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# REPORT ON EL ~~23/90~~ 29/92

## HEEMSKIRK AREA

## JUNE 30, 1992



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# 1 SUMMARY


1.1 Most of EL 23/90 is underlain by the Devonian-Carboniferous Heemskirk Granite, a small, partly offshore, pluton with significant tin and sulphide mineralisation (Ag-Pb-Zn) to its credit.

1.2 There are five types of mineralisation known to occur. Of these the most important economic variety is the tin-polymetalic sulphide (Ag-Zn rich) mineralisation.

1.3 The Granite body has an extensive metamorphic aureole. Associated mineralisation is predominantly replacement type skarn or fissure-infilling tin-polymetalic sulphides.

1.4 Several smaller replacement-type tin-sulphide deposits are known adjacent to the northern contact of the Heemskirk Granite. Of these, St.Dizier has indicated reserves of 5mt at 0.5% Sn.

1.5 Total recorded tin production was 667.57 tons Sn-in-concentrate to 1962. There is a small scale alluvial tin mining operation in the North Heemskirk area (Twelve Mile Creek) at present. Production from this operation was 2.395 tonnes in 1986/87. There has been little production since.

1.4 The area has seen extensive regional and prospect evaluation since the sixties. Despite this, the area is relatively underexplored. Several anomalies identified by geophysics and geochemistry have yet to be drilled for more detailed assessment.

1.5 The Heemskirk Granite has not been systematically exploited for its dimension stone value in the past. Initial marketing has shown there is a strong buyer interest in red and white varieties of the Heemskirk Granite.

1.6 The alluvial deposits in the North Heemskirk area do not appear to have been extensively explored. The deposits in the Tasman River valley were worked early this century, producing 167.06 tons Sn-in-concentrate to 1939.

1.7 The South Heemskirk area (Federation-Sweeney's-Globe) was extensively explored by Renison in the late 70's and early '80's. Tonnage potential exists at Sweeney's, Anomaly 1 and Anomaly 4 (Agnew Grid). The potential is >1,000,000 tonnes at 0.6% Sn, 2% Zn and 30 g/t Ag. Further drilling will be required to quantify tonnage and grade.

1.8 Several anomalies have been identified at North Heemskirk

by geophysics and geochemistry. These require further exploration. Some are too deep for surface exploration so diamond drilling will be required. Geopeko Ltd drilled an intense elongate magnetic anomaly near Gourlays Creek, north of Granville Harbour and established widespread sub-economic tin-sulphide skarn mineralisation. No diamond drilling has been carried out to test the Central Anomaly in the St.Dizier-Big H area. The North Heemskirk area has excellent potential for Renison-style replacement skarn tin-polymetalic sulphide mineralisation.

1.9 No deep drilling (200-500 metres) has been carried out in the area covered by EL 23/90. The most likely target for deep drilling is South Heemskirk in the Federation-Sweeney's-Globe Mine area.

1.10 There is a strong investor and buyer interest in the development of this granite/tin mining project. The investment interest is potentially worth A$ 200 million over two years and is dependant on both areas of operation, i.e., the granite dimension stone quarrying operations and the tin mining operations. A company is being set up to manage the project.

1.11 An exploration program has been designed to test the above concepts.

## 2. GENERAL INTRODUCTION

EL 23/90 was issued to Cavenridge Pty Ltd on May 29, 1991. On August 15, 1991 it became the subject of litigation between Cavenridge and Western Red Mining NL.

This report details the research and field reconnaissance that was done on the area. Also included is a proposed work program for 1992-93 to support Cavenridge's application for ETA 294.

## 3. REVIEW OF PREVIOUS WORK

### 3.1 Introduction

The review has included everything that could be found on the area and its products. Because there is a significant amount of material yet to be studied, the review will continue into 1993.

The Heemskirk Granite outcrops as the Heemskirk Range, west of Zeehan on the West Coast of Tasmania. The intrusion is of Devonian/Carboniferous age (330-360 million years), and consists of a red granite in the upper and eastern part, which was intruded by a slightly younger white granite in the lower and western part near the coast.

The Heemskirk is a mineralised granite comparable to other mineralised granites in the world. Tin was discovered at North Heemskirk in 1876. Then followed a boom period which saw many operations go bust because of over-optimism and failure to identify reserves before investing in plant and equipment. Mining has been sporadic since then, with 667.57 tons of tin in concentrate being produced to 1962.

Modern exploration started in the 1960's. The area has been extensively explored by several large companies, including CRA, Geopeko, Aberfoyle, and Renison. In their annual reports to the Mines Department, these companies identified a number of geophysical/geochemical anomalies and ore bodies which were not large enough to warrant further exploration expenditure by these companies.

The main types of mineralisation have been identified as follows :

1. Cassiterite in greisen veins, pipes and masses of soft greisenised granite, and in quartz-tourmaline-topaz-muscovite alteration in fracture zones.

2. Cassiterite in argillised red granite immediately above the red/white granite contact.

3. As polymetalic veins and bodies, the dominant variety being tin - zinc - silver sulphides.

4. As replacement in country rocks, usually as pyroxene-garnet skarns with tin as complex borates and silicates.

5. As a result of the above mineralisation, detrital (eluvial) and alluvial deposits of tin occur in valleys to the north and south of the Heemskirk Range.

There is not much mining activity in the area at present. A small scale alluvial tin mining operation has been working a number of leases and prospecting claims in the North Heemskirk Field. However, the prospectivity of the area remains high for tin and base metal deposits.

3.2 North Heemskirk

Following is an extract from Lewis 1985 on Exploration Licence 2/85 held by Gippsland Oil and Minerals NL. EL 2/85 covered the northern area of EL 23/90 :

" . . .

The licence area straddles the northern contact of the Devonian Heemskirk Granite with the enveloping sequence of Adelaidean-Cambrian sediments (Oonah Quartzite etc.). This intrusive is the source of tin (tungsten) and base metal (Pb-Ag-Zn-Cu) mineralisation, including Queen Hill, Severn and Montana. Several tin prospects have been located in the North Heemskirk area such as the St.Dizier-Central Anomaly-Big H Zone, Donnelly's and Twelve Mile Creek. A small tin resource has been drilled out at St.Dizier on mineral leases held by Apollo-Renison joint venture.

Most of the tin occurrences are skarn related mineralisation traced from past workings, outcropping gossan or by follow-up of magnetic and E.M. anomalies. A substantial amount of alluvial tin has been recovered from sections of the Tasman River. Minor tin occurrences have been found in greisen patches at the margins of the intrusive body. . . ."

