



TASMANIA
DEVELOPMENT
AND RESOURCES

Mineral Resources Tasmania

REPORT 1994/04

Geochemical reconnaissance of the Four Mile Creek Exempt Area

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INTRODUCTION

The most common style of known gold mineralisation in northeastern Tasmania is mesothermal, quartz-sulphide veins (e.g. Golden Gate mine, Mathinna) in the turbiditic sequences of the Mathinna Beds of Ordovician to Early Devonian age. The Mathinna Beds have been intruded by granitoids of the Scottsdale and Blue Tier batholiths with the production of narrow contact metamorphic aureoles. The granitoids range in composition from granodiorite to alkali feldspar granite and include I- and S-types, which also contain sulphide, magnetite and/or cassiterite mineralisation.

Gold-quartz mineralisation occurs within or close to granodiorite/diorite at Lisle-Golconda and in the Golden Ridge area west of Scamander. Klominsky and Groves (1970) and previous workers have suggested a genetic link between gold deposits and hornblende-bearing granodiorite throughout the northeast.

The St Marys Porphyrite, lying to the south of the zoned mineral deposits of the Scamander-St Helens district, is the only volcanic equivalent of the extensive Devonian-Carboniferous granitoids in northeastern Tasmania.

Scanning of the available exploration records in 1989 showed that this volcanic complex had never been subject to modern mineral search. Consequently it was decided, in the absence of company interest, to take out an exempt area as part of the proposed NETGOLD project, and evaluate the porphyrite for high level gold deposits, either epithermal style veins (e.g. Creede) or breccia-related styles (e.g. Mt Leyshon, Kidston).

The exempt area of 149 square kilometres was proclaimed on 4 December 1989. Subsequently, a report was lodged in the Department by Billiton describing the results of an open range survey of the gold potential of northeastern Tasmania.

During that study, some geochemical sampling was carried out over the St Marys Porphyrite with negative results.

When NETGOLD received project status in 1993 it was decided to complete a more comprehensive geochemical reconnaissance and release the results along with the other NETGOLD data packages for consideration by industry.

Access for exploration is relatively good, with the Tasman Highway traversing the district and the new Chain of Lagoons coastal road and a network of forestry tracks combining to allow four wheel drive vehicles into most areas. The land classification is either State Forest or Private Freehold Land, with two State Reserves at St Marys Pass and St Patricks Head.

GEOLOGICAL SUMMARY

A full account of the geology of the St Marys Porphyrite and associated rocks is available in the explanatory reports of the St Marys (Turner and Calver, 1987) and St Helens McClenaghan *et al.*, 1992) 1:50 000 scale Geological Atlas Series maps published by the Department of Mines. A simplified version of the geology compiled from these sources is represented in Figure 1. The following geological summary is drawn mainly from the most recent published work on the porphyrite by Turner *et al.* (1986), in which a comprehensive bibliography of earlier work can be found.

The St Marys Porphyrite is a felsic, quartz porphyrite body covering some 84 km² in the St Marys, Falmouth and Four Mile Creek districts. It is the only known extrusive representative of the granitoids of northeastern Tasmania. It has a Devonian emplacement age, radiometrically dated as 388 ± 1 Ma.

The body has the form of an extrusive eastern sheet (Zone A) up to 1400 m thick of welded, recrystallised ash flow tuffs, and an intrusive, vesiculated western part which is

