**RGC EXPLORATION PTY. LIMITED**
(on behalf of Renison Ltd)

# EXPLORATION LICENCE NO.'S 102/87, 55/89 & 12/92

("Queenstown", "Mt Darwin" &
"Queenstown South")

West Sedgwick & Garfield/Clark Valley

Annual Report April 1993- April 1994

Vol 1 of ..

Compiled by:

SCOTT HALLEY
Senior Geologist

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Distribution:

- Tasmanian Department of Mines
- BHP Minerals Ltd - Brisbane
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# SUMMARY

Exploration Licences 102/87 Queenstown, 55/89 Mt Darwin and 12/92 South Queenstown cover a 40km N-S trending exposure of Cambrian Mt Read Volcanics from Lake Margaret to South Darwin Peak. E.L.'s 102/87 and 55/89 are held by BHP Minerals Ltd and explored by RGC Exploration under a joint venture agreement entered into on 29th November, 1991. RGC acquired an adjoining area as E.L. 12/92 on 12th October 1992, and this was also included in the joint venture. The total area covered by these licences was reduced from 249 sq km to 130 sq kms in March 1994 as part of a compulsory relinquishment.

During 1993/94 exploration focussed on two prospects, West Sedgwick and Garfield. At West Sedgwick, a silica, sericite, pyrite alteration zone was identified below the base of the Tyndall Group, adjacent to a Cambrian growth fault. This zone was tested by a 499m drill hole, WS007. This hole intersected a strongly pyritic alteration system, which was devoid of base metal sulphides. Isotope analyses indicate that it is an area of low temperature alteration, but it has similarities to the stringer envelope zone at Hellyer.

At Garfield, a 388m drill hole, GAR001 tested a pyritic alteration zone. This hole intersected a significant Prince Lyell-style Cu-Au mineralized system. Ground magnetic and induced polarisation surveys were successfully employed to delineate the extent of the alteration system.

# 1. INTRODUCTION

Exploration Licences 102/87 - Queenstown and 55/89 Mt Darwin are held by BHP Minerals Ltd. (BHPM) and an adjoining licence, E.L. 12/92 is held by RGC. These licences are explored by RGC Exploration Ltd under the terms and conditions of a joint venture agreement. Approval was granted allowing the joint reporting of the exploration work because the tenements form a single coherent geological block.

The tenements currently occupy a total area of 130 sq kms surrounding Queenstown extending to the north, in part, some 30 kms to Moxon Saddle and to the south some 25 kms to South Darwin Peak (Figure 1). They cover a significant portion of the Cambrian Mount Read Volcanics. These rocks host a variety of significant mineral occurrences.

| | | | |
|---|---|---|---|
| (i) | Zinc | - | volcanic-hosted massive sulphide deposits, eg. Hellyer, Que River, Rosebery, Hercules and Tasman Crown |
| (ii) | Copper | - | Mt Lyell style mineralisation |
| (iii) | Gold | - | Henty style mineralisation. |

Much of the previous work in this area targeted copper-gold mineralisation of the Mt Lyell style. More recently BHPM covered selected areas with blanket UTEM looking for VMS mineralisation. This was supported by some geological mapping and rock chip/stream sediment geochemistry.

RGC is also exploring these EL's for Rosebery-style VMS mineralisation. The exploration approach which has been applied involves detailed geological mapping in an attempt to identify Cambrian growth faults, possible mineralised horizons and alteration zones. This mapping is supported by multi-element soil and rock geochemistry. Any alteration zones thus identified can be tested by deep drilling and down-hole geophysics.

## 2. LAND TENURE

E.L. 102/87 - **Queenstown** was granted to BHPM on 22nd April, 1988. The tenement initially covered 95 sq kms in three separate parts (Figure 1)

Part (i) - Queenstown of 74 sq kms
Part (ii) - Garfield of 19 sq kms
Part (iii) - Moxon Saddle of 2 sq kms

Part (i) totally enclosed the Mt Lyell Mine Lease, 30M/80. In 1988 Mining Lease Application areas (MLA's) were cancelled by Mt Lyell increasing the area of Part (i) to 79 sq kms. Again in early 1992 additional MLA's were relinquished further increasing Part (i) to 84 sq kms. This tenement covered 105 sq kms and was due for 50% reduction on or before 22nd April, 1993. A meeting with representatives of the Department of Mines Tasmania (DMT) was held on 15th April, 1992 where RGCE expressed its interest in postponing the reduction date by 12 months due to its recent entry into the Agreement with BHPM.

