

**EL 13/2015 “Frankland River”
Annual Report on Exploration
Nov. 2021 to Nov. 2022
- D & B Mining Pty Ltd**

Grant MacDonald (B.Sc. Hons.), M.A.I.G.
on behalf of
D & B Mining Pty Ltd
15 Anglesea St
Wivenhoe, Tasmania 7320

Abstract

Work on EL 13/2015 “Frankland River” during the reporting year has been carried out in conjunction with work on the other contiguous tenements which constitute the Balfour project, i.e. EL 10/2014, EL 12/2015, EL 9/2021 and ML 1M/1976.

This work has consisted of a thorough review of all historical exploration over the project area, including the appraisal and summary of over 220 reports, processing of existing geophysical data, the generation of an Independent Technical Assessment Report by CSA Global, and the updating of the Mineral Resource Estimate for the Murrays Reward/Central Mt. Balfour resource.

The proposed VTEM survey has been shelved at this stage due to the recognition that such a survey is not optimal for the style of mineralisation likely present.

Work specific to EL 13/2015 has;

(1) recognised and prospectivity of the Rocky Cape Group for sedimentary hosted copper+/-base metal deposits, and

(2) delineated three stratigraphic horizons with potential for this style of mineralisation with targets where these horizons meet mapped structures.

(3) defined a new IOCG prospect at Little Frenchmans and recommended further work on this anomaly and anomalies number 3, 4 and 5 defined by Jaguar in the 2002 WTRMP hummingbird EM data.

Other work of relevance to EL 13/2015 has been the recognition of granite at shallow depths beneath the Rocky Cape Group and associated hydrothermal pyrrhotite alteration producing high tenor magnetic anomalies.

<u>Table of Contents</u>		page
1.0	Introduction	1
1.1	Exploration Rationale	1
1.2	Location and access	1
1.3	Land status and usage	1
1.4	Tenure	1
1.5	Geology	3
2.0	Summary of Previous Work	9
2.1	Prior to Current Tenement	9
2.2	During Current Tenement - Zeb's Minerals Pty Ltd (2014 – 2020)	9
3.0	Exploration completed during the reporting period	10
4.0	Discussion of Results	11
4.1	Compilation/Appraisal Work	11
4.1.1	Historical Mining and Prospecting	11
4.1.2	Modern Exploration	11
4.2	Target Definition	11
4.2.1	Sedimentary Hosted Copper (base metals) Targets	11
4.2.2	Tennant Creek IOCG Copper+/-Gold "Temma Ironstones" Targets	12
5.0	Conclusions and Recommendations	28
6.0	Environment	29
7.0	Expenditure	30
8.0	References	31

Tables

4.1	Historical Exploration Licences and Special Prospecting Licences Which Covered Part or All of EL 13/2015	17
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Figures

1.1	Location of EL 13/2015 "Frankland River" within the Balfour Project Area.	2
1.2	Land Tenure showing Balfour Project Area tenements, including EL 13/2015, over the Land Tenure layer from The LISTmap (https://maps.thelist.tas.gov.au/listmap/app/list/map)	3
1.3	Geology of EL 13/2015 (as originally granted) and associated D & B Mining Pty Ltd tenements (geology after figure 3.8 in Calver et. al. 2014)	3.
1.4	Togari Group stratigraphic column (after figure 3.29 in Calver et. al. 2014). Note significantly different vertical scale to figure 1.5. The Togari Group is of the order of 3km thick whilst the Rocky Cape Group is of the order of 10km thick.	4
1.5	Rocky Cape Group stratigraphic column (after figure 3.7 in Calver et. al. 2014)	5
1.6	Mineral Resources Tasmania 1:25,000 sheet series geology with modelled granite depth contours after Everard et. al. 2002.	6
2.1	Rock sampling locations with magnetic susceptibilities shown ($\times 10^{-3}$ SI units) on TMI	9
4.1	Tenement location of EL 13/2015 on a montage of Ward (1911) maps of the tenement position, and location of "lodes" as red lines. These red lines have been copied and superimposed on subsequent figures. Almost all workings lie outside of EL 13/2015 the exception being the Balfour United workings in the south-eastern corner of EL 13/2015.	13
4.2	Tenement location of EL 13/2015 on MRT's 1:25,000 maps of the tenement position, with Wards (1911) location of "lodes" i.e. quartz lodes with or without sulphide mineralisation as red lines. Note the broad correspondence between "lodes" and mapped faults.	14
4.3	Tenement location of EL 13/2015 on TMI RTP, with Wards (1911) location	

	of “lodes” as red lines.	15
4.4	Balfour United workings) showing historical tenement boundaries, current tenement boundaries and red “lodes” from Ward (1911) which are quartz lodes +/- copper, on background of semi-transparent overlays of Ward (1911), 1:25,000 MRT geological mapping, and total magnetic intensity (2002 WTRMP survey).	16
4.5	Total magnetic image from 2002 WTRMP Hummingbird survey, northern section, processed and enhanced by Phil Muir, SMEG.	18
4.6	Total magnetic image from entire 2002 WTRMP Hummingbird survey processed and enhanced by Phil Muir, SMEG.	19
4.7	Conductivity image from 2002 WTRMP Hummingbird survey 880hz channel, northern section, processed and enhanced by Phil Muir, SMEG.	20
4.8	Conductivity image from 2002 WTRMP Hummingbird survey 880hz channel, entire survey, processed and enhanced by Phil Muir, SMEG.	21
4.9	Rocky Cape Group stratigraphic column (after Calver et. al. 2014 showing stratigraphic horizons with potential for sedimentary hosted copper (or base metals).	22
4.10	Stratigraphic horizons with potential for sedimentary hosted copper (or base metals)	23
4.11	Stratigraphic horizons with potential for sedimentary hosted copper (or base metals) with Targets defined by blue circles.	24
4.12	Little Frenchman prospect considered to represent an example of a Tennant Creek IOCG “Temma Ironstone” type on total magnetic intensity.	25
4.13	Little Frenchman prospect and Jaguar anomalies 3, 4 and 5 – all considered to represent potential Tennant Creek IOCG “Temma Ironstone” type anomalies on colour enhanced image (Phil Muir SMEG) of hummingbird EM 800hz data.	26
4.14	Little Frenchman prospect and Jaguar anomalies 3, 4 and 5 – all considered to represent potential Tennant Creek IOCG “Temma Ironstone” type anomalies on alternative colour enhanced image (Phil Muir SMEG) of hummingbird EM 800hz data.	27

Appendices

- A Balfour United Summary – Ward (1911)**
- B Balfour Project Exploration Summary Report**
- C Geophysics Memo, Phil Muir SMEG**

1.0 Introduction

1.1 Exploration Rationale

D & B Mining Pty Ltd, a wholly owned subsidiary of Zebs Minerals Pty Ltd is exploring the Balfour Copper Belt for copper, gold, tin and tungsten as well as any other commodities of value.

1.2 Location and access

EL 13/2015 “Frankland River” lies in Tasmania’s west coast south of Smithton in the Balfour area.

Access to the tenement is via the Bass Highway to Smithton from Burnie and then on to Balfour via the Western Explorer Highway and the Balfour track. Access within the tenement is reasonable with logging tracks over much of the area.

1.3 Land status and usage

All of the land within the licence is owned by the crown.

The majority of the licence area is Permanent Timber Production Zone Land or Future Potential Production Zone Forest. The south-eastern and south-western parts of the tenement are Arthur-Pieman Conservation area with the Sumac Regional Reserve intruding into the eastern side and the Warra Creek regional Reserve in the very north-western corner.

1.4 Tenure

The tenement, EL 13/2015 was granted to Zebs Minerals Pty Ltd on 15th November 2016 for a period of five years and applies to all Category 1 minerals. The licence originally covered an area of 247.5 square kilometres.

A decision was made in 2020 to relinquish an area of 64 km² considered relatively non prospective and retain the remaining 183.5 km² as shown on figure 1.1.

The tenements were transferred into D & B Mining Pty Ltd, a wholly owned subsidiary of Zebs Minerals Pty Ltd in early 2022.

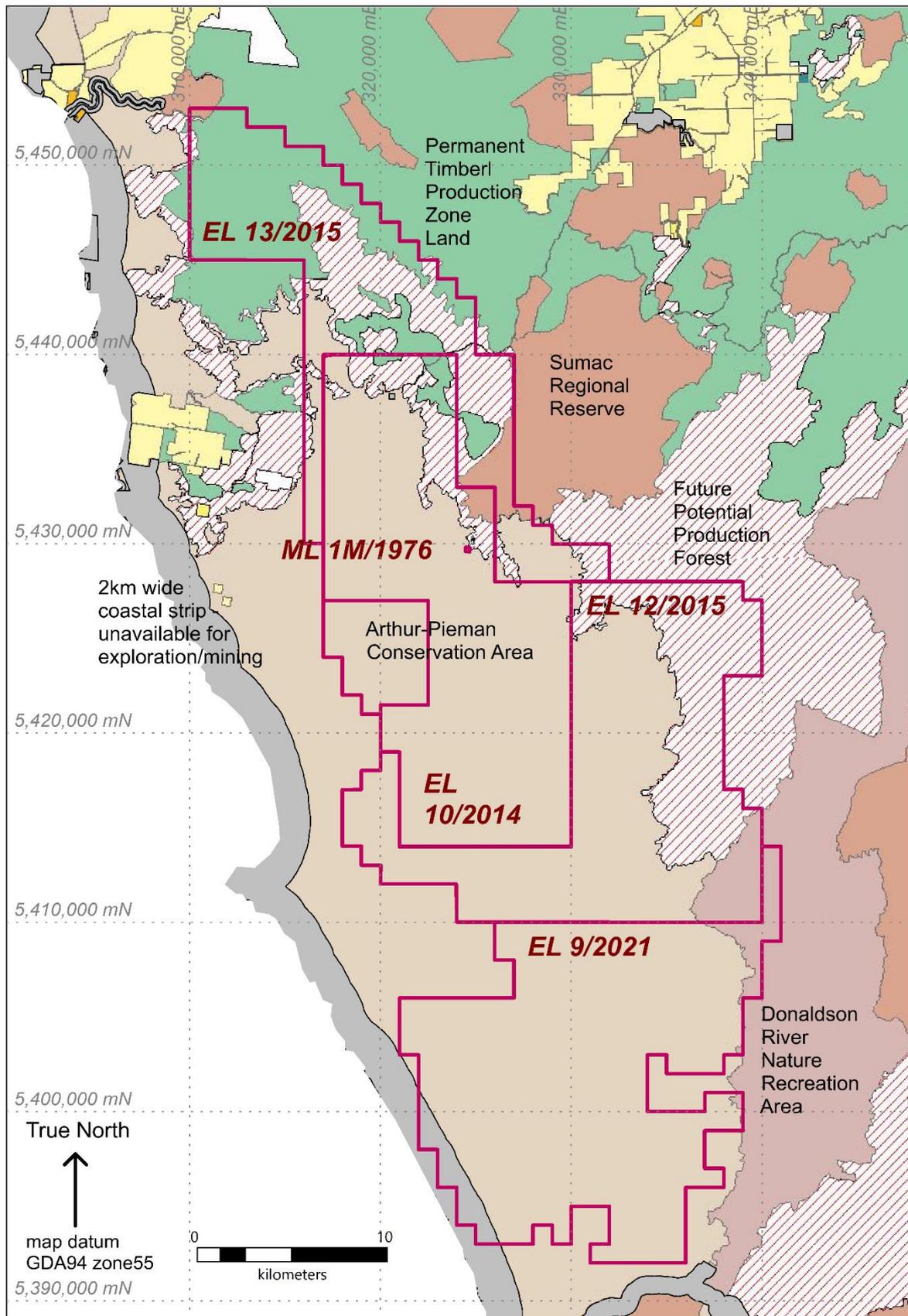


Figure 1.2: Land Tenure showing Balfour Project Area tenements, including EL 13/2015, over the Land Tenure layer from The LISTmap (<https://maps.thelist.tas.gov.au/listmap/app/list/map>)

1.5 Geology

The geology of EL 13/2015 consists of early Neoproterozoic-late Mesoproterozoic metasediments (and dolerite dykes) of the Rocky Cape Group, with a thin fault bound wedge of the disconformably/unconformably overlying Cryogenian Togari Group near to the northern boundary of the licence). In the southwest of the licence elevated aeolian sands and dunes obscure the underlying Proterozoic rocks. The Proterozoic geology is summarised neatly in figure 1.3.

Structurally the folded Proterozoic rocks are folded are transected by north-northwest trending west-southwest dipping faults which have been shown in a number of instances to be east verging thrusts. The fault which hosts the copper mineralisation at Balfour (on EL 10/2014) is an example of such a thrust.

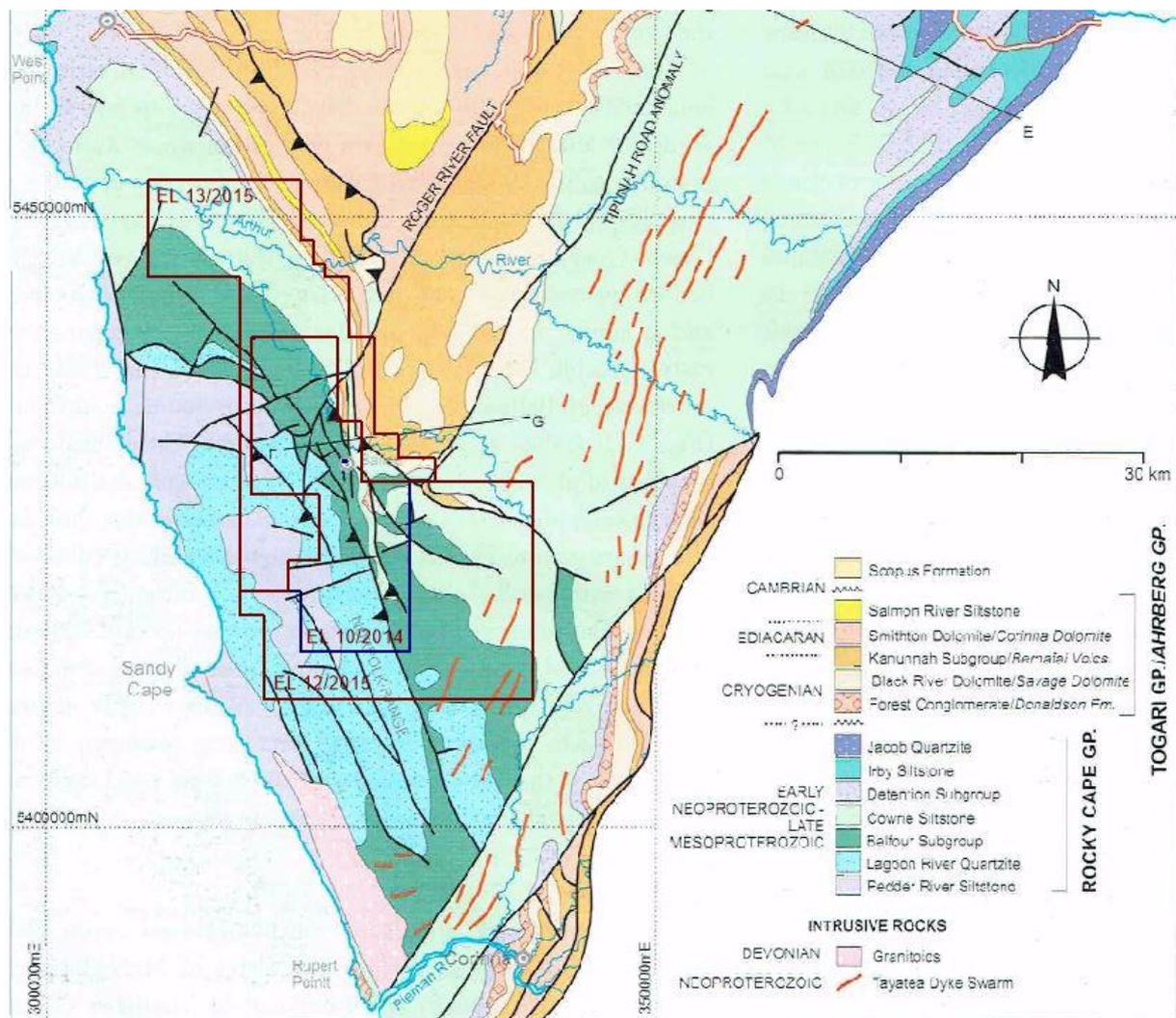


figure 1.3: Geology of EL 13/2015 (as originally granted) and associated D & B Mining Pty Ltd tenements (geology after figure 3.8 in Calver et. al. 2014).

The Rocky Cape Group is a sequence of moderately folded silty to sandy shelf facies metasediments, intruded in part by north-northeast trending dolerite dykes.

The Togari Group is a sequence of shelf facies clastics and carbonates with intercalated rift tholeiites which unconformably or disconformably overlies the Rocky Cape Group.

The stratigraphy of both of these Groups is illustrated in figures 1.4 and 1.5.

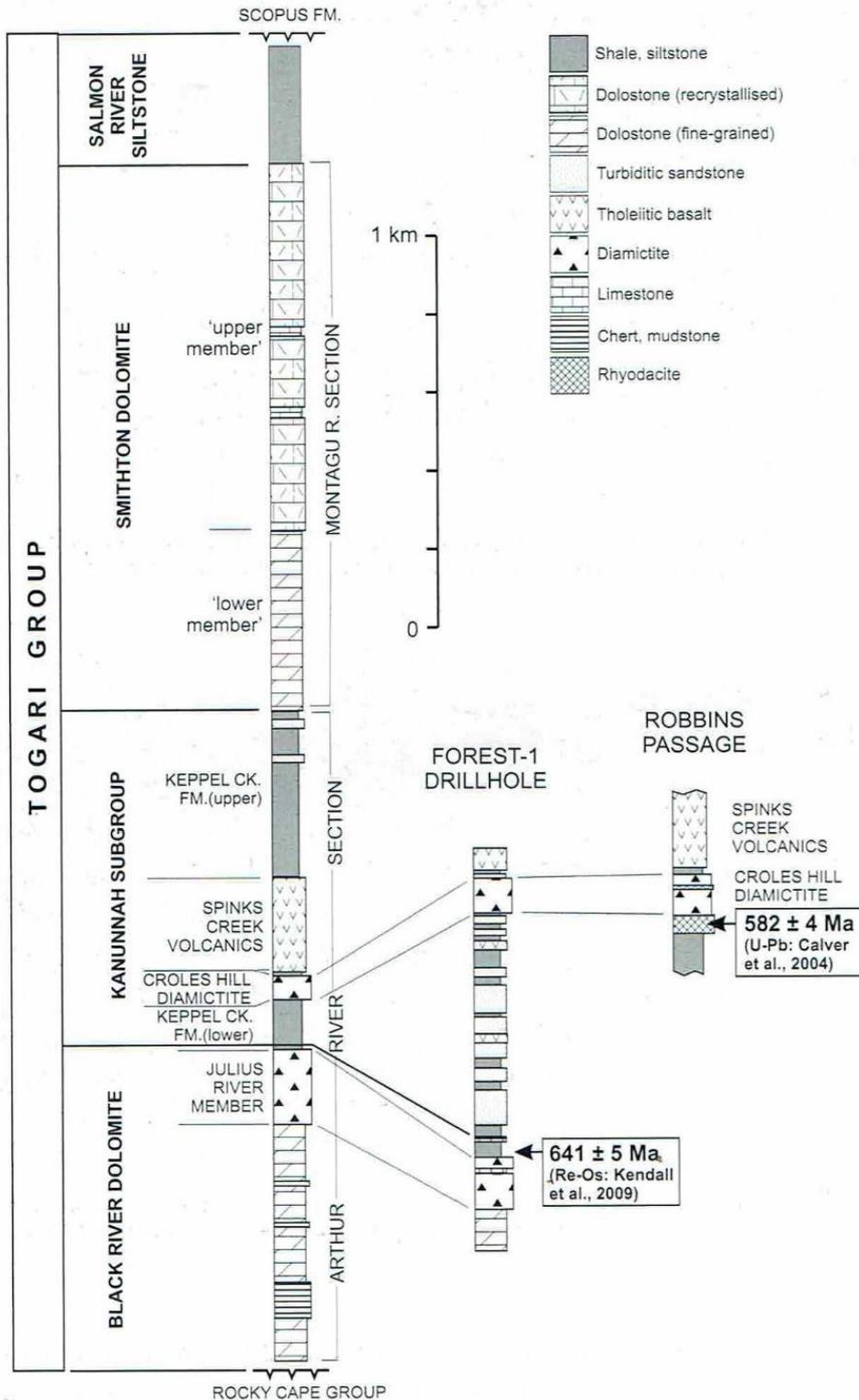


figure 1.4: Togari Group stratigraphic column (after figure 3.29 in Calver et al. 2014). Note significantly different vertical scale to figure 1.5. The Togari Group is of the order of 3km thick whilst the Rocky Cape Group is of the order of 10km thick.

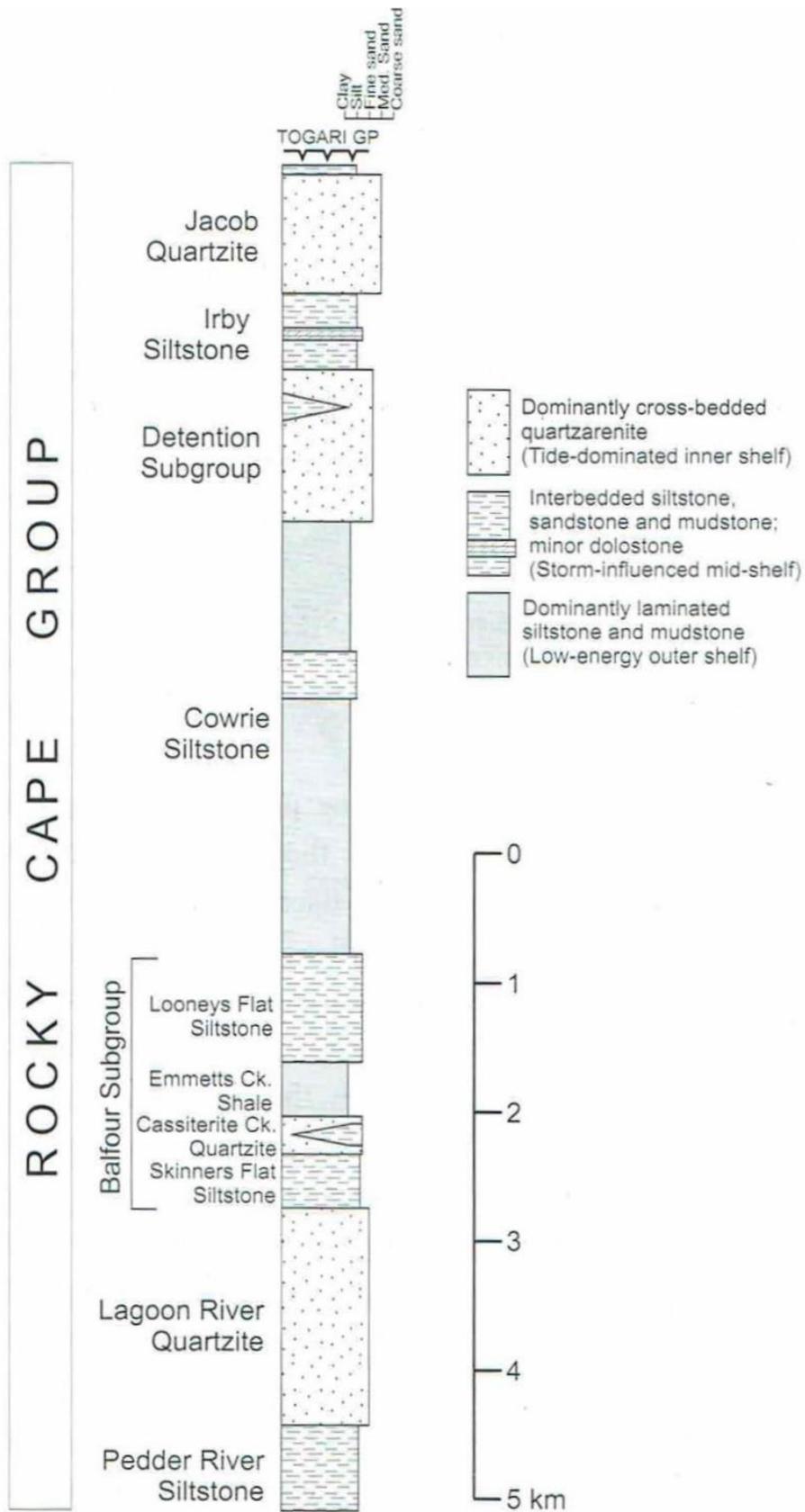


figure 1.5: Rocky Cape Group stratigraphic column (after figure 3.7 in Calver et. al. 2014)

Gravity data shows that the Middle Devonian Interview River Granite, which outcrops to the southwest of the tenements, also underlies the Balfour area to a depth <1km (as modelled).

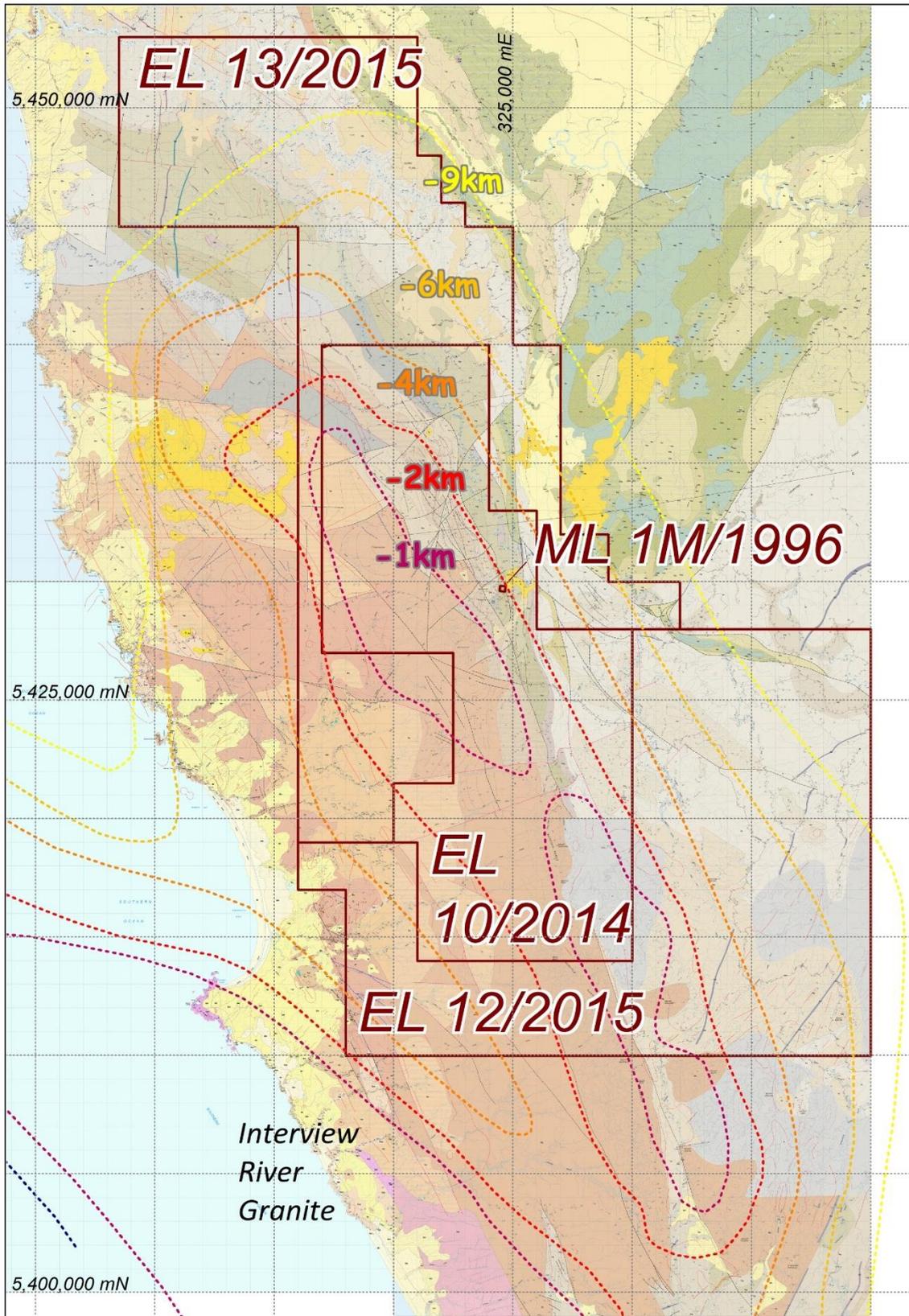


figure 1.6: Mineral Resources Tasmania 1:25,000 sheet series geology with modelled granite depth contours after Everard et. al. 2002.

In the northern part of EL 13/2015 the basement geology is obscured by a veneer of Tertiary gravels, whilst in the easternmost part of the tenement (southeast of the Roger River Fault) the basement is obscured by Quaternary alluvium and a small inlier of Tertiary basalt.

Taheri and Bottrill (2005), citing Reed in Everard *et. al.* (2002) summarise the structural history of the Balfour region as follows. "Two early phases of syndepositional extension were followed by at least four compressional phases of deformation within the area. The first two phase of deformation (D1, D2) are possibly of Cambrian age whereas D3 and D4 are considered to be Devonian in age. D3 is the main deformation phase and is characterised mainly by northwest-trending folding, some cleavage development and major northeast-directed low and high angle thrusts, one of which hosts the copper mineralisation at Murrays Reward mine along the copper belt. East of Balfour east-northeast to northeast trending strike slip faults pre-date late northwest-trending reverse faults. One of these faults hosts vein style Sn-W mineralisation at Specimen Hill."

The Interview River Granite has intruded in the Middle Devonian and likely syn-D3.

2.0 Summary of Previous Work

2.1 Prior to Current Tenement

A detailed summary of previous work on the tenement was supplied in MacDonald (2020) and won't be repeated here.

2.2 During Current Tenement - Zebs Minerals Pty Ltd (2014 – 2020)

There has been limited field work on the tenement to date. Most of the work has focused on planning and preparing for a VTEM™ survey which has since been shelved.

Fieldwork to date has consisted of a limited amount of rock sampling in order to define the source of magnetic anomalies.

Rocks corresponding to a strong northwest linear magnetic high were mapped by CRAE as pyrrhotitic siltstone (Parkinson, 1993) and by MRT as the Looneys Flat Siltstone.

A logging track crosses the anomaly off the Frankland Road, west of the Frankland River bridge allowing ready access to outcrop along the roadside in order to assess the source of the anomalism.

5 rocks were collected from each of two locations within the bounds of the magnetics anomaly.

All rocks sampled are of finely very light grey quartz siltstones and finer grained sandstones with chloritic porphyroblasts.

Magnetic susceptibilities ranged from 0.052×10^{-3} to 0.117×10^{-3} SI units with a mean of 0.090×10^{-3} SI.

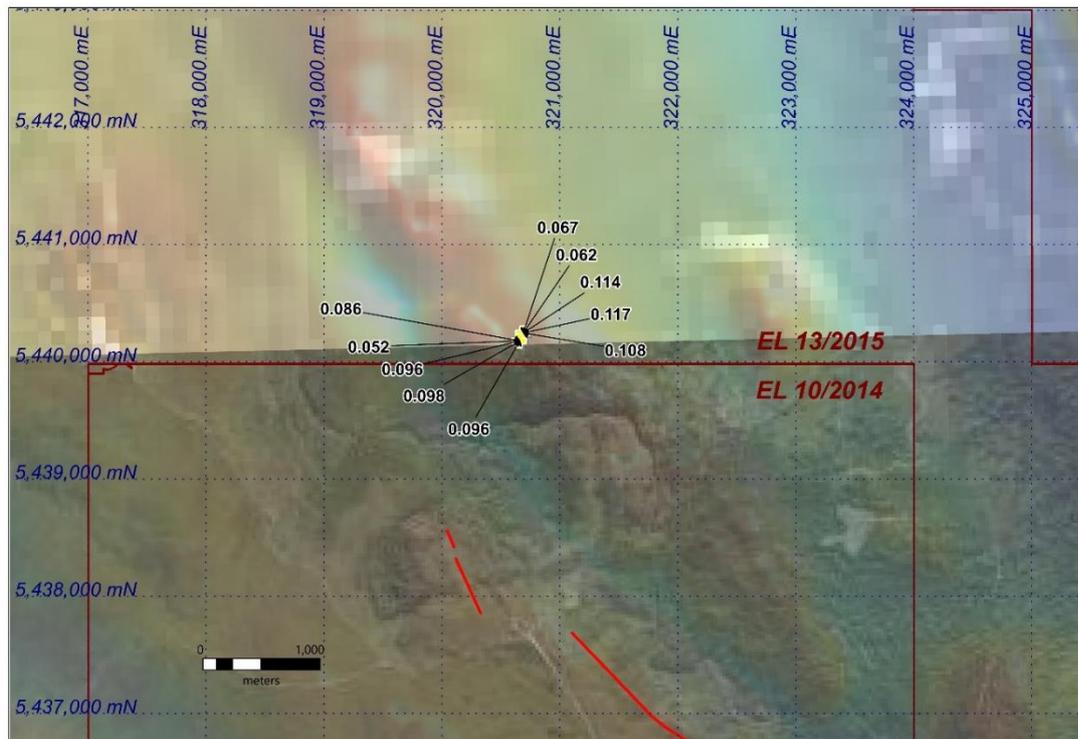


Figure 2.1: Rock sampling locations with magnetic susceptibilities shown ($\times 10^{-3}$ SI units) on TMI

The rocks collected on the traverse west of the Frankland River bridge do not appear to explain the aeromagnetic anomaly.

3.0 Exploration completed during the reporting period

Work on EL 13/2015 “Frankland River” during the reporting year has been carried out in conjunction with work on the other contiguous tenements which constitute the Balfour project, i.e. EL 10/2014, EL 12/2015, EP 9/2021 and ML 1M/1976.

This work has consisted of

- a thorough review of all historical exploration over the whole of the Balfour Project Area, including the appraisal and summary of over 220 reports (not all of which relate to EL 13/2015 specifically)
- processing of existing geophysical data,
- the generation of a summary report on historic exploration to date which has been incorporated into an Independent Technical Assessment Report by CSA Global, and
- the updating of the Mineral Resource Estimate for the Murrays Reward/Central Mt. Balfour resource on adjacent tenements EL 10/2014 and ML 1M/1976.

Consideration has been given to the geology and prospectivity of the project area, particularly

- the Rocky Cape Group and its provenance,
- regional structural history
- copper mineralisation, its structural setting and potential source
- tin and tungsten mineralisation and its relationship to underlying granite
- nature and origin of aeromagnetic anomalies
- Tayatea Dyke swarm

4.0 Discussion of Results

4.1 Compilation/Appraisal Work

4.1.1 Historical Mining and Prospecting

The only historical workings which lie within EL 13/2015 are the Balfour United workings to the east of the main Balfour field (see figures 4.1, 4.2, 4.3 & 4.4).

Ward (1911) states “to the east of Balfour, and for the most part on the eastern side of a small tributary of the Frankland River, are a number of sections on some of which active prospecting work has been carried out by the Balfour United Syndicate. Unfortunately this work has not yet been successful in locating any ore-body which offers promise of proving to be of commercial value.” (see figure 4.4)

A 27' shaft is described on Section 4274-M on a northwest striking lode with a little pyrite and a 12' deep excavation just inside the northern boundary on the same lode carrying traces of copper mineralisation.

Elsewhere trenches have exposed quartz veining in slate but no further visible in-situ copper mineralisation though it is reported (unverified) from a trench in Section 4268-M and traces of galena are noted from the western bank of a creek in Section 4724-M.

Ward's (1911) full descriptions of the Balfour United workings is reproduced as appendix A.

4.1.2 Modern Exploration

Much of the work compiled into the Exploration Summary Report (in appendix B) lies outside of EL 13/2015 and of the tenements which constitute the Balfour Project Area EL 13/2015 has seen relatively the least exploration.

Exploration tenements (and Special Prospecting Licences) which covered part or all of the current EL 13/2015 tenement area are listed in Table 4.1.

Aside from the compilation of historical data the magnetics and electromagnetics data for the 2002 MRT WTRMP hummingbird survey were processed by Phil Muir of SMEG and whilst this survey only covered the very southern parts of EL 13/2015 images from this work are included as figures 4.5 to 4.8. Phil's report is included as appendix C.

4.2 Target Definition

The principal target models considered in target definition on the Balfour Project were determined to be:

- Structurally hosted copper (+/- gold) – e.g. Balfour type
- Granite related tin +/- tungsten in veins, greisens and possibly skarns (e.g. Specimen Hill type) and also possibly granite associated copper, lead and zinc as part of a zoned system
- Sedimentary hosted copper (SEDEX) as source of the structurally hosted copper type, also possibly silver, lead, zinc, cobalt variants of same
- Mt Isa type copper
- Tennant Creek type IOCG copper +/- gold – “Temma Ironstones”

These models and the geological justifications for are elaborated on the Balfour Project Exploration Summary Report in appendix B.

4.2.1 Sedimentary Hosted Copper (base metals) Targets

Figures 4.9 and 4.10 illustrate the sedimentary hosted copper (and base metal) target stratigraphic horizons and spatial locations respectively. The only field work has in part assessed the potential of these stratigraphic horizons is limited stream geochemistry. Targets are defined where these horizons meet mapped structures (see figure 4.11).

4.2.2 Tennant Creek IOCG Copper+/-Gold “Temma Ironstones” Targets

The Little Frenchman prospect in EL 13/2015 is considered to be analogous with the Roaring 41 South coincident gravity (single data point) and magnetic anomaly which lies just east of EL 13/2015 in EL 10/2014 and which was recognised and defined by Pleiades and drilled with scissor drill holes R41S_01 and R41S_02.

R41S_01 intersected 5m @ 0.9% Cu and 0.01g/t Au from 54m depth associated with fault/breccia hosted magnetite-siderite-pyrite mineralisation whilst drillhole R41S_02 intersected 1.0m @ 0.5% Cu and 0.1g/t Au from 208m but did not intersect a source of the magnetic anomaly despite being drilled through the centre of the modelled anomaly to a depth of 259.8m. DHEM recorded a small off-hole conductor in R41S_01 but not R41S_02 which was not followed-up.

It was concluded by Callaghan (2010) that the Roaring 41 South deposit is one of a number of similar magnetite+siderite bodies which are well known in the Temma district 10-15km's west and north of Roaring 41 South of which one, Nelson Bay River, has recently been exploited by Shree Minerals Pty Ltd for iron. Other examples are Rebecca, Strickland and Possum Creek.

“Exploration models for Geopeko and Pacific Nevada were based on Proterozoic Iron oxide copper-gold deposits, principally Tennant Creek Style replacement ironstones and breccia pipes”. (Callaghan, 2010).”

“The Temma ironstones consist of magnetite-siderite-quartz, Fe-rich amphibole, pyrite and chlorite bodies with a wall rock assemblage of biotite and garnet often replaced by retrograde chlorite alteration. The bodies are considered to be a pyrometasomatic replacement of mafic intrusives and host sediments (Weber, 1983, Newnham, 2000)” (Callaghan 2010)

The Little Frenchman presents in magnetic data as analogous to the Roaring 41 South prospect but without the coincident gravity anomaly.

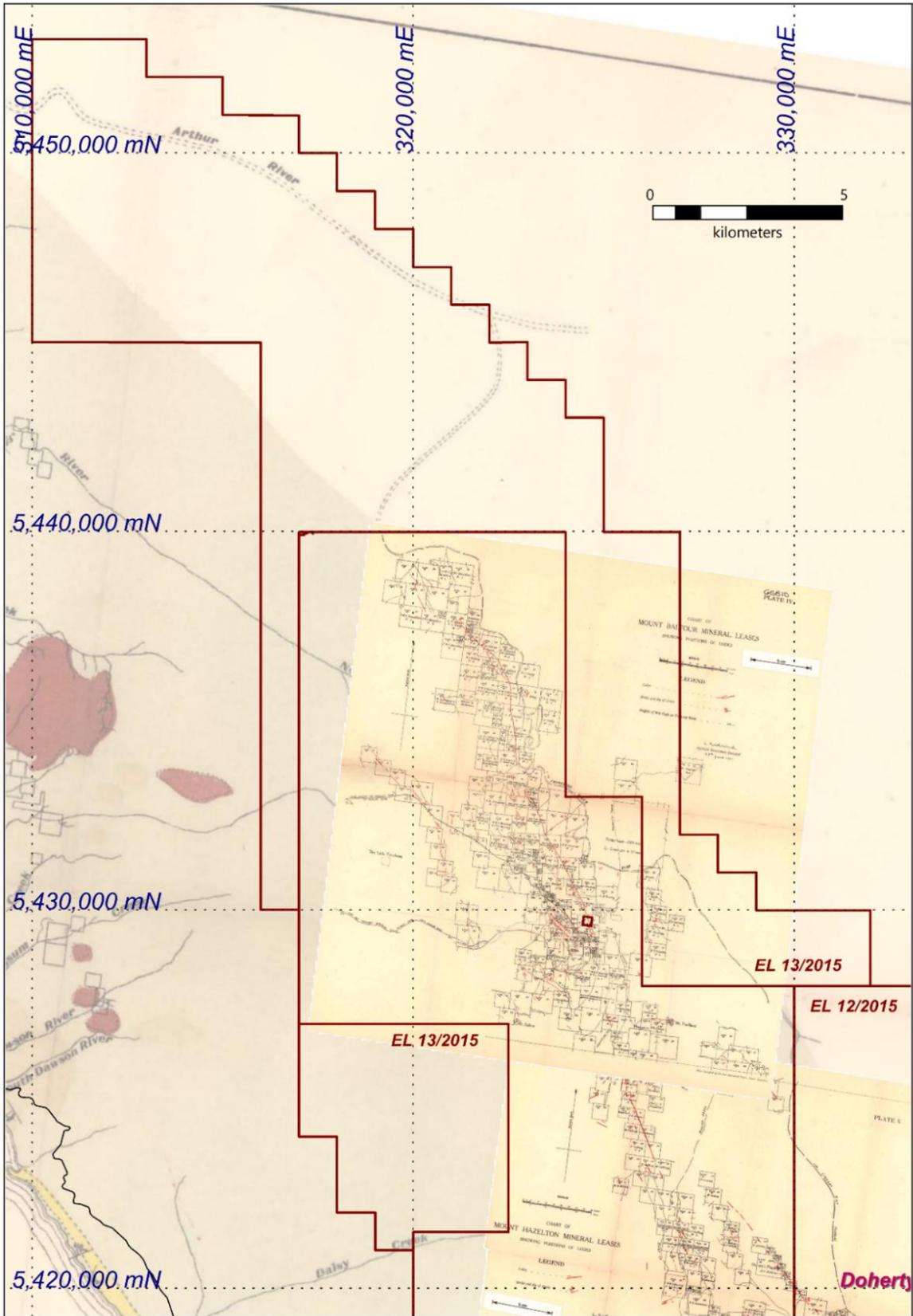


Figure 4.1: Tenement location of EL 13/2015 on a montage of Ward (1911) maps of the tenement position, and location of “lodes” as red lines. These red lines have been copied and superimposed on subsequent figures. Almost all workings lie outside of EL 13/2015 the exception being the Balfour United workings in the south-eastern corner of EL 13/2015.

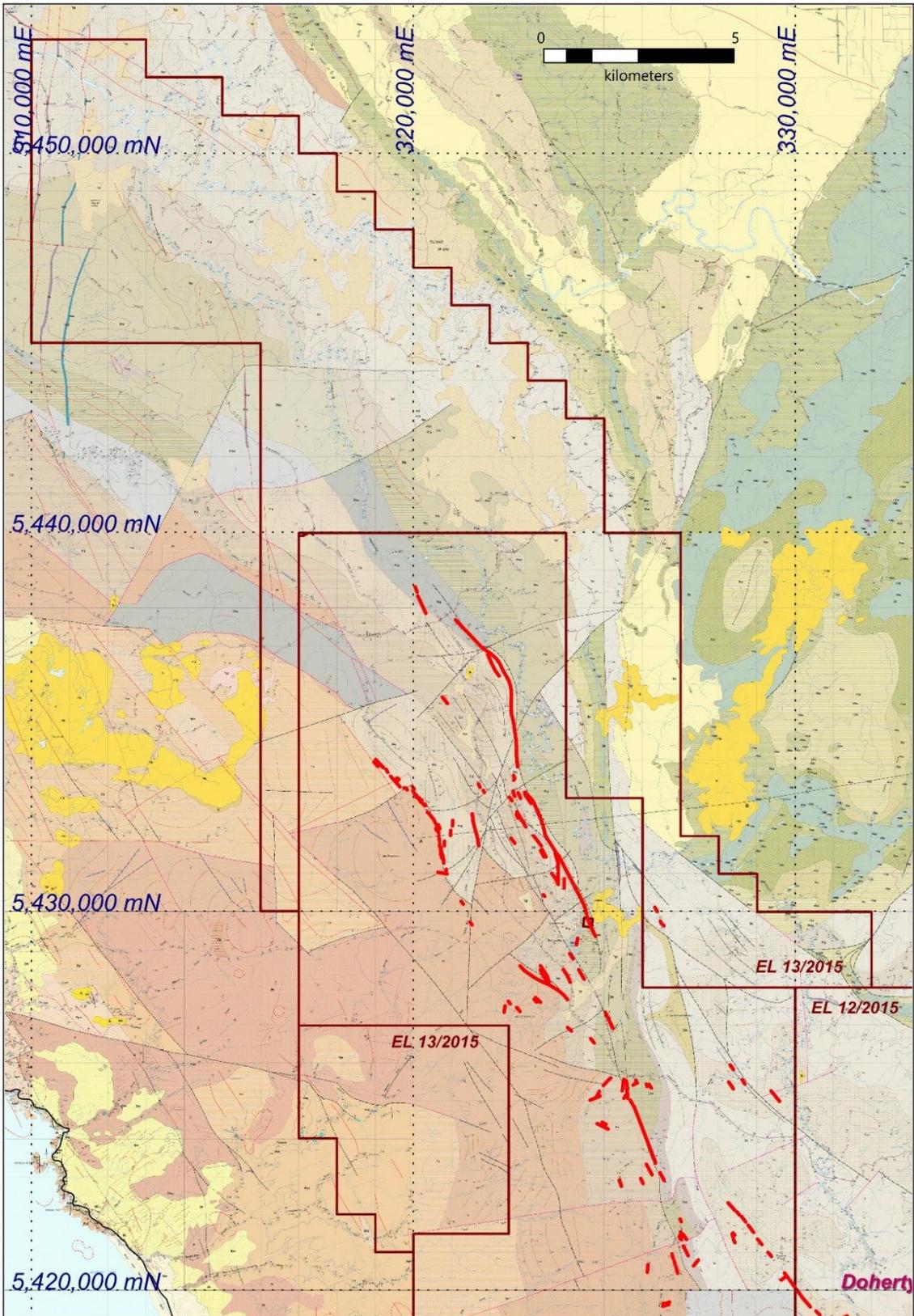


Figure 4.2: Tenement location of EL 13/2015 on MRT's 1:25,000 maps of the tenement position, with Wards (1911) location of "lodes" i.e. quartz lodes with or without sulphide mineralisation as red lines. Note the broad correspondence between "lodes" and mapped faults.

