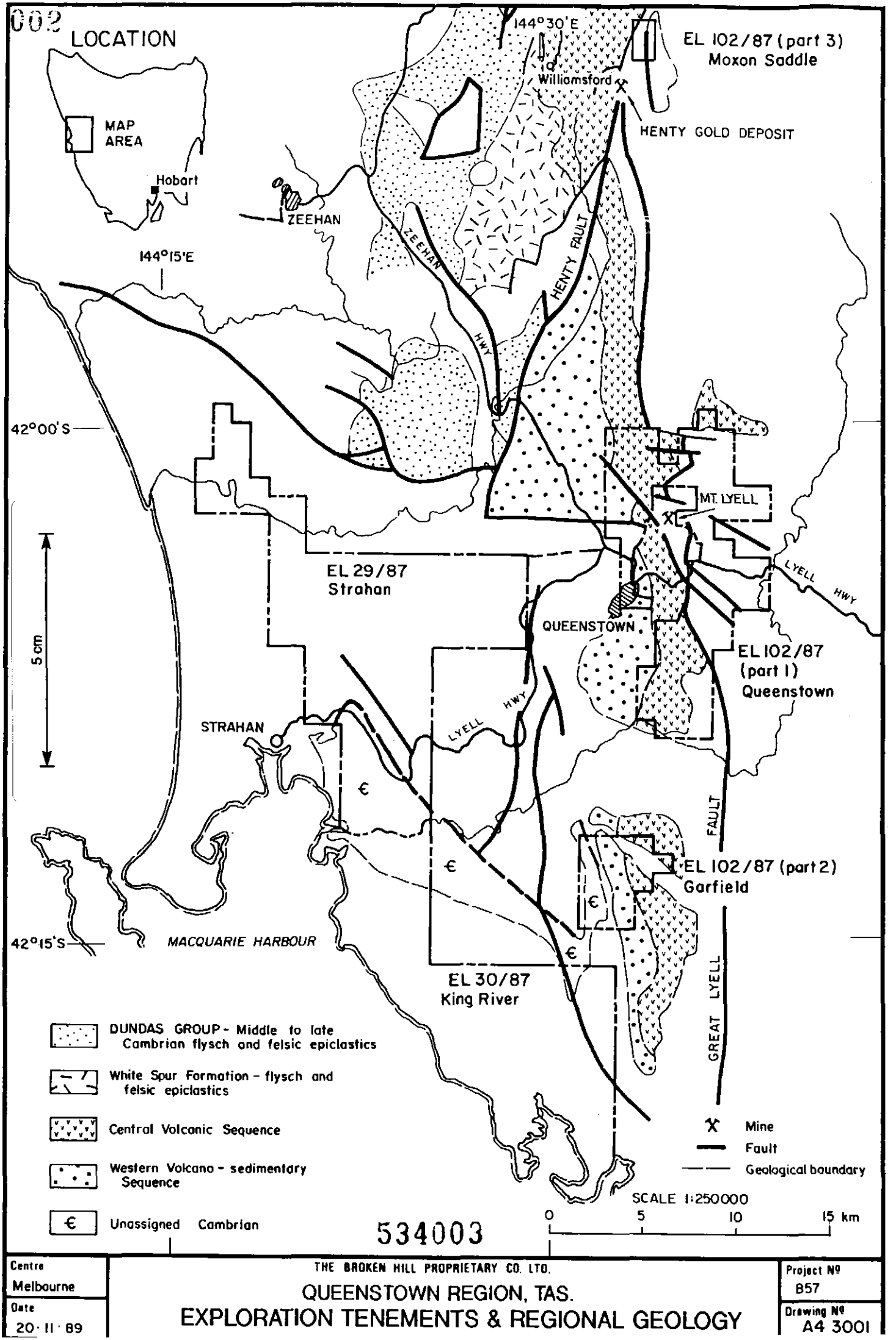
CONTENTS



Centre: Melbourne	THE BROKEN HILL PROPRIETARY CO. LTD.	Project Nº: B57
Date: 20·11·89	QUEENSTOWN REGION, TAS. EXPLORATION TENEMENTS & REGIONAL GEOLOGY	Drawing Nº: A4 3001

1. INTRODUCTION

E.L. 29/87 "STRAHAN" comprising 150 km^2 (Fig. 1) was granted to New Holland Mining N.L. on the 18th September 1987. BHP Minerals and New Holland Mining N.L. signed an option agreement in June 1988, and BHP Minerals has been manager of the EL thereafter.

The primary target is a volcanogenic Zn-Pb massive sulphide deposit in Cambrian rocks. Secondary targets are Henty-type gold mineralisation and post-peak metamorphic quartz-vein gold deposits in folded upper Palaeozoic rocks.

All activity to date has been carried out within the Cambrian rocks exposed to the south of the licence area. The main aim of the program was to assess the level of base-metal anomalism using a stream sediment survey. In addition geological traversing, rock-chip geochemistry and petrography was carried out in order to assess whether there were surface indications for the operation of a VMS-style hydrothermal system.

This report presents data which were collected during the Year 2 program, but which were unavailable at the time of submission of the annual report, and interpretations thereof.

2. SUMMARY OF RESULTS

A -80# stream sediment survey of Cambrian rocks within EL 29/87 has revealed low level Cu-Zn anomalism (up to 228 ppm Zn, 63 ppm Cu) in the south-west of the EL, which is probably associated with base-metal enriched mudstone and siltstone (maximum 300 ppm Zn - Cromer, 1988).

There are few indications that hydrothermal activity has been intense in this area. The most altered rocks encountered are "andesites" (probably former dacites) which outcrop in the south-western corner of the licence. A curious, albite-rich rock was found in Beehive Creek, and its origin is obscure.

Despite the large area of basaltic to andesitic rocks mapped by Corbett and McNeill (1988), the only outcrop of andesites is very small and restricted to close to the old Lyell-Strahan railway. Rhyolite lavas showing possible hyaloclastic brecciation outcrop in Beehive Creek, within the area previously thought to be part of a basalt/andesite unit. Approximately 50% of the Cambrian sequence is composed of volcaniclastic deposits, containing pumice and glass shards. Thus, the bulk of the sequence evidently has a felsic provenance. It is not clear whether the volcaniclastic rocks represent pyroclastic flaws or epiclastic deposits.

Work to date has not provided strong evidence for the presence of a substantial alteration system which could be associated with an exhalative sulphide body. Nevertheless the area will be covered by airborne TEM (GEOTEM) is January or February, and possible follow-up will be determined by the results of this survey.