NOTES :

1. Queen Hill, Severn and Montana are 5 - 6 km east of the Heemskirk Granite intrusion. They are not included in EL 23/90.

2. The St.Dizier Leases are now held by Paringa Mining and Exploration Co. P.L.C. Indicated reserves are 5mt at 0.5% Sn.

3. Aberfoyle/Gippsland's 'Donnelly's Anomaly' appears to be the southern extension of Geopeko's 'Granville East Anomaly'.

Work completed on Donnelly's by Aberfoyle in 1982 included soil sampling. Soil geochemistry was very erratic with maximum values of 650ppm Sn, 100ppm $WO_3$, 810ppm Cu, 400ppm Pb and 1950ppm Zn. A chip sample of skarn located south of the grided

area returned a value of 1.35% Sn. A chip sample of gossan assayed 25ppm Sn, 467ppm $WO_3$, 1700ppm Cu, 135ppm Pb and 2.6% Zn (see Rumbout 1984).

Geopeko assays of costean samples of the 'Granville East Anomaly' returned values up to 11% Sn and averaged 3% Sn over 10 metres. (see Heithersay 1983).

Diamond Drilling was conducted by Pickands Mather International in the St.Dizier-Big H area in 1967. Hole H101 was collared 200m west of the anomaly defined by ground magnetics by Cominco Exploration in 1973 (the Central Anomaly). This hole was 160 metres long and drilled parallel to strike. 1.2 metres of 0.45% Sn was intersected in the last 20 metres of the hole, with the highest value being 0.64% Sn.

No further diamond drilling has been carried out at the Central Anomaly. Cominco estimated the depth of the anomaly to be approximately 130 metres from ground magnetics. In June 1980 Aberfoyle conducted a RAB drilling program. The highest value obtained was 650ppm Sn.

In 1980, Aberfoyle conducted a bedrock geochemical program on the Twelve Mile Creek Anomaly. Maximum values obtained were 30ppm Sn, 30ppm $WO_3$, 60ppm Cu, 40ppm Pb, 90ppm Zn and 20ppm As. Trench sampling gave maximum values of 260ppm Sn, 20ppm $WO_3$, 160 ppm Cu, 20ppm Pb and 25ppm Zn.

Geopeko drilled the Gourlays Creek Anomaly and established widespread sub-economic tin mineralisation.

The review of existing data has shown that the alluvial deposits at North Heemskirk have not been extensively investigated by the large companies. However, local knowledge is quite extensive and has revealed eight prospects in the North Heemskirk area covered by Exploration Licence 23/90. The local knowledge is from several sources who do not wish to be named for fear of persecution.

Six of these prospects are in valleys of tributary streams of the Tasman River and Healy Creek, between St Dizier Creek and Healy Creek. The other two prospects are tributary streams of the Heemskirk River, south of the Pieman Road and west of the River. These deposits appear to be pods ranging in size from about three metres to about 200 metres diameter.

### 3.3 South Heemskirk

The West Cumberland Tin Mining Company commenced mining on the Federation Mine property in 1879. The Federation Mine was the largest producer on the Heemskirk Field, ceasing production in

1938. Total recorded production is 194 tons Sn-in-concentrate.

Several other mines in the South Heemskirk area have produced tin. The majority of these older mines exploited cassiterite-rich quartz/topaz and/or tourmaline zones of greisen vein complexes. The main mines of interest in the area covered by Exploration Licence 23/90 are Sweeney's (or Birthday) Mine, Globe Mine and Montague Mine.

The area between the Federation Mine, Sweeney's Mine and the Globe Mine was extensively explored by Renison between 1976 and 1986. Exploration included geophysics (magnetic, electromagnetic, induced polarisation, resistivity, and self-potential surveys), geochemical surveys, and diamond drilling.

Sweeney's Mine was investigated between 1976 and 1979, including eighteen diamond drill holes. Six of these holes intersected poly-metallic sulphide mineralisation with economically significant tin, zinc and silver grades. Results for the mineralised sections of two such diamond drill holes are as follows:

| | | |
|---|---|---|
| SWY 11 | 23 m | 1.17% Total Sn, 0.81% Acid Soluble Sn, 1.70% Zn and 121 g/t Ag. |
| SWY 15 | 31.4 m | 0.62% Total Sn, 0.09% Acid Soluble Sn, 1.92% Zn and 31 g/t Ag (see Wells 1977). |

The area between Sweeney's Mine and the Globe Mine was investigated between 1980 and 1984 by Renison. Ten anomalies were identified by geophysics and geochemistry. Subsequent diamond drilling at Anomalies 1 and 4 (see Figure 4) intersected poly-metallic sulphide mineralisation similar to Sweeney's. Cartwright (1983) has included order-of-magnitude estimates for the tonnage potential of the ore bodies at Sweeney's and Anomaly 1. Both orebodies are similar with potential for 500,000 tonnes. Only one hole was drilled at Anomaly 4 so no estimate of the tonnage potential could be made. However, the tonnage potential is expected to be of similar magnitude to Sweeney's and Anomaly 1 (Cartwright 1983).

At Sweeney's, Anomaly 1 and Anomaly 4, two styles of mineralisation were found. One is the tin and silver rich poly-metallic sulphides; the other is tin-bearing but sulphide poor. Geophysical methods would have great difficulty locating the sulphide poor zones.

Extracts from Wells (1978a) and Cartwright (1983) are included in the Appendix.

## 4. GRANITE DIMENSION STONE

### 4.1 Introduction

The potential of the Heemskirk Granite as building and ornamental stone was recognised early this century by R.T.Baker (1915). A small amount was mined and shipped from Granville Harbour in the early 1900's. A small quarry was established near Trial Harbour by Dunn Monumental Masons Pty Ltd in 1989. These appear to be the only commercial exploitations of the Granite as dimension stone.

Several different varieties of the granite have been identified. These include whites, greys, speckled whites, greens, pinks, bright reds, dark reds and porphyritic types. All these varieties may be marketed, subject to the establishment of a viable quarrying operation.

### 4.2 Initial Exploration

Initial exploration has shown that there are three main varieties of the Heemskirk Granite. These are a medium-coarse grained dark red variety, a medium-coarse grained white variety and a fine-grained white variety. On Exploration Licence 23/90, the most easily accessible of these for development is the medium-coarse grained white. We have named the medium-coarse grained white 'Tasman'. The area of interest is between the Tasman River and Fosters Creek on the coast.

### 4.3 Initial Marketing

Initial market research has indicated that there are markets for both the dark red variety and Heemskirk 'Tasman'. The major market for both 'Tasman' and the dark red variety appears to be Japan.