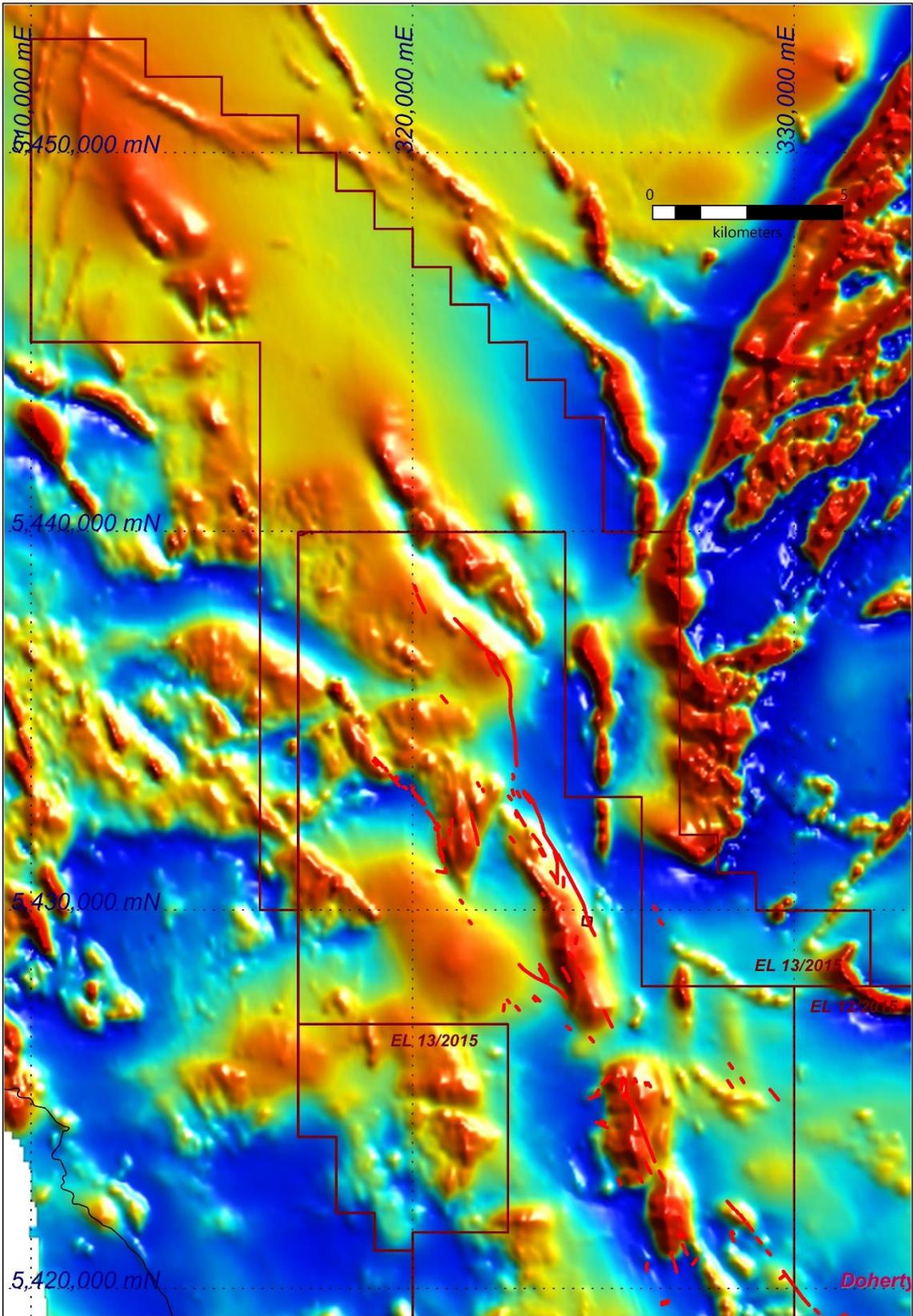


Figure 4.3: Tenement location of EL 13/2015 on TMI RTP, with Wards (1911) location of “lodes” as red lines.

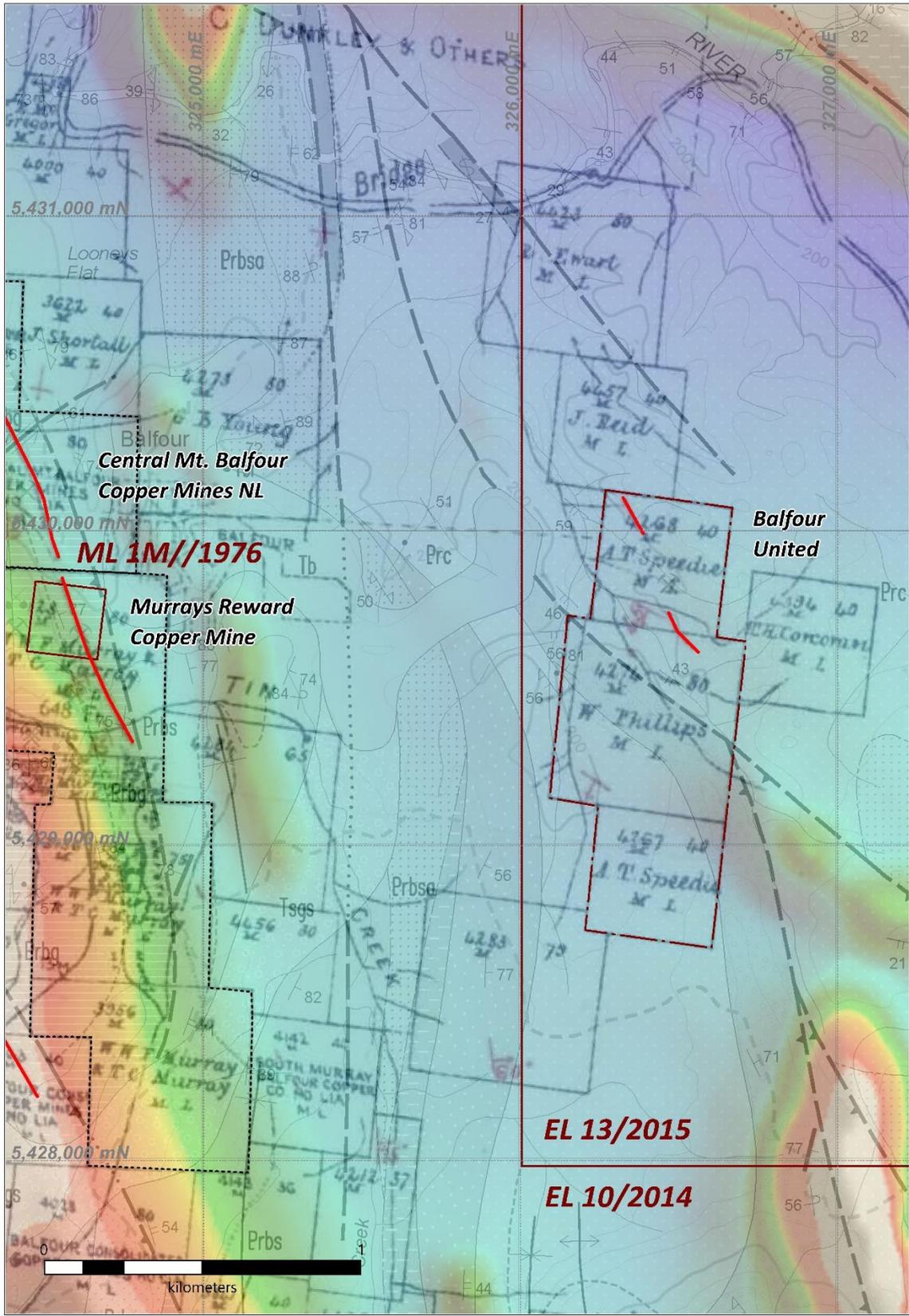


Figure 4.4: Balfour United workings) showing historical tenement boundaries, current tenement boundaries and red "lodes" from Ward (1911) which are quartz lodes +/- copper, on background of semi-transparent overlays of Ward (1911), 1:25,000 MRT geological mapping, and total magnetic intensity (2002 WTRMP survey).

Table 4.1: Historical Exploration Licences and Special Prospecting Licences Which Covered Part or All of EL 13/2015

Tenement	Locality	Company (Licensee)	Held
EL5/1968	Salmon River	Quest Exploration Pty Ltd	1968 - 1970
EL16/1968	Western Tasmania	A C I Operations Pty Ltd	1968 - 1975
EL6/1972	Christmas Hills	Australia and New Zealand Exploration Company	1972 - 1973
EL8/1972	Balfour	Australia and New Zealand Exploration Company	1972 - 1973
EL11/1973	Marrawah	Australia and New Zealand Exploration Company	1973 - 1974
EL21/1987	Balfour	Sierra Nevada Resources Pty Ltd and Another	1988 - 1992
EL26/1987	North Pedder River	New Holland Mining NL	1988 - 1990
EL57/1987	Redpa	Kingstream Resources NL	1988 - 1989
EL52/1989	Balfour	Peko Exploration Ltd	1990 - 1991
EL18/1992	Balfour	Rio Tinto Exploration Pty Ltd	1992 - 2002
EL19/1992	Trowutta	CRA Exploration Pty Ltd	1992 - 1994
EL13/1997	Sumac Road	Morritt Holdings Pty Ltd	1997 - 2002
EL15/1997	Arthur River	Morritt Holdings Pty Ltd	1997 - 2002
EL17/2001	Stephens Rivulet and Roger River	Morritt Holdings Pty Ltd	2002 - 2007
EL8/2002	Temma	Ausvaal Projects Pty Ltd	2003 - 2007
EL10/2002	Balfour	Ausvaal Projects Pty Ltd	2003 - 2007
EL27/2005	Temma	Jaguar Minerals Limited	2006 - 2011
EL31/2005	Stephens Rivulet and Roger River (Trowutta)	Manasia Mining and Metals Ltd (in Liquidation)	2007 - 2012
EL17/2007	Salmon River (15km SE of Redpa)	IMX Resources Limited	2007 - 2013
EL57/2007	Horton River (12km E of Balfour)	Regalpoint Exploration Pty Ltd	2008 - 2013
EL13/2015	Frankland River	Zebs Minerals Pty Ltd	2016 - 2021
SPL252		Hall J M	1955 - 1955
SPL261		Elliston J	1955 - 1955
SPL261		Elliston J	1955 - 1955
SPL302	N.W. Tas	Matheson R S	1959 - 1959
SPL370	Balfour	John G A	1962 - 1962
SPL383	Balfour	Kingston G C	1963 - 1963
SPL392	Balfour	Kingston G C	1964 - 1964
SPL410	Balfour	Kingston G C	1966 - 1966
SPL17	Balfour	Kingston G C	1968 - 1968
SPL142	Salmon River	Tominex Pty Ltd	1975 - 1976
SPL762	Balfour	Ware J D	1977 - 1977

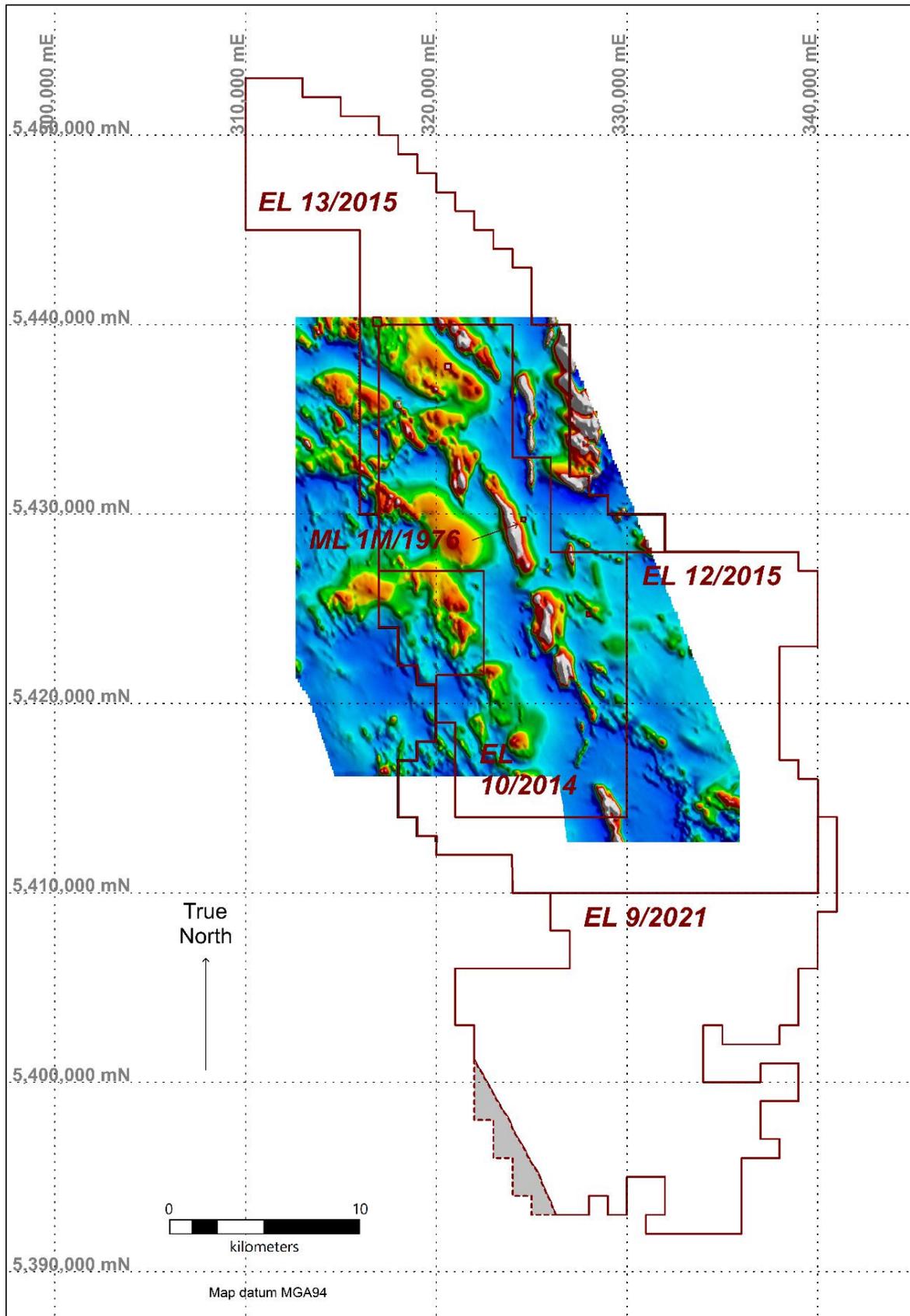


Figure 4.5: Total magnetic image from 2002 WTRMP Hummingbird survey, northern section, processed and enhanced by Phil Muir, SMEG.

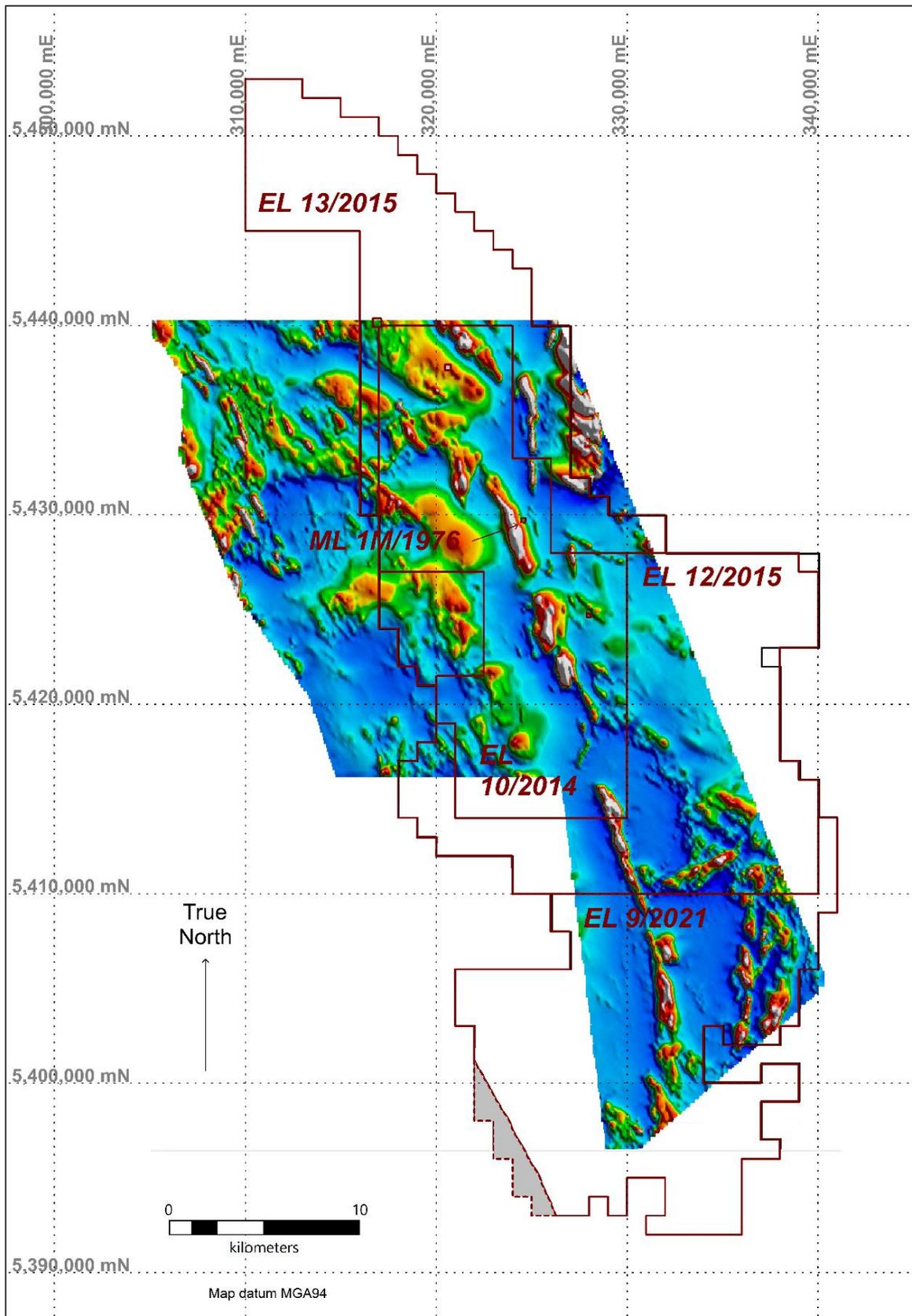


Figure 4.6: Total magnetic image from entire 2002 WTRMP Hummingbird survey processed and enhanced by Phil Muir, SMEG.

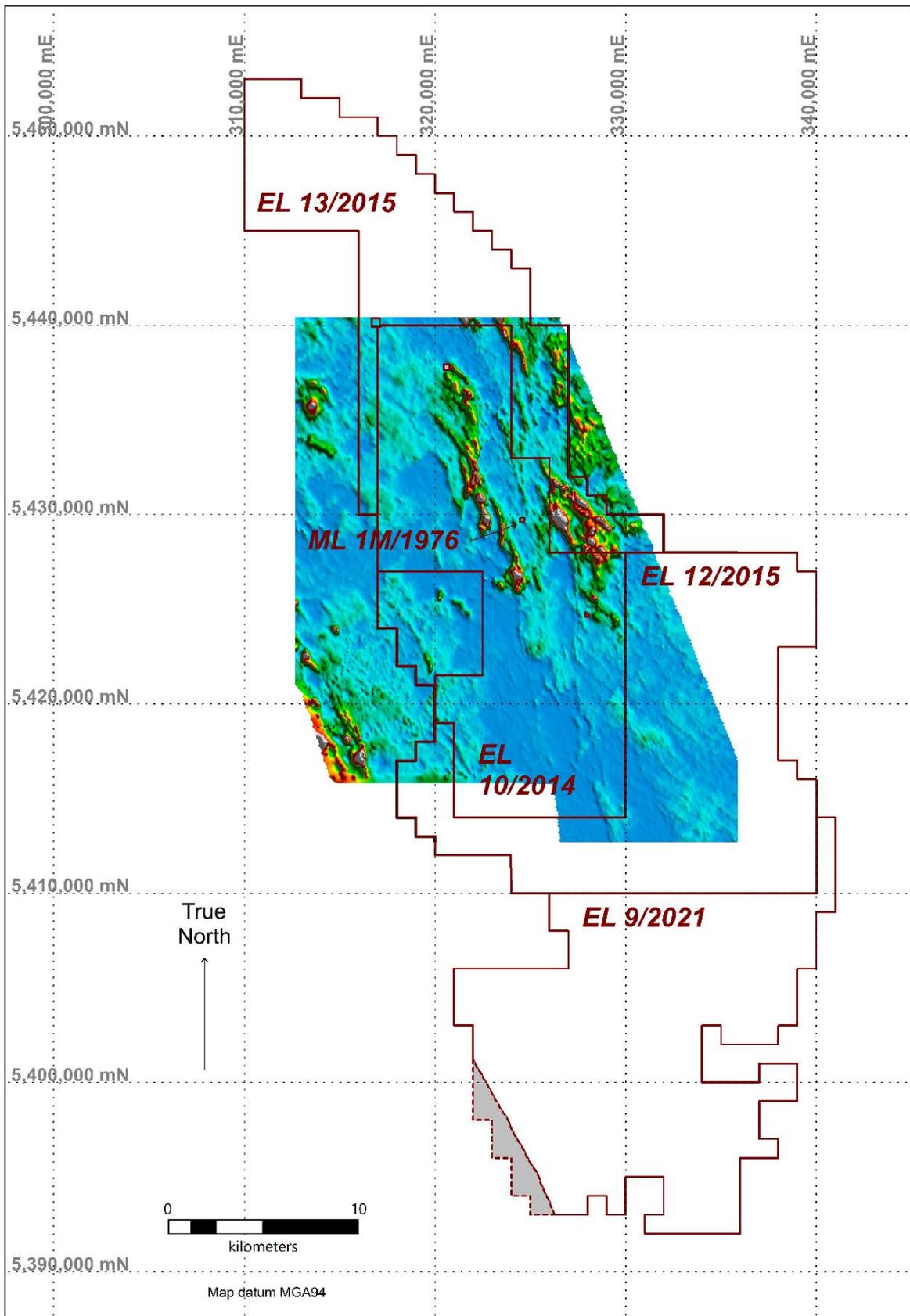


Figure 4.7: Conductivity image from 2002 WTRMP Hummingbird survey 880hz channel, northern section, processed and enhanced by Phil Muir, SMEG.

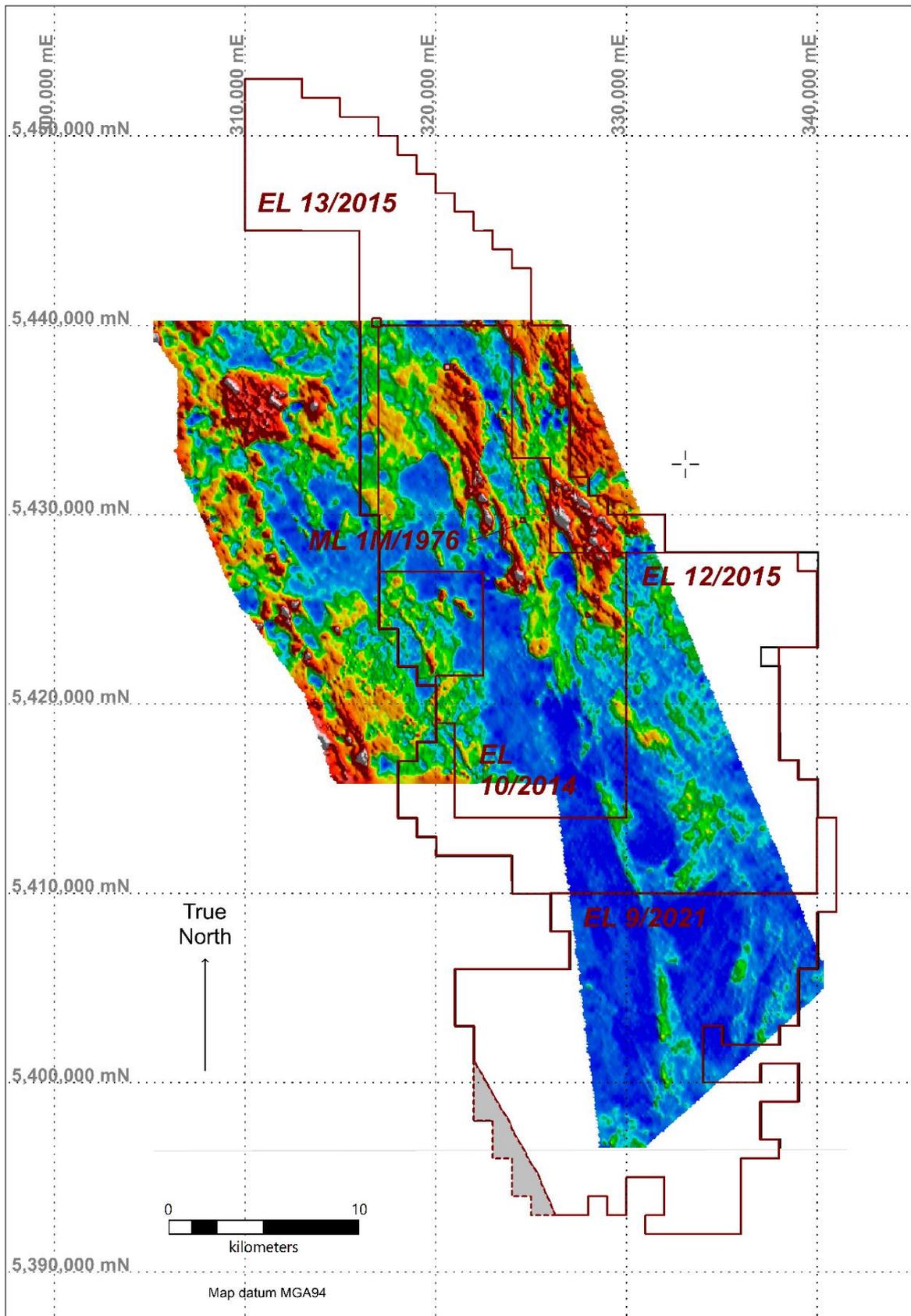


Figure 4.8: Conductivity image from 2002 WTRMP Hummingbird survey 880hz channel, entire survey, processed and enhanced by Phil Muir, SMEG.

Sedimentary Hosted Copper “Traps”

- CRAE/Rio Tinto targeted a pyrrhotite bearing siltstone within the Skinners Flat Siltstone which stratigraphically overlies the Lagoon River Quartzite
- Other potential chemical (redox) traps are carbonaceous shales in the
 - Emmetts Creek Shale and
 - Cowrie Siltstone

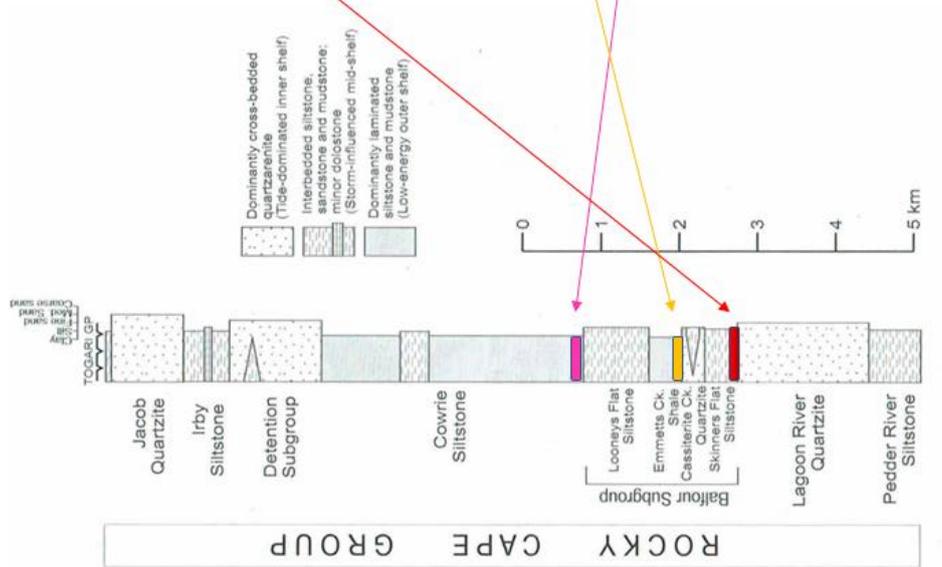


Figure 4.9: Rocky Cape Group stratigraphic column (after Calver et. al. 2014 showing stratigraphic horizons with potential for sedimentary hosted copper (or base metals).

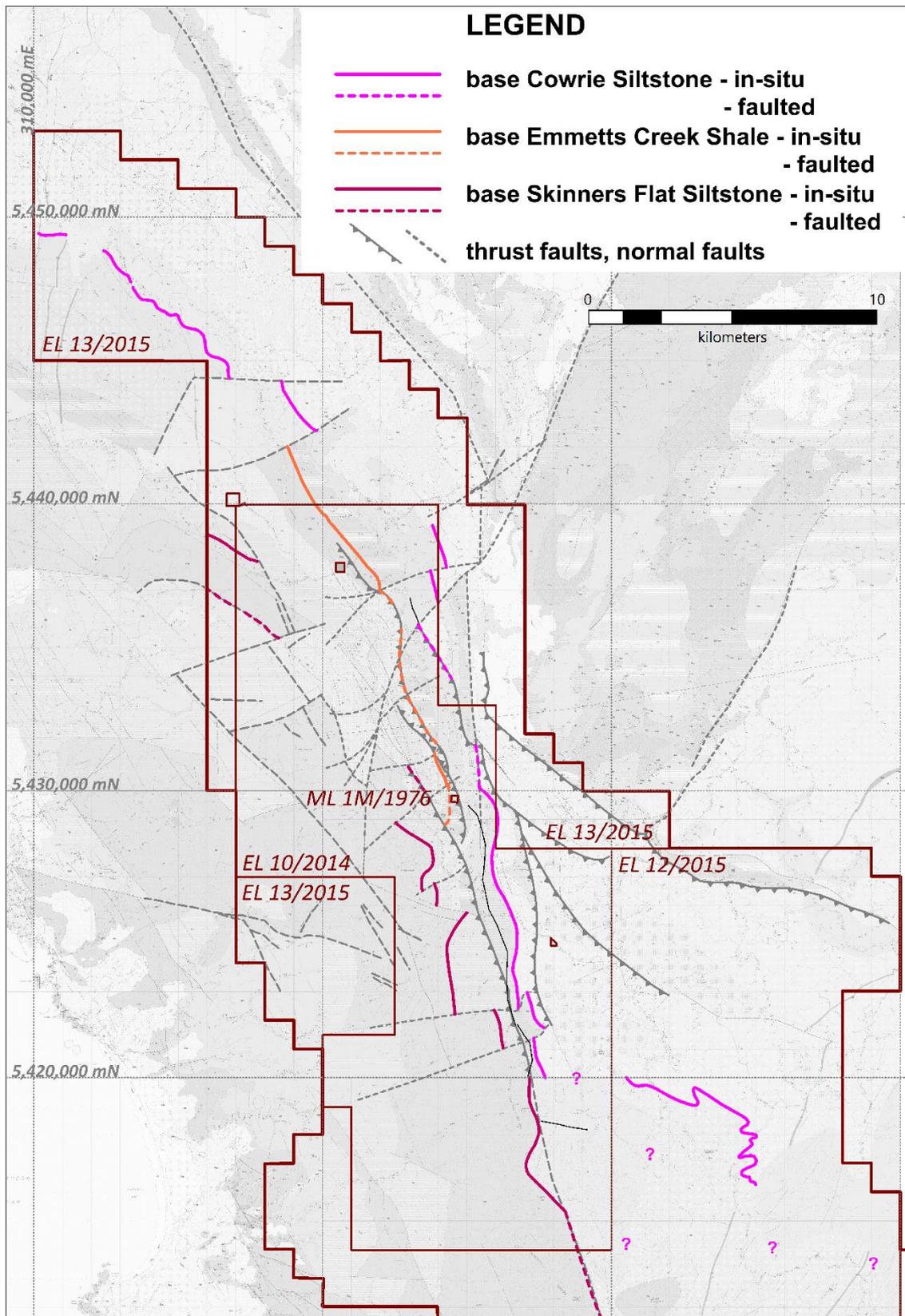


Figure 4.10: Stratigraphic horizons with potential for sedimentary hosted copper (or base metals)

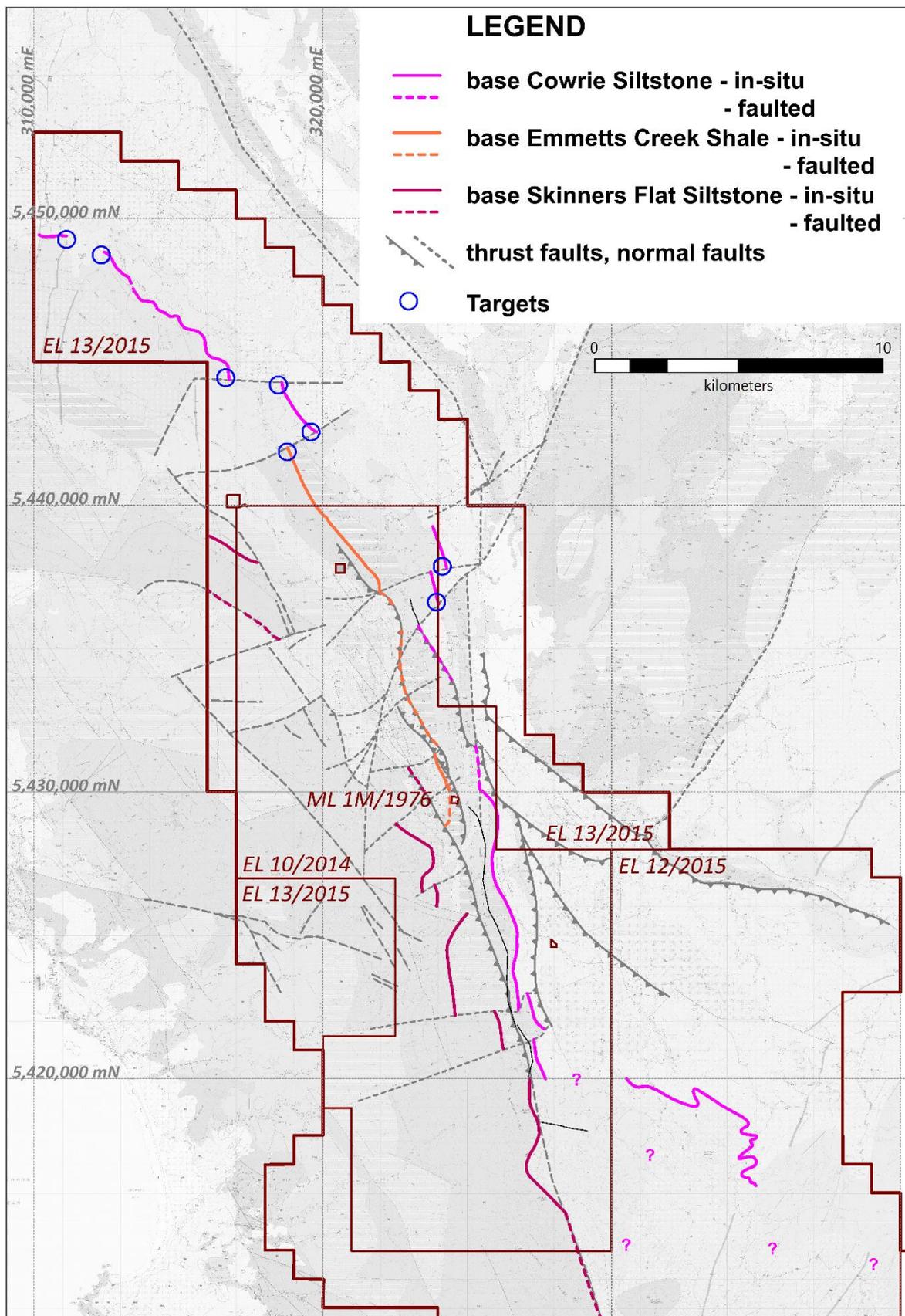


Figure 4.11: Stratigraphic horizons with potential for sedimentary hosted copper (or base metals) with Targets defined by blue circles.

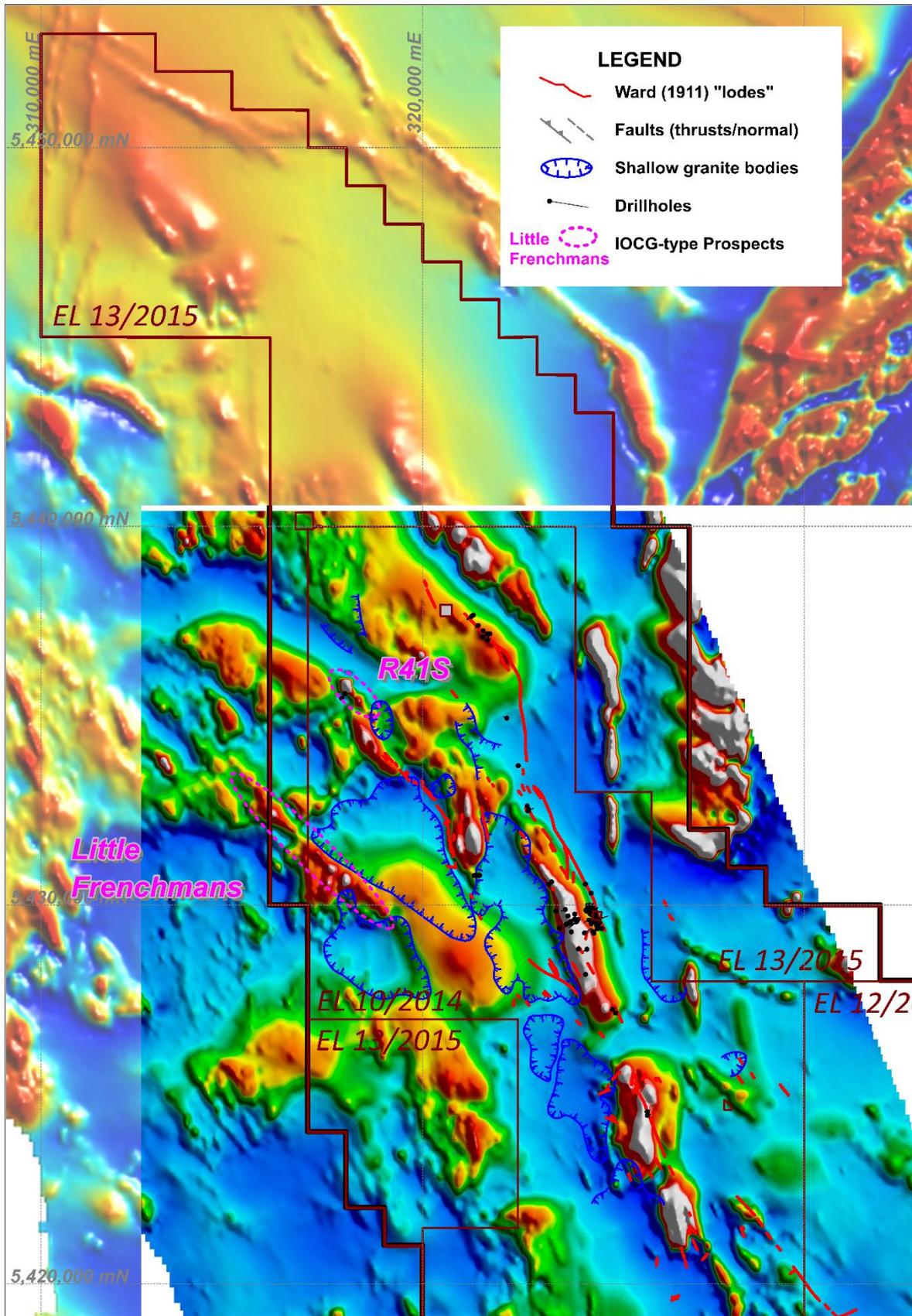


Figure 4.12: Little Frenchman prospect considered to represent an example of a Tennant Creek IOCG "Temma Ironstone" type on total magnetic intensity.

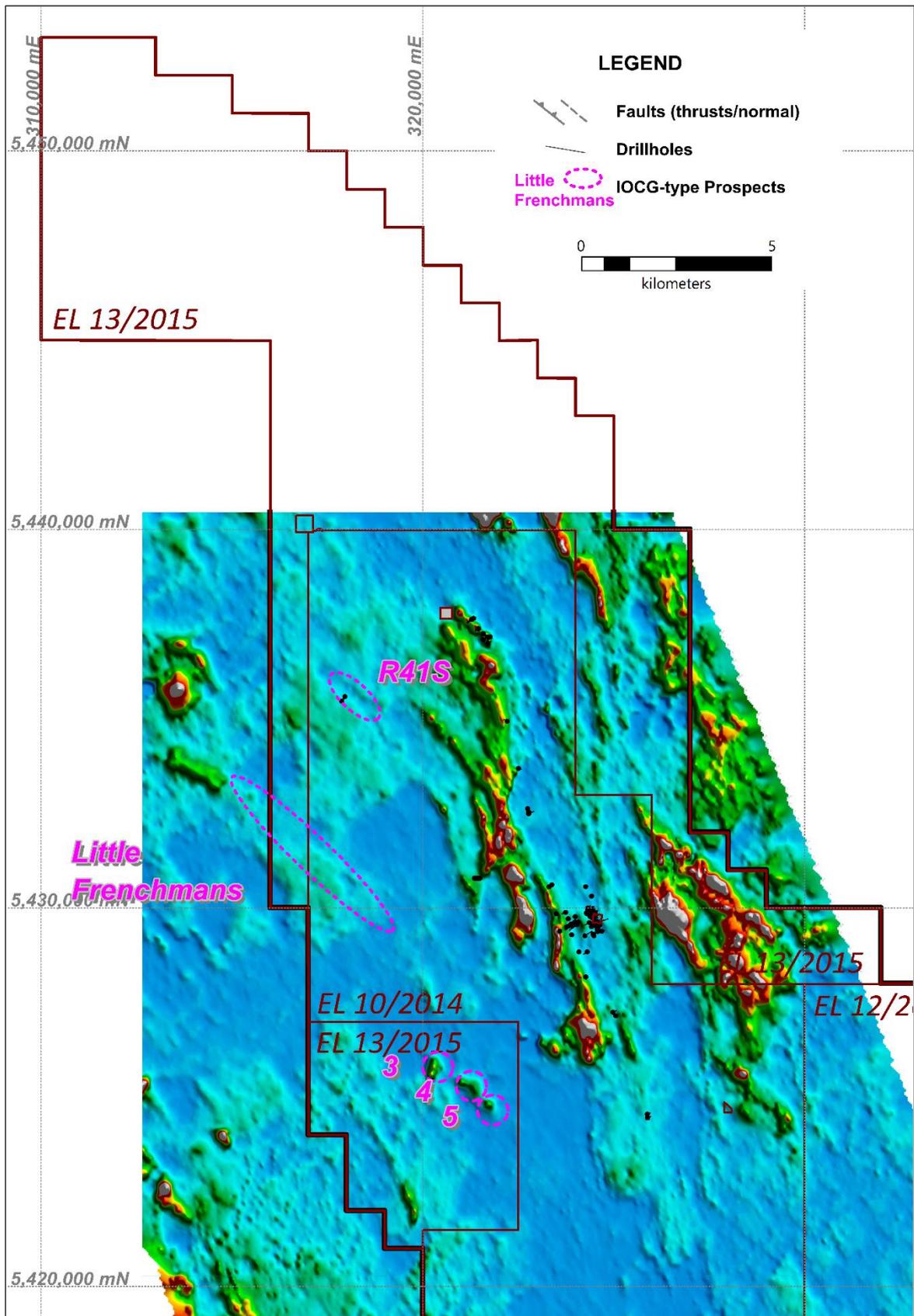


Figure 4.13 Little Frenchman prospect and Jaguar anomalies 3, 4 and 5 – all considered to represent potential Tennant Creek IOCG “Temma Ironstone” type anomalies on colour enhanced image (Phil Muir SMEG) of hummingbird EM 800hz data.

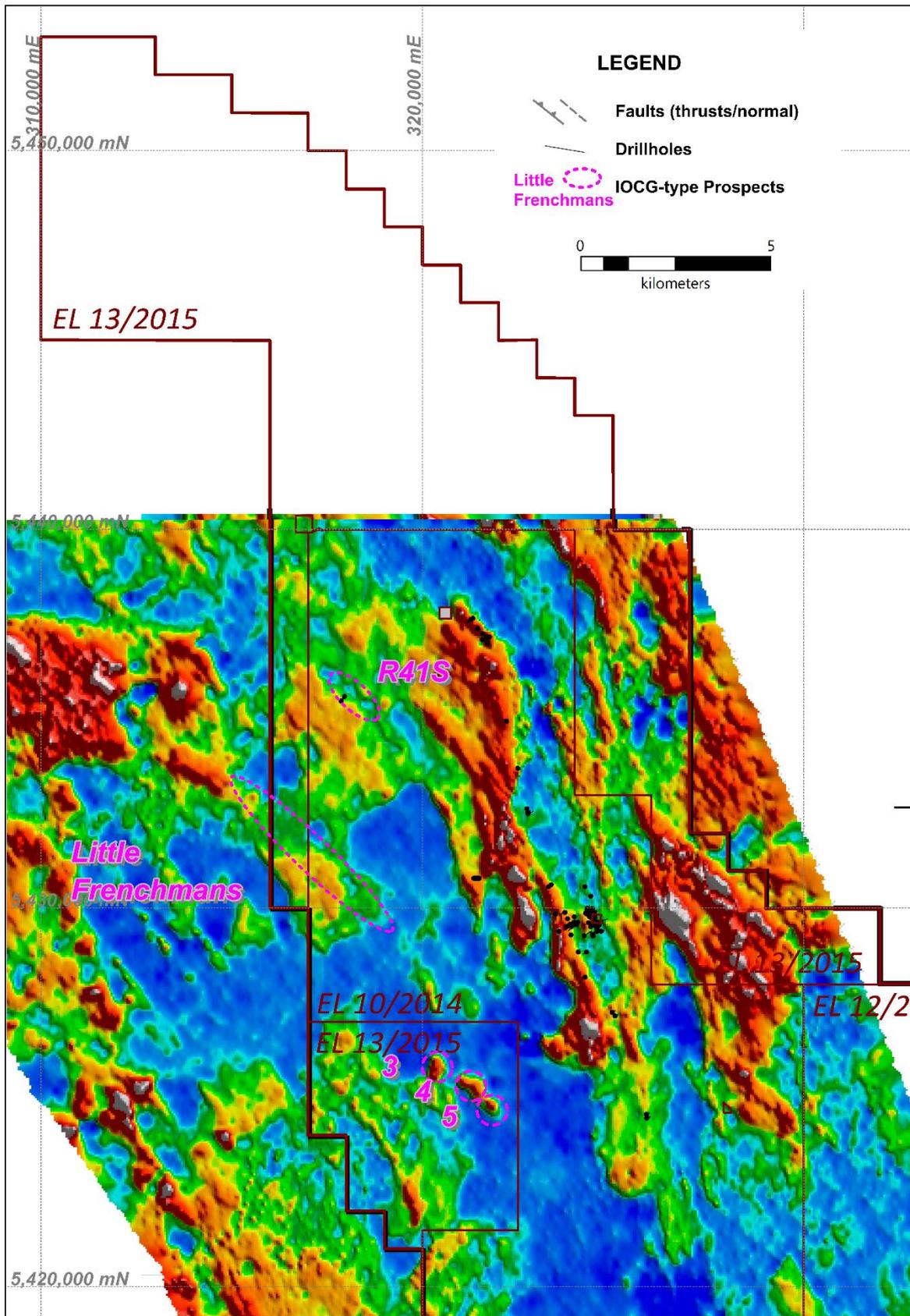


Figure 4.14 Little Frenchman prospect and Jaguar anomalies 3, 4 and 5 – all considered to represent potential Tennant Creek IOCG “Temma Ironstone” type anomalies on alternative colour enhanced image (Phil Muir SMEG) of hummingbird EM 800hz data.