3. EXPLORATION ACTIVITY YEAR 2

3.1 STREAM SEDIMENT SURVEY

Thirty-eight samples of stream sediment (including four duplicates) were collected at nominal spacings of 1km in all drainages within the exposed Cambrian sequence. Locations are shown in figure 2. Approximately 3kg of -2mm material was collected, dried and seived to -80#. Samples were then dispatched to Analabs for analysis of Cu, Pb, Zn, (Method 101), Fe, Mn (Method 102) and Au (Method 334). Analytical data is given in Appendix 1.

An area of elevated Cu and Zn is revealed in the south-western portion of the licence. The maximum Zn value is 228 ppm and Cu is 63 ppm. Zinc in excess of 100 ppm was found in twelve sample sites in creeks draining radially from a point at 6600E 28000N. The anomalous zone trends NNW-SSE and may be exposed along the abandoned railway track, where Cromer (1988) described a quartz-chlorite rock with 294 ppm Zn (NHS 37a, table 2). A sample of stream sediment nearly 500m west of this location (BX 4629) yielded the maximum gold value of 7ppb.

It is apparent that high Zn and Cu correlate well with high Fe. Since few of the stream sediment samples contained even minor iron hydroxide coatings this may indicate an iron-rich source rock, rather than scavenging of base-metals by iron-oxides in the stream sediment. Iron/manganese ratios in the stream sediments are typically 10:1 (by weight). Only vein-quartz fragments (<1% of bed load) show any significant Mn and Fe oxide coating.

3.2 BULK-ROCK GEOCHEMISTRY

3.2.1 Trace Element Analysis of Rock Chips:

Twenty-two samples of rock-chips were submitted for analysis of Cu, Pb, Zn, Ag, Au, As and Ba. Table 1 presents the results, and includes six samples (BX4695-4700) whose analysis were received after completion of the annual report. The average values in parts per million, are as follows:

Sample No.	Au	Cu	Pb	Zn	Ag	As	Ba	Rock Type
BX 4661	<0.01	14	6	44	<1	19	10	Vein quartz
BX 4662	<0.01	17	6	14	<1	9	690	Porphyritic rhyolite
BX 4663	<0.01	13	8	13	<1	8	510	Flowbanded rhyolite
BX 4664	<0.01	15	8	24	<1	11	440	Vitric tuff
BX 4665	<0.01	9	16	26	<1	11	250	Volcaniclastic sandstone (tuff)
BX 4665	<0.01	10	4	6	<1	9	60	Albite rock
BX 4667	<0.01	14	12	40	<1	6	440	Porphytic dacite
BX 4668	<0.01	34	52	19	<1	115	490	Slate
BX 4669	<0.01	8	14	7	<1	7	460	Volcaniclastic sandstone (tuff)
BX 4670	<0.01	7	12	10	<1	8	510	Volcaniclastic sandstone (tuff)
BX 4671	<0.01	19	52	8	<1	62	490	Sandstone/ mudstone
BX 4672	<0.01	50	24	110	1	16	340	Siltstone/ mudstone
BX 4673	<0.01	13	18	84	1	5	440	Porphyritic andesite
BX 4674	<0.01	9	8	22	<1	5	980	Porphyritic rhyolite
BX 4675	<0.01	46	12	40	<1	7	740	Tholeiitic dolerite
BX 5676	<0.01	10	4	18	<1	5	1020	Porphyritic rhyolite
BX 4700	0.009	55	<5	185	<0.5	<2	340	Sandstone/ mudstone
BX 4699	0.010	50	<5	125	<0.5	4	310	Micaceous siltstone
BX 4698	0.010	140	<5	100	<0.5	<2	690	Volclanistic sandstone
BX 4697	0.018	10	<5	60	<0.5	3	360	vitric tuff
BX 4696	0.016	35	<5	45	<0.5	15	420	Schistose volcaniclastic
BX 4695	0.010	35	<5	170	<0.5	4	350	Laminated mudstone

TABLE 1. Bulk rock analysis of rock-chip samples, the locations of which are given in figure 3. All results in ppm. BX 4700 - BX 4695 analysed by Analabs. Cu, Pb, Zn, Ag method 101 (AAS) Au 309 (fire assay) As, Ba 401 (XRF). BX 4661 - 4676 analysed by Classic Comlabs Cu, Pb, Zn, AASI, Ag AA32, gold FA1 (fire assay) and Ba, As (XRF1).

PPM	Cu	Pb	Zn	As	Ba
Rhyolite Lava	13	8	22	7	728
"Tuffs" (?epiclastics)	10	13	17	9	415
Andesite/dalite	13	18	84	5	440
Monzodiorite intrusive	46	12	40	7	740
Sandstone/mudstone	55	13	106	15	420

It is apparent that the sedimentary units within the area are somewhat enriched in Cu and Zn relative to the other rock types present. This is consistent with the results of Cromer's (1988) sampling along the King River which revealed minor base-metal enrichment in fine-grained pyritic sediments (max. 190ppm Zn, 160ppm Pb, 10 ppm Cu). This is probably a regionally extensive enrichment, and such values are not uncommon in argillaceous members of the Mt. Read Volcanics. No samples contained in excess of 20ppb gold and silver was detected in only two samples, with a maximum of 1ppm.

3.2.2 ICP Analysis of Major Elements:

Four rocks were submitted to Classic Comlabs for determination of major element concentrations by ICP. These were three samples of so called basaltic-andesitic volcanics from Beehive Creek and a "dolerite" pebble. It is clear from Table 2 that the three samples from Beehive Creek have bulk chemistries incompatible with andesite or basaltic nomenclature. In terms of their Si, Al, Fe and Mg contents these rocks are rhyolites, although Ca in particular and Na are somewhat depleted relative to unaltered rhyolites. A similar depletion was noted in the "andesite" analysed by Cromer (1988). Such depletion is explicable by incongruent dissolution of feldspar to give white-mica ("sericite") for which there is petrographic evidence (see below). The white mica alteration may also account for slightly high K contents of these rocks.

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TABLE 2: Major element chemistry of selected rock types from EL29/87.