E.L. 55/89 - **Mt Darwin** was granted to BHPM on 5th May, 1990. This tenement covered 78 sq kms and links Parts (i) and (ii) of E.L. 102/87 (Figure 1) resulting in a continuous exposure of Mt Read Volcanics over a strike length of 40 kms which is explored as a single coherent block. Because of this BHPM was successful in gaining approval from the DMT to jointly report on exploration activities (15th March, 1991).

E.L. 12/92 - **South Queenstown** was granted to RGC on 12th October 1992. This tenement forms a narrow strip partly enclosing the other E.L.'s. It was divided into 3 parts:

Part (i) - 49 sq kms on the eastern side of the West Coast Range
Part (ii) - 15 sq kms over Mt Sorell and Mt Strahan
Part (iii) - 2 sq kms south of Lake Margaret.

A significant portion of E.L.'s 102/87 and 55/89 was within the South-West Conservation Area (SWCA) and considered to be environmentally sensitive. Despite the revocation of Conservation Area status in

areas north of Macquarie Harbour exploration activities in the Garfield/Clark Valley are still subject to approval from the Mineral Exploration Working Group.

In March 1994 as a result of a compulsory partial relinquishment the total area covered by the three E.L.'s was reduced to 130 sq kms. This is made up of:

E.L. 102/87 Part (i) Queenstown - 56 sq kms
Part (ii) Garfield - 18 sq kms
Part (iii) Moxon Saddle - 2 sq kms

E.L. 55/89 Part (i) Mt Darwin - 28 sq kms

E.L. 12/92 Part (i) West Coast Range - 16 sq kms
Part (ii) Mount Sorell - 8 sq kms
Part (iii) Lake Margaret - 2 sq kms

# 3. WORK COMPLETED

## 3.1 West Sedgwick

Diamond Drilling Tas were contracted to drill WS007 from the saddle between Agglomerate Hill and Zig Zag Hill. An LY44 rig was flown in by helicopter on 4 February 1993. The hole was cased off in HQ at 103m and continued in NQ to 499.2m. The hole was ended on 8 March 1993. At the time of writing last years annual report the rig and core had not been removed from the drill pad. After the core was lifted out it was logged and sampled. Since most of the core was altered but not obviously mineralized, it was sampled with a core grinder in ten metre composite intervals. The intention was to resample in more detail any anomalous zones evident from the first round of sampling. The zones of most intense alteration were cut in half and sampled in one metre intervals. All samples were analysed for Cu, Pb, Zn and Ag by AAS at Analabs in Cooee, and were also assayed for Au by fire assay.

Drill holes WS006 and WS007 were surveyed with down hole SIROTEM. This work was done on contract by McSkimming Geophysics. Existing grid lines were used as far as possible to lay out the energising loops, but some additional line cutting was required. An array of 200m by 200m energising loops was used at each hole so that at least one of the loops would effectively couple with a hypothetical conductor in the vicinity of the drill holes.

In October 1993 Outer Rim Geophysics were contracted to survey the Comstock drill hole C072 with the new Crone 3-component Pulse EM system. It was decided at the same time to resurvey WS007 with this system. This time a single 400m by 400m energising loop was employed.

The nature of the alteration system in WS007 was investigated with a small number of stable isotope analyses. Two samples were analysed for whole-rock Delta $^{18}O$ and three pyrite samples were analysed for Delta $^{34}S$. The analyses were performed at the Central Science Laboratory at the University of Tasmania.

## 3.2 Garfield Prospect

During the initial mapping of the Garfield grid a zone of intense chlorite-pyrite-sericite alteration was noted within an andesite unit. The alteration zone appeared to be related to a fault which offset the andesite to the south. Soil samples from the alteration zone reported up to 0.48% Cu and 0.12ppm Au (Halley, 1993). It was decided to investigate this area in more detail. An area of approximately 1km by 1km was remapped at 1:1000 scale. Following this a drill hole was designed to test the alteration zone. The hole was drilled by Diamond Drilling Tas with a Longyear 38 rig. The final depth of the hole was 388m. The equipment was flown in from a clear pad near the surge pond beside the Mount Jukes Road. Drilling commenced on 23rd May, 1993 and was finished on 18th June, 1993. The hole intersected a broad copper bearing pyritic alteration zone. One hundred and five metres of core was sampled in 1m intervals. It was assayed at Analabs for Au by fire assay and for Ag, Cu, Pb and Zn by AAS.

