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ANNUAL REPORT-EL 5/98
COPPER MINES TAS.
P HARBON

Copper Mines of Tasmania Pty Ltd

578001

Exploration Licence 5/98 - Queenstown

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EXECUTIVE SUMMARY

Queenstown EL 5/98 lies within the Mt Read Volcanics, a belt of highly prospective ground containing most of the major western Tasmania ore deposits. Exploration in the licence area by MLMRC/GFEL and BHP Minerals has been reasonably extensive since the 1960s, with some work in the 1930s to 1950s and prospecting/mining in the early 1900s. Drilling has taken place in several areas and prospects, including Jukes Proprietary (5 holes), Huxley (1 hole), the Great Lyell-Little Owen area (at least 7 holes) and Garfield (12 holes).

Year 1 exploration focused on literature and field review of the most prospective areas and historic workings. With a long history of exploration and small scale mining, data collation and review was a significant undertaking. Field visits were made to prospects and old workings for familiarisation, reconnaissance mapping, re-establishing grids and selective rock chip sampling (to be analysed). This work, together with literature review, was used to prioritise prospects and prepare exploration proposals to more fully assess prospectivity in the licence area. A total of 16.9 km of grid lines were repegged or established at Jukes Proprietary, Nasty Knob, Mt Ellen and Mountain Maid prospects to improve access and allow reconnaissance work.

However, not all prospects have been adequately explored and modern geophysical methods combined with detailed geological interpretation are recommended to locate new and evaluate known prospects. The next phase of exploration should identify subtle features which may control mineralisation and generate drilling targets deeper than previously explored (> 200m), as extensions to known mineralisation or new areas.

Copper Mines of Tasmania Pty Ltd (CMT) experienced financial difficulties in 1998, reflected in reduced funding for exploration. Following the appointment of an Administrator to CMT's parent company Mt Lyell Mining Ltd on 12 December 1998, a survival plan was initiated. The plan involved mining and milling of high grade ore and excluded funding for exploration, while a new owner was sought. All exploration staff were retrenched. The Sterlite Group, through its associate company Twin Star Holdings Pty Ltd, became the new mine owner on 7 April 1999, operated by subsidiary CMT. Consequently, there has been no exploration activity since November 1998 and a suspension of work on CMT exploration licences has been agreed between Sterlite and the State Government from 1 April 1999 to 31 March 2001.

Exploration will recommence following the two year exemption period. Plans proposed by CMT prior to change of ownership include delineating drill targets at Jukes Proprietary, determining whether drilling is warranted at Mt Ellen and generating targets in the Huxley area. Proposed regional scale prospect generative work includes using airborne electromagnetics/radiometrics and LandSat data as a basis to be used in an interpretation of structure and alteration which may highlight areas of potential mineralising pathways.

TENEMENT INFORMATION

EL 5/98 is a 96 km² block centred 10 km south of Queenstown (Figure 1). The licence was awarded to Copper Mines of Tasmania in May 1998, as a successful bidder for the 128 km² Exploration Tender Area 463.

CMT have 100% equity in EL 5/98, and this report deals with exploration conducted in licence year 1, which covers the period 1 May 1998 to 1 May 1999.

Following agreement between the State government and Sterlite (CMT parent company), CMT is exempt from work conditions on the licence until 31 March 2001. Correspondingly, the licence shall remain in force for an extended period of two years.

Exclusions from within EL 5/98 total 5.5 km², comprising 1.2 km² of Crown Reserves, 4.3 km² of Mining Leases, an exclusion zone surrounding the HEC King Tunnels System and a Queenstown Water Reserve.

The South-West Conservation Area forms part of the southern boundary to the licence (SWCA proclaimed in March 1979), with exploration in this area requiring consent from the MWE Group through TDR.

Vehicle access from Queenstown to the northern half of the licence area is reasonable, via the Lyell Highway in the north and the Jukes Road and Crotty Road in the east. However, no vehicle access exists to the southern half of the licence. A four hour walking track exists into the Garfield prospect, which is also accessible by helicopter to a basic camp established by RGC.

CMT EXPLORATION PHILOSOPHY

The basic philosophy is to maximise the potential for discovering Mt Lyell style copper-gold and Henty style gold orebodies which could be viable to process at CMT's Mt Lyell mill. This can be achieved by:

- developing understanding of the geological controls on ore location
- applying a successful mix of modern exploration methods (eg CSAMT, MMI) and careful detailed geological interpretation (eg mapping alteration, structure)
- maximising benefits of existing land use zoning, infrastructure and contractors in the Queenstown region

It is recognised by CMT that prospective rocks exist south of Macquarie Harbour, but high exploration and development costs substantially increase investment risk in this area. Logistical factors are considered by CMT to have been traditionally underrated in terms of their impact on threshold tonnage and grade figures for orebody definition. On a geological and logistical basis, the area of interest to CMT lies between the Henty Fault system and Macquarie Harbour, especially areas of major structures with probable Cambrian movement.

Concepts of how mineralisation is formed within the Mt Read Volcanics (MRVs) are important for exploration in the belt. Contract geologist Denver (1998) advocates that most of the mineralisation within the MRVs is contiguous and related to a particular (unknown) magmatic event. If this is correct, then stratigraphic position in the exploration search for economic mineralisation is extremely important.

Mt Lyell, Henty and Rosebery deposits are hosted at or very near the CVC/Tyndall Group contact or their time equivalents in deep water (Rosebery or shallow water (Henty) facies. Any indication of mineralisation in this position is significant.

The discovery of a Mt Lyell analogue at Garfield, after the region was seemingly sterilised for VMS deposits, is very encouraging. Suite II andesites (Crawford et al 1992), stratigraphically near the top of the CVC and known to host some Mt Lyell orebodies, were shown by RGC to also occur near the top of the Yolande River Sequence at Garfield. A deep leach, non-digest method of soil geochemistry such as Mobile Metal Ion (MMI) should be effective in detecting subtle gold and copper anomalies above deeper buried mineralisation such as at Garfield.

Closer to Queenstown and on EL 5/98, Jukes Proprietary prospect is also of much interest to CMT, with a minimum orebody target size less than that of RGC and other explorers due to mine infrastructure. This prospect has the highest exploration priority of all known prospects in the licence. Written information obtained from HEC during the ETA period shows the exclusion zone around the tunnel below Jukes Pty is 70m radius, not 200m as carried by RGC. Sufficient volume exists for a relatively high grade orebody to be feasibly mined and trucked to Mt Lyell.

Jukes Proprietary

Work at Jukes Proprietary has been patchy and repetitive (summary information in Appendix 1B). Adit excavation at the turn of the century was associated with proximity to the Crotty smelter. Failure of the smelter resulted in abandonment of the lease. Interest in the prospect was renewed in the 1940/50s and has continued intermittently to the present. Exploration activity has varied in intensity, being influenced by exploration philosophies and corporate goals. Generally most explorers were looking for high volume deposits (say >10 Mt) and superficially the prospect does not meet this criteria.

First mentioned in 1900 by government geologist Twelvetrees, the area has been the subject of geological study in theses (Solomon 1957, Doyle 1990, Wyman in progress) and by exploration companies, especially during the 1970s to 1990s. Volcanic facies and chlorite alteration studies were made along the Jukes Road as part of government and industry sponsored AMIRA P439 project in 1996-98 (Wyman, 1998).

Five diamond holes have been drilled: Z142003 (1974) and JP1 to JP4 (1982-87). JP3 intersected 9m @ 0.65% Cu, 0.08g/t Au within weakly magnetic, strongly K-feldspar altered volcanic rock surrounded by strongly magnetic, strongly K-feldspar altered and brecciated volcanic. However, mapping has been poorly interpreted and holes may not have been drilled in the best positions to test for mineralisation. A short hole was proposed by RGCE to test an IP anomaly to the north, but not drilled.

Mt Ellen

The Mt Ellen gold mine dates back to the late 1890s - early 1900s, when notable mine development and surface infrastructure was in place. Historical records available are incomplete and complicated by the fact that the Huxley Tunnel and Mt Ellen appear to have been one and the same. An oblique reference to salting does not have an obvious explanation, particularly in light of the amount of work expended on the mine. Actual production figures appear to have been low.

The historic workings consist of a small open cut (or large trench) off which two adits were developed. One of the adits has since collapsed completely, while the entrance to the second has deteriorated over time. Several shafts and smaller trenches were developed around the open cut. The exact purpose of these shafts is unknown.

During the period 1920 to 1970, no significant work was done on the prospect. It is difficult to locate any documentation that even acknowledges the existence of the former Mt Ellen gold mine. It is possible that LEE (MLMRC joint venture company in the 1960s) as well as Pickands Mather International looked at the old workings, but no evidence of this or results has been found.

It was not until the 1970s that attention again focussed on Mt Ellen. MLMRC located and chip sampled the old workings, as part of their exploration of EL 10/69, with

some encouraging results. It is interesting to note that they found the country difficult to access due to dense vegetation. In the early to middle 1980s regional stream sediment and soil sampling programs (GFEL exploration on EL 9/66) returned some anomalous results, the exact source(s) of which were not identified.

BHP Minerals carried out broad spaced geophysical surveys and resampled the historic workings (on their licence EL 102/87) in the late 1980s - early 1990s. Results were not overly encouraging and they queried the reliability of some earlier high value gold assays. The RGCE/BHP Minerals joint venture arrangement over ELs 10/87, 55/89 and 12/92 saw no work done on Mt Ellen through to 1997, when the licences were relinquished.

Huxley Area

The area does not contain any significant historical workings (except Mt Ellen prospect discussed above), even though at the turn of the century the eastern margin of the EL would have had numerous prospectors scouring the country, most of them travelling from Lynchford.

Modern exploration dates from the mid to late 1960s, although there was some regional mapping in the 1950s. MLMRC constructed access roads which were later extended during the course of HEC developments. In the 1970s (EL 10/69) work encompassed establishment of grids, regional mapping, soil and stream sediment surveys and ground magnetics. Geological interpretations were revised, with glacial cover necessitating careful interpretation of geochemical results. A threshold value of 50 to 110 ppm for background Cu was determined from soil geochemistry.

More extensive work was done in the 1980s, particularly associated with enlarged EL 9/66 held by GFEL. Grids were extended, allowing for further stream sediment work, with samples assayed for multi-elements. Geophysics included a Dighem airborne survey, EM and magnetics. A major geological review was carried in 1983 and results focussed GFEL's activities over the next three years preceding licence relinquishment. In 1984 a dipole-dipole IP survey reviewed by Bishop failed to locate any massive sulphide bodies, although responses were obtained over prospective zones identified by geochemistry and geological mapping.

In the late 1980s to early 1990s the area was covered by EL 102/87, held by BHP Minerals. The company carried out extensive geophysics (IP and UTEM) and a BLEG survey, the latter indicating many anomalous drainage sites in the Huxley area.

From early 1990s through to relinquishment in 1997, exploration activities were managed by RGCE under joint venture with BHP Minerals. Very little work was done in the area during this period, except for detailed investigation of the Mountain Maid prospect in 1996. This included mapping, rock chip sampling and an IP survey.

Only one exploration hole has been drilled in the area. HX1 was drilled near Nasty Knob in 1985 to test for massive sulphides beneath a dipole-dipole IP anomaly, adjacent to a geochemical anomaly on Island Ridge. The hole intersected weakly

mineralised and altered epiclastics (black shales, tuffaceous sandstones and siltstones). The black shales were thought to be the source of the IP anomaly.

Great Lyell-Little Owen Area

Known prospects in the region include:

- Little Owen (Au, \pm Cu)
- Great Lyell (Cu, \pm Au)
- Duke Lyell (Cu, \pm Au) and Duke Lyell Extended
- Empress Lyell
- Conglomerate Creek (Cu and Au)
- Moore's Creek (Au)
- Haematite Tunnel (Fe, \pm Cu, \pm Au)
- Sandstone Hill (Pb)
- Copper Estates (on 1M/95 but considered here for geological continuity)

Most of these prospects have some historic workings, some yet to be located (see Figure 8). Adit and shaft development at the turn of the century was followed some decades later by comprehensive geophysical surveys (1940/50s through to 1980s). Geochemistry has involved trial soil surveys (generally unreliable due to smelter fallout contamination) and fairly extensive rock chip and channel sampling, the latter from both surface and underground.

pre 1910: Tunnel and adit development on several prospects. Little documentation.

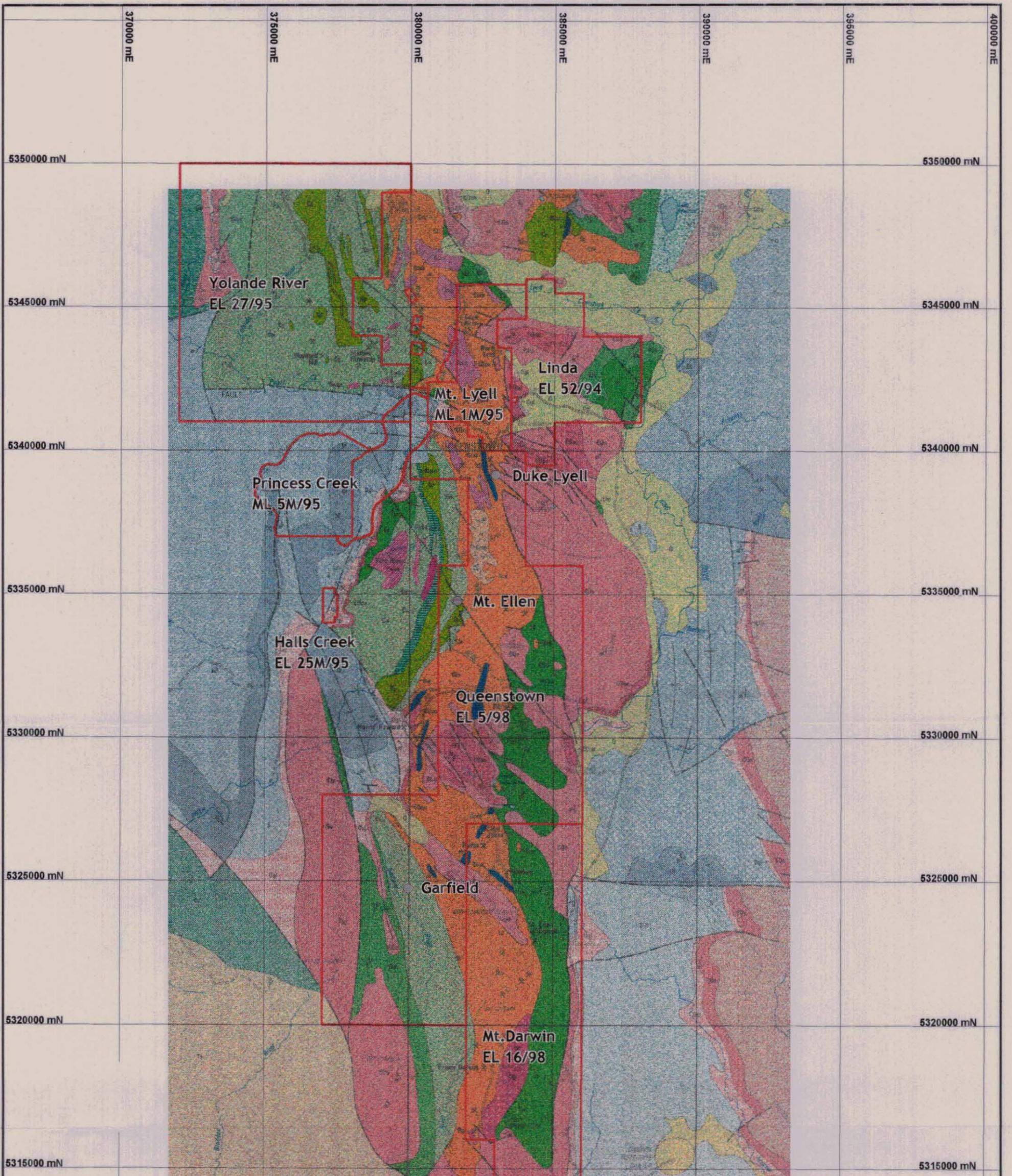
1930s - 1950s: Geophysical surveys, both through MLMRC and by BMR. Some regional geological mapping.