Sample locations in 89-3020

	RHYOLITES			MONZO-DIORITE	ANDE-SITE	"VITRIC TUFF"		QUARTZ CHLORITE ROCK
Wt%	BX 4662	BX 4663	BX 4674	BX 4675	NHS 49	NHS 35	NHS 46	NHS 37a
SiO_2	69.2	75.4	70.4	60.1	57.4	75.0	77.3	31.1
TiO_2	0.43	0.40	0.42	0.56	0.75	0.57	0.05	0.06
Al_2O_3	15.1	14.3	15.2	15.0	18.1	12.5	13.1	21.7
Fe_2O_3	5.75	2.60	2.46	7.25	4.56	2.63	1.09	19.5
FeO	*	*	*	*	6.18	1.02	0.81	12.0
MnO	0.04	<0.01	<0.01	0.10	?	0.06	0.08	0.15
MgO	0.37	0.38	0.43	3.68	2.62	0.74	0.53	8.70
CaO	0.14	0.03	0.06	5.15	0.17	0.21	0.10	0.11
Na_2O	1.87	0.53	2.18	2.14	1.18	0.43	0.13	0.05
K_2O	5.35	4.42	5.95	2.74	1.38	2.50	2.70	0.07
P_2O_5	0.06	0.02	0.03	0.05	0.11	0.13	0.05	0.05
CO_2	N/A	N/A	N/A	N/A	0.62	0.26	0.55	0.55
SO_3	N/A	N/A	N/A	N/A	.005	0.01	.005	.006
S	N/A	N/A	N/A	N/A	0.02	0.06	0.03	.02
TOTAL	98.31	98.08	97.13	96.77	93.22	96.38	96.53	94.07
PPM								
Cu	17	13	9	46	10	14	8	6
Pb	12	8	8	12	10	14	5	25
Zn	14	13	22	40	57	22	7	211
Ba	690	510	980	740	38	139	52	<10
As	9	8	5	7	N/A	N/A	N/A	N/A
Ag	<1	<1	<1	<1	N/A	N/A	N/A	N/A
Au	<0.01	<0.01	<0.01	<0.01	0.1	.001	.001	N/A

* All iron as Fe_2O_3. BX Samples – analysis by ICP (Comlabs) for major elements & minor elements by a combination of AAS, XRF & fire assay. ? – error in original tabulation (Cromer, 1988). NHS Samples were tabulated in the annual report for year 1 and are included here for completeness. N/A – not analysed.

The "dolerite" pebble, of unknown provenance from Beehive Creek, has a surprisingly high Si content, some 10% above the typical 50% SiO_2 of Dolerite (cf Cox et al, 1979). Its fresh nature suggests that there has been minimal modification of the original chemistry by weathering or hydrothermal alteration. Its major element chemistry suggests that the rock is a trachyandesite, or considering its coarse grain size a monzodiorite.

3.3 PETROGRAPHY

Twelve rock samples were submitted to Geochempet Services for petrographic description. These samples were a representative selection of the volcanic and volcaniclastic lithologies found in EL. Petrographic reports are given in Appendix 2.

The samples from Beehive Creek identified as rhyolite on the basis of their chemistry were described by consultant Joyce as rhyodacites. This probably stems from the paucity of quartz phenocrysts in the rock (2-3% volume). A phenocryst assemblage of plagioclase, biotite, quartz and Ti-bearing oxide (probably ilmenite) is found in all the ryholites, although these minerals (excepting quartz) show evidence of alteration at low temperature. Feldspar (plagioclase) shows "moderate to intense" sericitisation, which no doubt accounts for low Ca, and Na seen in bulk chemical analyses. Biotite is altered to a white-mica/TiO_2 assemblage. The groundmass, composed of feldspar and quartz, also shows significant development of white-mica. Sample BX 4662 reveals a breccia texture, "involving densely-packed, mildly displaced angular clasts" of the host rock, which is tentatively identified as a hyaloclastic breccia. Flow banding is seen in BX 4663.

Also from Beehive Creek is a curious ALBITITITE, consisting of 55% fine-ground albite, with minor rutile or chlorite aggregates. Diagnostic textures are lacking, but Joyce has suggested that this rock represents "an acid tuff or lava". Its proximity to the Beehive Creek rhyolite suggest the latter.

Samples of volcaniclastic sediments reveal evidence of "cuspate vitric shards" and ragged pumice, suggesting a link with explosive felsic volcanism. Whether these rocks represent primary pyroclastic flaws or epiclastic deposits is currently uncertain. As with the Beehive Creek lavas, these rocks typically contain much white mica comprising as much as 75% of the rock. Such white-mica may represent the product of regional low-grade metamorphism (rather than hydrothermal alteration associated with exhalative volcanic fluids) involving pseudomorphous replacement (and hydration) of feldspathic debris.

Samples BX 4673 and 4667 were taken from the old railway line to Queenstown near the south-western corner of the EL, where Corbett and MacNeill's (1988) compilation map shows an outcrop of andesitic to basaltic volcanics (Fig. 2). Sample BX 4673 was described by Joyce as a porphyritic andesite. It differs from the rhyolite samples in containing up to 20% chlorite, some of which seems to replace pyroxene crystals. Abundance of chlorite and white-mica is reflected in low total oxides (table 2). Some feldspar (plagioclase) is preserved, but often shows evidence for replacement by mica, reflected in lower than expected Ca and Na contents. Sample BX 4667 from close by, was however described as a porphyritic dacite, and contains a few quartz phenocysts. This rock also contains chloritic pseudomorphs after presumed mafic phenocysts. Phenocysts and matrix in both samples record evidence of shearing. There seems to be little difference between BX 4667 and 4673 apart from presence of 0.5% quartz phenocysts in BX 4667. The evidence for those rocks being of andesitic to dacitic composition is:

- presence of chloritic clots, inferred to have been altered pyroxene
- abundance of chlorite (i.e. reflecting original Fe & Mg - rich bulk chemistry)
- low bulk SiO_2 content of 57%

If the SiO_2 content is "normalised" to account for 7% water, then the rocks SiO_2 content prior to hydration could have been 62%. Chloritic clots could equally well have replaced feldspar, and abundance of chlorite may be a reflection of intense hydrothermal alteration, rather than high original bulk Mg and fe content. Thus it is considered that these rocks should be viewed as andesites with some caution.

Finally, the pebble from Beehive Creek, geochemically a monzodiorite, was found to be relatively coarse-grained (up to 5mm), with a two-pyroxene feldspar assemblage. There is also interstitial graphic intergrowth between quartz and K-feldspar. It is likely to have been derived from an intrusion, but its location is currently unknown. The possibility that this rock has been transported a considerable distance from its source (e.g. glacially) cannot be discounted.