5.0 Conclusions and Recommendations

A number of targets have been defined within EL 13/2015 for field follow-up work in the 2022/23 year.

Sedimentary hosted copper targets have been defined in a number of locations (see figure 4.11). These anomalies should be followed-up with reconnaissance geological mapping and stream sediment, rock and possibly C-horizon soil geochemical sampling.

The Little Frenchman's IOCG target (see figure 4.12) should be followed up with ground magnetics traverses, geological mapping and stream, rock and C-horizon soil geochemical sampling.

Hummingbird EM anomalies numbers 3, 4 and 5 (see figures 4.13 and 4.14) were not adequately explained (Busbridge, 2008) and warrant further work in order to do so.

6.0 Environment

There has been no environmental impact to date.

7.0 Expenditure

	\$
Geology	32,725
Geochemistry	0
Geophysics	0
Remote Sensing	0
Drilling	0
Gridding	0
Land Access	0
Rehabilitation	0
Feasibility Studies	0
Other	11,291
Administration	4,402
Total	48,418

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Appendix A – Balfour United Summary – Ward (1911)

The Balfour United Syndicate's Sections and the adjoining Sections – (Ward, 1911)

“To the east of Balfour, and for the most part on the eastern side of a small tributary of the Frankland River, are a number of sections on some of which active prospecting work has been carried out by the Balfour United Syndicate. Unfortunately this work has not yet been successful in locating any ore-body which offers promise of proving to be of commercial value.

The syndicate holds three sections, 4267-M, 4268-M. and 4271-M, comprising in all 160 acres. A lode formation has been found running across Section 4268-M, and entering the Section 4274-M. In the northern part of the latter a shaft has been sunk to a depth of 27 feet on a quartz lode carrying pyrites. The country-rock is heavily mineralised slate. The lode appears to have a course bearing N. 35° W. Traces of copper are said to have been seen in the quartz of this lode at a point just outside the northern boundary of Section 4274-M, where an excavation has been made to a depth of 12 feet. At this place the lode-stuff appears to have a brecciated structure. To the northward there are several trenches which give shallow exposures of the northern extension of this lode formation, which consists of graphitic slate charged with pyrites and carrying small quartz veins. One of the trenches on the bank of a creek was continued underground as a short tunnel, but without resulting in the exposure of any further information.

In the northern part of Section 4268-M a trench 3 chains long has been carried up the bed of a small creek, and exposed the bedrock. The northern continuation of what is apparently the same formation as that prospected in the southern part of the section is exposed for a width of 160 feet by this trench. The formation consists of dark quartzite and black indurated slate impregnated with pyrite and containing innumerable veinlets of quartz, with which chlorite and pyrite are associated. The structure is very irregular, the veins and fragments of impregnated country-rock possessing no constant directions of strike or dip. The formation at the southwestern end of this trench is said to be cupriferous, though no copper-bearing mineral was visible in that portion of it still *in situ* at the time of the writer's visit. The lode-matter is such that a shoot of copper ore may at any time be located within the formation for it corresponds mineralogically with the non-productive portions of cupriferous lodes throughout the field. The ore obtained from this lode and shown to the writer cannot have been derived from any shoot of material size since all traces of its existence have been removed from the solid lode. It does not appear that the prospects at this place are very encouraging. The value of the formation must depend upon any discoveries that may be made in the future.

In the north-western part of Section 4274-M some trenches have been cut in the bed of the creek which crosses the section diagonally. The trenches show disturbed and contorted slate carrying a little graphite and a few small veins of quartz. On the western bank of the creek traces of galena are visible with pyrites in some iron stained quartz.

To the northward of the Balfour United Syndicate's leases no work had been done at the time of the writer's visit. White quartzite, which marks the bleached outcrop of the northern extension of the formation exposed in the creek near the northern boundary of Section 4268-M. projects here and there through the button-grass in the southwestern part of Section 4437-M charted in the name of J. Reid. No indication of the existence of any more definite or more promising formation can be detected at the surface.

No work has been done on the remaining sections in this district save the cutting of a long shallow trench in an east-and-west direction in the southern part of Section 4283-M. Unmineralised slate only is exposed.”

Appendix B – Balfour Report – Exploration Summary Report

Balfour Project Exploration Review

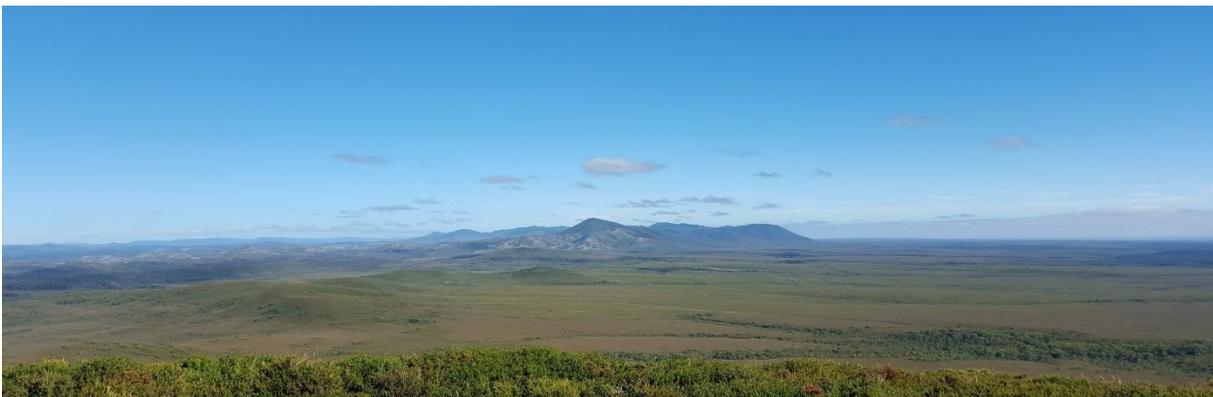


Table of Contents

	pg	
1.0	Introduction	1
2.0	Introduction to the Balfour Project	1
2.1	Location and Access	1
2.2	Tenements, Tenure and Project Ownership	2
2.3	Land Classification/Usage	3
3.0	Geology	5
3.1	Introduction	5
3.2	Stratigraphy	5
3.3	Structure	8
3.4	Intrusives	10
	3.4.1 Proterozoic Mafic Dykes – Tayatea Dyke Swarm	10
	3.4.2 Devonian Granite	11
	3.4.3 Tertiary Basalt	11
3.5	Mineralisation	16
	3.5.1 Copper (+/- gold)	16
	3.5.2 Tin +/- Tungsten	22
	3.5.3 Lead +/- Silver +/- Zinc	23
	3.5.4 Magnetite+/-Copper+/-Gold (+/-base metals) ('Temma ironstones')	23
4.0	Mining and Exploration History	25
4.1	Introduction	25
4.2	Historical Mining and Prospecting (pre-WW2)	25
4.3	Modern Mining and Exploration (post-WW2)	32
	4.3.1 Interview River Wolfram Syndicate 1953 – 1954	32
	4.3.2 Rio Tinto Australian Exploration 1956	32
	4.3.3 Pickands Mather and Co. International (EL 12/1965)	32
	4.3.4 Balfour Mining Syndicate 1963 – 1968 (SPL17, SPL383, SPL392, SPL410)	32
	4.3.5 Broken Hill Proprietary Company Ltd 1963-1965 (SPL392, SPL410, ML 38M/63)	32
	4.3.6 Australian Consolidated Industries Limited (ACI) 1968 – 1974 (EL 16/1968, EL 48/1970, EL	36
	4.3.7 Australia and New Zealand Exploration Company 1972 – 1973 (EL 6/1972 and EL 8/1972)	45
	4.3.8 Interview River Mining and Associates Pty Ltd 1973 – 1980 (EL 1/1973)	45
	4.3.9 Esso Exploration and Production Australia Incorporated 1973 – 1974 (EL 2/1973)	46
	4.3.10 CRA Exploration Limited/Geopeko 1977 – 1985 (EL 1/1977 and JV's with ML's and SPL's over the Balfour area)	48
	4.3.11 Mt. Lyell Mining and Railway Company Limited 1978 - 1981 (EL 26/1978 and EL 27/1978)	51
	4.3.12 CRA Exploration Limited 1980 – 1985 (EL 36/1980)	52
	4.3.13 Electrolytic Zinc Company of Australasia Limited 1980 – 1985 (EL 56/1980)	53
	4.3.14 Abignano Constructions 1981-1989 (EL 1/1973, EL 13/1981 and EL 64/1983 also included Mining Leases)	53
	4.3.15 Geopeko Ltd. 1883 – 1984 (EL 17/1983)	56
	4.3.16 Wolston Developments Pty Ltd/Monier Limited. 1985 - 1990 (EL 34/1985 and EL 6/1988)	56

4.3.17	Aureole Resources Pty. Ltd. 1987 – 1991 (EL 21/1987)	59
4.3.18	New Holland N.L. 1987 – 1989 (EL 26/1987 and EL 27/1987)	59
4.3.19	Soloriens Mining Pty. Ltd. 1988 – 1992 (EL 53/1988)	60
4.3.20	Geopeko 1989 – 1991 (EL 52/1989)	60
4.3.21	CRAE/Rio Tinto Exploration Pty Ltd 1993 – 1997 (EL 4/1994, EL 18/1992 and EL 19/1992)	60
4.3.22	Pacific Nevada Mining Pty Ltd 1998 – 2003 (EL 13/1997, EL 15/1997, EL 4/1998)	69
4.3.23	New Challenge Resources Pty. Ltd./Jaguar Minerals Pty. Ltd. 2002 – 2007 (EL 4/2002)	69
4.3.24	Ausvaal Projects Pty. Ltd. 2002 – 2004 (EL 8/2002, EL 9/2002 and EL 10/2002)	72
4.3.25	Jaguar Minerals Limited 2002 – 2007 (EL 27/2005)	72
4.3.26	IMX Resources N.L. 1997 - 2013 (EL 17/2007)	73
4.3.27	Stonehenge Metals Ltd 2007 – 2009 (EL 12/2007)	73
4.3.28	Pleiades Resources Pty. Ltd. 2007 – 2014 (EL 27/2007 and EL 40/2007)	74
4.3.29	Regalpoint Exploration Pty. Ltd. 2008 – 2010 (EL 57/2007)	81
4.3.30	Torque Mining Pty. Ltd. 2011 – 2012 (EL 6/2011 and EL 21/2011)	82
4.3.31	Zeb's Minerals Pty. Ltd. 2014 – today (EL 10/2014, EL 12/2015, EL 13/2015, EL 9/2021, ML 1M/1976)	82
4.4	Government and Academic Work	93
4.4.1	Introduction	93
4.4.2	Government Work	93
4.4.3	Academic Work	94
5.0	Exploration Models and Prospects	95
5.1	Introduction	95
5.2	Copper (+/- Gold, Silver, Cobalt)	95
5.2.1	Introduction	95
5.2.2	High Grade Copper (+/- Gold)	96
5.2.3	Large Scale Sedimentary Hosted Copper (+/- silver, cobalt, base metals)	114
5.3	Tungsten +/- Tin	118
5.4	Zinc +/- Lead +/- Silver	135
5.5	Magnetite +/- copper +/- gold (+/- base metals) ('Temma ironstones')	136
6.0	Recommendations.	138
7.0	References	142

Tables

3.3.1	Deformation Events in the Balfour-Temma Area	10
4.2.2	Historical Tin Production Reported in Thomas and Henderson (1943)	29
4.2.1	Historical Copper Production Reported in Thomas and Henderson (1943)	30
4.3.31.1	Total (non JORC-2012 compliant) Quantum of Mineralised Rock including Murrays Reward Remnants	85
4.3.31.2	Tons and Grade Murrays Reward/Central Mt. Balfour Copper Lode Excluding Murrays Reward Remnants	85
4.3.31.3	Tons and Grade McIntyre Shoot	86
4.3.31.4	Drillhole Intersections used in 2022 Resource Estimate	88
4.3.31.5	Inferred Resource Tons and Grade Murrays Reward/Central Mt. Balfour Copper Lode	90

Figures

2.1.1	Balfour Project location (maroon outline) on Tasmania's west coast	1
2.2.1	Balfour Project Area on Tasmania's west coast showing tenements	2
2.3.1	Balfour Project Area on a map of Tasmania's Strategic Prospectivity Zones.	3
2.3.2	Balfour Project Area Land Tenure showing Balfour Project Area tenements	4
3.1.1	Regional geology (from Taheri and Bottrill, 2004)	6
3.2.1	Rocky Cape Group stratigraphic column (after 3.7 in Calver et. al. 2014b)	7
3.2.2	Togari Group stratigraphic column (after 3.29 in Calver et. al. 2014b).	8
3.2.3	Showing location of Tasmania in the Nuna Supercontinent	9
3.4.1	Distribution of mid-Palaeozoic Tasmanian granites.	12
3.4.2	Bouguer anomaly gravity image of Tasmania's northwest	13
3.4.3	Leaman and Webster (2002) ternary radiometrics image overlain by interpretation by Webster in Leaman and Webster (2002).	14
3.4.4	Schematic, illustrative composite cross-section based on the section on MRT 1:25,000 'Dempster' mapsheet (Everard et. al. (1999)	15
3.5.1	Outcrop at Balfour South lode.	17
3.5.2	DBBA1 Main Reef structure.	18
3.5.3	Balfour project area showing tenements with Mineral Resources Tasmania's mineral occurrences database metallic prospects	20
3.5.4	Total Magnetic Image (TMI) of Tasmania's	21
3.5.5	Quartz veins of the style which host tin and tungsten mineralisation on Specimen Hill	22
4.2.1	"Plate III Geological Sketch Map of the Mount Balfour Mining Field" (Ward, 1911)	27
4.2.2	Composite plan combining Ward (1911) Plates IV, V and VI showing the mine leases at the time of his visit in 1910 with current Prospects named.	28
4.2.3	"Geological Sketch Map Balfour Tin Field" (Thomas and Henderson, 1943)	31
4.3.5.1	Plans showing results of geological mapping and sampling of the accessible parts of the Murrays Reward and Central Mt. Balfour mines carried out by BHP (anon., 1965)	34
4.3.5.2	Surface plans and underground sections showing results of geological mapping and sampling of accessible parts of the Murrays Reward and Central Mt. Balfour mines carried out by BHP (anon., 1965)	35
4.3.6.1	ACI mapping of the Murrays Reward No.1 and No.2 adits (Davies, 1969; TCR 69_0577)	38
4.3.9.1	Composite image of airborne EM surveys to date in Tasmania's northwest with the Balfour Project Area as maroon outline. All surveys are frequency domain surveys	47
4.3.14.1	Interview River prospect showing historic grids (now overgrown) and drillholes on background of MRT's 1:25,000 'Interview' geological map (Vicary, 2004)	54
4.3.16.1	Location gossan samples G1, G2 and G3 EL34/1985 (Anon., 1988; 88_2793).	57
4.3.21.1	Coloured CRAE plan showing targeted sedimentary horizons	63
4.3.21.2	CRAE's new structural model for high grade copper deposits along the north-northwest trending Balfour Copper Trend fault	66
4.3.21.3	CRAE cross-sectional interpretation AA' through both Specimen Hill and Murrays Reward showing thrusting and sub-surface granite (Tear and Russel 1998a; 98_4115)	67
4.3.23.1	"3. Balfour - Geology and Prospects" from Turner (2004; 04_5056) showing the interpreted sub-surface granite ridge and first round	

	EM targets determined from the 2002 WTRMP Hummingbird frequency domain EM survey.	71
4.3.28.1	“Location of the eight high priority electromagnetic anomalies and previous drilling. Background data is CP 6.6 khz in phase HEM data image” 5 from Busbridge (2008). Anomalies 3,4,5, and 7 lie within the Balfour Project Area.	73
4.3.28.1	Pleides gravity image (Bouguer anomaly upwardly continued) and interpretation modified to enhance interpreted intrusive anomalies and target areas (Bissett, 2009a; 10_6024A) with area of Specimen Hill and tourmaline breccia zones added.	75
4.3.28.2	Interpretative geological cross-section on northing 5,429,350mN MGA94	78
4.3.28.3	Roaring 41 South prospect showing existing drillholes R41S01 and R41S02	80
4.3.30.1	Drill hole collar positions and drill hole intersections used in the estimation shown with respect to historic mine workings.	89
4.3.31.2	Inferred Resource Tons and Grade Inferred Resource	90
4.3.31.3	Long section view (looking due west) showing MRCMB_copper_lode_2022.mdl coloured according to copper grade	91
4.3.31.4	Proposed drilling of the Murrays Reward/Central Mt. Balfour resource	92
4.4.2.1	1:25,000 mapsheet coverage of the Balfour Project Area	94
5.1	Mineral occurrences from Mineral Resources Tasmania’s database according to commodity association on background image of Total Magnetic Intensity, also showing the outline of the following four detailed mapsheets. Note broad correspondence between copper occurrences and magnetic highs.	
5.2	Compilation of all historic soil samples and compilation of rock samples from CRAE’s extensive and MRT sampling programmes (Mt Balfour mineral field mapsheet) colour coded according to copper grade, on a background of Total Magnetic Intensity and very faint background of historical tenements from Ward (1911), also showing prospects, historic drill collars and traces, and major structural elements as grey linework.	99
5.3	Ward (1911) “Chart of Mt Balfour Mining Leases – Plate IV” (northern section of main copper belt) showing mine leases at the time of his visit in 1910. Red lines referred to as “lodes” by Ward (1910) are the quartz veins and fault structures being explored by these early prospectors and do not necessarily indicate the presence of copper mineralisation, however, they may be used as a guide to more detailed exploration. Black dots are drill collars to date.	100
5.4	Compilation of all historic soil samples and compilation of rock samples from CRAE’s extensive and MRT sampling programmes (Mt Hazelton mineral field mapsheet) colour coded according to copper grade, on a background of Total Magnetic Intensity and very faint background of historical tenements from Ward (1911), also showing prospects, historic drill collars and traces, and major structural elements as grey linework.	101
5.5	Ward (1911) “Chart of Mt Hazelton Mining Leases – Plate V” (southern section of main copper belt) showing mine leases at the time of his visit in 1910. Red lines referred to as “lodes” by Ward (1910) are the quartz veins and fault structures being explored by these early prospectors and do not necessarily indicate the presence of copper mineralisation, however, they may be used as a guide to more detailed exploration. Black dots are drill collars to date.	102
5.6	Compilation of historic rock samples and soil samples (Toner River mineral field mapsheet) colour coded according to copper grade, on a background of Total Magnetic Intensity and very faint background of historical tenements from	103

	Ward (1911).	104
5.7	Compilation of historic rock samples (Copper Reward mineral field mapsheet) colour coded according to copper grade, on a background of Total Magnetic Intensity and very faint background of historical tenements from Ward (1911).	105
5.8a	Composite of the four dipole-dipole Induced Polarisation surveys conducted over the Balfour area with anomalies as interpreted shown. Positions of surveys and anomalies have potential inaccuracies due to georeferencing. Accuracy is approximately +/-50m for each survey. Backdrop is MRT 1:25,000 mapping in greyscale.	106
5.8b	Composite of the four dipole-dipole Induced Polarisation surveys conducted over the Balfour area with anomalies as interpreted shown as for 5.8 but now with Ward (1911) "lodes" shown as black lines.	107
5.9	Murrays Reward/Central Mt. Balfour copper resource block model with existing IP surveyed lines from ACI survey only showing anomalies coincident with resource.	108
5.10	Murrays Reward/Central Mt. Balfour copper resource outline with existing IP surveyed lines from ACI survey only showing anomalies coincident with resource.	109
5.11	Existing IP surveyed grids, anomalies and prospective copper bearing structures.	110
5.12	Existing IP surveyed grids, anomalies and prospective copper bearing structures with IP anomalous trends interpreted..	111
5.13	"Razorback" ridgelines as traced from LISTmap hillshade LIDAR image (blue lines), Ward (1911) "lodes" (red lines) and mapped geological structures (grey lines) at regional scale.	112
5.14	"Razorback" ridgelines as traced from LISTmap hillshade LIDAR image (blue lines), Ward (1911) "lodes" (red lines) and mapped geological structures (grey lines) at more detailed scale.	113
5.15	World-class sedimentary hosted copper deposits.	114
5.16	Schematic showing the basic sedimentary hosted copper model.	115
5.17	Sedimentary hosted copper prospective horizons.	116
5.18	Sedimentary hosted copper (+/- base metals) target horizons and structures.	117
5.19	Middle Devonian granite outcrop and depth contours with major Tasmanian tin and tungsten deposits. King Island lies to the northwest of this map. Balfour Project Area is shown as a maroon outline.	120
5.20	Gravity image with superimposed interpretation from Bissett (2009a; 10_6024a). Also showing outline of shallow granite ridge (solid black linework), outline of Specimen Hill workings (solid green linework), location of Specimen Hill and Sluiced Flat.	121
5.21	Tin and/or tungsten skarn deposits and outcropping Devonian Granites on Total Magnetic Intensity also showing position of Specimen Hill and outline of Interview Granite subsurface outline	122
5.22	Tin and tungsten occurrences on background image of Total Magnetic Intensity.	123
5.23	Total Magnetic Intensity image in immediate Balfour area showing the location of tin +/- tungsten hard rock and alluvial workings, hard rock copper workings, and major structures (grey linework).	124
5.24	Better drillhole tin and tungsten drill results on a backdrop Total Magnetic Intensity image. Drill results are collated from historic company reports.	125
5.25	Better drillhole tin and tungsten drill results on a backdrop image showing gravity (after "Plan 2 Balfour Project, Balfour Gravity Survey, Interpretation over Residual Gravity Anomaly" in Bissett (2009a; 10_6024a)). Drill results are collated from historic company reports.	126

5.26	Pleiades gravity data image (after Bissett, 2009a; 10_6024a) with gravity anomalies, magnetic anomalies, MRT mapped and Bissett (2009a) interpreted structures and prospects overlain.	128
5.27	TMI image with shallow granite bodies outlined, mapped lodges of ACI, Ward (1911) "lodes" structures (see discussion earlier in text), arsenic soil geochemistry, CRAE's Nelson grid IP survey anomalies (other IP surveys not shown on this for clarity), existing drillholes and prospects. Pink ovoids and text are the discrete target zones defined by this work and described in text.	129
5.28	Bottom part of is cross-section through Specimen Hill showing drill traces, faults, geology polygons, tin and tungsten occurrences. Upper part of is magnetics profile from aeromagnetic data.	130
5.29	Same as 5.21 but now with conceptual tin +/- tungsten mineralisation added.	130
5.30	Waratah/Furious 50's prospect TMI showing the gravity interpretation of Bissett (2009d), major structures (see legend for structures in 5.20)	131
5.31	Gravity interpretation linework of Bissett (2009a) superimposed on magnetics modelling of the Waratah/Furious 50's magnetic anomaly by Bissett (2009d) showing the shallow magnetic modelled bodies (multicoloured) and deeper magnetic modelled bodies (dark and mid blue) with background of TMI.	132
5.32	Section through the Waratah/Furious 50's magnetic anomaly showing Bissett's (2009d) interpretation of shallow magnetic bodies (red, yellow and green shapes) required to model the magnetics profile in upper part of figure, with the addition of an approximate possible position of the deeper magnetic body shown in 5.23 against a possible modelled granite body. The deeper magnetic body and granite body models require refinement before drill targeting this anomaly.	133
5.33	Existing gravity data coverage over the Balfour Project Area with the data points for a proposed gravity survey at the Balfour South prospect as well as the outlines of further gravity survey areas should initial results warrant this work. Background is TMI image also showing mineral occurrences from MRT database, gravity interpretation from Leaman (1991; 91_3213), "lodes" from Ward (1911) and geological structures from MRT 1:25,000 mapping.	134
5.34	Total magnetic intensity image underlying the known 'Temma ironstones' occurrences (from MRT's database of mineral occurrences), the Roaring 41 South prospect, and other potential "look-alike magnetics" target areas.	137
6.1	Summary of prospects and proposed gridding on TMI in the main Balfour area.	141

Appendices

- A **Drill hole details for all drill holes (excluding auger) in Balfour Project Area**
- B **Better Drill Intersections**

1.0 Introduction

This report was originally written as a summary report for use by an independent mining consultant to generate an Independent Technical Assessment Report with section 1.0 for details regarding the independent author etc. For ease this section has been left at section 1.0 to avoid needing to renumber all figures, sections etc (which are cumbersome enough as it is).

2.0 Introduction to the Balfour Project

2.1 Location and Access

The Balfour Project covers an area of 861.6 square kilometres on Tasmania's west coast between the Pieman and Arthur Rivers (see figure 2.1.1). The only town in the area, Balfour, has less than 10 residents, and is accessible by rough gravel road off the Western Explorer highway.

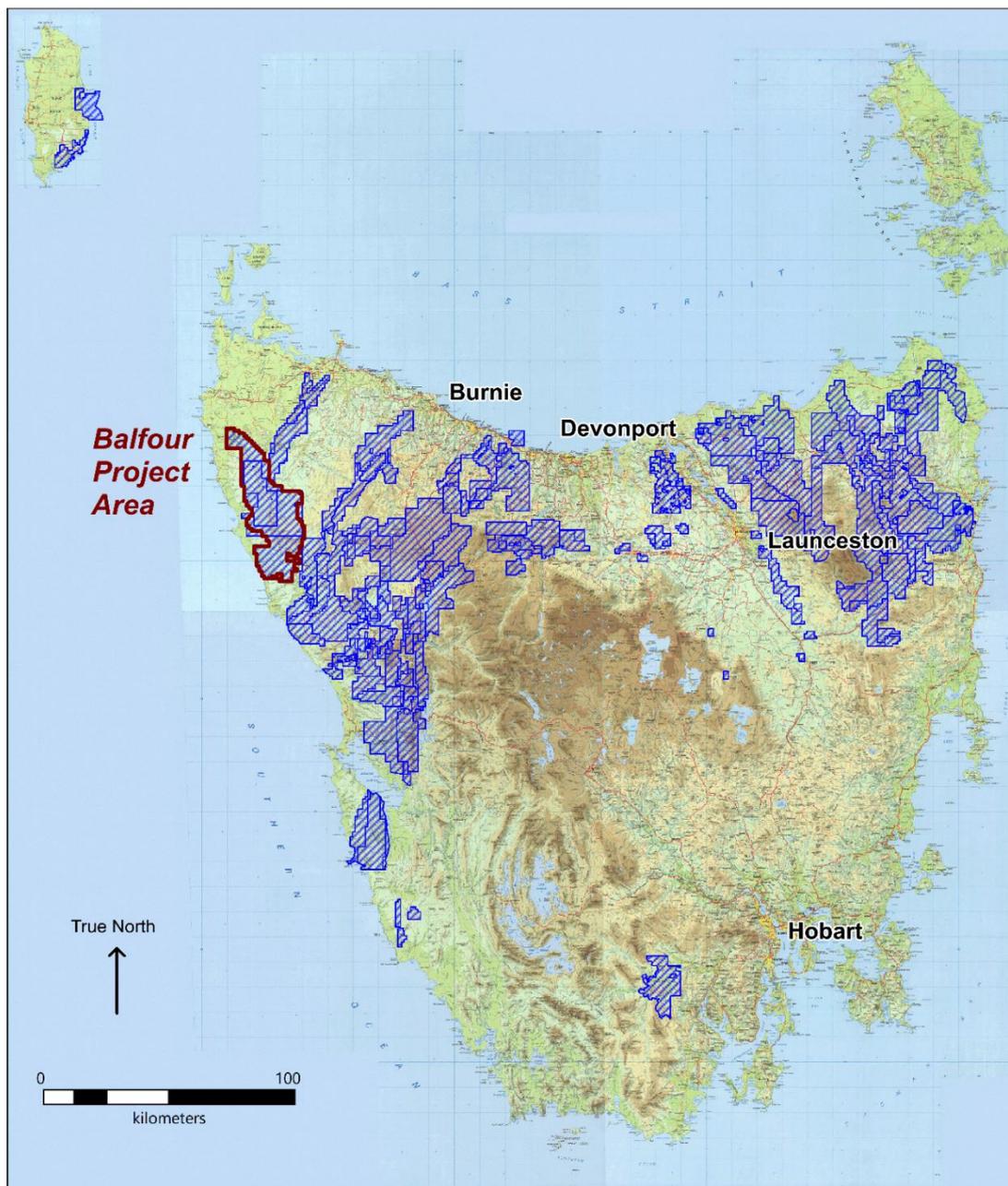


Figure 2.1.1: Balfour Project location (maroon outline) on Tasmania's west coast with Category 1 (metallic minerals) exploration tenement coverage as at 8th August 2022 shown in blue hatch..

2.2 Tenements, Tenure and Project Ownership

The Balfour Project consists of 4 contiguous Exploration Licences, being EL's 10/2014, 12/2015, 13/2015 and 9/2021, as well as a Mine Lease 1M/1976 (see figure 2.1.1). All tenements are held wholly by D & B Mining Pty. Ltd.

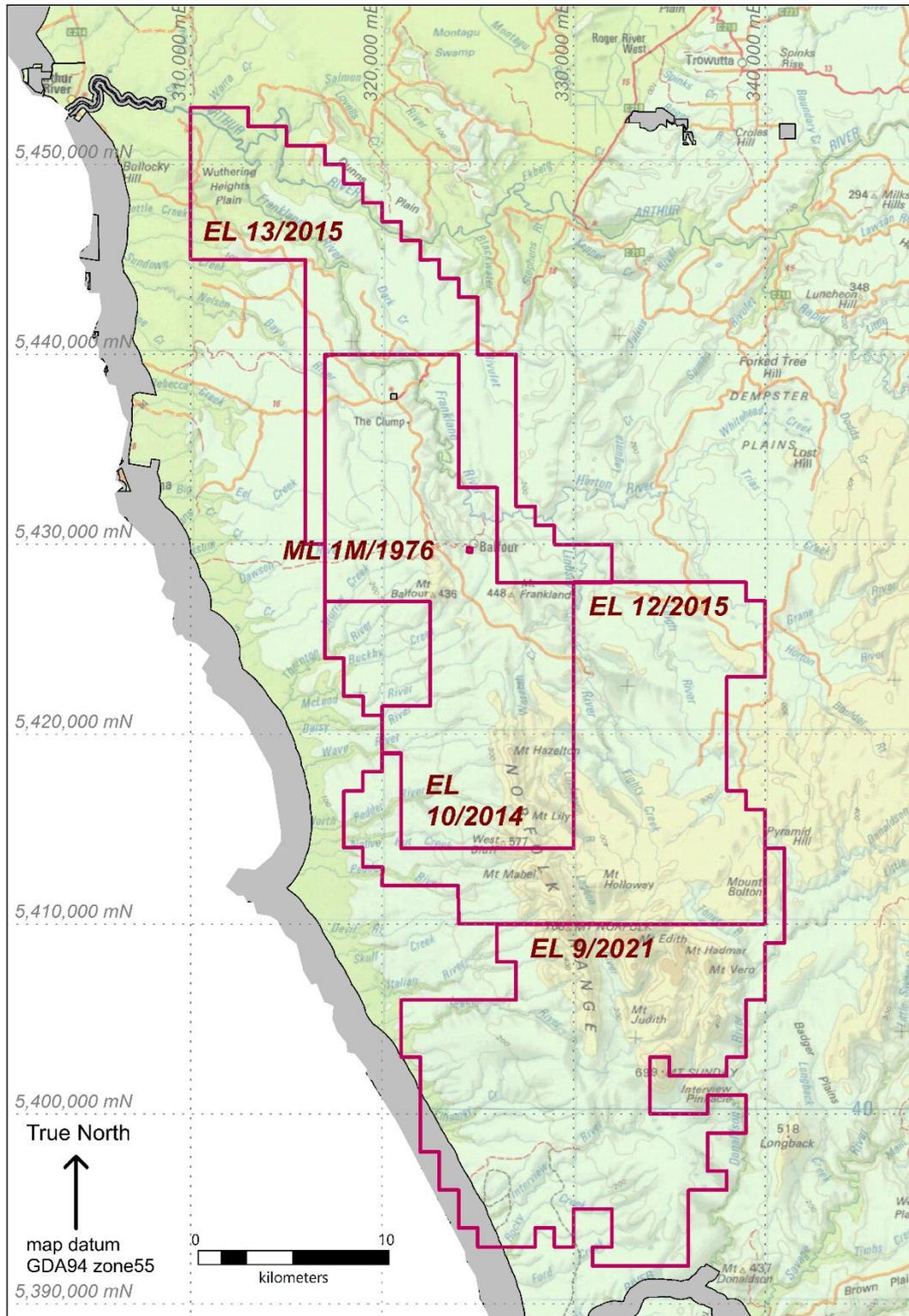


Figure 2.2.1: Balfour Project Area on Tasmania's west coast showing tenements on 1:250,000 topographic base map.

2.3 Land Classification/Usage

The Balfour Project area lies wholly within the State Government legislated Balfour Strategic Prospectivity zone (see figure 2.3.1).

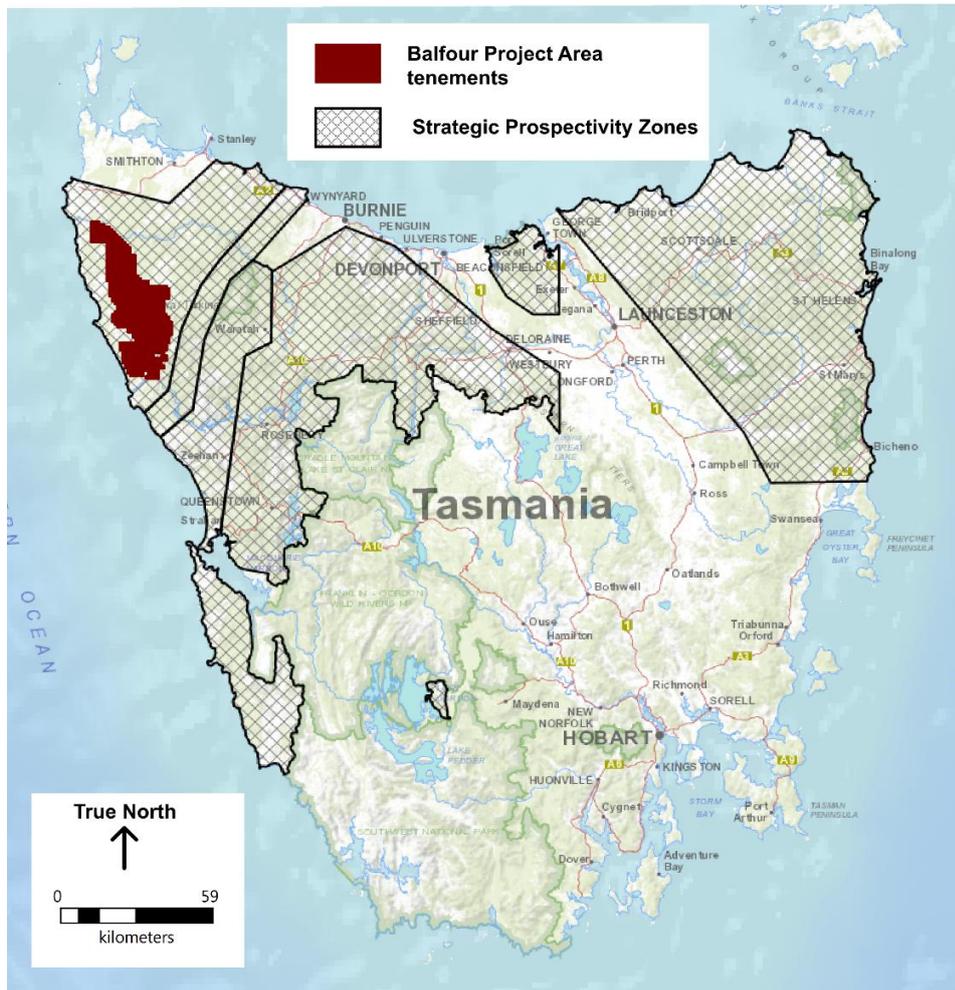


Figure 2.3.1: Balfour Project Area on a map of Tasmania's Strategic Prospectivity Zones. The Balfour Project Area lies wholly within the Balfour Strategic Prospectivity Zone.

The Balfour Project Area covers a range of land use tenure and usage (see figure 2.3.2).

Much of the Balfour Project Area falls within the Arthur-Pieman Conservation Area with smaller areas within the Sumac Regional Reserve and the Donaldson River Nature Recreation Area which are managed by the Tasmania Parks and Wildlife Service. Portions of the north and western parts of the Balfour Project Area cover either Permanent Timber Production Zone Land and Future Potential Production Forest managed by Sustainable Timber Tasmania. All of these areas are available for exploration and mining.

A 2km wide coastal strip (shown in grey on figure 2.3.2) is unavailable for exploration and mining under current legislation as is a small area at the junction between the Rebecca Road and Heemskirk Roads which is reserved as a gravel quarry for the Department of Main Roads.

A number of small private freehold blocks exist at the Balfour township. Whilst exploration and mining are permitted on private land such exploration must not be within 100m of a permanent dwelling or water reservoir, and mining requires a compensation agreement with the landowner, meaning that the potential for exploration to occur on these private blocks is limited.

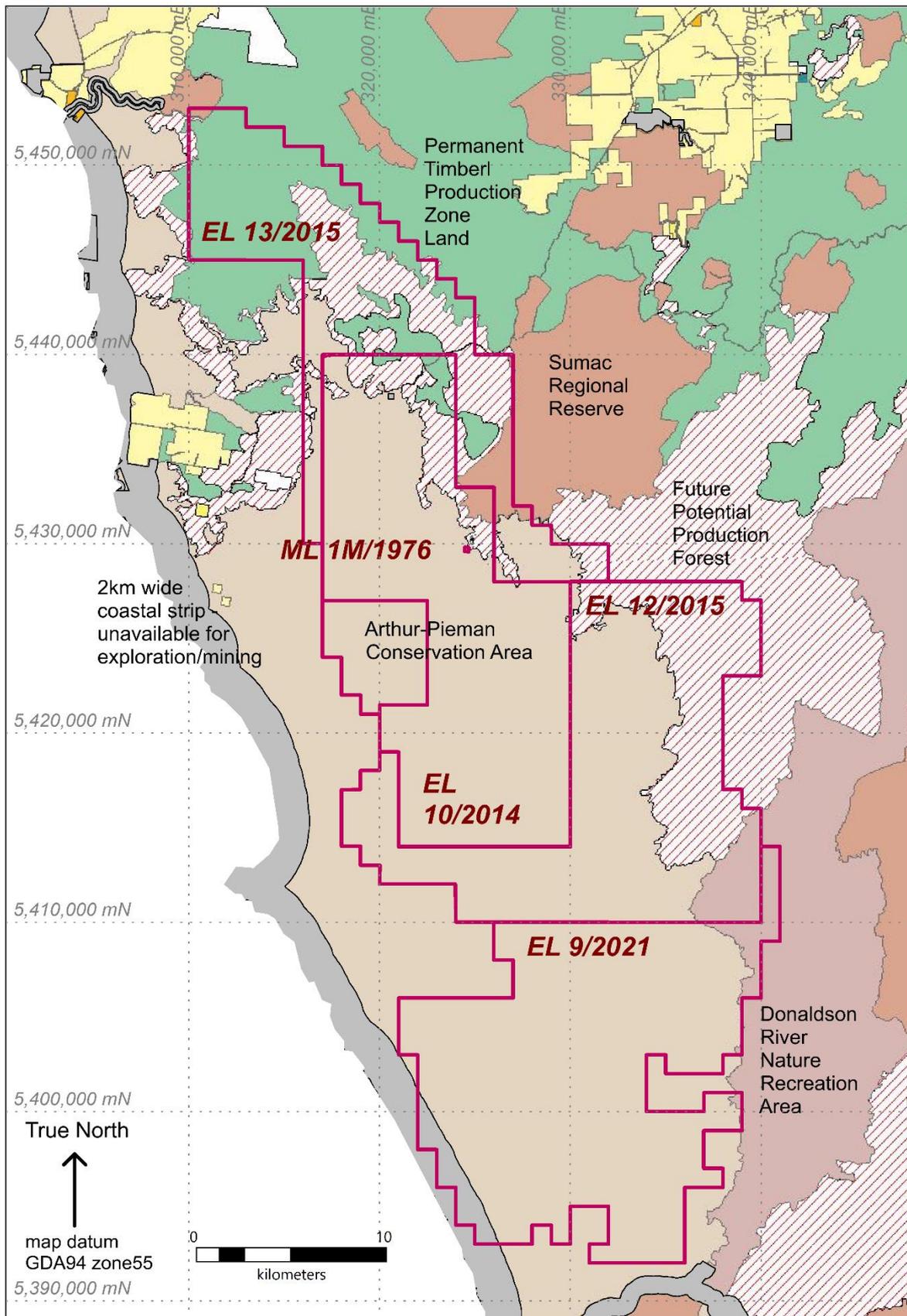


Figure 2.3.2: Balfour Project Area Land Tenure showing Balfour Project Area tenements over the Land Tenure layer from The LISTmap (<https://maps.thelist.tas.gov.au/listmap/app/list/map>)

3.0 Geology

3.1 Introduction

The geology of northwestern Tasmania has been studied by many geologists including Spry (1957, 1962), Gee (1968), Gee *et al.* (1969), Bell (1972), Lennox *et al.* (1982), Brown (1989), Turner (1989), Seymour and Baillie (1992), Everard *et al.* (1996) (see Taheri and Bottrill, 2004 for references) and Everard *et al.* (2007).

More recently Calver *et al.* (2014b) have provided an excellent summary of the stratigraphy of the region in their chapter on the Proterozoic rocks of Tasmania, and Seymour *et al.* (2014) in their chapter on Mid-Palaeozoic orogenesis, magmatism and mineralisation in “The Geological Evolution of Tasmania” (Calver *et al.*, 2014a).

The following description of the regional geology draws heavily from Taheri and Bottrill (2004), Everard *et al.* (2007)) and Calver *et al.* (2014).

The regional geology is shown on figure 3.1.1.

The basement geology of the Balfour Project Area is dominated by the Mesoproterozoic Rocky Cape Group rocks, with a small area of the Neoproterozoic Togari Group along the northeastern margin of the project area.

Recent academic work dating monazite and zircons and measuring palaeocurrent directions (Halpin *et al.* 2014 and Mulder *et al.* 2015) has shown the Rocky Cape Group to be ~1.45Ga, with palaeographic reconstructions suggesting it was deposited in a basin between what is now East Antarctica and western North America forming part of the ancient continent of Nuna (Mulder *et al.* 2015).

In the southwestern part of the project area the Middle Devonian Pieman Granite (also referred to as the Interview River Granite with the northern outcrop at Sandy Cape specifically referred to in some literature as the Sandy Cape Granite) outcrops with gravity data indicating that this granite body underlies portions of the Balfour Project Area at relatively shallow depths (see figures 3.4.1 and 3.4.2).

These rocks are overlain in a very small part by Tertiary aged gravels and basalt, generally as thin hill cappings, with Quaternary alluvium in low lying swampy areas and along river valleys.

3.2 Stratigraphy

“The Mesoproterozoic Rocky Cape Group contains the oldest rocks in the area and forms the basement sequence in northwest Tasmania. It consists of a thick, unfossiliferous, dominantly siliciclastic shelf sequence, the basement of which is unknown.

Stratigraphically in the most recent classification (Everard *et al.*, 2007), the Rocky Cape Group has been divided (from youngest to oldest) into: Jacob Quartzite (Gee, 1968), Irby Siltstone (Gee, 1968), Detention Subgroup (Gee, 1968), Cowrie Siltstone (Spry, 1957; Gee, 1968), Balfour Subgroup, Lagoon River Quartzite (Gee *et al.*, 1969; Bell, 1972), and Pedder River Siltstone (Bell, 1972)” (Taheri and Bottrill, 2004) (see figure 3.2.1)

“The Balfour Subgroup consists of interbedded sandstone and siltstone, carbonaceous pyritic siltstone and shale, quartz arenite and chloritic siltstone. It conformably overlies the Lagoon River Quartzite and is apparently conformably overlain by a correlate of the Cowrie Siltstone in the vicinity of Balfour.” (Taheri and Bottrill, 2004)

“The Rocky Cape Group is overlain by the Togari Group of Neoproterozoic–Early Cambrian age. A low angle unconformity separates Rocky Cape Group rocks from the overlying Togari Group along the eastern margin of the Smithton Synclinorium, near the mouth of the Black River east of Smithton (Lennox *et al.*, 1982; Brown, 1989). On a regional scale, the Rocky Cape Group is overlain by the

Togari Group at different stratigraphic levels in different localities around the margin of the synclinorium

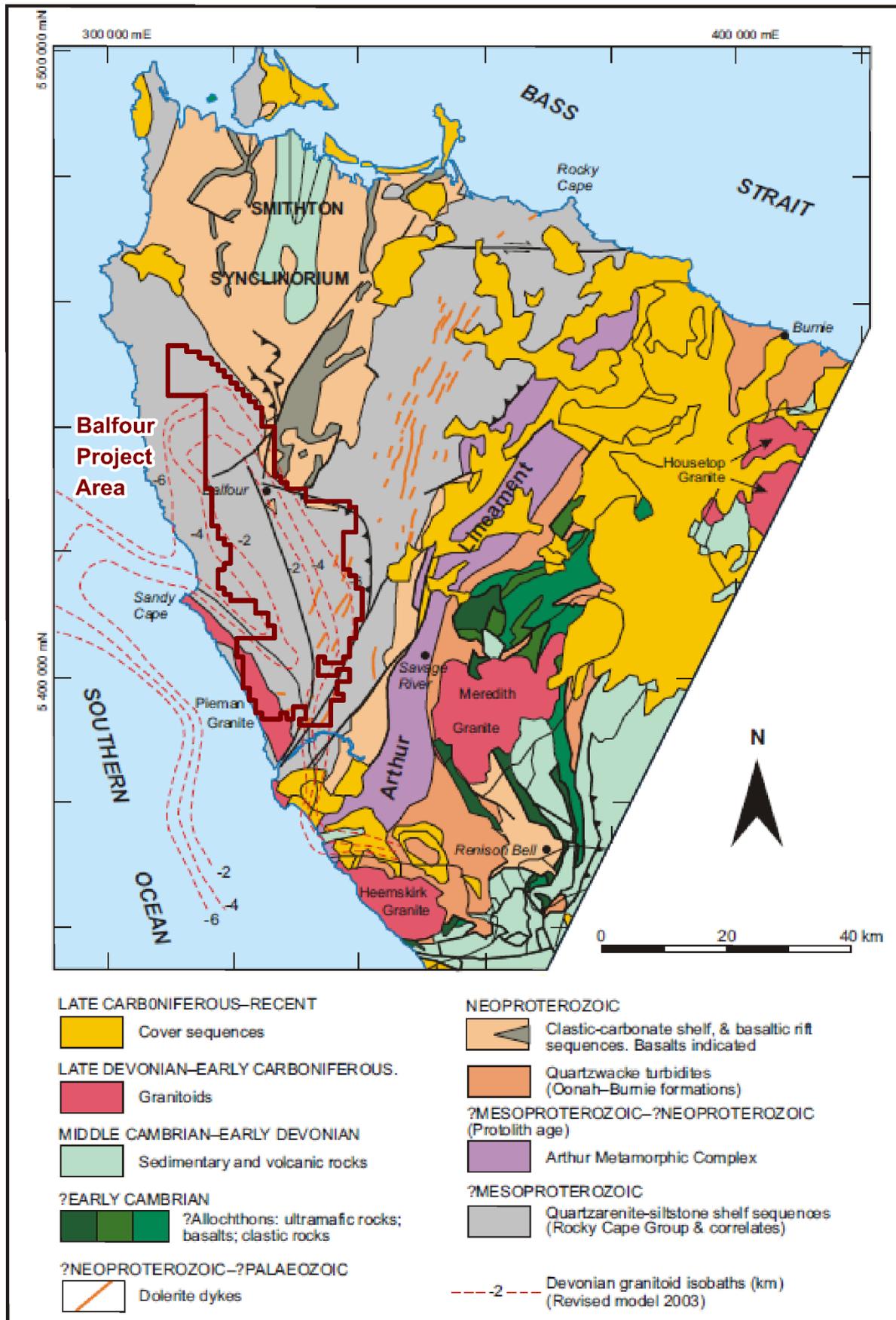


Figure 3.1.1: Regional geology (from Taheri and Bottrill, 2004) showing the Balfour Project Area as a maroon outline. The Sandy Cape and Pieman Granite bodies are part of the Interview suite.