1960s (EL 10/69): Soil surveys (subject to contamination through smelter fallout) and diamond drilling. Five holes (GL1 to GL5) drilled in the Great Lyell prospect by MLMRC. Several holes (RM series) drilled by Pickands Mather International.

1970s (EL 10/69): Adit and dump sampling, some rock chip sampling, geological mapping, gradient array IP and ground magnetics surveys. Soil sampling orientation survey returned a threshold value of 50 ppm Cu. Little Owen ridge mapped as a core synclinal structure. Four styles of mineralisation were recognised. No work done in the area after EL 10/69 merged with EL 9/66 joint venture.

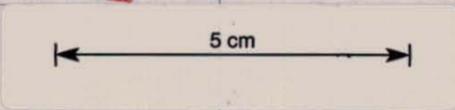
1980s (Authority to Prospect): Geological mapping, surface geochemistry and ground magnetics. Identification and reassessment of gold potential. Two holes (LO1 and LO2) drilled in the Little Owen prospect. Adit sampling returned some anomalous gold values (eg 20 g/t Au). Structural setting of the Little Owen prospect compared with that of Henty. Recognition of dominant chlorite alteration with anomalous gold.

1990s (A to P): No exploration carried out in the area after the A to P was terminated (February 1992). Work done at Mt Lyell through AMIRA P291 (structure and mineralisation in MRV) has implications for the Great Lyell/Little Owen area. Similarly with the structural interpretation carried out by Steve King (1998).



Copper Mines of Tasmania
Regional Geology - Mount Read Volcanics
Map No.6
Showing C.M.T. Tenements

Figure 2. Scale 1:125 000



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CONCLUSIONS FOLLOWING REVIEW OF PREVIOUS EXPLORATION

EL 5/98 contains a large portion of Mt Read Volcanics, renowned for hosting world class Cu/Au/Pb/Zn/Ag deposits. The potential for locating Mt Lyell style Cu/Au, Henty style Au and Rosebery style Pb/Zn/Cu/Ag mineralisation within the licence area is considered to be moderate.

Numerous small historic workings exist in the area, dating from the early 1900s, including those at Jukes, Mt Ellen, Nasty Knob, Mountain Maid and in the Great Lyell - Little Owen area near Queenstown (Figure 2).

The licence area has been the subject of modern exploration by BHP Minerals and the RGC group for 10 years, with a total expenditure around \$4.5M. It could be assumed that the most obvious exploration targets have been tested. What remains to find and test are more subtle targets caused by moderately buried orebodies, together with careful reassessment of some of the known prospects such as Jukes and Mt Ellen.

Despite BHP seemingly sterilising the area for VMS deposits using electromagnetic (UTEM) surveys, exploration by RGC discovered a Mt Lyell analogue at Garfield, though the low grades make it uneconomic. The prospect was found by a combination of detailed mapping (andesites and pyrite-sericite-chlorite-chalcopyrite alteration), rock chip and soil sampling.

Further exploration needs to develop new geology models and explore deeper (below 200m) to be successful, using tools such as CSAMT, electromagnetics and regional scale modelling of magnetics, gravity and structure to find controls to mineralisation.

EL 5/98 YEAR 1 EXPLORATION

Year 1 exploration focused on a literature and field review of the most prospective areas and historic workings, with selective rock chip sampling (to be analysed). With a long history of exploration and small scale mining, data collation and review was a significant undertaking (see Table 1 and Appendix 1, Godsall, 1998). Field visits were made to prospects and old mines for familiarisation and reconnaissance mapping. This work, together with the literature review, was used to prioritise prospects and prepare exploration proposals to more fully assess prospectivity in the licence area.

Regional

Plans were generated using MRT digital data and meshed with RGC geology on a prospect scale (Jukes Proprietary). Historic sample data (rock chip, stream sediment and soil) was collated from old reports and entered onto spreadsheets. Accurate coordinates are required before data can be loaded into CMT's exploration database.

A review of the good quality aeromagnetic data over the licence with geology was begun to determine structural trends, especially in the Mt Owen-Mt Huxley-Miner's Ridge-Mt Jukes area. Magnetic data needs to be enhanced at a prospect scale.

Jukes Proprietary Prospect

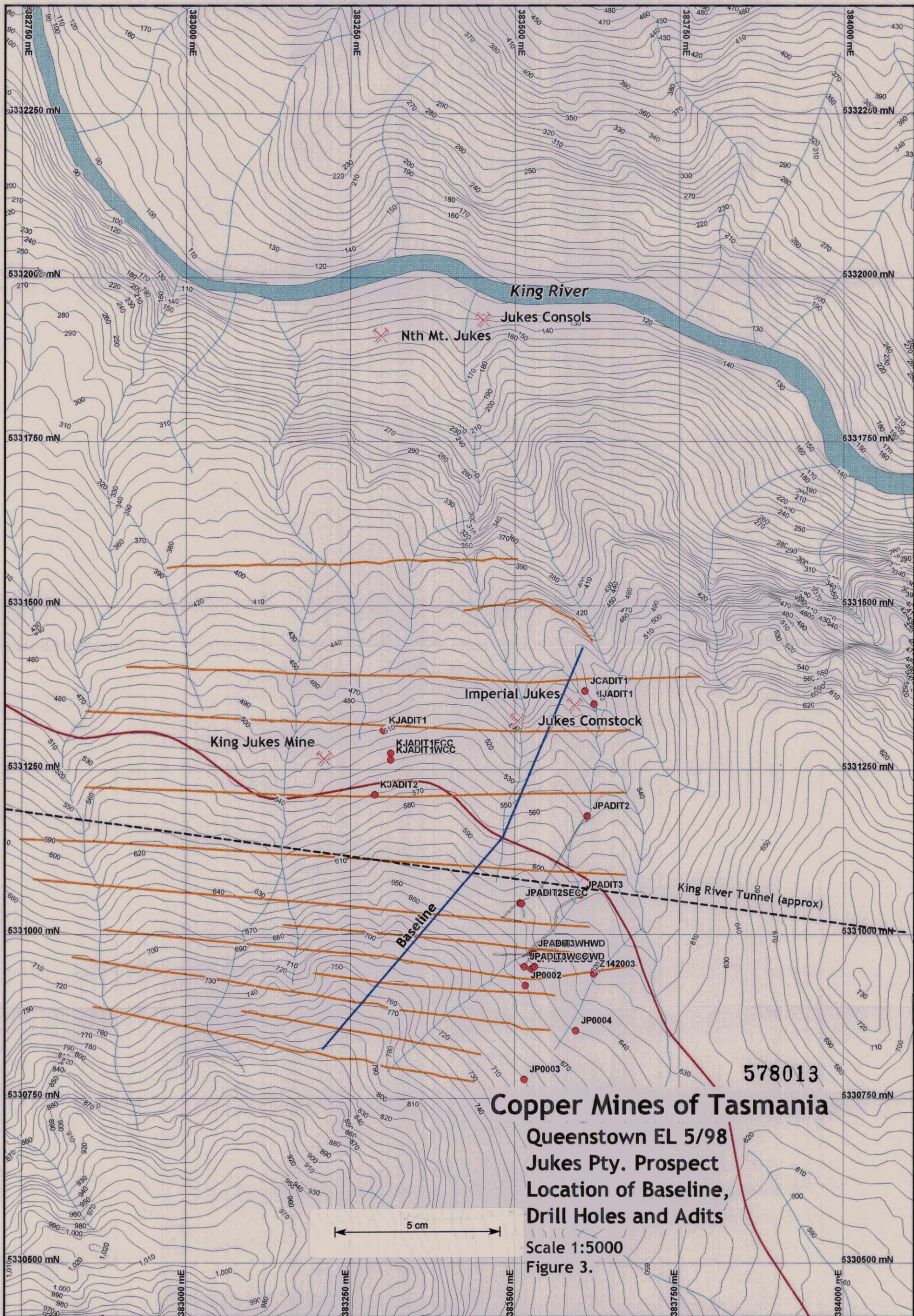
Introduction

A significant volume of exploration has been carried out over the Jukes Proprietary prospect (see Appendix 1A). Known mineralisation has potential to increase the CMT resource base, although establishment of such resources needs to be proven through drilling. Delineation of previously identified targets and generation of additional targets through review, ground truthing and fresh interpretation is necessary.

Geology

Ground truthing began along the baseline, collecting rock samples and checking previous mapping and geological interpretation. Most rocks collected were quartz phyric lavas, of rhyolitic to dacitic composition, with local brecciation towards the conglomerate contact. Demarcation of the Owen contact is difficult, with both Jukes and Owen conglomerates recorded in this area by previous explorers. Volcaniclastics sampled north of the highway and close to the Owen contact are interpreted as belonging to the Eastern Quartz Phyric Sequence, although there is potential for gold and copper hosting basal Tyndall rocks in this area.

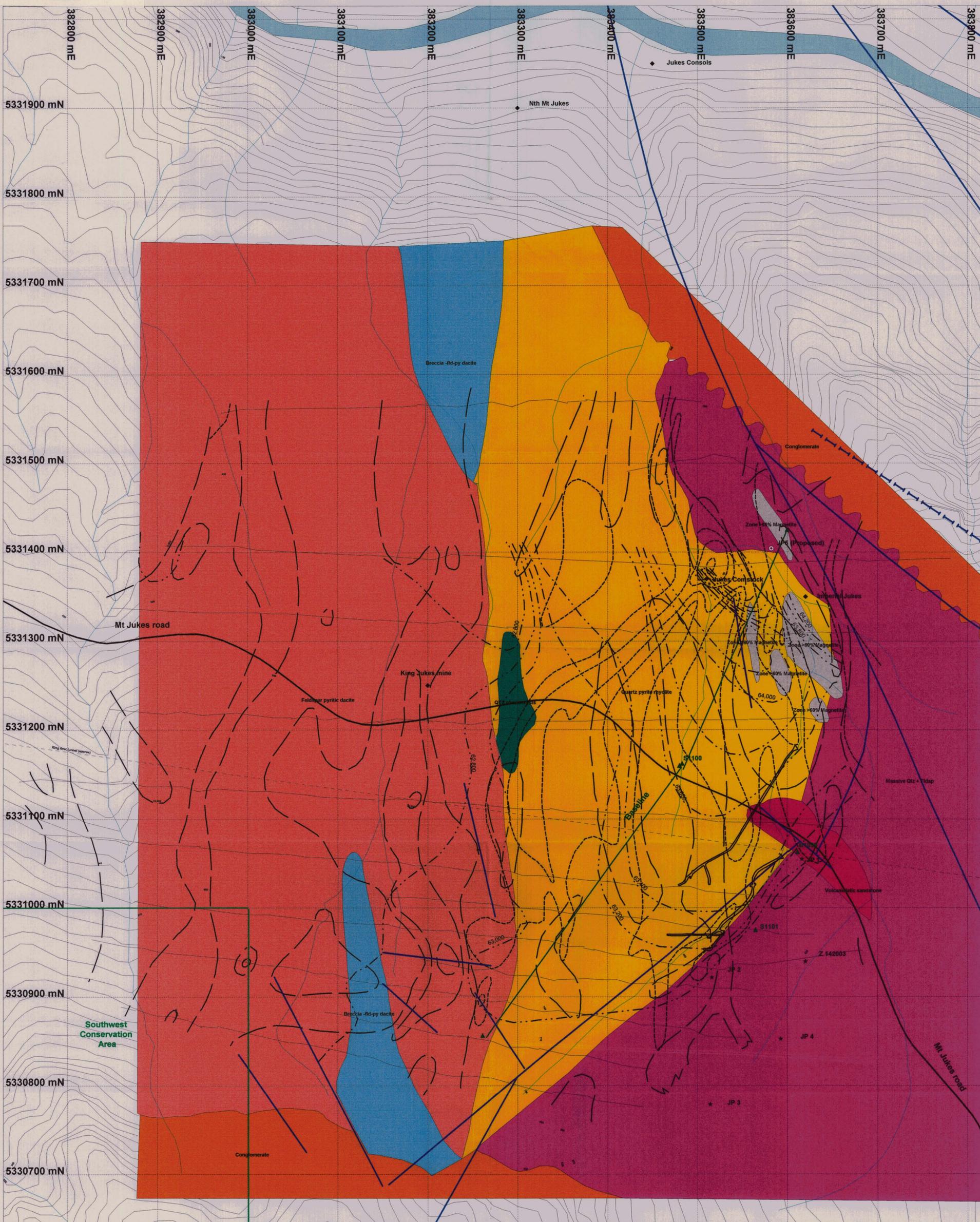
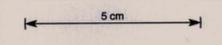
There appears to be a correlation between magnetite contact and higher grade material, with magnetite forming an annulus around copper mineralisation. Faults oriented at 350/80° W contain chalcocite and covellite(?) but no primary sulphides. These mineralised faults do not coincide with old workings and should be mapped along strike to determine potential for a small, high grade copper deposit.



Copper Mines of Tasmania
 Queenstown EL 5/98
 Jukes Pty. Prospect
 Location of Baseline,
 Drill Holes and Adits
 Scale 1:5000
 Figure 3.

5 cm

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- ◆ Historic workings
- ★ Drill hole collar
- ▲ Survey point
- Proposed drill hole
- Boundary to Southwest Conservation Area
- Baseline
- Old grid lines
- Fault - from MRT data and RGCE geological mapping
- Foliation ex MRT data

- Resistivity contours
- Chargeability contours
- Magnetics total field

Work completed includes data compilation covering surface geophysics, surface geochemistry, entry of drill hole data into the exploration database and digitising of the latest geological mapping. A working file of historic information was collated (Appendix 1A) and a baseline crossing the Jukes Road established.

Gridding

At least two historical grids have been used over Jukes Proprietary. The first dates back to the 1950/60s and the second to the 1980s (some pegs are still standing). Reconnaissance work showed the old grid unsuitable for reuse. A new baseline was established under survey control, extending north and south of the Mt Jukes Road by some 300 metres and 375 metres respectively. It is intended to use the baseline to establish other lines as required, using GPS and compass and avoiding any track cutting. Survey base stations were established near No. 1 and 3 adits (see Figure 3).

Data compilation

Geochemistry: surface sampling (rock chip and soil), adit sampling (at King Jukes, Imperial Jukes and Jukes Comstock) and the Jukes road traverse with multi element analyses (through AMIRA P439 alteration investigation) - entered into the database. Underground sample data, grid and adit locations were digitised.

Geophysics: ground magnetics and IP surveys (1980s) - useable through MapInfo. Ground truthing did not identify an obvious cause of the IP chargeability anomaly. Gradient array and dipole-dipole IP plots were generated, contoured and digitised with data entered into the exploration database to enable plotting with geology (Map 1).

Geology: digitising RGCE mapping (1995) saved as a MapInfo table. The regional 1:25,000 digital MRT geology was updated with RGC work (see Map 1). Inspection of the spoils heap near the historic Jukes Comstock adit showed significant pyrite mineralisation. Local notable malachite staining was observed along dropoffs on Jukes Proprietary Creek.

Drilling: JP0001, JP0002, JP0003, JP0004 and Z142003 - assay data entered into the database with available collar and downhole survey data; logs found and coded.

Drill core: Found and moved to CMT mine site - JP3 and JP4; available at MRT's core storage yard - JP1, JP2 and Z142003.

Mt Ellen Prospect

Introduction

The Mt Ellen prospect includes the former Mt Ellen gold mine and the Diorite Creek West alluvial workings approximately 200 metres west of the old mine. The two occur in different geological settings but are considered together due to their proximity to each other. At Mt Ellen two adits (one collapsed) and a trench were rediscovered (not found by previous explorers). Old grid lines cleared and repegged to access workings.

Previous exploration recognised the prospect as a potential gold source. In spite of a dearth of evidence for significant gold, anomalous results (eg 6.2 g/t, 3.95 g/t and 2.18 g/t) are unexplained. Detailed work around the prospect is limited, with most previous exploration being broad based over 200 metre line intervals.

Work completed includes review of previous exploration, spreadsheet compilation for database entry, location of historic workings and refurbishment of grid lines. A working file of historic information has been compiled (see Appendix 1B).