3.4 GEOLOGICAL TRAVERSING

Several geological traverses were carried out in the process of collection of stream sediment and rock chip samples. These included a traverse along the Lyell Highway and gridlines 28,000 and 29,000N, the latter incorporating Beehive Creek (Fig. 3). The main result of these traverses was to establish the lack of andesitic or basaltic material at outcrop, although outcrop is often poor. A traverse along 28,000N revealed numerous outcrops of siltstone and volcaniclastic sandstone. It is considered unlikely that any igneous rocks occur along this traverse line.

4. CONCLUSIONS

The Cambrian sequence exposed within EL 29/87 appears to have a mainly felsic provenance. The bulk of the sequence is composed of volcaniclastic deposits containing pumice glass shards, interbedded with laminated siltstones and mudstones, which commonly are Cu- and Zn- rich. Rhyolite lavas, not andesites, are exposed in Beehive Creek, and there is some evidence for submarine extrusion, in the presence of hyaloclastic brecciation. These lavas have low Ca and Na contents which is due to the incongruent dissolution of feldspar to yield white-mica, probably under low fluid to rock conditions. This alteration may be related to a VMS system, but more likely is merely a reflection of regional green-schist facies metamorphism. Intense chlorite alteration is found only in a few outcrops of so-called andesite in the south-western corner of the licence. These "andesites", however, could equally well be altered dacites. High Cu and Zn contents in sedimentary units within the sequence may be due to distal fall-out of base-metal rich exhalations, but such enrichment is certainly not uncommon within the Mt. Read Volcanics.

An area of Cu and Zn enrichment in stream sediments was located in the south-western part of the EL, close to the chloritised "andesite" unit. A maximum of 220 ppm Zn was found, but this may simply be a reflection of base-metal enrichment within the sedimentary part of the sequence.

5. RECOMMENDATIONS

The Cambrian succession within EL29/87 will be covered by airborne TEM/magnetics and radiometrics (GEOTEM) in January or February of 1990. Follow-up work will therefore depend on the results of this survey. If any significant conductors are located by the GEOTEM system it is recommended that the following program is carried out:

- TRACK CUTTING & GRIDDING AT 200m GRIDLINE SPACING OVER THE CONDUCTOR(S)

- GROUND VERIFICATION OF THE CONDUCTOR BY TEM

- GEOLOGICAL MAPPING & ROCK-CHIP GEOCHEMISTRY OF THE DETAILED GRID

- SHOULD THE CONDUCTOR THEN WARRANT DRILLING IT WOULD BE DRILL TESTED, AND THE HOLE(S) LOGGED BY TEM & GAMMA-RAY

It is likely that any drilling would need to be helicopter supported, but the possibility of vehicular access will be considered. A sum of $100,000 or more is recommended in order to fully evaluate any GEOTEM conductors.

REFERENCES

CROMER W.C., 1988, EL29/87 STRAHAN, TASMANIA. ANNUAL REPORT YEAR 1. New Holland Mining N.L.

COX K.G., BELL J.D. & PANKHURST R.J., 1979. The Interpretation of Igneous Rocks" George, Allen & Unwin, 450p.

CORBETT K.D., McNEILL A.W., 1988, Map 6. Geological Compilation Map of the Mt. Read Volcanics and Associated Rocks Hellyer to South Darwin Peak. Tasmanian Mines Dept.

APPENDIX #1

STREAM SEDIMENT (-80#) DATA

ARW:CH
1339m

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ANALABS

A division of MacDonald Hamilton & Co. Pty. Ltd.
52 Murray Road, Welshpool, W.A. 6106
Phone (09) 458 7999
FAX: 004 31 8890
Telex AA92560

8 SEP. 1989

ANALYTICAL REPORT No. 14.4.08.06454

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

Andy Wilde
B.H.P. Minerals
P.O. Box 503
Queenstown
Tasmania 7468

ORDER No.	PROJECT
11193	857
DATE RECEIVED	**RESULTS REQUIRED**
25/08/89	ASAP

No. OF PAGES OF RESULTS	DATE REPORTED	No. OF COPIES	TOTAL No. OF SAMPLES
2	01/09/89	1	39

STATE OF SAMPLES	PRE-TREATMENT								ANALYSIS			
REFER BELOW	SAMPLE NUMBERS	DRY	CRUSH	SPLIT	PULVERISE	SIEVE	OTHER SEE REMARKS	NONE		REFER TO ANALYSIS SECTION	PREPARATION	METHOD
	BX4616/4654	SS							Fe,Mn/101,Cu,Pb,Zn/102			
	BX4616/4654	SS							Au,AuCh2/334			

RESULTS TO

Andy Wilde
B.H.P. Minerals
P.O. Box 503
Queenstown
Tasmania 7468

RESULTS TO

Andy Wilde
B.H.P. Minerals
P.O. Box 619
Hawthorn
Victoria 3122

REMARKS

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

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ANALABS

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ANALYTICAL DATA

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

		14.4.08.06454	01/09/89	11193	1 OF 2

TUBE No.	SAMPLE No.	Cu PPM	Pb PPM	Zn PPM	Fe %	Mn PPM	Ag PPM	Au PPM		
1	BX4616	11	12	54	2.08	440	0.004	0.003		
2	BX4617	11	5	50	1.94	440	0.001	-		
3	BX4618	36	2	110	4.32	295	0.001	-		
4	BX4619	43	16	191	6.34	680	0.001	-		
5	BX4620	63	16	183	5.66	715	0.007	0.010		
6	BX4621	13	1	79	2.17	580	0.001	-		
7	BX4622	28	16	225	5.95	1050	0.001	0.002		
8	BX4623	17	11	149	3.21	480	0.001	-		
9	BX4624	3	2	26	0.66	55	0.001	-		
10	BX4625	1	<1	16	0.24	15	0.001	-		
11	BX4626	2	<1	18	0.52	40	0.001	-		
12	BX4627	6	1	35	1.11	170	0.001	-		
13	BX4628	17	<1	131	3.62	780	<0.001	-		
14	BX4629	22	12	120	4.25	485	0.001	-		
15	BX4630	8	1	19	1.04	90	0.001	-		
16	BX4631	14	11	85	3.74	400	0.001	-		
17	BX4632	7	12	60	2.43	525	0.001	-		
18	BX4633	16	19	103	2.64	410	0.001	-		
19	BX4634	15	25	166	3.67	480	0.001	-		
20	BX4635	8	2	40	1.73	135	0.001	-		
21	BX4636	12	20	100	2.70	270	0.001	0.002		
22	BX4637	12	19	100	2.89	320	0.001	-	DUPLICATE	
23	BX4638	37	17	228	6.46	630	0.001	-		
24	BX4639	32	11	130	6.05	745	0.002	-		
25	BX4640	12	3	41	2.25	205	0.001	-	X	

