

# Exploration Potential of Oonah Mine and EL 63/2004

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## Summary

Exploration Licence EL 63/2004, which includes the abandoned Oonah and Montana Silver-Lead mines and a number of other minor Devonian granitoid-related lode type deposits, covers a 24 square kilometre area immediately northwest of Zeehan. An Ordovician-Silurian-Devonian sedimentary succession at the western margin of the Zeehan Syncline, including minor Gordon Limestone at its base, occupies about one-tenth of the licence area, along the eastern boundary of the EL north of Zeehan. A complexly deformed Late Proterozoic succession, dominated by interbedded quartz sandstone and shaly mudstone of the Lower Oonah Formation, and sandstone and siltstone with minor interbedded carbonates, black shales and mafic volcanoclastics and lavas of the Upper Oonah Formation, occupies the remainder of the EL area. The north-trending, west dipping Tenth Legion Fault, marks a major structural contact along the eastern boundary of the EL, where the Proterozoic succession was thrust eastwards over the edge of the Palaeozoic synclinal succession. Part of the Devonian Heemskirk granite batholith underlies most of the area, at estimated depths between 750 and 2500 m below surface, generally deepening eastwards.

The minor carbonate units in the Late Proterozoic Upper Oonah Formation, and to a lesser degree the Ordovician Gordon Limestone, have potential to host granite-related Renison-type cassiterite-sulfide replacement deposits, particularly in favourable structural settings adjacent to the Tenth Legion Fault. This concept was thoroughly explored without success by RGC Exploration nearly two decades ago, and most of the EL area can now be regarded as having low prospectivity for that type of deposit. There is a single exception in airborne magnetic anomaly No. 370, which was identified by RGC's consultant geophysicist as having high priority, but it has not been effectively followed up or tested. This subtle bull's eye magnetic anomaly lies just west of the Tenth Legion Fault in a favourable structural setting and uncertain but potentially favourable Crimson Creek or Upper Oonah Formation rocks. It warrants a geologic and ground magnetic reconnaissance survey.

The partially mined Stannite Lode at the Oonah Mine, close to the south eastern corner of the EL, contains a remaining inferred mineral resource conservatively estimated at about 180,000 tonnes at grades of about 1.2% Sn, 1.6% Cu, 143g/t Ag, with a current in ground metal value of about AU\$70,000,000, and it is open at depth. Most of its tin and copper appears to be in the mineral stannite, which is of dubious recoverability and saleability. There is high exploration potential to increase the Stannite Lode resource by diamond drilling - if this type of narrow fissure lode can be efficiently mined, and its complex mixed sulfide assemblage can be effectively processed.

A number of old prospects based on minor argentiferous galena lodes in the southern half of the EL, particularly around the Oonah Mine, are considered to have low exploration potential and they warrant no further exploration.

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## Introduction

Bass Metals Ltd. is exploring EL 63/2004 on behalf of a joint venture partnership with Geoinformatics. The licence covers 24 km<sup>2</sup> situated immediately northwest of Zeehan town. It includes a number of old mines and prospects, of which the Oonah and Montana Silver-Lead were the most significant producers of ore from small, Devonian granitoid-related Pb-Ag and Sn-Cu-Ag fissure lode deposits.

Apparently, Bass Metals Ltd. initially took up the licence to explore for Devonian granitoid-related carbonate-replacement (Sn?) deposits. To date, however, their exploration in the area has focused mainly on the Montana Silver Lead Mine, where a shallow drilling program has demonstrated that no ore remains within 70 metres of surface. Bass Metals has also carried out an inconclusive soil geochemical survey to follow up some isolated soil-tin anomalies in the north-eastern sector of the EL, which were detected nineteen years ago by RGC Exploration P/L.

Bass Metals Ltd. has commissioned me to examine the existing exploration data (excluding Montana Silver-Lead data) and comment on the exploration potential in EL 63/2004, particularly on economic potential of the Stannite Lode at the Oonah Mine. This work has been undertaken as a short-term geological consultancy; apart from a one-day orientation visit it has not involved any fieldwork nor generated new data.

## Oonah Mine area

### Production History

Mining of several galena-rich lodes around the Oonah Mine commenced around 1890 and was continued intermittently by a series of mining companies and tribute parties until about 1924 for a total recorded galena ore production of about 19,377 tons (Blissett, 1962). A separate stannite-rich lode discovered around 1897 was worked on a small scale by tributers working in upper levels up to about 1905. That was subsequently developed on a larger scale down to the No. 6 (424 ft, 129 m) level by Oonah Mines Ltd., which produced significant ore for local smelting between 1908 and 1910. Blissett (1962) reported production of 14,664 tons of stannite ore from the mine. Thompson (1951) obtained information 'from Mines Department publications and by questioning local men who had worked in the mine' and tabulated incomplete quarterly production records totalling a slightly higher figure of 16,862 tons. He estimated that the total stannite production was actually around 20,000 to 25,000 tons and noted that 'by 1910 much of the stannite ore above the No. 6 level had been mined'.

Blissett (1962) acknowledged that the Oonah Mine was held under leases by various leaseholders until 1954 but there had been little production after 1924.

## Oonah local geology and lode description

Country rocks at the prospect are quartzites, slaty siltstones, and grey to black shales with interbedded mafic 'spilitic' lavas and volcanoclastics. These were originally all assigned to the Upper Proterozoic-Lower Cambrian Oonah Formation (e.g. Thompson, 1951; Blissett, 1962; Pearce, 1971). CRAE geologists in the early 1980s subsequently subdivided the sequence into a lower quartzite-slaty siltstone group assigned to the Upper Proterozoic Oonah Formation, overlain by a group of grey-black shales, mafic volcanics and interbedded quartzite-siltstone assigned to the Lower Cambrian Success Creek Formation (e.g. McKay, 1980; Odell, 1982). RGC's geologist John Crossing (1989) subsequently reverted to the former interpretation by placing the latter group into the Upper Oonah Formation, which he described as dominated by shales and siltstones with lesser sandstone, dolomite, and mafic volcanics. He noted that the dolomites are poorly represented in outcrops, and that the volcanics included interbedded volcanoclastics, highly vesicular lavas, and intrusives. Crossing's lithologic subdivision into Lower and Upper Oonah successions is consistent with Brown's (1992) descriptions of the Oonah Formation along the Pieman Road east of Stanley River.

The sequence is folded into a major east-south-east plunging antiform. Near the Oonah Mine the rocks strike approximately N-S and dip easterly around the nose of the fold, albeit apparently significantly disrupted by NW- to NE-trending faults (Figure 1 & Figure 2). In the vicinity of the Oonah Mine, Crossing (1989) interpreted the increased thickness of the Upper Oonah Formation to be due to its lower competency leading to thickening around the hinge of the 'regional anticlinorium' and thinning along the limbs. Blissett (1962) considered that much of the 'complex disturbance' by faulting in the Oonah and greater Zeehan area was attributable to post-Permian fault movements on pre-existing Tabberabberan 'structures and zones of weakness'.

The most important mineralized lodes in the Oonah Mine area are the 'main galena lode' and the 'stannite lode' (Blissett, 1962). They are separated at surface by about 75-90 metres, sub parallel in strike 'a few degrees west of north', and dip steeply to the east to north-east; i.e. semi-conformable to the host rocks. The Stannite Lode dips at 50-60° eastwards, apparently at slightly gentler angle than the adjacent galena lode; Pearce (1971) speculated that the two lodes may join at depth. CRAE's geologists observed that the Stannite Lode is hosted mainly by brecciated and quartz+siderite veined black and grey shales and mafic volcanics (Odell, 1982), and considered that 'the mineralized zone is broadly stratabound and can be correlated with the stratigraphy' (McKay, 1980).

Thompson (1951) described the character and dimensions of the Oonah Stannite Lode/s in considerable detail, which he obtained from Mines Department records and local anecdotal reports. His significant points include the following, which I have extracted nearly verbatim:

- 'The majority of lodes in the locality are of the fissure filling type and the ore shoots appear to be controlled by fracture intersections - viz. faults and lode shears - with limited replacement in the fractures.'
- 'A fault, or to use the local term [Main] "slide", striking N75°W and dipping north-north-east at 72° marks a crush zone extending without deviation through the mine workings (Figure 1 & Figure 3). The actual plane of movement is reported to be shown by a brecciated channel up to two feet (0.6 m) wide. The lode fractures appear to be either contemporary or post-fault in age.'
- 'The main or "galena" lode is gradually bent from a north-south strike going north into the plane of the fault in which it continues as bunched mineralization. It has not been found on the northern side of the fault.'
- 'The stannite lode is of a composite character'... with 'eastern and western stannite lodes in the upper levels and the surface workings'.
- 'The underground development below the No. 3 level appears to have been entirely on the eastern stannite lode. In plan the lode is parallel to the lead lode and is shaped like an elongated "S", formed by a high-grade southern limb, a low grade central portion within the [Main Slide] fault zone, and a northern limb which was stoped only above the No. 3 level' (Figure 4).
- 'On the Nos. 4, 5 and 6 levels the Stannite Lode merges into the walls of a sideritic lode up to seven feet (2.1 m) wide, containing chalcopyrite, pyrite with a little galena and tetrahedrite ... the "West Carbonate" lode.'
- 'A similar siderite lode... the "North Carbonate" strikes N40°E and dips south-east at 45° and crosses the fault without displacement as does the west stannite lode at the main adit level'. This observation supports Thompson's assertion (above) that the lode fractures are syn- or post-fault in age.
- 'The width and attitude of the stannite lode in detail varies markedly both in plan and section. The southern terminations of the stannite lode diminish to one-inch (25 mm) threads of stannite, but widths generally improve as the fault is approached.'
- 'The best level was the No. 5 (322 ft, 98 m), which was stoped for 270 feet (82 m) south of the [Main Slide] fault and in places the stannite reached a width of four feet (1.2 m). The average width of the stannite ore throughout the mine is approximately 30 inches' (0.76 m).
- 'On the No. 6 level the north drive exposes about 130 feet (40 m) of stannite, probably 30 inches (0.76) wide. This ore may continue for a further 200 feet (60 m) north to the fault. Whether this ore continues into and through the [Main Slide] fault, as was the case in the upper levels, is not known.'

Williams and Both (1971) commented that the Stannite Lode's remarkable mineralogy was 'unlike any other in the Zeehan field, with the exception of Clarke's lode on the Silver Queen lease' and that it 'represents a major anomaly in the simple [metallogenic] zonal scheme'.

Crossing (1989) speculated that: 'The anomalous mineralogy of the Stannite Lode compared to the other fissure lodes at Oonah can possibly be explained by its location on a relatively persistent structure, which dips [southeast] toward Queen Hill. This may have allowed access by tin-bearing fluids ultimately derived from the same source as similar mineralization associated with the complex Clarke orebody at Queen Hill. Cross-structures at depth (such as the Oonah Fault<sup>1</sup>) may also play a role in this regard'.

## Oonah Mine Exploration History

### 1963-64; BMR geophysical surveys

Relatively modern exploration of the Oonah lodes commenced in 1963 with IP, SP, Turam-EM, and magnetic intensity geophysical surveys carried out by the Bureau of Mineral Resources on behalf of the Tasmania Department of Mines and Clutha Minerals (references cited by: Pearce, 1971; Crossing, 1989). The surveys delineated a series of strong coincident IP, SP and EM anomalous zones extending from the Oonah workings southwest to Bradshaw's Lode (Figure 1 & Figure 3).

### 1963-65; Placer Prospecting P/L, SPLs 12, 13, & 404

The BMR geophysical anomalies were partly tested by Placer Prospecting P/L in a drilling program of seven holes totalling 4,364 ft (1,330 m), four at Oonah Mine and three at Bradshaw's Lode a few hundred metres to the southwest. The Oonah holes (2,3,4 and 5) intersected significantly mineralized zones and apparently 'confirmed that the anomalous zones were due to the stannite lode' (Pearce, 1971). Nevertheless, Placer's consulting geologist A.B. Clark (1965) expressed doubts about the geophysical responses, and suggested that acid water in the old mine workings 'over-emphasized' the anomalies. CRAE's geological plan (reproduced here as Figure 3) indicates close spatial relationship between the geophysical anomalies and a band of black shale lying between quartzite and mafic volcanoclastic-dominated lithofacies units. Clark (1965) seems to have been generally disgruntled by the way the Placer's exploration and drilling program had been conducted. Placer may have been equally disgruntled with Clark, because 'all their Tasmanian projects were suddenly curtailed in 1966' (Pearce, 1971). The options lapsed and the SPLs subsequently became part of Minops' EL44/70.

### 1971; Minops P/L, EL 44/70

Minops relocated the BMR survey grid and Placer's drill holes and followed up with another ten drill holes (M1-M10, totalling 1829 m) designed to test the along strike and down dip extents of the Stannite Lode (Pearce, 1971). It was a reasonably successful program insofar as five of those holes (M1, M3, M4, M8, M10) intersected significant mineralized zones and contributed to 'tentative' estimates of the geologic resource (Table 1).

The Placer and Minops drilling results confirmed the existence of at least several lodes of varying metal ratios and grades, and showed that some of the mineralized zones were considerably wider than the narrow Stannite Lode widths of a few feet previously reported (e.g. by Thompson, 1951; Blissett, 1962). M1, for example intersected a 19 ft wide zone (true width, 5.8 m) @ 1.5% Sn, 1.9% Cu and 153 g/t Ag. That intercept was obviously not of solid stannite; it included several 0.2-0.5 m wide segments of <0.1% Sn. The best assay in the intercept was 0.5 m @ 6.3% Sn, 6.6% Cu and 612 g/t Ag, which is closely comparable to the 4.5% Sn, 5.5% Cu and 674 g/t Ag bulk grade of ore mined from the Stannite Lode in 1909 (analysis 2 in Table 19 of Blissett, 1962). The Minops resource estimates were based on some quite arbitrary assumptions of strike length and dip extents (550 ft and 720 ft), and a simplistically derived average width (12.9 ft) that did not allow for thinning near the extremities despite clear evidence of the variability in thickness.<sup>2</sup> Pearce (1971) suggested further and deeper drilling to better ascertain the extent of the Stannite Lode but it seems that Minops carried out no more exploration during the 1970s.