Geology

Alluvial workings at Diorite Creek West are presumed to date back to the same era as the Mt Ellen gold mine. The workings are characterised by distinctive quartz rubble/float with no obvious mineralisation that straddles the boundary between the Western Sequence and CVC feldspar phyric volcanics. Contemporary geochemistry (circa 1980s) returned some elevated gold that warrants limited further investigation. Attempts to locate the Nuggety Creek/Diorite Creek workings were not successful and it is likely that these are not significant (see Figure 4).

A prospect review (Denwer, 1998) recommended additional mapping and sampling to test for extensions to mineralisation.

Gridding

At least two historical grids cover Mt Ellen. The Mt Ellen grid was cut in 1985 and straddles the old Mt Ellen mine. The larger Huxley grid was used for geochemical surveys that gave broad regional coverage. Both grid layouts have been digitised.

Access to the old workings necessitated refurbishment of lines 3200E, 8000N and 7800N of the Huxley grid. The Mt Ellen grid lines are still extant but will require significant re-cutting if they are to be used in future work.

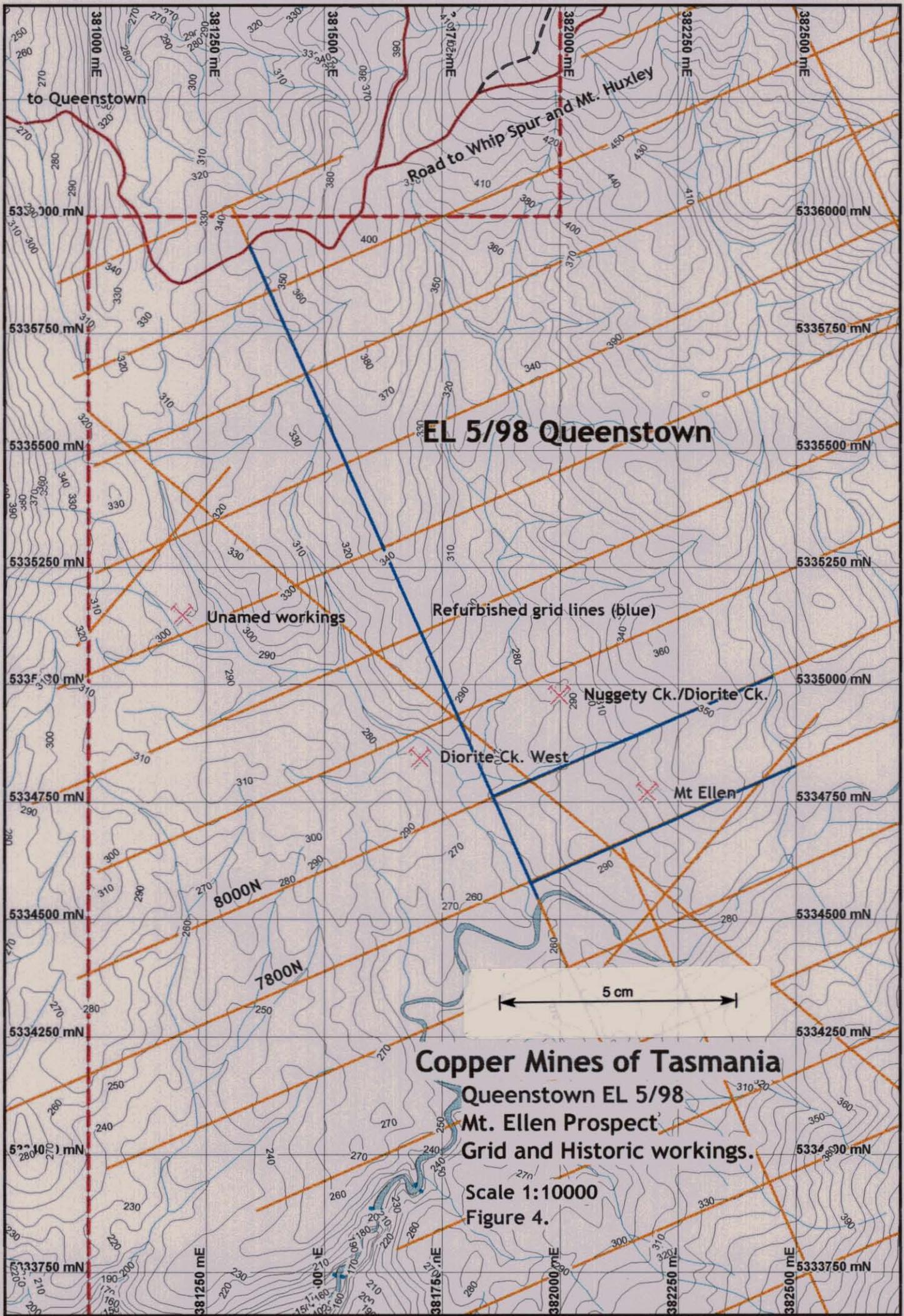
In the course of line refurbishment, an historic five head stamp battery was located downslope of the open cut and MRT notified of its location. All except one of the known shafts have been located and flagged (open shafts a potential safety hazard).

Data compilation

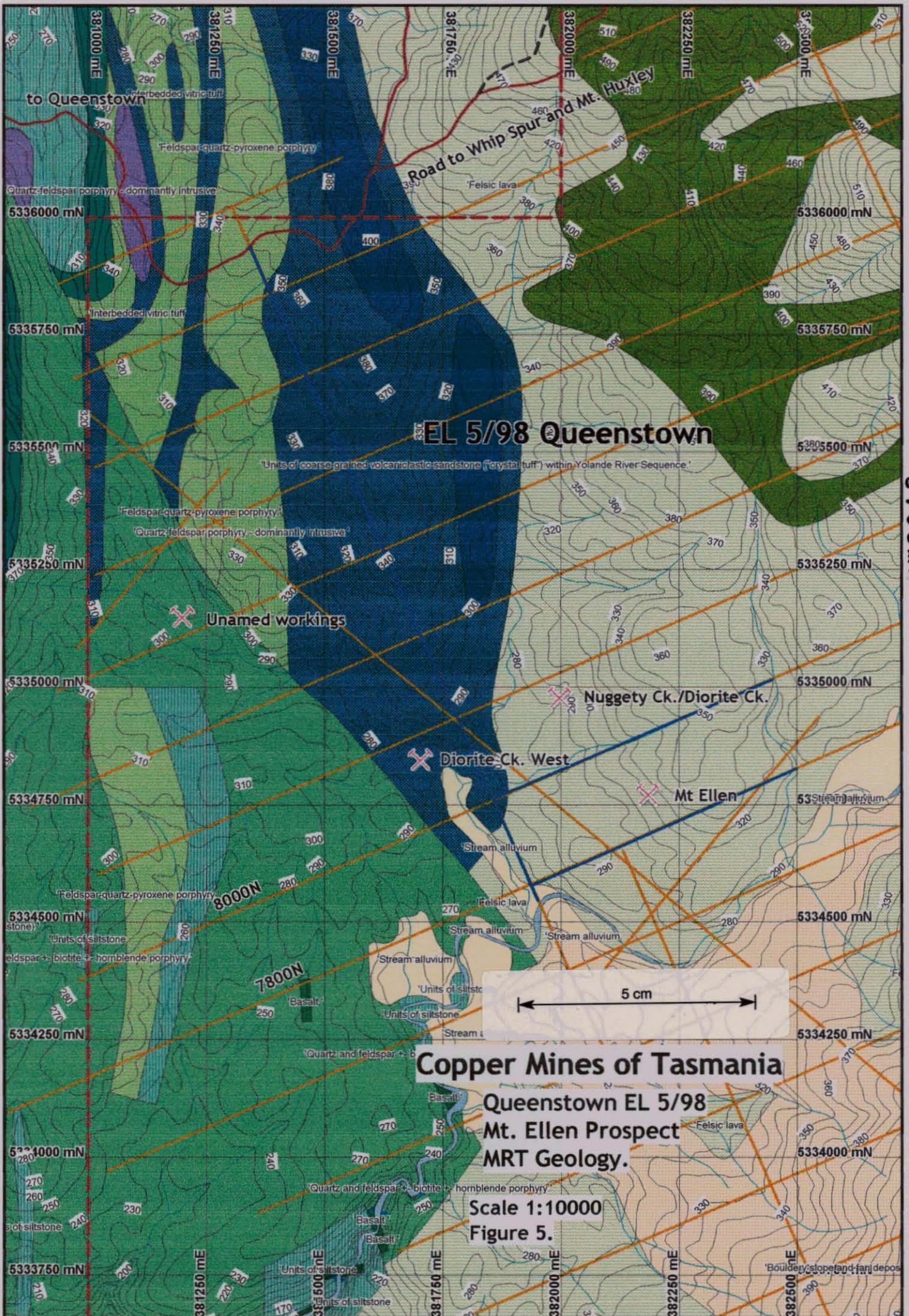
Geochemistry: spreadsheet compilation of surface sampling (rock chip, whacker and soil) has been made from relevant annual reports. Grid coordinates need to be converted to AMG before assays can be entered into the database.

Geophysics: raw survey data has not been located although several reports (eg 1990/91 annual report) contain profiles of the results.

Geology: GFEL mapping (1980s) digitised and saved as a MapInfo table plus 1:25,000 digital data ex MRT (see Figure 5).



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EL 5/98 Queenstown

**Copper Mines of Tasmania
Queenstown EL 5/98
Mt. Ellen Prospect
MRT Geology.**

Scale 1:10000
Figure 5.

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Huxley Area

Introduction

The Huxley area constitutes a large prospective block within EL 5/98, extending from Whip Spur in the north through to the King River in the south. The eastern boundary roughly parallels the Mt Owen - Tofft river drainage system. To the west, the licence boundary is parallel to and east of a distinctive spur that is Miner's Ridge.

The area has had broad exploration coverage in terms of geological mapping, surface geochemistry and geophysics (UTEM, dipole-dipole IP and aeromagnetics). Geological mapping has broadly identified rocks known to host MRV-style mineralisation, although significantly more detailed work remains to be done. Similarly, identified structural trends and features now require a more in-depth and integrated regional interpretation with aeromagnetic data.

A literature review has been carried out, with much information to assimilate before exploration strategies can be fully implemented. A working file of historic information has been compiled (see Appendix 1C).

Geology

There are several known prospects and mineral shows within the area. Of these, Nasty Knob (Cu, base metals, \pm Au) and Mountain Maid (Au) are well known and identified through surface geochemistry. Nasty Knob may be an extension of Little Owen mineralisation, but for logistical reasons is included in the Huxley area. Previous geological mapping of the Nasty Knob gossan confirmed its prospectivity, although specific documentation is generally poor. Mountain Maid was explored in some detail by RGCE in 1996 and is considered to have low prospectivity. There is little information on other mineral shows in the area.

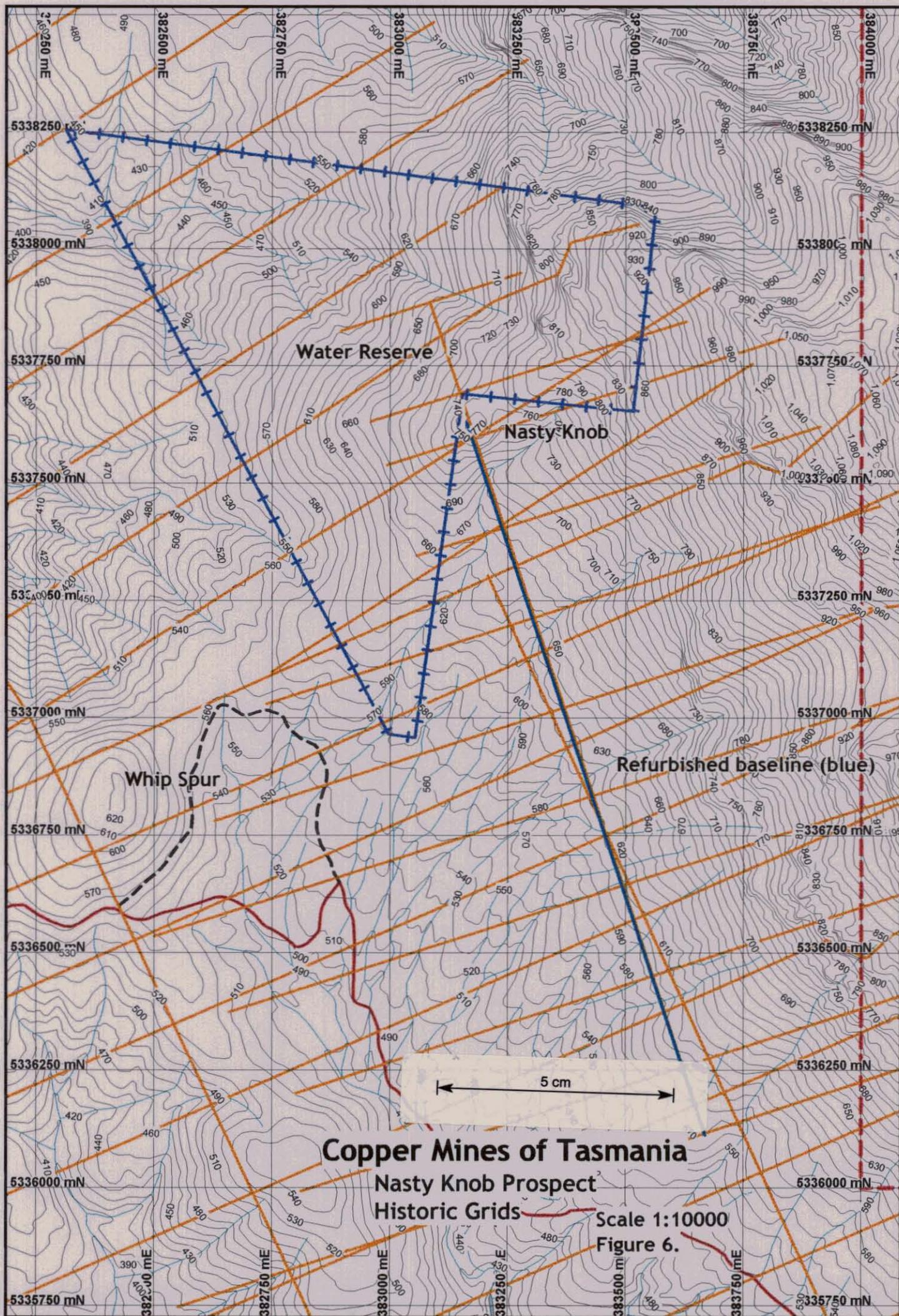
At Nasty Knob, reconnaissance mapping from the baseline sought to identify possible gossan outcrop mapped by previous explorers. Weakly gossanous material was found. The volcanic host rock has a cleavage and texture characteristic of Lyell schist. These are favourable indicators of prospective rock, although sulphides have not been seen (see Figure 7).

Field observation (Denwer, 1998) interprets a gradational contact on grid line 4S between volcanics with large quartz clasts and Owen Conglomerate with identical clasts. This implies a conformable contact, and the volcanic unit may be lower Tyndall Zig Zag Hill Formation. Surrounding lithologies are mapped as CVCs, so the prospect may be at the CVC/Tyndall Group stratigraphic contact.

A prospect review (Denwer, 1998) recommended a complete re-interpretation of the Nasty Knob area, with commensurate mapping and sampling.

Gridding

The grid over Mountain Maid has been re-pegged (line 7600N requires re-establishment), to be used for reconnaissance/check mapping. Remnants of several old grids were found.



Copper Mines of Tasmania

Nasty Knob Prospect

Historic Grids

Scale 1:10000

Figure 6.

The Nasty Knob baseline has been refurbished for use in reconnaissance mapping (partly completed). In this area there are at least two historical grid systems (MLMRC in 1960s, BHP Minerals in 1980s), so the refurbished line has been given a new numbering system to avoid confusion (see Figure 6).

Data compilation

Geochemistry: spreadsheet compilation of surface sampling (rock chip, whacker and soil) was made from relevant annual reports. The Huxley grid has been digitised and grid coordinates need to be converted to AMG before assays can be entered into the CMT database. Care needs to be taken in identifying different grids. Resampling of historical workings (small trench \pm adit) was carried out, but samples await assaying.

Geophysics: raw survey data has not yet been compiled. Data from the Mountain Maid IP survey is contained on the ETA 463 data disc. Images are available of the aeromagnetic survey (flown by RGCE in 1995) for use in structural interpretation.