Results in ppm unless otherwise specified

AT = element present, but concentration too low to measure

AX = element concentration is below detection limit

— = element not determined

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ANALABS

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ANALYTICAL DATA

SAMPLE PREFIX	REPORT NUMBER	REPORT DATE	CLIENT ORDER No.	PAGE
	14.4.08.06454	01/09/89	11193	2 OF 2

TUBE No.	SAMPLE No.	Cu	Pb	Zn	Fe	Sb	Bi	Ag (Oz/t)		
1	BX4641	3	3	18	0.64	165	0.001	-		
2	BX4642	28	4	76	3.60	160	0.001	-		
3	BX4643	14	2	52	1.99	255	0.002	-		
4	BX4644	5	<1	33	1.04	80	0.001	-		
5	BX4645	5	1	35	1.25	100	0.001	-	DUPLICATE	
6	BX4646	4	2	29	0.86	85	0.001	-		
7	BX4647	7	7	50	2.24	365	0.001	-		
8	BX4648	33	30	65	2.68	105	0.002	-		
9	BX4649	7	5	34	1.67	265	0.001	-		
10	BX4650	20	15	84	3.87	350	0.001	-		
11	BX4651	2	<1	20	0.59	40	0.001	-		
12	BX4652	25	4	73	3.62	155	0.001	0.002	DUPLICATE	
13	BX4653	11	4	42	2.16	215	0.001	-	DUPLICATE - 640	
14										
15										
16										
17										
18										
19										
20										
21										
22										
23	DETECTION	1	1	1	0.05	5	0.001	0.001		
24	UNITS	PPM	PPM	PPM	%	PPM	PPM	PPM		
25	METHOD	102	102	102	101	101	334	334		

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

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APPENDIX #2

PETROGRAPHIC DESCRIPTIONS

ARW:CH
1339m

534020 STRATHAN BX4662

Sample Number : Z7269

Identification : Lightly weathered, sericitized and silicified breccia of moderately sericitized, porphyritic rhyodacite

Description :

The sample is a lightly weathered, orange pink hand specimen displaying phenocrysts of quartz and feldspar set in a fine groundmass. Sawn surfaces reveal subtle lithic fragmental textures, probably breccia textures.

A cobaltinitrite staining test revealed abundant K-feldspar in the fine groundmass.

In thin section the sample is seen to have breccia textures involving densely packed, only mildly displaced angular clasts of porphyritic volcanic rock and a matrix of quartz and sericite.

The rock which has been brecciated displays many subhedral and corroded phenocrysts (about 0.3 to 2mm) set in an allotriomorphic (about 0.02mm grainsize) groundmass. The phenocrysts are quartz, lightly to moderately sericitized plagioclase, sericite-rutile pseudomorphs of biotite, and leucoxene-rutile pseudomorphs of small oxide grains. The groundmass is moderately sericitic and finely quartzofeldspathic. An approximate composition of the clasts is :

10-15%	lightly to moderately sericitized plagioclase phenocrysts
2-3%	sericite-rutile after biotite phenocrysts
2-3%	quartz phenocrysts
tr	leucoxene/rutile after oxide phenocrysts
65-75%	groundmass feldspars and quartz
10-15%	groundmass sericite

The matrix between the clasts is a finely crystalline assemblage of quartz (0.03 to 0.05mm) and sericite.

The specimen consists of about :

70-80%	altered rhyodacitic clasts
15-20%	matrix sericite
5-10%	matrix quartz

Comments and Interpretations :

This rock is interpreted to have originated as porphyritic rhyodacitic lava. It was quite similar to the rock in Z7270 and may represent the same unit.

The rhyodacite has been brecciated by tensional (e.g. faulting) or expansive processes (e.g. hydrothermal venting) and a hydrothermal cement of fine quartz and sericite formed. No metallic mineralization is apparent, but the rock is lightly weathered.

STRHAN BX4663

534021

020

Sample Number : Z7270

Identification : Lightly weathered, moderately to heavily sericitized, porphyritic, flow-banded rhyodacite

Description :

The sample is a lightly weathered hand specimen displaying phenocrysts of quartz and other altered minerals set in a pale orange, fine groundmass with suggestions of undulating flow bands.

Cobaltinitrite stain gave diffuse, inconclusive reaction.

In thin section the sample displays abundantly porphyritic, finely crystalline, flow-aligned and flow-banded textures. Subhedral to euhedral and corroded phenocrysts are about 0.2 to 2mm in size and the groundmass is allotriomorphic and has grainsizes around 0.01 to 0.02mm.

Quartz forms smoothly corroded and deeply embayed phenocrysts. Plagioclase forms blocky prismatic phenocrysts, moderately to completely sericitized. Thin and thick flakes of inferred biotite are pseudomorphed by coarse sericite and fine rutile. There are leucoxene and fine rutile aggregates after small oxide phenocrysts. The groundmass is very finely quartzofeldspathic and moderately sericitic. Flow bands vary in their degree of sericitization.

An approximate mode is :

10-15%	moderately to intensely sericitized plagioclase phenocrysts
3-5%	sericite-rutile after biotite phenocrysts
2-3%	quartz phenocrysts
tr	leucoxene/rutile after oxide phenocrysts
65-75%	groundmass feldspars and quartz
10-15%	groundmass sericite

Comments and Interpretations :

This rock is confidently interpreted to have originated as porphyritic, flow-banded rhyodacitic lava.

There is now moderate to heavy sericitization, but no metallic mineralization, and no obvious deformation. Weathering is light.

021 534022 STRATHAN BX4664

Sample Number : Z7271

Identification : Weathered, intensely sericitized, unwelded vitric tuff

Description :

The sample is a light olive grey, lightly weathered hand specimen of fine-grained rock. Binocular examination of sawn surfaces yields some vague suggestions of vitroclastic textures.

A staining test revealed no K-feldspar.

In thin section the sample is seen to be intensely sericitized and also rendered porous and lightly stained by weathering. Primary textures are not well preserved, but the shapes of weathering pores, the patterns of sericite and fine quartz (0.02mm grainsize), and some patterns of leucoxene all point to the former existence of unwelded cuspate vitric shards, about 0.1 to 0.5mm long, and small ragged clasts of pumice.