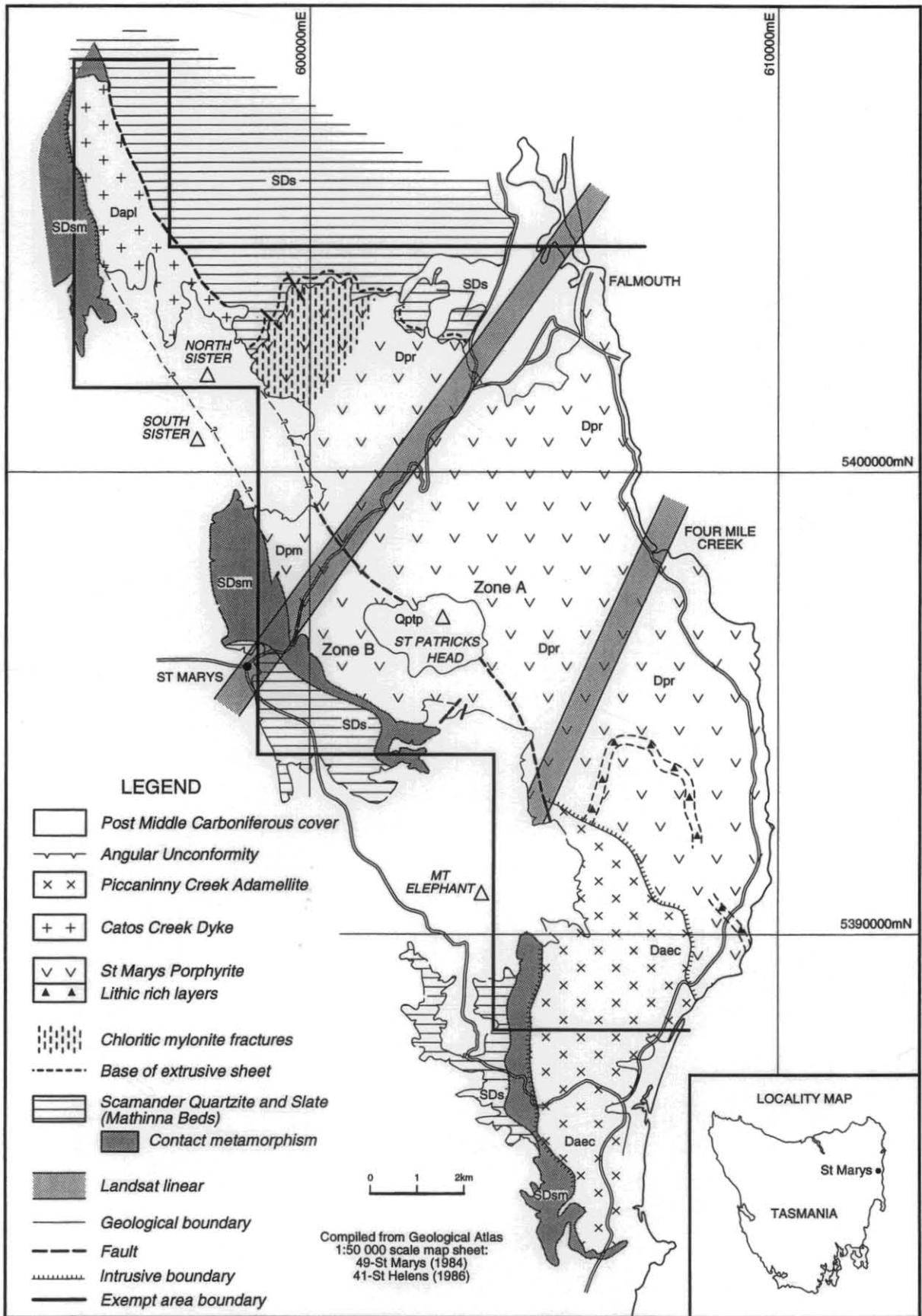
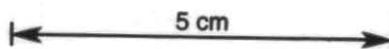


Figure 1

Geology of the Four Mile Creek Exempt Area



interpreted as the high level feeder of the volcanics. This western part (Zone B) is believed to extend to the north under covering Permo-Triassic formations and Jurassic dolerite to eventually find expression in the Catos Creek dyke as a deeper, unvesiculated part of the volcanic feeder.

The boundary between the feeder and the extrusive part of the body is regarded as a subsidence fault.

In the north of the area, the base of the extrusive part (Zone A) of the porphyrite stratigraphically overlies the Scamander Formation (a local variant of the Mathinna Beds) of turbiditic sandstone, siltstone and mudstone with no thermal metamorphic effects. There is some brecciation in the Scamander Formation adjacent to the contact which may be partly of sedimentary origin.

In contrast, the western part (Zone B) and the Catos Creek dyke, a porphyritic, biotite-hornblende micro-granodiorite, are intrusive into the Scamander Beds with a thermal aureole of variable width. The eastern boundary of the Catos Creek dyke has no thermal aureole in the adjacent sediments and is faulted and sheared. An early intrusive breccia is reported along this contact, mostly poorly preserved, but reaching up to 10 m wide north of Cheeseberry Hill.

To the south, the Piccaninny Creek Adamellite, a biotite-hornblende adamellite with a marginal diorite phase, intrudes the St Marys Porphyrite, cutting across compositional banding.

Deformation, following the emplacement of the volcanic rocks, is expressed as chloritic mylonitic fractures throughout the St Marys Porphyrite, becoming locally intense in the north of the area where a narrow fold hinge extends from the sediments into the porphyrite.

Two prominent Landsat linears transect the porphyrite in a NNE direction. The more northerly is defined by the alignment of Ferntree Glen Creek and St Marys Rivulet, the more southerly by the trend of Four Mile Creek. These linears may indicate unrecognised structural breaks. They have the same general trend as several mapped faults within the area and in the region to the north near St Helens, where the faulting is collinear with a prominent structural alignment defined in the detailed NETGOLD aeromagnetics.

Chemically, the St Marys Porphyrite is predominantly dacitic with minor rhyolitic phases. Petrographically, the body consists of crystal fragments, in decreasing abundance, of plagioclase, quartz, biotite, pyroxene, alkali feldspar and minor opaque minerals in a felsic matrix.

On the basis of isotopic evidence and geochemistry, the St Marys Porphyrite, Catos Creek Dyke, and Scamander Tier Dyke to the north, are comagmatic and distinct from the Piccaninny Creek Adamellite to the south, and are part of the early I-type phases of the Blue Tier Batholith.

The depositional environment of the St Marys Porphyrite is considered to be subaerially within a caldera, with the feeder dykes being linear rather than arcuate.

MINERALISATION

No mineralisation has been recorded in the St Marys Porphyrite.