Geology: digitising of GFEL geological mapping (1980s) has been saved as a MapInfo table and needs to be compared with the 1:25,000 geological data released in digital format by MRT. At Mountain Maid, an old adit was found on line 7100N.

Drilling: Data from drill hole HX1 has been compiled onto spreadsheet but awaits loading into the CMT exploration database.

Great Lyell - Little Owen Area

Introduction

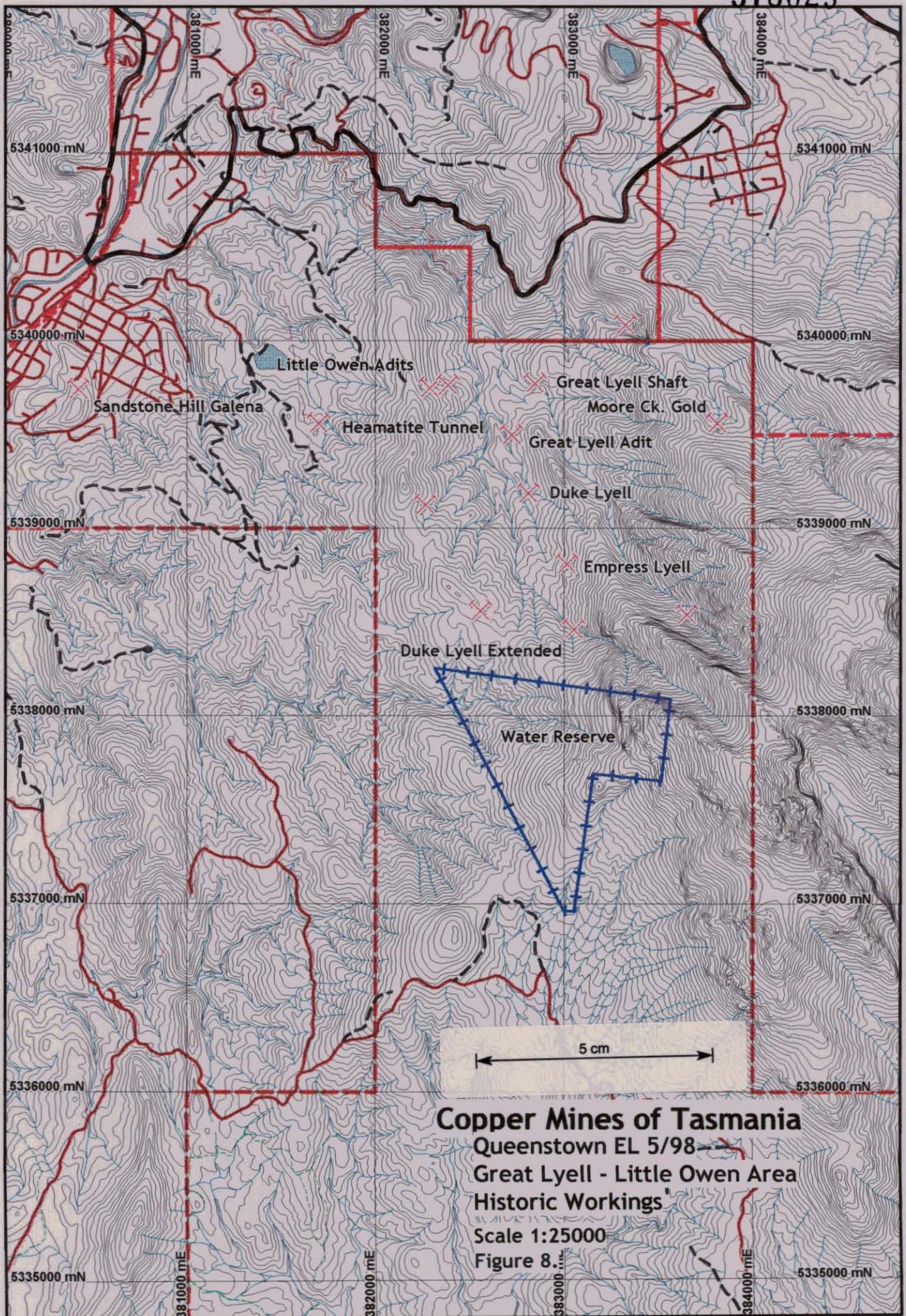
The Great Lyell - Little Owen area is at the northern end of EL 5/98 and immediately south of mine lease 1M/95. The area has been well explored through exploration licences (ELs 9/66 and 10/69) and an Authority to Prospect and is not viewed as a high exploration priority.

Little field work has been done in the area since EL 5/98 was granted. Following talks with The University of Tasmania, an Honours project was outlined for this area but did not proceed, titled "Alteration Zonation, Geochemistry and Mineralisation in the Little Owen Area". As the area was mooted as a possible research project, a literature review was made of previous exploration, follow by field reconnaissance and familiarisation (see sections below and Appendix 1D).

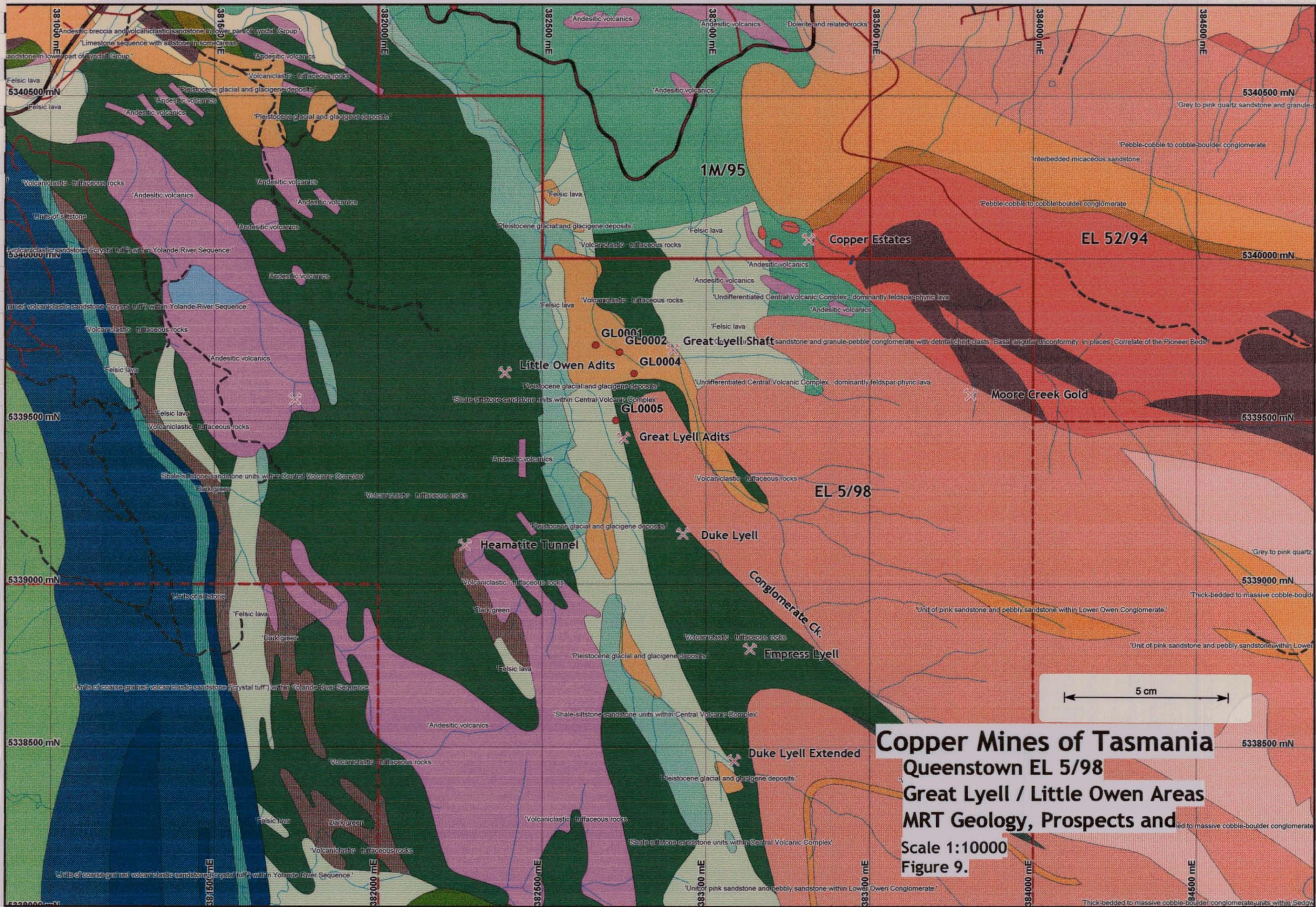
Geology

Rocks in this area are mainly acid and intermediate volcanics with associated volcanoclastics, volcanic sediments, epiclastics and subsidiary andesitic intrusions. Anomalous gold values identified through previous work are associated with dominantly chlorite altered zones that frequently show an element of structural control. The area is considered prospective for high grade gold shoots and deeper core sulphide mineralisation.

Field reconnaissance located historic workings, including three adits and a shaft site on Conglomerate Creek, an adit at Duke Lyell and two adits at Little Owen prospect.



Copper Mines of Tasmania
 Queenstown EL 5/98
 Great Lyell - Little Owen Area
 Historic Workings
 Scale 1:25000
 Figure 8.



Prospects showed distinctive alteration of country rock, with regional east-west structural trends and pyrite clearly visible.

The alteration system that characterises the Mt Lyell field extends south into the area and several styles of mineralisation have been identified. Structure is recognised as having a significant control or influence on mineralisation.

Data compilation

Geochemistry: Reports containing relevant geochemical data have been identified for spreadsheet compilation.

Geophysics: No raw data from geophysical surveys has been located.

Geology: Geology plans and diagrams showing adit/shaft development have been identified for digitising.

Drilling: Data for drill holes LO1 and LO2 (core stored at CMT Industrial Estate) has been compiled onto spreadsheet but not yet entered into the CMT database.

Core for drill holes GL1 to GL5 (Great Lyell drill holes) is stored in the CMT IOS shed. Drill hole data is in the exploration database. Drill logs and core from holes drilled by Pickands and Mather International (RM series) is yet to be located and reviewed. Regional geology, prospects and drill hole locations are shown on Figure 9.

EXPENDITURE

Expenditure on EL 5/98 for the 11 month period since licence granting on 1 May 1998 to 31 March 1999 was \$62,376. This includes money spent in March-April 1998 on literature review, following written confirmation from MRT in January 1998 that CMT was successful in tendering. This work proceeded while final ministerial approval was delayed due to calling of a State election and subsequent change of government. Licence documents were received in June 1998.

Costs in March-April 1998 were \$17,663, being \$22,049 less \$4,386 debited in May-June 1998 due to costing corrections. There has been no work since December 1998.

YEAR 2 WORK PROGRAM PROPOSAL

The new owners of CMT Pty Ltd, Twin Star Holdings (a member of the Sterlite group of companies), have been granted exemption from work commitments on all four CMT exploration licences in Tasmania until 31 March 2001 while the company focuses on making Mt Lyell mine profitable.

Consequently, exploration on Queenstown EL 5/98 is postponed, however a Year 2 work program had been proposed by CMT prior to change of ownership:

Regional Exploration

Large parts of EL 5/98 have limited access, so are relatively unexplored. This has necessitated regional airborne surveys to focus exploration. Interpretation of existing aeromagnetic data and flying EM/radiometrics are recommended, to identify areas of possible mineralised volcanics. Acquisition of LandSat imagery would assist in delineating structure and alteration which may be controls on mineralisation.

A structural geology study based on existing aeromagnetics and field mapping, similar to that carried out over Linda EL 52/94 (King, 1998) was proposed for the Year 1 program and a quote received but not undertaken due to lack of funds. This study would be of benefit in delineating possible alteration zones and structural lineaments which may have been pathways for mineralisation.

In conjunction with regional exploration, work is proposed on Jukes Proprietary and Mt Ellen prospects, together with exploration in the Mt Huxley-Little Owen and Clark Valley (Garfield, Flannigans Flat) areas. Methods may include track cutting and gridding, mapping, rock chip and soil geochemistry, ground magnetic, CSAMT, IP and gravity surveys and RC/diamond drilling. Most prospects were gridded by previous explorers and it is intended to re-establish and extend these grids where practical.

Prospect Exploration

Prime objectives are to delineate drill targets at Jukes Proprietary, determine if drilling is warranted at Mt Ellen and generate targets in the Huxley area.

Jukes Proprietary Prospect

The next phase of exploration will focus on source areas of mineralisation, including:

- Interpretation of aeromagnetic data and ground truthing
- Structural review
- Ground magnetics
- Geological mapping, relogging of drill core (5 holes) and interpretation
- Rock chip sampling
- Review of RGC proposed drill target and generation of new drill targets
- Shallow RC/diamond drilling program

Mt Ellen Prospect

The next exploration phase requires detailed geological interpretation. Rock types, alteration patterns and structure need to be mapped in detail. Surficial cover and very limited outcrop will make this slow work. Proposed work includes the following:

- Ground truthing, clearing old lines and workings and gridding
- Geological mapping - description of rock types, delineation of alteration patterns and identification of any mineralisation
- Rock chip geochemistry
- Structural and stratigraphic review and interpretation
- Interpretation of aeromagnetics
- Ground magnetics survey

The objective will be to generate drill targets to test for near surface mineralisation down dip and along strike.

Huxley Area

Proposed work includes alteration mapping, in-fill sampling around known geochemical anomalies, interpretation of aeromagnetic data, structural review, geological interpretation, modelling and generation of targets for followup geophysics.

Broad coverage is required, with detailed investigation in the more prospective zones such as Nasty Knob (track refurbishment, mapping, sampling, CSAMT/IP surveys). A review of structural controls is needed before more detailed work is carried out.

Great Lyell/Little Owen Area

Proposed work includes mapping, gridding, sampling, compilation of geochemical and geophysical data, inspection and relogging of drill core and digitising of available geology. Subsequently, it is planned to undertake a re-interpretation of potential geological models and evaluate known deposits, refining exploration targets.

Garfield Prospect

RGC exploration results need to be reviewed and followup requirements identified. Mapping, relogging, geochemistry and grid geophysics (CSAMT, possibly IP) has been proposed, with potential for better mineralisation at depth. Exploration is constrained by logistics (relative isolation) and weather to spring-summer months.

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- Wyman, B., 1998. Chlorite Alteration Associated with Syn-Volcanic Granites and Cu-Au Mineralisation: a Pilot Study along the Jukes Road in AMIRA P439 Studies of VHMS-Related Alteration: Geochemical and Mineralogical Vectors to Ore, Final Report Vol 2. CMT ref lib T1998-031.