Following the success of the first drill hole a second phase of exploration was planned. Magnetite within the alteration system indicated that ground magnetics would be a simple way to delineate the extent of the alteration system. The similarity to Prince Lyell mineralization also indicated that IP would map out the extent of sulphide bearing alteration. Since the existing grid was at a line spacing of 200m, a local baseline at 2100E was cut from 1800N to 3400N and infill cross lines at 100m spacings were cut from 1900N to 2700N. Also additional short N-S lines were cut at 1800E, 2000E and 2200E where further information was required to accurately locate a NE trending fault.

The initial soil sampling survey sampled every second line, that is at 400m spacings, at 50m intervals, although this was closed up to 200m line spacings over the Garfield Prospect. After the new lines were cut, they were soil sampled by hand auguring at 25m intervals. The sampling interval was also closed up to 25m on the original lines. These samples were analysed for Au, Ag, Cu, Pb and Zn. The N-S lines across the NE-trending Garfield Fault were also soil sampled at 25m intervals. These samples were analysed for a suite of elements by INAA with the objective of using the trace element chemistry to distinguish lithologies and constrain more tightly the position of the fault.

The ground magnetic survey was contracted to Brendan Stedman. Approximately 12 km of grid lines were surveyed. The data was processed in-house by RGC and presented as a series of stacked profiles and as a contour plan. The gradient array IP survey was conducted by Geoterrex. The transmitting electrodes were located on line 2200N at 1300E and 3100E. The receiver dipole was 50m in length and lines between 1800N and 2600N were surveyed. In addition, line 1800N was surveyed with dipole-dipole IP.

Drill hole GAR001 was surveyed by Outer Rim Geophysics with 3-component down hole pulse EM. Two 400m by 400m energising loops were used. The survey was designed to test for massive sulphides stratigraphically above the pyritic alteration zone, and to test for more massive mineralization along the fault zone.

## 3.3 Penghana Prospect

Following the discovery of the mineralization at Garfield some common features of mineralized systems south of Henty were recognised. Most of the Cambrian alteration systems in this area can be related to andesitic to basaltic volcanics belonging to the "suite 2" of Crawford et al., (1992). The alteration at Garfield also included a magnetite-rich zone similar to Prince Lyell. As a result of these observations, the open file aero-magnetic data was overlaid on the regional geology to see if any other "suite 2" andesites had a magnetic signature similar to the Garfield andesite. The most obvious area was the "Horse Paddock Andesite" at Penghana Hill near the Lake Margaret turnoff. Furthermore, this andesite occurs in the stratigraphic footwall of the Madam Howards Barite prospect and a hydrothermal system related to the andesite might provide an explanation to these enigmatic veins. Work on the Penghana Prospect is at a preliminary stage and results are not yet available for reporting. Work underway at present includes reclearing the old West Sedgwick grid and cutting infill lines at a 100m spacing, mapping at a scale of 1:1000, a ground magnetic survey and a soil geochemistry survey sampling 200m spaced lines at 25m intervals.

# 4. RESULTS AND DISCUSSION

## 4.1 West Sedgwick

A summary log of drill hole WS007 is as follows:

0 - 69m felsic feldspar-phyric volcaniclastics
69 - 157m amygdaloidal basaltic pillow lava
157 - 289m strongly foliated andesite
289 - 348m massive intermediate to massive lava
348 - 499m interbedded siltstone and crystal-rich feldspathic sandstone

A more detailed log and the assays are presented in Appendix 1. Zones of significant silica-sericite-pyrite alteration occurred from 45 to 155m and from 295 to 350m. The basaltic lavas contain abundant siliceous spheres up to 10mm in diameter which are interpreted to be silica-filled vesicles. Irregular bands of grey cherty material up to 5cm wide commonly occur within the basalt. These are interpreted to be interpillow chert. Pyrite occurs throughout this unit, typically around 1 to 2%, but locally up to 20%.