The value of the Japanese granite dimension stone industry was worth about A$ 1.1 billion in 1990. It is estimated that the total dimension stone industry in Japan is worth between A$ 5 and 6.4 billion annually, comprising building stone A$ 2 billion, and tombstones between A$ 3 and 4 billion (Tradescope Aug 1991).

Mr John Dobson of Hobart has been a stone mason for 17 years. Mr Dobson has advised there is currently a Chinese granite on the market which looks very similar to Heemskirk 'Tasman'. This granite is available in small block sizes only, up to about one cubic metre.

'Tasman' is available in large joint block sizes up to about 10 x 3 x 3 metres. It appears that the chinese variety is very popular but, according to Mr Dobson, it would be an advantage if it were available in larger block sizes for some contracts. It appears that quarries producing Heemskirk 'Tasman' would, therefore, have a ready-made market. Market research has concentrated on both the dark red variety and Heemskirk 'Tasman'.

Several companies have shown an interest in the development of Heemskirk Granite as a dimension stone resource. They include:

- Normandy Poseiden Ltd (Manfred Marx, Exploration Manager Diamonds and Commercial Minerals);
- Destag (Germany, Horst Homberg);
- Melocco (wholly-owned subsidiary of Boral Ltd; Kevin Hurst, General Manager);
- Simon Friend (Melbourne, importer/exporter);
- Dobsons Monumental (J.Dodson, Managing Director);
- CDK Stone Pty Ltd (Jonathan Hiatt, Russell Saton);
- Western Granites (Bathurst NSW, Tim Hector, Managing Director);
- Finska (stone producer, Finland);
- Kokan Kogyu (Japanese mining company);
- Amatek (Rocla Quarry Products, SA, John Hall);
- Stonetile (NSW);
- Clutha Minerals (Malcolm Robinson, Manager Exploration and Minerals); and
- Arup Facade Engineering (John Perry).

## 5 OTHER WORK

### 5.1 Field Work

Permission to do field work (reconnaissance and hand sampling) was granted with the granting of EL 23/90.

Chris Sharples (Consultant Geologist, Dimension Stone) visited the North and South Heemskirk Granite on June 25-26, 1991 and again on July 9-11, 1991. This was an initial exploration program designed to locate potential quarry sites for red granite. No easily accessible sites were located in either the North or the South Heemskirk areas of EL 23/90.

Several field trips were made to visit old workings and to walk the length of the Coast Road (Climie's Track). The purpose of these trips was for identification of granite types and for reconnaissance. The trips were made by the writer and by Mark Tseglakoff of Cavenridge (on some). The areas visited were Globe Mine, Sweeney's Mine,

Federation Plateau, Montague Mine, Cornwall Mine and Prince George Mine and the Coast Road. Some hand samples were taken.

## 5.2 Finance

There is a strong investor interest in this project. The strongest interest is coming from Asian sources (Hong Kong and Japan) but there is also a European interest.

Negotiations with some investors are at an advanced stage. There is a potential investment of around A$ 200 million over the next two years.

## 5.3 Marketing

Market research has concentrated on both the dark red variety and Heemskirk 'Tasman'.

### 5.3.1 Brief History of the Industry

Mankind has used natural stone for building and construction purposes since the earliest times. The Pyramids of Egypt are an important example and are evidence of the strength and durability of the stone used in their construction.

Dimension stones are natural rocks that are cut to specific dimensions for use mainly by the building, construction and monumental industries. Granite, sandstone, slate and marble are important to the industry in Australia.

The Australian dimension stone industry began soon after the arrival of the First Fleet with the quarrying of sandstone for buildings. The quarrying of granite started in the early 1900's. Since this time, granite has been widely used for monuments, structural work, external claddings, and steps and paving.

From the early 1950's to the late 1970's, usage declined due to the increased use of concrete for structural work, and artificial cladding materials replaced granite because they were cheaper and easier to handle. Subsequently, granite has been used mainly for large development projects of both high and low-rise buildings, particularly public and semi-public buildings.

In the past decade, durability problems in some concrete products has resulted in architectural preference for

natural stone, particularly granite. In addition, recent technological advances in the production of granite slabs have reduced costs considerably. These factors have increased the demand for granite, both within Australia and overseas.

5.3.2 Applications of Granite Dimension Stone

Granite is without doubt the hardest and most durable stone used for building. Because it is such a hard stone, granite can take the roughest and toughest treatment without a care. Because of its time defying characteristics, granite is used extensively for external work. It is largely unaffected by erosion and pollution. It is commonly used in polished form, but may also be used with honed, flamed, exfoliated and other surface finishes. Typical applications include:

- Large dimension blocks are used for load bearing structures (e.g. large monuments, base courses and plinths, bridge piers, retaining walls, etc). These are a minor modern use;

- Veneers are a major modern use, with interior and exterior applications (e.g. wall cladding). Granites used for external work, in particular, must be free from deleterious minerals which would cause staining or erode;

- Furniture and decorative features (e.g. bench- and table-tops). Granite has become popular as an almost indestructible kitchen working surface. Initial research has shown that there is a strong demand for Heemskirk 'Tasman' for this type of interior work;

- Paving. Tiles may be of various sizes. Small blocks called "setts" are used for a "cobble-stone" effect (e.g. driveways);

- Monuments and memorials (e.g. gravestones). The monumental industry is a mainstay of the granite dimension stone industry;

- Crushed granite has a variety of uses [e.g. "terrazzo", concrete aggregates (including pre-stressed concrete beams), reconstituted granites, cement rendering, landscaping, etc]

5.3.3 Australian Production

Different methods of recording production and sales

| | 1987/88 | | 1988/89 | | 1989/90 | | 1990/91 | |
|---|---|---|---|---|---|---|---|---|
| | t | A$ | t | A$ | t | A$ | t | A$ |
| TAS | 925 | NA | 163 | NA | 85 | NA | 865 | NA |
| VIC | NA | | NA | | 12600 | 472900 | NA | |
| SA | 10002 | 1564709 | 12060 | 2302377 | NA | | NA | |
| WA | NA | | 0 | 0 | 1239 | 1789485 | NA | |

Table I : Australian Production of Granite Dimension Stone.
(Source : State mines departments)

statistics have made market research difficult. The Australian Stone Industry Association has "guessed" that Australian production is about 5000 cubic metres per annum (personal comment by Malcolm Robinson, President of A.S.I.A.). Available state production figures are presented in Table I. The major producing states are Victoria, South Australia and New South Wales. The Mines Department of New South Wales does not distinguish between granite and other dimension stones in recording statistics.

Tasmania is a small producer by national standards and Australian production is insignificant by world standards.