TABLE 1: HISTORICAL REPORTS/ REFERENCES ON EL 5/98

MRT (TCR) Number	CMT INMAGIC number	Title	Author	EL Number	Extract	Comments
				(c=complete report, p=partial/selected sections only)		
1	T1900-015 F00462	Report on the mineral districts of Mt Huxley, Jukes and Darwin	Twelvetreets		c	Jukes Pty., Mt Ellen, Mountain Maid
2	T1914-003	The Jukes-Darwin Mining Field	Loftus Hills (Hills C.L.)		c	History, geography, geology, and mining properties/leases. Reviews all deposits/mineral occurrences in the area.
3	57-143	Magnetic anomaly 3N/6	Rodda		c	Report on magnetic anomaly - not clear whether work done by Rodda or by another (eg. BMR geologist)
4	67-475	T1967-006 Annual report	Elms	9/66	c	** All work carried out in the Henty area - and therefore not directly relevant to EL 5/98
6	69-569	T1969-008 Progress report	Newnham	9/66	c	** All work carried out in the Henty-Tyndall area and therefore not directly relevant to EL 5/98
7	70-654	T1970-010 Annual report	Newnham	9/66	c	** Consolidated Syndicate. All work carried out in the Henty-Tyndall area and therefore not directly relevant to EL 5/98
8	70-710	Annual report	Newnham	10/69	c	Reviews (briefly) previous work (notably Pickands and Mather); summarises work completed; recommends further work.
9	71-840	T1971-011 Annual report	Wells	10/69	c	Includes work in the Owen-Huxley area (Little Owen, Great Lyell, Mt Ellen)
10	72-892	T1972-009 Annual report	Wells	10/69	c	Includes work carried out in Mt Huxley - Whip Spur - Lyell Highway area.
11	T1973-008	Annual report - New area evaluation	Wells and Sheppard	-	c	Consolidated syndicate. Some good historic background info, in particular Jukes - Darwin.
12	73-973	Annual report	Lee	10/69	p	Geological mapping - confirmed unconformity immediately below Comstock Tuff and correlated with unconformity overlying the Comstock orebodies. Further mapping recommended
13	74-1039	T1974-010 Annual report	Wells	10/69	c	Includes work in Little Owen grid, Whip Spur - Lyell Highway areas.
15	74-1046	T1974-012 Annual report	Wells	9/66	c	** Work mainly on Henty - Newton Creek - Basin Lake area and therefore not directly relevant to EL 5/98
17	T1975-006	Cambrian Volcanism and Mineralisation in SW Tasmania	White N.C.		c	PhD thesis (Tas Uni). Describes most of the known mineral occurrences/prospects.
18	75-1117	Annual report	Brophy	10/69	p	Geological mapping, geophysics, geochemistry through Little Owen - Whip Spur and Huxley areas. IP survey. Soil geochemistry - affected by smelter contamination.
18	76-1172	Annual report	Brophy	10/69	p	Geological mapping and rock chip geochemistry through Owen-Mt Ellen-Huxley area (Roaring Meg Ck, Miner's Ridge, Little Owen, Great Lyell, Mt Ellen, Mt Huxley)
21	79-1384	Annual report	Reid et.al.	9/66	p	Work done in the Clark Valley (Snake Spur), Garfield river and Bird river ironstone. Rock chip and stream sediment geochemistry. Collation of geophysics data.
22	T1981-013	Minutes of JV meeting	MLMRC	9/66	c	Mt Huxley - Whip spur, Whip Spur - Lyell Hwy, Mt Sedgewick - Comstock Valley
23	81-1626 81-1634	T1981-023 MRV alteration study	Eastoe	MRV	p	Alteration study and relationship to mineralisation. Jukes - Darwin, Mt Huxley, King river
24	81-1660	T1981-024 Annual report	Meares et.al.	9/66	p	Dump sampling at Jukes Proprietary.
25	T1982-021	JV program and budget	MLMRC/Getty Oil/RGC	9/66	c	
26	T1982-023	JV meeting agenda	MLMRC/Getty Oil/RGC	9/66	c	
	82-1709	T1982-038 Examination of lithophile mineralisation	Sillitoe	NSW & Tasmania	p	Investigation with respect to ore genesis, volcanic style, deformation and prospectivity. East Darwin, Huxley, Jukes Pty, Prince darwin and Lake Jukes.
27	82-1791	T1982-037 Annual report	Meares, Pruvis, Hutton, Komysan	9/66	p	Good coverage of Jukes including geochem, geophysics and drilling JP1 and JP2 - text and figures
28	83-1995	T1983-019 Geological Review	Purvis, Jones and Poltock	9/66	p	Review of EL prior to relinquishment of 40% of the licence. Good information on: jukes-Darwin ridge, Jukes Pty, East Darwin, Garfield and Currie valleys, Clark valley, Huxley; Mt Ellen, Mountain Maid, West Diorite creek, King River gold mine.
28	83-1995	T1983-019 Geological Review	Purvis, Jones and Poltock	9/66	p	83-1995. Poltock report: Over Jukes-Darwin ridge gives a broad summary and recommends more Au work on Darwin. All known prospects on Jukes-Darwin ridge of no economic importance.
29	83-1996	T1983-020 Annual report	Purvis	9/66	p	Huxley - text+figures: Nasty Knob, Windy ridge, Huxley saddle
30	84-2137	T1984-046 Annual report	Roberts and Cartwright	9/66	p	Jukes Pty drill hole - JP3, Garfield Valley - Poltock report - Snake Spur, Sailor Jacks, Flannigans Intercolonial Spur, Lake Jukes, Huxley - text only - Poltock report.
30	84-2137	T1984-046 Annual report	Roberts and Cartwright	9/66	p	84-2137 Poltock reports. Garfield valley: 30 days fieldwork proprospective areas Snake Spur/Sailor Jacks for Cu/Au and Ag-Pb-Zn; Currie/Garfield divide for Au and stratobound base metals; Currie/West Jukes for Pb; Flannigans for detrital Au.
30	84-2137	T1984-046 Annual report	Roberts and Cartwright	9/66	p	84-2137 Poltock reports. Mt Huxley: Lady Havill - Sunrise - red Blow prospects between Huxley - Huxley East), sample of Tofft; Pb anomaly eastern Mt Huxley; Au anomalies in western area to south of King river (west of Jukes Pty); adit at Mountain maid.

TABLE 1: HISTORICAL REPORTS/ REFERENCES ON EL 5/98

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MRT (TCR) Number	CMT INMAGIC number	Title	Author	EL Number	Extract	Comments	
						(c=complete report, p=partial/selected sections only)	
31	85-2459	T1985-035	Annual report	FitzGerald and Pease	9/66	p	Huxley + Mt Ellen; Snake Spur, Garfield/Flannigans; Gold Pan Concentrate Survey Sedgewick-Huxley-Garfield (Pollock) (Appendix D); Dipole-dipole IP (Bishop) (Appendix E); UTEM Survey (Bishop) (Appendix E); UTEM Survey (Bishop) (Appendix H); sample results
31	85-2459	T1985-035	Annual report	FitzGerald and Pease	9/66	p	85-2459 Pollock report - Huxley: Diorite ck west explained (!) & no further work needed; Mt Ellen-Huxley results restrict potential, stream Au anomaly not confirmed, reappraise - 80# Golden Apple samples; Tofft/Huxley divide no further work warranted
31	85-2459	T1985-035	Annual report	FitzGerald and Pease	9/66	p	85-2459 Pollock report - Huxley: Diorite ck west explained (!) & no further work needed; Mt Ellen-Huxley results restrict potential, stream Au anomaly not confirmed, reappraise - 80# Golden Apple samples; Tofft/Huxley divide no further work
31	85-2459	T1985-035	Annual report	FitzGerald and Pease	9/66	p	85-2459 pollock report - Huxley (cont'd): Tofft/Huxley although bedrock sampling over/around alluvial workings recommended; Tofft/Mt Owen weakly anomalous Au warrants some further field work; King River/Jukes low base metal anomaly.
31	85-2459	T1985-035	Annual report	FitzGerald and Pease	9/66	p	85-2459 Pollock report - Garfield: Flannigans soil & bedrock sampling; Currie/Garfield divide bedrock traverses; Sailor jacks close spaced bedrock traverses; SW currie rivulet small anomalous Au test by bedrock sampling; Upper Garfield downgraded.
32		T1986-001	Notes on Geological Mapping	Hermann	Queenstown	c	Mapping and interpretation in the Glen Lyell - Great Lyell area (and Western Tharsis)
33	86-2566	T1986-039	Annual Report	FitzGerald and Cartwright	9/66	p	Huxley; Snake Spur-Flannigans; Huxley drill hole HX1 + petrography; Slate Spur drill holes SS1, SS2 + petrography; DHEM loops; Pollock notes - Tofft, Snake Spur, Flannigans; sample results; text and figures
33	86-2566	T1986-039	Annual Report	FitzGerald and Cartwright	9/66	p	86-2566 Pollock notes: Tofft chl-mag 48N/1200-1260E prospected by shallow pits, detrial gold 41N/1550E+qtz+spec hem in alluvial workings; Snake Spur geology OC-volcaniclastics-ignimbrites-rhyolitic lavas-qtz phric volcanics, occasional pyrite lens
33	86-2566	T1986-039	Annual Report	FitzGerald and Cartwright	9/66	p	86-2566 Pollock notes (cont): Flannigans geology Tertiary/recent - OC/Eldon Group - epicslastics - volcaniclastics
34		T1987-001	Authority to Prospect progress report	FitzGerald	Queenstown	c	Historical review and work accomplished in Great Lyell-Little Owen area
35		T1987-002	Authority to Prospect application	Roberts	Queenstown	c	Renewal in size of ATP to 10 sq. km
36		T1987-003	Authority to Prospect relinquishment report	FitzGerald	Queenstown	c	Relinquishment of 1,596 ha; Linda Valley, East Queen and southern slopes of West Sedgewick
37	87-2675	T1987-028	Relinquishment report	FitzGerald	9/66	c	Reviews work since 1966
38	87-2674	T1987-039	Annual Report	FitzGerald (and Bishop)	9/66	p	White Spur, Basin Lake, West Sedgewick, Jukes Pty, DHEM, logs
39		T1988-001/022	Authority to Prospect annual report	FitzGerald	Queenstown	c	Work in Little Owen (significant) and Comstock areas
40	89-2927	T1989-037	Annual Report	Anon	102/87	p	pp1-13 text only; Huxley area grids; Huxley Au occurrences; Duke Lyell Extended Cu-Au; Nasty Knob base metal zone
41	89-2946		Final and relinquishment report	Austmin Resources NL	104/87	c	EL covered Jukes Pty Prospect. Some rock chip sampling assayed for Au only
42		T1989-001/020	Authority to Prospect annual report	Fleming and White	Queenstown	c	Little Owen grid; relogging of drill holes LO1, LO2; ground magnetics
43		T1990-005	Authority to Prospect annual report	Uttley and Dufty; Wyatt	11M/90, 10M/90	c	Ground magnetics, aeromagnetics, aerial photography
44	90-3012	T1990-032/046	Annual Report	Wilde and Kerr	102/87	c	BLEG survey Great Lyell-Owen-Mt Ellen; IP survey Mountain Maid & Mt Ellen; south Huxley soil geochemistry
45	91-3252	T1991-056	Annual Report	Cameron and Read	102/87, 55/89	c	Garfield & Clark Valley geology, geochem & geophysics; Mt Ellen BLEG samples; no assay results for surface geochem
46	93-3426	T1993-037	Annual Report	Halley	102/87, 55/89, 12/92	p	Text only (from MRT CD). Garfield/Clark Valley geochem & petrology
47	94-3549	T1994-035	Annual Report	Halley	102/87, 55/89, 12/92	p	Text only (from MRT CD). Garfield mapping, drill hole GAR001
48	95-3721	T1995-072	Annual Report	Halley, Vicary and Boyd	102/87, 55/89, 12/92	p	Text only (from MRT CD). Garfield drill holes
49	96-3834	T1996-046	Annual Report	Halley, Vicary, Corlett and Wyman	102/87, 55/89, 12/93	c	Comprehensive, with good sections on Jukes and Garfield; helimag survey
50	97-3983	T1997-082	Annual Report	Joyce, Vicary and Gregory	102/87, 55/89, 12/92	p	Text only (from MRT CD). Slate Spur soil sampling
51	97-4059	T1997-076	Relinquishment report	Vicary and Denwer	102/87, 55/89, 12/92	c	Includes review by W Hermann
52		T1990-047	Geology, Geochemistry and Genesis of Cu-Au and Magnetite-Apatite Mineralisation at the Garfield Prospect	Duncan		c	BSc thesis 1997
53		T1997-089	The Geology, Mineralisation and Alteration of the Jukes Proprietary Prospect	Doyle		c	BSc thesis 1990
54		T1997-077	ETA 463 Queenstown Supplement to Application	Benjamin and Morrison	ETA 463	c	Outlines CMT exploration philosophy and methods for identifying targets
55		T1997-081	Assessment of ETA 463 Queenstown	Benjamin	ETA 463	c	CMT internal memorandum

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APPENDIX I

**HISTORICAL REPORTS/ REFERENCES ON
QUEENSTOWN EL 5/98**

APPENDIX IA

HISTORICAL REPORTS/ REFERENCES

ON THE

JUKES PROPRIETARY PROSPECT

 Summary of reports/references on prospect exploration

1998-1996 AMIRA P439 (several papers) (T1996-017 T1997-052 T1998-030)

Alteration project with traverses along the Jukes road (Wyman). Multi element and whole rock analyses. Papers need time for reading and digestion (!!) but contain some good work

1997 Relinquishment report and Herrmann review (T1997-076 97-4059) RGCE

RGCE considered it not worthwhile proceeding with further drilling at this prospect (generally constrained by position of King river tunnel).

Herrmann suggested short diamond hole(s) to test chargeability anomaly as part of the untested potential to the north.

1995/96 Annual report (T1996-046 96-3834) RGCE Appendix 12 (Corlett)

Comprehensive review of Jukes Proprietary with a proposed drill hole to test geophysical anomalies. Useful tabulation of historical work.

- geology
- mapping
 - ◊ CVC
 - lavas, feldspar phyric dacite, quartz and/or feldspar phyric and non-phyric rhyolite, volcanoclastic sediments, volcanic breccias, (monomict, clast-supported and polymict), porphyritic intrusives
 - ◊ eastern sequence - ? Tyndall Group equivalents
 - rhyolite, epiclastics
 - ◊ Owen and Jukes conglomerates
 - ◊ King river power tunnel
 - samples collected by MRT (*assume still available*), traceable sulphides in most samples
- alteration
 - ◊ potassic - strong association between k-fdsp and magnetite; possible at least two phases of potassic alteration
 - ◊ K-fdsp and chlorite - central part of the prospect usually with associated sulphides; some local destructive brecciation by magnetite
 - ◊ intense chlorite - pervasive, 1-5% disseminated sulphides, ±tourmaline; along fault contact
 - ◊ sericite - in both alteration phases; carbonate alteration widespread
- mineralisation
 - ◊ disseminations and veins associated with potassic alteration
 - ◊ disseminations and veins associated with intense chloritic rocks
 - ◊ pyrite/magnetite veins that brecciate k-fdsp altered rocks
 - ◊ sulphide stringers and disseminations within brecciated fault zones
 - ◊ fault breccias with malachite and native copper
- geochemistry - Cu: Au relationship of 1:1
 - ◊ rock chip and soil geochemistry (MLMRC)

Summary of reports/references on prospect exploration

- ◇ adit sampling
- ◇ rock chip from King river tunnel
- ◇ Jukes road traverse with multi-element analyses through CODES and AMIRA P439
- geophysics
 - ◇ helimag survey
 - ◇ gradient array IP
 - ◇ dipole-dipole IP
 - ◇ ground EM
- conclusions and recommendations - untested potential to the north
 - ◇ elevated Cu and Au assays
 - ◇ broad 1:1 Cu:Au relationship
 - ◇ untested elevated rock chip geochemistry overlying three co-incident geophysical anomalies
 - ◇ strong chargeable anomaly overlying a weak resistant zone
 - ◇ a magnetic high
 - ◇ elevated molybdenum, scheelite and magnetite (?porphyry environment)
 - ◇ intense potassic alteration - ?analogous to classic porphyry systems
 - ◇ untested potential to the north of previous activities (mining and exploration)

HEC (circa early 1990s) King tunnel geology - diagram only

1990 Doyle honours thesis (T1990-047)

Interesting comparison of Jukes Proprietary with porphyry copper systems

Relogs of JP1, JP2 and Z142003 (*hence assume this core is available through MRT*)

1989 Relinquishment report (T1989-040 89-2946) Austmin Resources NL
EL 104/87

This small EL over Jukes Proprietary was a consequence of the relinquishment of EL 9/66 by GFEL (and also possible a consideration with the imminent King river power HEC scheme). The relinquishment report has been the only one located for EL 104/87 (and with particular relevancy to EL 5/98). Austmin reviewed previous work (the thoroughness of the review should be treated with circumspect) and also carried out limited surface rock chip sampling that was assayed *for gold only*. Samples from HEC tunnel did not reveal any significant alteration. Concluded that potential is low for a suitable near-surface resource.

1987 Relinquishment report (T1987-028 87-2675) GFEL EL 9/66

Summarises work done during the 1980s (includes four of the five holes drilled into the prospect) mainly by MLMRC - GFEL. Most of the work was done in the earlier part of the decade. Recommends dropping of the area.

1986/87 Annual report (T1987-039) GFEL EL 9/66

Contains a good summary of historical work over Jukes Proprietary.
Rock chip sampling of Newell to Crotty road - disappointing results.
Drill hole JP4 - stopped/completed in elevated gold mineralisation
Mineralisation may be "...an expression of impersistent copper-gold veins which pervade the lava complex."