### 1974-77; Aberfoyle-Gippsland Minerals JV, EL47/71

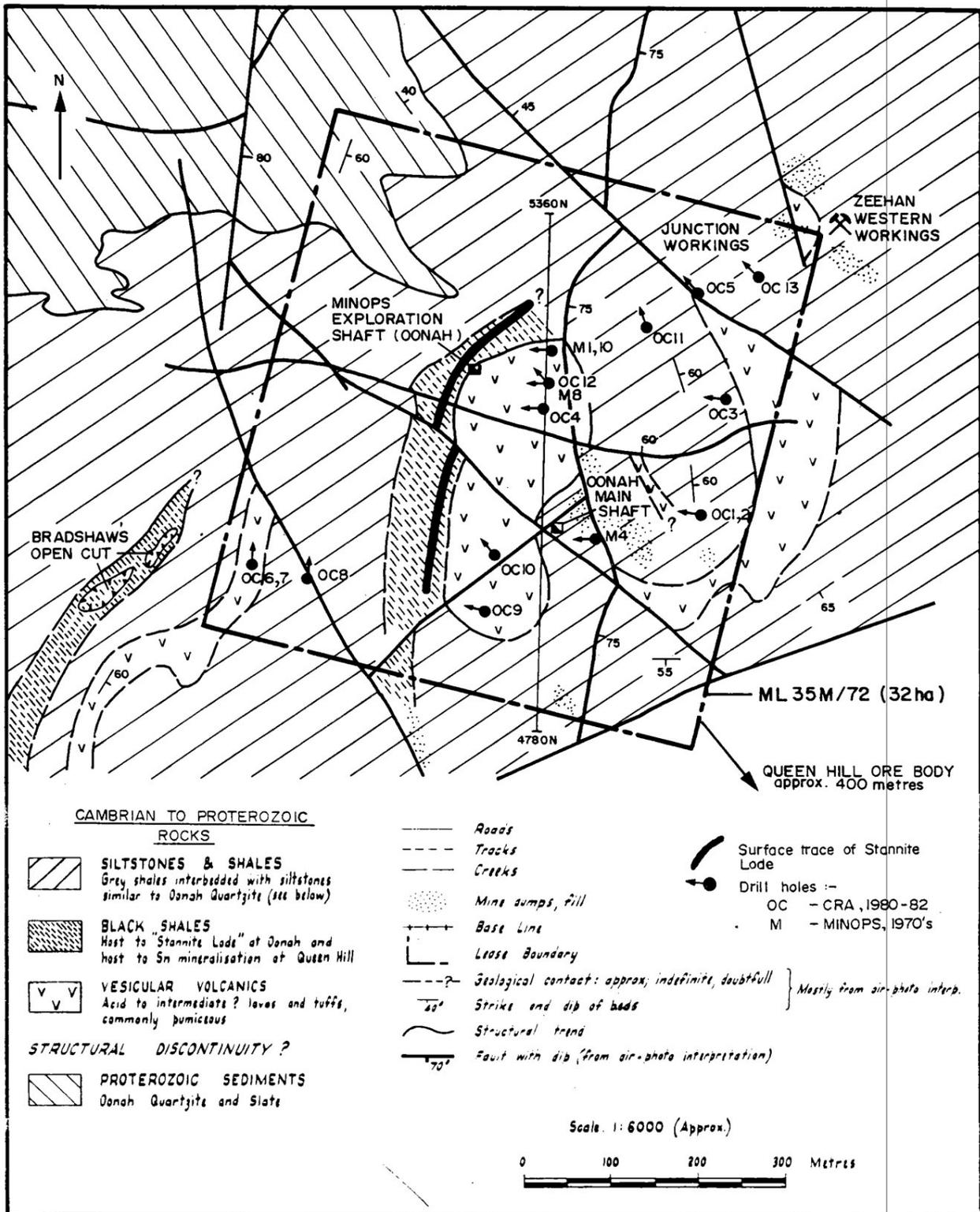
Crossing (1989) briefly noted that 'Cominco drilled an unsuccessful hole aimed at Bradshaw's Lode'. The results from six other holes drilled in the Bradshaw's area, by Placer in the 1960s and CRAE in the 1980s, have likewise been unimpressive, so I have not followed up the intervening Cominco data.

### 1979-1982; CRA Exploration P/L

CRAE joint ventured into the Oonah project with Minops in the late 1970s. Over the next couple of years they established a new metric local grid, carried out detailed outcrop mapping at 1:500 scale, re-assayed some of the Minops holes to verify the grades, and drilled twelve more diamond core holes (OC1/2 to OC13, totalling 2,370 m) around the prospect (McKay, 1980; Odell, 1982). This led to a rough and ready resource estimate of 1.3 Mt @ 0.57% Sn (discussed below) and recommendations for further deep drilling. CRAE had exceeded its JV expenditure commitments early in the program, after drilling only two holes, and it is unclear from their reports whether Minops elected to contribute to subsequent exploration or dilute their 30% interest. Anyhow, it seems that the JV didn't follow up Odell's (1982) recommendations for more drilling but CRAE continued to hold the Oonah Mine as a 32 hectare mining lease (ML35M/72). In 1993 the lease area was re-issued as EL 11/93 to allow CRAE to carry out site rehabilitation work, in the three years up to 1996. In late 1996, after reviewing the previous exploration data, they finally concluded that 'there was little potential for the Oonah area to host an ore body likely to be of interest to the RTZ-CRA group' (von Strokirch, 1996).

<sup>1</sup> Crossing's Oonah Fault is the Main Slide. It apparently continues southeast passing between Queen Hill and Montana (see also Fig.7 of Crossing, 1989)

<sup>2</sup> The S.G. used in calculating Minops' resource was not stated but it works out at about 3.7, which is mildly optimistic considering the S.G. of pure stannite is around 4.4. An arbitrarily assumed lode composition of 50% quartz at S.G. 2.7, 40% siderite at 3.8, and 10% total sulfides at 5.0, would have a bulk S.G. of about 3.4.



**Aberfoyle Resources Limited**  
EXPLORATION DIVISION

WESTERN TASMANIA  
**OONAH PROSPECT**  
**GEOLOGY**

Compiled : JGP  
Drawn : after CRA, 1980  
Traced : RJE  
Checked :  
Plate No. : FIG 9-2

REVISIONS			
Init.	Date	Init.	Date

Location Code :

Scale : As shown

Date : March, 1989

Figure 1 Map of the Oonah Mine area showing simplified geologic and structural setting, orientation of lode, and distribution of some exploration drill holes (adapted from Purvis, 1989).

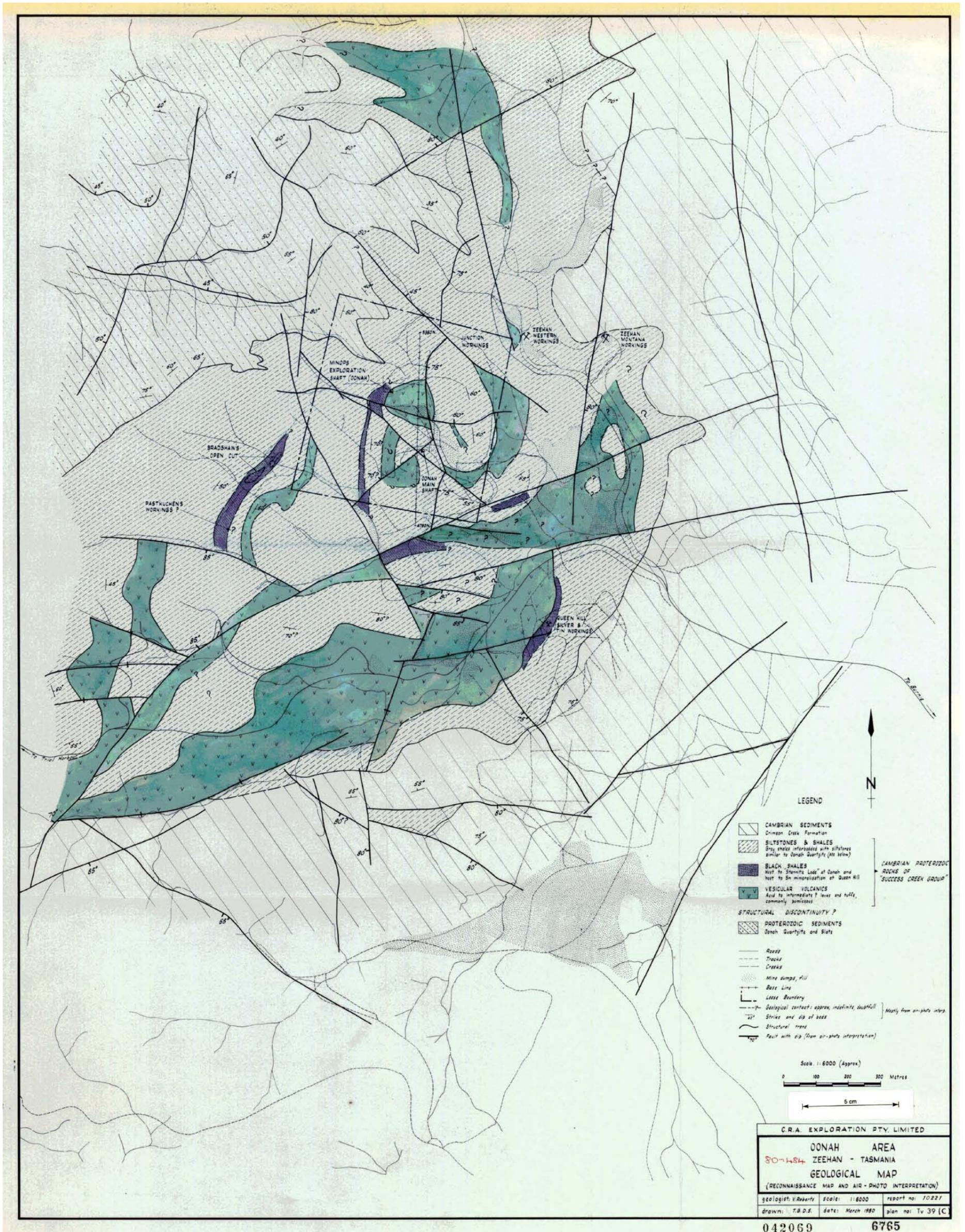


Figure 2 CRAE's geological map of the Zeehan-Oonah area showing the main lithofacies associations and structural elements (adapted from McKay, 1980)



Figure 3 CRAE's surface map of the Oonah Mine area, showing locations of the workings and drill holes (adapted from, Odell, 1982).

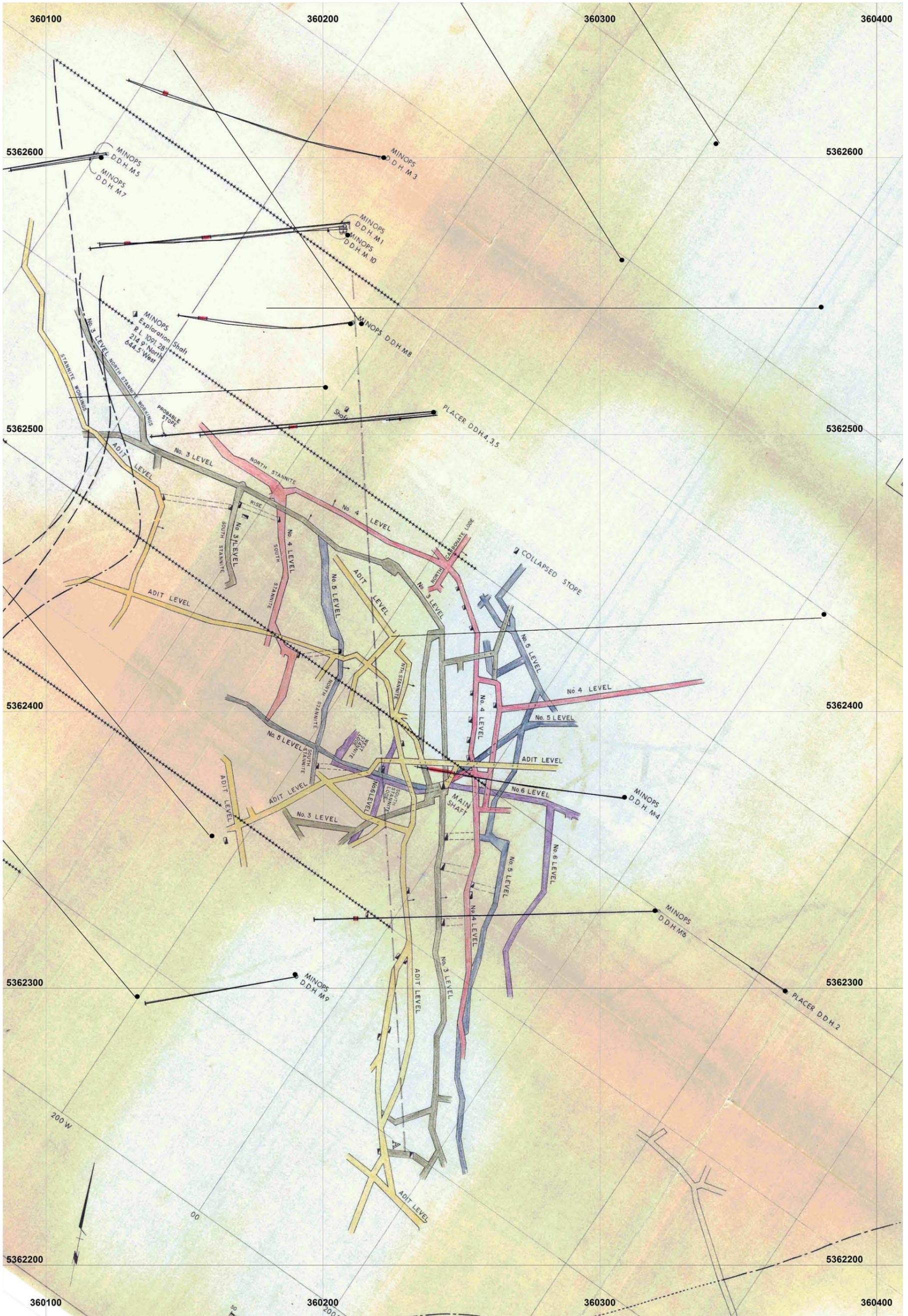


Figure 4 Minops' map of the Oonah Mine showing extent of underground workings and drill hole traces (adapted from Pearce, 1971)

## Stannite Lode Resource

The most recent assessment of geologic resources of the Stannite Lode at the Oonah Mine was carried out in 2003 by Mt Conqueror Minerals NL and Central west Gold NL (McLatchie, 2003). That report also summarised several previous estimates by Placer, Minops, and CRAE. Those several widely differing resource and grade estimates (summarised in Table 1) suggest the present day in situ value<sup>3</sup> of the Stannite Lode deposit ranges from about A\$77m to A\$250m.

The upper end of that range is a tantalizing figure for Bass Metals Ltd., notwithstanding the uncertainties about stannite recoverability and saleability. However, the great variance amongst them casts doubt on the reliability of the estimates. Indeed, the methods of estimation all seem very sloppy and are poorly documented. CRAE's 'calculation', for example, was presented only as a conclusion: 'Dimensions of the Stannite Lode itself are of the order of 150 metres along strike and 10 metres thick, representing some 1.3 million tonnes (at 3 tonnes per cubic metre) to a depth of 300 metres' (Odell, 1982). That report does not include a longitudinal projection and the resource estimate considerably overestimates the known average width of the lode. Gerald Purvis in his (1989) review of Tasmanian tin potential for Aberfoyle gave it a suitably scathing assessment: 'The CRA work was very shoddy. The data is [sic] inaccurate, inconsistent and badly presented.'