A tributary of Devils Creek, just east of the St Marys Pass area, has the enigmatic name of Gold Mine Gully. Locally, the gully has the reputation of having contained indications of alluvial gold but there are no old workings known and the occurrence remains unconfirmed.

Mr L Rhodes has reported occasional microscopic grains of gold in black sand found in the drainage gutters entering a dam on his property at Four Mile Creek.

There are also local accounts of old hard-rock workings in the Crown Land Block immediately south of Irishtown, presumably in hornfelsed sediments. They have not been visited and located and their possible significance remains unknown.

PREVIOUS EXPLORATION

In 1970, a 166 km² licence (EL 34/70) was taken out by Bay Exploration Pty Ltd and included most of the St Marys Porphyrite as well as the Mathinna Beds to the north. An initial report (Green, 1970), reviewing possible exploration targets in the licence, called attention to the breccia zone in the Mathinna sediments under the St Marys Porphyrite as worthy of further investigation.

A reconnaissance geochemical program was carried out involving both stream sediment and soil sampling (both -80 mesh), of which 19 sites were on limited parts of the porphyrite. The samples were run for copper, zinc, silver and arsenic, and an anomalous subset for antimony, lead, cadmium and tin.

Three anomalous areas were outlined in the porphyrite at Four Mile Creek, Ferntree Glen Creek and south of St Patricks Head, based mainly on antimony values, and these sites were recommended for further work (Abbott, 1970). The licence was relinquished when re-analysis of the samples gave considerably lower values.

A narrow coastal strip of the porphyrite was prospected in 1970 by Inland Exploration NL under licences EL 1/70 and 19/71 (Shirley, 1971), for the heavy mineral content of beach sands which are sporadically developed along the coast. No analyses in any of these licences were carried out for gold.

In December 1991, a report was submitted to the Department describing the results of a study of the gold potential of northeastern Tasmania (Randell, 1991). The assessment included an open range reconnaissance geochemical survey during which ten drainage points were sampled on the St Marys Porphyrite and three at the north end of the Catos Creek dyke. At each site, three sediment samples were collected, namely BLEG, PANCON and -80 mesh. None of the above samples were considered anomalous.

GEOCHEMICAL SURVEY

For a reconnaissance geochemical survey of the gold potential of the St Marys Porphyry, it was decided to concentrate on stream sediment sampling.

The main watershed lies mainly in the west of the area through Mt Elephant (757 m), St Patricks Head (683 m) and the North and South Sisters. As a result, most streams drain east to the Tasman Sea, the exceptions being St Marys Rivulet and Margisons Creek which drain west and Catos Creek which drains north to the Scamander River.

The creeks have relatively steep gradients and are actively erosional with bed loads of boulders, sand and gravel and a relative absence of silt and mud-sized fractions. Consequently, it was decided to collect only a bulk leach (BLEG) and pan concentrate (PANCON) sample at each site and not to attempt the collection of the -80 mesh silt fraction.

Twenty-five drainage sites, spread among the main creeks in the area, were sampled for BLEG and PANCON samples. All samples are composite, being taken from a number of spots along a 20 m section of drainage. Two of these sites proved unsuitable for BLEG samples because of the complete absence of the silt-sized fractions. Duplicate samples were taken from Four Mile Creek and Ferntree Glen Creek (PANCON only) because of their locations on the Landsat linears (fig. 2)

Two PANCON samples of sheet wash were selected from drainage gutters leading into a dam on Rhodes' block, where gold had been reported. One sample of black sand from this area was also subject to a mineralogical scan.

The BLEG samples were selected from active portions of the stream sediment, making sure the fine-grained fraction was not lost.

The material was passed through a 1/4 inch sieve into large plastic bags from which the excess water was carefully decanted after settling. Following air drying, all samples exceeded 5 kg in weight. The samples were submitted to ANALABS for bulk leach extractable gold (BLEG) analysis.

The PANCON samples were selected from sediment trap sites and panned on site down to 100 g or less, the samples being then carefully washed into small plastic bags. Further panning in the laboratory reduced the material to 30 g or less of black sand which was then sent through ANALABS for analyses of gold plus 28 elements by NEUTRON ACTIVATION by Becquerel Laboratories at Lucas Heights.

Three grab samples were taken from prominent oxidised stockworks found locally in the Four Mile Creek area and Salters Gully area. These were submitted to ANALABS for gold, arsenic, copper, lead, zinc, tin and tungsten analyses.

RESULTS

The full analyses of the PANCON samples for gold and 28 other elements are arranged in Appendix 2. Of the 25 sediment samples, only five registered above the 5 ppb detection limit in gold (Table 1). There is no correlation

Table 1
PANCON samples registering above gold detection limit

<i>Sample No.</i>	<i>Drainage</i>	<i>Au (ppb) (PANCON)</i>
C100134	Banticks Creek	328.0
C100135	Little Marsh Creek	24.7
C100137	W Creek	26.6
C100142	Catos Creek	2180.0
C100143	Ferntree Glen Creek	84.0

between these higher gold values and arsenic contents. All silver contents are below 5 ppm.