1983/84 Annual report (T1984-046 84-2137) GFEL EL 9/66
1983/84 Pan concentrate survey (Pitloch)

Drill hole JP3 - log and results.
Some surface rock chips

Geological Review 1983 (Purvis et.al) (T1983-019 83-1995) GFEL

Report reviews geology and sampling results (both from drill holes and from various campaigns of adit sampling). Two types of mineralisation; presence of a faulted contact along the mineralised rocks; Jukes Pty fault post-mineralisation; traces of galena, sphalerite and barite. Estimates a potential for at least 5 mt at Jukes Proprietary. Recommends two drill holes, each to be drilled at least 50 metres into the enclosing lavas (i.e. through the zone of visible mineralisation) to test for flanking copper-gold mineralisation.

1981/82 Annual report (T1982-037 82-1791) MLMRC EL 9/66

Significant work done on the prospect during the year: mapping, petrology, geochemistry, geophysics and diamond drilling. (Note: report refers to HEC seismic line (860N) *indicating a date for the HEC work.*) Helicopter access. Grid and base line.

- Stratigraphy and alteration - refers to work of Corbett and Eastoe.
- Structure - attitude/strikes, cleavage and faults.
- Alteration - intensity of chlorite alteration, presence of tourmaline
- Mineralisation - three styles; magnetite-pyrite, chalcopyrite-pyrite, manganiferous siderite rich in chalcopyrite
- Discussion and genesis - granite body now faulted out; relationship and control of mineralisation; faulting; explosion breccias
- Geochemistry - adit sampling, rock chip and soil sampling
- Geophysics - gradient array IP, dipole-dipole IP, ground magnetics, ground EM
- Diamond drilling - JP1 and JP2, JP1 stopped/completed in weakly altered basalinal rocks. JP1; 2m @ 0.53%Cu, 3g/t Ag. JP2 13.4m @ 1.6%Cu, 1.6g/t Au, 5.4g/t Ag.

Sillitoe 1982 (T1982-038 82-1709)

Discusses geology and suggests Jukes Proprietary is worth further work.

1980/81 Annual report (T1981-024 81-1660) MLMRC EL 9/66

Renewed exploration interest with emphasis on gold potential. Adit dumps were sampled (all high value copper). Report makes the observation that the sulphide lens may have been faulted out.

Eastoe 1981 (T1981-023 81-1626, 81-1634, 81-1661)

Eastoe alteration study investigated the Darwin - Lyell region. Minor specific information/description on the Jukes-Darwin area and the King river section:

Ruddock (T1974-023 74-1010) Work by INAL (for BHP) EL 13/65

Comprehensive report covering work done over two year time span.

- Geology - flanking pyroclastics (interfingering crystal-lithic tuffs, agglomerates and lavas) overlying massive central core lavas; Jukes Proprietary fault trends north-east and dips steeply at 75-85° demarcates the boundary of the mineralised chlorite alteration zone; magnetite-haematite veins common in the central core volcanics; foliations trend 310° and dip 85° to south-west.
- Mineralisation - three "parts"; central where mineralisation tends to be continuous along strike, northern where mineralisation occurs in discontinuous chloritic lens and southern where mineralisation is more complex being associated with shears and occurring as fine disseminations and as coarser aggregates.
- Geophysics - strong IP anomalies correspond to mineralisation in the central part (strongest just below No 1 and 3 workings).
- Drill hole Z142003 ; 139.2m-145.2m ⇒ 6m @ 0.59%Cu
- Concluded that mineralisation does not extend in depth: "...possible that near surface mineralisation represents secondary enrichment of leaner primary mineralisation." No economic mineralisation within 500ft of surface. Drill core confirmed deposition near the base of thick pyroclastic flows (ignimbrites) laid down in the central portion of massive (rhyolitic) lavas.

Corbett and Cuffley (T1974-024 74-1060) Geology of Jukes-Darwin field LEE EL 13/65

Discusses geology and mineralisation - disseminated sulphides with relatively rich zones containing small shoots of massive sulphides within quartz chlorite schist. Little copper mineralisation associated with extensive haematite-pyrite veining. Note: diagram shows Imperial Jukes below and north of Jukes Proprietary (c.f. Twelvetreeces above). Magnetometer survey (Rodda) did not show unexpected anomalies. Self potential anomaly not explained. Adit no 1: 24ft @ 4.10%Cu, 0.53oz/ton Ag, 0.27oz/ton Au; dump sample 12.4%Cu. Adit no 2: no significance assays; dump sample 4.3%Cu. Adit no 3: 1.30%Cu, 0.03%Zn, 2.5dwt/ton Ag.

Summary of reports/references on prospect exploration

Gilfillan (T1967-487 67-487) Literature survey and preliminary inspection USMRC EL 2/64

Report gives a brief description on most of the workings in the Jukes area:

- North Mount Jukes
- King Jukes
- Jukes Comstock
- Jukes Proprietary
 - * geology - faulting, alteration, haematite-chalcopryrite relationship not understood
 - * sampling - dump samples returned high assays
 - * geophysics - self potential survey, magnetometer survey (Rodda)

plans show geology and geophysics contour lines

Rodda (T1957-009 57-143) **Report on magnetic anomaly 3N/6 SPL 307, SPL 308**

Original interpretation of the ground magnetics. From the report it is not clear whether or not Rodda actually carried out the field work. Four traverses were made. Anomalies (both strong and weak) were indicated on each line. A major fault was identified/confirmed (Jukes Proprietary fault) trending NE-SW. A structural similarity to the Linda Disturbance was commented on. Stratigraphy uses "old" terminology (e.g. Dundas rocks). Suggests a nuée ardente origin for some of the rock types. Two styles of mineralisation were identified - veined and disseminated sulphides (pyrite and chalcopryrite) and massive oxides (magnetite and haematite). Concluded that the magnetite outcrop(s) were the cause of the anomalies.

Loftus Hills 1914 (T1914-003)

Section 6012-M (lessee H.H.Souter) Jukes Proprietary

Most prominent ore outcrop indicated by a brown ridge (pyrite ⇒ limonite) striking east of north. Discusses No 1 and 2 adits. Development of No 3 adit started just before Loftus Hills' visit. Briefly mentions two (note!) adits driven by the Jukes Comstock Company.

Twelvetrees 1900 (T1900-015)

Inspected all the workings in the area.

(a) King Jukes Mine

Not operating when inspected due to financial difficulties. Refers specifically to one tunnel. Country rock described as chlorite schist and felsite, chlorite alteration where mineralised. Pyrite and copper pyrites. Possible some haematite/magnetite ("dark black"). Fissures/joints subparallel to development.

(b) Jukes Comstock

Summary of reports/references on prospect exploration

Two tunnels (upper 15ft long, lower 84ft long and 250ft below the upper) below and on the same ore-belt as Proprietary Mine. Development in reddish felsite (quartz porphyry) with abundant pyrite and assays $3\frac{1}{2}\%$ Cu, $3\frac{1}{2}$ dwts Au. Minor galena in pug at the contact between felsite and (Silurian) sandstone. Tunnel development subparallel to ore belt and generally disappointing. Carbonate staining at tunnel entrance suggestive of copper further in. Ore from tunnel assayed at North Lyell 6.02% Cu, 9.66% iron oxide and 3.90% lime. Country geology consists of ore-bearing felsite bounded to the east by pale schists and to the west by sandstone.

(c) Jukes Consols

Tunnel driven in felsite (as with the other mines). Not physically inspected by Twelvetrees.

(d) North Mt Jukes

?not inspected?

(e) Mt Jukes Proprietary (Jas Bean - Manager)

Upper tunnel (No 1 adit) developed in schistose felsites varying from green (chlorite) and mineralised to grey and poorly mineralised. Schistose rock alternates with felsite. Identified twinned feldspar (i.e. igneous origin). Winze sunk on the ore band returned assays of 15% Cu, 12 dwts Ag, $3\frac{1}{2}$ dwts Au. Drive and x/cut development off the winze. Lower tunnel (No 2 adit) advancing. Trenches (at surface) below the lower tunnel. Haematite outcrop in NW corner passes into the Jukes-Comstock section. No zinc in this field. (Note: middle (No 3) adit developed after this report written) Relationship between iron and copper not understood.

(f) Queen Jukes - east of Jukes Proprietary and south of King Jukes

Minor development but very little work done. Mineralised rock.

(g) Imperial Jukes

East of Lake Jukes. Confusing!! ??????

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APPENDIX IB

HISTORICAL REPORTS/ REFERENCES

ON THE

MT ELLEN PROSPECT

1900 Twelvetrees

Twelvetrees inspected/visited Mt Ellen mine. Charted in the name of J.B.Curran. Mr.J.H.Havill (prospector) living on site. Description is a bit confusing as he refers to both the Huxley tunnel and Mt Ellen. The report does not cite any production figures although does quote some gold costs (i.e. Huxley gold worth £3 15s per oz, Nuggety creek gold worth £4 2s 6d per oz.)

Felsitic rock and cupriferous chlorite schist. Decomposed to a soft reddish clay seamed with flat quartz leaders and thin veins of ore. No gold found in the hard felsite - seems restricted to softer parts of the rock. Dish prospects returned mossy gold and flakes, some attached to fragments of white quartz.

Gold is not alluvial but in situ. Represents an auriferous district with the gold sparingly distributed and restricted to a few peculiar formations.

1900s Government quarterly reports

Prospecting work, erection of a five-head battery (June 1900), sluicing and crushing (December 1902), and production of 6½ ounces of gold (June 1903). Reports in CMT library are almost complete. Reports for 1904-1907 do not mention Mt Ellen (reports in CMT shelves are almost complete) - this is needs to be investigated further as the 1975/76 annual report (MLMRC) references Batchelor extracts from MLMRC letter book. Note also that September 1902 report states the Mount Ellen was formerly called Huxley (Huxley tunnel) as well as making reference to salting.

1920s - 1960s ??any work done??

Need to ascertain if any work/exploration done in the Mt Ellen area during this period.

1970/71 Annual report MLMRC (T1971-011) EL 10/69

Literature search re Mt Ellen gold mine - suggests it has little or no economic potential. (Actual reports referenced are not documented.) Attempts to locate the mine not successful.

1975/76 Annual report MLMRC (T1976-010 76-1172) EL 10/69

Mt Ellen gold mine relocated December 1975. Some chip sampling; 6.2ppm Au beneath old battery stamp, averages 1.1ppm Au, 209ppm Cu, 44ppm Pb, 43ppm Zn. Unaltered sequence of fdsp porphyry lavas.

1981/82 Annual report GFEL (T1982-037 82-1791) EL 9/66

Notes that an earlier gradient array IP survey (doesn't state which one) was not completed as planned.

A stream sediment survey returned low to moderate order anomalies in Cu, Pb, Zn in the vicinity of Mt Ellen.

1982/83 Annual report GFEL (T1983-020 83-1996) E 9/66

No specific details on Mt Ellen. Geological mapping through the Huxley area was carried out in a reasonable amount of detail

1983 Geological review GFEL (Purvis et.al.) (T1983-019 83-1995) EL 9/66

Review discusses the Huxley area in general and some additional information on individual prospects. Not a lot of detail on Mt Ellen.

Mt Ellen: Mineralisation may represent a weak root zone to a stratiform pyritic body. Stockwork comprises quartz and limonite veinlets hosted by argillically altered and deeply weathered intermediate lava.

Diorite creek west: alluvial and possible elluvial workings that staddle the boundary between the Western Sequence and fdsp phytic volcanics of the Central Sequence. Small (10m x 30m) insignificant lens of chlorite pyrite mineralisation.

1983/84 Annual report GFEL (T1984-046 84-2137) EL 9/66

Comments on the (poor) quality of previous/initial sampling in the Dirite Creek/South Conglomerate Creek areas. Mt Ellen is inferred to be source of gold anomalism, but details are not enumerated or discussed.

Outcrop geology is shown along a traverse taken up south conglomerate creek from the helipad (Figure 37) - rhyolitic lavas and tuffaceous sediments.

1985 Annual report GFEL (T1985-035 85-2459) EL 9/66

Pan Conc Survey (Poltock)

Dipole-dipole IP survey (Bishop)

Reconnaissance and soil bedrock sampling over Mt Ellen (hand augur and Wacker). Disappointing results. Samples taken every 25 or 50 metres where not obscured by glacial overburden. Samples seived to minus 80 mesh and assayed for Au, Cu, Pb, Zn, Ag, As and Ba. Possible that sampling technique not seeing through the glacial cover. Geological mapping similarly hampered. Source of gold remains unexplained.

Dipole-dipole IP survey over Huxley area identified some weak anomalies but not in the Mt Ellen area.

Poltock exercise reports on gold pan concentrate survey. Mt Ellen characterised by coarse gold with specular haematite. No visible mineralisation. Some magnetite (in rhyolites) on 3400E.

Summary of reports/references on Mt Ellen gold mine

Mt Ellen grid - consists of 4 lines;

(a) a "baseline" labelled 1000N with 0E positioned at the edge of the EL. Pegged at 25 metre intervals over an easterly distance of 2400 metres. Located south of Mt Ellen workings.

(b) a north-south line along 300E, over a distance of 500metres from 600mN to 100mN and pegged every 25metres

(c) a north-south line along 1600E, over a distance of 700metres from 800mN to 1500mN, pegged every 25 metres

(d) a north-south line along 2400E, over a distance of \approx 800metres, from \approx 900mN to 1675mN, pegged every 25 metres. The northerly limit of this line is close to Mountain Maid workings (and probably crosses the Mountain Maid grid lines)

1988/89 Annual report BHPM (T1989-037 89-2927) EL102/87

Briefly reviews what is known about Mt Ellen and West Diorite creek (latter exploited lag gravels - Jones (1983) found no evidence of significant veining in the exposed bedrock).

1989/90 Annual report BHPM (T1990-032 90-3102) EL 102/87

BLEG survey showed north Mt Huxley to contain the largest area of anomalous drainages. Anomalies at Diorite and West Diorite creeks.

Reviews historical information; decomposed reddish clay gradational with massive felsite and cupriferous chlorite schist. Gold restricted to softer clay rock. In a nearby trench gold associated with oxidised cubes of pyrite.

Resampled by BHP. BHP and GFEL sampling did not reproduce high Cu values of MLMRC - possible laboratory contamination of latter.

Two test IP lines. 50m dipole spacing. Broad poorly defined anomaly associated with Mt Ellen workings.

Recommends high priority follow up geochemical work to generate drill targets around Mt Ellen environs.

1990/91 annual report BHPM (T1991-056 91-2352) ELs 102/87 and 55/89

Extended BLEG survey with some anomalous results reflecting a bedrock source upstream of Mt Ellen.

Rock chip samples taken from walls of the two adits (channel sampled). Best results 5m @ 2.18g/t and 3.95g/t. Stringer veins produced \leq 0.5g/t. Gold appears to be related to thin quartz stringers. Exposed mineralisation is weak and may be distal to the primary source.

Summary of reports/references on Mt Ellen gold mine

1991/92 Annual report RGCE (92-3373) ELs 102/87 and 55/89

Report needs to checked for any reference to work done in the Mt Ellen - Mt Huxley areas.

1997 Relinquishment report RGCE (T1997-076 97-4059)

Herrman review; Trial IP survey returned a broad chargeability response not clearly associated with mineralisation. Chip sampling results 5m @ 2.2g/t Au and 2m @ 4g/t Au in quartz veins.

Note: RGCE relinquishment report does not refer specifically to Mt Ellen. i.e. RGCE apparently did no work on the Mt Ellen prospect - the RGCE reports from 1992 to 1996 indicate that this was the case.

However it is possible there was a mix up or confusion over results thought to be from Mountain Maid but which were in fact from Mt Ellen. (Significant work was done on Mountain Maid prospect - see RGCE 1996 report (T1996-046, 96-3834)).

1998 Denver report (T1998-019 F00747)

Noted anomalous gold assays from MLMRC and BHPM sampling. Commented briefly on rock types, alteration and veining. A significant stream anomaly of 1.27ppm (MLMRC 1980) needs to explained. Recommends more detailed mapping of the workings and any outcrop along existing grid lines, followed up by more tightly spaced gridding, mapping and soil sampling. (Note: Access route to the workings is stored as waypoints in the GPS. This route follows geography/topography. Refurbished grid lines (3200E and 8000N) now provide easier access.)