### 5.3.4 Overseas Trade

Last financial year, Australia exported A$ 2.5 million worth of granite dimension stone, mainly as unworked stone, and imported A$ 36.6 million, mainly as finished products. This is a ratio of 14.6:1 and obviously contributes to Australia's balance of trade problems. However, it is more satisfactory than in some previous years, as shown in Table II.

There is, therefore, a need to replace imports with Australian stone products and this is currently being encouraged. Opportunities exist for preference to be given to Australian stone, particularly in public projects.

The Australian industry is dominated by small scale producers and is labour intensive with relatively low technology still applied by most producers and processors. Most of the companies involved are limited by lack of scale and the inability to supply larger project

requirements on time. This has resulted in a preference for more reliable overseas suppliers.

These factors contribute to Australian granite being generally more expensive than overseas products. Production costs for Australian producers and processors are generally higher and quarry resources smaller. Governments of some import countries give assistance to their producers.

| YEAR ENDING JUNE: | IMPORTS (A$) | EXPORTS (A$) |
|---|---|---|
| 1991 | 36,582,895 | 2,507,893 |
| 1990 | 36,534,351 | 2,697,536 |
| 1989 | 20,865,867 | 1,070,173 |
| 1988 | 8,103,501 | 259,160 |

Table II : Overseas Trade (Source: ABS)

The industry in Australia has not marketed itself well in the past. It has a poor image both within Australia and overseas and there is an urgent need to overcome entrenched attitudes and outdated management practices. The Australian Stone Industry Association has recently been formed with the objective "to promote the use of Australian dimension stone both within Australia and overseas."

5.3.5 S.W.O.T. Analysis

Analysis of strengths, weaknesses, opportunities and threats best summarises the position with regard to the dimension stone industry.

5.3.5.1 Strengths

The primary strength is resource availability. The Heemskirk Granite has been described as the largest 'ore-body' in Tasmania for development as a dimension stone resource. It covers a large area of Exploration Licence 23/90.

The Heemskirk Granite is an undeveloped dimension stone resource. All granites are essentially unique which means that markets should be forthcoming for all varieties of both the red and white granites.

Access to the northern area of the granite is good with a sealed road (the Pieman Road) to within seven kilometres of the closest outcrops of Heemskirk 'Tasman'. It would only be necessary to upgrade about 2.5 kilometres of gravel road to be able to produce from the first quarries.

Initial test results indicate that Heemskirk 'Tasman' is free from deleterious minerals.

Initial market research has shown that there is a market niche for Heemskirk 'Tasman'. That is, filling the gap in the market which results from the chinese granite which is very similar to Heemskirk 'Tasman' but is only available in block sizes up to about one cubic metre.

Initial market research has shown that there is a strong demand for Heemskirk 'Tasman' for interior work.

Preference is being shown for natural stone, particularly granite, in modern architecture.

All parties associated with this project are enthusiastic about making a success of it by turning current weaknesses into future strengths.

5.3.5.2 Weaknesses

The major weakness is lack of experience in dimension stone quarrying operations. However, all parties involved agree that the development of expertise in large and efficient quarrying operations is only a matter of time.

There is also a lack of expertise in marketing of dimension stone.

There is poor availability of marketing information.

The access road to Heemskirk 'Tasman' includes two bridges. The bridge over the Tasman River is in good condition but will require re-decking before work can progress to trial excavations at sites identified. There is another bridge over a creek which will need to be completely upgraded. However, the mining contractor has indicated that there is an inexpensive solution to this problem.

The West Coast of Tasmania is very isolated from potential markets.

There is a high freight component in all stone mined on the West Coast.

Currently, there is no opportunity to add value to stone by processing within Tasmania. Our short term future is therefore in quarrying.

There is limited availability of local capital for

development.

The dimension stone industry is a high risk business, needing capital to start and where returns cannot be guaranteed.

5.3.5.3 Opportunities

This is a unique opportunity offering the potential to develop a unique resource. The only commercial exploitation of the Heemskirk Granite to date has been on a small scale.

There is a strong interest from overseas investors in this project.

Opportunities exist for import replacement with local granites.

5.3.5.4 Threats

The industry within Australia is extremely competitive.

The Australian industry is dominated by imports.

Overseas, the industry is dominated by big players and is also extremely competitive.

There is the possibility of overseas companies purchasing Australian resources. This could prevent further development of the resources.

Currently world markets are over-supplied with granite dimension stone. Despite this, there is the opportunity to develop unique resources.

There is a national downturn in the Australian building industry and, according to industry sources, any upturn is unlikely before 1994.

There is strong competition from substitute products. Despite this, granite seems to be maintaining, if not increasing its market share.

Getting planning approvals for new quarry developments is complex and time consuming and there is no guarantee that approval will be granted.

5.3.6 Competitors

5.3.6.1 Tasmania

In Tasmania, the only producer of granite dimension stone is Dunn Monumental Masons Pty Ltd based at Launceston. Dunns are a small scale producer, operating four quarries, including one near Trial Harbour, in the Heemskirk Red Granite. None of Dunn's quarries are in continuous production and the major use is for local monumental work.

It is understood that another small quarry is to be developed in the Heemskirk Granite by Western Red Mining N.L. in the near future. This quarry will be near the Dunn quarry and both quarries will produce the dark red variety. It is expected that the Western Red Mining quarry will also be a small scale producer, not geared for the export market.

5.3.6.2 Australia

All companies surveyed were very reluctant to talk about their operations and generally seemed very bearish about new prospects. The largest producers of granite dimension stone in Australia are Melocco, Amatec and Stonetile.

New South Wales : Melocco is a wholly owned subsidiary of Boral Ltd and the largest dimension stone producer in Australia. They are based at Alexandria NSW and operate 30 quarries of granite, marble, bluestone and sandstone in New South Wales, Victoria and Northern Territory. Melocco employs about 200 people in its operations.

The General Manager of Melocco, Mr Kevin Hurst, has shown an interest in the development of the Heemskirk Granite to the extent that he has offered a Quarry Master to train our own. He has indicated that Melocco may be able to assist us with marketing. Mr Hurst says Melocco has a product which is very similar to the Heemskirk dark red variety.

Stonetile is also based in Alexandria, and produces granite and sandstone. Director, Mr Robert Grimson, has indicated that Stonetile may be able to assist with marketing.

Granite production in New South Wales is increasing and appears to be developing export potential. New South Wales has the largest processing capacity.

South Australia : Amatek is based in Gepps Cross SA, trading as Rocla Quarry Products. They specialise in

granite quarrying and processing and are very bearish about new prospects.