McLatchie's (2003) report includes a roughly drawn longitudinal projection (Figure 5), which was based on CRAE's earlier longitudinal projection of the Stannite Lode (Plan No. Tv77, McKay, 1980) but it is equally unconvincing because of its lack of a grid, and a scale bar that does not match the distance between mining levels shown. McLatchie's calculation also simplistically applies an average lode width of 3.7 metres based on the nine drill hole intercepts with >0.5% Sn, but without allowing for narrowing towards the extremities of the mineralized shoots.

Accordingly, validating the previous resource estimates, or producing a credible alternative estimate, are not trivial matters because of the previous poor reporting, and complications inherent in integrating the twenty- to forty-year-old drilling data based on different imperial and metric local grids. I eventually 'bit the bullet' on these inadequacies and laboriously:

- Entered the Placer and Minops drill hole assay data into a spreadsheet to combine with the CRAE data, which Bass Metals had previously somehow acquired in digital form.
- Corrected some obvious errors in the CRAE data; e.g. inconsistencies in the 'From' and 'To' depths.
- Classified all the assayed intercepts that have in situ metal values of greater than AU\$100 into three types: stannite-type with elevated Sn, Cu, Ag values and Sn/Cu ratios ~1; cassiterite-type containing elevated

<sup>3</sup> London Metal Exchange values at 1/7/2009: Sn 14460, Cu 5042, Pb 1695, Zn 1545 US\$/t; Ag 13.74 US\$/oz. Troy; A\$ = 0.8US\$.

Sn but low Cu, Ag, Pb, Zn; and Pb-Ag-types with low Sn.

- Plotted projections and plan locations of the mineralized intercepts and interpreted the probable continuity of the main Stannite Lodes amongst the plethora of minor lodes.
- Picked the main Stannite Lode intercepts, and calculated true thicknesses and weighted average grades for input to a resource estimate.
- Delineated panels in a longitudinal projection for a conservative estimate of the mineral resource.

Table 2, Table 3, and Figure 6 summarize the details of this new inferred mineral resource estimate. Briefly, the reasonably inferred mineral resource of the remaining Stannite Lode is around 179,000 tonnes<sup>4</sup> at an average lode width of 2.5 m, and grades of 1.2% Sn, 1.6% Cu, 143g/t Ag, with a total in ground metal value of about AU\$70,000,000.

This estimate is limited by the following assumptions and parameters:

- I applied an arbitrary cut off value of A\$100/t (based on LME metal prices as at 1/7/2009) to pick the mineralized zones. That equates to grade of about 0.55% Sn, or 1.6% Cu, or 0.4% Sn and 0.4% Cu combined.
- There are numerous minor mineralized intercepts of greater than the \$100/t cut off value but generally less than a metre wide, which indicate subordinate lodes or mineralized zones that exist within several tens of metres in the both hangingwall and footwall of the main Stannite Lode (e.g. in drill holes M1, M8, OC12; Figure 8).
- Those minor mineralized zones have variable compositions, which I've broadly classified into Sn-Cu-Ag, Sn, and Pb-Ag types. The orientation, continuity, and extent of those minor lodes is highly uncertain, and they have not been included in this resource estimate.
- Likewise, the Sn-only cassiterite-type or Pb-Ag type mineralized intercepts have not been included in this resource estimate, despite that some may be continuations of the Stannite Lode but of different mineralogy; e.g. the OC3 intercept of 4.8 m @ 0.4% Sn at about 20 m RL, which may represent the down dip extension of the north Stannite Lode (Figure 8). Purvis (1989) emphasized this possibility, commenting that: 'It would be a mistake to assume all the tin mineralisation is stannite as zoning changes to cassiterite can be expected, particularly at depth.'
- I have selected the intercepts for this resource estimation on the basis of earlier documented interpretations and descriptions of the orientation of the Stannite Lode including the distribution of old

<sup>4</sup> This resource estimate is lower than previously reported (Table 1). It most closely compares to CRAE's final estimate (von Strokirch, 1996), which apparently included some Pb-Ag type lode/s but was unsupported by documented methodology. Despite that uncharacteristic lapse, the observation that our estimates are about one third to one half of the others (in metal \$ values) may reflect the Teutonic origins of the authors.

workings, metal contents and Sn/Cu ratios, and the greatest grade by thickness products. I doubt if that could be done confidently, from existing drilling data alone, without the information from historic mine workings.

- Table 3 lists the drill hole intercepts used in this resource estimate.
- There is great variation in thickness of the main Stannite Lode. For example: the mean true thickness of seven intercepts in the north part of the Stannite Lode is 3.3 m, the standard deviation is 2.3, and true width intercepts in holes P3, M8 and M1 are 6.1, 1.7, and 5.2 m respectively, despite their along-strike separations of only about 35 m at approximately the same level ~110-120 m RL.
- Likewise there is great variability in grade, laterally and through the lode; e.g. M1 and M8 only 35 m apart at the same level in the north Stannite Lode have average grades of 1.5% Sn, 1.8% Cu, 147g/t Ag (\$466/t) and 0.6% Sn, 0.3% Cu, 123g/t Ag (\$194/t), respectively. Individual short assay intervals in the 5.2-metre-thick M1 intercept range over two orders of magnitude from 0.06% to ~6% in both Sn and Cu.
- The above two factors render the existing drill spacing of about 35 to 75 metres inadequate for a reliable resource estimate.
- Blissett (1962) recorded that ‘It was believed that the “slide” deviated but did not fault the lodes, and that it had itself become a definite ore channel with patches of ore over two feet wide’. Similarly Thompson (1951) noted that the galena lode curved westward into the fault where it ‘continues as bunched mineralization’. However, drill holes M4 and OC1/2 passed through the Main Slide apparently devoid of significant mineralization. Consequently, and for lack of data, I have not included the offset between the south and north segments of the Stannite Lode in this resource estimate.
- Early reports indicate the Stannite Lode gradually thins towards its margins; e.g. in the southern segment on Level 5 ‘the ore at the end of a shoot 160 feet long slowly tapers out to only one inch of stannite, with no indication of faulting’ (Blissett, 1962). Accordingly, I have included dummy intercepts of zero metres in the calculations estimating average widths in each of the lode panels considered, where there is more than one drill hole. This is a very arbitrary treatment, obviously distorted by the number of drill intercepts in a panel, but I consider it more realistic than assuming the lodes are simply terminated at average thickness.
- I deduced the collar locations relative to AGD66 of the Minops and Placer holes, which were drilled on imperial local grids, by registering a digital copy of Minops plan of the Oonah Mine (Fig. 4 in: Pearce, 1971) to the locations of some of the Minops drill hole collars depicted on CRAE’s plan TASH 566, projecting it in AGD66 in ArcView GIS software, and then manually picking the other Minops and Placer collars from the Minops plan. Thus, some of the important collar locations are graphically determined from plans of dubious accuracy.
- Credible collar RLs are available for only three of the CRAE drill holes (OCs 10, 12 & 13); all other collar RLs were deduced from elevation contours on the TASMAR 1:25,000 series DUNDAS topographic map.<sup>5</sup>
- Downhole directional data are available only for the twelve CRAE drill holes (OC1/2 to OC13) and one of the Minops holes (M2); all other Minops and Placer holes are assumed not to have deviated from their collar directions.
- True thickness estimates are based on the approximate average lode orientations deduced from early reports and distribution of the mine levels. These are: south Stannite Lode dips 50° to azimuth 095° (UTM); and north Stannite Lode dips 60° to azimuth 070°.
- I have used a bulk S.G. of 3.4 to estimate tonnages. This figure is arbitrarily based on an assumed volumetric lode composition of 50% quartz at S.G. 2.7, 40% siderite at S.G. 3.8, and 10% total sulfides at S.G. 5.0.
- The Main Slide orientation is assumed to dip 72° on an azimuth 040° (UTM), based on Thompson’s (1951) description and CRAE’s plan TASH 566 (Odell, 1982), reproduced here as Figure 3. Accordingly, the line of intersection between the south Stannite Lode and the Main Slide plunges at roughly 50° on azimuth 107°, and the intersection of the north lode with the Main Slide at about 56° to 101°. These lines ideally define the northern and southern limits of those lode segments, respectively (Figure 6).
- Thompson (1951) ‘believed that nearly all of the exposed payable ore has been mined’ above the 6 Level, (~101 m RL) south of the Main Slide. His description suggests extensive workings on the 4 and 5 Levels but his longitudinal projection shows only small areas of stopes on all the levels. It is uncertain whether those stope outlines preceded or followed<sup>6</sup> the main phase of stannite production in 1909-10, and there are no subsequent drill holes in the upper part of the south Stannite Lode. Nevertheless, I have taken a conservative view and assumed that no lode remains above any of the drives developed on the south lode.

<sup>5</sup> Dundas, sheet 3636, has topographic contours at 10 m intervals and stated elevation accuracy of about 5 metres; i.e. the deduced collar RLs are only approximate, possibly ±5 metres.

<sup>6</sup> Thompson’s longitudinal projection was adapted from an earlier work by Twelvetrees & Ward, 1910.

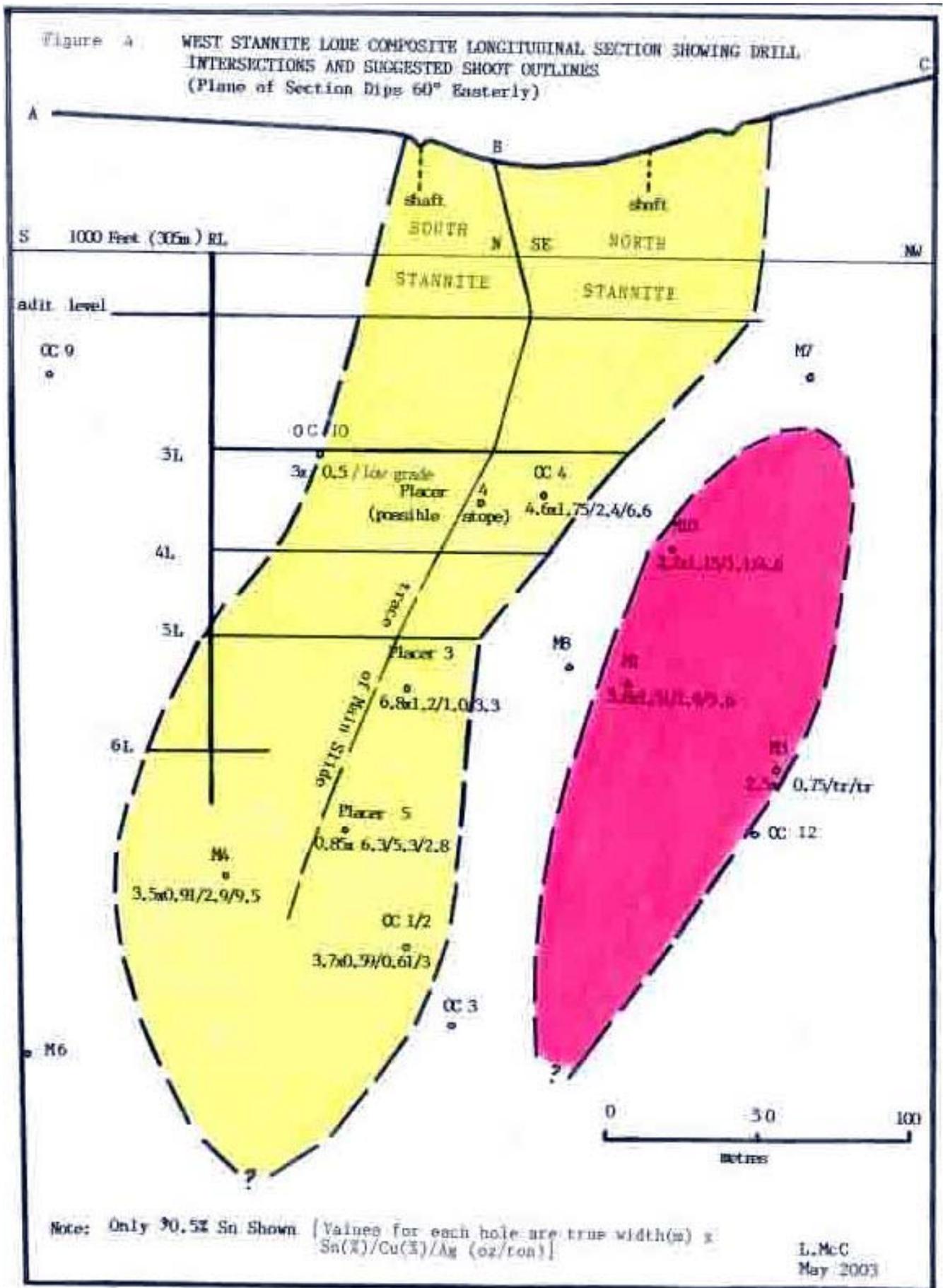


Figure 5 The longitudinal projection of the Oonah Stannite Lodes, which formed the basis of the Mt Conqueror-Central West Gold 2003 resource estimate; (from McLatchie, 2003).

Table 1 Previous estimates of mineral resources in the Oonah Stannite Lode<sup>7</sup>.

Year	Author	Company	Report No.	Tonnage	T/t	Sn %	Cu %	Ag g/t	Pb %	Sn cut %	Strike m	Depth m	Width m	In situ value AU\$
1971	Pearce	Minops	TCR 71-0715	540,000	tons	1.46	1.8	156			168	220	3.9	254,000,000
1971	Pearce	Minops	TCR 71-0715	670,000	tons	1.1	1.25	113					4.9	231,000,000
1982	Odell	CRAE	TCR 82-1699	1,300,000	tonnes	0.57		minor						134,000,000
1989	Purvis	Aberfoyle	Purvis, 1989	<1,000,000	tonnes	0.7 – 1.0								~150,000,000
1996	Von Strokirch	CRAE	TCR 96-3947	200,000	tonnes	0.5	0.4	284	5.3					77,000,000
2003	McLatchie	Mt Conqueror	TCR 03-4935	440,000	tonnes	1.25	1.48	136		0.5				173,000,000

Table 2 Summary of the Stannite Lode mineral resource calculations.