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APPENDIX IC

HISTORICAL REPORTS/ REFERENCES

ON THE

HUXLEY AREA

Summary of exploration -activities/reports/refernces

Huxley Area

1997 Relinquishment report RGCE (T1997-076 97-4059) ELs 102/87,55/89,12/92

Reviews Mountain Maid. Silica-pyrophyllite-pyrite alteration in CVC dacite lavas and sediments. Rock chip samples up to 0.31g/t Au. IP survey carried out.

1995/96 Annual report RGCE (T1996-046 963834) ELs 102/87, 55/89, 12/92

Major project work done on Mountain Maid prospect. Otherwise nothing of significance in the Huxley area.

1989/90 Annual report BHPM (T1990-032 90-3102) ELs 102/87, 55/89

BLEG survey - area north of Mt Huxley contains largest area of anomalous drainages (drains an area underlain by GLF).

1988/89 Annual report BHPM (T1989-037 89-2927) ELs 102/87, 55/89

BHP compile and evaluated previous data, re-samples old prospects. Gridded and UTEM surveyed the entire area. UTEM response showed Huxley area to contain promising signs of gold and/or base metal mineralisation. The low UTEM response indicated that any potential orebody would lie in depths in excess of 200metres.

Recommended:

- IP coverage of central Huxley
- bedrock geochemistry
- follow up UTEM in areas of interest
- geological mapping and re-logging of drill core

1987 Relinquishment report GFEL (T1987-028 87-2765) EL 9/66

Reviews work done in chronological order but does not specifically discuss potential in the Huxley area.

1985/86 Annual report GFEL (T1986-039 86-2566) EL 9/66

Drill HX1. No significant assay values. No notable response from downhole EM.

Tofft geochemistry (Poltock).

1984/85 Annual report GFEL (T1985-035 85-2459) EL 9/66

Poltock pan conc survey
Bishop dipole-dipole IP survey

 Summary of exploration -activities/reports/refernces

Geology: Mapping of the Cambrian Central sequence hampered by glacial cover and structural complexity. Rocks are described for the vicinity of Nasty Knob, south of Windy Ridge to Huxley Saddle, and west of Nasty Knob (area south of Huxley Saddle not mapped in detail). Both Jukes Bx and Owen Conglomerate are described.

Structure:

- ◆ primary control is a probable N-NNW depositional basin
- ◆ two phases of deformation and associated faulting
- ◆ D1 developed large scale folds in the more competent units and small scale tight folds with axial planar cleavage in the finer grained units; probable that major faults such as GLF related to D1; a major fault 300m west of and parallel to GLF
- ◆ D2 developed strong NW overprinting cleavage, strong NW trending faulting, and minor folding

1983 Geological review (Purvis et.al.) (T1983-019 83-1995)

Huxley area divided into three geological units:

- an older westerly sequence of sediments, tuffs and intermediate to basic volcanics
- a central intra-caldera sequence of acid volcanic nature within which rhyolite domes, ignimbrites, air-fall tuffs, and sediments ± exhalites have been recognised
- Owen conglomerate in faulted contact with the underlying Cambrian volcanics

Targets/recommendations:

- ⇒ stratiform base metal potential extending south from Nasty Knob close to the Owen conglomerate; 2 holes recommended totalling 400 metres of drilling preceded by mapping (particularly some 150metres south of Nasty Knob where Jukes bx (?) occurs as an apparent fault wedge discordant with the Owen - ??Tyndall equivalents??) and rock chip sampling
- ⇒ Au potential of potential pyritic exhalite units; further mapping and geochemistry required
- ⇒ low order Au stream sediment samples should be followed up

Unreliability of earlier (1972) geochemical sampling commented on.

The Nasty Knob gossan is structurally complex outcropping in deformed volcanics and possibly representing remobilisation of stratiform mineralisation into a shear zone. The mineralised horizon extends south as a tuffaceous unit that represents a potential environment for massive sulphides.

1981/82 Annual report MLMRC (T1982-037 82-1791) EL 9/66

Brief review of previous exploration: Pickands Mather 1966/67 stream sediment survey that included the Huxley west area. Samples assayed for cold extractable Cu and total extractable Cu, Pb, Zn and As. Huxley grid established in 1971/72 and used for mapping, soil sampling and ground magnetics. A gradient array IP survey was not

 Summary of exploration -activities/reports/refernces

completed as planned. Dighem airborne EM survey from Lynch creek to Whip Spur in 1980.

Stream sediment survey 1982. Assayed for Cu, Pb, Zn, Mn, Fe, Co \pm Au. Low to moderate order anomalies in Cu, Pb, Zn south of Whip Spur in a belt of sericitised felsic tuffs and lavas. Au generally above background. Glacial moraine derived from OC of Mt Owen and Mt Huxley.

Dighem survey flown in 1982, 150m line spacing, bird height 35m. EM, resistivity, magnetic plans produced at 1:10,000. Low order EM anomaly near Huxley track, approx 2kms north of Mt Huxley. Resisitivities were mostly high. Several magnetic anomalies outlined. (? Where ???)

1975/76 Annual report MLMRC (T1976-010 76-1172) EL 10/69

Rock chip sampling of a trench 1km north of Mt Huxley (??Mountain Maid). Semi-massive pyrite and quartz within sheared silicified siltstone. Sediment lens occurs in a sequence of altered haematitic, fdsp porphyry lavas. Pyrite zone occurs along the contact of the two rock types.

Geological mapping from Roaring Meg creek to miners slate ridge.

1974/75 Annual report MLMRC (T1975-014 75-1117) EL 10/69

Whip Spur - Mt Huxley area; regional mapping, soil and stream sediment surveys.

Mapping: north of Mt Huxley and west of the Huxley track sequence dominantly acid lavas rather than pyroclastics as previously mapped. Three units within the lava sequence; (i) ?rhyolites (ii) fdsp porphyry lava (iii) interbedded lavas and pyroclastics (xtl tuffs \leftrightarrow agglomerates \leftrightarrow welded tuffs). Acid lava sequence has a sharp contact with the Queenstown pyroclastics (acid tuffs \pm interbedded shale and siltstones) with qtz porphyry bodies along the contact (either intruded as sills or extruded as lavas). Faulting may be significant.

Reconnaissance soil survey indicate regional trends: 200ft (61m) spaced samples (base of B horizon wherever possible) along Huxley grid. Both size fractions assayed for Cu, Pb, Zn. Extensive glacial/ scree cover and transported soils. Statistical treatment of results. Cu threshold 50ppm - 110ppm; Pb background 70ppm - 75ppm; Zn bimodal distribution with separation at 40ppm.

1972/73 Annual report MLMRC (T1973-014 73-973) EL 10/69

Extension of grid lines for general access (lines 32N, 16S, 48S, and 80S). Interpretation of geology from field mapping.

1971/72 Annual report MLMRC (T1972-009 72-892) EL 10/69

Summary of exploration -activities/reports/refernces

Establishment of exploration grid (lines labelled 00, 1600S, 3200S, 4800S, 6400S, 8000S, 9600S and 11200S). Detailed geological mapping (two unconformities within the Cambrian). ground magnetics, surface geochemistry.

1960s

Modern exploration dates from the mid-sixties.

APPENDIX ID

HISTORICAL REPORTS/ REFERENCES

ON THE

GREAT LYELL - LITTLE OWEN AREA

1997 & 1998 S.King (ERA Maptec & Solid Geology) (T1998-004 and T1998-036)

Interpretation of aeromagnetic and gravity data and structural interpretation on 1M/95 did not cover in detail the Little Owen - Great Lyell area. However Copper Estates was identified as prospective, being a structurally complex area of Owen conglomerate surrounded by volcanics (? repeat of North Lyell scenario ?); fault-shear pattern, gently dipping cleavage, changes in strike and isolated slivers of Owen Conglomerate

1997 Relinquishment report RGCE (T1997-076 97-4059) ELs 102/87, 55/89, 12/92

No reference made to Great Lyell - Little Owen area. The section on previous exploration makes no reference to the A to P. Similarly Herrmann's report does not mention the area between the Lyell Highway and Nasty Knob.

1993 AMIRA P291 (Berry) (T1993-036)

Information on the GLF (Great Lyell fault) is relevant to the Great Lyell - Little Owen region. In places the volcanics/OC contact is depositional, interpreted as an onlap surface. Where identified, faulting is at high angle to bedding. The Glen Lyell fault demarcates a tectonic regime; Mt Lyell mineralisation is a continuous east facing sequence, changing to west facing in Conglomerate Creek (which is west of the fault).

1992 Old mines, new vision (Flitcroft and McKeown) (T1992-003)
(also Dufty, 1991)

Review of relevant mineral shows includes: Dixon street lead anomaly, Copper Estates, Lyell Reserve, Great Lyell, Duke Lyell, and the Little Owen gold mine (Empress Lyell is referred to in photograph 10-6).

Recommends drilling of Little Owen to test a significant gold target. No work done on Little Owen prospect since 1989

1992/93 Annual report RGCE (T1993-001) ML 30M/80

In February 1992 the A to P was terminated. The Great Lyell - Little Owen area covered by the A to P was added to EL 102/87 (BHPM) a tenement which was included in a BHPM-RGCE JV. (This needs to be confirmed, as ML 30M/80 not exactly the same as 1M/95.)

1991/92 Annual report GFEL (T1992-001) A to P

Summary of previous work outlines work done in the Great Lyell - Little Owen area (late 1970s through 1980s). (Note pencil comments (?Flitcroft) on some aspects not followed up, viz. - trend of the Au anomalous chloritic alteration zone, unit of intrusive andesites.) Otherwise no work in the Great Lyell - Little Owen area.

Downhole geophysics on drill hole GL14 (Glen Lyell).

1990/91 Annual report GFEL (T1991-001) A to P

No work in Little Owen - Great Lyell area.

Work in the Glen Lyell area. Detailed geological mapping, rock chip sampling, two diamond drill holes (GL13 - abandoned at 676.5m due to puggy faults (planned depth 1100m); and GL14 - completed at 1155.7m), and downhole geophysics. No significant Cu mineralisation, although an extensive zone of qtz-ser-py alteration was confirmed. "Room exists for an orebody at least the size of Western Tharsis".

1989/90 Annual report GFEL (T1990-005) A to P

Grd mag survey (conducted late 1988/89) indicated a strong correlation between Little Owen alteration zone and a series of magnetic highs. This together with interpretation of aeromag resulted in recognition of a magnetic signature to Little Owen mineralisation. Wyatt (Appendix 2 - interpretation of aeromag) found that the most extensive anomalies correspond with outcrops of Tyndall. Three separate anomalies within the A to P possibly associated with andesitic volcanics of the Tyndall.

Aerial photography flown over A to P (and the ML). Photogrammetry sheet over Little Owen being produced by HEC.

1988/89 Annual report GFEL (T1989-001) A to P

Work completed included:

- establishment of a grid (25metre line spacing) over Little Owen adits
- detailed mapping and rock chip sampling at 1:500
- relogging of drill holes LO1 and LO2
- ground mag survey (readings at 5metre intervals)

Linear trend previously identified now known to be part of a broad zone dominated by strong chloritic alteration. Significant Au associated with chl±pyr±hem±mag±cpy. Rock chip assays generally disappointing.

Conclusions

- rocks difficult to identify due to alteration and deformation histories, frequently deeply weathered
- structure is not definitive in defining areas of gold mineralisation although does control the shape of the alteration zone
- chloritic alteration is dominant frequently veined or brecciated, and a significant alteration assemblage consists of chl-py-hem-mag-cpy
- Au mineralisation occurs throughout the alteration zone as opposed to a linear Au trend

For spreadsheet compilation/data entry: rock chip geochem (Appendix 2), re-logs of drill holes LO1 and LO2 (Appendix 3).

1987/88 Annual report GFEL (T1988-001) A to P

Investigations aimed at identifying structural controls on gold mineralisation in vicinity of Little Owen adits. Entailed detailed mapping, systematic channel sampling (surface) and re-opening followed by channel sampling of adits (Great Lyell, Duke Lyell and Empress Lyell). Recommends diamond drilling around and below the Little Owen adits as well as additional geochemical and geological work.

Geochemical sampling with mapping by Herrmann (Appendix B) did not identify extensions to known mineralisation. Structural controls on the gold mineralisation were not identified. No evidence for major WNW trending fault zone. Volcanics - OC contact considered to be not faulted and distribution of these sequences controlled largely by folding. Potential for higher grade shoots with attractive tonnages remains untested.

Petrology samples (Joyce - Appendix C)

For spreadsheet compilation/data entry: surface channel samples, adit channels samples and rock chip geochem (Appendix C),

1987 Application for renewal GFEL (T1987-002 87-2679) A to P

Considers the Little Owen area to still be prospective for gold. Structural setting similar to Henty. Further work considered necessary:

- insufficient drilling to date to test the patchy nature of gold distribution
- intercept of GLF and Little Owen mineralised trend prospective with two historic workings (Empress Lyell and Duke Lyell) close to this location
- WNW striking structures parallel to Little Owen considered prospective, particularly where approaching GLF

Proposed work includes:

- completion of diamond drill testing near Little Owen adits
- systematic bedrock sampling across WNW trending structures east of Little Owen
- channel sampling of selected historic workings near GLF and Little Owen mineralised trend
- assay selected drill core for gold

1987 Progress report 1986/87 GFEL (T1987-001) A to P

A significant volume of exploration carried out in the Little Owen area (helicopter-supported!).

Report gives a useful historical review viz.

Summary of reports/references

- *pre 1910* Great Lyell leases (Little Owen adits, haematite tunnel, Great Lyell (Whim) shaft, Great Lyell adits), Duke Lyell, Empress Lyell, Duke Lyell Extended, Lyell Reserve
- *1910 - 1965* Generally little activity over this time span. Douglas (for MLMRC) inspected some of the workings 1936-37, as did the government inspector (Harrison). Wade and Solomon covered the area as part of their regional mapping and this was followed by geophysical surveys (1957, BMR - EM, magnetics, SP, Turam; 1959, McPhar - IP). Five holes were drilled in 1961 - 1962.
- *1965 - 1969* Covered by EL 12/65 (Pickands Mather International Ltd). Stream sediment surveys covered Little Owen and Roaring Meg areas and indicated some anomalies in the latter although results generally disappointing (glacial moraine and scree cover plus smelter contamination). Geophysics surveys. Eight holes drilled, with only one (RM201 just west of the Hematite Tunnel) intersecting any notable mineralisation
- *1969 - 1976* Covered by EL 10/69 (MLMRC). Relogging of drill core, sampling of dumps (adits unsafe) geological mapping, IP survey (gradient array and moving Schlumberger), geochemical work and drill hole proposals (Brophy)
- *1977 - 1986* Little Owen area excluded from EL 9/66 JV and hence no work done (Little Owen area) 1977-1984. Gradient array IP survey over Conglomerate Creek and Copper Estates (1982), gold assessment (Jones) and mapping (Herrmann).

Geology

- Central Sequence complex suite of volcanics simplified from west to east - lavas (rhyolitic to dacitic, feldspar-phyric) and intrusives, epiclastics (tuffaceous, ± shales, siltstones etc.), felsic pyroclastics of the Owen ridge (include agglomerates, tuffs and ash - ? ignimbritic?); andesitic intrusions (west and south of Little Owen) and numerous smaller dykes; detail is complicated by
 - ⇒ rapid facies variations
 - ⇒ masking/destruction (alteration) of original textures
 - ⇒ deformation ± intense surface leaching
 - ⇒ lag-gravel and scree cover
 - ⇒ lack of distinctive marker horizons
- underlying Cambrian MRV sub-aerial felsic to intermediate volcanics with associated intrusives and epiclastics; in the west abut the predominantly marine volcano-sedimentary Western Sequence; in the east in faulted contact with OC (possible folded depositional contact represented by outcrops of haematitic volcano-lithic conglomerate)

Little Owen area gold mineralisation lies at the south-western extremity of the large Mt Lyell hydrothermal alteration system.