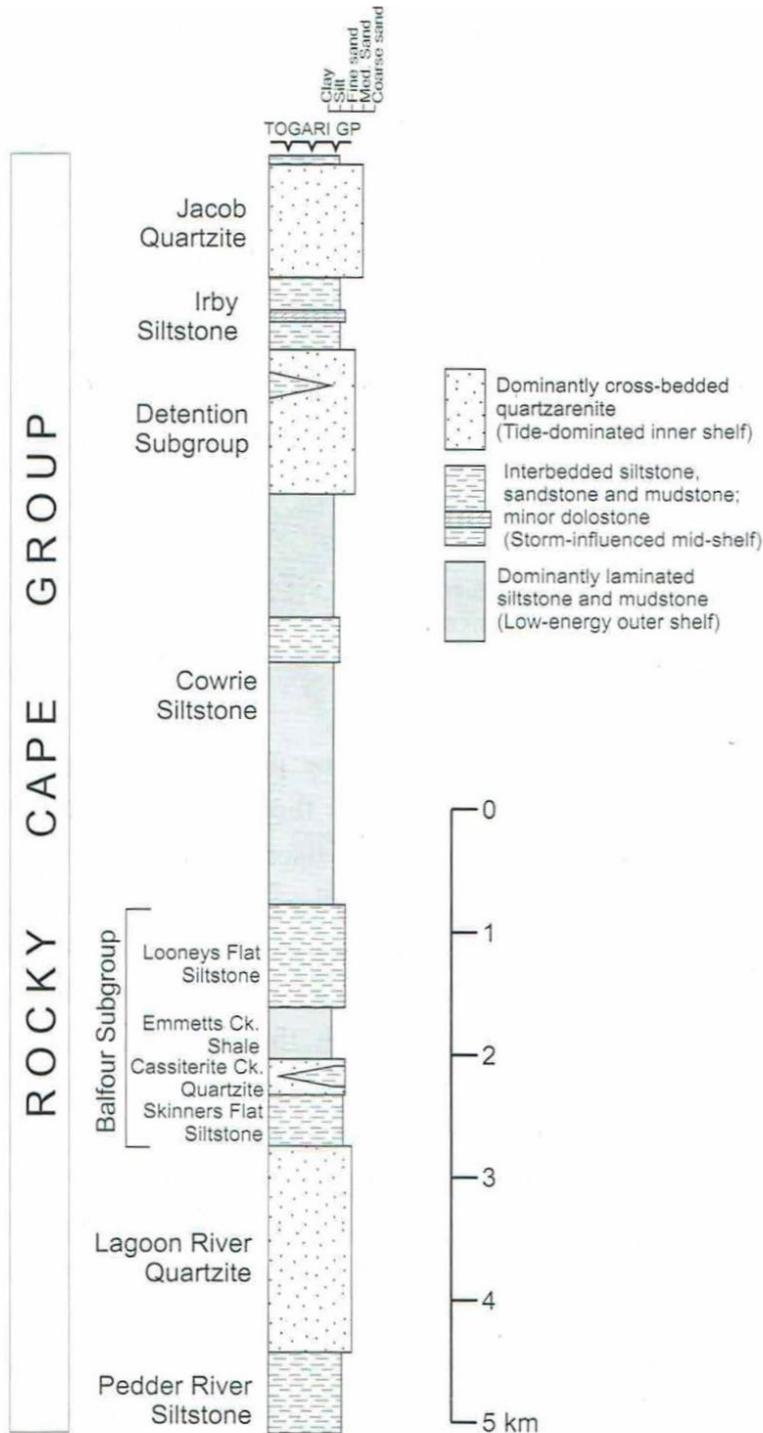


Figure 3.2.1: Rocky Cape Group stratigraphic column (after figure 3.7 in Calver et al. 2014b)

(Seymour and Baillie, 1992; Everard *et al.*, 1996). This has previously been ascribed to a compressional deformational event prior to Togari Group deposition, but it is also consistent with extensional tectonism during that time (Everard *et al.*, 2002).” (Taheri and Bottrill, 2004)

“The Togari Group is up to four kilometres thick and mainly consists of conglomerate, dolomite and chert, siliceous and volcanoclastic sedimentary rocks, and basalt. It is divided into the Forest

Conglomerate and Quartzite (0–120 m thick), Black River Dolomite (~800 m), a sequence of intercalated lithicwacke, tholeiitic basalt, diamictite, lithicarenite, hematitic ironstone, mudstone and impure carbonate (Kanunnah Subgroup ~1400 m), Smithton Dolomite (~1500 m), and the uppermost Salmon River Siltstone (~350 m).” (Taheri and Bottrill, 2004) (see figure 3.2.3). “The basalt units (Spinks Creek Volcanics) form the middle to lower part of the Kanunnah Subgroup and are thickest east of the Roger River Fault. They mainly consist of massive to locally pillowed, dominantly tholeiitic basalt. The volcanic rocks are metamorphosed up to the prehnite-pumpellyite or, rarely, greenschist facies. They are commonly anomalous in copper, reaching up to 590 ppm (Everard *et al.*, 2007).” (Taheri and Bottrill, 2004)

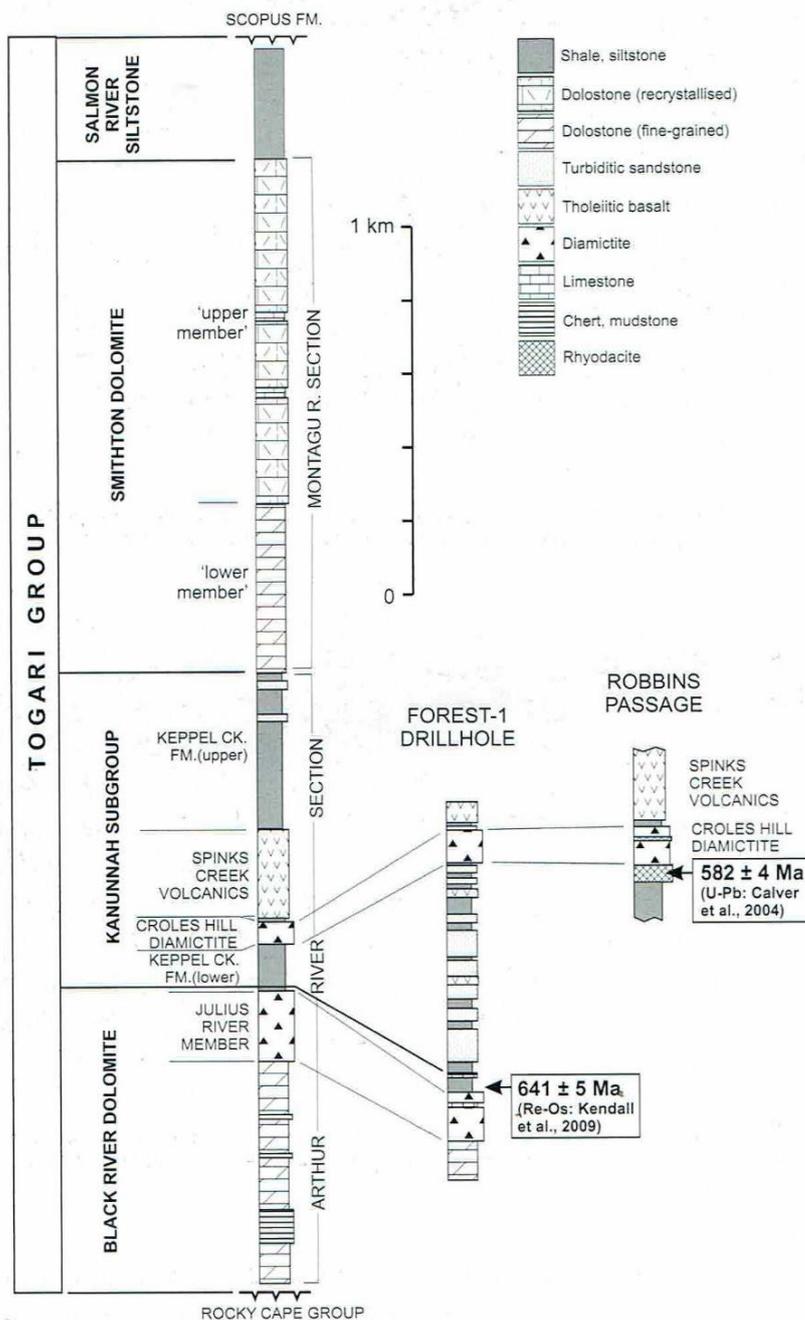


Figure 3.2.2: *Togari Group stratigraphic column (after figure 3.29 in Calver et. al. 2014b). Note significantly different vertical scale to figure 1.4. The Togari Group is of the order of 3km thick whilst the Rocky Cape Group is of the order of 10km thick.*

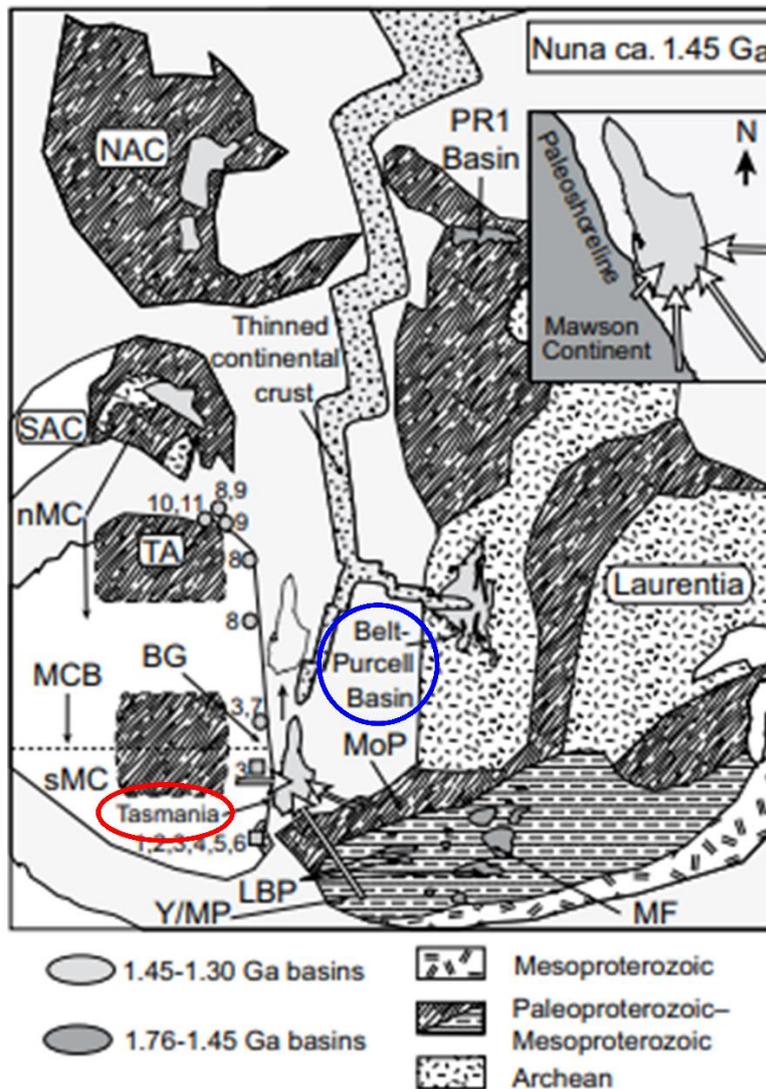


Figure 3.2.3: *Showing location of Tasmania in the Nuna Supercontinent c.a. 1.45Ga (after Figure 2 from Mulder et. al., 2015). "Proto-southwest United States-East Antarctica (SWEAT) paleogeographic reconstruction of Nuna ca. 1.45 Ga showing basement terranes and Paleoproterozoic-Mesoproterozoic sedimentary basins relevant to this study (following, e.g., Goodge et al., 2008; Medig et al., 2014 – see Mulder, 2015 for references). The relative positioning of the continents follows Pisarevsky et al. (2014), but rotated ~180° to reflect present-day orientations. Inset shows inferred paleoshoreline and dominant paleocurrent modes derived from crossbedding in lower-middle Rocky Cape Group (RCG), northwest Tasmania (present-day coordinates). The paleoshoreline of the Tasmanian Mesoproterozoic basin has been rotated to parallel the orientation of the inferred Mawson continent margin. The exact position of Tasmania along this paleomargin is poorly constrained (dotted outline marks possible alternative position), but our detrital zircon data suggest a close link to 1.45 Ga crust in the southern Mawson continent. NAC—North Australian craton, SAC—South Australian craton, nMC, sMC—northern and southern Mawson continent, TA—Terre Adélie, Y/MP—Yavapai-Mazatzal Province, MoP—Mojave Province, GR—Grenville Province, LBP—lower Belt-Purcell correlates, MF—Marquënes Formation, BG—Byrd Glacier, MCB—boundary between the northern and southern Mawson continent. Paleocratonic margins are unknown and approximated by light gray fill. Circle and square symbols mark location*

of data assigned to northern and southern Mawson continent, respectively; numbers adjacent to symbols correspond to data sources listed in the Data Repository (see footnote 1)". Red and blue circles showing likely position of Tasmania and Belt-Purcell basins respectively added.

3.3 Structure

“Two early phases of syn-depositional extension were followed by at least four compressional phases of deformation within the area. The first two phases of deformation (D1, D2) are possibly of Cambrian age whereas D3 and D4 are considered to be Devonian in age. D3 is the main deformation phase and is characterised mainly by northwest-trending folding, some cleavage development and major northeast-directed low and high angle thrusts, one of which hosts the copper mineralisation at Murrays Reward mine along the copper belt.” (Reed *in* Everard *et al.*, 2002).” (Taheri and Bottrill, 2004)

Table 3.3.1: Deformation Events in the Balfour-Temma Area

<i>Deformation events in the Balfour–Temma area (A. R. Reed and D. B. Seymour, pers. comm.)</i>			
<i>Deformation event</i>	<i>Nature of deformation</i>	<i>Description/location</i>	<i>Mineralisation</i>
Extension	Growth faulting associated with deposition of Rocky Cape Group	Outcrop-scale growth faulting near Temma coast	
Extension	Growth faulting associated with deposition of Togari Group	Block rotation during extension may account for unconformity between Rocky Cape and Togari groups	
D ₁	?Tyennan Orogeny	Foliation pre-dates chlorite porphyroblasts observed in thin sections of Rocky Cape Group rocks (e.g. southeast of Mt Franklin)	
D ₂	Tyennan Orogeny/ Tabberabberan Orogeny	E-W trending folds and cleavage in Rocky Cape and Togari groups (e.g. southwest of Mt Frankland)	
D ₃	Tabberabberan Orogeny	NW-trending folds and thrusts. Reactivation of Roger River Fault	Copper mineralisation (Murrays Reward mine), Sn-W mineralisation (Specimen Hill)
D ₄	Tabberabberan Orogeny	Open upright north-trending folds (regionally developed)	

“D3 is represented as NW trending NE vergent folding and axial planar cleavage associated with NE directed thrusting that partially inverted the stratigraphy of the Rocky Cape and Togari Groups (Everard *et al*, 2007). One thrust hosts the copper mineralisation of the Balfour District.” (Taheri and Bottrill, 2004).

3.4 Intrusives

3.4.1 Proterozoic Mafic Dykes – Tayatea Dyke Swarm

The Rocky Cape Group has been intruded by a series of mafic dykes known collectively as the Tayatea Dyke Swarm. The narrow but elongate sub-vertical bodies (up to tens of metres wide but up to kilometres in length) have chilled margins and a range in composition but are generally tholeiitic to transitional and doleritic in composition though unpublished work by MRT geologists (Bottrill pers. comm.) suggests that some have lamprophyric and/or kimberlitic characteristics. They are commonly altered with dolomite a common alteration mineral. They generally trend north to north-northeasterly in the northern part of the Balfour Project Area but can be more east-northeasterly to southeasterly in the southern part of the Balfour Project Area.

Examples are intersected in DDH R41S02 at the Roaring 41 South prospect and probably also in DDH29 at the Waratah prospect. They are also intimately spatially associated with copper mineralisation at both the Toner River and Copper Reward (Interview River East) prospects with

copper mineralisation occurring immediately adjacent or in cross-cutting or conformable internal veins though there is no suggestion of them being coeval.

They have been dated as older than 584-600Ma and are not known to intrude the Togari Group. A likely explanation is that they represent an early Ediacaran period of rift magmatism (Calver and Everard, 2014 in Calver *et. al.* 2014).

Recent unpublished work on examples from the Temma area to the immediate west of the Balfour Project Area suggests that some show characteristics of lamprophyres or kimberlites and Bottrill *et.al.* (unpublished) draws attention to the fact that the only known occurrence of diamonds in Tasmania is in rivers and creeks draining Rocky Cape Group rocks in the Donaldson River area to the immediate southeast of the Balfour Project Area.

3.4.2 Devonian Granite

On the coast along the southwestern margin of the Balfour Project Area and just to its west are two outcropping bodies of granite referred to individually as the Pieman (or Interview) and Sandy Cape Granite bodies with the surface between the two obscured by recent sands and gravels. These are referred to collectively as the Interview Suite or Interview Granite (McClenaghan, 2014 in Calver *et. al.*, 2014).

The exposed Interview Granite is a strongly peraluminous biotite k-feldspar S-type granite consisting of quartz, perthitic k-feldspar, plagioclase, biotite, muscovite and accessory cordierite and garnet. The Interview Granite is one of the most highly fractionated of the western Tasmanian granites with elevated Rb content (McClenaghan, 2014 in Calver *et. al.* 2014).

The Interview Granite has been dated as 300-340Ma and was emplaced late in the Middle Devonian Tabberrabberan Orogeny. The granite is associated with known hard rock tungsten and tin mineralisation as well as alluvial tin at the Interview River prospect.

Modelling by Leaman and Richardson (1992, 2003) in figure 3.4.1, Leaman (1991; 91_3213) in figure 3.4.2, Leaman and Webster (2002) in figure 3.4.3, and Bissett (2009a; 10_6024a) in figure 4.3.28.1 indicates that a granite ridge intrudes to less than 1km from the surface at Balfour just west of Specimen Hill with Leaman and Richardson (1992, 2003), Leaman (1991; 91_3213) and Leaman and Webster (2002) also suggesting that the granite ridge extends the length of the north-northwest Balfour Copper Belt linear with deeper batholith underlying the majority of the Balfour Project Area (see figures 3.4.1, 3.4.2 and 3.4.3).

The depth to granite contours are summarised in the following figures which strongly suggest that the granite body beneath the Balfour Project Area is contiguous with granitic bodies (of both I and S type) which underlie and have generated the world class tin deposits at Renison Bell and Mt Bischoff as well as numerous other smaller deposits (see figures 3.4.1 and 5.3.1).

Webster (Leaman and Webster, 2002) interprets ternary radiometric data to suggest that the granite underlying the Toner River may be an I-type body in contrast with the S-type which outcrops on the coast. This may explain the presence of allanite in wallrock alteration at the Silver Reward prospect, a mineral more associated with I-type granite bodies.

Besides the presence of granophile metals (tin, tungsten) at Balfour greisenised veining has been exposed at Tatlows prospect at Balfour and near The Clump. DDH BJV004 intersected a felsic dyke described by Callaghan (2011) as a "pale cream, fine grained felsic dyke? muscovite-carbonate altered, vughy with coarse cassiterite. Griesenised granitic intrusive? Tourmaline altered selvedge".

The presence of granite bodies near surface at Balfour is of major significance in the recognition that the Balfour Project Area may well be hiding a world class tin and/or tungsten deposit as well as the potentially genetically associated copper deposits and base metal deposits in a zoned system around a granite body.

3.4.3 Tertiary Basalt

In addition to the above the Balfour Project Area contains a few small outliers of Tertiary basalt lavas and potentially intrusive plugs. These are not of economic interest. One such occurrence underlies the copse of trees after which The Clump is named. The township of Balfour is built on another occurrence.

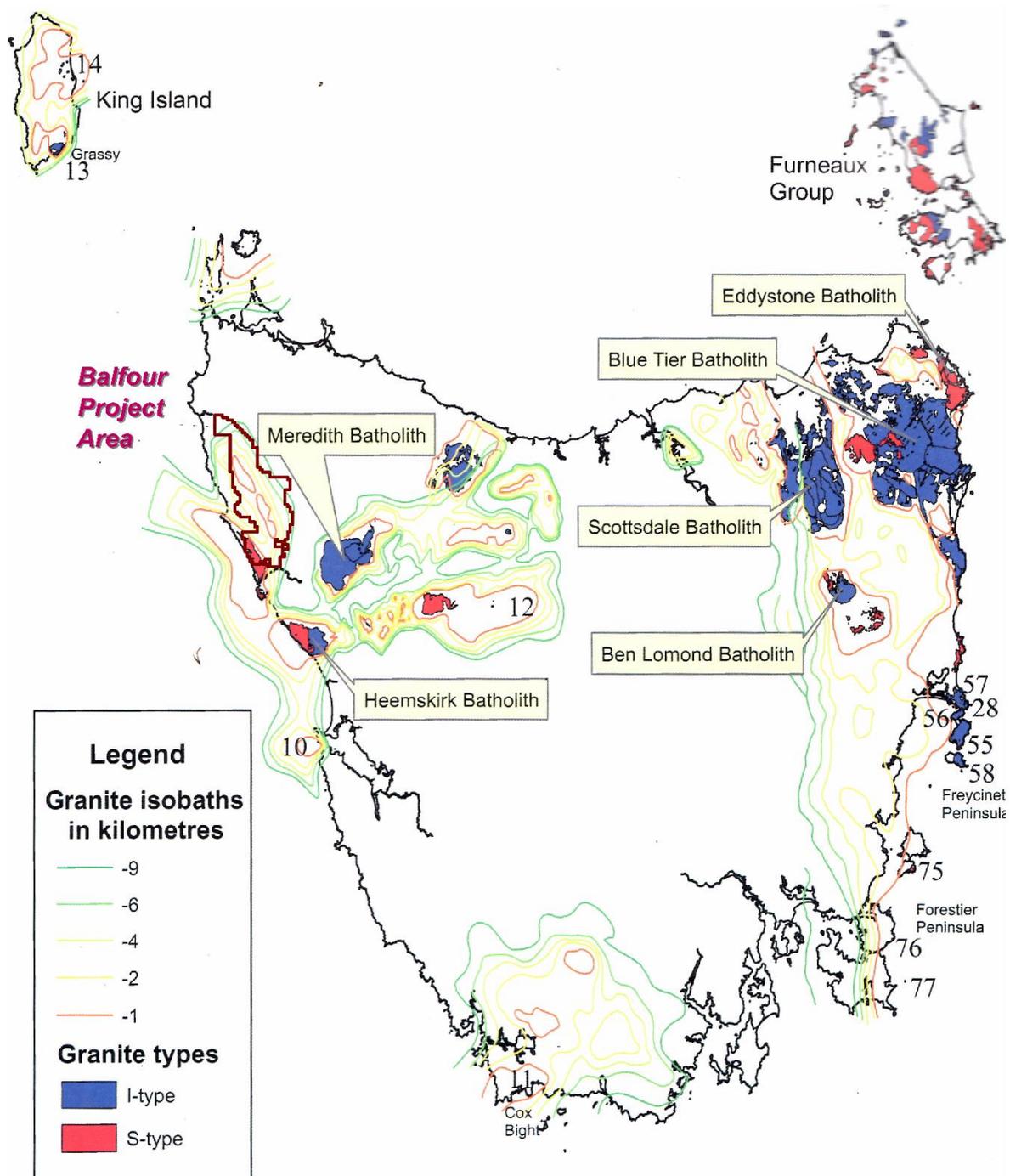


Figure 3.4.1: “Distribution of mid-Palaeozoic Tasmanian granites. Numbers on the map correspond to the numbers in brackets after granite bodies in Table 6.1 (in Calver et. al. 2014). Isobaths of upper surface of granite, inferred from gravity, after Leaman and Richardson (1992,

2003)" taken from figure 6.20 in Seymour et. al. 2014 in Calver et. al. (eds) 2014, with the addition of the Balfour Project Area outline in maroon.

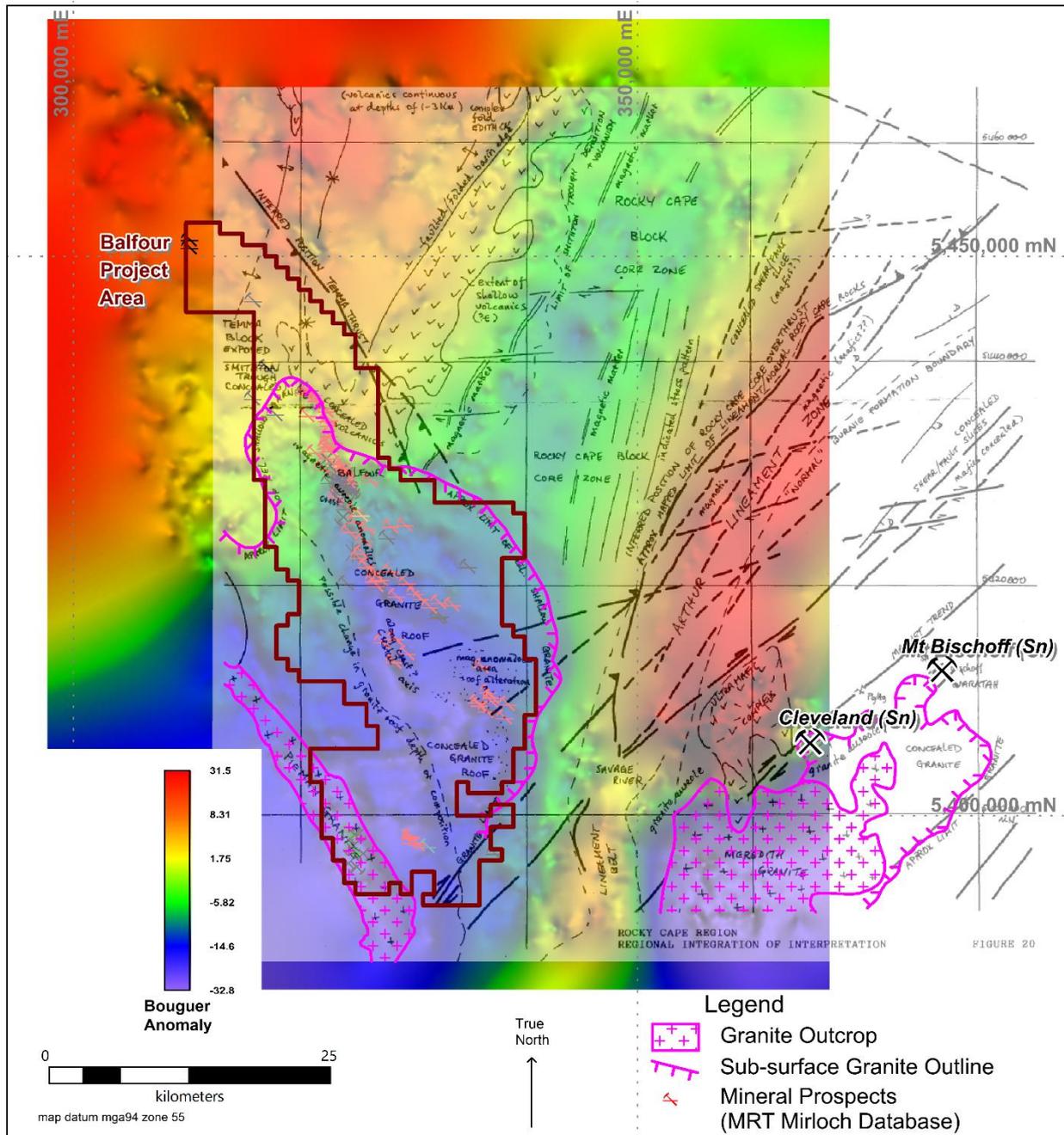


Figure 3.4.2: Bouguer anomaly gravity image of Tasmania's northwest with the Balfour Project Area as maroon outline. Data is from Tasgrav database with superimposed interpretation from Leaman (1991). Coloured symbols are mineral occurrences from MRT's database (legend for these is in figure 3.2.1). The outcropping granite bodies and sub-surface granite outlines have been colour enhanced to aid in visualisation).

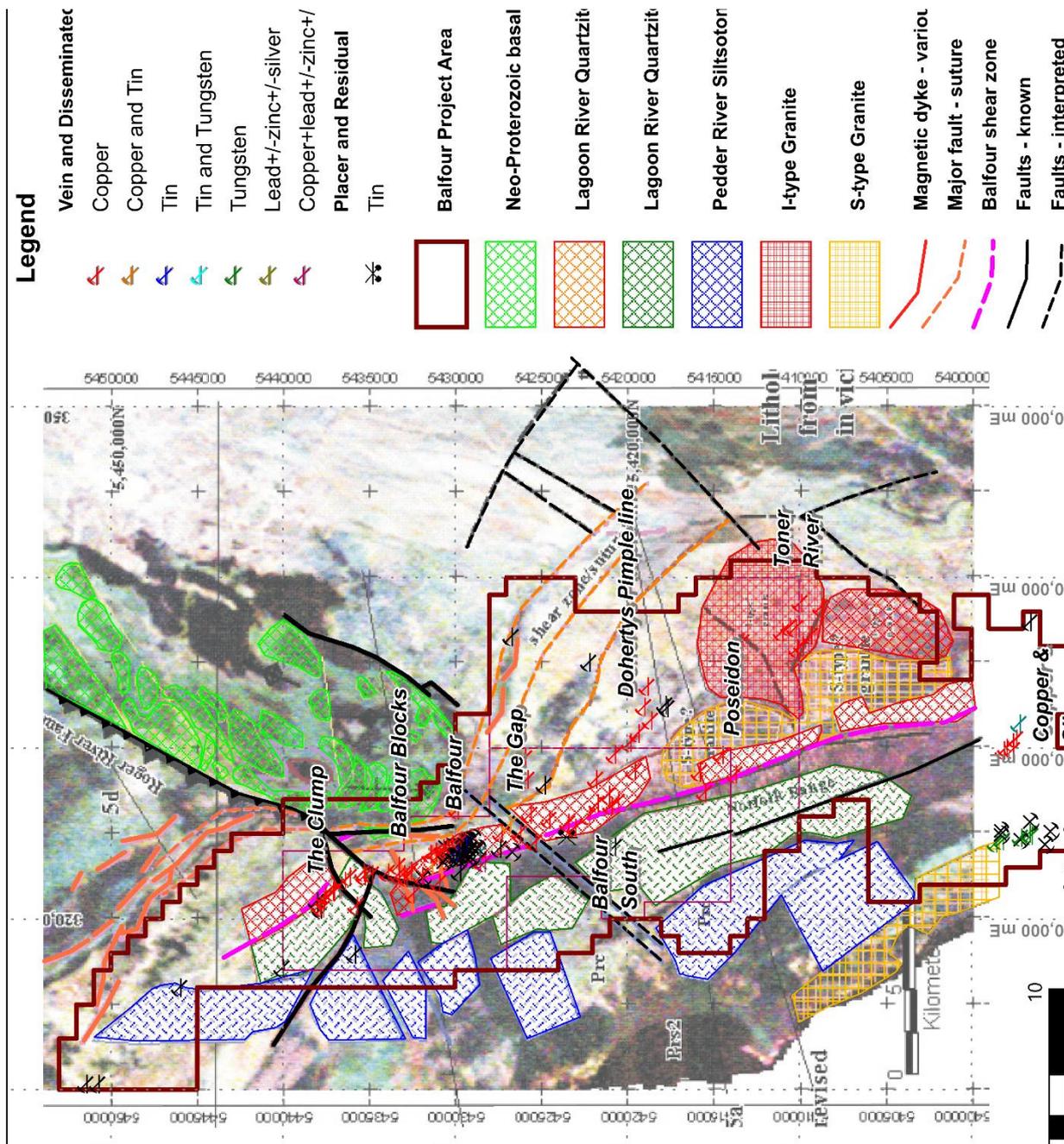


Figure 3.4.3: *Leaman and Webster (2002) ternary radiometrics image overlain by interpretation by Webster in Leaman and Webster (2002). This image has been overlain with coloured polygons and linework traced from Webster's original image to enhance a poorly pixelated image in Leaman and Webster (2002). Mineral prospect locations from MRT's database have been also overlain.*

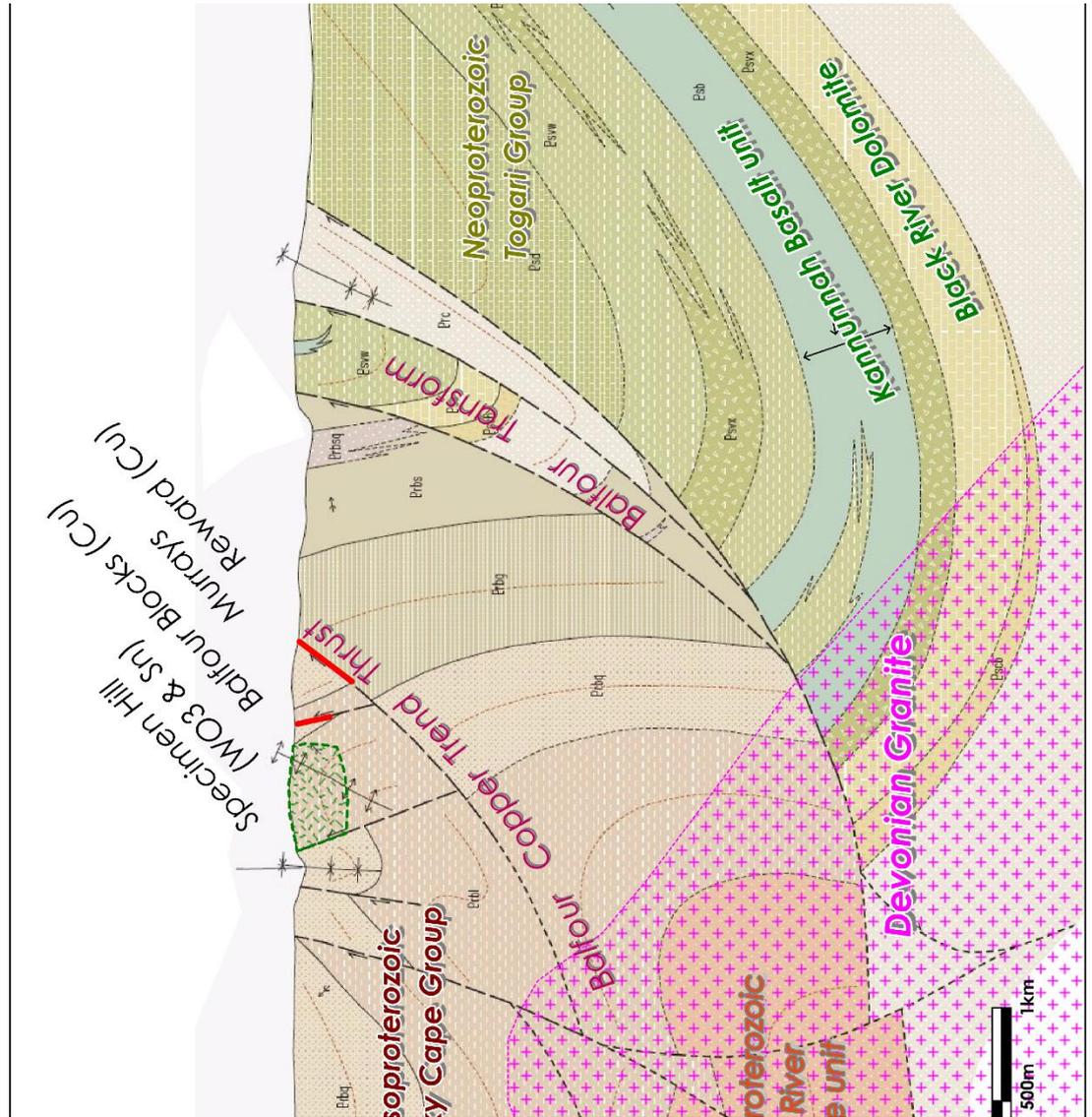


Figure 3.4.4: Schematic, illustrative composite cross-section based on the section on MRT 1:25,000 'Dempster' mapsheet (Everard et. al. (1999) with significant rock units and structures named, the structural location of copper mineralisation at Murrays Reward (projected 2.5km north) and Balfour Blocks, the extent of known WO₃ and Sn mineralisation on Specimen Hill (projected 2.5km north) shown as green hatch, and the modelled extent of Devonian Granite (based on contours in Taheri and Bottrill, 2004 – see figure 3.1.1).

3.5 Mineralisation

The geology of the Balfour Project Area (BPA) is known to contain hard rock metallic mineralisation in four main assemblages though with some overlap between these (see locations on figures 3.5.3 and 3.5.4).

- copper (+/-gold),
- tin +/- tungsten (+/- copper, zinc, lead)
- lead, silver and zinc (+/- copper)
- magnetite+/-copper+/-gold (+/-base metals)

D & B Mining Pty. Ltd. are aware that other commodities of value might exist such as silica and graphite and possibly diamonds but these have not been addressed in this report.

The mineral occurrences shown on figures 3.5.3 and 3.5.4 are taken directly from Mineral Resources Tasmania's database of mineral occurrences available on their website and are categorised in the field 'commodity' as shown on this figure.

Aside from the work carried out by previous explorers and prospectors detailed in section 4.1 the knowledge of draws from work carried out in the early 2000's Mineral Resources Tasmania on the Balfour region by Mineral Resources Tasmania as part of the Western Tasmania Regional Minerals Programme. The work completed by MRT is described in more detail in section 4.4.2 but includes a number of studies of mineralisation in the Balfour area i.e. Taheri and Bottrill (2004; UR2004_05 "The nature and origins of copper and tin-tungsten deposits in the Balfour-Temma area, northwestern Tasmania") as well as ground truthing of aeromagnetic anomalies and associated studies of mineralisation Taheri, Bottrill and Green (2011; UR2011_01) and Bottrill and Taheri (2003; UR2003_18)

3.5.1 Copper (+/- gold)

The "Balfour Copper Belt" (as per Taheri and Bottrill, 2004; UR2004_05) is a 35km long (arguably 45km if Copper Reward is included), generally <2km wide north-northwest trending mineral field in Tasmania's northwest, containing over 100 known occurrences of copper mineralisation according to MRT's database (see figure 3.1).

Whilst these occurrences are classified as copper deposits there has been a remarkably limited amount of gold assaying (only four of a total of forty three drill holes targeted at copper have been assayed for gold). However, rock sampling has shown that gold does occur with copper mineralisation in many instances and at grades which would potentially complement the value of any copper concentrates produced hence the copper (+/- gold) description of this particular assemblage.

Rock sampling (grab samples) by such workers as Taheri and Bottrill (2004; UR2004_05) report assays of up to 1g/t gold and 5.8% copper at the Murrays Reward mine (sample 108214), and 2g/t gold and 0.1% copper (sample 108409C) and 0.2g/t gold and 9.65% copper (sample 108409B) at the Balfour South prospect.



Figure 3.5.1: Outcrop at Balfour South lode.

Known copper (+/- gold) mineralisation is hosted within structural settings within the Rocky Cape Group rocks, and particularly in the pyritic carbonaceous and/or chloritic shale facies of the Balfour Subgroup.

Mineralisation consists of veins, disseminations, replacements, breccia infillings (splashes) and semi-massive pods occupying dilational zones, largely within a in a persistent north to north-northwest striking, west dipping reverse fault system referred to herein as the Balfour Copper Trend Thrust, as well as in secondary splays and discrete but coeval faults such as the structure which extends southeastwards beneath Doherty's Pimple.

Copper mineralisation occurs as chalcopyrite in fresh rock but has oxidised in part to chalcocite, covellite and digenite near surface. Malachite and azurite also occur at surface in some instances with a bulk sample of 134 tons @ 24% copper of largely malachite dug from surface at the Murrays Reward mine (Marty Laan pers. comm.).

Copper mineralisation within faults is hosted in a gangue of massive quartz+/-carbonate (predominantly dolomite)+pyrite vein material or in smaller quartz+/-carbonate(predominantly dolomite)+pyrite veinlets within sheared carbonaceous and/or chloritic slate. Many examples of mineralisation show evidence of deformation and there are a number of generations of barren quartz+/-dolomite veining indicating that mineralisation occurred during deformation.

Whilst not apparently associated with copper mineralisation extensive early chloritization has altered to host rocks in many instances. Later chlorite also commonly accompanies quartz+/-carbonate+/-sulphide veins.

The early chloritization is commonly overprinted by pervasive silicification.

In the mineralised zones massive carbonate, predominantly dolomite but also siderite and magnesite, predates the later copper bearing quartz+/-carbonate+/-sulphide(+/-chlorite).

Recent drill hole DBBA1 intersected the main reef structure at a depth of approximately 350m below the surface, the reef displays a number of the characteristics described above.

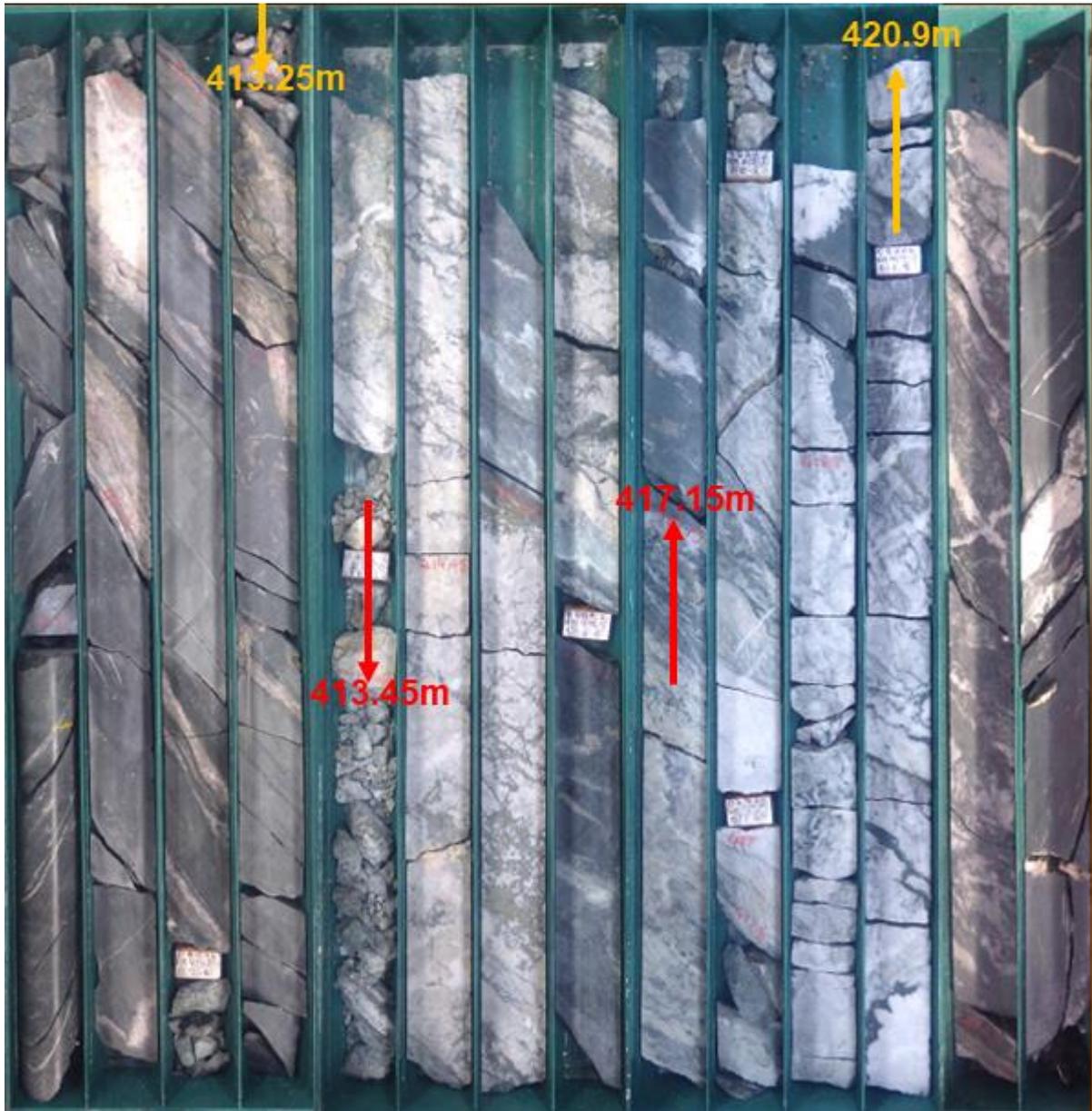


Figure 3.5.2: DBBA1 Main Reef structure. Interval 413.25m to 420.9m assayed 7.65m @ 0.81% copper including 413.45m to 417.15, 3.7m @ 1.59% copper.

Taheri and Bottrill (2004) report that sulphur isotopes of sulphide minerals in quartz+/-carbonate+sulphide (+/-chlorite) veins are uniformly high (sedimentary dominated) ranging from ~20-23 per mil. with fluid inclusions in the quartz of low salinity (2-15 weight per cent equivalent NaCl) with variable homogenisation temperatures (<200° to 400° C). They also note that there is no correlation between fluid inclusion homogenisation temperatures and sulphur isotopes with the modelled depth of granite from gravity data. They also note that the copper bearing veins are commonly anomalous in Co, Ni and to a lesser degree Au but lack any heavy metals.

Taheri and Bottrill (2004; UR2004_05) conclude that the copper deposits along the copper belt at Balfour were formed during regional hydrothermal events which focussed metamorphic, late granitic and meteoric fluids along faults. These fluids dissolved, transported and subsequently deposited copper, possibly from an existing, sediment-hosted copper deposit."

The regional hydrothermal event is considered to be the Middle Devonian Tabberrabberran Orogeny.

Regarding the source of the copper Taheri and Bottrill (2004; UR2004_05) state that it is “conjectural” but that a sedimentary origin is favoured drawing parallels with the Zambian Copper Belt noting that the Balfour copper mineralisation is similarly anomalous in Ni and Co.