Lode	Segment	Strike m	Dip Extent m	Area m <sup>2</sup>	Average true width m	Vol. m <sup>3</sup>	Tonnes t	Sn %	Cu %	Ag g/t	Pb %	Zn %	\$/t AU\$/t	\$ in situ \$ rounded	Comment	Thickness parameters m
South Stannite	Between 5 & 6 Levels	65	40	2,630	1.7	4,472	15,000	assumed same as lower panel							Thickness estimate is arbitrarily based on reports of 'up to four feet' on level 5 (Blissett, 1962) and the rounded up average of intercepts in the panel below Level 6.	0, 3, 2
South Stannite	From Level 6 to 40 RL	100	80	7,963	2.6	20,704	70,000	0.54	1.56	169	0.05	0.02	290		Using intercept 175.1-178.8 m in M4 (same as Pearce's ,1971, 574.4-586.8 feet). M4 intersected unusually high Cu & Ag content and Sn/Cu ≤0.3, i.e. it is not typical of stannite lode.	0, 3.14, 4.2, 3
<b>South Stannite Sub Total</b>					<b>2.4</b>		<b>85,000</b>	<b>0.54</b>	<b>1.56</b>	<b>169</b>	<b>0.05</b>	<b>0.02</b>	<b>290</b>	<b>25,000,000</b>		
North Stannite	P4 area above Level 3	21	23	490	1.0	490	1,700	0.38	0.70				113	192,000		1
North Stannite	Mid zone between Levels 3 and 6	96	92	8,813	2.8	24,675	84,000	1.30	1.30	133	0.06	0.03	392	33,000,000		5.6, 6.1, 1.7, 2.6, 5.2, 0.8, 0
North Stannite	Lower zone around P5 above 50 RL	43	69	2,938	0.8	2,350	8,000	6.27	5.25				1,464	12,000,000		0.8
<b>North Stannite Sub Total</b>					<b>2.6</b>		<b>93,700</b>	<b>1.71</b>	<b>1.63</b>	<b>119</b>			<b>477</b>	<b>45,000,000</b>		
<b>South &amp; North Stannite TOTAL</b>					<b>2.5</b>		<b>179,000</b>	<b>1.15</b>	<b>1.60</b>	<b>143</b>				<b>\$70,000,000</b>		

<sup>7</sup> Von Strokirch's 1996 estimate includes high Pb & Ag components, presumably not only of the Stannite Lode.

Table 3 Drill hole intercepts used in estimating the inferred mineral resource of the Oonah Stannite Lode.

Lode	Hole	From	To	From	To	East	North	Elevation	True width	Sn	Cu	Ag	Pb	Zn	\$ value
		feet	feet	m	m	AGD66	AGD66	m ASL		m	%	%	g/t	%	%
North Stannite	P3	410.0	434.7	125.0	132.5	360185	5362504	118	6.1	1.20	1.00	102	0.10		337
North Stannite	P4	279.0	282.0	85.0	86.0	360170	5362505	186	1.0	0.38	0.70				112
North Stannite	P5	538.0	542.0	164.0	165.2	360211	5362507	72	0.8	6.27	5.25				1499
North Stannite	M1	448.4	471.0	136.7	143.6	360161	5362568	119	5.2	1.47	1.79	147	0.10	0.27	466
North Stannite	M8	449.7	457.0	137.1	139.3	360163	5362536	111	1.7	0.59	0.32	123			194
North Stannite	M10	398.0	407.0	121.3	124.1	360131	5362565	158	2.6	1.11	1.06	134			340
North Stannite	OC4			91.5	97.4	360141	5362503	164	5.6	1.87	2.23	193	0.08	0.09	587
South Stannite	M4	561.2	586.8	171.0	178.8	360249	5362371	58	6.6	0.35	1.70	157	0.02	0.02	258
South Stannite	OC1/2			209.8	214.2	360264	5362438	65	4.2	0.59	0.61	85	0.06	0.01	194

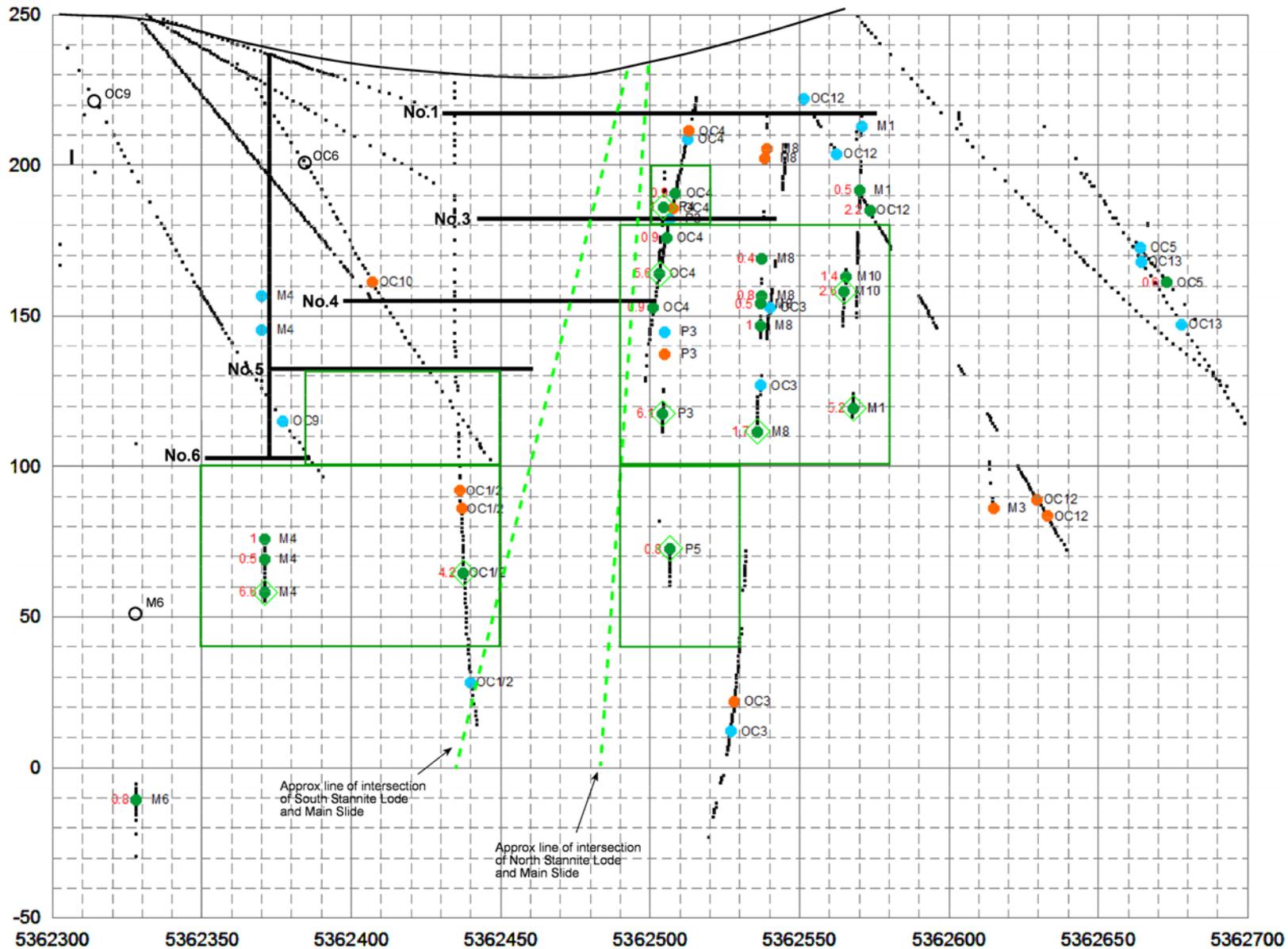


Figure 6 Longitudinal (north-south) projection of all mineralized drill hole intercepts averaging >\$100/t metal content in the central Oonah Mine area. Green dots indicate stannite-type Sn-Cu-Ag zones; orange dots are Sn-rich cassiterite-pyrite (?) intercepts with low Cu & Ag contents; blue dots are Sn-poor Pb-Ag type lode intercepts; open black circles indicate the approximate position of the south Stannite Lode in barren holes. The tiny black dots in linear arrays indicate locations of individual assay samples, and thereby crudely outline the projected hole traces. The green rectangles indicate the panels used in my new estimate of geologic resource; small green diamonds enclose the stannite-type intercepts used in the calculation and listed in Table 3.

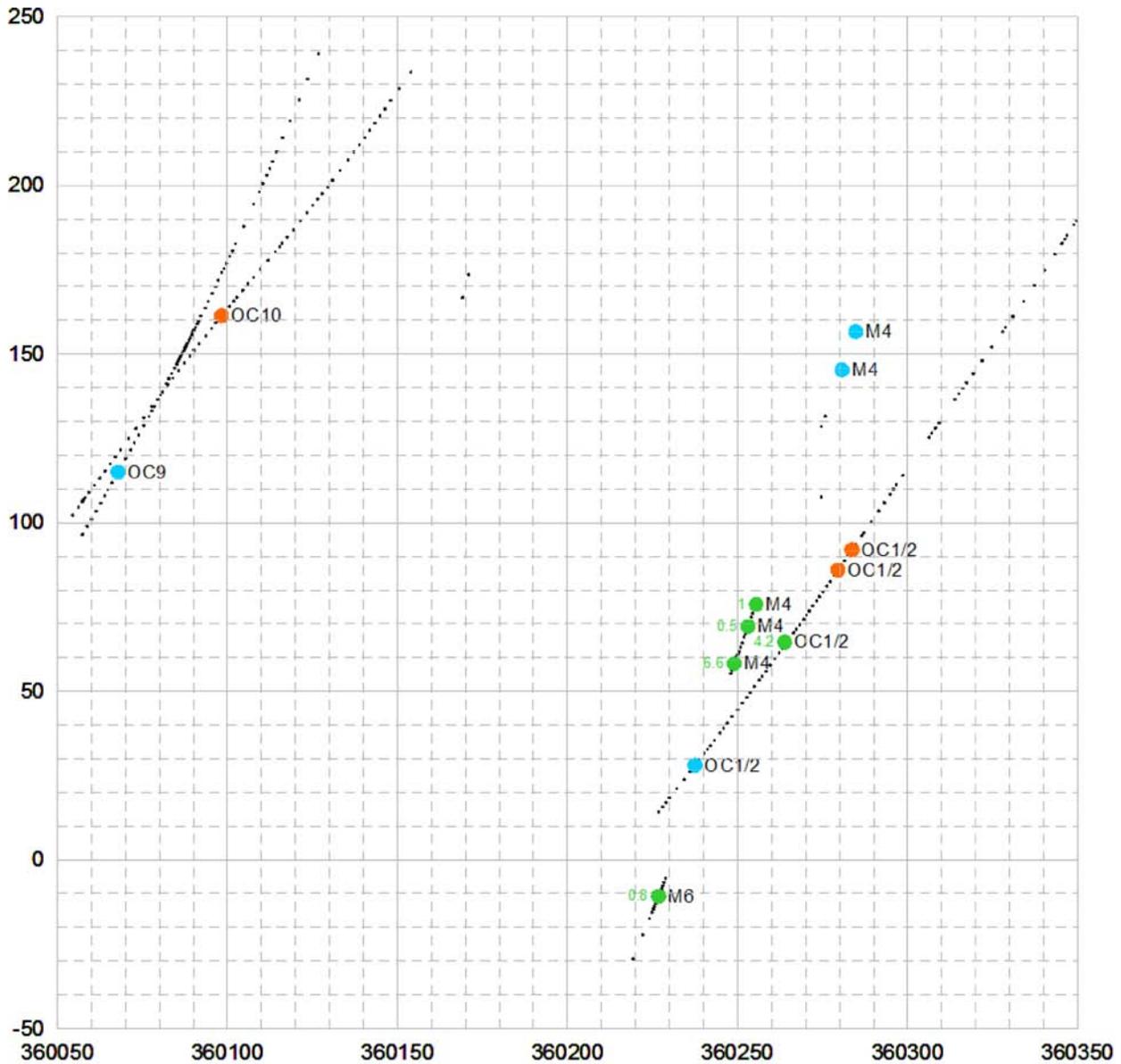


Figure 7 East-west projection of all drill hole intercepts with >\$100/t metal value south of the Main Slide. Green dots indicate stannite-type Sn-Cu-Ag zones; orange dots are Sn-rich cassiterite-pyrite (?) intercepts with low Cu & Ag contents; blue dots are Sn-poor Pb-Ag type lode intercepts. Annotations in green text at left of green dots indicate true widths of stannite-type intercepts. The tiny black dots in linear arrays indicate locations of individual assay samples, and thereby crudely outline the projected hole traces.

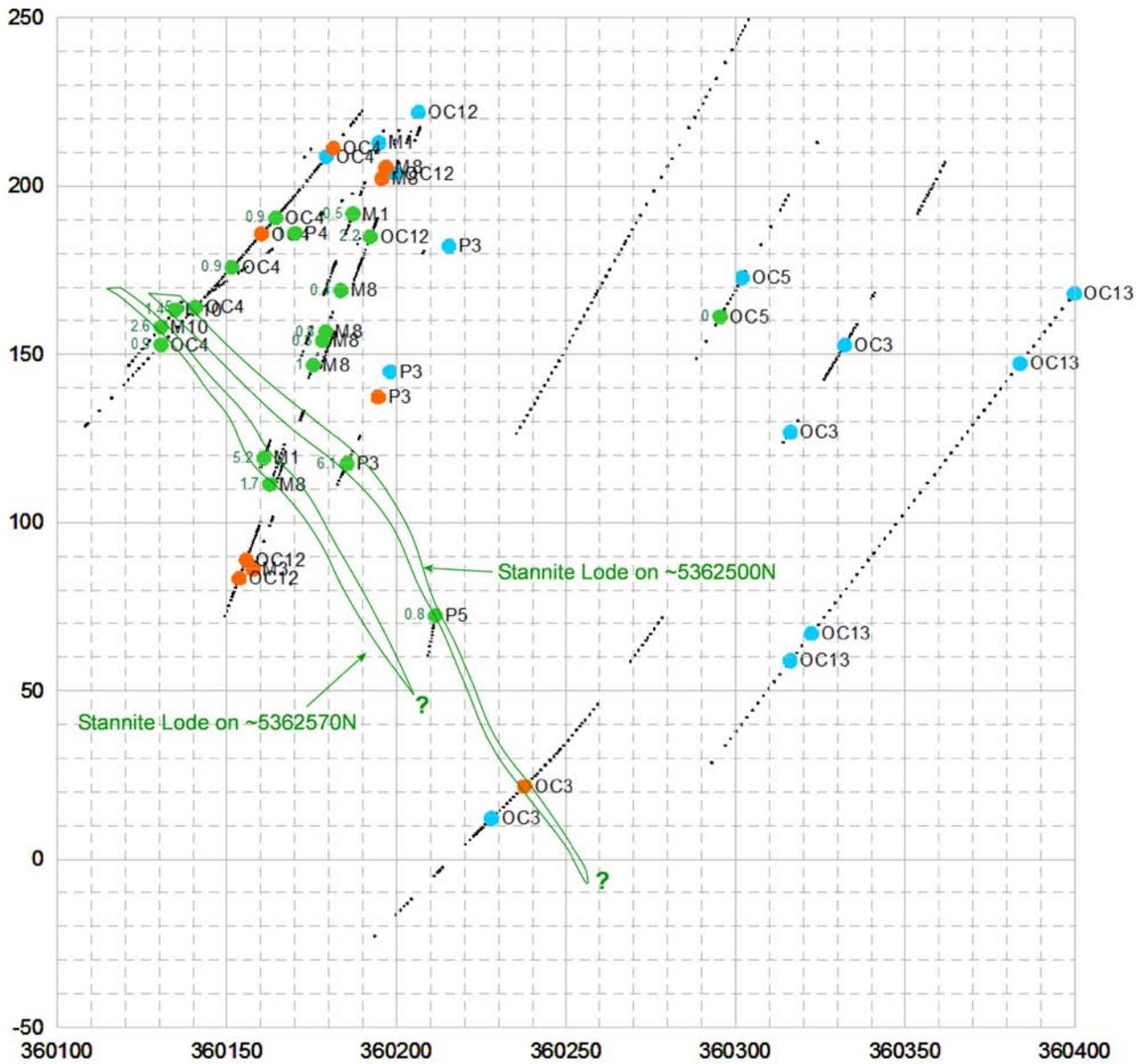


Figure 8 East-west projection of all drill hole intercepts with >\$100/t metal value north of the Main Slide. Green dots indicate stannite-type Sn-Cu-Ag zones; orange dots are Sn-rich cassiterite-pyrite (?) intercepts with low Cu & Ag contents; blue dots are Sn-poor Pb-Ag type lode intercepts. Annotations in green text at left of green dots indicate true widths of stannite-type intercepts. This projection illustrates the profusion of minor, mostly narrow mineralized zones of various metal associations in the hanging wall, and to lesser extent in the footwall, of the North Stannite Lode.