Mr John Hall of Amatek said the domestic market is dead and they have been exporting. Mr Hall says that Amatek would be interested in exceptional colour varieties only (strong reds, green, blue and gold).

5.3.7 Market Research - Tin

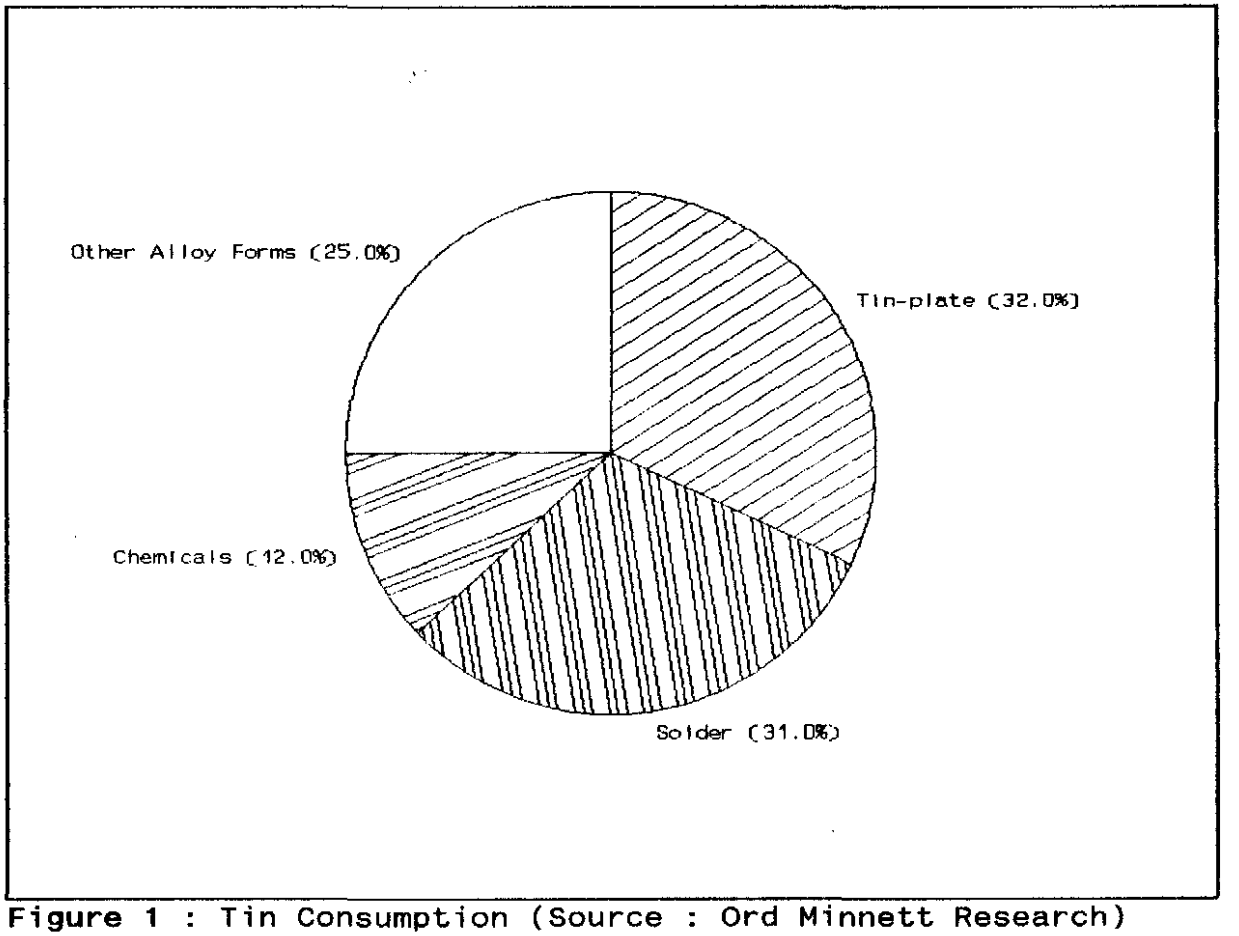


**Figure 1** : Tin Consumption (Source : Ord Minnett Research)

In the second quarter of 1992, the tin price made some significant improvement. In June 1992, the Kuala Lumpar tin price was A$ 8316 and steady.

Mine and smelter closures continued throughout 1991. Brazilian authorities finally shut down the Bom Futuro garimpo in August 1991 on environmental grounds. This has caused a drop in metal output from Brazil with exports unlikely to exceed 18,000 tonnes for the year.

RTZ closed the Canadian East Kemptville mine in late 1991. This has removed approximately 4,500 tonnes from 1992 world production. RTZ also closed the Capper Pass refinery in the UK in early 1991.

Malaysian production fell by almost 30% during 1991. This was a far bigger fall than had been expected.

During 1991 the world tin supply fell by almost 10% (to 159,000 tonnes), while consumption fell by a little over 2.5% (to 176,000 tonnes). Recent improvements in the tin price could see the Malaysian miners back to their old workings during the second half of 1992.

## 6 CONCLUSIONS AND RECOMMENDATIONS

6.1 With strong buyer and investor interest, the development of a viable granite/tin mining operation in Heemskirk Field seems certain. The investment opportunities are equally dependent on both areas of operation, namely granite dimension stone quarrying and tin mining and concentrating. There is a potential investment in Tasmania of around A$ 200 million over the next two years.

6.2 Due to the strong buyer interest, the evaluation of suitable quarry sites in the Tasman River-Fosters Creek area is recommended. This area has potential for quarries of the medium-coarse grained white granite (Heemskirk 'Tasman'). This work would require a number of trial excavations to be carried out, testwork (by Amdel Ltd), and a market survey to be completed. A feasibility study should then be completed.

6.2 Little exploration appears to have been done on the alluvial deposits at North Heemskirk. These deposits have been worked sporadically since 1876, often by inefficient operations, and little work has been reported on evaluation of the extent of the deposits.

A program of geochemical sampling, pneumatic drilling (to bedrock) and trenching is therefore recommended to evaluate the tonnage and grade of the alluvial/detrital deposits at North Heemskirk. This program would require the cutting of grids in areas identified by geochemical stream sampling.

A feasibility study should be conducted to determine if the tonnage and grade would support a processing plant. This will require metallurgical testing and bulk sampling.

6.3 Tonnage potential exists at Sweeney's, Anomaly 1 and Anomaly 4 (Agnew Grid). The potential is >1,000,000 tonnes at 0.6% Sn, 2% Zn and 30 g/t Ag. A processing plant treating 400 tonnes per day would therefore have a possible life of >10 years.