“Copper-anomalous, sedimentary pyrite-rich, carbonaceous slate and siltstone has been identified within the Balfour area and may represent a low-grade, stratiform copper deposit. This represents a possible source of sulphur and copper for the fault-related copper deposits along the belt. Magnetic images indicate a spatial association between the locations many of the copper ore deposits in the Balfour and the Temma areas and some linear anomalies probably representing underlying, shallow, strongly magnetic bodies (figure 3.4.4). Low grade copper is also known in Proterozoic basalts, but these have not been observed in the mineralised areas. The magnetic nature of the copper-rich units identified at Balfour is not known.” (Taheri and Bottrill, 2004; UR2004_05)

Previous explorers, specifically CRAE and Pacific Nevada have also favoured a sedimentary origin for the high grade structurally hosted copper deposits known from along the Balfour copper belt.

A number of explorers have tested the magnetic anomalies intersecting disseminated pyrrhotite which when remanent magnetism is considered appears to explain these anomalies at least in part, and have based subsequent exploration on this understanding. In contrast semi-massive magnetite has been intersected at the Roaring 41 South prospect (Callaghan, 2010; 10_6024) and noted from outcrop at Copper Reward (Taheri, Bottrill and Green, 2011; UR2011_01) prospect whilst disseminated magnetite is reported from DDH6 at The Clump (McIntyre 1973; 73_0947), possibly at Balfour South (Ward 1911; GSB10) and Toner River prospects (Bishop, 1989a; 89_2969a).

As noted in section 3.2 recent academic work by Halpin *et. al.* (2014) and Mulder *et. al.* (2015) on the geochronology of the Rocky Cape Group rocks has suggested that these rocks are correlates of the Belt-Purcell Supergroup rocks in North America, with Tasmania originally part of Laurentia around 1.45Ga. This is highly significant to the prospectivity of the Rocky Cape Group as the Belt-Purcell Supergroup is known to contain a number of significant sediment hosted copper and base metal deposits.

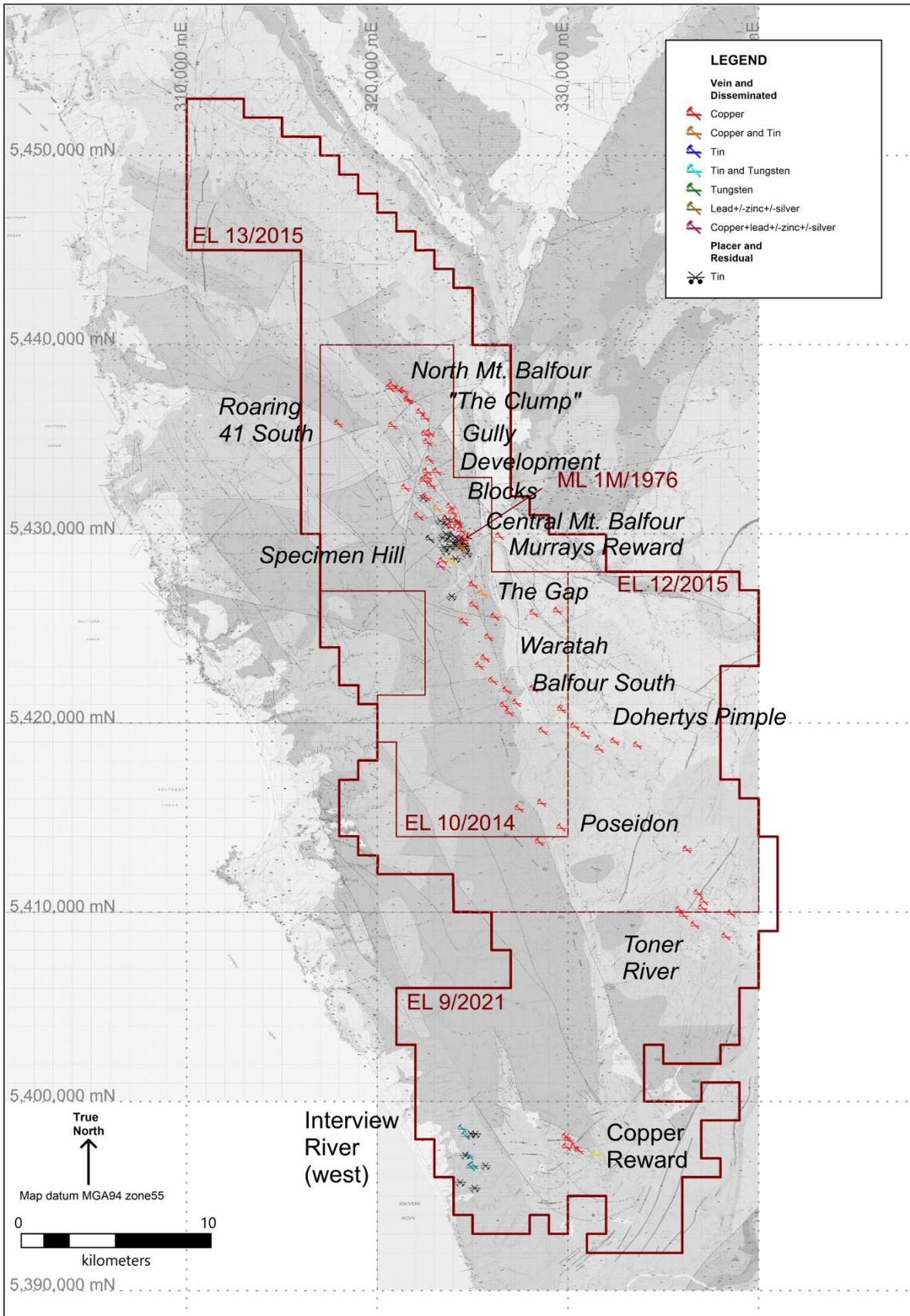


Figure 3.5.3: Balfour project area showing tenements with Mineral Resources Tasmania's mineral occurrences database metallic prospects shown as symbols colour coordinated per commodity

with major prospects named, against a backdrop of Mineral Resources Tasmania's 1:25,000 mapsheets.

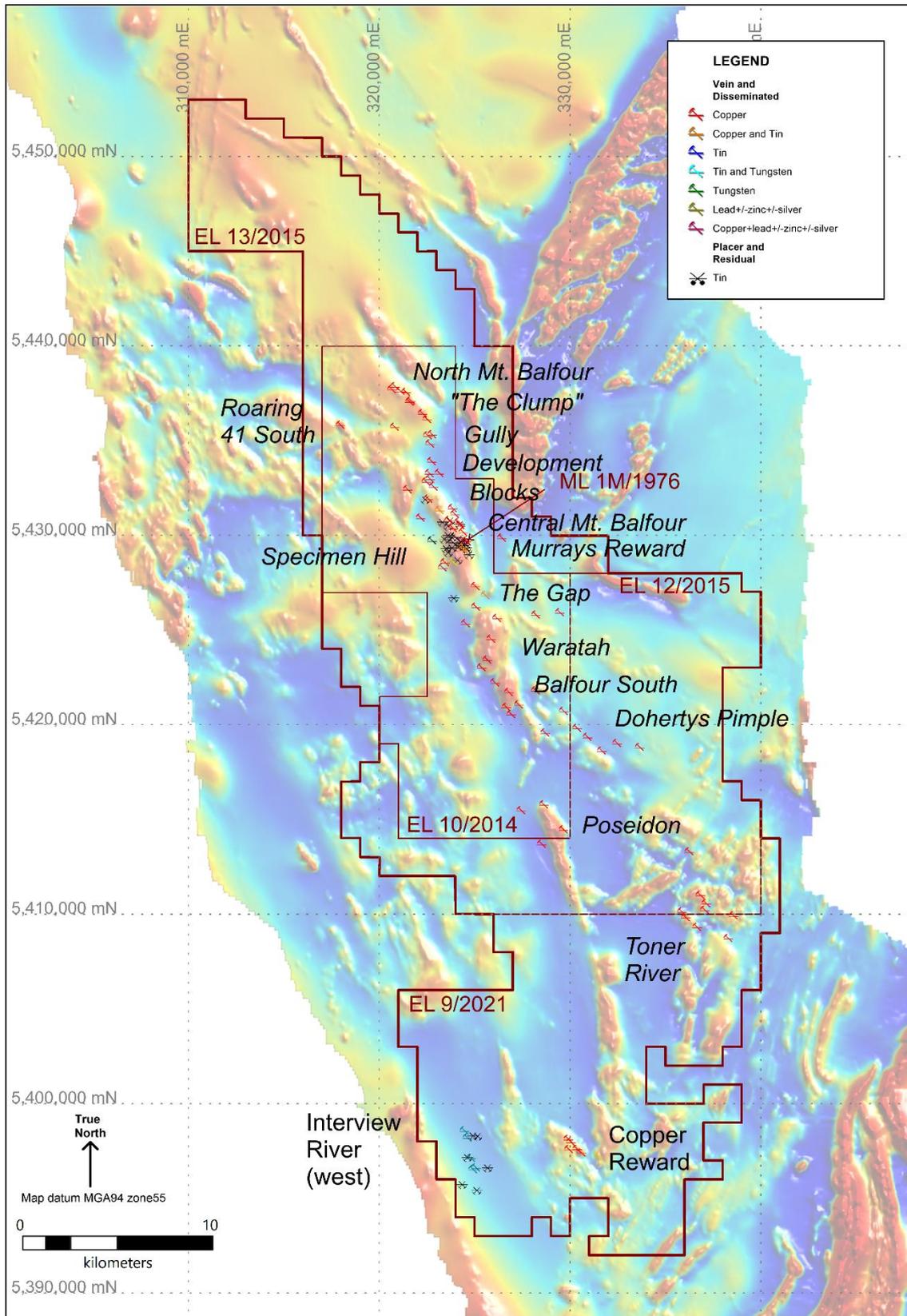


Figure 3.5.4: Total Magnetic Image (TMI) of Tasmania's northwest with the Balfour Project Area as maroon outline. Magnetic data is from MRT's WTRMP 2002 aeromagnetics survey. Prospects as per figure 3.4.1. Note quite strong broad spatial correlation between magnetic highs (red) and known copper prospects.

3.5.2 Tin +/- Tungsten

As described in section 4.2 the Balfour mineral field was originally discovered by early prospectors due to the alluvial tin found in the creeks in the immediate Balfour area. Alluvial tin occurs in Cassiterite (Tin) Creek, Emmetts Creek, Matrix Creek, Looneys Flat, Skinners Flat as well as other unnamed creeks draining the eastern slopes of Mt Balfour. Eluvial tin occurred quite extensively on Specimen Hill and to a lesser degree Peters Ridge.

Similarly the Interview River (west) mineral field at the southwestern corner of the Balfour Project Area was originally discovered and worked for its alluvial tin in Cooneys Creek, Race Creek, Kennys Creek and Spencer Creek, and in tributaries of the latter two creeks.

Hard rock tin as well as associated tungsten mineralisation occurs at both areas.

At Specimen Hill at Balfour and the other nearby hardrock prospects i.e. Tatlows, Robbies, Peters Ridge tin and tungsten mineralisation is hosted within the Rocky Cape Group sediments, whilst at the Interview River (west) prospect in the southwestern corner of the Balfour project Area it is hosted within the Interview (Pieman) Granite.

At Specimen Hill outcropping tin and tungsten occurs in thin commonly vuggy quartz dominant veins with tin as cassiterite and tungsten as wolframite respectively. Below the water table these veins are massive to semi-massive sulphide with variable quartz. Sulphide minerals include pyrite, pyrrhotite, arsenopyrite, and chalcopyrite. Tourmaline is often associated both in veins and wallrock alteration, silicification occurs in wallrocks and disseminated pyrrhotite occurs in specific spatially associated sedimentary units.



Figure 3.5.5: Quartz veins of the style which host tin and tungsten mineralisation on Specimen Hill (after Plate 25 " A network of quartz-cassiterite-wolframite veins hosted by siltstone in the Specimen Hill area." in Taheri and Bottrill, 2004)

The veins occupy fractures within pre-existing and reactivated tensional zones which have been exploited by volatiles exsolving from the Devonian granite body. On Specimen Hill this tensional zone is in a the hinge zone of a north-northwest trending, south plunging anticline, on the eastern side of an east dipping fault.

Taheri and Bottrill (2004) report that sulphur isotopes in these veins are lower than in the copper veins and range from 7.44 to 15.2 per mil. with fluid inclusions in the accompanying quartz low salinity at ~7% weight equivalent NaCl and record high homogenisation temperatures up to 400° C.

These characteristics and the clear granophile mineral assemblage (including greisen style alteration in Tatlows shaft as well as to the north of the Clump) also provides compelling evidence for a genetic relationship with the shallow (~1km) granite ridge beneath Specimen Hill modelled from gravity data. (Leaman, 1991, ;Leaman and Webster, 2002; and Bissett, 2009a; 10_6024a)

This interpretation of a granite ridge is shown in figures 3.4.1 and 3.4.5.

At the Interview River (west) field north-northeast striking quartz, pyrite, wolframite, tourmaline, sericite and arsenopyrite and minor cassiterite and scheelite veins generally <0.4m thick occur in an en-echelon pattern which extends arguably over a strike length of 2.5km (Taheri , Bottrill and Green 2011; UR2011_01). Mineralisation occurs within veins as well as in greisenised selvages and greisen. Significantly anomalous gold was reported from one of the only two drill holes to have tested the structures at (moderate) depth with DDH1 assaying 2.48m (from 44.15m) at 0.13g/t gold as well as 300ppm Sn, 800ppm WO₃ and 200ppm Mo (Brink, 1985b).

3.5.3 Lead +/- Silver +/- Zinc

There are a number of base metal occurrences within the Balfour Project Area (other than copper), though none yet have approached potential ore grades or volumes.

Anomalous zinc and to a lesser degree lead occur in some tin +/- tungsten veins and is probably part of a zoned system around the granite body at depth. Anomalous zinc and lead in soils to the southwest of Specimen Hill was drill tested by drill hole JB3 which intersected galena and sphalerite in narrow quartz veins and is likely of this origin.

At the Nelson Prospect anomalous lead and zinc in soils was drill tested by a fence of shallow drill holes which intersected elevated zinc in a carbonaceous sediment which is considered to explain the anomaly. This occurrence might be more related to a sedimentary hosted style.

Towards the southern end of the BPA the Silver Reward workings contain argentiferous galena (as sampled from dumps around the shaft). Work by Bottrill *et. al.* (2011) shows that this occurrence is associated with elevated REE, U and Th and unlikely to be granite related. The occurrence is also associated with deeper magnetic anomalies which are apparently unexplained. They recommend more work on resolving the genesis of this style of mineralisation.

3.5.4 Magnetite+/-Copper+/-Gold (+/-base metals) ('Temma ironstones')

Lodes of dominantly magnetite are known from the Temma area to the west of the Balfour Project Area and referred to informally as the 'Temma ironstones'. These bodies strike north-northwest to northwest dipping steeply to the west, cross-cutting the northeast dipping host sediments and are up to 15m wide and 1km long (Dove, 1988). They contain varying amounts of hematite, chalcopyrite, tetrahedrite, galena, sphalerite, pyrite, Fe-Mn carbonates, stilpnomelane and grunerite, but relatively little quartz (Taheri and Bottrill, 2003).

The Nelson Bay River deposit is the largest of these but others include Strickland, Rebecca and Little Eel (all outside of the BPA) (see figure 5.5.1). They have been interpreted as metasomatized mafic or

ultramafic dykes (Seymour *et. al.* 2014) probably of the Tayatea Dyke Swarm intrusives and whilst only the Nelson Bay River deposit has been mined for direct ship iron, elevated copper and gold has been reported in cross-cutting veinlets and copper in chloritically altered wallrocks with 10m at 0.47% copper reported from the Little Eel prospect (Dove, 1988) and gold grades up to 2.2g/t gold reported from the Strickland prospect (Newnham, 2000).

Callaghan (2011) interprets the Roaring 41 South prospect, defined by coincident anomalously high magnetics and gravity (single point anomaly high), and containing sub-economic but elevated copper and gold, within the BPA as an example of this type of deposit. Callaghan (2011) also draws parallels between this style of deposit and the Tennant Creek ironstones.

Taheri and Bottrill (2004) included samples from these Temma Ironstones and concluded that they had similar oxygen and sulphur isotopes and fluid inclusions to the copper deposits and suggest that they have a related genesis.

4.0 Mining and Exploration History

4.1 Introduction

Mineral Resources Tasmania (previously Department of Mines, Tasmania) maintain a comprehensive GIS spatial database of all mines, prospects and mineral occurrences in Tasmania. A query of the prospects within the Balfour Project Area provides a bibliography of reports, old mine plans, mineral occurrences etc. and the ability to download these on-line.

The prospecting and early mining history of the country between the Pieman and Arthur Rivers is described in the following government reports Waller (1901), Ward (1911), Henderson (1935), Thomas and Henderson (1943), Henderson (1943), Taheri and Bottrill (2003), Taheri and Bottrill (2004), Taheri *et. al.* (2011) and Everard (2007).

Tasmanian historian Nic Haygarth, who specialises in early Tasmanian mining history sourcing much of his material from the newspapers of the day, has posted a number of pieces on his website (https://nichaygarth.com/index.php/tag/copper-murrays-reward-mine/#_ftn19;) providing further details of the mining history of the Balfour area.

4.2 Historical Mining and Prospecting (pre-WW2)

The principal source for early mining and geological understanding is Ward (1911) who visited the whole field in 1910. The earliest source is that of Waller (1901) (*Report on Some Wolfram Sections Near Pieman Heads, Dept. of Mines Tasm., OS-079*) but he only visited the Interview River tungsten+tin field initially describing the presence of “three men engaged in (alluvial tin-mining) the small creeks which traverse the granite belt.” before continuing on to state that “in the past years a considerable quantity of tin has been won from the district, but as yet has never been found in-situ.”

Ward (1911) – The Balfour Mining Field. Dept. of Mines Tasm., Geol. Survey Bull. No.10

Ward (1911) provides the best description of the early history of the Mt Balfour Mining field up to his visit in 1911 for the Tasmanian Mines Department and does so as follows:

“The history of the region round Mt. Balfour, or Mt. Lyons, as it was first called - runs back to the beginning of the period of systematic prospecting and exploration on the western coast. The first discovery made on the field was that of alluvial tin ore. The exact date of this discovery is unknown, but alluvial workings are known to have been in existence in 1884, and from that time onwards there have been a few men at work on the alluvial deposits. In March, 1889, a tin reward claim was granted to John Dally for a term of 21 years. This reward lease (No. 694-87M), the term of which has but just expired, was granted for an area of 22 acres on Specimen Hill, near the township of Balfour, which John Dally had held as a prospector's lease since September, 1886.”

“Prospectors made their way southwards, and the southern part of the area with which this bulletin is concerned received some attention during this earliest period of activity. The alluvial workings on the granite country which lies along the coast to the south of Sandy Cape ultimately led to the discovery of wolframite lodes in the granite. A reward claim for wolfram, now Section 5119-M, was applied for by Alfred Foster, and granted to him in the year 1891. Little work, however, was carried out at this time.”

“During the period at which attention was attracted towards this southern portion of the region there was little activity near the present site of Balfour. Only three men were on the field and the tin workings were temporarily abandoned. While prospecting in the district. these three men. "Messrs. V. F. and T. C. Murray and F. H. Smith made the first discovery of copper ore in Tin (= Cassiterite) Creek, near the southern boundary of the reward section (123-M). This reward was applied for in December, 1901.”

“No material progress was made for some years, but the discovery of copper ore on this reward lease led to the prospecting of the country to the northward and southward. The progress of the work of prospecting may to some extent be traced by means of the several reward claims which have been successively granted to prospectors. A. V. Chester's reward section, 2699-M, dates from November, 1906; T. B. Moore's reward on the Toner River, 3484-M, from December, 1907; M. M. McArthur and J. E. Elliott's reward on the Interview River, 3921-M from January, 1908; and R. J. Henry's silver-lead reward, 4930-M, near the last-mentioned, from July, 1910.” (Ward, 1911).

Ward (1911) contains a number of detailed mapsheets with large scale sheets showing the overall extent of tenement coverage with respect to the regional geology, and detailed tenement coverage of each of the individual fields (see figure 4.2.1 which is underlain by Ward's “Plate III Geological Sketch Map of the Mount Balfour Mining Field”).

Ward (1911) also contains individual charts of the various parts of the overall Balfour Project area i.e. “Plate IV Chart of the Mt Balfour Mineral Leases”, “Plate V Chart of the Mt Hazelton Mineral Leases”, “Plate VI Chart of the Toner River Mineral Leases”, “Plate VIII Chart of the Eastern Group of Interview River Mineral Leases”, and “Plate IX Chart of the Western Group of Interview River Mineral Leases”.

These charts of Ward (1911) underlie a number of figures in this report.

On them Ward shows “lodes” as continuous red lines. From reading his detailed report it is clear that he uses the term “lodes” on these plans to refer to a range of geological rock types, including massive barren quartz veins, quartz veins with pyrite with or without copper mineralisation, quartz with tin and/or tungsten, faults and shear zones with chloritic and/or carbonaceous slate, faults and shear zones with or without quartz+/-dolomite veining, and faults and shear zones with quartz+/-dolomite veining with pyrite+/-copper mineralisation – all essentially geological structures. As noted in the text of the report some of these “lodes” are also massive quartzite beds which the early prospectors had mistaken for potentially copper bearing structures.

Thus it is important not to interpret these red “lode” lines as just representing copper, tin and/or tungsten bearing structures. Having said this, overlaying these (georeferenced) red “lode” lines onto geological mapping e.g. MRT's 1:25,000 sheets, as well as industry produced geological maps, shows quite good correlation in many instances with mapped structures, a number of which have been shown to be copper, tin and/or tungsten mineralised, such that it is reasonable to conclude that the red “lode” lines on Ward (1911) plans mostly represent potentially copper, tin and/or tungsten structures which had been discovered during this period of more intense prospecting activity and as such provide a good guide for focussing further exploration.

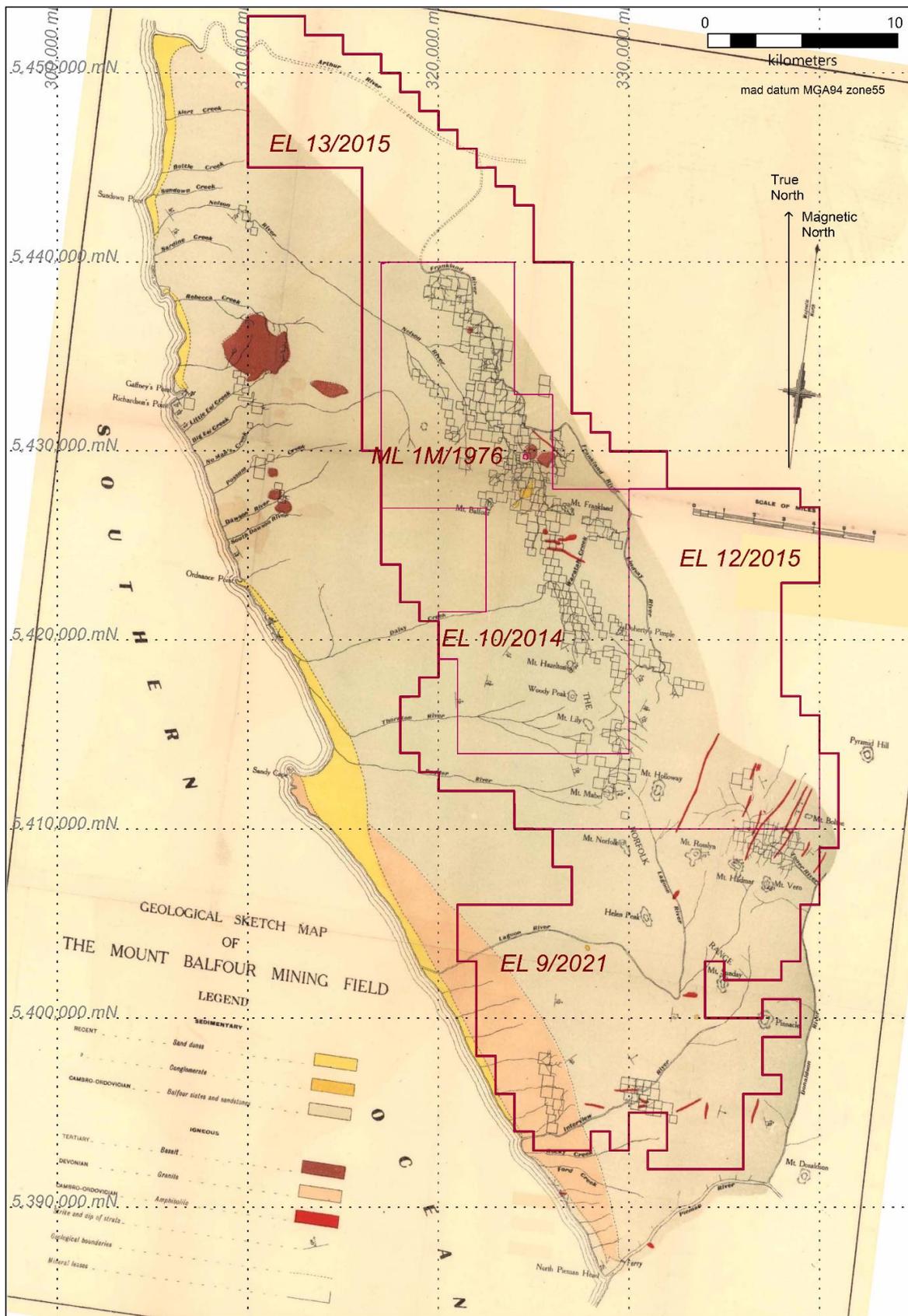


Figure 4.2.1: "Plate III Geological Sketch Map of the Mount Balfour Mining Field" (Ward, 1911) showing the extent of mine lease "Sections" at the time of his visit, with Balfour Project tenements overlain and shown as maroon outlines.

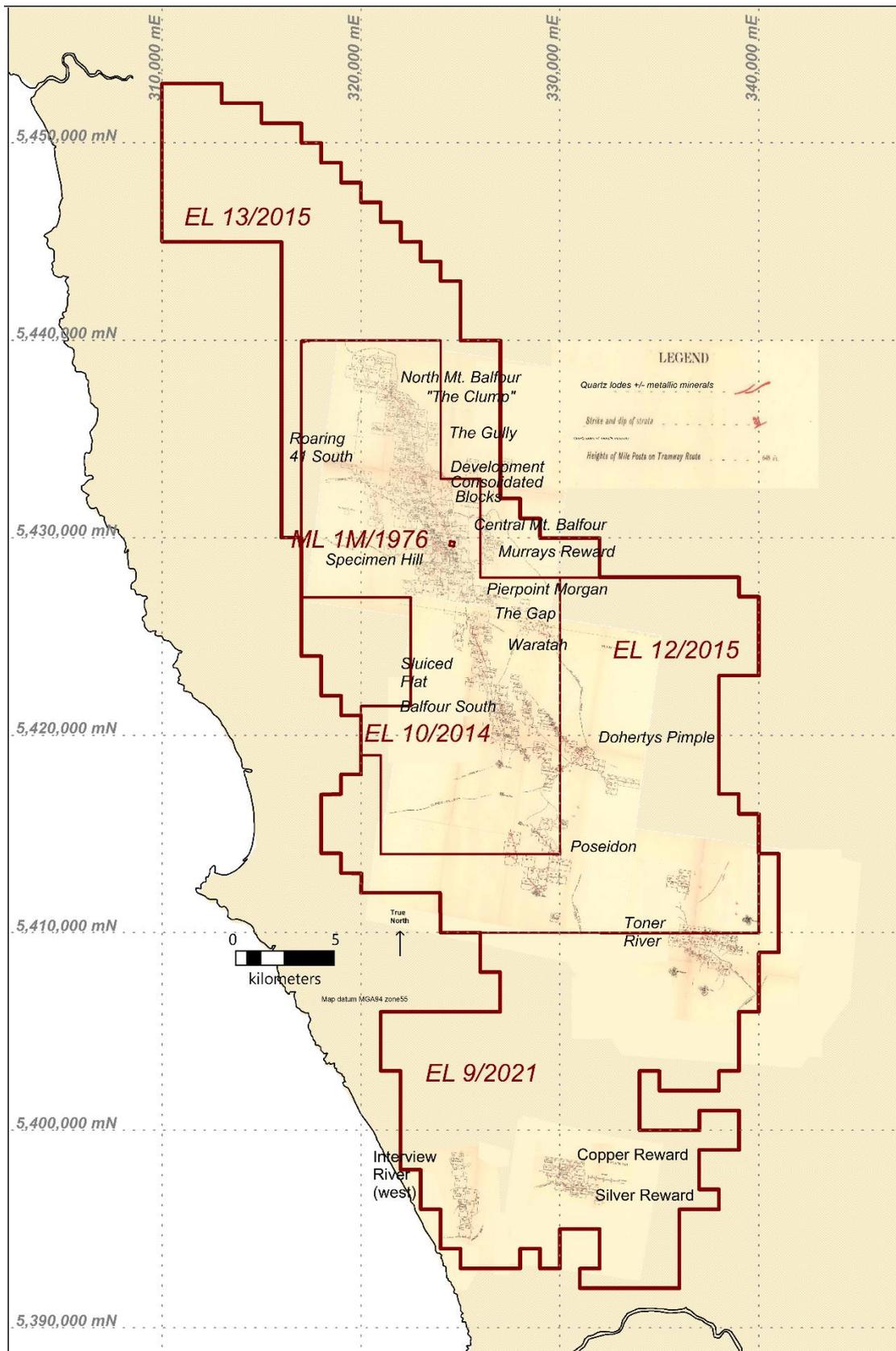


Figure 4.2.2: Composite plan combining Ward (1911) Plates IV, V and VI showing the mine leases at the time of his visit in 1910 with current Prospects named. Current D&B Mining Pty. Ltd. tenement outlines are shown in maroon linework and text.

Henderson (1935) – Report on the Balfour and Interview River Tinfields. UR1935, 8-19

Henderson (1935) was the next government geologist to visit the Balfour and Interview River fields, doing so in 1934 at a dry spell where a lack of water meant that small parties were limited to working Tin (Cassiterite) Creek itself at the time of his visit. Henderson describes the then current state each of the separate alluvial tin workings known colloquially as Tinville, Bricky’s, Skinner’s, Wander’s and Looney’s and provides further detail of the ownership of tin sections in up to his visit on MRT Plan 677.

Whilst Henderson (1934) principally describes the alluvial tin workings he also notes the presence of alluvial gold in the Looneys Flat workings where “gold up to half a pennyweight was also won”, as well as noting the presence of hard rock veins or lodes containing tin and tungsten at Tinville, Emmetts Creek and Specimen Hill.

Henderson refers to Ward’s (1911) statement that “small parcels (of tin) have been filtering away for the last 20 years and it is estimated that thus some 300 tons has been sent to the smelters.”

At Interview River, at the southern end of the Balfour Project Area, Henderson states that “it is quite apparent that the field has not received any attention since L.K. Ward’s investigation – 1910, who then reported that practically nothing had been done since G.A. Waller’s visit – 1901.” Most of the visible work had occurred “in a small deeply entrenched creek, about a mile and a half north of the Interview River.”

Thomas and Henderson (1943) – Balfour Mining Field, UR1943, 154-160

In 1943 Thomas and Henderson (1943) visited the Balfour field in order to ascertain whether any prospects warranted the expenditure of £1000 as requested by the Circular Head Municipal Council and provide the best detail on actual tin and copper production up to that point.

Regarding copper veins Thomas and Henderson (1943) say that “no information additional to that available in Geol.Surv.Bull.No.10 can be given, as all mine openings are now inaccessible. Plans of work since the above bulletin was published could not be obtained from official sources. Although some drilling has been undertaken by private enterprises since then, details are not available.”

“There are numerous exploratory workings over a wide area, along certain defined lines. The exploratory work has been extensive rather than intensive and forces one to the conclusion that the shoots of ore must be short and not as continuous as indicated on L.K. Wards map.

Thomas and Henderson (1943) provide details on annual production of copper and tin up to the time.

Table 4.2.1: Historical Copper Production Reported in Thomas and Henderson (1943)

MURRAY'S REWARD.	<u>BALFOUR COPPER</u>	
YEAR	QUANTITY TONS ORE	VALUE
1907	Nil	-
1908	Nil	-
1909	1207.25	14,793
1910	487.00	6,450
1911	2083.00	21,367
1912	1214.00	8,008
1913	947.00	4,557
1914	44.00	178
1915	25.00	200
1916	76.00	1,726
1917	93.75	980
	<u>6177.00</u>	<u>£58,259</u>

Table 4.2.2: Historical Tin Production Reported in Thomas and Henderson (1943)

BALFOUR TIN.

YEAR.	QUANTITY.	VALUE £
1907	45)	5,094
1908	3)	280
1909	3)	278
1910	Nil)	-
1911	")	-
1912	")	-
1913	29.15)	3,873
1914	30.5)	3,074
1915	4.5)	506
1916	26.93)	3,310
1917	6.98)	1,132
1918	11.71)	2,535
1919	6.25)	1,526
	<u>METALLIC TIN.</u>	
1920	2.52	675
1921	0.60	103
1922	2.41	364
1923	1.00	202
1929	1.22	243
1930	0.88	121
1931	0.30	32
1942	0.044	11
	Total .. 125.8	£23,359

Thomas and Henderson note that "the tin wolfram veins are restricted to the one area which has Specimen Hill as the locus" and note that surface veins are oxidised down to a depth of ~20 feet where the "pyritic zone" was reached, going on to say that "operations always ceased when this pyritic zone was encountered, and there is no record of anyone attempting to calcine the ore" and that "during our visit, no vein was available for examination down to the sulphide zone."

Henderson (1943) Interview River wolfram deposits, UR1943_146_151

Henderson also visited the Interview River working during the Second World War due to the strategic importance of tungsten. Kenny's workings had some 120m in total of trenches exposing veins of about 25cm wide bearing wolfram. A 15m long trench was dug south of the creek and a shaft 6-7.5m deep was found just to the north of the creek, along with a few more trenches. Henderson also located two shafts on the Reward Lease (Section 5119-M) and a number of trenches.

Henderson concluded that small scale mining would be possible and recommended trenches be dug every 15m to establish the position of the narrow ore veins.

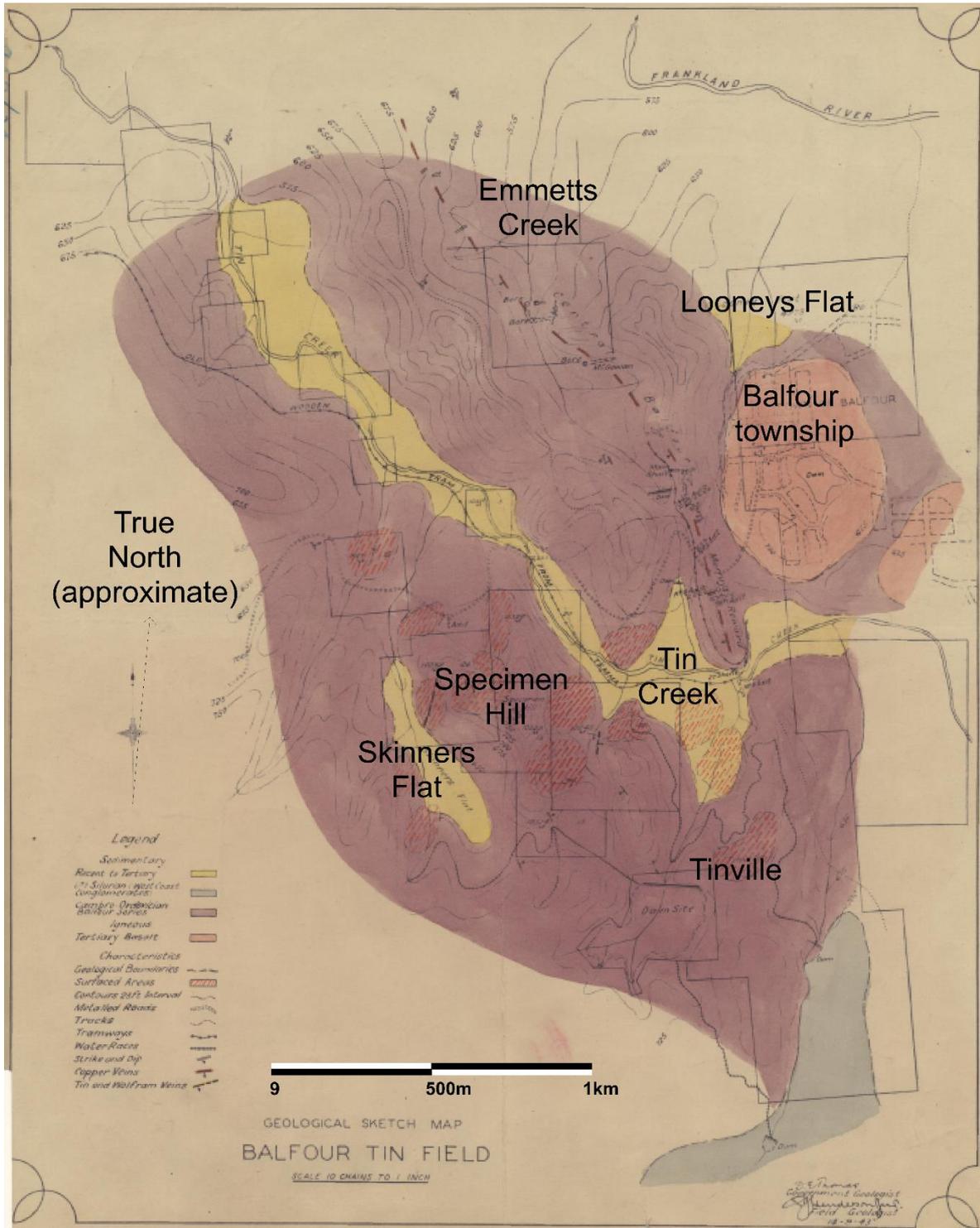


Figure 4.2.3: "Geological Sketch Map Balfour Tin Field" (Thomas and Henderson, 1943) MRT Plan 843C showing tin leases and localities with Copper Veins and Tin and Wolfram Veins indicated.

4.3 Modern Mining and Exploration (post-WW2)

Mineral Resources Tasmania maintains a GIS spatial database of historical exploration licences which essentially covers the post-World War Two period. The database is included as Appendix A These were queried spatially against the Balfour Project Area and a list generated of all historical tenements. Most historical tenements straddle the Balfour Project Area with activities conducted outside of the Balfour Project Area not discussed in this report unless relevant to the potential of the Balfour Project Area. Exploration is described in chronological order.

4.3.1 Interview River Wolfram Syndicate 1953 – 1954

The Interview River Wolfram Syndicate was formed in 1953 to undertake work looking for wolfram in the Interview River area. A track was put in from Pieman Heads to the Interview River; bridges were built crossing the Rocky, Ford and Interview Rivers.

Exploratory work over a period of about two years consisted of sinking a 12m deep shaft and digging more trenches but the price of tungsten crashed in 1954 and work stopped.

4.3.2 Rio Tinto Australian Exploration 1956

Rio Tinto Australian Exploration (RTZ) flew a large scale aeromagnetics survey over the northwest of Tasmania in 1956. This initial aeromagnetic surveying work is poorly reported but contour plans exist and are downloadable (Anon, 2002; 02_4780).

4.3.3 Pickands Mather and Co. International (EL 12/1965)

Pickands Mather and Co. International (Pickands Mather) carried out a major regional stream sediment sampling over a 4000 square mile tenement area. ~80# samples were analysed for Cu, Pb, Zn, Ni, Co, As (and occasionally Mo) by AAS, Sn by XRF and cold extraction copper "CxCu" by colorimetry (Weir, 1982; 82_1801). No anomalous results appear to have been followed up within the Balfour Project area. (Anon. 1966; 66_0439, Anon. 1967; 67_0457 and Weir, 1982; 82_1801)

4.3.4 Balfour Mining Syndicate 1963 – 1968 (SPL17, SPL383, SPL392, SPL410)

The Balfour Mining Syndicate was formed by two (or three?) Smithton men who pegged Special Prospecting Leases over the Balfour field between The Clump south to around the Pierpoint Morgan prospect. They formed a JV with BHP early on (see below). There is no report for SPL383 whilst reports for SPL 392 and SPL410 have BHP (or consultant) authors. The exception is SPL17 which has a report on an IP survey conducted by McPhar Geophysics over selected prospects (Hallof and Ball, 1967; TCR 67_0467) which was done for the Balfour Mining Syndicate (presumably following on from a recommendation by BHP in their final report (Chesnut 1965; TCR 65_0394).

Three east-west lines of dipole-dipole IP were read over the The Clump, three lines over The Blocks, 3 lines over Central Mt. Balfour, three lines over Murrays Reward also extending towards Specimen Hill, three north-northeast trending lines over Tatlows prospect and a single east-west line over a magnetic anomaly just north of the Central Mt. Balfour mine. Anomalies were recorded in each area (Hallof and Ball, 1967; TCR 67_0467). This initial survey was incorporated into ACI's subsequent IP survey (McIntyre 1973a; TCR73_0947).

4.3.5 Broken Hill Proprietary Company Ltd 1963-1965 (SPL392, SPL410, ML 38M/63)

The Broken Hill Proprietary Company Ltd (BHP) were attracted to the tin and tungsten potential of the immediate Balfour area and joint ventured into SPLs 383, 392 & 410 (and possibly SPL17) (all SPL's cover the same 25 square mile area but each only remained in force for 1 year periods) and ML 38M/63 (320 acres) held by the Balfour Mining Syndicate (Mr G Force & G Kingston).

BHP sampled approximately 170 pre-existing pits on Specimen Hill with separate samples of the surface peat and subsurface eluvial material ("gravel") which were each panned for a field estimate and crushed and assayed. (Chesnut, 1964; TCR 64_0373)

On the basis of the results of this soil tin distribution survey, a series of seven costeans totalling about 7,600 feet were cut by bulldozer. Cleaning and sampling of the bedrock exposed in these costeans was commenced but later discontinued due to difficulties experienced by the bulldozer leading to significant uncertainty as to the reliability of the samples – became clear. (Chesnut, 1964; TCR 64_0373)

Following this work an initial programme of scout drilling (6 diamond drill holes DDB1 to DDB6 for 825.9m – see details in appendix A) was carried out. Sampling and assaying of these holes is very poorly presented with no QA/QC or explanation of methodologies. Results of this work should be treated with caution and are considered to be relatively unreliable.

The first hole DDB1 was drilled to 88.6m with results generally not encouraging except for one section which assayed 1.9m (from 48.65m) at 0.54% Sn including 0.09m @ 10.12% Sn. (Chesnut, 1964; TCR 64_0373). DDB2 drilled to 73.2m did not intersect and significant mineralisation.

A third short hole DDB3 was drilled to 30.6m to test beneath a relatively major vein about 20cm thick which outcropped on the western side of Specimen Hill and intersected a vein ~25cm thick assaying 1.41% Sn. A fourth hole DDB4 drilled deeper beneath DDB3 and the outcrop intersected only low tin values. (Chesnut, 1964; TCR 64_0373)

BHP mapped Specimen Hill in detail based largely on the unsampled trenching and carried out both ground magnetics and gravity surveys.

The ground magnetics survey defined the north-south magnetic high which trends through the Specimen Hill prospect. This anomaly was tested by holes DDB5 (283m) and DDB6 (183m), the latter intersecting a narrow zone of 5% - 10% sulphide mineralisation between ~134.45m and ~135.95m.

“The core had a fairly strong magnetic attraction indicating that pyrrhotite was a major constituent of the sulphide mixture. Pyrite, minor chalcopyrite and very minor galena and sphalerite made up the rest of the sulphide mineral assemblage. No cassiterite or wolframite was evident but a 10.6 foot (~3.2m) section of quartzite (silicified siltstone) between 415.8’ (~126.45m) and 426.4’ (~129.65m) assayed 0.19% tin.” (Chesnut, 1965; TCR 65_0394). This zone was considered to explain the magnetic anomaly.

BHP had samples of DDB4 and DDB5 sent for petrology Whitehead and Apthorpe (1964; 64_0374) and Whitehead (1965; 65_0383) respectively. In the sample from 524.8 feet in DDB4 Whitehead (1964) reports the presence of “secondary carbonate and sulphides mainly pyrrhotite but with traces also of sphalerite and chalcopyrite”. In DDB5 Whitehead and Apthorpe (1965) describes the rocks as “metamorphosed siltstones and shales with bands of carbonaceous material and they possibly contained some fine grained syngenetic sulphide ... Authigenic tourmaline present in all specimens has definitely formed by introduction of boron in specimens below 800 feet ... Pyrrhotite is of epigenetic origin and crystallised after the rock forming minerals, authigenic tourmaline and the very minor sphalerite.”

Recommendations were made for further magnetic surveying, an IP survey for on-magnetic sulphides, and two further drill holes to test the magnetic anomaly. The drilling work does not appear to have been carried out.

The mapping and sampling of the accessible workings of the Murrays Reward and Central Mt. Balfour copper mines was done in some detail – possibly by the Balfour Mining Syndicate. Whilst no information is given regarding the methodologies utilised in the sampling and assaying of the samples whose copper values are presented on the relevant mapsheets, there is considerable geological detail presented on these mapsheets. Also note that the long section of the Murrays Reward mine excludes a further lower level which is recorded on MRT Mine Plan 28_004 dated 1915. In addition McPhar Geophysics carried out the IP survey (see previous section).



Figure 4.3.5.1: Plans showing results of geological mapping and sampling of the accessible parts of the Murrays Reward and Central Mt. Balfour mines carried out by BHP (anon., 1965)

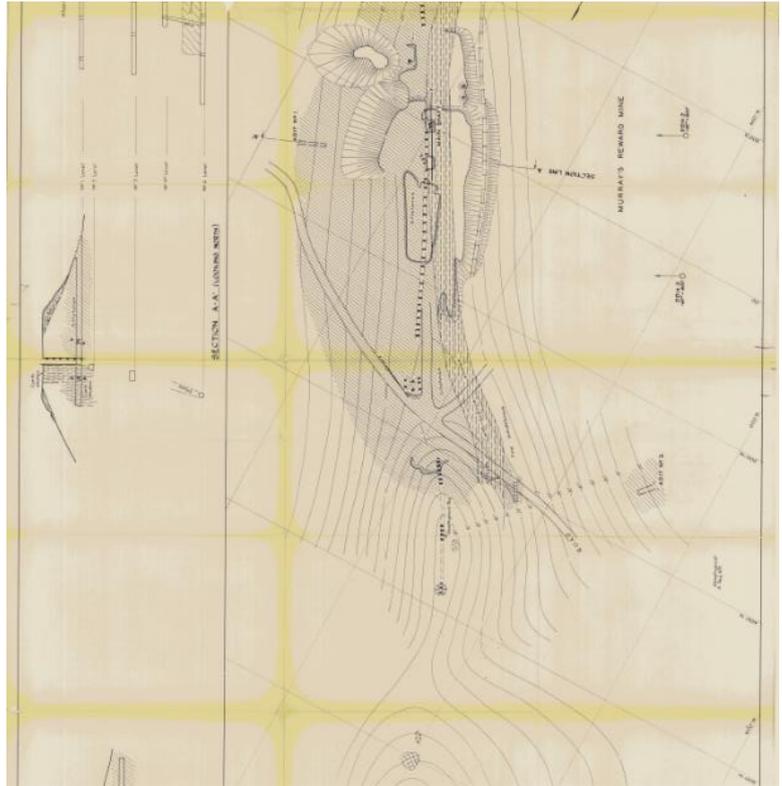


Figure 4.3.5.2: Surface plans and underground sections showing results of geological mapping and sampling of accessible parts of the Murrays Reward and Central Mt. Balfour mines carried out by BHP (anon., 1965)

Samples of the Murrays Reward/Central Mt. Balfour lode collected during this work were utilised in the Inferred resource estimated for this copper deposit. (MacDonald, 2020, 2021 and 2022)

4.3.6 Australian Consolidated Industries Limited (ACI) 1968 – 1974 (EL 16/1968, EL 48/1970, EL 49/1970)

ACI pegged EL 16/1968 over the northern part of the Balfour copper belt and also joint ventured with Renison Limited, Mt. Lyell Mining and Railway Company Limited and Consolidated Goldfields Aust. Limited over EL's 48/1970 and 49/1970 over the southwestern part of the BPA including the Interview River, Copper/Silver Reward and Chimney Creek areas.