The highest gold concentration is found in Catos Creek in the far north of the area, with over 2 ppm Au in the pan concentrate (C100142). The catchment is composed of Catos Creek micro-granodiorite and flanking Scamander Bed sediments, hornfelsed on the western side and unmetamorphosed on the eastern side. Lesser Au values occur in the streams draining porphyry lithologies at Banticks Creek (328.0 ppb), Ferntree Glen Creek (84.0 ppb) and W Creek (26.6 ppb). Little Marsh Creek in the south gave a value of 24.7 ppb from its catchment which contains the Piccaninny Creek adamellite lithologies.

No gold values above 5 ppb were found in the pan concentrates from streams draining the chlorite mylonite zone in the north or from Gold Mine Gully or from the drainage gutters of Rhodes' block dam.

Mineralogical analyses carried out on a pan concentrate (C100133) from Rhodes' block using a magnetic separator and x-ray diffraction revealed that the black sand consists of mostly ilmenite and quartz with minor rutile, magnetite, K-feldspar, zircon and very minor plagioclase.

The gold contents of the BLEG samples (Appendix 1) are disappointingly low, ranging from 1.20 ppb down to the detection limit of 0.05 ppb. The samples containing the top five gold contents are shown in Table 2.

None of these samples correlate with the PANCON samples containing the highest gold values. None of the BLEG samples would be considered anomalous when compared

Table 2
BLEG samples with the top five gold contents

<i>Sample No.</i>	<i>Drainage</i>	<i>Au (ppb) (BLEG)</i>
C100136	Little Beach Creek	1.20
C100121	Devils Creek	0.93
C100122	Yorkys Creek	0.45
C100120	Gold Mine Gully	0.44
C100128	Whites Gully	0.31

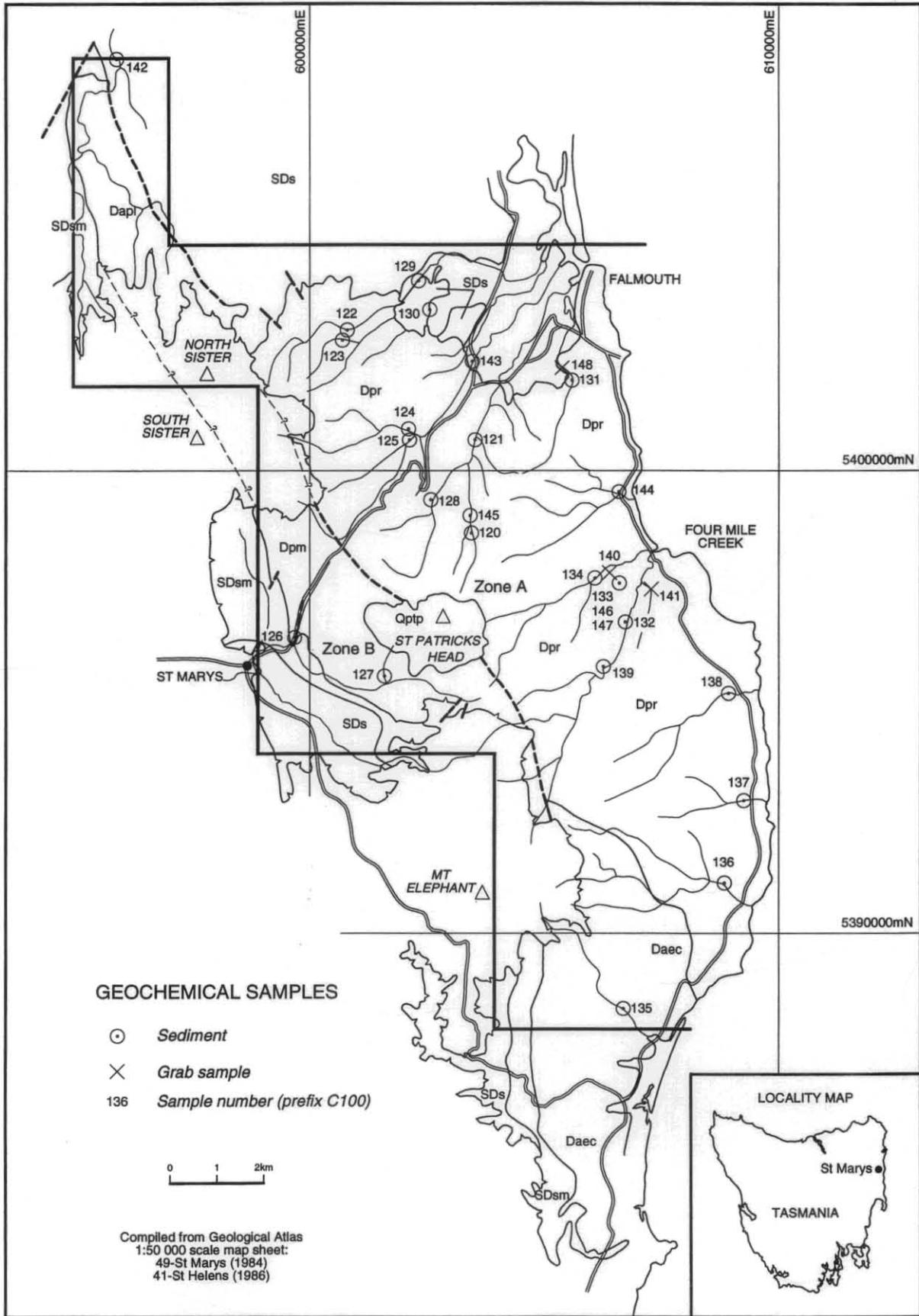
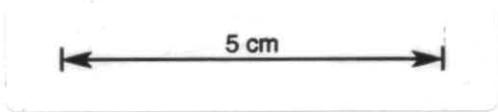