There are several porous, limonite-stained, thin quartz veins, ranging up to 0.2mm wide.

An approximate mode is :

65-75%	sericite
25-35%	quartz
0.1-0.2%	leucoxene
0.2-0.3%	limonite pigment
0.3-0.5%	porous quartz veins

Comments and Interpretations :

This rock is considered to have originated as unwelded, pumiceous vitric tuff. It was devoid of phenoclasts and lithic clasts, suggesting distal airfall onto land or into water.

The tuff has been intensely sericitized and cut by a few thin quartz veins. The fine quartz within the bulk of the altered tuff is likely to be an in situ product of the devitrification and alteration : it need not have been introduced. The rock is now weathered.

534023

STRTHN BX4665

Sample Number : Z7272

Identification : Weathered, well jointed, intensely sericitized, unwelded, pumiceous vitric tuff

Description :

The sample is a lightly weathered hand specimen of abundantly jointed, fine-grained rock. Joint surfaces are stained with limonite. Internally the specimen is light olive to greenish grey and has textures vaguely suggestive of vitric tuff.

A staining test revealed no K-feldspar.

In thin section the sample is seen to be intensely sericitized and also rendered porous and limonite-stained by weathering. Primary textures are not well preserved, but there are plentiful indications that the primary rock was unwelded vitric tuff, with cuspate shards 0.1 to 0.5mm long and a few small wispy pumiceous clasts ranging up to 2mm. The clasts re rendered conspicuous in places by selective limonitic pigmentation. Elsewhere they are discernible from patterns of fine quartz (about 0.02mm grainsize) and sericite and from patterns of leucoxene.

Numerous open joints are lined by limonite.

An approximate mode is :

65-75%	sericite
25-35%	quartz
0.3-0.5%	limonite
0.1-0.2%	leucoxene

Comments and Interpretations :

This sample is quite similar to Z7271. There are trivial differences in jointing and pigmentation, and a few more pumiceous clasts.

The original rock seems to have consisted of unwelded vitric shards and small fragments of pumice. Distal airfall onto land or into water is implied.

The tuff has experienced intense sericitization, followed by jointing, followed by weathering.

023

534024

STRATHN BX4666

Sample Number : Z7273

Identification : Fractured, quartz-veined, densely albitized rock

Description :

The sample is a lightly weathered hand specimen, displaying finely crystalline, yellowish grey, feldspathic rock cut by several thin quartz veins which are now disrupted by micro-faulting.

A staining test revealed no K-feldspar.

In thin section the rock is seen to consist mainly of a sutured mosaic of untwinned and poorly twinned albite (about 0.02 to 0.1mm in grainsize). There are quite sparse albitized phenoclasts or phenocrysts (0.3 to 1mm) of plagioclase and rare strained phenoclasts or phenocrysts of quartz (1 to 1.5mm). Other trace components are small rutile aggregates (up to 0.2mm) and chlorite aggregates (up to 0.2mm).

Several fracture veins (1 to 2mm wide) carry moderately strained, relatively coarse quartz and rare chlorite. They are cut by several stylolitic sericite veins and faulted by weathered fractures.

An approximate mode is :

95-96%	fine albite
tr	albitized feldspar phenocrysts or clasts
rare	quartz phenocrysts or clasts
tr	rutile aggregates
rare	chlorite aggregates
4-5%	quartz veins with rare chlorite
0.1%	sericitic veins

Comments and Interpretations :

This sample is considered to be an intensely, finely albitized rock. There are a few remnant indications that the precursor rock may have been acid tuff or lava.

Fracture veins of quartz post-date the albitization. Stylolitic veins of sericite post-date the quartz veins. Later fractures faulted the quartz veins.

534025 STRATHM BX 4667

Sample Number : Z7274

Identification : Moderately weathered, mildly deformed, heavily sericitized and chloritized, porphyritic dacite

Description :

The sample is a moderately weathered hand specimen, displaying many small, altered phenocrysts set in a pale brownish, soft groundmass.

A staining test revealed no K-feldspar.

In thin section the sample displays porphyritic, finely crystalline textures of volcanic style. Subhedral and corroded phenocrysts about 0.5 to 1.5mm in size are set in an altered, hypidiomorphic groundmass displaying some feldspar laths about 0.1mm long.

Quartz forms smoothly corroded phenocrysts. Plagioclase forms prismatic phenocrysts, mainly intensely altered to sericite and stretched by mild deformation. Prismatic mafic silicates of uncertain type have been pseudomorphed by chlorite (now deformed and weathered). The groundmass is dominated by heavily sericitized feldspar, but carries many small, mildly strained, equant grains of quartz. There is also plentiful chlorite and plentiful leucoxene.

An approximate mode is :

0.3-0.5%	quartz phenocrysts
3-4%	intensely sericitized feldspar phenocrysts
2-3%	intensely chloritized mafic phenocrysts
50-60%	intensely sericitized groundmass feldspar
20-25%	groundmass quartz
12-18%	groundmass chlorite
2-3%	groundmas sleucoxene

Comments and Interpretations :

This rock is considered to have originated as porphyritic dacite lava.

There has been heavy alteration to sericite, chlorite and leucoxene, followed by mild shear deformation, followed by moderate wethering.

Sample Number : Z7275

Identification : Slightly weathered, intensely sericitized, unwelded, pumiceous vitric tuff

Description :

The sample is a slightly weathered hand specimen, displaying many yellowish grey, dispersible, altered small clasts within a greenish grey, altered matrix. Textures suggest a vitroclastic tuff.

A staining test revealed no K-feldspar.

In thin section the sample is seen to be intensely sericitized and also rendered mildly porous by weathering. Primary textures are not well preserved, but there are plentiful indications of ragged, uncompressed, pumiceous clasts (1 to 2mm in size) dispersed abundantly through a matrix of cuspate formerly vitric shards (about 0.1 to 0.5mm in size). The clasts are revealed variously by pore shapes, patterns of sericite and fine quartz (0.02mm grainsize), and patterns of leucoxene. The pumiceous clasts are especially sericitic and account for about 35 to 40% of the rock.

An approximate mode is :

65-75%	sericite
25-35%	quartz
0.2-0.3%	leucoxene

Comments and Interpretations :

This rock is considered to have originated as unwelded tuff in which numerous small clasts of ragged pumice were dispersed through a matrix of smaller vitric shards. Such textures could be generated by distal airfall into water or onto land. The absence of phenoclasts and lithic clasts is a distinctive characteristic of the tuff.

The rock has experienced intense sericitization, then slight weathering.