On the latter two tenements work was managed by Renison Limited who carried out an aeromagnetic survey and regional stream sediment sampling programme with more detailed work including ground magnetometer, rock and soil sampling carried out over the Interview River and Copper/Silver Reward fields and the Chimney Creek aeromagnetic anomaly before the bulk of the ground (including all within the BPA) was dropped (Newnham, 1972; TCR 72_0909).

Bell (1972) describes the Copper Reward workings as “the most extensive in the area, comprising two shafts (one vertical, one inclined at about 45 degrees) and some 100 feet of trenching along the outcrop of the mineralised ‘vein’. The ‘vein’ is clearly exposed to the south in the bed of the Interview River, varying in width from about 0.1 to 0.5 metres and carrying locally rich chalcopyrite and covellite (up to a maximum thickness of 7.5cm).” (Bell, 1972; TCR 72_0876). Of a 70kg sample of mullock from around the shaft three grab samples assayed the following:

- sample A assaying 10.5% copper, 2.02oz/ton silver and 0.04oz/ton gold,
- sample B 12.5% copper, 1.88oz/ton silver and 0.04oz/ton gold, and
- sample C not assayed for copper but assayed 1.82oz/ton silver and 0.04oz/ton gold.

It is stated in text that XRF was used for analysis.

Bell notes that whilst Ward (1911) reported that the shaft had been sunk on the contact between amphibolite and slate, only slate was found on the dump, but that a large dolerite(?) body outcrops 30-60m to the north.

Bell (1972) collected a 0.5kg grab sample from the Copper No1 dump he considered “not representative of the grade of ore” as assaying 2.5% copper and 250ppm zinc with less than 10ppm lead and nickel, with a second sample assaying 1.5% sulphur, 200ppm copper, 80ppm zinc and less than 10ppm lead and nickel.

Rocks collected from Copper Reward are in shown on figure 5.7.

On EL 16/1968 ACI were attracted by the presence of copper, iron-ore, tin, chromite and possibly nickel within the licence area, with mineralisation in extensive copper lodes, alluvial tin, magnetite lodes (outside of BPA), and coastal sand dunes containing tin, chromite, zircon and rutile as well as interesting copper, nickel and zinc stream sediment geochemical anomalies from the earlier Pickands Mather survey in centre of licence area (Davies, 1968; TCR 69_0599).

ACI proved to be one of the most committed explorers for copper on the Balfour copper belt carrying geochemical and geophysical surveys and ultimately drilling 37 diamond drill holes (for a total of 5,712.33m – see Appendix A for details).

In their first year ACI inspected four of the existing old copper mines being The Clump, Murrays Reward, Central Mt. Balfour and The Blocks carrying out geological mapping and reconnaissance geochemical sampling. Davies (1969; TCR 69_0577) selected the area around the old Clump mine as the most prospective area to date where pyrite+chalcopyrite mineralisation is present over an 80' (~24.33m) width in a shear zone, old workings have proved the mineralisation average strike length of 450' (~136.85m) to a depth of 70' - 100' (~21.3m - ~30.4m) below surface, old dump material has analysed up to 13% copper and leached samples from the old workings have assayed from 0.019% to 3.4% copper, noting also that the other mines examined have each in the past yielded high-grade ore from narrow ore bodies (5' - 12' wide) (~1.5m - ~3.65m).

Davies (1969) concludes that “there are reasonable prospects for locating new, and proving extensions of, existing ore bodies in the area as earlier work has been severely hampered by very poor exposure and the non-development of ferruginous gossans”, and that “geochemical orientation surveys have not been successful. In most cases all the minerals (including pyrite) have been completely removed from the upper parts of mineralised zones, leaving white porous quartz.”

The latter point is considered highly significant and has been reiterated by later workers.

The reconnaissance geochemical sampling was carried out over both the Murrays Reward and The Clump mines by a series of pits dug on 25' (~7.6m) spacings with soil, eluvium and bedrock sampled and assayed for Ni, Cu, Pb and Zn. Whilst an anomalous copper response was recorded down slope to the east of the Murrays Reward line, no such responses were recorded over The Clump and Davies (1969) states that “no strong anomaly exists over the geochemical line although pits 8 to 12 show Cu values of 40 to 125 p.p.m. at the eluvial horizons. The bedrock samples show no Cu values of interest although copper mineralisation was observed in the old workings below the geochemical pits. All minerals have been completely leached from surface bedrock leaving a white quartz with small cavities. Geochemistry is therefore of little value for delineating possible ore bodies in geographical and climatic environments similar to the Clump. Additionally, the surface expression of potential ore bodies is likely to be a white, cavernous quartz ‘gossan.’”

“From Ward (1911) copper minerals were observed only in the region around the Clump Prospect in creek beds where stream erosion had cut down at least 50' below the main penepain level of the area. It is considered that complete leaching occurred during the period of plantation and only recent erosion has exposed partially leached and gossanous material.” (Davies, 1969; TCR 69_0599)

Davies (1969; TCR 69_0599) concludes that “geochemical orientation surveys have been undertaken with poor results and the best tool for locating new and extending knowledge of existing deposits is geophysics, an E.M./I.P. survey being the most promising method of attack”, and recommends that a regional electromagnetic (E.M.) geophysical survey be carried out over the prospective area to delineate areas for further investigation and that “Induced polarisation (I. P.) geophysical surveys be carried out over E.M. anomalies and existing mines.”

ACI also showed interest in a tin lode held on ML 58M/1968 held by a Mr. Jaeger and drilled 4 shallow auger holes. At Cut A BH5 intersected 5’6” to 6’9” (~2.05m – ~1.67m), 1’3” (~0.38m) @ 4.8% (no details are given regarding sampling or assaying methodologies) whilst BH4 intersected “only trace” SnO₂. In Cut B BH2 intersected a vein reportedly 4.65” (~0.11m) at 2.4% true thickness. These shallow auger holes have not been included in Appendix A.

In addition a stream sediment survey was carried out in the Balfour area with assaying for Ni, Cu, Pb and Zn.

In the 1970-71 year ACI carried out more systematic exploration at five historic copper mines/prospects (McIntyre 1973a; TCR73_0947) with ground magnetometer and dipole-dipole IP surveys over a newly established broadly spaced east-northeast/west-southwest oriented grid (1600’ = ~485m line spacings with wing lines generally 3000’ = ~975m) from The Clump south to the Pierpoint Morgan mine and detailed work over each of the following three old mines

- Murrays Reward - 14 new lines, 1200’ long wing-lines (~366m) spaced 150’ (~45.7m) apart
- The Clump – 16 new lines, 1200’ long wing-lines (~366m) spaced 250’ (~76.2m) apart, and
- The Blocks – 8 new lines, 1200’ long wing-lines (~366m) spaced 100’ (~30.4m) apart

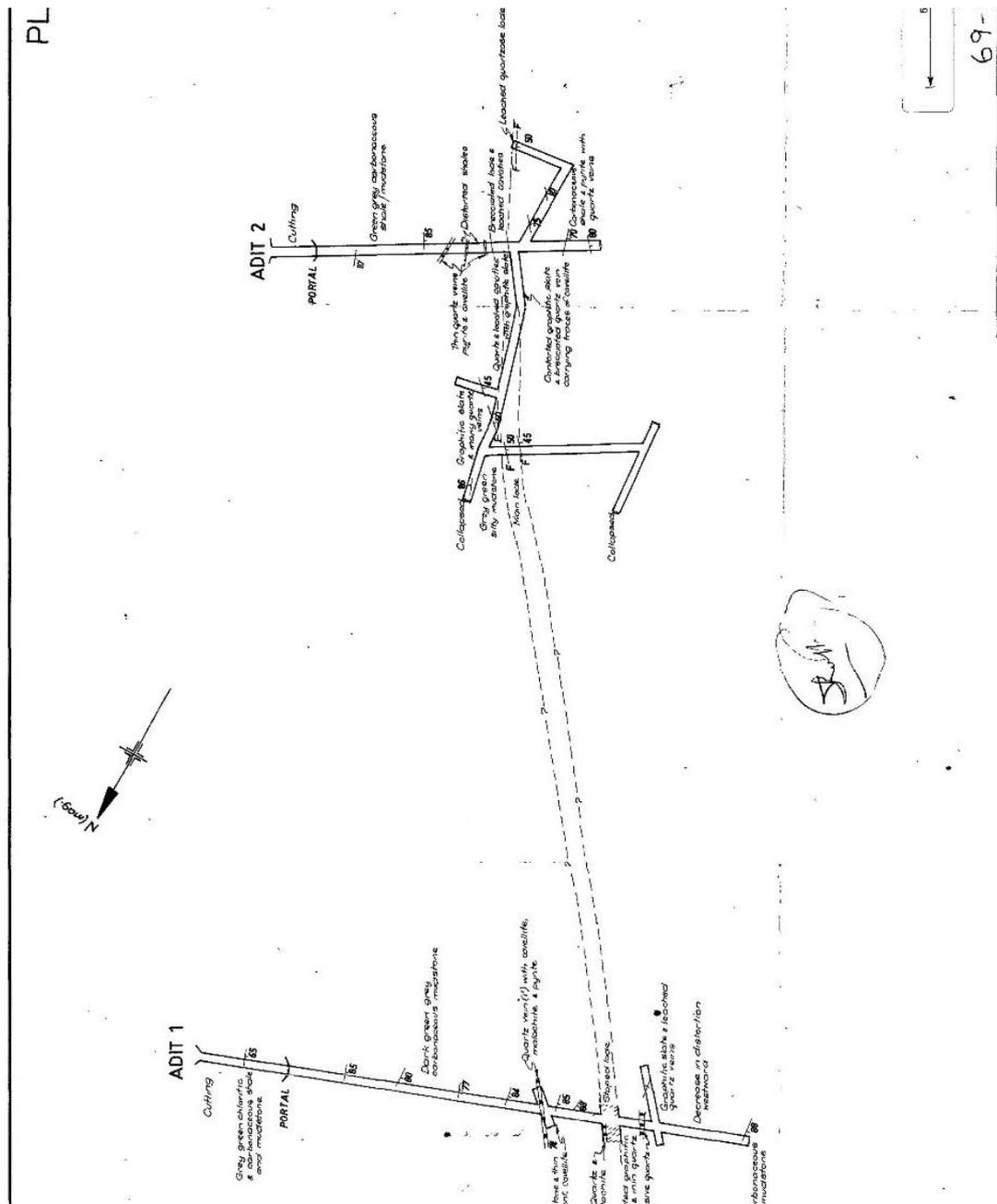


Figure 4.3.6.1: ACI mapping of the Murrays Reward No.1 and No.2 adits (Davies, 1969; TCR 69_0577)

Anomalous chargeability trends were recorded over the full lengths of each grid. McIntyre (1973a; TCR73_0947) states that “Pyrite alone occurs in sufficient quantities in most prospects to account for some of the I.P. anomalies. Many of the anomalies are attributed to the presence of graphite, particularly at the Clump Prospect where graphite appears to be associated with a line of brecciation and deformation along which the copper mineralisation exists and thus, although copper sulphides are not necessarily being detected directly, the association of graphite and sulphide mineralisation renders effective the use of I.P. methods as an exploration tool in the Balfour area.” (McIntyre, 1973a)

The ground magnetometer survey was initiated on the basis of the presence of magnetite in diamond drill hole DDH6 (see below). No anomalies are were reported from the survey though aeromagnetics suggest otherwise.

At the Balfour Blocks prospect McIntyre (1973; 73_0947) states that “definite and probable I.P. anomalies were detected on all eight lines but the most notable feature of the survey is that the old working's, in which sulphide mineralization is known to occur, yielded only probable anomalies, while a continuous line of eight definite anomalies coincides with the low siliceous ridge to the west of the main lode. This line of anomalies was partially tested by DDH5 and minor pyrite and chalcopyrite was intersected. These sulphides are not considered to be present in sufficient quantities to account for the anomalies and it is possible that higher concentrations of sulphides occur at greater depth.”

An extensive programme of costeaning utilising a bulldozer was conducted over five old mines i.e.

- Murrays Reward - 3 three costeans dug and sampled
- The Clump - 7 costeans were dug initially with another 3 dug later and sampled but not mapped
- Development – 2 costeans dug
- The Gully – 7 costeans dug of which 5 were sampled and mapped
- The Blocks – 5 costeans dug of which 3 were mapped and sampled (best 410ppm Cu) initially with a further 4 dug later but not sampled or mapped

Samples were assayed for copper (also gold to a detection limit of 0.01oz/t. All gold assays were below detection). Assay details for these costeans are shown as bar charts with no numeric assay data (McIntyre, 1973a; TCR73_0947)

Copper grades at most prospects were generally low with the best result 1545ppm Cu in a costean above the Central Mt. Balfour mine. McIntyre (1973a; TCR73_0947) notes that at the five prospects the lode structure is defined by copper grades above 80ppm and typically 200ppm at most and with anomalous grades to 200ppm in costeans reflecting copper grades of ~1% in drillholes beneath these costeans, i.e. 500 times weaker.

McIntyre (1973a; TCR73_0947) describes the lode as being cavernous material with cavities after sulphides and dolomite. He states that surface copper anomalies are associated with leached cavernous lode material or wall rocks,

McIntyre also states with regards to the Clump that “the mineralised zone has undergone severe leaching to 150m”.

Following this a programme of diamond drilling (12 holes for 1771.13m) was completed at the same five prospects. (1973a; TCR73_0947)

- The Clump – DDH's 1, 2, 3, 4, 6 and 9 (6 holes for 988.9m)
- Blocks - DDH's 5, 7 and 8 (3 holes for 361.2m)
- Murrays Reward - DDH10 (1 hole for 179.8m)
- The Gully - DDH11 (1 hole for 143.0m)
- Development - DDH12 (1 hole for 98.2m)

Details of this drilling is given in Appendix A.

Drill holes are geologically logged in some great detail. Recoveries in the mineralised zone were often poor with the suggestion that chalcocite (reported in a number of holes may be being lost. Drill hole down hole surveys were only carried out on some holes.

Selected sections of core were cut and assayed for copper only. The methodology is described as “The drill core was originally split in half' and one half split in two”. Initial sampling involved taking one quarter core over 5 foot intervals, irrespective of lithology. The drill hole was resampled by Dr. P. Solomon, taking half core samples over the mineralised zone.” Some sludge sample assays are also reported.

McIntyre (1973; 73_0947) describes the results of the first round of drilling at The Clump prospect as follows:

“The mineralized zones intersected by the drillholes consist of quartz and dolomite containing pyrite and chalcopyrite with lesser amounts of chlorite, graphite and traces of magnetite, actinolite and rare traces of secondary copper sulphides, notably covellite.”

“The mineralized zones are commonly cavernous after carbonate and sulphides and herein lies the major difficulty in fully evaluating the Clump Prospect. The cavernous nature of the mineralized zones has resulted in poor core recovery and the grade and lithology of recovered material is therefore not representative of the whole of the mineralized zone. In some instances, non-rotating drillrods have fallen under their own weight. In particular, the basal 13.8 m of DDH.2 returned a core recovery of 7 per cent and in DDH9 a 23.3 m interval returned only 9 per cent core recovery. Such zones of low core recovery probably consisted originally of dolomite, with lesser amounts of quartz and sulphides, which has been severely leached leaving a delicate framework of quartz having insufficient strength to support the weight of the drill string.”

Drill results as summarised by McIntyre (1973; 73_0947) were:

- DDH1; 54.18m to 76.46m, 22.28m @ 0.25% Cu (recoveries generally 100% with lowest 87%) with sporadic mineralisation in quartz-carbonate veins to end of hole at 138.08m
- DDH2; 60m to 72.2m, 12.2m @ 0.19% Cu. Hole was abandoned at 72.2m due to extremely low recovery (2% to 13%)
- DDH3; a potentially mineralised zone was encountered from 61.97m to 84.43m 71.47m to 84.43m assaying 12.96m @ 0.45% Cu
- DDH4; no potential mineralised zone of significant thickness was intersected, but rather a series of thin quartzose zones or vein systems containing minor chalcopyrite i.e. 19.92m to 21.47m, 1.55m @ 0.8% Cu, 57.45m to 58.8m, 1.35m @ 0.21% Cu, 96.44m to 9.93m, 0.49m @ 0.19% Cu, 12.45m to 162.93m, 0.48m @ 0.19% Cu and 18.07m to 169.36m, 1.29m @ 0.24% Cu
- DDH6; 170.99m to 190.84m, @ 0.16% Cu
- DDH9; mineralised zone with extremely poor core recovery intersected from 175.25m to 198.92m including 197.35m to 198.92m, 1.57m @ 1.52% Cu

In conclusion McIntyre (1973a; 73_0947) summarises the Clump prospect as being up to 1500m long, up to 20m in thickness, concordant with bedding, which has undergone severe leaching to a depth of at least 150m.

At The Clump McIntyre concludes that “six drillholes covering a strike length of 750 metres have indicated the presence of a potentially economic copper deposit consisting of chalcopyrite in a pyritic quartz-quartzose-dolomite gangue, enclosed within a sequence of fine-grained carbonaceous sediments”. (McIntyre, 1973a; TCR73_0947)

At Murrays Reward mine “the only drillhole on this prospect intersected a zone of potentially economic copper mineralisation within a sequence of carbonaceous and chloritic slates and phyllites” and that further attention is justified. (1973a; TCR73_0947). DDH10 drilled beneath the Murrays Reward workings intersected a mineralised zone from 120.64m to 126.6m assaying 2.48m @ 1.25% Cu which was part of a broader shear structure from 110.39m to 138.52m, 28.14m @ 0.129% Cu.

At The Gully prospect ACI drilled a single hole DDH11 beneath the old workings. McIntyre (1973a; 73_0947) reports “a suspected mineralized zone, was intersected between 107.87 and 111.83 m but core recovery was only 15 per cent. The core from this intersection consisted of chlorite, quartz and quartz-dolomite which contained traces of chalcopyrite and assayed 2825 ppm Cu.”

At the Development prospect DDH12 “intersected chloritic slate, phyllite and quartzite and a few quartz-dolomite veins containing trace amounts of chalcopryrite, the highest assay value being 0.07 per cent Cu over an interval of 2.45 m. No lode material corresponding to that on the nearby dump was intersected.” (McIntyre, 1973a; 73_0947).

At The Balfour Blocks prospect drilling results were described as follows (McIntyre, 1973; 73_0947):

DDH5 intersected a quartz-pyrite-chalcopryrite-chlorite lode from 47.63m to 48.32m (estimated true thickness 0.55m) which assayed 0.9m @ 0.25% Cu, however, McIntyre (1973a; 73_0947) visually estimated between around 4% and 5% chalcopryrite and he “considered that a sampling or analytical error has been committed.” (McIntyre, 1973a; 73_0947)

DDH7 intersected “a mineralised zone similar to DDH5” (McIntyre, 1973a; 73_0947) from 76.1m to 77.57m (estimated true thickness 1.2m) which assayed 1.47m @ 2.1% Cu.

DDH8 was sited “further to the west than either DDH 5 or DDH 7 in an attempt to determine the cause of the I.P. anomalies to the west of the main lode. This attempt was partially successful in that moderately to heavily silicified green chloritic slate and phyllite containing pyrite, pyritic quartz veins and minor chalcopryrite was intersected between 37.95 and 40.45 m. This interval assayed 0.275% Cu. A second mineralized zone containing 3975 ppm Cu was intersected between 118.05 and 119.17 m. This was a zone of low (13 per cent) core recovery.”

Mapping and sampling of the underground workings at The Clump was also carried out. (McIntyre 1973a; TCR73_0947). “The sampling did not cover the entire thickness of the lode and is therefore not representative but sufficient samples were taken for the assay results to give an indication of the grade of the leached and semi-leached lode material.” (McIntyre, 1973; 73_0947)

Channel samples across strike assayed

- Section B; 10.57m @ 0.4% Cu
- Section D: 10.57m @ 0.44% Cu including 1.52m @ 5.33% Cu
- Section E: 8.04m @ 0.9% Cu
- with a section to the east of the lode zone – Section A; 12.08m @ 0.4% Cu including 1.52m @ 3.02% Cu, and
- a section within the lode zone and parallel to it – Section C; 10.57m @ 0.44% Cu

Work in the 1971-72 year is detailed in McIntyre (1972a) which is included in a series of ACI reports referenced as Anon. (1974; TCR 74_1070) in addition to reports detailing mapping at The Clump (Jackaman, 1972a), Specimen Hill (Jackaman, 1972b) and Murrays Reward (McIntyre, 1972c).

Whilst there are no map sheets accompanying McIntyre’s mapping of the No1, No2 and No3 adits at the Murrays Reward mine (McIntyre, 1972c) he describes the geology in some detail.

Of considerable significance is his mapping and systematic channel sampling of the No3 adit which lies midway between the Murrays Reward and Central Mt Balfour mines at the base of the western side of the hill. This adit transects a major mineralised lode structure from 46.6m to 64.3m.

“The quartzose lode containing the copper mineralization occurs between about 46.6 and 64.3 metres and has a true thickness of about 15.8 metres. The lode appears to strike about N 50° - 60°W and dip about 55° - 70°W. It consists of massive quartz, pyritic and cavernous in parts, which intersects the bedding obliquely suggesting an epigenetic orebody.” (McIntyre, 1972c; 74_1070)

McIntyre (1972c; 74_1070) channel samples are continuous except for a section between 50.3m and 51.8m where it is stated that no sample was received.

The detailed geological mapping from the Clump to South Balfour included the construction of six costeans at Emmetts Creek (numbers 7 and 8 on the west side, numbers 9 to 12 on the east) north of the Central Mt. Balfour mine on a ridge where minor amounts of quartz and gossanous material

occur, four costeans south of Specimen Hill in an area of old copper workings, and one costean at with sampling and assaying for copper (and some lead and zinc).

Lode structures were intersected in most costeans but copper assays were generally low again due to leaching with a maximum 560ppm. (McIntyre, 1972a in Anon. 1974; TCR74_1070)

Reconnaissance mapping at the Pierpoint Morgan, South Balfour and Waratah prospects led to recommendations for refurbishing old workings for sampling which was only completed for the latter. (McIntyre, 1972a in Anon. 1974; TCR74_1070)

A major programme of diamond drilling was undertaken around and beneath the Murrays Reward and Central Mt. Balfour mines with a total of 14 diamond drill holes (DDH13 to DDH26) for 1618.2m over a strike length of approximately 6km. (McIntyre, 1972a in Anon. 1974; TCR74_1070) (Details of these holes are provided in Appendix A.

Mineralised drillhole intersections are as follows;

DDH13: "A thick zone of anomalous copper mineralization was intersected between 43.58 and 83.52 metres. This interval containing an average of 3420 ppm Cu over an estimated true thickness of 22.5 metres. The bulk of the copper is concentrated in three subzones:-

- (a) 43.58 to 46.02 metres (14800 ppm Cu)
- (b) 53.95 to 56.69 metres (4560 ppm Cu)
- (c) 71 .94 to 83.52 metres (7200 ppm Cu)"

DDH14: "A thick zone of anomalous copper mineralization was intersected between 84.43 and 105.61 metres. This interval containing an average of 0.95 per cent Cu over an estimated true thickness of' 16.68 metres. The bulk of the copper is concentrated in four subzones:-

- (a) 84.43 to 86.33 metres (1.78 per cent Cu)
- (b) 87.39 to 93.27 metres (1.41 per cent Cu)
- (c) 96.21 to 100.88 metres (1.12 per cent Cu)
- (d) 102.35 to 105.61 metres (0.91 per cent Cu)"

DDH15: "A weakly mineralized zone was intersected between 85.36 and 94.49 metres. This interval averaging 730 ppm Cu."

DDH 16: "A thick zone of copper mineralization was intersected between 54.87 and 96.16 metres. This interval containing an average of 9300 ppm Cu over an estimated true thickness of 38.0 metres. The mineralized zone may be subdivided into three subzones:-

- (a) 54.87 to 63.39 metres (3250 ppm Cu)
- (b) 63.39 to 84.13 metres (1.44 per cent Cu)
- (c) 84.13 to 96.16 metres (5075 ppm Cu)

DDH 17: "A suspected fault zone between 30.48 and 37.64, metres contains an interval of 0.95 per cent Cu although the bulk of the copper occurs within the interval 36.12 to 37.64 metres. This interval assaying 3.46 per cent Cu."

DDH 18: "Traces of chalcopryrite (7625 ppm Cu) were present in a fault zone intersected between 29.57 and 31.70 metres."

DDH19: "Copper mineralization was intersected between 60.66 and 73.50 metres. This interval, containing an average of 4850 ppm Cu over an estimated true thickness of 6.5 metres. The bulk of the copper is concentrated in the interval 68.37 to 70.15 metres, which assayed 1.73 per cent Cu."

DDH20: "abandoned at 33.53m"

DOH 21: "A thick zone of copper mineralization was intersected between 38.10 and 55.20 metres. This interval containing an average of 0.57 per cent Cu over an estimated true thickness of 13.2 metres."

DDH22: "A thick zone of low grade but anomalous copper mineralization was intersected between 67.67 and 84.90 metres. This interval containing an average of 800 ppm Cu over an estimated true thickness of 12.9 metres. Low core recovery and substantial leaching of sulphides have combined to mask the true grade of this zone."

DDH 23: "A thin zone of copper mineralization was intersected between 56.99 and 60.81 metres. This interval containing an average of 2.1 per cent Cu over an estimated true thickness of 3.1 metres."

DDH24: "A thick zone of low grade and sporadic mineralization was intersected between 187.00 and 232.35 metres. This interval containing an average of 1240 ppm Cu over an estimated true thickness of 39.0 metres. A subzone between 206.70 and 223.68 metres contains RII average of 2800 ppm Cu over an estimated true thickness of 14.8 metres. Traces of galena and sphalerite were observed in the core."

DDH25: "A thick zone of copper mineralization was intersected between 202.90 and 242.04 metres. This interval containing an average of 2450 ppm Cu over an estimated true thickness of 29.2 metres. This zone may be subdivided into three subzones on the basis of copper distribution

- (a) 202.90 to 212.46 metres (3590 ppm Cu)
- (b) 212.46 to 228.33 metres (400 ppm Cu)
- (c) 228.33 to 242.04 metres (4025 ppm Cu)"

DDH 26: "Two thin and weakly mineralized zones were intersected by DDH 26.

- (a) 144.86 to 145.91 metres (1800 ppm Cu)
- (b) 155.69 to 158.08 metres (2306 ppm Cu)"

The drilling forms part of the data set used in the Inferred resource estimated for the Murrays Reward/Central Mt. Balfour lode.

In addition two deeper diamond drill holes (DDH27 at 325m, DDH28 at 354m) were drilled at The Clump. Both intersected the mineralised lode (McIntyre, 1972a in Anon. 1974; TCR74_1070)

DDH27: 274.3m to 295.33m, 1.03m @ 0.11%,

DDH28: 304.62m to 309.09m, 4.47m @ 0.05% Cu

The next ACI general exploration report available on MRT's database is McIntyre (1973b; TCR 73_0948) which describes work during the 1972/1973 year.

Work was carried out at the

Waratah prospect

- Adit reaccessed, mapped and sampled.
- Two diamond drill holes (DDH29 at 161.5m, DDH 30 at 154.5m)

Pierpoint Morgan prospect

- Two diamond drill holes (DDH31m at 123.4m, DDH32m at 150.2m)

Murrays Reward/Central Mt. Balfour prospects

- Five diamond drill holes (DDH33 to DDH37, for 1054.34m)

Surface exploration was also undertaken near Emmetts Creek and south of Specimen Hill.

Diamond drilling at the Waratah Prospect revealed a thin, discordant, slightly cupriferous but sub-economic quartz formation which strikes NNW and dips about the vertical in a sequence of fine grained carbonaceous sediments which strike NNE and dip moderately towards the east. Better results were DDH29, 140.32m to 145.54m, 5.22m @ 0.0005% Cu, and DDH30, 135.9m to 138.96m, 3.06m @ 0.0036% Cu.

Two drillholes at the Pierpont Morgan Prospect intersected slightly cupriferous, but sub-economic quartz and quartz+dolomite containing minor amounts of magnetite and pyrite. Better results were DDH31, 103.27m to 111.3m, 8.2m @ 0.0037% Cu

In 1972/73 a third round of diamond drilling was carried out at the Murrays Reward mine testing the structure intersected between the Murrays Reward and Central Mt. Balfour mines and gave the following results (McIntyre, 1973d; 73_0950);

DDH33: "A cupriferous quartz and quartz-dolomite formation was intersected between 118.11 and 124.35 metres, this interval containing an average of 1.31 per cent Cu over a true thickness of 5.4 metres. The drillhole was continued to a depth of 254.16 metres in an unsuccessful attempt to prove the existence of a suspected cupriferous zone beneath the main Murrays Reward-Central Prospects ridge."

DDH 34: "This drillhole, some 61 metres northwest of DDH33, was completed at a depth of 173.28 metres. A cupriferous quartz-dolomite formation was intersected between 136.20 metres and 139.42 metres, this interval containing 0.26 per cent Cu over a true thickness of 3.0 metres."

DDH 35: "This drillhole, some 64 metres north of DDH 34, was completed at a depth of 182.9 metres, without intersecting cupriferous mineralisation. It is believed that the grade and thickness of the cupriferous mineralisation decrease significantly northwest along the strike of the fault zone and that the mineralised zone is represented in DDH 35 by the interval 143.64 to 147.50 metres which consists of irregular and discontinuous veins and segregations of quartz and quartz-dolomite in brecciated and fragmentary chloritic siltstone."

DDH 36: "This drillhole was completed at a depth of 237.78 metres. Sporadic, low grade cupriferous mineralisation was intersected between 189.32 and 221.78 metres, this interval containing an average of 2960 ppm Cu over a true thickness of 32.2 metres. The copper, which occurs mainly as chalcopyrite, is associated with quartz or quartz-dolomite although thin bands of massive chalcopyrite occur in sediments between 208.09 and 215.93 metres."

DDH 37: "This drillhole was completed at a depth of 222.77 metres. Low grade cupriferous quartz-dolomite was intersected between 204.90 and 210.04 metres, this interval containing an average of 2340 ppm Cu over a true thickness of 5.0 metres."

Diamond drilling at the Murrays Reward Prospect proved the existence of a small, low grade, cupriferous quartz-dolomite body which strikes north-west and dips moderately towards the south-west sediments in a sequence of fine grained chloritic and carbonaceous sediments which strike north and dip steeply towards the east. This cupriferous mineralization was believed by ACI (McIntyre, 1973b; TCR 73_0948) to have been remobilized and transported from the Murrays Reward sedimentary cupriferous formation and re-deposited in a transverse fault zone.

In the Emmetts Creek area costean geochemistry and sub-surface mapping indicated a discontinuous zone of low grade, cupriferous quartz or quartz-dolomite.

South of Specimen Hill costean geochemistry indicated traces of sulphide (Cu, Pb, Zn) mineralization."

McIntyre (1973b; TCR73_0948) notes that IP along a 12km strike between The Clump and Murrays Reward had recorded anomalies, which had been used for targeting and that magnetite is associated with copper ore in two drillholes/localities but that ground magnetic surveys show no anomalies due to the overall relative weakness of response.

4.3.7 Australia and New Zealand Exploration Company 1972 – 1973 (EL 6/1972 and EL 8/1972)

In 1972 Australia and New Zealand Exploration Company (ANZECO) pegged the area south of the Arthur River as EL 8/1972 and to the north under EL 6/1972. "A programme of geological reconnaissance and stream-sediment sampling by one geologist and one field assistant was

commenced in November 1972 and continued through December. During this period, a large part of the licence area was covered on a reconnaissance scale, but no significant tungsten anomalies were discovered and no evidence was found of any geological environments favourable for tungsten mineralization. The Precambrian quartzites in the Nelson River vicinity were investigated with a view to their possible value as sources of high-grade silica. Numerous samples were taken for analysis and some were found to be of a purity sufficient for ferrosilicon production. Trenching across the outcrop, however, showed that the high-grade silica horizons were very thin and lacked the necessary tonnage to support an open-pit operation. Exploration Licence 8/72 was relinquished in August 1973." (Brandt, 1973; TCR73_0982)

4.3.8 Interview River Mining and Associates Pty Ltd 1973 – 1980 (EL 1/1973)

The following summary of previous exploration of the Interview River area is drawn largely from Bacon (1992; UR1992_31).

In 1973, Mr M. P. Munday pegged exploration licence EL1/73 which was eventually held by Interview River Mining and Associates Pty Ltd.

Dozer cuts were made near Cooney's Workings and some drilling was undertaken. The area was examined by Geopeko in 1976 who concluded that the prospect had little economic potential as the tungsten was too irregular and too sparse.

In 1978, Mr M. P. Munday, his son, and two other men, uncovered various veins and opened an adit 35m south of Kenny's Shaft, following a 40cm wide vein for ten metres. Work initially stopped when the adit reached a fracture plane, striking 320°. The mineralised vein was offset, and although the adit was extended to 25.5 metres, the vein was not rediscovered. Some three tonnes of wolfram ore was produced. Mining equipment was acquired and taken to the site, including a compressor, a jaw crusher, roll table, and a magnetic separator.

Later in 1978, M. P. Munday and D. Holness applied for three mining leases (3M/78, 35M/78 and 19M/78). These were granted and transferred to Interview River Mining Associates Pty Ltd.

In November 1978, the Syndicate made application to the Tasmanian Department of Planning and Development for a Government guarantee over a proposed bank loan to facilitate working the deposit. To help in assessing this request, Department of Mines geologist P. L. F. Collins visited the workings in January 1979. Collins reported that the major prospect was at Kenny's Workings; old trenches and a shaft could be seen at Cooney's and trenching had been done at two places in between. However each of these four prospects had an entirely different small vein system and there was no evidence to indicate continuity between the four sets. At Kenny's Workings a number of trenches up to 2.5 metres deep, 5 metres long and 1.5 metres wide were seen, along with the adit, (25.5 metres in length).

Collins made a rough calculation of the reserves of wolframite at Kenny's Prospect, his assumptions were:

- the vein (0.32 m thick) to be continuous over the full 215 m exposed in the trenches, not proven at the time;
- grade of the vein assumed to be 3.8 mass% wolframite (2.9 mass% W03);
- a mining thickness of 1.20 m (0.32 m vein, 0.88 m granite waste);
- density of the vein 2.88 t/m³ and granite 2.67 t/m³
- therefore Kenny's Prospect could yield 1473 t of ore (416 tonnes vein, 1057 tonnes granite). (Bacon, 1992; UR1992_31)

Collins concluded that underground mining would not be feasible because of the irregular nature of the veins, the lack of proven depth extensions of the veins, and the capital expense involved in such a remote area. The Syndicate was contemplating crushing the ore and sluicing to obtain a concentrate, but Collins envisaged problems with a water supply during dry periods. Transporting the ore would also have been problematical.

Production from this phase of activity was confined to two parcels of ore sent for assay. Exploration Licence EL1/73 expired on 11 July 1980.

4.3.9 Esso Exploration and Production Australia Incorporated 1973 – 1974 (EL 2/1973)

Esso Exploration and Production Australia Incorporated (Esso) explored the southern half of the Balfour Project Area as part of their larger EL 2/1973. Initial work consisted of an airborne INPUT EM survey with magnetics and radiometrics also read (Neale, 1973; TCR73_0964 & Neale, 1974; TCR74_0987). INPUT EM anomalies were defined within the Balfour Project area with anomalies X2, X3, X4, X5 and X24 and X25 in the western part of the BPA, and anomaly X50 in the eastern. Anomalies X4, X5 and X24 (no were followed up with a helicopter borne field visit but no outcrop was noted (Neale, 1973; TCR73_0964) and the licence was dropped (Neale, 1974; TCR74_0987). Other anomalies nearer Sandy Cape were attributed to black shale. The anomalies X2, X3, X4, X5, X24, X25 and X50 remain technically unexplained.

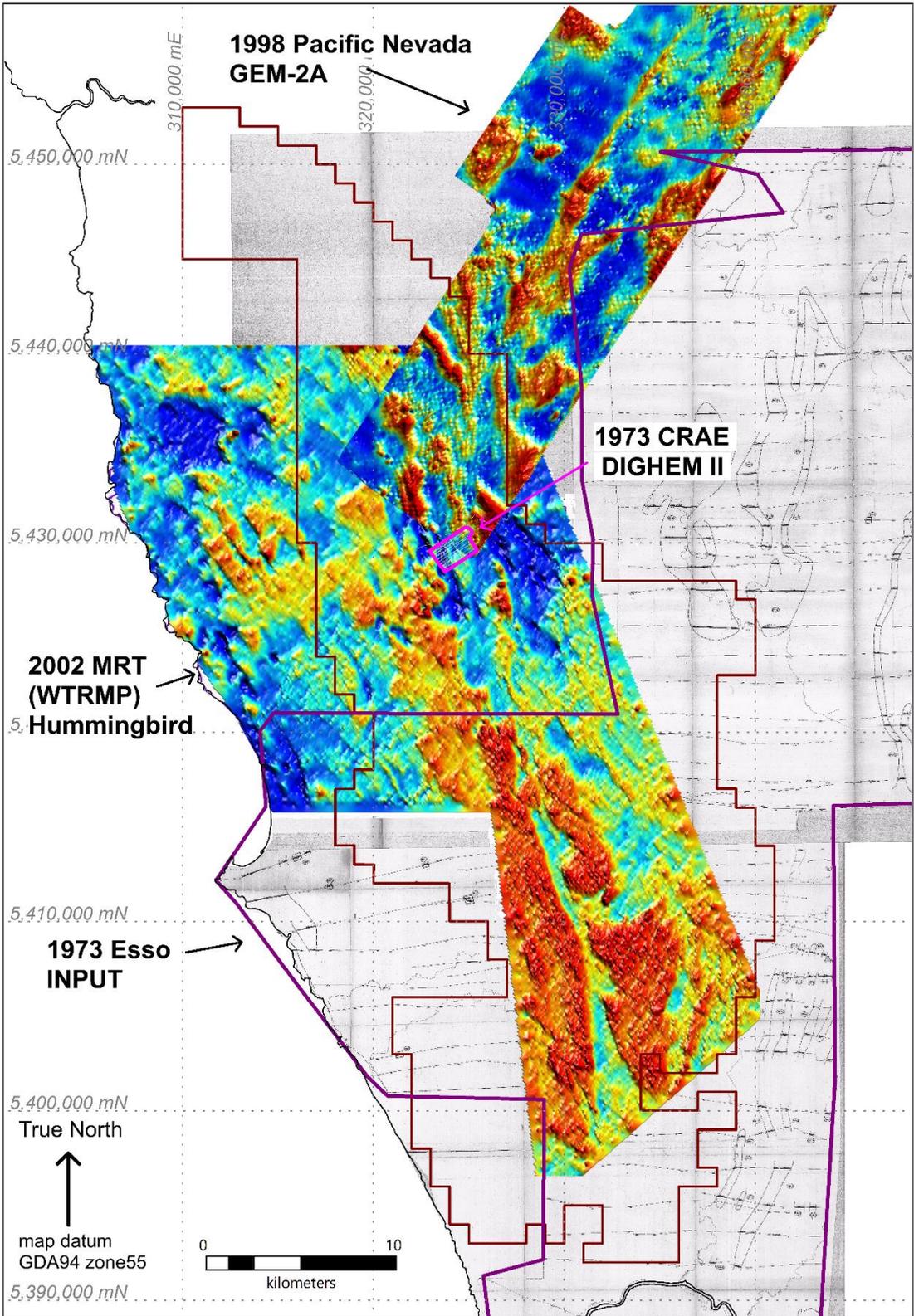


Figure 4.3.9.1: Composite image of airborne EM surveys to date in Tasmania's northwest with the Balfour Project Area as maroon outline. All surveys are frequency domain surveys.

4.3.10 CRA Exploration Limited/Geopeko 1977 – 1985 (EL 1/1977 and JV's with ML's and SPL's over the Balfour area)

CRA Exploration (CRAE) applied for a large holding on the west coast over a large area of the Balfour Project Area under EL 1/1977 and JV'd with Geopeko Limited (Geopeko).

In the immediate Balfour area they also formed a number of JV's with local mine lease holders M. Laan, P. Laan, W. Baker, S. Tatlow, R. South, J. Holloway, S. Caddy and N.R. Langsford, the holders of various SPL's (774 and 781) and numerous ML's (120M/67, 121M/67, 58M/1968, 59M/68, 63M/68, 1M/73, 10M/73, 4M/74, 1M/76, 2M/76, 45M/77, 72M/77, 93M/77, 94M/77, 95M/77, 103M/77, 8M/78 and 57M/78) largely over the alluvial tinfield in and around Balfour which necessitated (three) separate reporting.

CRAE/Geopeko carried systematic work over a 2.6km x 0.65km grid over Specimen Hill with work consisting of detailed geological mapping by both Heithersay (1982a; 82_1730, 1982b; 82_1731, 1982c; 82_1740, 1982d; 82_1743) and Langsford (1983; 83_1932), rock chip sampling including systematic vein sampling, Jacro augering (120 samples), ground magnetics, IP (Geoterrex survey) and later further infill, a DIGHEM II survey flown in March 1980 and ultimately the drilling of a total of 8 deeper diamond drill holes for 1530.65m (DD81BC1, DD81BC2, DD81BC3, DD81BC4, DD81BC5, DD81BC6, DD82BC7 & DD82BC8) and four shallower drill holes for 134.9m using the JACRO rig (i.e. DDB7, DDB8, DDB9 & DDB10) (Porter, 1980; 80_1475) (see details in Appendix A).

Early reporting prior to 1980 is not shown on MRT's database with the first available report a progress report on work in train (80_1469). Work was following up aeromagnetic anomalies and I am aware that on EL 36/1980 (adjacent to the south) their initial work involved interpretation of a recently flown Tasmanian Government aeromagnetics survey, a photogeological interpretation of the geology of the northwest region by Professor S. Carey, and compilation of all existing stream sediment geochemical sampling in the area so it is very likely that this work was also done on EL 1/1977 and informed subsequent work.

Over the Balfour area an appraisal of existing geophysical data was also completed (McKay and Flis, 81_1516) who summarise the results of their work as follows.

"Detailed ground magnetics carried out over the Balfour area have defined three major and one minor anomaly. These occur in a linear pattern trending approximately 320° (magnetic). One of these anomalies occurs above Specimen Hill. Two linear IP anomalies have been identified as shown on (their) Plan No. Tv 335. The IP anomaly on the eastern portion of the grid extends along strike for some 800 m and coincides with a clearly defined Sn and Zn geochem(ical) anomaly. Also this zone lies along the lithological boundary separating the green chloritic shale sequence and the grey shale/quartzite sequence as identified in the regional mapping" (McKay and Flis, 81_1516)

Regarding the magnetic anomalies under Specimen Hill McKay and Flis, 81_1516) state "BHP drilled a hole into the southernmost magnetic anomaly centred on line 88N. This hole (DD B5) intersected disseminated pyrrhotite in a sequence of interbedded shales and quartzites with minor white quartz veining. The core was relogged by Geopeko/CRAE and it was concluded that the anomaly could not be explained by the results of the drill hole because the amount of disseminated pyrrhotite was usually less than 5% (vol.) of the shale. To clarify this it was decided to submit core samples of DD B5 to the CSIRO with a request to carry out magnetic susceptibility measurements. The results ... show that the remnant susceptibility (Q) is about 20 times (Koenigsberger ratio) larger than the mean susceptibility. It is likely that the orientation of this remnant susceptibility is parallel with the earth's field, thus giving a positive anomaly. The results show that the remnant magnetism of the pyrrhotite is sufficient to explain the size of the magnetic anomaly."

McKay and Flis (81_1516) also report on the flying of a DIGHEM II airborne EM survey over a the Balfour area designed to detect and test conductors in the Specimen Hill vicinity. The survey was flown on ten two-kilometre east-west lines spaced at 150 metres with an EM bird height was a nominal 30 m whilst the magnetometer bird height was 50 m.

Three distinct linear EM anomalies were defined on the western portion of the grid. Lithologies in this area are dominantly black and grey shales. They also note that “the Dighem survey failed to give any response over the Murray's Reward Cu mineralisation.”

The fieldwork over the Specimen Hill grid, i.e. detailed geological mapping, rock chip sampling including systematic vein sampling, Jacro augering, ground magnetics, IP (Geotrex survey) and later further infill IP and SP surveying is reported in a series of separate reports specific to the particular JV (Porter 80_1475; Heithersay 82_1730; Heithersay, 82_1740; Heithersay 82_1741; Heithersay 82_1743; Dickson 83_1933; Dickson _83_1934; Dickson 83_1935). This work defined a number of anomalies which were subsequently drill tested.

(Note that CRAE number the drillholes as they are drilled within current programme whereas Geopeko include previous drilling by BHP so CRAE's drill hole DD81BC4 is the same as Geopeko's DDB14. MRT's database uses the CRAE nomenclature as is used herein.)

DD81BC1 (116m) and DD81BC2 (210.5m) (82_1740) were drilled to test the zone of maximum brecciation and tourmalinisation on Specimen Hill. In DD81BC1 veins average 1cm thickness and included quartz, pyrite, arsenopyrite, chalcopyrite, siderite, wolframite, sericite and cassiterite. Best zone of veining was 28m to 63m with a vein density approaching 3 veins/m. This interval assayed 115ppm Sn and 116ppm W.

DD81BC2 (82_1740) intersected variably tourmalinised and silicified siltstones with a vein density of 1/2m. Tungsten was elevated for much of the hole with 29m – 50m, 21m @ 0.12% WO₃; 57m to 72m, 15m @ 0.156% WO₃; 89m to 115m, 26m @ 0.24% WO₃ which combined gave 87m @ 0.137% WO₃. Vein density here is 1 vein per 2m. Heithersay says that this is best interpreted as a sheeted vein system with average strike 300 and shallow dip to northeast (82_1740). (This is disputed later by Langsford's mapping (83_1935) who describes a range of common orientations).

Heithersay (82_1740) also says no coincidence between IP and magnetics which are separate parallel trends and that surface tin geochemistry shows no relation to either. IP is considered to be due to shales (82_1740).

“Specimen Hill is the main locus of veining although mineralised veins are evident over a larger area. A hidden granite cupola is considered the controlling factor of veining in the area.” Heithersay, (82_1740)

DD81BC3 (143.1m) (82_1743) was drilled to test the zinc (to 0.26%) and lead (to 0.11%) soil anomaly to the southwest of Specimen Hill. The hole intersected no significant mineralisation except for three thin quartz+pyrite+sphalerite veins (82_1743).