It is recommended that a drilling program be carried out to quantify the tonnage and grade of Sweeney's, Anomaly 1 and Anomaly 4. A feasibility study should then be conducted to determine if the tonnage/grade would support a processing plant.

6.4 In the North Heemskirk area, little work appears to have been done on several anomalies identified by geophysics

(electro-magnetics, magnetics and induced polarisation). In most cases the anomalies have been prospected by surface exploration but little diamond drilling has been conducted. In some cases the anomalies are too deep for surface exploration. At the present stage, the anomalies which appear to have the highest potential are Central Anomaly, Gourlays Creek and Granville East/Donnelly's.

A diamond drilling program is therefore recommended to test these anomalies.

6.5 No deep drilling (200-500 metres) has been carried out in the area. A program of deep drilling is therefore recommended. At the present stage, the most likely target area will be the Federation-Sweeney's-Globe Mine area at South Heemskirk.

# 7 PROPOSED WORK PROGRAM

## 7.1 Development Proposal

A company is being set up to manage the development proposal which is as follows:

1. The development of a viable dimension stone industry using the Heemskirk Granite. This includes:

   (a) exploration, evaluation and development of quarries to provide a range of marketable products;

   (b) marketing of quality products to Australian and overseas customers; and

   (c) research and development of facilities for down-stream processing of the granite to add value to export dollars and provide local employment opportunities.

2. The development of a viable tin/base metal mining industry in the Heemskirk field. This objective includes :

   (a) exploration, evaluation and development of alluvial tin mining operations in the North Heemskirk field;

   (b) further exploration, evaluation and development of other tin/base metal prospects in the area;

   (c) research and development of concentrating facilities for the products of these base metal mining operations;

   (d) marketing of the products of these base metal mining and processing operations.

It is proposed to develop dimension stone quarrying operations and alluvial tin mining operations during the first 12 months of operations.

## 7.2 Proposed Work Program 1992/93

### 7.2.1 Dimension Stone

With a view to developing a dimension stone quarrying operation during the first half of 1993, the following

work is proposed during 1992/93:

1. Exploration and evaluation of potential quarry sites in the medium-coarse grained Heemskirk White Granite ('Tasman') in the Tasman River-Amy Creek area on the coast.

2. Trial excavations be completed on a number of the sites identified during stage 1. Testwork and a market survey to be completed.

3. A feasibility study be completed with the view to developing a quarry or quarries in this area during the first half of 1993.

4. Exploration and evaluation of potential red granite quarry sites.

5. Trial excavations be completed on a number of the sites identified during stage 4. Testwork and a market survey to be completed.

6. A feasibility study be completed with the view to developing a quarry or quarries in the red granite in the second half of 1993.

7.2.2 Tin

With a view to developing an alluvial tin mining operation in the North Heemskirk field during the second half of 1993, the following work is proposed for 1992/93:

1. Continue the review of existing data to identify the most prospective areas for alluvial/detrital tin deposits. Collate data of previous explorers.

2. Conduct a geochemical drainage survey to further eliminate unprospective areas.

3. Cutting of grids in most prospective areas. Soil sampling will be carried out. Pneumatic drilling to bedrock will be required. Some trenching will be necessary to obtain samples for metallurgical testwork. An estimate of tonnage and grade will be made.

4. A feasibility study will be completed to determine if tonnage/grade will support a processing plant.

7.3 Proposed Work Program 1993/94 and 1994/95

This is a preliminary proposal for subsequent years and may be subject to change:

1. Continued exploration and evaluation of dimension stone quarry resources.

2. Diamond drilling to quantify tonnage and grade at Sweeney's, Anomaly 1 and Anomaly 4 (Agnew Grid) South Heemskirk. Completion of a feasibility study.

3. Drilling of anomalies at North Heemskirk. At the present stage, the most prospective anomalies for drilling are Gourlays Creek, Central Anomaly and Granville East/Donnelly's.

4. Deep drilling (200-500 metres) will be conducted in 1994/95. At the present stage, the most likely target area for deep drilling is the Federation-Sweeney's-Globe Mine area at South Heemskirk.

## 7.4 Proposed Budget 1992/93

### 7.4.1 Dimension Stone

| | |
|---|---|
| Preliminary exploration & evaluation | $ 7600.00 |
| Roadworks & trackworks | 35000.00 |
| Trial excavations | 13400.00 |
| Preparation & testwork | 8000.00 |
| Market surveys | 10000.00 |
| Review of quarry operations | 2000.00 |
| Surveying and mapping | 18,900.00 |
| Development plans/feasibility studies | 50000.00 |
| Rehabilitation | 5000.00 |
| TOTAL (Dimension Stone) | $ 149,900.00 |

### 7.4.2 Alluvial Tin

| | |
|---|---|
| Review of existing data | $ 3500.00 |
| Geochemical stream sampling | 900.00 |
| Grid cutting | 4200.00 |
| Soil sampling | 4000.00 |
| Pneumatic drilling | 32000.00 |
| Costeans and sampling | 4200.00 |
| Consultants | 17000.00 |
| Metallurgical testwork/assaying | 45000.00 |
| Feasibility study | 20000.00 |
| Rehabilitation | 5000.00 |
| TOTAL (Alluvial Tin) | $ 135,800.00 |
| TOTAL EXPLORATION BUDGET | $285,700.00 |

# 8 APPENDIX

## 8.1 REFERENCES

### 8.1.1 General Geology

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8.2 EXTRACTS FROM SELECTED REFERENCES

8.2.2 From Lewis (1985) :

pages 4 - 6

" . . .

3. PREVIOUS EXPLORATION: SUMMARY DETAILS OF MAIN PROSPECTS

a) Donnelley's

Following Dighem and ground magnetic surveys, a tin gossan was found. This magnetite-skarn mineralisation which assays up to 1.35% Sn is located adjacent to and partly within the Heemskirk Granite. The secondary sequence (Oonah Quartzite and equivalents) contains: quartzite, interbedded mudstone and quartzite, mudstone, skarn and calc-silicate. Mapping has revealed at least two different skarn horizons. Ground magnetic coverage has located several anomalies in this area. Soil sampling indicates that areas anomalous in tin, tungsten, copper, lead and zinc are located about the features detailed by ground magnetics.

No drill testing has been conducted.

b) St.Dizier Zone

This zone is composed of three mineralised skarn occurrences located along an E-W trending suite of contact metamorphosed sediments. (St.Dizier, Central Anomaly and Big H.)

The mapped area shows a magnetite-pyrrhotite zone bounded to the north by tourmalinised sediments and quartzites and to the south by argillites.