This sample is interpreted to be closely related to Samples Z7271 and Z7272. Indeed, the only substantial difference, other than weathering, may be a progressive increase in the proportion, or size, of pumice from Z7271 through Z7272 to Z7275.

534027

STRAHAN BX4670

Sample Number : Z7276

Identification : Weathered, intensely sericitized, unwelded, pumiceous vitric tuff

Description :

The sample is a soft, faintly brownish light olive grey, moderately weathered hand specimen of altered rock with vaguely vitroclastic textures.

A staining test revealed no K-feldspar.

In thin section the sample is seen to be intensely sericitized and pervasively lightly stained by limonite. Moderately preserved primary textures are consistent with ragged pumiceous clasts (about 1 to 2mm) scattered through an unwelded matrix of cuspate vitric shards (about 0.1 to 0.5mm in size). The various clasts are displayed by heavier pigmentation of the most densely sericitized clasts and by "dusty" patterns of leucoxene. Fine quartz has an even grainsize, around 0.02mm.

An approximate mode is :

65-75%	sericite
25-35%	quartz
0.1-0.2%	leucoxene
0.1-0.2%	limonite

Comments and Interpretations :

This rock is interpreted to have formed as an unwelded accumulation of vitric shards and pumice, without any accompanying phenoclasts or lithic clasts. Distal airfall onto land or into water could produce the observed textures.

The tuff has been heavily sericitized and more recently weathered.

This sample shows close similarities in original texture to Z7272. It is generally quite similar to Z7271, Z7272 and Z7275.

Sample Number : Z7277

Identification : Weathered, foliated, sericitic, laminated, micaceous, labile fine sandstone, siltstone and mudstone

Description :

The sample is a moderately weathered, argillic, pale yellowish brown hand specimen of laminated, sedimentary rock.

A staining test revealed no K-feldspar.

In thin section the sample plainly displays sedimentary laminations (about 0.5 to 6mm) involving finely sandy (up to 0.1mm clasts) and silty to slaty variants.

The thickest, most sandy layers display moderately sorted angular clasts of quartz, feldspar (mainly now sericitized), biotite (now quite limonitic) and muscovite. A typical mode is :

55-65%	feldspar and derived sericite
20-30%	quartz
10-15%	biotite and derived limonite
2-3%	muscovite

The most slaty layers are richly sericitic, but heavily limonite stained. They have a metamorphic foliation inclined at about 15° to the bedding laminations and carry many angular silt grains of quartz and some goethite specks of uncertain significance.

Other silty layers of transitional character display plentiful limonite-stained sericite, but with a substantial detrital component of muscovite, biotite, quartz and feldspar.

Comments and Interpretations :

This rock originated as finely laminated micaceous, labile, fine sandstone, siltstone and mudstone. The abundance of detrital micas is distinctive.

Regional metamorphism has generated much sericite and induced a foliation inclined at about 15° to bedding. Moderate weathering has generated pervasivelimonitic staining, probably emanating mainly from detrital biotite.

028 534029 STRATHMORE BX4673

Sample Number : Z7278

Identification : Weathered, moderately chloritized and sericitized, abundantly porphyritic andesite cut by a thin quartz vein

Description :

The sample is a moderately soft, moderately weathered hand specimen displaying abundant small yellowish grey feldspar phenocrysts and a few dark chloritized phenocrysts set in a pale brown groundmass.

A staining test revealed no K-feldspar.

In thin section the sample is seen to be moderately altered and moderately weathered, but primary textures are plainly of abundantly porphyritic, hypidiomorphic, volcanic style. There are two generations of phenocrysts, the largest and least common are about 0.5 to 1.5mm and the others are mainly 0.2 to 0.5mm. The groundmass features feldspar laths about 0.1 to 0.2mm long.

The most common phenocrysts are prismatic plagioclase with light to moderate sericitic alteration. The others are mainly deformed chlorite pseudomorphs of inferred pyroxene prisms. Some small phenocrysts of inferred ilmenite or titaniferous magnetite now consist of leucoxene. Groundmass feldspar is lightly to moderately sericitized and there is much limonite-stained chlorite and some fine leucoxene.

A mildly deformed, 0.5mm wide fracture vein carries quartz.

An approximate mode is :

30-35%	lightly to moderately sericitized plagioclase phenocrysts
2-3%	chlorite pseudomorphs of pyroxene phenocrysts
0.1%	leucoxenized oxide phenocrysts
45-50%	lightly to moderately sericitized groundmass plagioclase
12-18%	groundmass chlorite
2-3%	groundmass leucoxene
0.5-0.7%	quartz vein

Comments and Interpretations :

This sample is considered to have originated as abundantly porphyritic pyroxene andesite lava.

The rock has experienced moderate alteration to chlorite, sericite and leucoxene and has been penetrated by a quartz fissure vein. Mild tectonic deformation has affected the chloritized phenocrysts and the quartz vein. Weathering has softened the rock and generated limonitic staining from the chlorite.

020

534030

STRAHAN BX4674

Sample Number : Z7279

Identification : Weathered rhyodacitic porphyry with light alteration to sericite and chlorite and with minor veining by quartz and chlorite

Description :

The sample is a porous, lightly weathered hand specimen of altered acid porphyritic rock. Phenocrysts of quartz, feldspar and other variously altered and eroded minerals are set in a finely crystalline, moderate orange pink groundmass.

A staining test revealed plentiful K-feldspar in the groundmass.

In thin section the sample displays many corroded, subhedral phenocrysts (about 0.3 to 4mm) and some apparently autoxenolithic material (2 to 15mm clasts) set in an allotriomorphic fine groundmass (about 0.05 to 0.1mm grainsize).

The phenocrysts are smoothly corroded quartz, smoothly corroded lightly to moderately sericitized plagioclase and slim plates of inferred biotite (now coarse sericite and fine rutile ± chlorite). The groundmass is lightly sericitized and consists of untwinned feldspar and quartz. The autoxenolithic material has generally fine groundmass grainsizes and more phenocrysts.

Several porous thin veins (0.2 to 0.5mm wide) carry quartz and chlorite. Some other irregular pores occur in phenocrysts.

An approximate mode is :

1-2%	quartz phenocrysts
10-12%	lightly to moderately sericitized plagioclase phenocrysts
8-10%	autoxenoliths
20-25%	groundmass quartz
45-55%	groundmass feldspar
3-4%	groundmass sericite
0.1-0.2%	groundmass leucoxene
0.5-1%	porous veins, carrying quartz and chlorite
2-3%	other pores

Comments and Interpretations :

This rock has a rhyodacitic composition. Its textures are interpreted to be more consistent with a subvolcanic, intrusive porphyry than a lava flow.