## Stannite Ore Processing

I have extensively but largely unsuccessfully searched the World Wide Web and UTas scientific databases for current information on the processing of stannite ores. The search turned up a few archaeological articles speculating that improvements in bronze manufacture that led to cultural advance in the Bronze Age may have stemmed from the accidental smelting of stannite ores in mistake for the copper-arsenic ores that toxically produced the earliest bronzes. Nowadays however, most of the global tin concentrate production<sup>8</sup> comes from cassiterite; stannite contributes only a minor proportion and consequently it does not feature in the technical ore processing literature.

Modern smelting of cassiterite concentrates 'is largely in reverberatory furnaces, by direct reduction, using anthracite or petroleum coke as fuel, and minor quantities of limestone as flux' and 'penalties are payable for impurities in cassiterite concentrates, of which Fe, S, Sb, Pb and Bi are the most important, with lesser emphasis on Cu, Zn, W, As, Co and Ni' (Berkman, 2001).

There seems to have been only limited and brief historical success in direct smelting of the Tasmanian stannite ores, presumably of handpicked material. Blissett (1962) recorded that smelters were built at South Zeehan in 1908 to treat the complex stannite ore and 'by early 1910 about 60 tons were being sent to the smelters daily...but towards the end of the year the mine and smelters ceased operations'. Pearce's (1971) brief history also mentioned that Oonah Mines Ltd. erected a smelter 'at Silver Bell, south of Zeehan, to produce a copper-silver matte and a copper-tin alloy' but 'shortly afterwards the mine closed down apparently due to ineffective smelter treatment'. Likewise, a short report by A.M. Reid in 1929 implied that smelting of the stannite was not easy: 'The stannite-bearing ore-bodies of the Oonah and Zeehan-Queen Mines at Zeehan seem to be worthy of investigation. They have been worked in both mines and they appear to be persistent, and maintain their metal contents at depth. Many years ago a smelting plant was erected at Zeehan to treat the ores, but the metallurgical difficulties proved insurmountable and the works were closed without achieving any good result' (Reid, 1929).

Half a century later in 1966, when sulfide flotation had become routine for mineral processing, an 'ore dressing investigation' of stannite, commissioned by Placer Prospecting Ltd. at the Department of Mines Laboratory, found that 'stannite behaves similarly to chalcopryrite in flotation and that good recoveries of the copper-bearing sulfide could be obtained by the use of sodium ethyl xanthate in the presence of lime and sodium cyanide' (Wellington et al., 1968; Pearce, 1971). Furthermore that: 'it is feasible [by flotation] to produce from this type of ore a sulfide concentrate containing 19% copper, 10% tin and 200 oz./ton (6,120 g/t) silver' and it was anticipated 'that a market could be found for such a concentrate'.

Table 4 lists analyses of the copper concentrate produced in the two flotation experiments conducted at the Department of Mines Laboratory. The head grade of the flotation test samples was 3.18% Cu, 2.25% Sn in stannite, and 2.25% Sn as SnO<sub>2</sub>; the modal mineral proportions were quoted as about 8% stannite, 2% chalcopryrite and 2.9% cassiterite<sup>9</sup>. The higher proportion of Cu in the flotation concentrate than in the sulfide component of the head grade (Cu/Sn 1.6-1.9 compared with 1.4, respectively) suggests significant chalcopryrite floated to the concentrate. What is more, the low total of copper + soluble tin (26 – 30%) and significant iron (24 – 27%) suggests it was an impure flotation concentrate that contained a fair bit of pyrite, as well as other Pb, Zn, As, Bi, and Sb bearing sulfides, and evidently minor cassiterite reported as insoluble tin. The low recovery of soluble tin quoted in **Error! Reference source not found.** indicates that more than a third of the stannite did not float. In other words, the flotation experiment floated parts of all the species of sulfides to produce polymetallic sulfide-rich concentrates but recovered only about two thirds of stannite based tin and copper.

Somewhat encouraged by these ambiguous indications I subsequently sought the opinion of the Process Manager at a current Tasmanian tin mining operation, who was very forthcoming and convincing, but prefers not to be quoted. According to that source:

- Stannite cannot be recovered by flotation – it will not float! - and selective flotation cannot produce a stannite concentrate.
- Stannite is readily smelted. It causes no problems in smelting of cassiterite, and the tin and copper metal can be separately extracted. Therefore tin smelter companies should readily accept stannite concentrate.
- The only feasible way to concentrate a stannite ore would be to firstly float off all the other sulfides (stannite will not float) then follow with a gravity concentration method to separate stannite from the non-sulfide gangue. Provided that the ore does not need to be very finely ground for liberation, this should produce a reasonably clean stannite concentrate with reasonable recoveries, and it should also pick up coarse-grained cassiterite.

That opinion contradicts the previous references to sulfur and iron being penalised components in cassiterite concentrates (Berkman, 2001) and also the Department of Mines experiments showing that Oonah stannite- and chalcopryrite-bearing rock can be selectively floated to produce a copper-tin-iron sulfide concentrate (Wellington et al., 1968).

My inexpert geological conclusion is that processing the Oonah Stannite Lode is going to be tricky, the recoveries may be low, and the sulfide concentrate may have low value because of its impurities. I suggest that Bass Metals Ltd. engage a more expert metallurgical consultant with up to date experience in tin ore processing to look into the question, if it requires resolution on the treat-ability of Oonah and other stannite deposits in the Zeehan District.

<sup>8</sup> 216 000 tonnes in 1998 (Berkman, 2001)

<sup>9</sup> Stannite (Cu<sub>2</sub>S.FeS.SnS<sub>2</sub>) contains 29.5% Cu, 13.1% Fe, 27.5% Sn and 29.9% S compared with Chalcopryrite (CuFeS<sub>2</sub>) which contains 34.5% Cu, 30.5% Fe and 35% S (Dana, 1957).

Table 4 Analyses of two copper flotation concentrates (from Wellington, et al., 1968)

Element		F4C1	F4C2	% Mean Recovery
Copper	%	19.5	16.0	74
Soluble Tin	%	10.4	10.0	62.9
Insoluble Tin	%	0.86	0.86	5.9
Antimony	%	2.70	3.00	
Arsenic	%	1.33	1.74	
Lead	%	3.10	1.80	
Bismuth	%	0.90	0.70	
Zinc	%	1.10	1.0	
Iron	%	24.0	27.2	
Sulfur	%	31.6	32.61	
Acid Insol.	%	4.0	4.1	
Silver	oz/ton	192	207	61

## Exploration History of other areas in EL 63/2004

This section describes exploration history and prospects elsewhere in EL 63/2004 outside the vicinity of Oonah Mine.

### 1987-1995, RGC Exploration P/L, EL42/87

RGC's former EL 42/87 covered most of the current Bass Metals EL 63/2004 and it extended several kilometres further south over many other tin prospects and old mines in the Zeehan to Comstock area. RGC Exploration obtained EL 42/87 by tender, initially intending to explore it for tin deposits in combination with the enclosed Queen Hill leases, which they had hoped to purchase from the Aberfoyle-Gippsland Minerals JV (Crossing, 1989). However, the acquisition deal failed and RGC went on to explore the wider EL area. The RGC EL excluded the Oonah Mine area, which was at that time held by CRAE as ML35M/72 of 32 hectares.

### 1989

John Crossing (1989) firstly carried out a 'major literature review spanning 2-3 weeks' of the previous exploration. His report includes a comprehensive summary of exploration prior to 1989, which was largely prospect-scale work focused on small leases over the known old workings such as Comstock, Sylvester, Oonah, Spray, Queen Hill, and Montana. With the exception of Oonah, these areas are all south of Bass Metals' territory and their exploration history needs no reiteration here. Crossing's (1989) report also includes a useful summary of the several (fissure-lode, stockwork and replacement) styles of tin deposits in the Zeehan area.

RGC's subsequent exploration program involved:

- Credibly detailed 1:10,000 geological mapping.
- Rock chip sampling of outcrops and mine dumps.
- Helicopter-borne magnetic intensity survey (75 m terrain clearance, east-west flight lines at 150 m spacing).

The rock chip sampling detected seven anomalies associated with old workings, mostly around Comstock-Sylvester. The only one within the current EL63/2004 was at Bradshaw's Lode where the pyritic lode was found to contain up to 0.78% Sn, 0.36 g/t Au and anomalous Cu and As.

Crossing concluded that the most Sn-prospective zone was in the Comstock area and along the southern boundary of EL42/87 because gravity and magnetic data suggested an ENE-trending line of magnetic skarns in carbonate-bearing sequences and potentially favourable structural settings above a spine of granite – and the area had never been routinely explored for tin. He recommended gridding that southern zone area for C-horizon soil and bedrock (Wacker) geochemical, and gradient array IP and magnetic geophysical surveys. He considered that the northwestern area had been mapped in enough detail to preclude further work and it 'could be excised from the EL'.

## 1990

RGC cut extensive grids at Sylvester in the southern, and at Parting Lake in the eastern, parts of EL42/87. They carried out the most intensive exploration including drilling of two holes at Sylvester, but it is outside Bass Metals' EL63/2004 territory and will not be described here. The objective at Parting Lake was clearly tin deposits, but there was no specific aeromagnetic target, and the grid was not surveyed by ground magnetometer. The grid appears to have been placed largely on the potentially favourable setting of carbonate-bearing Oonah Formation adjacent to the north trending Despatch Fault, which marks the boundary between the PreCambrian Oonah Formation and the Ordovician-Silurian-Devonian sedimentary sequence (including Gordon Limestone) in the Zeehan Syncline to the east.

The Parting Lake grid was covered by a C-horizon soil geochemical survey with samples obtained by motorized auger at 25 m spacings on east-west lines about 400 m apart. The grid was geologically mapped, largely by logging the auger cuttings. ANALABS analysed the samples for Cu, Pb, Zn and Bi by AAS (method 101) and for Sn by XRF (method 401). About 40% of the samples were also analysed by neutron-activation at Becquerel for a broad suite of elements including Sb, As, Ba, Br, Ce, Cs, Cr, Co, Eu, Au, Hf, Ir, Fe, La, Lu, Mo, K, Rb, Sm, Sc, Se, Zn, and Zr<sup>10</sup>. The survey detected 'a few scattered base metal anomalies at the south end of the grid'. The most significant were PbZn(Sn) anomalies (Figure 9 and Figure 10) located near the old Zeehan-Western and Tasmanian Crown mines in the far southeast corner of Bass Metals' EL63/2004. These are clearly related to surface pollution around the mines where soil Pb and Zn peak at 9300 and 4450 ppm, respectively, in contrast to their median values of 20 ppm over the entire survey. Tin concentration peaks at 183 ppm in the vicinity of Zeehan-Western compared to the median value of 3 ppm. Crossing (1990) commented that the anomalous Sn at Zeehan-Western coincides 'with an ENE trending structure that is interpreted eastward extension of the Stannite Lode of the old Oonah Mine'. The Stannite Lode does not have an ENE trend, but he may have been referring to the general trend of occurrences from Bradshaw's through Oonah to Junction workings, rather than the orientation of the lode.

Crossing noted the PbZn(Cu+Sn) soil anomalies in the vicinity of the Despatch Fault, near Tasmanian Crown, and in a spot high about one kilometre further north, had been previously detected by Aberfoyle who had interpreted Pb-isotope data from there as related to Devonian vein-style deposits. RGC regarded this eastern zone to be prospective for replacement-style tin deposits in the Ordovician Gordon Limestone adjacent to the Despatch Fault.

<sup>10</sup> I recall that RGC had developed an 'in-house' geochemical recipe for detecting granitoid related altered and mineralized systems using trace element ratios; the multi-element neutron activation data were presumably partly for that purpose. Crossing (1990) mentioned Rb and Cs as potential indicators of magmatic hydrothermal systems, but concluded that the signals were masked by primary lithological variations. However, elevated Rb in the southern half of the grid was 'interesting' in view of a known Rb anomaly over Queen Hill and the Severn deposit.

## 1991

A re-interpretation of available gravity data suggested a 'granitoid cupola' exists at about 1700 m depth below the Zeehan-Western to Tasmanian Crown area, where soil geochemical data indicate 'subtle Sn-W anomalism' (Crossing, 1991). This was considered prospective for replacement- or skarn-type tin deposits. However, the low levels of Sn and W in soils suggested that the potential mineralized zone would be deeper than the Severn deposit, and the 'depressed state of the tin market and Renison's poor performance' made it a low-priority target.

## 1992-95

In mid 1992 RGC relinquished the northern section of EL42/87 north of the Montana Silver-Lead mine, and a small section north of Zeehan, which is east of Bass Metals' current EL 63/2004 (Crossing, 1992a).

Despite the negative sentiment expressed in the previous year, RGC took a bold conceptual punt and drilled a 673 m deep hole at Montana Hill to test a 'series of westerly dipping thrust faults', which were interpreted to lie above the gravity-interpreted granitoid cupola and suspected to be feeder conduits for the Zeehan Montana and Zeehan-Western deposits (Crossing, 1992b). The hole, PL001<sup>11</sup>, was a total failure; it intersected neither major faults nor any mineralization in the target zone. It did intersect traces of galena and sphalerite between 35 and 52 m depth, in siderite-altered Gordon Limestone adjacent to a fault, but that had been previously known, and it was not the target style. The best interval was two-metres that averaged 0.76% Pb, 0.17% Zn and 17 g/t Ag (Halley, 1993).