The western area of mineralisation (St.Dizier) is contained within leases held by the Apollo Group/Renison J.V. A potential reserve of 600,000 tonnes at 0.6 % Sn has been outlined by drilling.

In the Central Anomaly area there are at least three parallel skarn horizons. Ground magnetics delineated a magnetite bearing skarn horizon with an interpreted depth of 130 metres. Previous drilling by Pickards Mather in 1967 intersected a narrow interval of tin (1.2m at 0.45% Sn) in hole 101. This hole was 200 m west of the magnetic anomaly and drilled parallel to strike.

The skarn horizons in the Central Anomaly region need further exploration by drilling to determine whether the

anomalies represent economic mineralisation at depth. Unlike St.Dizier and Big H, where the mineralisation is near the surface, the depth of the anomalies in the Central Anomaly region prohibits further evaluation by surface exploration.

c) Twelve Mile Creek

Originally selected as a conductive zone from the Dighem Survey. This area is dominantly argillaceous sediments and a SIROTEM survey did locate a narrow conductor with a strike length of 100m. However, the ground magnet survey outlined a lenticular anomaly with a strike length of 600 metres and of similar appearance to the anomalies about the St.Dizier skarn zone. The area has limited outcrop and this possible skarn occurrence remains untested.

d) Tasman River Zone

An area of anomalous magnetics and low resistivity delineated in the Dighem survey. A zone of possible skarn horizon is indicated by ground magnetics conducted over grided area."

. . .

"f) Dighem Anomalies 228C and 229A

These anomalies are considered to be possible conductor anomalies with associated magnetic responses. Limited IP and ground magnetic surveys have located the anomalies as a 120 gamma peak."

. . .

"h) N.W. Anomaly plus Granite Anomalies

These magnetic anomalies are believed to be situated within the Heemskirk Granite.

. . . "

8.2.2 From Heithersay (1983)

pages 19 - 20

" . . .

3.4 Granville East Mineralisation

Several occurrences of magnetite and pyrrhotite have emerged in the Granville East Prospect. Magnetite is limited to the costean on line 9990N and the narrow intersection in DDH 1. Sn values from the one metre channel samples over the magnetite siderite zone averaged 3%Sn with one value reaching a high of 11%Sn. These extraordinary values of Sn warranted closer inspection, so samples of the mineralisation were sent to Central Mineralogical Services." . . . "H.W. Fander's conclusion was that the dominant tin species was hydrocassiterite, which appears as a white leucoxene like mineral in thin plates and cellular aggregates. Fander considered that this hydrocassiterite was introduced from elsewhere, possibly as a result of a breakdown of Sn sulphide. Part of the Sn species are acid soluble indicating stannite. The crushed magnetic fraction was assayed and found to have over 1%Sn, indicating that some of the tin is indeed contained in magnetite probably as cassiterite. In addition to this study a 1 metre sample from DDH 1 was selected. The interval from 39-40m was chosen as the metre interval assayed 0.36%Sn. This interval was segmented into approximately 10cm blocks and individually assayed.

The results were as follows:-

| Sample No. | Sn | Cu | As | Zn | Bi |
|---|---|---|---|---|---|
| .11471 | 50 | 1010 | 500 | Tr | Tr |
| .11472 | 500 | 200 | 300 | 300 | 500 |
| .11473 | 250 | 300 | 300 | 400 | 300 |
| .11474 | 750 | 750 | 100 | 500 | 500 |
| .11475 | 300 | 200 | 100 | 200 | 1000 |
| .11476 | 100 | 1000 | | 1500 | 300 |
| .11477 | 500 | 100 | | 100 | - |
| .11478 | 1% | 500 | | 300 | Tr |
| .11479 | 1.5% | | | 200 | - |
| .11480 | 1500 | | | 2000 | - |

Samples 11472, 11474, 11478 and 11479 were submitted for petrographic investigation." . . . "H.W. Fander's conclusion is that the tin is present as fine needle cassiterite. Individual crystals are of the order of 5-10 microns thick, with aggregates attaining a maximum size of 200 microns, generally within quartz and goethite and occasionally in magnetite. Fander suggests that this has formed as a late

stage supergene, low temperature formation, that is post dating skarn formation. He also discusses Sn in silicate form released during serpentinisation. Fander's conclusion is that Sn occurs as these two forms and has not moved far from source.

. . . "

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. . .

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| .11474 | 750 | 750 | 100 | 500 | 500 |
| .11475 | 300 | 200 | 100 | 200 | 1000 |
| .11476 | 100 | 1000 | | 1500 | 300 |
| .11477 | 500 | 100 | | 100 | - |
| .11478 | 1% | 500 | | 300 | Tr |
| .11479 | 1.5% | | | 200 | - |
| .11480 | 1500 | | | 2000 | - |

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stage supergene, low temperature formation, that is post dating skarn formation. He also discusses Sn in silicate form released during serpentinisation. Fander's conclusion is that Sn occurs as these two forms and has not moved far from source.

. . . "

8.2.3 From Wells (1978 a)

pages 31 - 32

" . . .

In the upper parts, of the Sweeney mineralisation, nearly all the Sn occurs as very fine-grained cassiterite (1µ - 20µ) with coarser clusters, 200mm across, being friable due to the cassiterite grains having interstitial sericite. The fine grained nature of the cassiterite was considered by Fander (1977) as suggesting a "low temperature of formation with insufficient energy available to develop larger crystals" and he considers the assemblage to represent "a low temperature 'outer halo' of weak greisenisation". Deeper down in the mineralisation there is a change in mineralogy, possibly due, in part, to a higher temperature; the fine-grained cassiterite gradually gives way to Ag rich, coarse-grained stannite, up to 1.5 mm across; which is associated with some chalcopyrite and semi-massive pyrrhotite: Paralleling the change to stannite is the appearance of increasing amounts of topaz, which occurs as aggregates and may be pseudomorphing after felspars; the gangue can also include some siderite (Fander 1977). Deeper yet again, the mineralogy appears to revert to an assemblage similar to the higher one, i.e. the majority of the tin occurs as cassiterite and this may be the top of a separate sulphide lense (?). Similar, but higher grade, mineralisation has been described from Huari-Huari, Bolivia (Coburn et al 1977) and sphalerite bearing greisen veins have been reported from Luruei, Nigeria (Kinnaird, pers. comm.).

. . . "

8.2.3 From Cartwright (1983)

pages 19 - 21

" . . .

8. CONCLUSIONS AND RECOMMENDATIONS

At the present stage of exploration, three mineralised bodies have been found. They are Sweeneys, Anomaly 1 and Anomaly 4. All three have certain features in common and these are listed below:

(i) They are irregularly shaped pipe-like bodies of stanniferous/silver - base metal sulphide mineralisation.