The rock shows light alteration to sericite and minor chlorite, along with fracture veining by quartz with minor chlorite. Pores within some altered phenocrysts and within the veins may well reflect carbonate, now completley removed by weathering.

534031 STRAHAN BX4675

030 Sample Number : Z7280

Identification : Tholeiitic dolerite

Description :

The sample consists of two surficially weathered hand specimens of fine to medium-grained, crystalline igneous rock. Unweathered parts of the rock are slightly greenish, medium dark grey.

A cobaltinitrite staining test revealed disseminated patches of fine K-feldspar.

In thin section the sample displays subophitic, hypidiomorphic and interstitial micrographic textures.

The largest grains (up to 5mm) are pyroxene, apparently both clinopyroxene and orthopyroxene, occurring as prisms which are commonly locked subophitically with plagioclase laths. There are a few anhedral grains of olivine (about 1 to 2mm). The main framework is formed by laths and prisms of fresh, well twinned, calcic plagioclase (0.5 to 1mm). There are a few, generally equant grains of opaque oxide. Interstitial patches, about 0.5 to 2mm in size, consist of micrographic K-feldspar and quartz, commonly accompanied by chlorite and apatite. Additional chlorite occurs as a rim alteration of some pyroxene grains. There are several veins of anisotropic zeolite.

An approximate mode, based on a brief count of 100 widely spaced points, is :

44%	plagioclase
32%	pyroxenes (clino- and ortho-types)
11%	micrographic K-feldspar and quartz
8%	chlorite
3%	opaque oxides
1%	olivine
1%	apatite
<1%	zeolite

Comments and Interpretations :

This rock is identified as tholeiitic dolerite. It is expected to represent a sill, dyke or similarly small intrusion.

The freshness of olivine and plagioclase in this rock is quite inconsistent with a Palaeozoic rock : the rock is probably Tertiary.

Jurassic

031

362000E 640000E 660000E 680000E 370000E 720000E

36000N

34000N

5332000N

5330000N

5328000N

5326000N

5324000N

5322000N

STRAHAN

MACQUARIE HARBOUR

KING RIVER

HWY

LYELL

EL 29/87

EL 30/87

651 627 644, 645 (d) 646 632 631 630 634 633 635 636, 637 (d) 641 643 665 664 666 629 662, 663 674-6 628 622 695 623 696, 697 698 699 638 700 640, 653 (d) 650 639 642, 652 (d) 647 648 649 617 616 667 673 621 672 620 661 619 618 670 624 669 671 626 668 625

51 49 46 39 34, 35, 37 32 29 23 22 19 18 13-16

654 Stream sediment (-80 #) sample location (prefixed BX4, (d) = duplicate sample)

×672 Rock chip sample location (prefixed BX4)

⊗39 Rock chip sample location (Cromer 1988, prefixed NHS-)

90-3076

Scale 1:25000

0 500 1000 1500 2000 2500 metres

FIG. 2

5 cm

534032

BHP-Utah Minerals International
Asia Pacific Division - Exploration Department

EL 29/87, STRAHAN & EL 30/87, KING R, TAS

STREAM SEDIMENT (-80#) AND ROCK CHIP SAMPLE LOCATIONS

Prepared: A. Wilde	Date: Sept. 89	Centre: Melbourne
Drawn: M. Rosker	Project No.: B48/B49	Fig
Checked: A. Wilde	Drawing No.: AI-2345	

032

362000E 64000E 66000E 68000E 370000E 72000E

36000N 34000N 32000N 31000N 30000N 29000N 28000N 26000N 24000N 22000N

STRAHAN

MACQUARIE HARBOUR

LYELL HIGHWAY

TEEPOOKANA FAULT

BLACKWOOD CK

BEEHIVE CK

KING RIVER

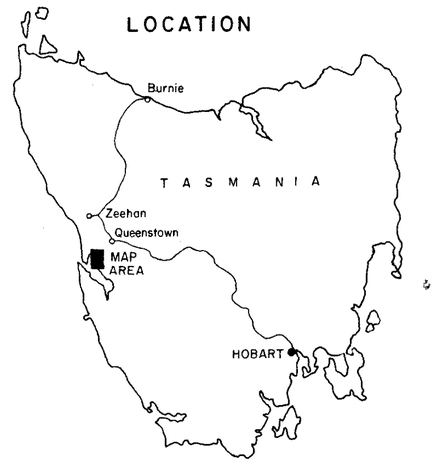
GRAVELLY CK

EL 29/87

EL 30/87

Db Df Sa Og Ss Sv Pc Ts P Qa

LOCATION



LEGEND

POST-CARBONIFEROUS COVER	QUATERNARY	Qa	*Alluvium and dune sands*
	TERTIARY	Ts	*Mainly non-marine sandstones*
	PERMIAN	P	*Glacial sediments*
	DEVONIAN	Db	*Interbedded sandstone and mudstone ('Bell Shale')*
		Df	*Fine sandstone ('Florence Quartzite')*
	SILURIAN	Sa	*Mudstone, minor sandstone*
	ORDOVICIAN	Og	*Gordon Limestone*
	CAMRIAN	€ss	*Turbidite sandstone and siltstone*
		€sv	*Possible volcaniclastic debris flow deposits (65%) and laminated siltstone with micaceous sandst. (35%)*
		€pc	*Pine Cove Creek Volcanics Cleaved basalts and pyroxene andesites. Rare siltstone*

Lithological boundary

Fault, mapped and inferred from aerial photographs and landsat imagery.

Airphoto/Landsat lineament (no evidence of displacement)

Aeromagnetic lineament

Major anticlinal/synclinal axis

Dip and strike of bedding

Dip and strike of dominant foliation

Exploration grid, pegged every 25 m (200m interval shown)

90-3076 I

Scale 1:25000

0 500 1000 1500 2000 2500 metres

FIG. 3

5 cm

534033

BHP-Utah Minerals International
Asia Pacific Division - Exploration Department

EL 29/87, STRAHAN & EL 30/87, KING R, TAS

GEOLOGY & LOCATION OF EXPLORATION GRID

Prepared: A. Wilde	Date: Dec 89	Centre: Melbourne
Drawn: M. Rosker	Project No.: 848/849	Fig
Checked: A. Wilde	Drawing No.: AI-2346	