Crossing summarized the venture in a suitably subdued manner: 'At Parting Lake a single deep stratigraphic hole was drilled to test for potential base metal and/or stanniferous replacement deposits within Upper Oonah Formation carbonates above a gravity-defined cupola. The hole failed to intersect significant carbonates [in the Oonah Formation], and the large thrust faults identified at the surface proved insignificant at depth. Some low grade disseminated galena and sphalerite was associated with recrystallised Gordon Limestone at shallow depth, adjacent to a fault, however the style of mineralization is very distal and the hole failed to intersect any sulfide rich mineralization suggestive of proximity to a granite cupola.' He subsequently considered that the Parting Lake area had no further exploration potential (Appendix 3 in: Halley, 1993).

Meanwhile, RGC had carried out a feasibility study on the inferred resource<sup>12</sup> at Sylvester, which they estimated at a maximum of 6 Mt @ 3.3% Pb, 5.5% Zn and 40 g/t Ag, with potential for smaller (2-3 Mt) but higher grade zones at the eastern end. However, it failed to meet their

<sup>11</sup> PL001 of 673 m depth was reportedly drilled westward from (AGD66) 361190E 5362230N, inclined at -55° on an azimuth of 250°. This site is outside of Bass Metals' EL 63/2004, located at the southern foot of Montana Hill, about 400 m northeast of the junction of the Heemskirk Road and Trial Harbour Road.

<sup>12</sup> RGC based the Sylvester resource estimate on 15 diamond drill holes, totalling 5,165 m over a one-kilometre strike length.

economic (size) criteria. The project was unsuccessfully offered as a joint venture, and finally the EL was recommended for relinquishment (Corlett and Halley, 1995).

### 1996-2002, RioTinto & Allegiance, EL 2/96

In early 1996 Rio Tinto Exploration P/L acquired EL 2/96 of 29 km<sup>2</sup> over the Comstock-Oonah-Parting Lake area to explore for Oonah Formation shale-hosted zinc deposits analogous to Century, Rammelsberg and Meggen, and Irish-style Pb-Zn deposits in the Gordon Limestone (von Strokirch, 1997). But the exploration program never got started. A 1996 review of Rio's Tasmanian zinc projects concluded that it was 'difficult to see potential for a major zinc deposit of the size and grade that would interest the Rio Tinto Group', and von Strokirch (1997) recommended that they should sell off or farm out their tenements.

In late 1997 Rio Tinto joint ventured EL 2/96 out to Allegiance Mining NL to explore for nickel sulfide and shale-hosted or Irish-style zinc deposits (Newnham, 1998). Allegiance flew a high-resolution helicopter borne magnetic survey (parameters not specified) and concluded that the results over the northern half indicated 'diminished prospectivity' for the target sought. Therefore, the Rio-Allegiance JV partners relinquished that northern part (north of 5362000 N). Even so, and despite Rio Tinto's negative assessment of Tasmanian zinc potential, they retained a 2 km<sup>2</sup> Retention Licence (RL 9705) over the Oonah to Zeehan-Montana Mines, and the southern part of the EL from Zeehan to a couple of kilometres west of Comstock. Allegiance's program of mapping, litho-geochemical sampling and drill core re-logging concluded that 'most of the magnetic anomalies in the Tenth Legion area are due to magnetite skarns', which were not considered prospective for Aveybury-style nickel deposits, and the licence was relinquished (Newnham, 2002).

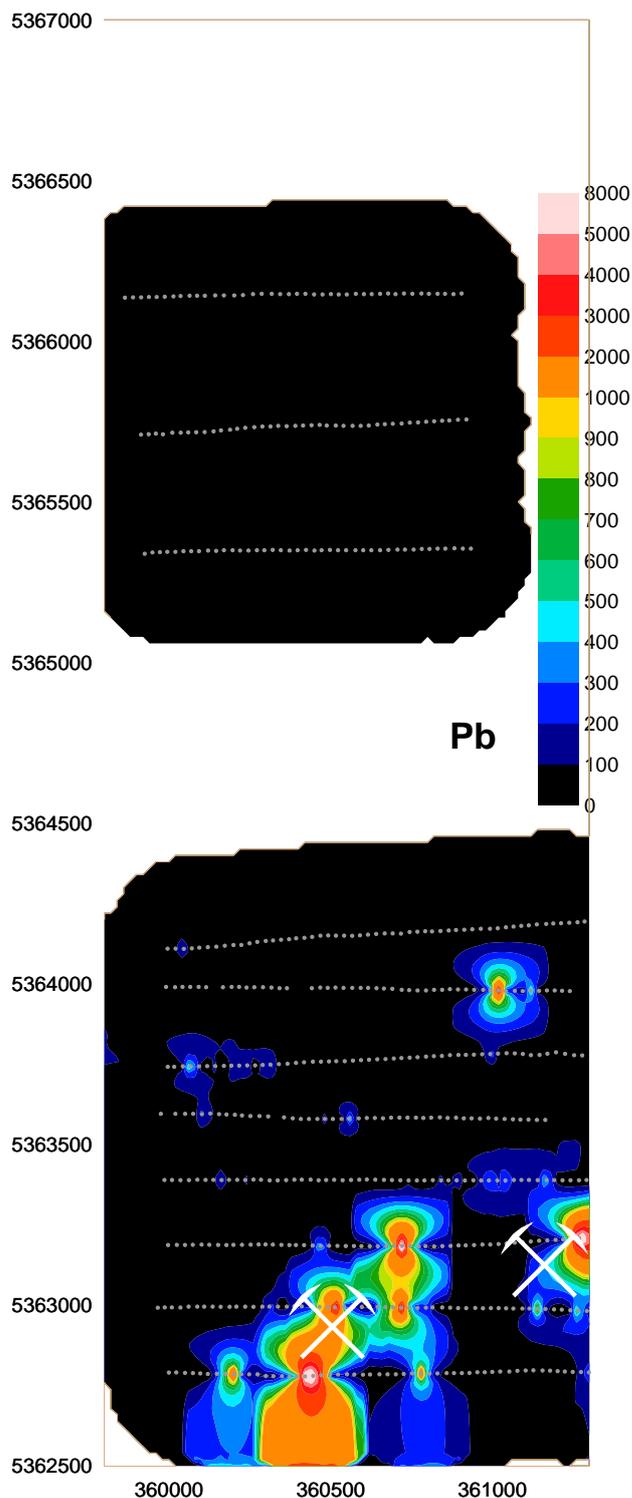


Figure 9 Contoured plot of RGC's Parting Lake Pb and Sn soil geochemical data showing spatial coincidence of principal anomalies and the old mine workings at Zeehan-Western (360500E 5362950N) and Tasmanian Crown (361250E 5363120N).

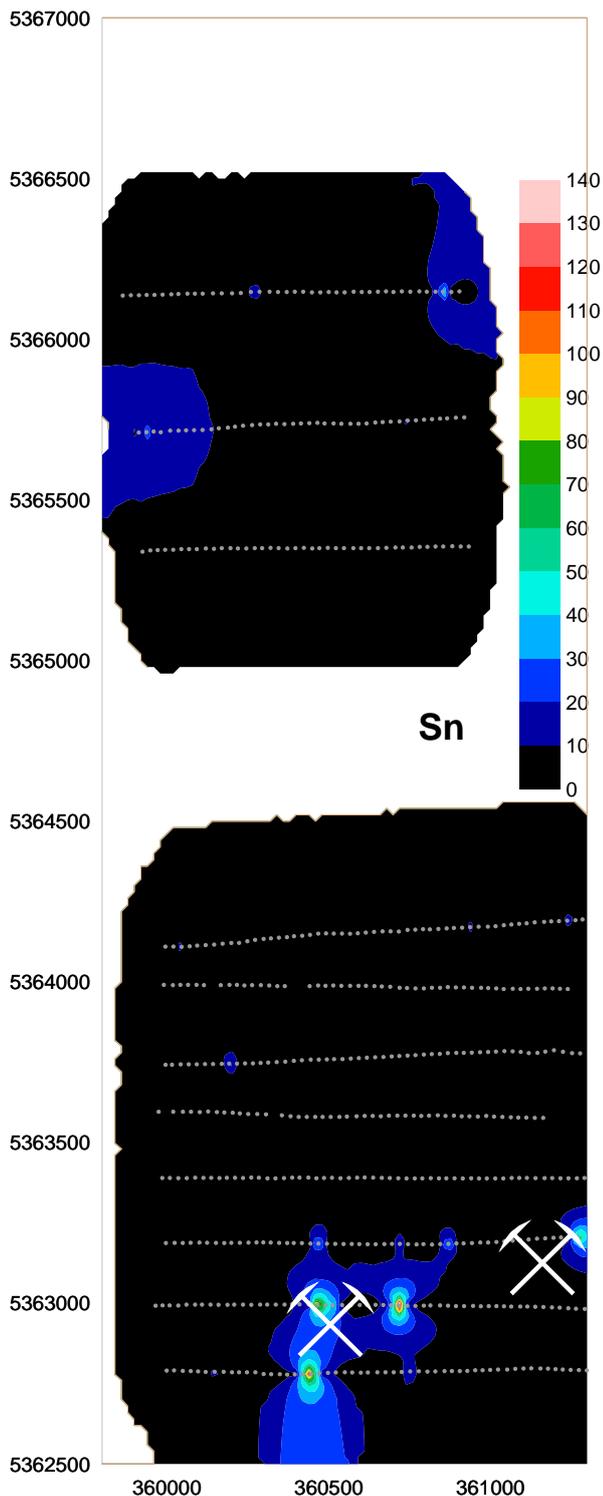


Figure 10 Contoured plot of RGC's Parting Lake Sn soil geochemical data over the same area as Figure 6.

## 2002-2003, Mt Conqueror & Central West Gold, EL 7/2002

EL 7/2002 of 12 km<sup>2</sup> (coincident with the southern half of bass metals' current EL 63/2004) was granted to Mt Conqueror Minerals NL & Central Western Gold NL in June 2002 to 'enable re-assessment of previously reported Sn-Cu-Ag resources in the Stannite Lode' at the Oonah Mine (McLatchie, 2003). They briefly concluded that the Stannite Lode was 'not sufficient to support a stand-alone mining operation', subsequently did no other work on the greater licence area, and relinquished it within a year.

## 2004-2009, Bass Metals Ltd., EL 63/2004

Bass Metals apparently took up the exploration licence 'primarily because the Tenth Legion Fault<sup>13</sup> is interpreted to thrust the Burnie & Oonah Formations on top of younger units including the Gordon Limestone, which is considered prospective by Bass for carbonate-replacement mineralization' (Turnbull, 2006).

Bass Metals' exploration in the first few years was limited to reviews of previous work and compilation of the existing data for a Geoinformatics-style three-dimensional analysis and target generation. Turnbull (2006) reported that the Geoinformatics process generated four 'intrusive-related carbonate replacement targets generally associated with the interpreted position of the Tenth Legion Fault' but did not specify the exact criteria used in the modelling. In fact, the Geoinformatics target zones lie up to about a kilometre west of the 10<sup>th</sup> Legion Fault (Figure 11), either in Oonah Formation, or in Ordovician Gordon Limestone below the thrust - or possibly even in Cambrian volcanics as postulated by Findlay and Brown (1992).

That compilation drew attention to some NNW-trending magnetic 'features', and patchy soil geochemical tin anomalies previously outlined by RGC's work on the northern part of the Parting Creek grid (Figure 12). Bass Metals considered this northern sector of the EL area was under-explored because it contains no known mineral occurrences (Turnbull, 2007). However, the Sn soil anomalies in this area are less than spectacular, and the colour coding applied in Figure 12 is mildly misleading. Line profiles in Figure 13 show that only four of the samples can be considered anomalous in the local context of the northern part of the grid. Admittedly, the most anomalous samples, 19, 32 and 52 ppm Sn, all lie near the southern ends of two separate magnetic anomalies, and the 52 ppm sample also lies close to the 10<sup>th</sup> Legion Fault. The latter sample comes from a low-lying area between two creeks and its high Sn concentration may therefore be partly due to alluvial contamination. Whilst clearly anomalous against local background, they are all

<sup>13</sup> Crossing (1989 etc.) called the N-S trending fault, at the western edge of the Zeehan Syncline north of Zeehan town, the Despatch Fault. Findlay & Brown subsequently interpreted it and the complex of linked faults to the south west (Crossing's Waller, Sylvester and Balstrup Faults) as a single folded early-Tabberabberan thrust fault, which they termed 10<sup>th</sup> Legion Thrust (Findlay and Brown, 1992).

essentially isolated spot anomalies, not well-supported by Cu, Pb, Zn and Sb, and not comparable to the more coherent and widespread Sn anomalies in the Sylvester area.

Still, it was good enough for Bass Metals Ltd. who subsequently extended and in-filled the existing geochemical data (Figure 12) with soil samples collected by un-specified means on 200 x 50 m spacings (Bates, 2008). The samples were analysed at Genalysis' Adelaide laboratory for Au, Ag, As, Bi, Mo, Pb, Sb, Sn, Tl, and W by mass spectrometry and Cu, and Zn, by atomic absorption spectroscopy following Aqua Regia digestion of 10 g aliquots of whole soils<sup>14</sup>.

These may not be directly comparable to RGC's soil geochemical data. RGC's samples were obtained from C-horizon by motorized auger but Crossing (1990) did not state their sample preparation method (whether the analyses were of whole soil or of a sieved fraction). Bass Metals in contrast, obtained samples by hand auger from a variety of A-B, A-C, B, B-C, and C soil-horizons and analysed the whole (non-sieved) soil.

However, there is no doubt about the tin data; they are clearly incomparable, because RGC (correctly) analysed for tin by XRF, whereas the Aqua Regia digestion used in the Bass Metals analyses would not have dissolved tin present as cassiterite. That difference is plainly obvious in the order of magnitude contrasts between the mean Sn value of 7 ppm for the RGC data from the northern part of Parting Lake grid, and mean of 0.7 ppm for the Bass Metals data from the same area. Likewise, the maxima in that northern area differ by nearly an order of magnitude; 52 and 6 ppm Sn, respectively. The analytical Sn (and Sb & Mo) discrepancies are also graphically evident in contoured plots of the combined RGC and Bass Metal data (Figure 14). So, Bass Metals' soil sampling survey has not effectively followed up the RGC tin anomalies.

Although the dissolution techniques were broadly comparable, there is still some risk in combining data from the two surveys for other elements such as Cu, Pb, and Zn - because of the different soil sampling technique of different soil horizons. Nevertheless, plots of the combined data suggest they are qualitatively similar (Figure 15). The 50 x 200 m spaced Bass Metals data show several spotty anomalies in Zn, Pb, (Cu), which were not apparent in the 25 x 400 m spaced and less extensive RGC data. They are all single sample anomalies, and in most cases not coincident between elements. For example the sample from 360900E 5366400N on Dunkley's Tramway contained 0.28% Zn but had background levels of Pb and Cu; its location on the Tramway might indicate contamination from an exotic source.