(ii) They are all outcropping or sub-outcropping (the upper, more flat-lying, tabular parts) with narrow, steeply dipping feeders extending below.

(iii) All three bodies lie in a linear belt, striking approximately 060°. The Globe Mine and Anomaly 3 also lie on this belt (Fig. 2). It seems highly probable that some form of structural control has been exerted on the formation of these deposits.

(iv) The three prospects all occur within coarse-medium grained, partly porphyritic ("red") granite which is underlain at varying depths by a later phase medium-fine grained, non-porphyritic tourmalinised ("white") granite relatively close to the southern granite margin. The Globe Mine is situated within the "red" granite very near a major exposure of the "white" granite and its mineralisation is distinct from the other three, being tourmaline rich.

(v) Sub-horizontal, narrow aplitic sills are ubiquitous within the three deposits. These appear to act as localising structures for the mineralisation particularly the upper tabular bodies. This suggests that such mineralisation can occur as "blind" bodies within the granite.

Drilling of the three prospects to date, has reached a different stage for each. The most advanced is Sweeneys where eighteen holes have been drilled into a shallow tabular body and a pipe-feeder at depth. However, as most

of the holes were designed to intersect the pipe, little is known about the shape of the upper part of the body. The tonnage potential at Sweeneys has been roughly estimated at 0.5 million tons (L.A.Newnham pers. comm.). More detailed information about the grade, size and shape of the tabular body is required for a better tonnage estimate.

At Anomaly 1, where six holes have been completed, an estimated 0.4 million tonnes potentially occurs, however this body is not as yet completely closed off horizontally or vertically. A knowledge of the grade and limits of the upper mineralised portion of Anomaly 1, would enable a far more accurate estimate of the tonnage potential at this prospect.

One diamond drill hole has been completed at Anomaly 4 and no real indication of the size of the mineralised body can be obtained. Several further holes would have to be drilled in order to gain an idea of the tonnage potential there.

The current exploration objective on this area is to define a series of Sweeney-style deposits which may collectively support an economic mining operation. Given the typical grades of the mineralisation (0.5% - 0.6% Sn with appreciable silver and zinc credits), a resource in excess of three million tonnes is probably an appropriate economic target. Both Anomaly 1 and Sweeneys appear to be of the order of 0.5 million tonnes and Anomaly 4 seems unlikely to be any larger. Clearly to obtain the suggested target, these bodies must be shown to be substantially larger and/or more deposits must be found. Given that undiscovered, blind deposits may well occur in this geological environment, there must be a good chance of discovering more Sweeney-style bodies.

. . . "

## 8.5 Map Showing Areas of Interest

Key to map:

1. Gourlays Creek Anomaly
2. Big Rocky Creek Anomaly
3. 11000 Anomaly
4. Granville East Anomaly
5. Donnelly's Anomaly
6. Tasman River Anomaly
7. Twelve Mine Creek Anomaly
8. Central Anomaly
9. St.Dizier Ore Body
10. Dighem 228C & 229A Anomalies
11. North West Anomaly
12. Granite Anomalies
13. Alluvial Tin Prospect
14. Federation Mine
15. Montague Mine
16. Sweeney's Mine
17. Anomaly 1 (Agnew Grid)
18. Anomaly 4 (Agnew Grid)
19. Globe Mine
20. Prospective Area for White Granite
21. Prospective Area for Red Granite

EL 23/90
CAVENRIDGE PTY LTD

SOUTHERN OCEAN

PIEMAN RIVER

MOUNT HEEMSKIRK 742

MOUNT AGNEW 846

MOUNT LINDSAY

MOUNT ZEEHAN 702

Granville Harbour

Cumberland Lake

Trial Harbour

Zeehan

STRAHAN 26km

5 cm

SCALE 1: 100000

1 centimetre represents 1kilometre

PRODUCED by the Mapping Division, Lands Department, Hobart, 1984

NOMENCLATURE: Topographic names on this map have been approved by the Nomenclature Board of Tasmania.

MAP ACCURACY: The average accuracy of this map is ± 25 metres in the horizontal position of well defined detail and ± 5 metres in elevation.

MAP RELIABILITY: Topographic information shown on this map is correct to Nov 1983

PUBLIC RIGHT OF WAY: Roads or tracks on this map do not necessarily indicate a public right of way.

CORRECTIONS: To assist in correcting future editions of this map, users noting errors and omissions are invited to write to the Director of Mapping, GPO Box 44A, Hobart, Tasmania, 7001.

UNIVERSAL GRID REFERENCE

BEFORE GIVING A GRID REFERENCE, CIVILIAN USERS SHOULD STATE THE NUMBER AND NAME OF THIS MAP:

7914 : PIEMAN

| GRID ZONE DESIGNATION: 55G | TO GIVE A STANDARD REFERENCE ON THIS SHEET TO NEAREST 100 METRES |
|---|---|
| 100 000 METRE SQUARE IDENTIFICATION: CQ | SAMPLE POINT: 846 △ MOUNT AGNEW |
| | 1 Read letters identifying 100 000 metre square in which the point lies: CP |

Built-up area; National route marker

Roads maintained for continuous public use — sealed / unsealed

Primary road; Route number — A3

Secondary road; Route number — B31

Minor road; Route number — C317

Roads of restricted use or access

Other roads; Bridge

Vehicular track; Gate

Walking track

BLACK NUMBERED GRID LINES ARE 1000 METRE INTERVALS OF THE AUSTRALIAN MAP GRID, ZONE 55

GRID VALUES ARE SHOWN IN FULL ONLY AT THE SOUTH WEST CORNER OF THE MAP

VERTICAL DATUM FOR TASMANIAN MAINLAND: AUSTRALIAN HEIGHT DATUM (TASMANIA)

VERTICAL DATUM FOR OFF SHORE ISLANDS: MEAN SEA LEVEL

HORIZONTAL DATUM: AUSTRALIAN GEODETIC DATUM 1966

UNIVERSAL TRANSVERSE MERCATOR PROJECTION

CONTOUR INTERVAL 40 METRES

ELEVATIONS IN METRES

059044

Lake perennial; Stream perennial

LAND TENURE INDEX INFORMATION is curr
some areas of land tenure within built up
depicted. Colours are designed to indicate t
tion of a particular land status does not imply
land extend to low water mark. For full part
Registrar Generals Division, Law Departme
Department.

Private Freehold Land

Forestry Commission: State Forest; with
Timber Reserve

Lands Department: Crown Reserve