DD81BC4 (211.4m) and DD81BC6 (274.6m) (82_1730) were drilled on Peters Ridge to test coincident anomalous tin, tungsten, copper, lead and zinc surface geochemical anomalies. Both holes intersected thin mineralised quartz veins. Better assays for DD81BC4 were 35m to 38m, 3m @ 0.51% Sn, 66m to 70m, 4m @ 0.17% Sn, 113m to 116m, 3m @ 0.18% Sn and 139m to 154m, 15m @ 0.11% Sn. Better assays for DD81BC6 were 109m to 111m, 2m @ 0.27% Sn, 188m to 189m, 1m @ 0.14% Sn and 0.71% WO₃, 204m to 205m, 1m @ 1.05% Sn and 0.14% WO₃, 231m to 233m, 2m @ 0.36% Sn and 0.18% WO₃, 260m to 263m, 3m @ 0.30% Sn and 0.11% WO₃.

DD81BC5 (96.0m) (82_1741) was designed to test down plunge of the high grade tin shoot in Tatlows Shaft. The hole failed to intersect significant mineralisation and the Tatlows lode would appear to be a small lens with limited depth extent (82_1741)

DD82BC7 (179.1m) (83_1934) was designed to test the 108N magnetic anomaly. The anomaly was modelled (Flis, 1983; appendix A in 83_1934) who suggested that the anomaly was better explained by a dyke like body of significant depth with the caveat that remanence may have a significant impact on this interpretation. The hole intersected elevated pyrrhotite (some per cent) around the target zone between 95m and 115m which was considered at the time to explain the anomaly (83_1934). The hole continued intersecting major fault zone at 179m interpreted as the Specimen Hill Fault.

DD82BC8 (300.0m) (83_1935) was designed to test the zone of quartz vein brecciation and tourmalinisation on Specimen Hill at depth. A major fault zone (Specimen Hill fault) was encountered at 293m. "A total of 33 quartz veins with a thickness greater than 1 centimetre were encountered but there appeared to be no abnormal concentration of veins in anyone section of the hole. A weighted average of all vein material intersected in the hole ran 1830 ppm Tin 2300 ppm Tungsten, 5.1% Arsenic, 5200 ppm Copper, 1830 ppm Zinc and 7.5 ppm Silver." (82_1740)

CRAE/Geopeko concluded that whilst the vein grades were high enough themselves there is insufficient density to generate an adequate average grade for mining.

Dickson (83_1933) collates data from the 6 BHP (DDB1 to DDB6) and 8 CRAE holes (DD81BC1 to DD81BC6, and DD82BC7 & DD82BC8) in tables of veins density (Table 1), vein thickness (Table 2), vein assay (Table 3) (bearing in mind that not all BHP holes were assayed and in some instances samples were taken across broader intervals requiring back calculations and assumptions r.e. grade of wall rock) and concludes that the

- average grade of the veins intersected in drilling to date is 1.02% WO₃ and 0.81% Sn,
- veins range in width from 1cm to 67cm with a mean of 7.64cm
- average vein content is 0.66%

Dickson (83_1933) compares the deposit with Mt Carbine where similar style mineralisation is upgraded by rock sorting. Dickson believes that such might not work at Balfour due to the white quartzite being not separable from the vein material. More significantly is the fact that is "the fact that the sections with higher vein densities are widely scattered through the drill holes." In Dickson's "TABLE 4. - Proportion of core effected by different cut off densities." he notes that "The individual sections above the cut off level are all scattered. Only at 1% cut off level do any sections adjoin. They are -

- 60 ft between 120 and 180 feet in 00B2
- 60 ft between 420 and 480 feet in 00B6
- 20 metres between 130 to 150 in 0081 BC4 and that it would be impossible to mine these separate zones (at this 1% cut-off)"

Dickson (1983; 83_1933) also includes a petrology report by Cowan on 6 samples from DD82BC8 who states "All six samples are representative of a weakly polymetamorphic pelitic sediment sequence. Relict primary features indicate a weakly dolomitic, quartzose to subarkosic, shale-parted siltstone as the primary lithology. Individual samples reflect rather conspicuous detrital opaques and zircon, which may be significant in terms of stratigraphic correlation."

"Metamorphic features may be summarised as mild hornfelsing (albite-epidote hornfels facies) and semi-contemporaneous metasomatism followed by a weak, lowgrade "regional" metamorphism. Metasomatic phases are fine-grained schorl, impregnating shaly partings/interbeds, and sideritic carbonate as a replacement of dolomite. Minor shear-related quartz and adularia-ankerite veinlets postdate an earlier generation of minor quartz veinlets with accessory traces of chalcopyrite. A few samples include disseminated fine-grained pyrrhotite which, in part, appears to represent a contact-related replacement of "syngenetic" pyrite."

“Overall, this suite exhibits affinities with the low-grade contact-metamorphosed/metasomatised pelites marginal to, for example, the Renison mineralisation. Cassiterite was not detected, but assays for Sn may be warranted.” (Cowan in Dickson, 1983; 83_1933)

CRAE/Geopeko withdrew from further exploration in the immediate Balfour area for tin and tungsten.

On their larger EL 1/1977 Porter (1980a; TCR 80_1469) describes exploration largely outside of the BPA but some work is described at the Frankland magnetic anomaly to the northeast of Balfour where “a broad grid was cut (and) a ground magnetic survey, geological mapping and soil sampling (on three representative lines) was carried out.” without encouragement.

Most of their subsequent work was conducted outside of the BPA. In conjunction with their work on EL 36/1980 they compiled all previous stream sediment geochemical data and computer modelled anomalies, some of which do lie within the BPA i.e. Chimney Creek, North Pedder River and Toner River anomalies. (82_1801)

In 1982/83 (83_2013) CRAE carried out ground follow-up of a number of coincident stream sediment and aeromagnetic anomalies. Of these only the Chimney Creek anomaly lies within the BPA. Here two anomalous lead stream sediment samples corresponded with a high order north-south magnetic anomaly. Two east-west ground traverses were carried out with the magnetic anomaly explained by disseminated magnetite in siltstone. Anomalous stream sediment results were unable to be replicated and no further work was recommended. (83_2013).

In 1984/85 (85_2236) helicopter supported stream sediment sampling was carried out to infill earlier compiled work. Panned concentrate, -80# and clay fraction samples were collected. Anomalies were defined at Mt Holloway (1700ppm Zn in -80#), Waratah Creek (W and Zn) and Norfolk Ranges (W). Anomalous Pb, Mo and Ag in panned concentrates were found draining an area of old workings at Dohertys Pimple and anomalous gold in creeks draining Woody Peak (attributed to perched Tertiary gravels). Brief fieldwork was conducted on the old workings at Mt Holloway and Doherty's Pimple.

At Dohertys Pimple workings consisted of trenches both parallel and perpendicular to the strike of the lode (300° magnetic) with mineralisation consisting of pyrite, chalcopyrite and secondary copper minerals in a quartz vein 2m thick infilling a shear in pyjama siltstones. CRAE also visited old workings in the Dohertys Pimple area mapping and sampling collecting 9 rock samples. Best assays were 3.98% copper and 0.45g/t gold from mullock (Weir, 1985; 85_2236)

At Mt Holloway workings consist of a single trench with mineralisation dominantly pyrite and chalcopyrite in a 1m wide fault zone. Maximum assays were 12.5% copper and 0.1g/t gold from the fault. (85_2236)

4.3.11 Mt. Lyell Mining and Railway Company Limited 1978 - 1981 (EL 26/1978 and EL 27/1978)

The Mt. Lyell Mining and Railway Company Limited (MLMRC) acquired two tenements along the eastern margin of the southern part of the BPA including the Toner River field. EL 26/1978 was explored for diamonds with gravel sampling though not within the BPA) (Hutton, M., 1980a; TCR 81_1517)

On EL 27/1978 including the Toner River field (Hutton, M., 1980b; TCR 81_1520). MLMRC carried out rock and stream sediment sampling around the old workings of the Toner River field. Seven rocks were collected assaying 12.2%, 6.4%, 6.0%, 2.32%, 1.5%, 1.06% and 0.12% copper with best gold 25ppb.

4.3.12 CRA Exploration Limited 1980 – 1985 (EL 36/1980)

In 1981 CRA Exploration Limited (CRAE) pegged EL 36/1980 which “was taken to cover the southern extension of the Balfour - Norfolk - Interview magnetic lineament. The southern extension of this lineament is marked by several old copper workings and the old east Interview copper lead workings lie just to the west of the E.L.” (Dickson, 1982; TCR 82_1851).

In their first year a recently flown Tasmanian Government aeromagnetics survey was interpreted, photogeological interpretation of the geology by Professor S. Carey, and compilation of all existing stream sediment geochemical sampling in the area. This worked defined a number of encouraging anomalies which were prioritised for field work in the coming summer field season. (Dickson, 1982)

Major aeromagnetic anomalies defined by the aeromagnetic interpretation warranting follow-up were defined as Mt Sunday anomaly, Interview Pinnacles anomaly, Silver Reward anomaly, Nth. Silver Reward, Interview Copper anomaly and Chimney Creek anomaly.

In the first round of fieldwork CRAE carried out a gridded ground magnetics survey at the Interview River Copper anomaly (Copper Reward) where “a strong trend was mapped extending from the No.2 adit extending through the copper No.3 workings and extends off the grid to the east. The zone is coincident with a major quartz+pyrite+magnetite horizon trending roughly east-west through the southern half of the anomaly. The zone is probably transgressive and although wide and often strongly gossanous it shows very little evidence of base metal or gold content. CRAE collected 31 rocks samples assaying up to 16.8% Cu, 1.15% Cu, 1.12% Cu and 0.92% Cu, and up to 45.6% Pb (and 75ppm Zn in same sample) and 560ppm Pb (Dickson and Weber, 1983; TCR 83_1970). Bedrock soil sampling was recommended on lines crossing the anomaly.

The copper results and significant lead results from this rock sampling are shown on figure 5.7.

Two ground magnetics traverses were read across the Silver Reward anomaly defining a thin anomaly south from the old Silver Reward shaft.

Dickson and Weber (1983) state that “The mineralisation appears to be very restricted and confined to the 2 x 3 x 8 metres pit, or shallow shaft. Coarse grained galena occurs with quartz, chlorite and siderite on the dump but only a thin siderite rimmed quartz vein extends outside the shaft. The mineralisation is obviously related to the late stage quartz veining, but the surrounding sediments do contain anomalous lead values and further magnetic traversing together with bedrock geochemical sampling and geological mapping is recommended.”

Two lines of lines of ground magnetics were read across the North Silver Reward anomaly showing only a low order response.

In their next phase of fieldwork CRAE targeted the Interview-Pinnacles aeromagnetic anomaly (Weber, 1983; TCR 83_2012) with several ground magnetic traverses which were also soil sampled. The Mt Sunday anomaly could not be located with two ground traverses.

CRAE concluded that “the Interview - Pinnacles aeromagnetic anomaly corresponds to a unit of disseminated magnetite. Soil sampling over the siltstone sequence outlined a low-order lead anomaly (210 ppm) with corresponding increases in Zinc and Barium.” (Weber, 1983; TCR 83_2012)

Copper values were all low.

In addition “a stream sediment sample taken south of Interview – pinnacles contained anomalous basemetal values. This sample was taken in a fault/dolerite dyke zone and should be followed up. (Weber, 1983; TCR 83_2012)

In the 1983/84 year CRAE (Weir, 1984; TCR 84_2113) carried out further helicopter supported stream sediment sampling defining anomalies at the Bolton prospect and Pinnacles prospect as well as smaller anomalies at the Toner River and Mt Edith prospects. Results of rock samples collected during this work were unavailable at the time of reporting.

In the following year 1984/85 CRAE received the assays from the previous years work. They also undertook further helicopter supported stream sediment sampling in the Interview-Pinnacles area but were not able to reproduce the anomalous results from the previous years sampling. Suggestions that bushfires may have contributed metallic elements were considered a reasonable explanation for the difference. (Weir, 1985; TCR 85_2377).

Results of rock sampling from the Toner River (7 samples) visit the previous year and the regional stream sediment survey also included. Copper assays up to 9.1%, 3.1%, 1.76% and 810ppm with best gold 400ppb were reported.

“Although strong lead-zinc geochemical anomalies were obtained in the Pinnacles area during the 1983-84 field season, the results were not repeatable during 1984-85. A major bush fire had been through the area just prior to the 1983-84 survey and it is believed that unusually high levels of lead and zinc were released from plant ash into the streams immediately after the fire. This was later flushed out by normal rainfall and the lead-zinc values returned to normal background levels by the 1984-85 season.

No obvious geochemical targets existed and as known mineralisation as restricted to very small veinlets at Toner River, Silver Reward and Interview copper prospects, no further exploration was warranted.” (Dickson, 1985; TCR 85_2444)

4.3.13 Electrolytic Zinc Company of Australasia Limited 1980 – 1985 (EL 56/1980)

The Electrolytic Zinc Company of Australasia Limited (EZ) pegged the area around Sandy Cape overlapping the central eastern part of the BPA licence as EL 56/1980 and joint ventured with Tennaco Oils and Minerals Pty Ltd to explore for skarn style tin after the Mines Department flew a new aeromagnetics survey in the region. (80_1847)

A number of reports by John Bishop of Mitre Geophysics (as appendices) were commissioned to interpret the aeromagnetics survey. Nine anomalies were defined with fieldwork carried out over four of these.

Grids were surveyed over the four linear magnetic anomalies (numbers 1, 2, 4 and 6) (with ground magnetics over all four grids (85_2236; 81_1652; 82_1847) and Crone PEM surveys conducted over anomalies 1 and 2 grids (81_1652), the latter to determine whether the magnetic anomalies were conductors. (85_2236)

All but anomaly 6 lie just west of the BPA with anomaly 6 just inside it between the Interview and Italian Rivers. No anomalous responses were recorded over the anomaly 6 grid and it is explained as being due to disseminate pyrrhotite in sediments. (82_1847)

Anomaly 1 was drilled with two diamond drill holes SCP1 (targeting the Crone PEM anomaly) and SCP2 targeting the magnetic high. Proterozoic sediments including graphitic black shale and fault zone were intersected in SCP1 and explain the EM anomaly. No explanation for the magnetic anomaly was determined from SCP2 though besides more sediments it did intersect a rock described as a rhyolite but interpreted as an apophyse of the granite. (84_2207)

Anomalies 1, 2 and 6 all lie outside of the BPA but similar anomalies do lie within it and results of this work might be relevant to similar north-northwest trending magnetic anomalies.

4.3.14 Abignano Constructions 1981-1989 (EL 1/1973, EL 13/1981 and EL 64/1983 also included Mining Leases)

EL 1/1973 which covered the Interview River wolfram workings was transferred to Abignano Constructions in 1981 and a new exploration licence - EL 13/1981 - was taken out surrounding the leases.

Access to the site was still a problem therefore a study into a route (Stephenson Maunsell & Partners 1981) to the workings was completed, however the road was never constructed.

In 1981, a series of backhoe trenches was dug at intervals of 40m from Kenny's Workings in the north to Cooney's Workings in the south. All occurrences of mineralised veins were mapped. An adit at Kenny's Workings was re-timbered and extended. Numerous samples were taken and assayed. The vein system was estimated (by Gouge and Brink 1982) to extend over a distance of 2.5km and assumed to have depth extents of 200m. On this basis the area was estimated to contain, 1.6 million tonnes of ore, at a grade of 1.4% WO₃, giving (in 1982 dollars) a potential worth of \$125M, with \$1.7M estimated to prove (or otherwise) the target.

This resource is based upon the north-northeast veins at Kennys and Cooneys being part of a contiguous single vein offset on northwest striking sinistral faults, or continuous vein system with an en-echelon pattern. Average grades calculated by trenching along the strike of the lode had showed an average grade of 5% WO₃ and width of 0.3m mined over a 2.5km strike and 200m depth with 0.9m waste dilution on average.

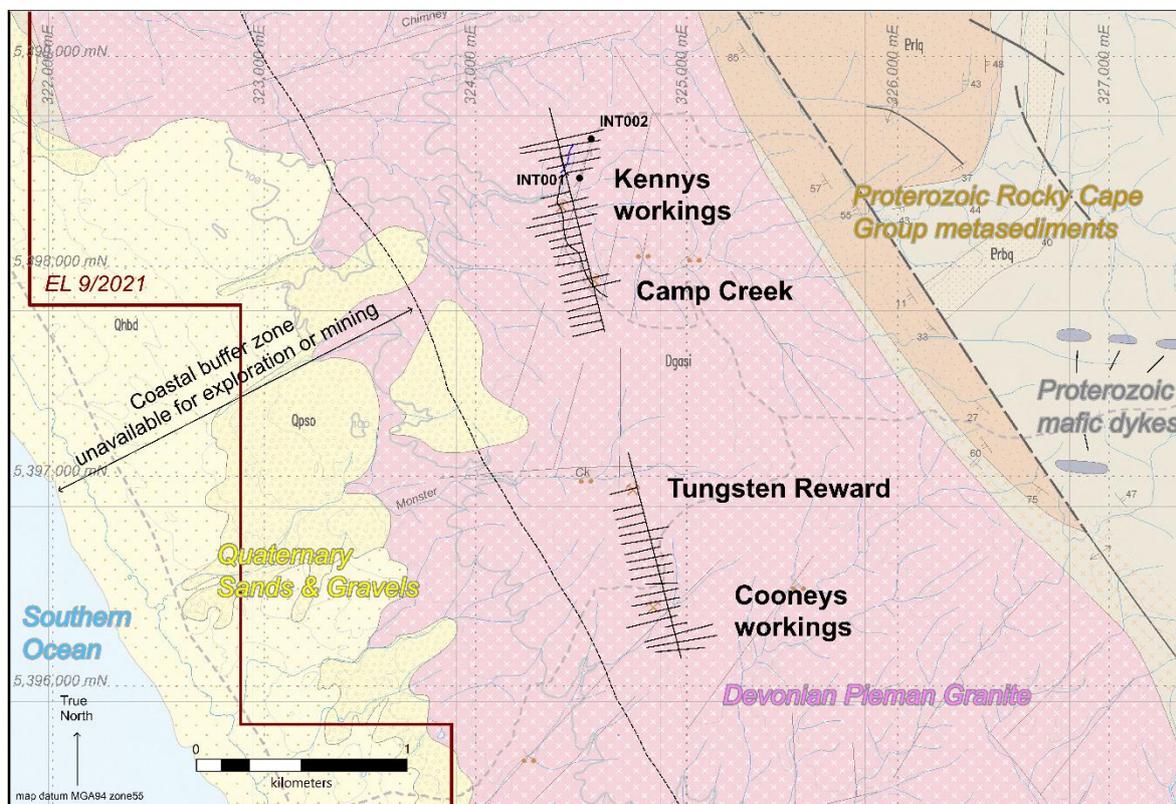


Figure 4.3.14.1: Interview River prospect showing historic grids (now overgrown) and drillholes on background of MRT's 1:25,000 'Interview' geological map (Vicary, 2004)

Exploration licence EL 13/1981 was relinquished in November 1982 but another licence EL 64/1983 was taken out over the same ground in 1983 by Abignano Constructions P/L.

Abignano commissioned Warman International Ltd. to conduct metallurgical testwork on a 68kg sample of ore consisting of ~3/4 griesenised granite and ~1/4 quartz vein (Lanyon, 1983)

This work showed that:

- “The sample contained 0.74% WO₃, 0.06% As and less than 0.01% tin.
- The tungsten was present as wolframite and also scheelite.
- Heavy liquid separation produced a concentrate containing 93.7% of the tungsten at a grade of 42.2% WO₃.

- The tungsten minerals present were coarse and well-suited to primary concentration by gravity means.
- The upgrading of a primary concentrate to sales grade is likely to be a complex process. The presence of scheelite limits the extent to which high intensity magnetic separation can be used.” (Lanyon, 1982)

In December 1984, two diamond drill holes were completed (Brink 1985a). Three drill sites were prepared at 200 metre intervals at the Kenny's Adit vein. Diamond drill holes (NQ) were drilled at 45° declination at right angles to the vein strike and aimed at intersecting the veins between 40 and 50 meters vertically below the surface. Only two holes were completed; serious breakdown of the rig prevented drilling of the third. INT001 was drilled to 71.0m and INT002 to 72.52m.

Assay results are shown in the following table.

Hole_ID	sample_id	from m	to m	depth m	Au g/t	Sn %	WO3 %	Mo %	Cu_ %
DDH1	1	43	44.15	1.15	0.08	0.04	0.04	0.02	0.01
DDH1	2	44.15	46.63	2.48	0.13	0.03	0.08	0.02	0.003
DDH1	3	46.63	48.63	2	0.07	0.02	0.04	0.02	0.002
DDH1	11	48.63	50	1.37	na	na	na	na	na
DDH1	12	50	52	2	na	na	na	na	na
DDH1	13	52	54	2	na	na	na	na	na
DDH1	14	54	56	2	na	na	na	na	na
DDH1	15	56	58	2	na	na	na	na	na
DDH1	16	58	59	1	na	na	na	na	na
DDH1	4	59	59.8	0.8	0.04	0.04	0.07	0.01	0.098
DDH1	5	59.8	61.4	1.6	0.04	0.03	0.06	0.02	0.002
DDH1	6	61.4	63.66	2.26	0.01	0.03	0.08	0.01	0.005
DDH1	7	63.66	64.8	1.14	<0.01	0.03	0.02	0.01	0.003
DDH1	8	64.8	67.34	2.54	0.06	0.03	0.07	0.02	0.003
DDH1	9	67.34	69.17	1.83	0.06	0.03	0.08	0.03	0.003
DDH1	10	69.17	71	1.83	0.03	0.03	0.08	0.04	0.004
DDH2	1	51.31	52.1	0.79	0.02	0.05	0.05	0.01	0.07
DDH2	2	58.6	59.33	0.73	0.02	0.03	0.42	0.01	0.03
DDH2	3	59.33	61.25	1.92	0.03	0.04	0.06	0.02	0.01
DDH2	4	53	53.3	0.3	<0.01	0.03	0.03	0.02	0.006
DDH2	5	53.3	53.8	0.5	0.04	0.04	0.09	0.01	0.52
DDH2	6	53.8	54.83	1.03	0.01	0.05	0.05	0.02	0.03
DDH2	7	54.83	55.77	0.94	0.01	0.09	0.09	0.02	0.05
DDH2	8	55.77	56.71	0.94	0.02	0.05	0.06	0.02	0.08
DDH2	9	56.71	58.6	1.89	0.06	0.03	0.11	0.02	0.01

Both holes intersected variably greisenised granite with showings of wolframite, scheelite.

Brink 1985b concluded most of the sampled and analysed core can be regarded as being mineralised, but apart from sample 2 of INT002 (DDH 2), all must be considered as sub economic, given current (1985) commodity prices. The overall low order of the assays resulted in the decision to defer

further exploration activities. However, the drilling indicated the continuation of the mineralised quartz reef at depth, as well as a pervasive mineralisation over considerable width. Brink also commented that, if and when tungsten prices attain more favourable levels, serious consideration may be given to investigating the prospect as a potential low grade, large volume open-cut target (Mt. Carbine tungsten ore grades about 0.1% W03 and is being mined commercially).

Brink continued saying “some of the gold values are in the significant category and also deserve further attention.

The lease lapsed in January 1987 and the three mining leases were forfeited in April 1989.

4.3.15 Geopeko Ltd. 1883 – 1984 (EL 17/1983)

Geopeko pegged EL 17/1983 which overlaps the central-eastern portion of the BPA, extending halfway cross the Toner River workings in the vicinity of Mt. Bolton, carrying out reconnaissance stream and soil sediment sampling over magnetic anomalies defined by the 1981 Mines Department aeromagnetics survey (Pemberton, 1984a & 1984b). The target model was tin skarn associated with magnetite and/or pyrrhotite. Anomalies Bolt 5, 6, 7, 8 and 9 lie within EL 12/2015 and all were attributed to syngenetic pyrrhotite in siltstone.

4.3.16 Wolston Developments Pty Ltd/Monier Limited. 1985 - 1990 (EL 34/1985 and EL 6/1988)

Essentially the same area as EL 17/1983 was pegged by Wolston Developments Pty Ltd (Wolston), a subsidiary of construction company Monier Limited (Monier) as EL 34/1985 initially exploring for silica associated with dolomite (Harrison, 1987; 87_2647).

An aerial photograph study was used to guide at helicopter supported sampling programme, which unsurprisingly encountered difficulties in access due to the thick bush. Samples collected were considered suitable for metallurgical silicon metal. In addition a pyrite vein in quartzite was collected from just west of the licence area (sample number CQ340135 at 334,000mE and 5.413,500mN AGD66 zone55 -no details re assaying methodology) assayed 4.7% Cu, 14ppm Zn, 42ppm Ni, 67ppm Co, 5.7ppm Ag, 17% Fe, <0.01% Sn and 0.27g/t Au. Harrison (1987; 87_2647) commented that “this was not encouraging due to the small size of the outcrop it does indicate that magnetic anomalies in the area should be checked for mineralisation.”

There must have been a change in focus as Monier engaged Longworth and Associates to undertake a five day helicopter supported sampling programme looking for gold and base metals. Stream sediment (66 samples), soils (4 samples) and rock chip sampling (43 samples) was undertaken by Longworth and McKenzie Pty. Limited in February, 1988 (Anon. 1988; 88_2793)

Samples were analysed for Cu, Au, Ag, Pb, Zn, Sn, Ni, Cd, W, Bi, Ce and La by S.G.S. laboratories using ICP and AAS. Much of the sampling was done outside of the EL. This work located three outcropping gossans (outside of EL 34/1985 but inside the BPA), two of which had reportedly previously relocated by CRA (Anon, 1988; 88_2793).

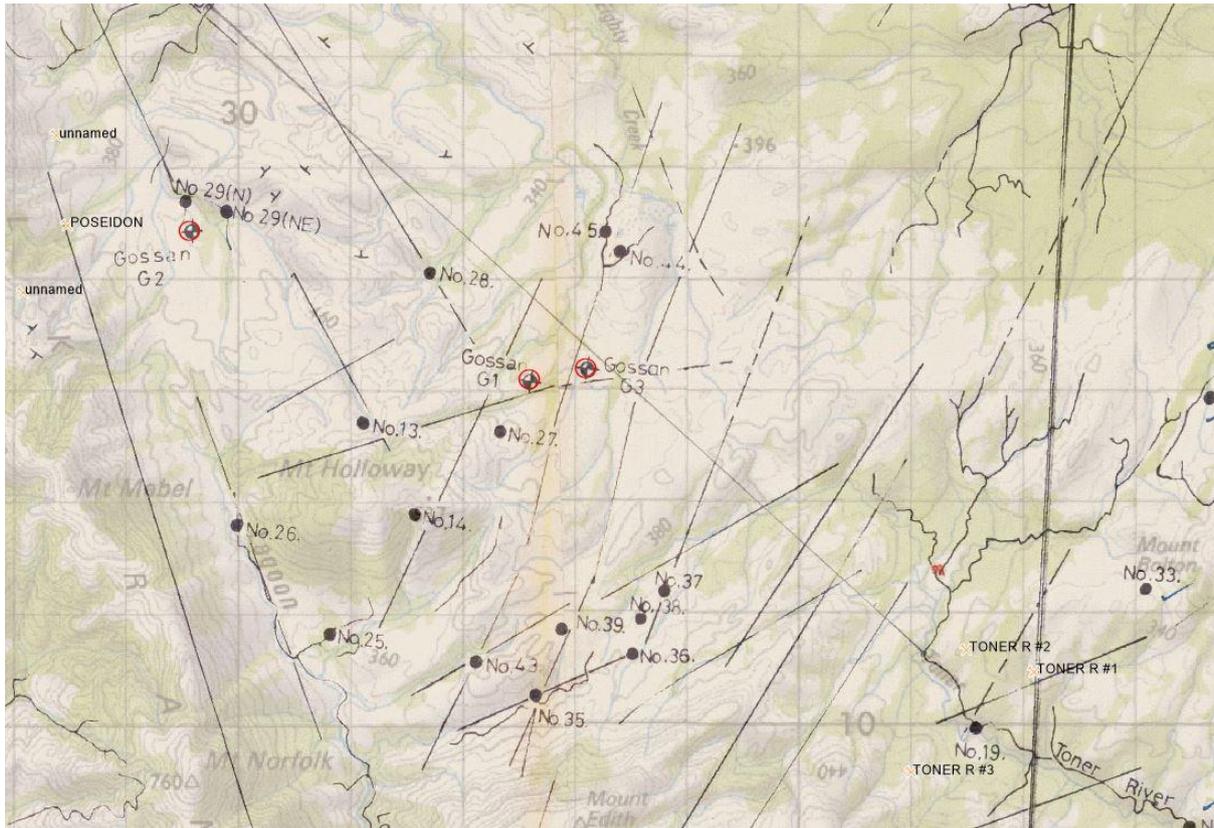


figure 4.3.16.1: Location gossan samples G1, G2 and G3 EL34/1985 (Anon., 1988; 88_2793).

Gossan G1 is most extensive with 2 shafts 5m to 10m deep and a trench across strike 10m long x 1.5m wide x 3m deep adjacent to a fault and an anticlinal fold in the host siltstones. Within the trench a richly mineralised 5cm to 8cm wide vein, striking 080° magnetic, occurs within a 1m wide zone of limonitic bedrock with pyrite, chalcopyrite, malachite and limonite. The sample from this location assayed 1.68g/t Au, 22g/t Ag, 12.6% Cu, 34ppm Pb, 164ppm Zn and 165ppm Ni (Anon, 1988; 88_2793).

Gossan G2 was reportedly previously located by CRA Exploration with the gossan workings a trench 10m long x 1.5m wide and 1m deep. The mineralisation here occurs as a pyrite and minor chalcopyrite vein. The sample from this location assayed 0.26g/t Au, 0.8g/t Ag, 0.267% Cu, 10ppm Pb, 9ppm Zn and 12ppm Ni. Aeromagnetics showed an adjacent magnetic anomaly (Anon, 1988; 88_2793). This position would correspond with the Poseidon workings, probably on Section 4450_M.

Gossan G3 is approximately 500m east-northeast along strike of G1 and has been worked by a 5m adit into the hill which was not accessed but which contained siltstones with quartz veining and "metalliferous" (pyritic?) mullock (Anon., 1988). The sample from here assayed 0.043g/t Au, BDL Ag, 0.0152% Cu, 25ppm Pb, 125ppm Zn and 15ppm Ni (Anon, 1988; 88_2793).

Conclusions and recommendations made by Anon. (1988; 88_2793) are;

"From the discussion of analytical results above, it appears possible that gold and copper occur in association in the in-situ rock, but during weathering and dispersion, only the copper remains as an indicator in the surrounding soil horizon."

"Should further work be undertaken, the use of copper as a path-finder for gold should be checked by means of an initial orientation survey."

"The gossans located should be the subject of further geochemical work, with sampling on a regular basis. Other gossans may well exist, although not yet located."

"The circular (magnetic) feature thought to be related to an igneous intrusion (Section 2.4) should also be inspected in the field."

Wolston Developments carried out a regional stream geochemical survey on their EL (before focusing their attention on the Toner River prospect (referred to in some reports as the Copper Reward workings) where they gridded an area on the northern side of the Toner River of the Section highlighted by Ward (1911) as most prospective. (Harrison, 1989; 89_3035)

The work on the Toner River grid is detailed somewhat poorly in a quarterly report on exploration on EL's 34/1985 and 6/1988 by Harrison (1989; 89_2969). This report contains the results of the gridding, geochemical surveys, and later geophysical surveys the latter in Bishop (1989; 89_2969a) which is included as an appendix.

Work consisted of soil and rock sampling, and ground magnetics, self-potential and some VLF-EM geophysical surveying over the grid

The grid established is oriented 305° magnetic with wing lines 100m apart, nominally 500m in length, with a baseline 800m long. Soil samples were collected on 25m spacings. Whilst northings and eastings are used for the geophysical data, sample locations use letters for eastings and +ve and -ve integers for northings making positioning geochemical data a headache. Following receipt of initial geochemical data some wing lines were extended. In addition (1) a single line was cut and sampled (50m sample spacings) on the next low ridgeline to the east, and (2) random soil and rock samples were collected in an area on the southern side of the Toner River (flanks of Mt Vera) where the bush was open enough to allow access.

This latter data set (on the slopes of Mt Vera) is very poorly documented with the sample results of a select number of samples shown with no indication of the positions of other samples. Some considerable effort has been extended towards correctly positioning soil and rock sample data but there is still potential for error, particularly with respect to the rocks.

Initially samples were assayed for gold, copper and arsenic. In the second round of sampling on infill and extensions to the grid assaying was only done for gold but the new areas away from the main grid were still assayed for gold, copper and arsenic. Some samples were also analysed for lead, zinc, barium, tin and chromium with the latter two invariably low.

Soil sampling defined anomalous gold and copper zones, the former reporting soil assays up to 1.650ppb gold, with next highest values 175ppb and 125ppb gold.

The copper results of soil and rock sampling are shown on figure 5.6.

Rock sampling of surface samples proved disappointing (most samples were only assayed for gold), however, assays (no description of methodologies of sampling so assumed that these are grab samples) of the "No.1" adit assayed up to 35.5% copper and 0.17g/t gold, with other samples assaying 9.2% copper (0.21g/t gold), 8.2% copper (0.17g/t gold), 6.3% copper (0.25g/t gold), 6.3% copper (0.185g/t gold) and 0.24% copper (0.003g/t gold). Samples from the adit at grid location "H5" were not assayed for copper and gold grades were low.

The geophysical surveys undertaken were ground magnetics (all grid lines), self-potential (all grid lines), and VLF-EM (four adjacent grid lines).

The magnetics defined a number of anomalies, apparently parallel to strike of bedding. These anomalies were interpreted to be due to "magnetite rich, strata-bound lithological units, which have been, in places, either faulted off or magnetite-depleted due to hydrothermal(?) alteration." (Bishop, 1989; 98_2969a). There is no mention as to the geological basis for the interpretation that the anomalies are due to magnetite, nor the presence of significant magnetite destructive

hydrothermal alteration. Bishop (1989) models the magnetic anomalies as three steeply dipping tabular bodies but cautions that insufficient information is known constraining these models.

The self-potential survey produced its largest single reading over the workings at 600E/1100N, but contoured data defines a strong anomaly centred at 700E/1065N "quite divorced from the trend of the vein and may indicate a further occurrence of sulphides, possibly at depth." (Bishop, 1989; 89_2969)

The VLF-EM survey was hindered by a less than optimal orientation to the North West Cape VLF transmitter and produced a number of low amplitude responses likely attributable to faults. Attempts to use a Japanese VLF source were unsuccessful.

Recommendations area made in Bishop (1989) for three 150m deep drillholes to test (1) the mineralised vein beneath the old workings, (2) test the adjacent broad self-potential anomaly, and (3) locate the source of the magnetic anomalies.

In their final report on the EL 34/1985 Harrison (1990a; 90_3114) states that at the former Copper Reward (Toner River) workings "there are numerous magnetic anomalies aligned to the strike of the rock which are probably related to magnetite enrichment or depletion. A massive sulphide anomaly was located above the former Copper Reward workings. Disseminated sulphides were not investigated in the first geophysical investigation."

"It is considered that there is enough information to put down 2-5 drill holes and that this is the next logical step before carrying out further geochemical or geophysical work to define other drill targets or to reduce the area." (Harrison, 1990a; 90_3114)

"Further geochemical and geophysical work could have been carried out but it was considered that the next logical step was to drill the sulphide anomaly and the magnetic anomaly so that the surface indications could be interpreted."

"Unfortunately, Wolston Developments parent company elected only to fund exploration for construction materials and the drilling was not carried out. An attempt was made to find a partner to carry out the drilling" but this was unsuccessful. (Harrison, 1990a; 90_3114)

In the final reports on EL 6/1988 Harrison (1990b; 90_3154 and 1990c; 90_3155) also refers to difficulties due to the pilots strike, and that the parent company was now Amatek Limited.

4.3.17 Aureole Resources Pty. Ltd. 1987 – 1991 (EL 21/1987)

Aureole Resources Pty. Ltd. (Aureole) in joint venture with Winston Resources Pty. Ltd. and Sierra Nevada Resources Pty. Ltd. pegged EL 21/1987 to the overlapping northeast and east portions of the BPA in order to "explore for platinum group metals, gold, and base metals, hosted mainly in receptive rocks along the eastern and southern margins of the Smithton Trough (outside of the Balfour Project area Anomalous base metal and platinum values have been reported for mafic volcanics and carbonates from the district. The intense aeromagnetic anomalies along the trough margin correspond in part to known mafic volcanics and may also indicate the presence of ultramafics within early Cambrian sequences. The southern part of tenement is also considered prospective for copper-tin mineralisation of the Balfour style." (Cromer, 1988)

By 1989 only the area immediately east of Balfour was retained with exploration undertaken in league with related company Soloriens Mining Pty. Ltd. on adjacent tenement EL 53/1988 though actual work only consisted of an appraisal of gravity data and limited reconnaissance mapping. (Hofto and Morrison, 1989)

4.3.18 New Holland N.L. 1987 – 1989 (EL 26/1987 and EL 27/1987)

New Holland N.L. (New Holland) pegged licences EL 26/1987 and EL 27/1987 which cover the western and southern margins of the BPA respectively. New Holland were exploring for skarn style

tin and base metals in the southern tenement (Cromer, 1989; TCR 89_2911) and skarn style tin and copper in the western (Cromer 1988; TCR 88_2892).

Modelling and interpretation of the available gravity and aeromagnetic data revealed the Pieman Granite (referred to as the Interview Granite) to have a more complex shape than previously thought. The pluton has significant east-west extension and fracture controlled intrusion is suggested. The east margin is steeply dipping but at least one rib and a complex shelf structure are recognised. (Leaman, 1988; 88_2892). Proposed detailed helicopter supported gravity surveying in the licences' second year did not eventuate.

4.3.19 Soloriens Mining Pty. Ltd. 1988 – 1992 (EL 53/1988)

Soloriens Mining Pty Ltd (Soloriens) held the main Balfour copper trend from the north end of the field to just south of Cassiterite Creek from 1998 to 1992 and carried out a regional scale helicopter supported gravity survey in joint venture with Mineral Resources Tasmania . 538 stations were read at a nominal spacing of 1km. Some readings were also collected in adjacent EL 21/1987 held by Aureole, a related company. (Hofto V. and Morrison, K.C., TCR 89_3057)

Preliminary assessment of gravity data indicated that a ridge of negative anomalies extending from Mt Balfour south to Mt Norfolk appeared to represent a spine of subsurface granite. Known tin and tungsten mineralisation in the Balfour region occurs in areas peripheral to this granite body. Ground geophysics was recommended.

Pb isotope dating of the Murrays Reward copper mineralisation was undertaken (Morrison, K.C., 1999; TCR 99_3315) and “on the basis of the low uranium concentrations measured by spectrometry (approx. 1 ppm), conclusions regarding the age of the mineralisation are; most likely Cambrian, less likely - Late Proterozoic, least likely - Devonian. A metamorphic fluid source is also suggested and this is consistent with the strong association between mineralisation and major linear structures at Balfour.”

Additional work was required to compare the age of the tin and copper mineralisation at Balfour as no lead-rich minerals had been located within the Specimen Hill tin prospect for isotopic analysis, but the trace element chemistry of waters draining the two sites was measured and indicate(d) significant differences.”

4.3.20 Geopeko 1989 – 1991 (EL 52/1989)

Geopeko's EL 52/1989, one of a large number of tenements they held under their Arthur River project, which they considered prospective for Mt Isa-McArthur River type lead zinc and Besshi-style copper, overlapped the BPA along its northeastern margin. They had David Leaman interpret the regional magnetics and gravity data (Leaman 1991; 91_3213) and carried out Huminex stream water sampling (methodology invented by Dr Bill Baker of MRT) but no samples were taken from within the BPA. They relinquished the tenement in 1992. (Virgoe and Mathison, 91_3229)

4.3.21 CRAE/Rio Tinto Exploration Pty Ltd 1993 – 1997 (EL 4/1994, EL 18/1992 and EL 19/1992)

CRAE, having explored the area under EL 1/1977 essentially reacquired the Balfour mineralised belt in contiguous tenements EL 18/1992, EL 19/1992 and later adding EL 4/1994 (ex Soloriens EL 53/1988 – see section 4.3.19) in order to explore for “sediment hosted Cu deposits in a range of lithological and structural settings.” (Parkinson, 1993; 93_3511)

The presence of numerous small vein hosted Cu workings along the 30 km NNW trend centred on Balfour indicated that Cu mineralising processes were active in the area capable of producing large copper orebodies.

Specific copper target models under consideration were;

- stratiform replacement of the Balfour pyrrhotitic siltstone, and
- large irregular, stratabound silica-dolomite bodies on the Balfour Cu trend

CRAE saw the Balfour pyrrhotitic siltstone as being “prospective for Cu deposits analogous to major stratiform sedimentary Cu deposits such as the Kupferschiefer, White Pine etc. where copper mineralisation is generally localised within a sedimentary chemical trap such as a sulphidic, carbonaceous or evaporitic unit, that overlies a porous arenaceous unit. Copper rich fluids migrating through the arenites or via faults are constrained by overlying less permeable horizons and react with the chemical trap to produce Cu sulphide rich beds.” (Parkinson, 1993; 93_3511)

Other examples of sedimentary hosted copper deposits referred to elsewhere Parkinson (1993; 93_3511) are the Zambian Copper Belt and the Belt Supergroup of North America. The correspondence with the Belt Supergroup (also known as the Belt-Purcell Supergroup) is highly significant as recent academic work by Halpin *et. al.* (2014) and Mulder *et. al.* (2015) suggests a direct correlation between Rocky Cape Group rocks and the Belt-Purcell Supergroup in the ancient Nuna supercontinent - see section)

“The magnetic Balfour pyrrhotitic siltstone sits at the boundary between the Lagoon River Quartzite and locally carbonaceous Interview Siltstone. The conceptual model being considered was that Cu-rich hydrothermal fluids migrating through the Lagoon River Quartzite or via major faults have replaced Fe in the pyrrhotitic siltstone to form a Cu sulphide horizon. Replacement of the pyrrhotite will cause the magnetic response to be destroyed.” (Parkinson, 1993; 93_3511)

Drawing on the interpretation by early ACI geologists (McIntyre 1973a; 73_0947 and Jackaman 1974a; 74_1070) who argued that copper mineralisation, particularly that at The Clump, is hosted in stratabound/stratiform silica+dolomite beds, CRAE also note that “in addition, small discordant quartz-dolomite veins along the Balfour trend may, in favourable structural locations, develop into large silica-dolomite (+/-Cu) bodies similar to the irregular but broadly stratabound Mount Isa Cu orebody.” (Parkinson, 1993; 93_3511)

CRAE commissioned Kevron Geophysics to fly a new aeromagnetics/radiometrics survey (to replace the existing 1983 500m spaced flight lines survey flown by the BMR). The fixed wing survey was flown in early 1993. Flight lines were 100m spaced for the most part with 200m spacings in the southern part of the survey over the Norfolk Range. Flight lines were largely east-west except for a 2km x 5km block between Mt Balfour and Mt Frankland which was flown north-south. The survey included the area of Soloriens EL 53/1988 (later relinquished and won under competitive tender by CRAE).

The survey confirmed the presence of a major north-south linear anomaly, swinging northwesterly at its northern end and interpreted to be due to this Balfour pyrrhotitic siltstone (BPS) unit.

CRAE also recognised several major structures in the magnetics data, including the northwest striking Balfour Transform and northeast striking Roger River Fault (both probably active over a long period) which intersect the pyrrhotitic siltstone and may have provided increased fluid access to this unit. “Some of these structural-stratigraphic intersections show destruction or weakening of magnetic response, possibly suggestive of sulphide replacement. Each of these areas requires investigation.” (Parkinson R.G., 1993; TCR 93_3511) with the first area selected accordingly named The Gap on the basis of the gap in the north-south trending magnetic anomaly and was targeted for detailed exploration.

Field work at The Gap prospect consisted initially of 177 hand augered C-horizon samples collected on 4 x 200m spaced grid lines. In addition discrete lines of ground magnetics were read (though data is of doubtful quality with no base stations) in order to map out the Balfour pyrrhotite unit, however, it was concluded that initial soil sampling programs probably did not extend far enough west to cover the pyrrhotitic siltstone and that further work sampling was required (Parkinson, 1993;

93_3511). This work was completed in the 1993/94 year but did not locate anomalous geochemistry and no further work was recommended (Parkinson, 1994; 94_3644).

However, contradicting this conclusion Parkinson (1994; 94_3644) states elsewhere in the same report that “the Balfour area has some difficulties that complicate exploration. The area is heavily leached near the surface to the stage that only quartz lag remains. Tertiary gravels cover portions of the area. As a consequence, soil and surface rockchip sampling have been demonstrated to be unreliable indicators of known mineralisation.” In addition “stream sediment geochemistry is largely ineffective as topography is too subdued to allow creeks to incise through this leached zone”. (Parkinson, 1994; 94_3644). The same conclusions had been drawn by earlier workers (e.g. Ward, 1911 and McIntyre)

On a positive note they add the fact that this “heavy surface leaching is not penetrative allowing geophysics to be employed with some success (with) magnetic surveys effective in delineating pyrrhotite and magnetite rich sequences and IP has clearly identified conductors and chargeable zones.” (Parkinson R.G., 1994; TCR 94_3644)

In their 1994 report CRAE (Parkinson R.G., 1994; TCR 94_3644) have also expanded their sedimentary hosted copper model now identifying a second sedimentary contact that may be favourable for developing stratiform Cu mineralisation caused by redox reactions, being the “boundary between carbonaceous, sulphidic siltstone (i.e. the Balfour pyrrhotitic siltstone) and chloritic, Fe oxide bearing siltstone”. They did note that to date no significant geochemical anomalies (had) been identified on these contacts (Parkinson, 1994; 94_3644), however, given what was said elsewhere regarding surface geochemistry perhaps unsurprising.

It was also during 1994 that CRAE pegged EL 4/1994 (previously Soloriens EL 53/1988) which covers the central part of the Balfour copper belt. Exploration was conducted concurrently but reported separately.

Prospects for exploration in 1995 were listed by Parkinson (1994; 94_3644):-

- quartzite - carbonaceous siltstone contact between Specimen Hill and Nelson Bay River, strike length 8km
- carbonaceous siltstone - chloritic siltstone contact between Murray's Reward and The Clump, strike length 8km
- intersections of Roger River Fault and Balfour Transform with the above stratigraphic zones

These stratigraphic and structural positions are shown as 1, 2 and 3 respectively are illustrated on figure 4.3.21.1.

Attention was focussed on the newly named Nelson prospect (see figure 4.3.21.1) which straddles the boundary between EL 18/1992 and EL 4/1994.

Work in 1995 consisted of gridding on 400m to 800m spaced east-west lines, geological mapping, rock sampling, augered or wackered C-horizon soil geochemical samples, ground magnetics and three lines of dipole-dipole IP (one line of which was mistakenly read instead of another). (Menpes, 1995; 95_3802).

Menpes (1995b; 95_3802) reports that the IP survey defined a chargeability anomaly 100-150m wide and >400m long corresponding with the Lagoon River Quartzite/Interview River Siltstone contact. Soil and rock geochemistry was not anomalous for copper but a Zn and Pb soil anomaly 150m wide and 400m long open to the south overlying the Interview River Siltstone (which is offset with respect to the IP anomaly) on the Roger River Fault structure. Ground magnetics confirmed the presence of a north-south high seen on the aeromagnetics.

CRAE chose not to drill the soil or geophysical anomalies.