The second alteration zone is more intense than the first and occurs in a mixed lava, volcaniclastic sequence. It includes some intensely silicified zones and pyrite contents locally up to 30%. In one interval, some epiclastic material appears to be bedded with semi-massive pyrite. This is overlain by a strongly pyritic quartz phyric unit. The alteration terminates abruptly at a black siltstone unit. The siltstone is followed by a grey crystal-rich feldspathic sandstone derived from an andesitic provenance. This is interpreted to be a local basal unit of the Comstock Tuff, similar to the Lynchford Tuff. The absence of a pink colouration in this rock is attributed to weak sericitic alteration. This drill hole indicates that the base of the Tyndall Group is an important stratigraphic position for VMS related alteration and mineralisation, as has been noted elsewhere in this region.

Ninety-three samples from WS007 were submitted for assay. This included 36, 10m

composite samples of ground core and 57, 1m intervals of halved core. The assay results were very disappointing. None of the base metals were above 1000ppm, and only a few of the gold assays were above the detection limit (0.008ppm).

A few samples were submitted for stable isotope analysis to determine why such a strong alteration system was devoid of mineralisation. Two whole rock samples were analysed for their oxygen isotope ratio and three pyrite samples were analysed for their sulphur isotope ratio. The whole rock delta$^{18}$O values were +13.5 and +13.1. These results suggest that the alteration was produced at a temperature of around 200 degrees. This explains the lack of base metals, since it is likely that temperatures of 250 to 300 degrees are required to transport significant levels of base metals. The pyrite delta$^{34}$S values were +15.3, +32.4 and +46.3. In low temperature, barren, pyritic VMS systems a delta$^{34}$S signature of around 0 per mil would be expected, this signature being derived from the leaching of rock-sulphur in the volcanic pile. The values from WS007 indicate that seawater sulphate has been the source of the sulphur. The sulphate has been reduced and $^{34}$S fractionated between oxidized and reduced sulphur species to produce the high sulphur isotope ratios. The reduction of sulphate to $H_2S$ has a high activation energy, and laboratory studies indicate that temperatures above 240 degrees are required to drive this inorganic reaction. This suggests that WS007 intersected the margins of a hotter alteration system, which does have potential for base metal alteration. The only other recorded place in Tasmania with the same combination of highly $^{34}$S-enriched pyrite and high whole rock delta$^{18}$O values is in the stringer envelope zone (SEZ) at Hellyer. The most likely interpretation of the Hellyer results is that the SEZ is a zone of entrainment and mixing of cold shallow-circulating seawater with hot upwelling reduced hydrothermal fluid. A similar situation is envisaged at West Sedgwick.

Drill holes WS006 and WS007 were logged with the SIROTEM downhole TEM system. No conductors were located within the vicinity of either hole. Details of the survey and its interpretation are presented in Appendix 2. The lack of any "character" in the WS007 survey was surprising given the amount of pyrite in the hole. It was decided to resurvey the hole with three-component Pulse EM when the contractors were on site at Mount Lyell. This survey corroborated the results of the first survey. These details are presented in Appendix 3.

## 4.2 Garfield

The Garfield Prospect was remapped at 1:1000 scale, with traverses along grid lines, and in the critical areas along creeks. Three main units were identified. These include: (i) a package of quartz-phyric lavas and volcaniclastics belonging to the Yolande River Sequence. These rocks are easily identified by their glassy quartz phenocrysts. They have a pale green, sericitic , moderately foliated groundmass. The volcaniclastics are medium to fine grained and are not easily distinguished from the lavas. (ii) a hornblende-feldspar-phyric andesite. The andesite has a sheet-like geometry, conformable with the stratigraphy, ranging between 20 and 150m thick. The geometry suggests that it is a lava, but conformable intrusive sills of other lithologies are common elsewhere in the YRS. The southern end of the andesite is offset by a SW trending fault. (iii) a pale grey, feldspar phyric lava lying stratigraphically above the andesite. This rock occurs within the YRS but resembles the CVC both mineralogically and chemically (eg. it has a high Zr/Ti ratio). In float, it is difficult to distinguish from finer-grained volcaniclastics of the YRS. Bands of andesite, possibly intrusive, occur within this unit. With the poor degree of exposure of these rocks, the andesite bands cannot be mapped out even with 1:1000 scale mapping.