Imbricate thrust structures characterise the volcanics/Owen contact in Copper Estates area. Further south the nature and extent of GLF is unclear. Spine of Little Owen ridge may represent the axis of a northerly striking syncline (D1). A strong penetrative NW trending cleavage complicates structural interpretations. This cleavage is related to D2 deformation and cross-faulting.

Summary of reports/references

Little Owen adits area (gold mineralisation): complex geology that includes fine epiclastics, massive tuffaceous sandstones and conglomerates, felsic lavas (\pm altered), coarse agglomerates, \pm ignimbrites, volcanoclastics and altered/detextured schists. Andesitic - dacitic. Disseminate py, minor cpy and minor but characteristic hem. Well defined IP anomaly. Specularite veinlets appear to cross-cut the penetrative cleavage. Notable hydrothermal and/or tectonic brecciation.

Geochemistry - three phases of sampling

- rock chips along grid lines, assayed for Au,Cu,Pb,Zn,Ag and As
 - channel sampling of adits using a lightweight percussion chipping hammer, assayed for Au and \pm Cu,Pb,Zn,Ag,As,Ba,Bi,Mo,W and Fe
 - surface channel sampling perpendicular to adits, assayed for Au and Cu
- Significantly anomalous gold (e.g. 2m @ 20g/t Au) with comprehensive checking of results (see Table 2). Apart from Cu there appears to be no other metal association with gold. Petrology investigation (Joyce - Appendix C)

Drilling - Two holes drilled (Kempe rig) - LO1 (130.0m) and LO2 (180.0m) - and assayed for Au,Cu,Pb,Zn and Ag, Gold grades disappointingly low.

Features delineated in the Little Owen adits area:

- an anomalous gold zone
- assays up to 20g/t Au
- parallels trend of major cross-faults that offset the GLF
- open along strike and down dip
- thin but anomalous shoots in proximity to the main anomalous zone

Recommendations

- detailed channel sampling
- diamond drilling
- structurally based mapping
- detailed rock geochemistry

For spreadsheet compilation/data entry: drill hole logs LO1 and LO2 (Appendix B), Little Owen adits channel samples (Appendix D2), Little Owen surface samples (Appendix D3), miscellaneous rock chip geochem (Appendix D4).

1986 Notes on geological mapping GFEL (Herrmann) (T1986-001)

Investigation of the Glen Lyell - Great Lyell - Nasty Knob area in response to recommendation (by Arnold) that lease mapping be extended southwards to delineate zones of primary volcanogenic mineralisation, position of the Owen/volcanics contact and alteration particularly of haematite, barite and silica. Historic workings were also sampled/reviewed.

Lithotypes and stratigraphy

- central volcanic - intrusive sequence; dacitic fdsp porphyries, felsic pyroclastics, epiclastic sediments, mafic intermediate volcanics, andesitic intrusives

Summary of reports/references

-
- Lyell schists; felsic, mafic, intermediate and undifferentiated schists
 - Owen conglomerate

Structure

- volcanics - conglomerate contact
- structure of the volcanics and schists

Mineralisation

- disseminated pyrite in qtz-ser schists
- silica-pyrite heads, pyritic beds, qtz-barite-py veins in qtz-ser schists
- haematite alteration at conglomerate contacts
- qtz-chl-carbonate-fdsp veins
- haematite-py veinlets and disseminations in chloritic schists

Sample descriptions: Great Lyell adits, Great Lyell shaft, Drill holes GL1 and GL2, Great Lyell workings, vicinity of Duke Lyell

Tables with assay results, photographs of rock types, diagrams showing geology, sample locations and structure.

For spreadsheet compilation/data entry: sampling data (Appendix A and Fig 4 for sample positions),

1985 Jones (T1984-018 F00106, T1985-006 F00110)

Assessment of gold results and gold potential. Sampled drill holes GL1 to GL5 for gold. Slightly anomalous results in haematitic material.

1984 Brook (T1984-004)

Reviewed exploration of the MLMRC. There is brief mention of Lyell Estates, Duke Lyell and Great Lyell as all being prospective, but the emphasis of the report is on other more prospective locations (e.g. North Lyell, Comstock etc.)

1984

Authority to Prospect granted 5th January subsequent to reduction in size of the Consolidated Mining Lease (15M/75) (with exploration over the mine lease carried out as part of the work programme on the adjoining EL 10/69) in 1980 (30M/80), formation of the "Buffer Zone" (not included in JV arrangement with Getty Oil Development Co. over EL 9/66) and pegging of Mining Lease Applications (MLAs). Renewals and relinquishments of MLAs subsequently incorporated in the A to P.

The A to P covered the Great Lyell - Little Owen area.

1982 Bishop (T1982-001) Geophysical survey of Mt Lyell field

Over Conglomerate Creek (i.e. vicinity of Great Lyell area) a shallow anomaly, probably due to leached pyritic schist (see Fig 9 - Turam survey). A poorly defined anomaly in the Copper Estates area (see Fig 5), that was only partially covered by Turam due to steep topography.

Appendix 2 is a chronological listing of geophysical surveys over the Mt Lyell field.

1977 Brophy M.Sc. thesis Geology and Mineralisation of Great Lyell Area

1975/76 Annual report MLMRC (T1976-010 76-1172) EL 10/69

Rock chip sampling over Little Owen grid (see Map 6) and dumps from Great Lyell shaft and adits. Cu, Pb and Zn values generally high and erratic and thus not a valid discriminator for geophysical anomalies. Dump results shown in Appendix I

For spreadsheet compilation/data entry: rock chip sampling (Map 6), Great Lyell adit and shaft dump samples (Appendix I - need coordinates)

1974/75 Annual report MLMRC (T1975-014 75-1117) EL 10/69

Compilation of detailed geological mapping and general assessment of Great Lyell, Duke Lyell, Copper Estates and Little Owen areas.

Geology;

- intermediate volcanic sequence - north and west of Lyell Highway - interfingering relationships, andesitic compositions, faulted (contacts), local extensive alteration (qtz-ser-py), minor cpy-ga mineralisation
- acid volcanic sequence - east and west of Little Owen ridge - lithic and welded tuffs, coarse agglomerates, minor acid lavas, interbedded sediment horizons, synclinal structure (N-S axis), intermediate intrusion in western limb of fold, mineralisation in an altered acid lava (fdsp porphyry) overlain by a chloritic tuff, sediment-pyroclastic unit, unconformity, coarse agglomerate, ignimbrites and tuffs
- acid volcanic sequence - east of South Owen fault - autobrecciated, banded lavas, recrystallised tuffs towards Copper Estates with extensive hydrothermal alteration, narrow lamprophyre dyke in cutting on Lyell highway
- intermediate intrusives
- Queenstown pyroclastics - south of Queenstown
- acid volcanic sequence - Whip Spur area

Geophysics 1957-1975;

Summary of reports/references

BMR	1957	Great Lyell - Duke Lyell	EM (Turam), SP, grd mag
McPhar	1959	Great Lyell - Duke Lyell	IP (frequency domain)
Pickands Mather	1967	Roaring Meg grid	EM, IP, grd mag
MLMRC	1973/74	Little Owen grid	grd mag (total field)
Scintrex	1973/74	Little Owen grid	EIP (time domain) + gradient array + Schlumberger array
Scintrex	1973/74	Little Owen grid	Schlumberger

- ◆ mag highs associated with haematite-rich unit east of Little Owen ridge, with displacement along the Little Owen fault
- ◆ relatively steep mag gradients associated with Darwin Rhyolite east of Whip Spur
- ◆ Tyndall Gp rocks close to the Little Owen baseline characterised by moderate mag gradients
- ◆ intermediate intrusives and intermediate pyroclastics are magnetically active

Several anomalies (A1,A2,A3,A4,A5) delineated (see Map 7). Background chargeabilities of the order 10 - 20 millisecc, background resistivities 300 - 2000 ohm metres. Anomalies related to both mineralisation and structure (Little Owen fault and South Owen fault)

Geochemistry - soil sampling programme over Little Owen grid anomalies A3,A4,A5. Orientation survey (Appendix III) indicated that depth of sample more important than size fraction wrt smelter fallout contamination, erratic results. Threshold value for soil and size fraction 50ppm Cu and 110ppm Cu respectively.

Mineralisation divided into four major zones;

- ◆ Great Lyell - Duke Lyell area, includes Great Lyell main no 1 adit, Great Lyell shaft (Whim Shaft), Duke Lyell Extended, and Empress Lyell; py+hem+cpy±chl±mag, accessory qtz and siderite in altered fdsp porphyry
- ◆ Little Owen area, includes Great Lyell lower no1 and upper no 2 adits, plus workings east of Little Owen ridge; py+hem+cpy±chl±mag, accessory qtz and siderite in altered fdsp porphyry
- ◆ Conglomerate creek area, includes Copper Estates in Waterfall gully and adits in Mt Lyell Reserve; qtz-ser-py (hydrothermal alteration of acid volcanic rocks)
- ◆ area close to contact of northern intermediate intrusive and 'haematite tunnel'; py-cpy-hem associated with contact of an intermediate intrusive body

For spreadsheet compilation/data entry: Map 9 surface sampling

1973/74 Annual report MLMRC (T1974-010 74-1039) EL 10/69

Two zones of sulphide mineralisation identified by previous mapping;

- Great Lyell - Duke Lyell area mineralised with pyrite and chalcopyrite, several anomalies outlined by geophysical surveys
- intrusive bodies (two) to SW of Great Lyell - Duke Lyell have haloes of sulphides with both pyrite and chalcopyrite

Summary of reports/references

Geophysics grid cut for both gradient array IP and ground magnetic surveys. IP survey encountered equipment problems due to electrical 'noise' (from DC u/g locus at Mt Lyell), was started with an IPR-7 instrument (Scintrex) and completed with an IPR-8 instrument using a moving Schlumberger array. A geometrics proton G816 magnetometer used for magnetics survey. Several anomalous zones delineated (see Map 3). (Need to get a plan showing the loop layout for the IP survey - possible reference Howland-Rose MRT 84-2219)

Detailed mapping over the Little Owen grid not completed. Sequence of acid lavas and pyroclastics mapped at Mt Lyell continue into the Little Owen area and contain zones of disseminated and massive sulphide mineralisation.

For spreadsheet compilation/data entry: ? digitise geophysical anomalies (Map 3)

1972/73 Annual report MLMRC (T1973-014 73-973) EL 10/69

Geological mapping mostly in Huxley area. Agglomerate on summit of Little Owen forms core of a syncline that is probably an extension of the structure on Whip Spur. Intruded by a qtz porphyry (to the west) and by 2 andesitic bodies in the central zone.

1971/72 Annual report MLMRC (T1972-009 72-892) EL 10/69

Geological mapping (see Maps 5,3, also section thro' King river gorge) through the Whip Spur - Lyell Highway area interpreted as a folded syncline striking north-south and affected by two NW-SE striking faults, the northern one being strongly mineralised (pyrite and chalcopyrite) where it passes through the Great Lyell - Duke Lyell areas. Rocks consist of an acid lava sequence containing tuffs and some fine grained sediments (banded siltstones). A qtz porphyry and two andesitic bodies intrude the syncline.

Geochemistry; sampling confined to gossans and dumps. Gossan outcrop adjacent to Duke Lyell adits was sampled. Ore samples collected from Great Lyell shaft (massive haematite with pyrite and chalcopyrite). Work by J.Walsh on trace elements. Pyrite from Great Lyell shaft have a Co:Ni ratio similar to Prince Lyell.

1970/71 Annual report MLMRC (T1971-011 71-840) EL 10/69

Access roads under construction/refurbishment. Literature search over Great Lyell - Duke Lyell area. Mineralisation values plotted and holes drilled in 1961 by MLMRC relogged. Pickands and Mather soil sampling at 100' intervals assayed for Cu, Pb, Zn, Ni and As reflect smelter contamination.

Upper Great Lyell adit sampled. (See Fig 4 in report) Old assays from Duke Lyell workings. Good mineralisation reported from the Great Lyell shaft. Lower and main Great Lyell adits remain unsampled.

For spreadsheet compilation/data entry: spreadsheet assays and digitise Fig 4 (Great Lyell adits and Duke Lyell adits)

1969/70 Annual report MLMRC (T1970-015 70-710) EL 10/69

Briefly reviews previous exploration in the area, by both MLMRC and Pickands Mather & Co International. Latter carried out a stream sediment programme over the area covered by EL 10/69 - analysed samples for Cu, Pb, Zn and As. Most of this work fell south of the Little Owen area. General criticism that work in the Little Owen area would have been subject to contamination from smelter fallout.

1967 Smith H. Exploration report - geological investigations in the Queenstown area

Pickands Mather Co drilled seven holes to test EIP, EM and soil geochemical anomalies. Only significant intercept RM201 20' @ 0.25% Cu. (ref. 1974/75 annual report, 1986/87 progress report)

1962 Five holes drilled by MLMRC: (ref. 1974/75 annual, 1986/87 progress reports)

Drilling started in 1961. Company annual report (1962) states that the geophysical prospect at Great Lyell was drilled and abandoned. Other background information to this drilling programme has not been found.

Original logs in Log Book 28 (GL is Great Lyell and not Glen Lyell!!)

Assay Summary

Hole No	From (ft)	To (ft)	Width (ft)	% Cu	% FeS
GL1	430	540	110	0.20	5.5
GL2	210	330	120	0.21	6.0
	275	315	40	0.40	5.5
GL3	160	190	30	0.22	3.0
GL4	420	500	30	0.07	0.75
GL5	not assayed				

Drill Hole Summary (from Book 80 - Drill Hole Index)

Hole No	Depth	N-S	E-W	RL	Dip	DIP	Target	Significant results
GL1	191.7m 628.8'	1462S	468W	1107	059	-50	To test BMR Turam anomaly 56/57 and McPhar IP anomaly north of Great Lyell Shaft	best assay 1.5m 0.41%Cu within 32m 0.2%Cu of brecciated qtz-ser and minor hem schist
GL2	134.3m 440.5'	11500S	220W	1129	059	-42	To test for extensions of mineralisation beneath Great Lyell Shaft	Best assay 1.5m 0.88%Cu within 36m 0.3%Cu + 6%FeS ₂ of hem qtz-ser schist
GL3	122.2m	11690S	45W	1172	062	-45	To test McPhar IP	Best assay 1.5m

Summary of reports/references

	401'						anomaly	
GL4	152.7m 501'	11690S	45W	1172	242	-45	To test BMR Turam anomaly 57/57 at NNW end	0.5%Cu within pink (hem) qtz-ser schist Average assay 9.5m 0.07%Cu in mixed chl±ser schist
GL5	149.2m 489.5'	12186S	155W	1198	059	-60	To test BMR Turam anomaly 57/57 in vicinity of Great Lyell adits	Weakly mineralised chl-ser±hem schists. Hole ended in OC. No assays

1959 McKenzie 1961, (see Bishop T1984-020)

McPhar IP survey Great Lyell no record held on site

1959 BMR geophysical survey, Record No 36 (Rowston) (T1959-001 F00385)

Helicopter transportation of heavier geophysical equipment for survey over the Great Lyell area. Complete coverage of area not possible because of the steep slopes. Geophysical grid with stations at 25ft intervals was surveyed by electromanetic (Turam), magnetic and SP methods along traverses 24 and 26 over known mineralisation. Turam and magnetics both identified anomalous zones (56/57 and 57/57 - see Plates 3A-3D) while SP effected by earth potentials generated by electric trains at WLOC. Most prospective anomalies those indicated by Turam.

1954 Wade (and Solomon)

Surface mapping completed by MLMRC geologists.

1934/38 Douglas and Blazey (T1938-001 F00253)

Geophysical surveys in Mt Lyell area - equipotential method. Dump samples (1936/37) - Great Lyell area. Results not encouraging.

1934 Nye (T1934-001 F00315)

Describes the Duke Lyell, Copper Estates (and Moore Creek) mineralised zones. Warrants further testing.

1901 Cundy (T1901-002 F00052, T1901-017 F00390)

Reports on Duke Lyell and Great Mt Lyell

1900 Schloesser (T1900-005 F00303) General notes on the Mt Lyell field

Report includes descriptions on Duke Lyell and Duke Lyell Extended, Great Mt Lyell, Mt Lyell Reserve and Empress Lyell