Two minor exceptions occur:

- The sample at 360400E 5365600N, which is highly anomalous in Pb (0.17%) and Ag (7g/t), supported by mildly anomalous Zn, As, Sn, and Sb, with the highest

Sn<sup>15</sup> and Sb values observed in the Bass Metals data set. The high Pb-Ag strongly suggests a Zeehan-type mineralized lode association. The location is about one kilometre northeast of Montana Silver-Lead Mine, exactly on a vehicle track linking the Heemskirk Road to Dunkley's Tramway; I haven't inspected that track but it may be reasonably suspected that the anomaly could be due to contamination - from ore spillage, or from mullock used to form the track? Otherwise it could be a minor undiscovered Pb-Ag lode.

- The sample at 360750E 5366800N, which contains mildly anomalous (~120-400 ppm) Cu, Pb, and Zn.

However, they are all single spot anomalies, more likely to represent individual small Zeehan-type lodges (or contamination?) rather than any coherent large mineralized zones, and therefore of no compelling interest. Bass Metals' December 2008 monthly report mentioned proposed geologic mapping to follow up some 'encouraging anomalies' that had been detected by the soil sampling program (Bates, 2009). However, subsequent reports indicate that no further work was done on this area in the first five months of 2009.

Between September and November 2008, Bass Metals carried out a program of geologic mapping, costeaning, chip sampling and reverse circulation drilling (10 holes totalling 531 m) to test for shallow Pb-Zn-Ag resources at the Montana Silver Lead Mine (Bates, 2009). Several of the holes intersected mineralized intervals of 5 to 19 m wide carrying up to a few percent Pb and Zn, and 40-100 g/t Ag; the best intercept was 3 metres @ 2.1% Zn, 9.3% Pb, 252 g/t Ag. The drilling program apparently conclusively demonstrated that 'very little mineralization' remains within 70 metres of the surface (Bates, 2009). I accept that conclusion and have not examined the data in any further detail.

<sup>14</sup> Genalysis Sample Submission No. 14513, 13/10/2007

<sup>15</sup> Highest Sn associated with other anomalous metals suggests that at least a small proportion of tin was amenable to Aqua Regia digestion.

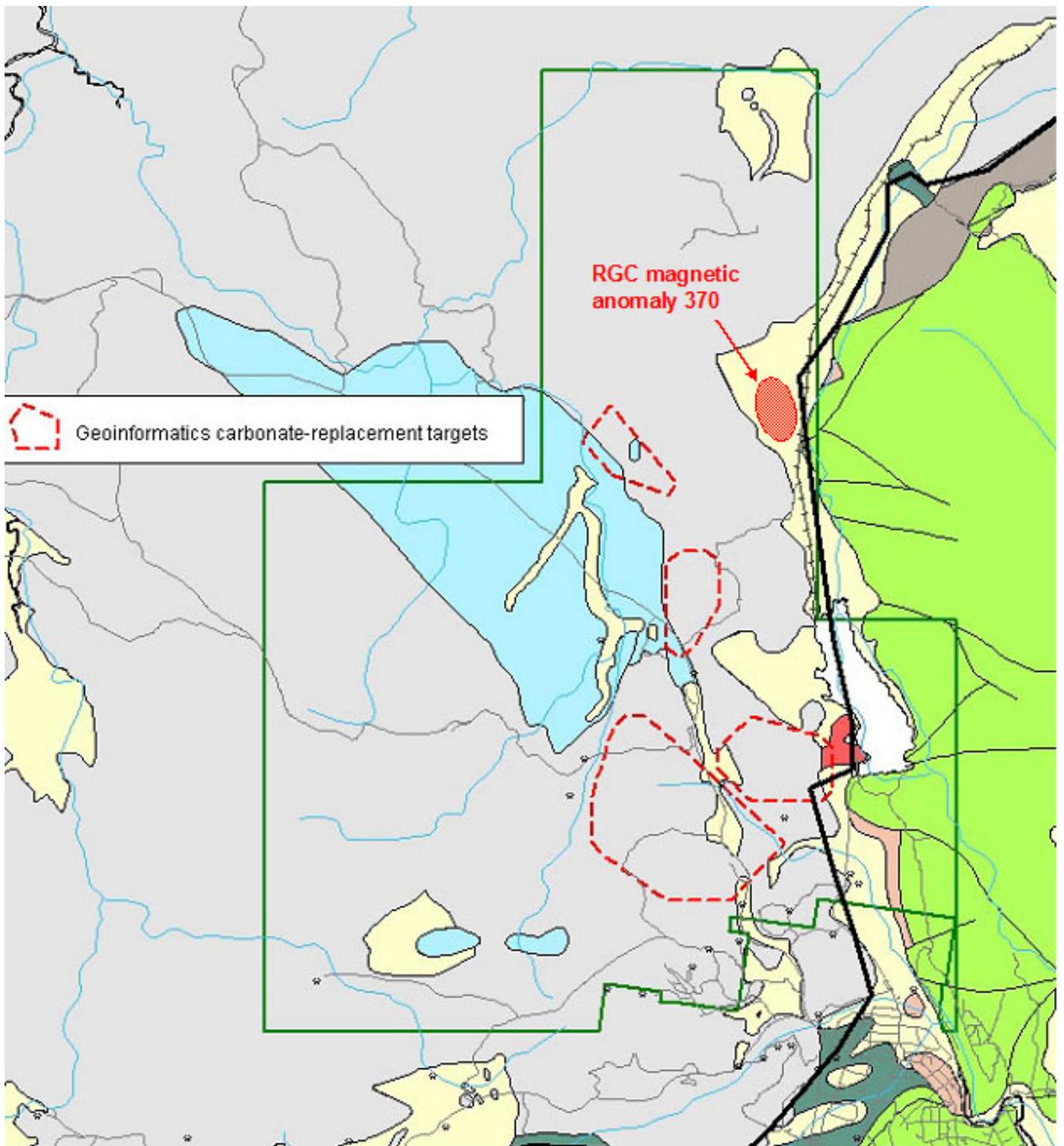


Figure 11 Location of carbonate replacement targets generated by the Geoinformatics 3-D modelling process, (adapted from Turnbull, 2006).

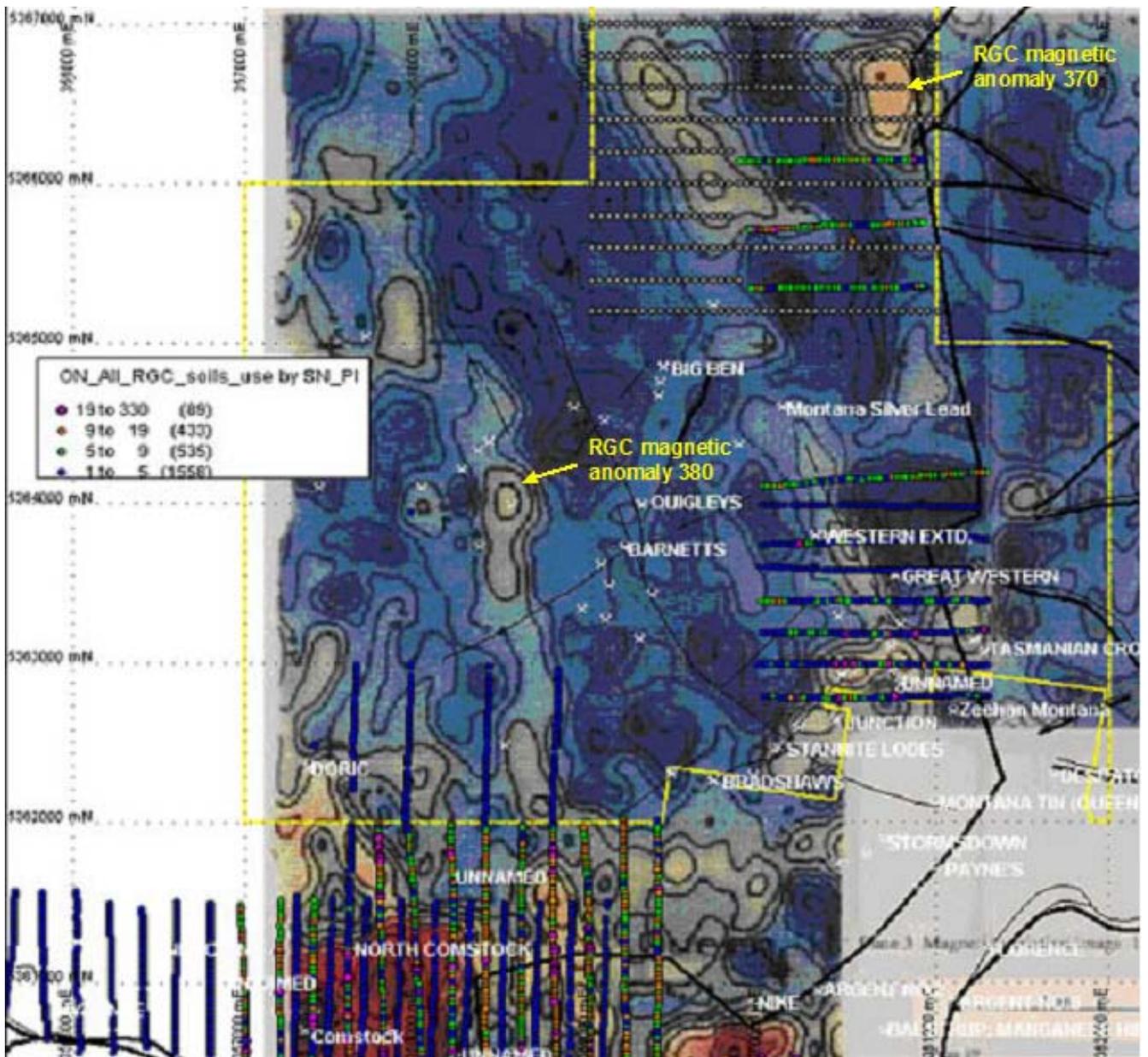


Figure 12 RGC's image of (aero) magnetic variation with RGC's C-horizon soil Sn data in coloured dots, and Bass Metal's proposed extensions to soil geochemical survey in grey dots (adapted from Turnbull, 2007).

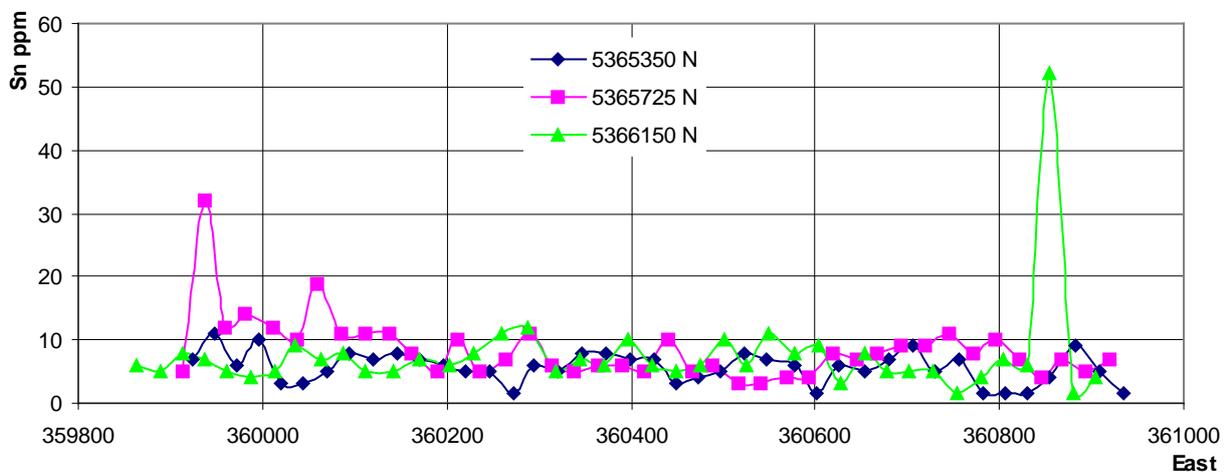


Figure 13 Profiles of RGC's C-horizon soil Sn data from the northern three lines of the Parting Lake survey. Ninety percent of the data (n = 123) fall between the mean  $\pm$  1 standard deviation values of 1.7 and 12.7 ppm Sn, respectively. Only four samples (three near the western end of line 5365725 N and one near the eastern end of line 5366150 N) exceeded the mean+1 standard deviation.

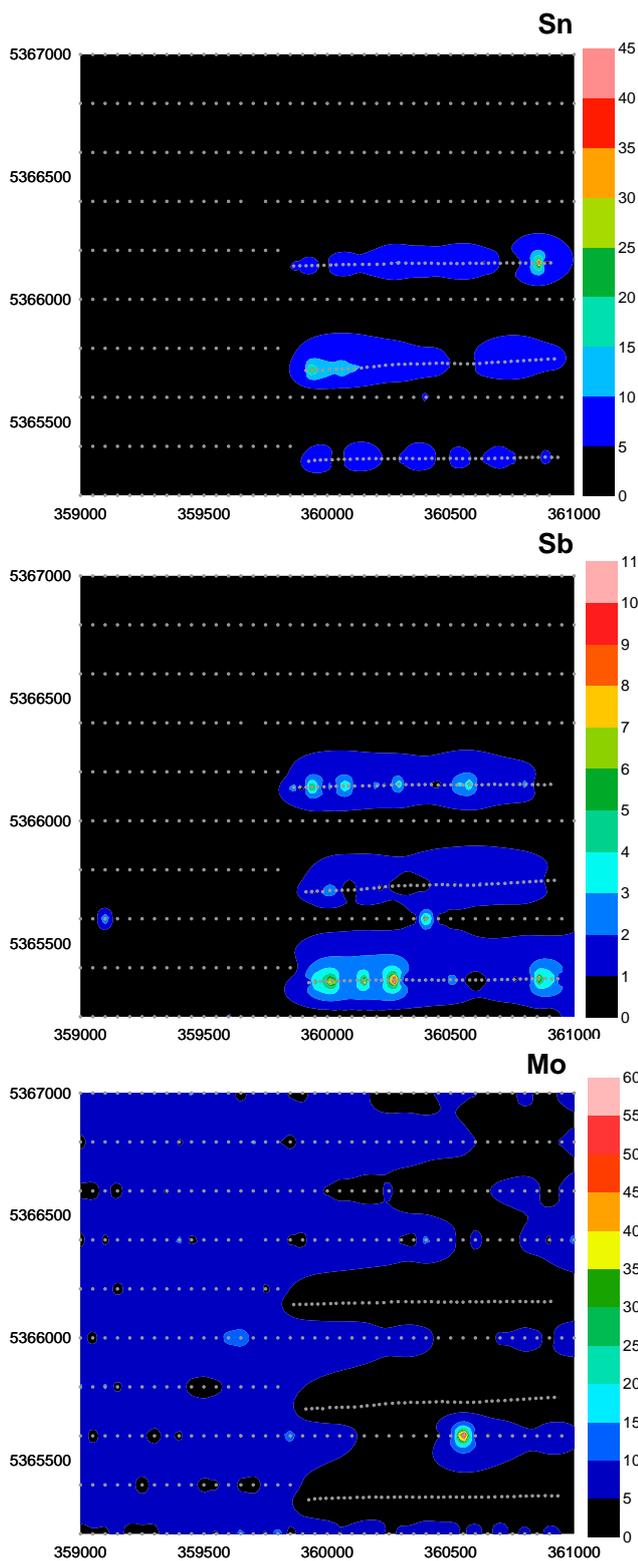


Figure 14 Contoured plots of tin, antimony and molybdenum from the combined RGC and Bass Metals Ltd. soil geochemical survey data. The east-west stripes are due to different analytical techniques. It is most noticeable in the tin data, because the RGC samples were analysed by XRF, whereas the Bass Metals samples were analysed by an acid digestion technique which underestimated the tin concentrations by about an order of magnitude.