Figure 2

Geochemical sample locations in the Four Mile Creek Exempt Area



with the results from known gold-bearing areas in northeastern Tasmania (Randell, 1991).

The three grab samples of oxidised stockworks (C100140, C100141 and C100148) were found to contain no metal values of any significance (Appendix 3). X-ray diffraction analysis reveals that the oxidised stockworks are combinations of quartz, micas (biotite, siderophyllite), clays (smectite, kaolin/halloysite), prehnite, zeolites, plagioclase and K-feldspar. The oxidised stockworks are considered to be the weathered equivalents of the chloritic mylonite shears.

INTERPRETATION

The Catos Creek sample (C100142, 2180.0 ppb Au) is the most gold-anomalous in the survey. It could be due to a hard-rock gold source in the micro-granodiorite dyke, or in the hornfelsed-sediment aureole to the west, or in the unmetamorphosed sediments to the east. The most predictable types of gold deposits could be disseminated styles in the dyke, stockwork or sheet vein styles in the aureole, or mesothermal quartz lodes in the eastern sediments. Breccia or vein-style gold deposits cannot be ruled out for the micro-granodiorite dyke, considering that breccia is reported along the dyke's eastern margin which is a faulted and sheared structure. It is worth noting that the best development of brecciation is reported in the south, an area drained to the northeast by Balpeys and Binns Creeks neither of which were tested in this survey.

Minor alluvial gold has been reported in tributaries of the Avenue River by Henderson (1939) from an unknown bedrock source. This occurrence is some 2 km northwest of the Catos Creek sample site in a different catchment which drains the aureole sediments.

The two lesser anomalies at Banticks Creek (C100134, 328.0 ppb Au) and Ferntree Glen Creek (C100143, 84.0 ppb Au) have catchments draining the extrusive part of the St Marys Porphyrite and are on or close to Landsat linears. They may indicate a hard-rock gold source in the volcanic rocks or in the interpreted subsidence fault separating the intrusive from the extrusive part of the porphyrite.

The significance of the two remaining gold values at W Creek (C100137, 26.6 ppb Au) and Little Marsh Creek (C100135, 24.7 ppb Au), although five times greater than the detection limit, remains obscure. W Creek drains an area of the porphyrite with a relative abundance of lithic fragments, while Little Marsh Creek has a catchment with an adamellite bedrock. There is a possibility that these values, and the others at Banticks Creek and Ferntree Glen Creek, are derived from the overlying Permian rocks, which form the watershed in the far west of the area, from gold lag on the pre-Permian unconformity or as palaeoplacers in the Permian sediments. This could be evaluated by follow-up sampling.

The failure of the BLEG samples to correlate with the anomalous PANCON samples, or indeed to provide any anomalous responses at all, may be due to the high energy environment of the drainage. The fine-grained sediment fraction may be selectively winnowed out by the streams during transportation and lost to downstream flood plains

and eventually the sea. This means that the BLEG samples will be a less reliable guide to gold anomalies in the catchments than the PANCON samples.

This interpretation is reinforced by the pattern of field sampling which was carried out in two periods separated by an interval of heavy rainfall and flooding over Christmas 1993. The average gold content of the first sampling period (samples C100120–C100132) is markedly greater than that of the second period (samples C100134–C100144), suggesting that flushing of fines is a factor influencing the reliability of BLEG samples to accurately reflect anomalous gold values in drainage catchments.

CONCLUSIONS

The results of reconnaissance stream sediment sampling of the volcanics of the St Marys Porphyrite demonstrate that there are no strong geochemical indications of a substantial gold deposit actively eroding within any of the catchments.

However, a strong PANCON anomaly in the extreme north of the area invites follow-up investigation of the Catos Creek dyke (a possible feeder of the volcanic rocks) and flanking Scamander Beds sediments for a number of possible styles of hard-rock gold deposits.

More subdued gold anomalies, some of which may show structural control (proximity to Landsat linears), may indicate poorly expressed bedrock sources in the volcanic rocks or in association with the subsidence fault interpreted as separating the volcanic rocks from the high-level intrusive part of the St Marys Porphyrite. Successful location of gold mineralisation in the Catos Creek dyke would encourage prospecting of Zone B of the St Marys Porphyrite.

Alternatively, the low-level gold anomalies may be due to dispersion of gold from the overlying Permian formations. Further testing would be required to solve the two possibilities.

None of the BLEG results are considered to be anomalous.