A zone of outcropping pyrite, chlorite, sericite alteration occurs in the andesite immediately to the north of the SW trending fault. The alteration has been mapped over an area of about 200m by 100m and is best developed on the western side of the andesite. Magnetite is locally abundant, but is more common towards the eastern side, separate from the pyrite. Within the alteration zone andesite outcrops generally have a leached outer rind about 2cm thick, but within the fresh kernel they are green and chloritic with veins of pyrite up to a few mm thick as well as disseminated pyrite. The pyrite content is up to 10%.

During the auger sampling of soil from the new grid lines and infill sampling from the old lines, 187 samples were collected. The Cu and Au values of these samples were surprisingly low when compared to the results from the first round of sampling (Appendix 4). The highest Cu value was 331ppm and the highest gold, 164ppb. This compares to a previous high of 4800ppm Cu. Two possible reasons for the discrepancy were investigated. Different digests for AAS were used in the two rounds of assaying, perchloric acid in the first

round and aqua regia/perchloric acid on the second round so that vanadium could be assayed from the same digest. Although it was considered unlikely that this would make a significant difference, a number of pulps from each round of sampling were reassayed using a perchloric acid digest. The repeat values are given below:

| sample | Cu value | Cu value (repeat) |
|---|---|---|
| T39948 | 4800 | 4750 |
| T39949 | 1200 | 1240 |
| T40037 | 175 | 175 |
| T40038 | 50 | 49 |
| T40054 | 260 | 261 |
| T40055 | 19 | 19 |
| T45272 | 40 | 42 |
| T45273 | 36 | 42 |
| T45274 | 40 | 44 |
| T45275 | 331 | 373 |
| T45276 | 126 | 140 |
| T45277 | 9 | 10 |

The repeat assaying indicated that the original assays are reliable and that the different digests made no difference. The possible affect of the sampling technique was also investigated. A number of sites were selected within the alteration zone and soil samples were collected at different depths in the soil profile (Appendix 5). Although there was some difference between samples from the same site, there was no systematic variation between B-horizon and C-horizon samples. The conclusions reached from the repeat sampling and check assaying were that the two high Cu values (4800 and 1200ppm) obtained in the first round of sampling were fortuitous, and secondly that the soil geochemical signature of the Garfield mineralisation is very subtle, typically 40 to 200ppm Cu, and any Au value above the detection limit is significant. Gold was the most reliable indicator of the mineralised zone with a range of 10 to 200ppb.

Drill hole GAR001 was designed to test the alteration zone at Garfield, north of the Garfield Fault. The hole was drilled far enough north to avoid the possibility the Garfield Fault might

have a northerly dip and cut off the mineralisation at depth. This placed the hole to the north of the best soil geochemistry values. A summary log of the hole is as follows:

0.0 - 17.5 feldspar phyric dacitic lava
17.5 - 34.5 andesite
34.5 - 89.4 feldspar phyric dacitic lava
89.4 - 102.7 quartz phyric rhyolite lava
102.7 - 148.4 andesite
148.4 - 175.0 quartz phyric rhyolite lava
175.0 - 318.5 mineralised, chlorite-pyrite altered andesite
318.5 - 388.5 rhyolitic epiclastics and lavas

Sulphides, dominantly pyrite, occurred from 170m to around 330m. The sulphides occurred in a widely spaced stockwork of veinlets up to 5mm wide. The veinlets commonly also contain calcite. Disseminated sulphides are also common. The sulphide content is typically 2 to 5% but locally up to 40%. The matrix of the rock is altered to chlorite and sericite, with narrow selvedges of sericite alteration commonly around the veins. Coarse crystals and veins of magnetite are also a common feature. These are not evenly distributed through the rock, but occur in discreet magnetite-rich zones. The magnetite commonly occurs in association with clusters of coarse pink apatite. Chalcopyrite is generally very fine grained and occurs in intimate association with pyrite. Intervals without visible chalcopyrite commonly returned significant Cu assays (up to 2000ppm Cu). The nature of the sulphides and the magnetite-apatite association is very similar to the Prince Lyell mineralisation.