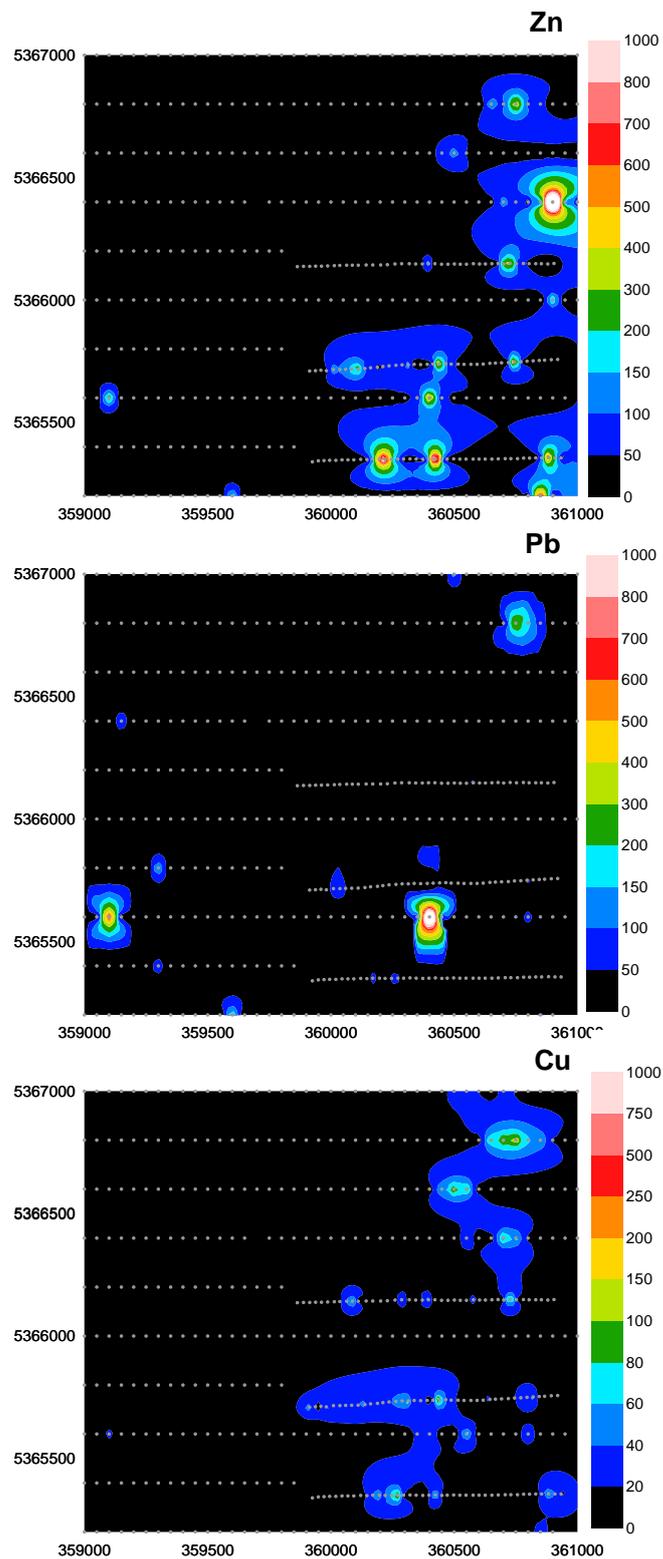


Figure 15 Contoured plots of zinc, lead and copper from the combined RGC and Bass Metals Ltd. soil geochemical survey data.

## Discussion of Exploration Potential

### Carbonate-replacement tin potential

RGC Exploration gave the Renison-type cassiterite-pyrrhotite carbonate replacement tin deposit model a thorough thrashing over a 5-year program commencing 20 years ago. They had the advantage of close association with Renison Mine, they knew what they were looking for, maintained continuity of geological staff throughout the program, carried out detailed on-ground geologic mapping and structural interpretation, applied all the right geophysical and geochemical techniques, and boldly tested their conceptual targets with deep 'stratigraphic', drilling.

Admittedly, most of their effort went into the Sylvester prospect (south of the current EL 63/2004), where the combined geologic, geochemical and geophysical indicators were most favourable. But they were well aware of the combination of favourable host lithologies, sub-surface granite, and structural setting along the north-trending Despatch Fault (now known as 10<sup>th</sup> Legion Fault) in the eastern part of the EL north of Zeehan. They covered it with high-resolution helicopter magnetic survey, outlined a couple of interesting magnetic anomalies, but didn't get much encouragement from soil geochemistry and reasonably concluded that any deposits in that zone must be at least a few hundred metres below surface. Even so, RGC took a bold punt in deep drilling of a gravity-interpretation based conceptual target of a granite cupola about 1750 m beneath the Montana Hill-Oonah Mine area, which is also just outside the current EL area. It unfortunately indicated that there were few favourable carbonate-host units in the Upper Oonah Formation, and the near surface Ordovician Gordon Limestone had only a narrow, weak galena-sphalerite mineralized zone.

The outcome is that there is about 4 km of strike length of structurally favourable 10<sup>th</sup> Legion Fault zone along the eastern edge of EL 63/2004 that remains untested by drilling. The best geophysical target in that zone is a bullseye magnetic anomaly at the northern end, centred at 360700E 5366650N. Wyatt (Appendix 6 in: Crossing, 1990) called it Anomaly 370, noted its proximity to the fault, and that it occurred over Crimson Creek Formation (Figure 12). It has amplitude of only about 10 nanoTeslas, and a NNW strike length of about 500 metres. The Severn deposit at Queen Hill gave a response of about 40 nT in the same magnetic survey.

Wyatt's theoretical modelling, based on realistic magnetic susceptibilities of semi-massive sulfide bodies containing about 20% pyrrhotite, suggested that a magnetic response of that amplitude (~10 nT) could be due to a 25,000 t deposit buried at about 40 m depth, or a 450,000 t deposit buried at about 160 m depth, or a 1,000,000 t deposit at about 300 m depth<sup>16</sup>. A one million tonne deposit at a

grade of 1% Sn would have a present day in ground metal value of about A\$180 million.

Anomaly 370 is one of only three anomalies (out of eighteen detected by the survey) that Wyatt marked as high priority, and recommended it for further investigation; the other two high priority anomalies are in the Comstock-Sylvester area. However, despite Wyatt's recommendation and Crossing's (1990) proposed follow up work, I have found no subsequent mention of anomaly 370 in the RGC reports. It seems RGC were discouraged by David Leaman's gravity modelling (Appendix 6 in: Crossing, 1991) which indicated that the Heemskirk Granite lies between 2000 and 2500 metres below surface in that northern area<sup>17</sup>, suggesting that any associated carbonate-replacement tin deposits would be too deep. RGC may also have been under pressure to reduce the area of the licence, which was five years old in 1992, and obviously preferred to retain the southern area around Sylvester where they had done the most work.

RGC's soil geochemical survey halted just south of anomaly 370, therefore we have no reliable Sn data over it, but it was covered by Bass Metals' soil survey. As mentioned above, Bass Metals' soil data show a moderately anomalous coincident Cu,Pb,Zn single sample spot-high on the northern edge of anomaly 370, and a singleton 0.28% Zn sample at its south-eastern edge. I believe these soil anomalies have little significance in their own right – possibly attributable to minor sulfide fissure lodes - but even so, they might be indicators of the distal/high level parts of a deeper granite-related carbonate-replacement mineralized zone.

Bull's eye anomalies are always attractive. This one is subtle, but the cassiterite-pyrrhotite deposits are only weakly magnetic, and geophysicist Wyatt gave it top priority ranking for that target type. Surprisingly, the Geoinformatics GIS modelling approach did not identify this anomaly as a target. However, I consider anomaly 370 warrants at least a ground magnetometer reconnaissance survey to better establish its magnetic character and elucidate the geologic setting, which may be difficult because it's in a flat swampy area of poor outcrop astride Parting Creek.

None of the other magnetic features should excite much exploration interest. Anomaly 380, centred at 358300E 5364150N, is a 2-km-long NNW trending linear anomaly of about the same amplitude (10 nT) that is partly coincident with the eastern end of an east trending 'rib' in Leaman's granite model, suggesting the depth to granite is only about 1400 m at that point. However, it looks 'formational' rather than due to a discrete sulfide source.

There are no other geological and geophysical features elsewhere in EL 63/2004 that suggest high potential for cassiterite-pyrrhotite carbonate replacement tin deposits.

<sup>16</sup> Wyatt modelled the three hypothetical deposits as triaxial ellipsoids with the following respective dimensions: 50x20x10 m, 150x50x15 m, and 250x100x20 m.

<sup>17</sup> Leaman's Map 3 of granite isobaths bears an annotation stating that the form of the granite is 'not well defined' in the vicinity of magnetic anomaly 370.

## Lead-silver lode potential

Several of the Oonah Mine drill holes intersected narrow zones of Pb-Ag type lodes, in both the hangingwall and footwall relative to the Stannite Lode, and also at the Junction workings to the northeast (e.g. Figure 8). Some of these minor lodes carry significant grades of lead and silver, with minor zinc, copper and tin, indicating in situ metal values of up to \$650 per tonne.

Table 6 lists ten intercepts with metal values greater than \$200 per tonne. However, these are all narrow lodes, with maximum widths ranging from about 0.2 metres to about one metre. The ten intercepts in Table 6 have an average metal value of about \$380/t, but they average only 0.6 metres in width.

These types of small Devonian granitoid related fissure lodes are (or were) abundant in the Zeehan field, but their typically narrow and discontinuous character makes them difficult exploration targets. And they not likely to contain large tonnages. With the exception of New North Mount Farrell, they have not been significant Tasmanian ore producers in at least the last half-century.

Moreover, although they may seem tantalizing shallow sources of potentially high-grade material, it must be remembered that the Zeehan field once swarmed with diligent and/or desperate prospectors and miners. It is unlikely that they missed any lodes that cropped out, and shallow lodes of payable grade and width were mined out early in those wild colonial days. For example, the Galena Lode in the upper levels of the Oonah Mine, was 'largely stoped out before 1900' (Blissett, 1962) and was then intermittently worked by tributers taking the crumbs until 1924. Likewise, Bass Metals Ltd's recent drilling campaign at the Montana Silver-Lead prospect demonstrated that 'very little mineralization' remains within 70 metres of the surface (Bates, 2009).

I consider these types of deposits at the several other clusters of old workings in EL 63/2004 (including Junction, Zeehan-Western, Tasmanian Crown, Montana Silver-Lead, Big Ben, Barnett's, Quigleys and Doric) to be distracting little red herrings, unworthy of further exploration.

## Oonah Stannite Lode potential

This most recent (and probably the only reasonably rigorous) assessment of the Stannite Lode exploration data conservatively estimates it to contain an inferred resource of around 179,000 tonnes, located between 50 and 200 m depth below surface, with an average lode width of 2.5 m, and grades of 1.15% Sn, 1.60% Cu, 143g/t Ag. That represents a current in-ground metal value of about AU\$70,000,000. It remains open at depth (Figure 6), and there may be some remnants of lode at shallower depths, such that it may be possible to double the inferred resource with a few additional well-placed exploration drill holes. There is also potential (and some existing

tenuous evidence) that the lode may change to cassiterite-dominant type with increasing depth beyond about 250 m below surface. Further exploration drilling would require substantial track construction and site preparation because the terrain is moderately steep and now mostly thickly overgrown.

Unfortunately, the treat-ability and saleability of stannite remains in doubt. Other mineral dressing expertise and possibly experimentation is required to resolve this uncertainty. Mine-ability may also be a significant limiting factor, because the narrow lode occupies a fault fissure dipping at about 50°, which is likely to cause stability and dilution problems.

Nevertheless, assuming that this type of narrow, complex sulfide lode is efficiently mineable and recoverable, and that the resource can be proven to about double its currently inferred size at similar grades – mindful of the observed great variability in grades and thicknesses – then the deposit could have an in ground value of about \$150 million. Even this, as McLatchie (2003) also concluded, is unlikely to support a stand-alone mining operation. It may, however, still be of interest to Bass Metals Ltd., which has in recent years demonstrated its ability to mine profitably at a small scale.

## Exploration Recommendations

### Oonah Stannite Lode

1. Obtain expert process metallurgical opinions on the recoverability of stannite from a mixed sulfide assemblage, and saleability of concentrates.
2. Undertake a 'back of an envelope' analysis of the economic feasibility of underground mining of a narrow fissure-lode deposit of less than 200,000 tonnes and \$100 million metal value.
3. If those both produce positive outcomes, then design and carry out a drilling program to properly define the Stannite Lode resource. That program should preferably be diamond core drilling, in oriented HQ3 (triple tube) to obtain maximum geologic and structural data and maximize the core recovery through the probably brecciated mineralized zones.

### Magnetic Anomaly 370

4. Conduct a geological reconnaissance and ground magnetometer survey of anomaly 370.
5. If the geologic setting and magnetic data modelling are favourable for a carbonate-replacement cassiterite-sulfide deposit, then test the target with an oriented-core diamond drill hole.
6. Ensure that all tin assays are done by X-ray fluorescence.

Table 5 Intercepts of Pb-Ag-type lodes of greater than \$200/t metal value in existing Oonah Mine drill holes.

Location	Hole	From (m)	To (m)	Intercept (m)	Pb %	Zn %	Ag g/t	Cu %	Sn %	\$/t
Hangingwall lode/s, east of North Stannite	M1	41.6	41.8	0.2	12.7	1.0	606	0.4	0.0	655
"	P3	99.1	100.0	0.9	7.5	0.0	302	0.0	0.4	399
"	OC4	34.9	35.6	0.7	9.5	0.1	300	0.1	0.2	398
"	OC12	24.0	24.6	0.6	8.2	0.3	235	0.2	0.0	329
"	OC12	46.5	46.7	0.2	7.4	1.8	205	0.2	0.0	314
Footwall lode, west of North Stannite	OC3	277.1	278.0	0.9	0.3	0.4	388	0.2	0.1	264
Galena Lode south of Main Slide?	M4	70.0	71.1	1.1	5.6	3.6	180	0.1		292
"	M4	82.5	82.8	0.3	3.1	0.7	349	0.1	0.0	276
Junction Workings	OC13	64.5	65.3	0.8	15.0	0.3	295	0.1	0.1	501
"	OC13	94.3	94.5	0.2	7.7	0.7	295	0.1	0.1	354

## Acknowledgements

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