Acknowledgements

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Within Mineral Resources Tasmania, Nic Turner was a valuable source of advice on the geology of the area. Richie Woolley provided the X-ray information, Anthony Hollick arranged the diagrams, Kellie Campbell typed the report which was edited by Michael Dix.

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[8 April 1994]

APPENDIX 1

Gold results from stream sediment samples

<i>Sample No.</i>	<i>Drainage</i>	<i>BLEG (ppb Au)</i>	<i>PANCON (ppb Au)</i>	<i>Sample No.</i>	<i>Drainage</i>	<i>BLEG (ppb Au)</i>	<i>PANCON (ppb Au)</i>
C100120	Gold Mine Gully	0.44	-5	C100135	Little Marsh Creek	0.28	24.7
C100121	Devils Creek	0.93	-5	C100136	Little Beach Creek	1.20	-5
C100122	Yorkys Creek	0.45	-5	C100137	W Creek	0.07	26.6
C100123	Yorkys Creek	0.24	-5	C100138	Old Billys Creek	<0.05	-5
C100124	Lohreys Creek	0.23	-5	C100139	Four Mile Creek	0.17	-5
C100125	Ferntree Glen Creek	0.22	-5	C100140	Banticks Creek Track	-	Grab sample
C100126	St Marys Rivulet	*	-5	C100141	Four Mile Creek Track	-	Grab sample
C100127	Margisons Creek	*	-5	C100142	Catos Creek	0.12	2180.0
C100128	Whites Gully	0.31	-5	C100143	Ferntree Glen Creek	0.15	84.0
C100129	Yorkys Creek	0.12	-5	C100144	Lumera Creek	0.08	-5
C100130	Styx Creek	0.26	-5	C100145	Gold Mine Gully	*	-5
C100131	Salters Gully	0.12	-5	C100146	Rhodes Block	*	-5
C100132	Four Mile Creek	0.23	-5	C100147	Rhodes Block	*	-5
C100133	Rhodes Block	*	Mineralogical analysis	C100148	Salters Gully	-	Grab sample
C100134	Banticks Creek	0.08	328.0				

* BLEG samples not taken

Appendix 2:

Neutron activation analyses

NEUTRON ACTIVATION ANALYSIS

NEUTRON ACTIVATION ANALYSIS REPORT

Date: 28-02-94

DAVE DUNCAN, MINERAL RESOURCES TASMANIA, INDUSTRY SERVICES DIVISION. REF. No: 0782. ANALABS TASMANIA REF. No: 109542.60.10025
BECQUEREL JOB # 633

Page 1 of 3

NOTE:- A NEGATIVE SIGN INDICATES "LESS THAN".

- RESULTS ARE IN PARTS PER MILLION (ppm) UNLESS OTHERWISE INDICATED.
- ELEVATED DETECTION LIMITS FOR SOME ELEMENTS IN SAMPLES WITH HIGH Ta AND Hf.
- ELEVATED DETECTION LIMITS FOR Mo IN SOME SAMPLES DUE TO URANIUM FISSION.
- ALL SAMPLE NUMBERS ARE PREFIXED "PC C".

ELEMENT	DL #	100120	100121	100122	100123	100124	100125	100126	100127	100128	100129
ANTIMONY	.2	-.20	.59	.71	.50	.59	.38	1.19	.69	.62	.59
ARSENIC	1.0	-1.00	1.61	4.03	2.04	1.65	1.13	1.07	-1.00	-1.00	2.04
BARIUM	100.0	372.0	403.0	363.0	376.0	556.0	515.0	362.0	158.0	430.0	496.0
BROMINE	2.0	2.78	-2.00	-2.00	-2.00	2.94	2.22	-2.00	-2.00	-2.00	2.58
CERIUM	2.0	28.70	23.90	50.80	23.40	30.90	21.60	19.20	54.10	37.00	34.50
CAESIUM	1.0	1.69	4.04	2.44	3.93	3.70	3.14	1.88	2.16	2.59	4.57
CHROMIUM	5.0	56.7	19.0	280.0	50.0	58.6	20.2	34.8	194.0	64.6	87.3
COBALT	1.0	10.80	5.44	23.30	11.20	11.90	7.45	4.01	6.61	9.80	12.40
EUROPIUM	.5	-.50	.62	.67	.56	1.02	.85	-.50	.63	.53	.70
GOLD, ppb	5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0
HAFNIUM	.5	96.00	21.90	38.70	66.20	14.20	17.80	83.50	143.00	54.40	14.90
IRIDIUM, ppb	20.0	-20.0	-20.0	-20.0	-20.0	-20.0	-20.0	-20.0	-20.0	-20.0	-20.0
IRON, %	.05	10.60	2.85	5.99	7.96	4.53	3.23	2.55	5.03	8.17	5.55
LANTHANUM	.5	11.40	10.80	23.40	10.00	14.10	11.80	8.40	24.00	17.20	17.00
LUTETIUM	.2	1.16	.41	.65	.89	.46	.43	.85	1.85	.75	.47
MOLYBDENUM	5.0	-5.0	-5.0	-5.0	-10.0	-5.0	-5.0	-5.0	-10.0	-5.0	-5.0
POTASSIUM, %	.2	1.01	2.16	1.20	.97	1.84	2.05	.97	.85	1.63	1.82
RUBIDIUM	20.0	42.9	73.8	43.9	62.7	104.0	107.0	37.2	37.3	69.1	83.9
SAMARIUM	.2	3.72	2.61	4.43	2.22	3.44	2.68	1.57	5.17	3.84	3.53
SCANDIUM	.1	33.90	11.90	30.70	33.20	20.80	14.60	12.70	23.20	28.70	25.90
SELENIUM	5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0
SILVER	5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0
SODIUM, %	.01	.54	1.35	.93	1.13	1.56	1.78	.23	.15	1.03	1.44
TANTALUM	1.0	29.20	5.75	6.47	16.20	5.69	6.31	8.76	16.90	22.70	8.08
THORIUM	.5	8.08	6.02	8.64	6.02	6.15	5.61	7.25	11.60	9.27	7.07
TUNGSTEN	2.0	16.70	3.80	-2.00	-2.00	-2.00	-2.00	6.58	11.10	11.00	-2.00
URANIUM	2.0	4.29	-2.00	3.09	5.45	-2.00	-2.00	4.88	5.61	-2.00	-2.00
YTTERBIUM	.5	6.32	2.70	3.81	4.36	2.78	2.61	3.97	9.20	4.20	2.76
ZINC	100.0	-100.0	-100.0	-100.0	-100.0	-100.0	-100.0	-100.0	-100.0	-100.0	102.0