The drill hole was assayed in 1m intervals from 175m to 280m. A detailed drill log and the assays are presented in Appendix 6. The Cu values averaged 0.38% over 105m. Gold occurred at low levels throughout the hole with a maximum value of 0.58ppm. Like Prince Lyell, the Zn and particularly Pb values are very low.

Following the recognition of magnetite as part of the alteration system at Garfield, it was decided to conduct a ground magnetic survey. The lines surveyed were from 1600N to 3200N, with readings taken at 5m intervals. Details of the survey and the results are in Appendix 7. The interpretation of the ground magnetics was constrained by measurements

of remnant magnetism in drill core samples from GAR001 (Appendix 8). The extent of the magnetite bearing alteration is clearly evident in the results of the survey. The main alteration zone extends from 2000N to 2300N as expected from the mapping. The surprising result is that the faulted-off southern extension of the andesite also contains secondary magnetite although no alteration had been mapped in this area.

The IP detected strong chargeability responses over the main alteration zone, particularly on lines 2000N, 2100N, 2200N and 2300N. Surprisingly, chargeability responses were also detected on lines 2400N and 2600N, although with a lower amplitude. A weak chargeability feature was observed on line 1800N, coincident with the magnetic anomaly on the southern part of the andesite. These results are also discussed in Appendix 7.

Drill hole GAR001 was surveyed with three component downhole Pulse EM. No off-hole conductors were detected. Specifications of the survey and an interpretation of the results is presented in Appendix 9.

# 5. PROPOSED WORK

## 5.1 West Sedgwick

One more hole is planned to test the West Sedgwick alteration zone. The alteration terminates to the north against an E-W growth fault. Mapping suggests that it dies out to the south. The lack of an EM response suggests that no mineralization occurs between the hole and the surface. The only option left is to drill a deeper hole beneath WS007. A hole has been planned to intersect the stratigraphic top of the alteration system 200m below WS007. This hole should commence in May 1994.

## 5.2 Garfield

It appears that the alteration at Garfield is controlled by the SW trending Garfield Fault, and their is a likelihood that higher grade mineralisation may be encountered adjacent to the fault. Consequently a second drill hole has been planned to intersect the alteration zone

between GAR001 and the fault. Other ideas under consideration are:

1. Drill testing the IP anomaly north of 2200N
2. Extending the IP survey to close off the chargeability anomaly north of 2600N
3. Drill testing the magnetic anomaly on line 1800N
4. Trying to identify the seafloor position at the time the Garfield mineralisation formed, and assessing the Pb-Zn potential of this horizon.

## 5.3 Penghana

As already mentioned, infill gridding, mapping, a soil geochemistry survey and a ground magnetic survey are already underway at Penghana. Assessment of these results is likely to be followed by an IP survey and drill testing of the best anomalies.

## 5.4 Other Areas

Earlier work by BHP at Moxon Saddle identified an IP chargeability anomaly along the Henty fault. RGC intend to follow up this anomaly by mapping, soil sampling and possibly by drilling. Also a review of previous exploration at the Beatrice Prospect, on the southern slopes of Mount Sedgwick, will be compiled. The possibility of an extension of the Beatrice mineralisation to the south beneath glacial cover will be assessed.

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# APPENDIX 1

## WS007 Drill Log and Assays

# APPENDIX 2

## Interpretation of Downhole TEM Survey Results, Drill Holes WS006 and WS007: by R.C. Deakin

# APPENDIX 3

**Report on Three Component Down Hole, Pulse EM Results from the West Sedgwick Prospect**

**by**

**R.C. Deakin**

# APPENDIX 4

**Soil Geochemistry Results**
**Garfield Prospect**

# APPENDIX 5

**Soil Geochemistry Results, Profile Sampling**
**Garfield Prospect**

# APPENDIX 6

## GAR001 Drill Log and Assays

# APPENDIX 7

**Interpretation of Ground Magnetic and Induced Polarization Data**
**Garfield Prospect, Tasmania**
**E.L. 102/87**

# APPENDIX 8

**Report on Magnetic Properties of Drill Core Samples from Garfield Prospect, Tasmania**

**by**

**P.W. Schmidt**

# APPENDIX 9

**Report on Three Component, Pulse EM Results from the Garfield Prospect, South West Tasmania**

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**R.C. Deakin**