BQ
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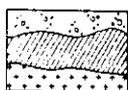
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NEUTRON ACTIVATION ANALYSIS

BECQUEREL JOB # 633

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ELEMENT	DL # 100130	# 100131	# 100132	# 100134	# 100135	# 100136	# 100137	# 100138	# 100139	# 100142	
ANTIMONY	.2	.36	.62	.52	.57	-.20	.50	.88	.91	.78	.29
ARSENIC	1.0	1.19	1.84	1.65	1.41	1.43	1.47	1.85	-1.00	2.07	1.84
BARIUM	100.0	367.0	461.0	470.0	303.0	308.0	453.0	412.0	304.0	460.0	360.0
BROMINE	2.0	-2.00	2.57	-2.00	-2.00	2.14	-2.00	-2.00	-2.00	-2.00	-2.00
CERIUM	2.0	26.70	21.60	34.40	25.10	52.40	32.90	30.50	29.20	47.70	62.20
CAESIUM	1.0	4.26	2.57	3.15	2.50	3.36	2.51	2.49	2.80	2.29	2.79
CHROMIUM	5.0	49.1	29.0	110.0	55.6	145.0	49.9	66.3	88.7	237.0	298.0
COBALT	1.0	10.70	8.09	11.50	11.70	11.40	9.68	14.10	19.00	14.80	9.59
EUROPIUM	.5	1.01	.75	.58	-.50	-.50	.71	.54	-.50	.56	.72
GOLD, ppb	5.0	-5.0	-5.0	-5.0	328.0	24.7	-.50	26.6	-5.0	-5.0	2180.0
HAFNIUM	.5	14.80	38.40	48.10	148.00	29.40	23.20	79.40	101.00	97.90	44.50
IRIDIUM, ppb	20.0	-20.0	-20.0	-20.0	-20.0	-20.0	-20.0	-20.0	-20.0	-20.0	-20.0
IRON, %	.05	5.51	4.97	4.69	10.20	5.02	4.59	11.10	15.90	7.07	5.23
LANTHANUM	.5	13.70	11.00	15.10	9.48	25.40	13.20	13.90	13.10	20.60	28.10
LUTETIUM	.2	.47	.60	.73	1.65	.72	.65	1.24	1.45	1.32	.75
MOLYBDENUM	5.0	-5.0	-5.0	-5.0	-10.0	-10.0	-5.0	-10.0	-10.0	-10.0	-5.0
POTASSIUM, %	.2	1.82	1.50	1.48	1.26	1.22	1.50	1.13	.89	1.37	1.11
RUBIDIUM	20.0	84.9	84.4	73.8	59.4	70.0	81.7	68.0	56.1	60.6	58.2
SAMARIUM	.2	3.06	2.32	3.59	3.19	5.34	4.61	3.75	3.18	4.73	5.82
SCANDIUM	.1	25.10	18.90	19.70	33.80	17.90	22.70	42.20	56.00	28.30	18.20
SELENIUM	5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0
SILVER	5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0
SODIUM, %	.01	1.67	1.69	1.00	.62	.59	.89	.74	.35	.78	.51
TANTALUM	1.0	5.30	12.10	11.60	33.70	6.45	6.57	29.60	43.50	17.00	8.25
THORIUM	.5	5.37	4.04	7.91	7.33	16.80	5.31	8.13	7.35	12.10	11.20
TUNGSTEN	2.0	-2.00	9.19	6.28	17.80	16.90	4.67	25.10	36.10	11.70	46.30
URANIUM	2.0	-2.00	-2.00	2.21	7.83	5.60	-2.00	5.79	6.62	7.96	2.69
YTTERBIUM	.5	2.87	3.26	4.50	8.06	4.31	4.36	6.38	6.79	6.90	4.16
ZINC	100.0	-100.0	-100.0	-100.0	118.0	-100.0	-100.0	169.0	204.0	-100.0	-100.0


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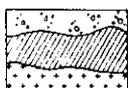
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N E U T R O N A C T I V A T I O N A N A L Y S I S

BECQUEREL JOB # 633

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ELEMENT	DL # 100143	# 100144	# 100145	# 100146	# 100147	
ANTIMONY	.2	.83	2.06	.92	2.76	3.13
ARSENIC	1.0	1.98	-1.00	1.68	7.46	11.60
BARIUM	100.0	480.0	153.0	175.0	-100.0	-100.0
BROMINE	2.0	-2.00	2.19	-2.00	-2.00	-2.00
CERIUM	2.0	32.00	20.40	22.20	46.40	51.20
CAESIUM	1.0	2.35	-1.00	1.21	-1.00	-1.00
CHROMIUM	5.0	103.0	96.8	65.9	163.0	165.0
COBALT	1.0	17.20	17.80	13.30	41.90	33.60
EUROPIUM	.5	.60	-.50	-.50	-.50	.55
GOLD, ppb	5.0	84.0	-5.0	-5.0	-5.0	-5.0
HAFNIUM	.5	124.00	116.00	111.00	817.00	832.00
IRIDIUM, ppb	20.0	-20.0	-20.0	-20.0	-20.0	-20.0
IRON, %	.05	12.50	17.50	15.10	29.10	24.40
LANTHANUM	.5	14.80	8.63	8.89	25.70	25.50
LUTETIUM	.2	1.67	1.42	1.22	7.75	7.13
MOLYBDENUM	5.0	-10.0	-5.0	-10.0	-60.0	-70.0
POTASSIUM, %	.2	.94	.99	1.11	-.40	-.40
RUBIDIUM	20.0	71.6	44.7	52.4	21.3	-20.0
SAMARIUM	.2	4.16	2.60	3.03	4.31	4.22
SCANDIUM	.1	48.90	59.10	45.00	90.40	82.10
SELENIUM	5.0	-5.0	-5.0	-5.0	-10.0	-10.0
SILVER	5.0	-5.0	-5.0	-5.0	-5.0	-5.0
SODIUM, %	.01	.89	.51	.44	.03	.02
TANTALUM	1.0	27.90	46.60	44.70	139.00	120.00
THORIUM	.5	9.75	6.07	7.00	29.10	35.10
TUNGSTEN	2.0	18.80	27.90	20.00	81.60	61.30
URANIUM	2.0	6.04	-2.00	6.63	43.80	44.10
YTTERBIUM	.5	8.34	6.91	7.05	31.10	30.70
ZINC	100.0	174.0	191.0	163.0	801.0	761.0



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Appendix 3

Grab sample geochemistry and mineralogy

<i>Sample No.</i>	<i>Cu</i>	<i>Pb</i>	<i>Zn</i>	<i>As</i>	<i>Sn</i>	<i>W</i>	<i>Au</i>
C100140	4	10	59	<50	8	<5	<0.008
C100141	6	8	52	<50	9	<5	<0.008
C100148	8	5	69	<50	12	10	<0.008
Detection limit	2	3	2	50	3	5	0.008

All values ppm, analysed by ANALABS

<i>Sample No</i>	<i>X-ray diffraction results</i>
C100140	laumontite, quartz, smectite, plagioclase
C100141	quartz, plagioclase, siderophyllite, smectite, kaolinite/halloysite
C100148	quartz, smectite, prehnite, stilbite, mica (biotite/siderophyllite), plagioclase, kaolinite/halloysite, ?pyroxene/K-feldspar

APPENDIX 4

AMG co-ordinates of sample locations

<i>Sample No.</i>	<i>mE</i>	<i>mN</i>	<i>Sample No.</i>	<i>mE</i>	<i>mN</i>
C100120	603 500	5 398 750	C100135	606 750	5 388 450
C100121	603 550	5 400 750	C100136	608 850	5 391 150
C100122	600 800	5 403 200	C100137	609 350	5 393 000
C100123	600 750	5 402 950	C100138	609 000	5 395 350
C100124	602 150	5 400 950	C100139	606 250	5 395 850
C100125	602 150	5 400 750	C100140	606 400	5 397 900
C100126	599 750	5 396 500	C100141	607 400	5 397 850
C100127	601 650	5 395 650	C100142	595 900	5 408 950
C100128	602 600	5 399 300	C100143	603 500	5 402 450
C100129	602 350	5 404 200	C100144	606 700	5 399 700
C100130	602 550	5 403 600	C100145	603 500	5 399 100
C100131	605 600	5 402 050	C100146	606 800	5 397 750
C100132	606 800	5 396 800	C100147	606 800	5 397 750
C100133	606 800	5 397 750	C100148	605 400	5 402 300
C100134	606 100	5 397 850			