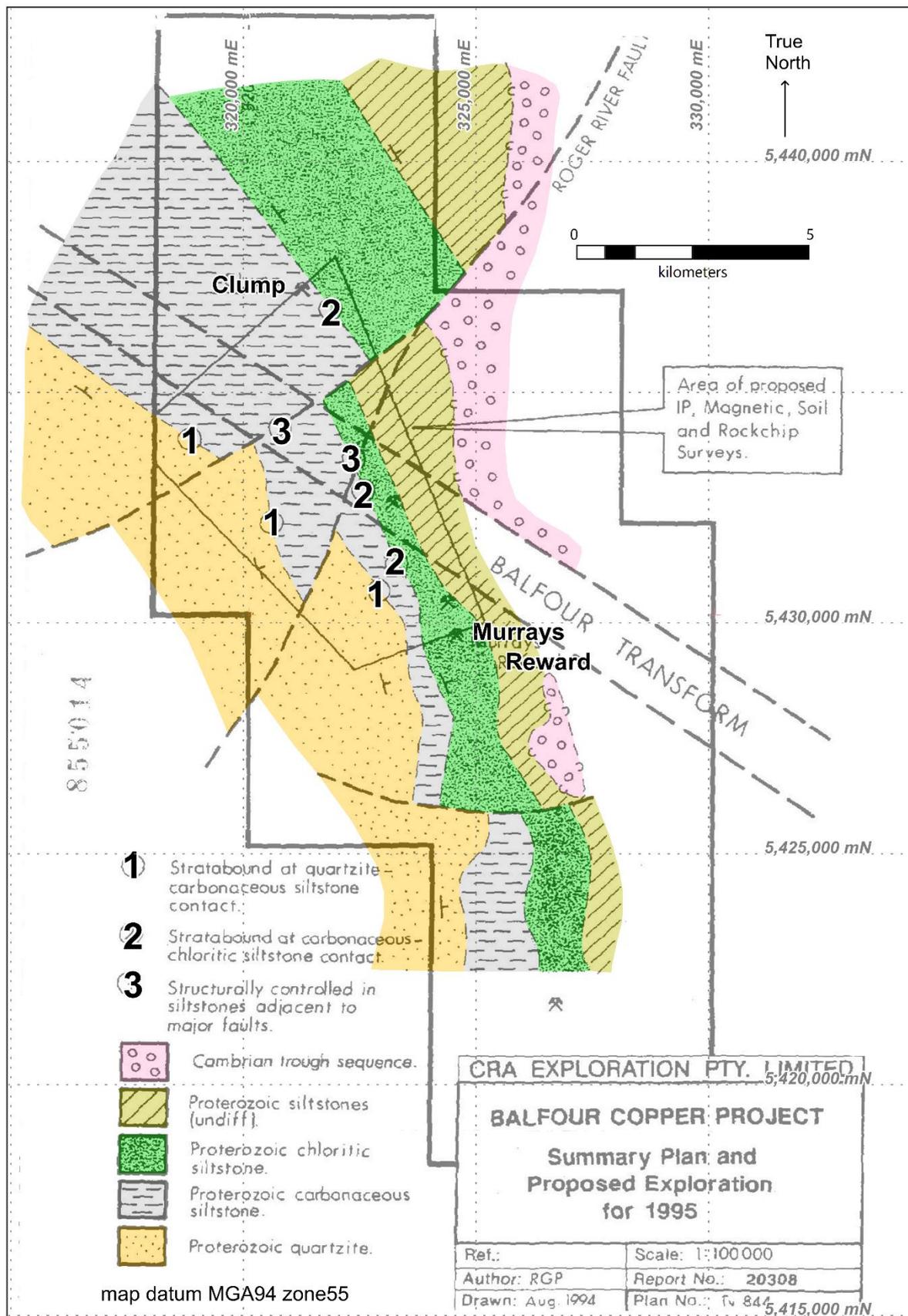


Figure 4.3.21.1: Coloured CRAE plan showing targeted sedimentary horizons at quartzite/carbonaceous siltstone contact (1), carbonaceous/chloritic siltstones contact (2) and structurally controlled position (3) (after plan Tv 844 in Parkinson, 1994; 94_3644).

Menpes (1995a; 95_3734) carried out data compilation/review of previous exploration with emphasis on rock and soil sampling and ACI and CRAE's earlier IP surveying.

With regards to historical IP data Menpes (1995a; 95_3734) concluded that IP surveys carried out by ACI over "The Clump" and other known Cu deposits on the Balfour Trend showed a very strong response from the mineralised zones. A major conductor with a high percentage frequency effect extends the full length of The Clump grid and appears to correspond to the carbonaceous siltstone/chloritic siltstone contact. Similar responses were described from 2 lines of ACI data 4km's south of The Clump and in Hudson Syndicate (= Balfour Mining Syndicate) and earlier CRAE data to the west of Specimen Hill.

Orientation C-horizon wacker sampling over the area of known trend of copper mineralisation (as determined from previous underground sampling and drilling) all assayed <50ppm was taken to indicate that copper is being leached at the surface, again confirming the ineffectiveness of surface geochemical sampling for copper.

Nick Turner (contract geologist) mapped and sampled both The Clump and Murrays Reward (Turner, 1995; 95_3734A) areas at 1:10,000 scale collecting 88 rocks which were assayed for multielements by ICP-MS in order to characterise mineralisation styles. The full set of results of this sampling are reported in Tear and Russell (1998; 98_4121) with the conclusion that there is no distinct multi-element pattern to copper mineralisation but that copper is generally associated with elevated arsenic, silver, cobalt and nickel.

In 1996 CRAE undertake a detailed review of a number of facets of the project in the 1996 annual report for EL 4/1994 Menpes (1996; 96_3912) (also reported on briefly in EL 18/1992's 1996 annual report Tear, 1996; 96_3931).

This work included the following;

- Compilation of previous drilling and the generation of interpretative plans and cross-sections for both The Clump and Murrays Reward/Central Mt. Balfour prospects, as well as a brief review of mineralisation styles, by consultant T.M Porter.
- Assessment of historic data for the Specimen Hill Tin and Tungsten prospect. (G.B. Patterson)
- Review of aeromagnetics (S Rajagopalan)
- Review of gravity data for Murrays Reward area (S Rajagopalan)
- Reassessment of IP data for overall Balfour Copper Trend with reinterpretation of Specimen Hill prospect data (T Aravanis)

T.M. Porter notes that "a discordant quartz-dolomite-sulphide lode is developed 100 to 150m west of the mapped Balfour Cu Trend. The lode appears to trend and plunge to the NW. Mineralised intersections include 21 .7m at 1.40% Cu from 62.5m in DDH16 and 25.5m at 0.77% Cu from 195.8m in DDH36" and that "the mapped Balfour Cu trend lode appears to be untested in this area."

T.M. Porter suggests five styles of mineralisation are present in the Murrays Reward/Clump area;

- Mixed massive sulphide (covellite-chalcopyrite-pyrite) and quartz lodes within the Balfour Cu Trend. Textures indicate tectonic remobilisation and are similar to the textures found in ore grade lodes at Dugald River.
- Brecciated quartz veins with fine sulphide (mainly chalcopyrite and pyrite), coarse crystalline dolomite and angular fragments of country rock suggesting post emplacement tectonism. This form of mineralisation is generally intermixed with the first style
- Massive sulphide-quartz lodes containing pyrite-marcasite, pyrrhotite, chalcopyrite, sphalerite, arsenopyrite, cassiterite etc. (e.g. Tatlows costean)
- Disseminated pyrite with associated weak sphalerite (up to 1% Zn) and chalcopyrite within carbonaceous siltstones and sandstones

- Quartz stockwork with coarse cassiterite and/or wolframite commonly hosted by tourmaline rich sediments (e.g. Specimen Hill)

Porter makes an interesting point with regards to the Nelson prospect noting that whilst copper may be being leached at its surface, zinc may be being scavenged by humic peaty material and may act as a surrogate for associated copper mineralisation.

Regarding the tin and tungsten potential of Specimen Hill G.B. Patterson notes that BHP's costeaning was at best only partially effective and that CRAE's 15kg samples and NQ core drilling were not sufficiently large enough for the coarse nature of tin (and tungsten) mineralisation. He recommends that bulk sampling by costeaning and/or RC drilling, or large diameter drilling should be considered to obtain more representative samples and that other drill targets such as Tatlows and Peters Ridge should also be considered.

The ACI IP data from the Murrays Reward - Specimen Hill area was examined by T. Avaranis and an interpretation plan prepared. Conclusions were that;

- A moderate strength IP feature with a 1650' (~500m) strike extent coincides with the Murrays Reward mineralisation. The feature is open to the south beyond line 600'S and appears to be terminated near 900'N
- Weak IP features (2-5% percentage frequency effect - PFE) dominate the ACI data north of the 900'N line
- A moderate strength IP feature interpreted on three traverses west of Murrays Reward appears to coincide with Peter's Flat (ie. west of Peter's Ridge)

Not all of CRAE's data for Specimen Hill could be located, nevertheless a reinterpretation plan was completed with the conclusion that "patterns exhibited in pseudosections indicated a combination of poor data quality and complex IP and resistivity sources". There is also some discrepancy between ACI and CRAE data in the Peters Flat/Peters Ridge area.

The gravity anomaly was considered likely due to elevation

Menpes (1996; 96_3912) concludes that "during the past permit year CRAE's exploration focus has changed from stratabound mineralisation in the Proterozoic quartzites, siltstones and shales west of the Balfour Cu Trend (Nelson Prospect) to the Balfour Cu Trend itself."

"The Balfour Cu Trend appears to be a multiply reactivated, NNW-SSE trending fault zone and may initially have been a major growth fault active during Proterozoic sedimentation. Ore grade examples of the mineralisation styles described ... occur where the NW-SE trending Balfour Transform (a fundamental structure interpreted from regional aeromagnetic data) crosses the Balfour Cu Trend. This area includes the Cu mineralisation at Murrays Reward, the Cu-Sn mineralisation at Tatlow's Costean and the Sn-W mineralisation at Specimen Hill."

"A model that may explain the mineralisation styles in the Murrays Reward - Specimen Hill area involve:

- the introduction of mineralising fluids to sediments adjacent to the Balfour Cu Trend, possibly in the waning stages of Adelaidean sedimentation, resulting in low grade, stratabound mineralisation
- structural upgrading of mineralisation through transverse movement of the Balfour Cu Trend fault and/or the Balfour Transform creating en-echelon dilation zones"

"Hence the target in the Murrays Reward - Specimen Hill area comprises broad (20-30m), steeply plunging shoots with limited lateral extent (a few hundred metres), but extensive depth continuity (> 1000m) within more extensive tabular zones of low grade mineralisation."

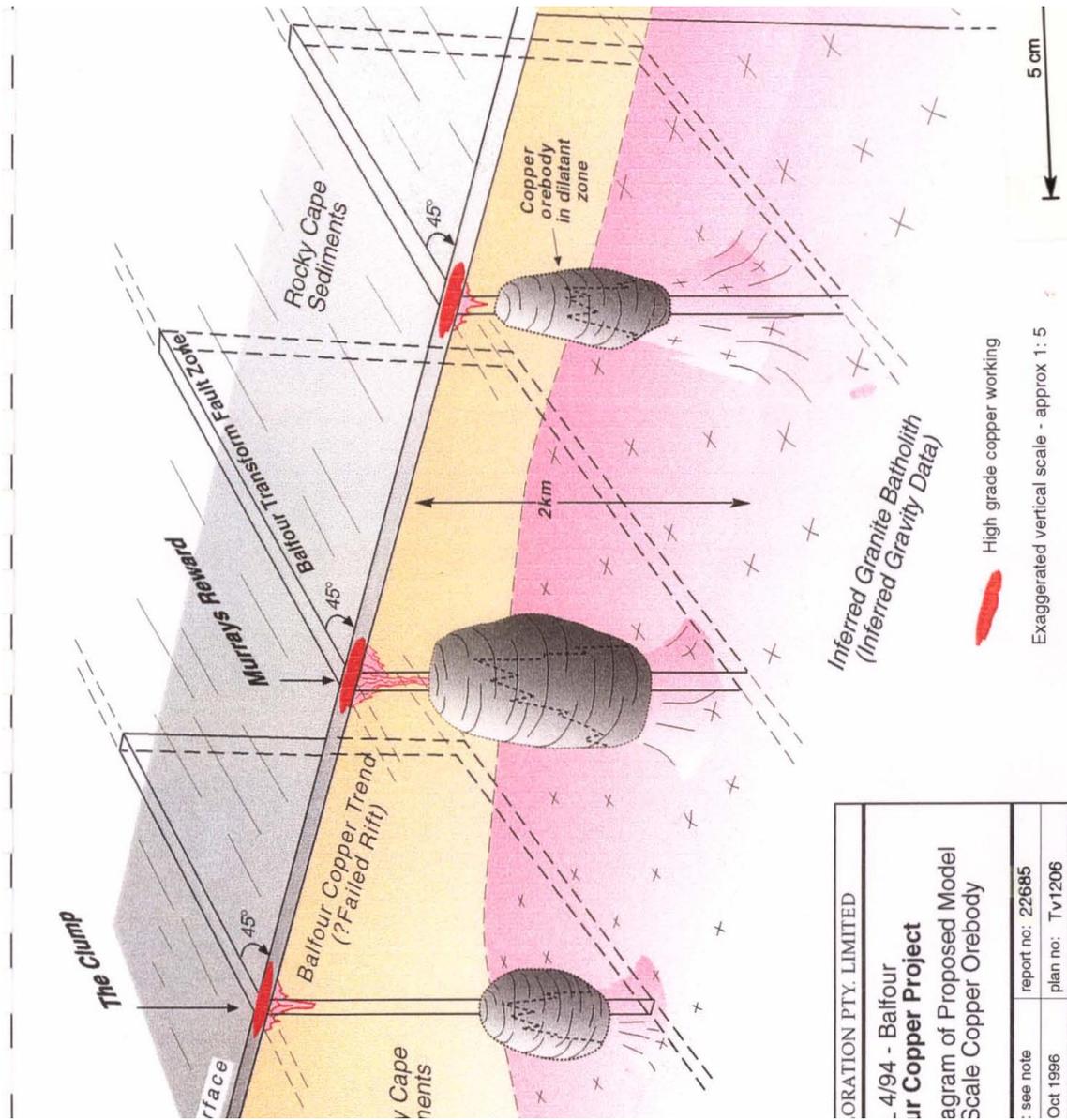


Figure 4.3.21.2: CRAE's new structural model for high grade copper deposits along the north-northwest trending Balfour Copper Trend fault where intersected by broadly east-northeast trending faults (figure was displayed in both Tear and Russel 1998a; 98_4115 and Tear and Russell 1998b; 98_4121)

ORATION PTY. LIMITED	
- 4/94 - Balfour	
ur Copper Project	
Diagram of Proposed Model	
Scale Copper Orebody	
: see note	report no: 22685
Oct 1996	plan no: Tv1206

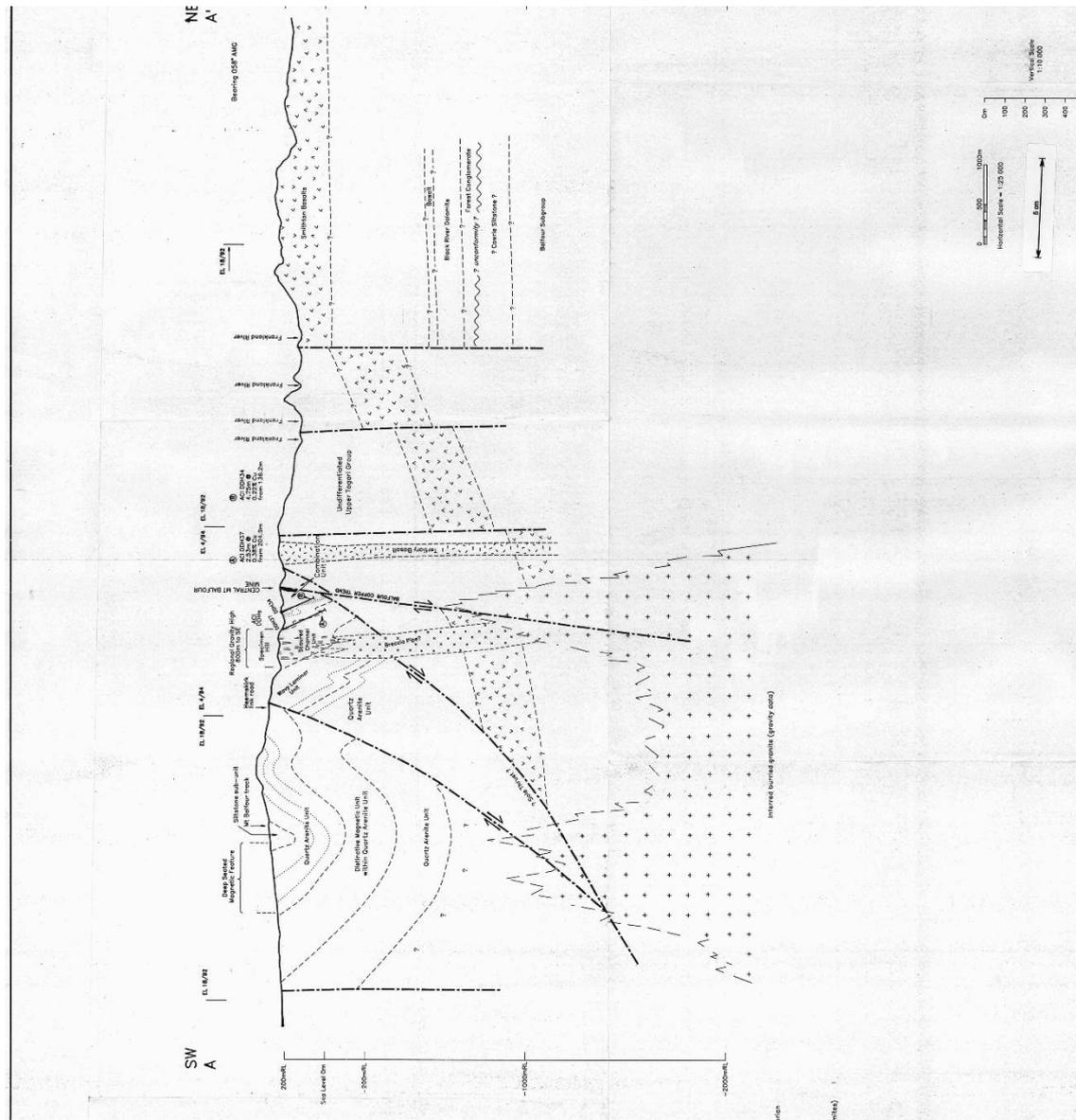


Figure 4.3.21.3: CRAE cross-sectional interpretation AA' through both Specimen Hill and Murrays Reward showing thrusting and sub-surface granite (Tear and Russel 1998a; 98_4115)

“This target type has limited surface extent and is more difficult to locate and delineate than larger, lower grade, stratabound deposits.”

In addition to the review work CRAE also carried out further wacker sampling at the Nelson prospect better delineating the Zn soil anomalies, and mapped and sampled the Balfour South workings.

On EL 18/1992 recommendations are made by Tear and Russell (1998; 98_4121) for Rio Tinto Exploration Pty. Limited (Rio Tinto) (following a full merger with sibling company CRAE) to drill the Balfour South and Nelson prospects, investigate the Dohertys Pimple line of workings and particularly where this trend meets the Balfour Copper Trend. The Balfour South drilling was not carried out due to bad weather whilst the Nelson hole was also not carried out.

Tear and Russell (1998; 98_4121) (this is the final report on this tenement) note the similarity between the quartz+dolomite alteration associated with copper mineralisation and the Mt Isa orebody, as well as suggesting similarities to Cobar.

Veskas completed his honours thesis titled “Geology, mineralisation and structure of the Balfour copper occurrence” in 1993.

On EL 4/1994 Rio Tinto drilled three holes at the Central Mt. Balfour/Murrays Reward prospect (Russell and Tear, 1998; 98_4115).

DD97BC9 (250.4m) was drilled as a direct twin of ACI hole DDH16 intersecting a similar width and grade of copper mineralisation and providing an effective field duplicate check for the Inferred resource (MacDonald, 2020 and 2021). The hole passed through chloritic siltstones intersecting mineralisation from 55.3m to 72.2m occurring as disseminated, blebby chalcopyrite within quartz+dolomite including two 30cm zones of semi-massive chalcopyrite associated with quartz.

DD97BC9’s mineralised zone assayed 55.3m to 72.6m, 17.3m @ 1.06% Cu, including 55.3m to 57.0m, 1.7m at 2.58% Cu, 64.0m to 67.0m, 3.0m @ 2.07% Cu, and 71.5m to 72.0m, 0.5m @ 5.44% Cu.

A second lower zone of quartz+dolomite assayed 2.0m @ 1.03% from 82.0m. Quartz+/-dolomite veining continues in chloritic siltstone to the end of the hole with a 20.5m zone of quartz and silicified chloritic schist intersected between 212.5m and 233.0m.

DD97BC10 (82.1m) was targeted beneath the Murrays Reward mine and at a gravity high but intersected a puggy clay altered fault at 79.7m and was abandoned at 82.1m and moved to the east and redrilled as DD97BC11.

DD97BC11 (464.5m) passed through chloritic siltstones before intersecting the Murrays Reward lode from 146.6m to 159.9m with best intersection 148.0m to 160.0m, 12.0m @ 0.64% Cu including 0.3m @ 4.04% Cu from 151.7m, with a second lower zone of 2.0m @ 1.46% Cu from 170.0m. A similar zone of intense silicification was intersected from 186.6m to 209.5m. There was no geological explanation for the gravity anomaly and it was attributed to an elevation correction error.

Conductivity measurements were collected from DD97BC9, however, all were below background noise. “Nevertheless, the mineralisation at Murrays Reward closely follows the trend of the main IP anomaly, suggesting that this technique could be useful in locating further copper mineralisation elsewhere along the Balfour Copper Trend.” (Russell and Tear, 1998; 98_4115)

CRAE also held EL 19/1992 (pegged at the same time as EL 18/1992). The tenement only overlaps a small part of the BPA on its northeastern margin and no exploration work was done on this area during its tenure.

However, Parkinson (1993; 93_3483) does state that CRAE was also exploring the licence for sediment hosted Cu deposits in a range of lithological and structural settings and that a “review of CRAE and competitor stream sediment geochemistry highlighted the Kanunnah Sub-group as having regionally anomalous Cu values.” In particular “additional stream sediment and rockchip sampling showed the mafic lithic wackes of the Kanunnah Sub-group to have average background levels of Cu and Zn of approximately 200 ppm. indicating the potential for this package to be a Cu source bed.”

4.3.22 Pacific Nevada Mining Pty Ltd 1998 – 2003 (EL 13/1997, EL 15/1997, EL 4/1998)

Pacific Nevada Mining Pty Ltd (Pacific Nevada) acquired a significant ground holding in the northwest of the state holding the main Balfour mineralised belt in EL 4/1998 with other tenements EL13/1997 and EL 15/1997 covering more peripheral parts of the northern and northeastern parts of the BPA as well as a number of other tenements outside.

Pacific Nevada (Westbrook, S., 1999; TCR 99_4346) selected the northwest of the state on the basis of its potential for the following deposit types of which the first two are geologically relevant to the Balfour Project Area .

- Stratiform Copper Deposits, especially along the contact between carbonaceous pyrrhotitic siltstones and chloritic-iron oxide rich siltstone.
- Stratabound Cu-Au Deposits associated with major structural zones such as the Balfour Shear Zone and the Roger River Fault.
- Sedex Pb-Zn Deposits associated with the southern extension of the structurally disrupted eastern margin of the Smithton Basin.
- Replacement Deposits formed in the carbonate rich members of the Togari Group.

The Balfour tenement was chosen as it lay on the “Savage River focal structure”, a major northwest striking structure interpreted by Pacific Nevada from the existing regional geophysical datasets.

Most work focussed on the Roger River Fault which extends into the northeastern edge of the BPA

Work consisted of stream sediment sampling for gold and base metals with BLEG and -80# at all sites and panned concentrate samples at most. In addition an airborne EM survey flown along the Roger River Fault extended into the Balfour Project Area over the Balfour copper trend near Murrays Reward mine. This helicopter borne survey by UTS was a frequency domain survey and was poorly reported though the digital data is available in MRT’s database.

4.3.23 New Challenge Resources Pty. Ltd./Jaguar Minerals Pty. Ltd. 2002 – 2007 (EL 4/2002)

Following the flying of a helicopter-borne Hummingbird frequency domain airborne EM survey on behalf of Mineral Resources Tasmania New Challenge Resources Pty Ltd (New Challenge Resources) secured the ground along the Balfour copper belt (Legge, P; TCR 03_4938) holding it from September 2002 to August 2007.

Jaguar Minerals Ltd (Jaguar) joint ventured with New Challenge Resources to ground follow-up electromagnetic anomalies defined by the government survey.

Jaguar prioritised EM anomalies west of the main Balfour copper trend as it was thought that these may be related to base metal mineralisation. Seven separate ground EM surveys were conducted on six airborne EM anomalies, and one over the Murrays Reward copper mine.

Jaguar report that “of the seven ground EM grids only 2 produced responses that had the characteristics of possible massive sulphide conductors. No EM anomaly was detected over the Murrays Reward prospect which indicates that there is no large massive sulphide within 400m of the surface below the current workings. Four areas produced anomalies but were believed to be in response to broad lithological units. The remaining two areas, Skinners Flat and Nelson B produced anomalies characteristic of narrow plunging conductors.” (Seed, R.I., 2005)

The survey over the Murrays Reward mine consisted of a 600m x 400m loop with data collected on two east-west grid lines. The northern grid line crossed the Murrays Reward/Central Mt. Balfour lode approximately 100m north of the No.3 adit whilst the southern line, approximately 285m south of the northern line, crossed the line of lode approximately 45m south of the Main Shaft. It is considered unsurprising that this EM survey was not able to detect the ~1% copper mineralisation that characterises this particular deposit in this area.

Of the other surveys none actually surveyed any of the lines of lode mapped by Ward (1911).

At The Clump survey the three east-west grid lines all lie west of the line of the mineralised zone.

At the Skinners Flat anomaly diamond drill hole JB3 (92.5m) was drilled into the anomaly intersecting thickly bedded carbonaceous fine-grained sandstone and siltstone and finely interbedded carbonaceous shale and siltstone including a strongly graphitic shale unit from 72.0m to 79.5m considered the most probable conductive unit responsible for the Skinners Flat EM anomaly.

Thin east dipping 1-2cm thick quartz-siderite-sulphide (pyrite, arsenopyrite, sphalerite and chalcopyrite) and minor cassiterite veins were also intersected. Best results are included in appendix B.

A second hole JB4 (136m) was drilled further south than JB3 in order to test both the EM anomaly and a prominent magnetic anomaly which extends beneath Specimen Hill. This hole also intersected thin east dipping quartz-siderite-sulphide veins with particularly elevated zinc. Better results are included in appendix B. Significantly the hole intersected between 2% and 4% disseminated pyrrhotite which is interpreted as a product of metamorphosed iron and sulphur rich carbonaceous sediments and considered to explain the magnetic anomaly. (Seed, R.I., 2005; 05-5195)

Due to the attribution of the airborne and ground EM anomaly to graphitic shale at Skinners Flat a hole planned for the Nelson B anomaly was cancelled.

Jaguar diamond drill tested the Tatlows workings, where drilling by BHP hole B14 drilled eastwards is believed to run parallel to mineralisation, with holes JB1 and JB2. No economic mineralisation was intersected in the drilling ... (however) in a similar fashion to JB3 and JB4, JB2 intersected a number of thin quartz/siderite/sulphide veins (1-2cm)." (Seed, 2005)

At CRAE's Nelson prospect Jaguar drilled a fence of 6 angled short diamond drill holes across the Zn and Pb soil anomaly intersecting interbedded carbonaceous shales, and thick carbonaceous shale, anomalous in zinc to 678ppm and considered to explain the soil anomaly.

Jaguar reassessed the Tasmanian Government's hummingbird EM survey again in the light of the results of the ground EM and drilling which they had conducted and defined a further set of anomalies warranting follow-up. This work would appear to have not been completed as there is no subsequent reporting on MRT's database.

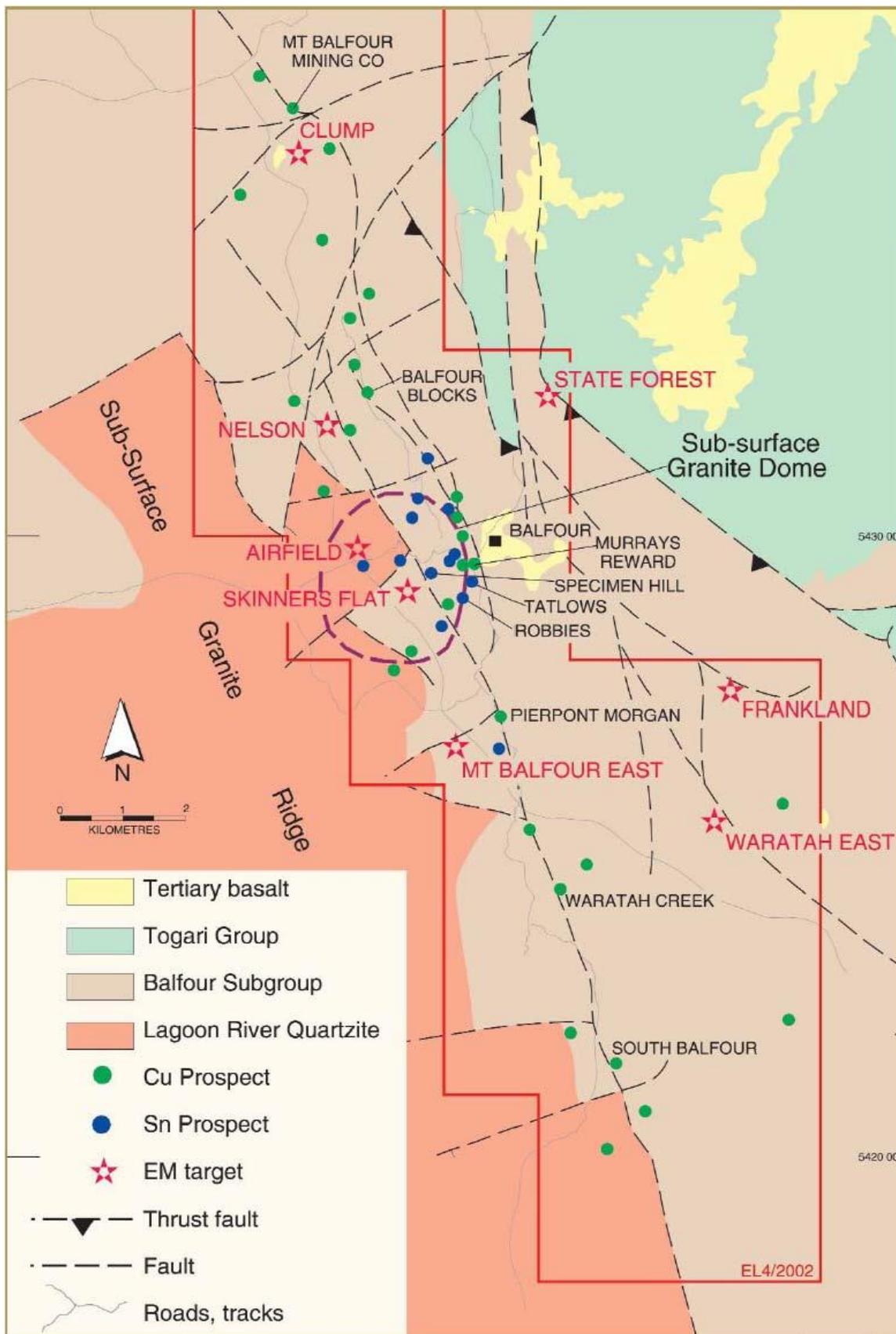


Figure 4.3.23.1: “Figure 3. Balfour - Geology and Prospects” from Turner (2004; 04_5056) showing the interpreted sub-surface granite ridge and first round EM targets determined from the 2002 WTRMP Hummingbird frequency domain EM survey.

4.3.24 Ausvaal Projects Pty. Ltd. 2002 – 2004 (EL 8/2002, EL 9/2002 and EL 10/2002)

Austvaal Projects Pty Ltd were also attracted by the survey results and secured the ground to the west (Jenke, G.P., 2004; TCR 04_4995) and small blocks to the east and northeast of that held by New Challenge/Jaguar.

Ausvaal Projects Pty. Ltd. (Austvaal) assessed the Tasmanian government's frequency domain electromagnetic survey over the known Balfour mineralisation held by New Challenge/Jaguar and conclude that there is no HEM conductivity response directly associated with the known mineralisation at Balfour. Numerous north-south conductors with strike lengths of 1-2km's have been identified around Balfour but these are most likely carbonaceous shales of the Balfour Shale (Veska, 1993) which can contains up to 40% graphite. At the Clump it appears a magnetic response and bedrock conductor are coincident with mineralisation. (Jenke, 2004)

An analogous position occurs at target B1 within Ausvaal's tenements.

"Conductive but non-magnetic trends also occur about 10km north of Balfour as a low priority target." (Jenke, 2004)

"Although the greatest concentration of conductive responses occurs on the Balfour trend, a similar area (Target B1) occurs about 3km to the SE of the mine in EL10/2002 where conductive trends extend over a strike length of 1km or more. A portion of one of these trends is coincident with a magnetic response, possibly indicating that the conductive source here is related to pyrrhotite rather than graphite, and therefore more likely to be associated with mineralization as at The Clump." (Jenke, 2004)

In the central area of the survey "there are instances of interesting, short strike length conductive responses in the southcentral part of the project area. These are designated as C1, C3 and C3 ... These prominent bedrock conductors (occur) within a resistive, quartzite unit about 6km SW of Balfour (C1 and C2), the latter of which is associated with a magnetic response. These conductive responses are among the best of the survey, and their source is unknown. The area is mapped as Lagoon River Quartzite which is noted as having rare conglomerate and shale, but this unit is otherwise devoid of conductors. A similar target occurs at C3 to the south." (Jenke, 2004)

4.3.25 Jaguar Minerals Limited 2002 – 2007 (EL 27/2005)

Jaguar Minerals pegged a tenement to the west of EL 4/2002 which they had JV'd with New Challenge and took a similar approach to exploration in following up MRT's WTRMP Hummingbird EM survey. Appraisal by Jovan Silic of Flagstaff Consultants defined 8 anomalies warranting follow-up of which 4 lay within EL 13/2015, i.e. discrete anomaly 7 and adjacent anomalies 3,4,5 aligned in a northwest trend.

Jaguar were targeting three mineralisation models (Busbridge, 2008)

- Structurally controlled Cu mineralisation within Proterozoic sediments.
- Structurally controlled Iron (Fe)-oxide hosted Cu-Au mineralisation (IOCG) within Proterozoic sediments of the Osborne Cu Au type.
- Statabound base metal mineralisation within Proterozoic Sediments. The Zambian Copperbelt in Africa provides examples of sediment hosted stratabound copper mineralisation

Helicopter supported field work was conducted. At anomaly #7 highly graphitic shale was considered to explain the anomaly.

At anomalies 3,4 and 5 follow-up fieldwork involved a field camp. Hand augered C-horizon soil samples on a nominally 200m x 50m grid were collected by a crew of 2 over 3 days. Samples were assayed at Genalysis Adelaide for Ag, As, Bi, Ca, Co, Cr, Cu, Fe, Mn, Mo, Ni, Pb, S, Sn, Zn via 4 acid

digestion with OES Inductively Coupled Plasma readout and Au via a proprietary digestion with Graphite Furnace Atomic Absorption Spectrometry. Results were uniformly low, particularly compared with sampling from other prospects and it was concluded that the soil sampling had been ineffectual. “Geochemical profiles suggested the samples collected were severely leached of residual metals and not representative of the underlying lithologies” (Busbridge, 2008), however, no further work was recommended nor carried out. Limited field work in subsequent years occurred west of EL 13/2015.

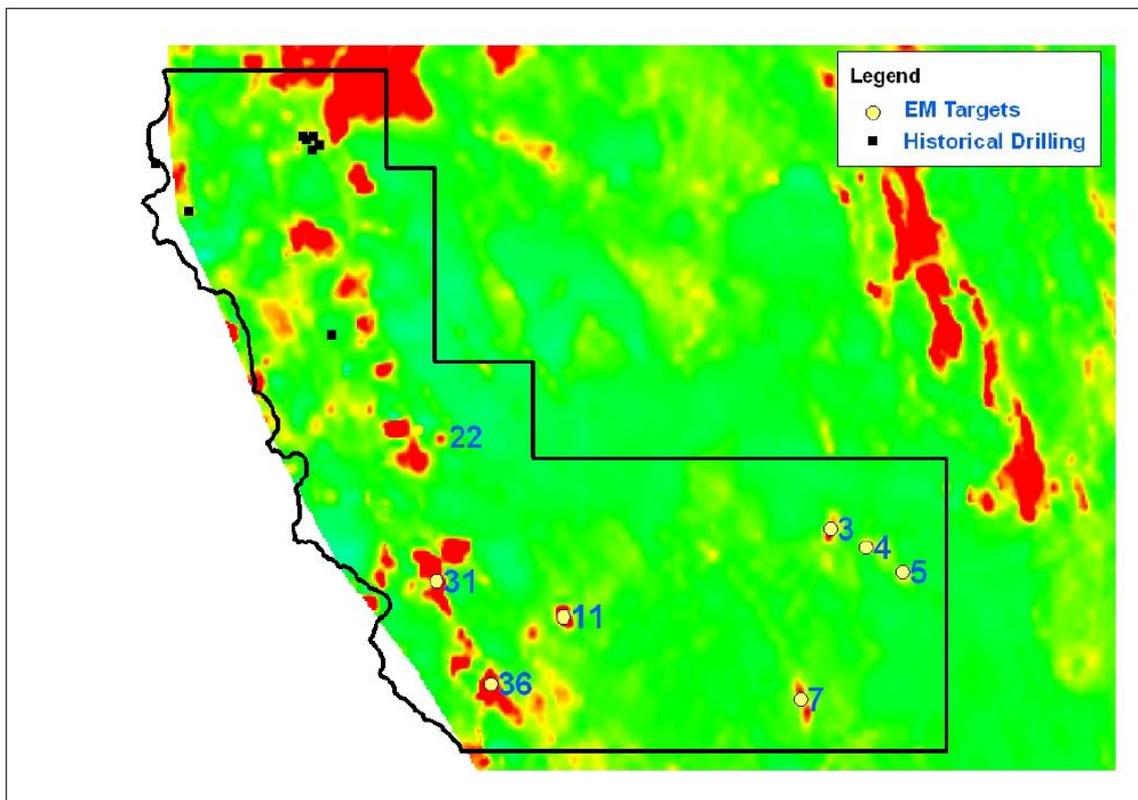


Figure 4.3.28.1: “Location of the eight high priority electromagnetic anomalies and previous drilling. Background data is CP 6.6 khz in phase HEM data image” Figure 5 from Busbridge (2008). Anomalies 3,4,5, and 7 lie within the Balfour Project Area.

4.3.26 IMX Resources N.L. 1997 - 2013 (EL 17/2007)

In 1997 IMX Resources NL (IMX) applied for a licence over the Togari Group rocks to the north of the BPA and flew a VTEM survey over the basalts and sediments at the base of the Togari Group which extend marginally into the northeastern part of the licence (Barret, F. *et. al.* ,2007; and Chai, 2008). VTEM anomalies at Dunns prospect just outside of the BPA were tested with 2 RC and 3 diamond holes with the anomalies due to black shales.

4.3.27 Stonehenge Metals Ltd 2007 – 2009 (EL 12/2007)

EL 12/2007, was granted to Stonehenge Metals Ltd in 2007 “in order to access the potential of the high-grade tungsten deposits and elevated copper levels that had been reported by previous explorers.” in the Interview River area (Vaarwerk 2008)

The company undertook a literature and digital data review of the area but relinquished the lease in 2009 reportedly due to the remote location of the tenement and the area’s environmental value. (Hamlyn, 2010)

4.3.28 Pleiades Resources Pty. Ltd. 2007 – 2014 (EL 27/2007 and EL 40/2007)

Pleiades Resources Pty. Ltd. (Pleiades) acquired the two contiguous tenements over the major part of the Balfour area and joint ventured with King Island Scheelite (KIS) to explore for tin and tungsten mineralisation associated with deep granitic bodies. Base-metals and gold were also sought. (Callaghan, 2010: TCR 10_6024). Pleiades held the ground from October 2007 until October 2013.

A detailed gravity survey with 1355 stations on 73 lines was completed covering the western portion of the tenements and south as far as South Balfour. (Anon. 2009: TCR-09_5859). This new gravity and existing magnetics data was processed and modelled (Bissett, 2009a: TCR10_6024A & Bissett, 2009b: TCR 10_6024B) with gravity and magnetic data supporting the presence of near surface granitic intrusives.

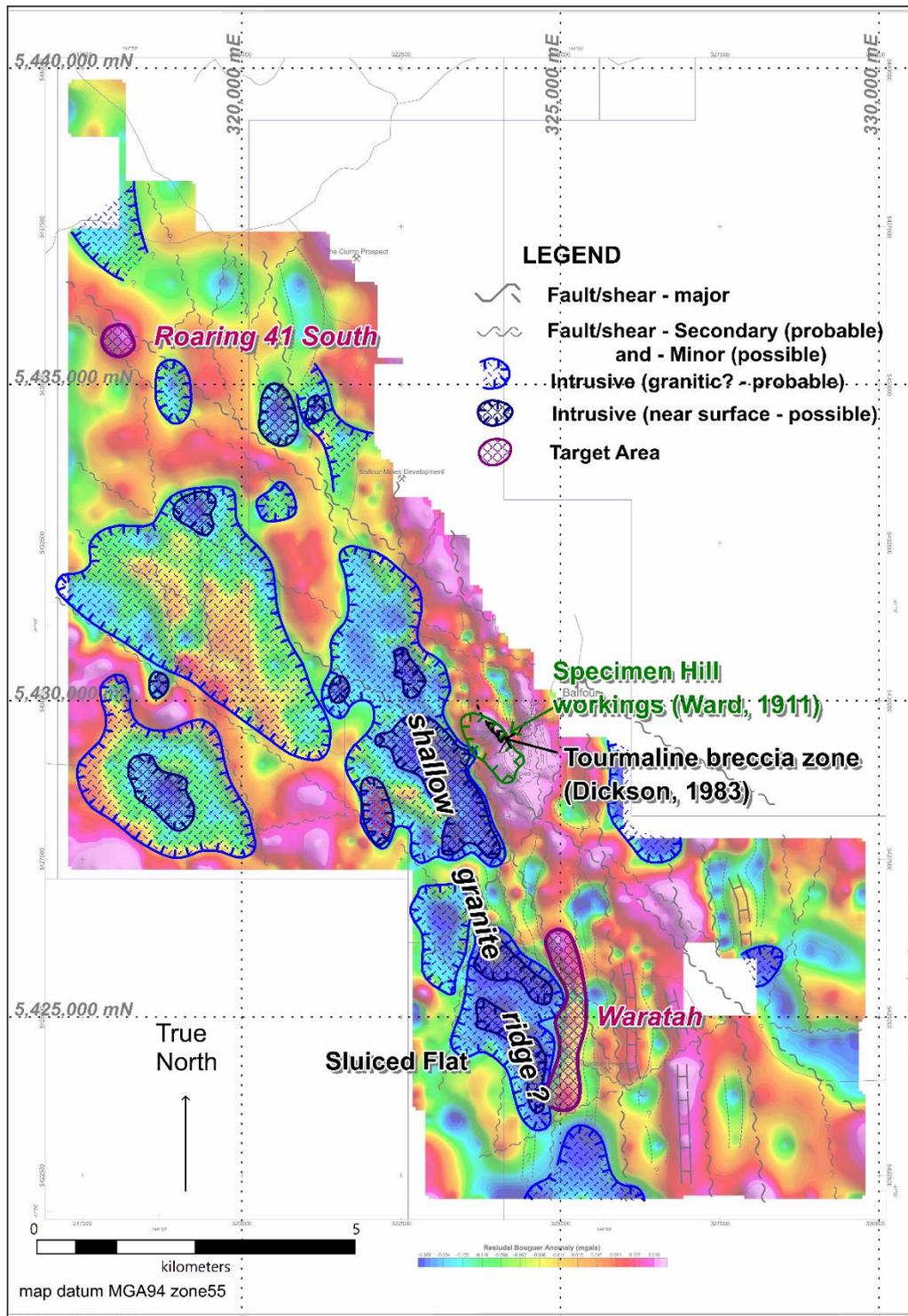


Figure 4.3.28.1: Pleiades gravity image (Bouguer anomaly upwardly continued) and interpretation modified to enhance interpreted intrusive anomalies and target areas (Bissett, 2009a; 10_6024A) with area of Specimen Hill and tourmaline breccia zones added.

A number of areas of interest were determined from this work being;

- Specimen Hill
- Roaring 41 South Prospect – coincident magnetics and gravity anomaly
- Sluiced Flat Prospect (Screaming 50's anomaly)

Bouguer anomaly gravity data shows a strong regional gravity gradient decreasing from the northwest towards the southeast. The calculated residual gravity anomaly image highlights a prominent gravity ridge spatially associated with known mineralisation at Balfour with a residual gravity low located west of the Specimen Hill Prospect which may be indicative of low density rock masses that have risen close to the surface. (Callaghan, 2009)

At Specimen Hill gravity and aeromagnetics modelling modelled a near surface granite cupola west of the Specimen Hill prospect with a magnetic body beneath it.

Bissett (2009b; 10_6024B) also modelled the magnetics anomaly beneath Specimen Hill summarising the findings from the modelling as;

“A north-east trending structure immediately south of Specimen Hill appears to separate shallower and less magnetic bodies to the north from deeper and more magnetic bodies to the south

The more magnetic body south of this structure is also coincident with an increase in the gravitational field which may indicate a relationship between the two” and commenting that “although not a comprehensive model, there is some indication of an empirical relationship between the more magnetic body south the Specimen Hill fault and the increased gravity values. This relationship should be investigated more thoroughly by joint modelling of magnetic and gravity data.”

The main mineralised zone was recognised as a silica+tourmaline breccia on the northwest margin of the prospect. Three drillholes were targeted on it (BJV001 to BJV003) with a fourth deeper hole designed to investigate the magnetic high.

“Mineralisation consists of coarse cassiterite-wolframite and scheelite associated with sparse quartz-carbonate-pyrite-arsenopyrite veining hosted in silica-tourmaline+carbonate altered siltstones and sandstones. Individual one metre samples assayed up to 2.2% WO₃ and 1% Sn. However, vein densities are low and most analyses from the host sediments are well below 0.1% for both elements.” (Callaghan, 2009)

Assays for BJV002 are unfortunately not included with the report but the drill log cover page lists better intersections as:

33.0 - 34.0 1.0m @ 0.4% Sn
36.0 - 38.0 2.0m @ 0.2% Sn
43.0 - 44.0 1.0m @ 0.3% Sn
51.0 - 52.0 1.0m @ 0.3% Sn
71.0 - 72.0 1.0m @ 2.2% WO₃
81.0 - 83.0 2.0m @ 0.1% WO₃
103.0 - 104.0 1.0m @ 0.5% Sn
133.0 - 135.0 2.0m @ 0.2% WO₃
144.0 - 145.0 1.0m @ 0.4% Sn
168.0 - 169.0 1.0m @ 0.2% Sn and 0.1% WO₃
210.0 - 211.0 1.0m @ 0.5% WO₃

Better Sn and WO₃ assays for BJV001, BJV003 and BJV004 are shown on figures 5.16 and 5.17.

However, copper was not analysed for in spite of drill logs describing a number of massive sulphide bodies consisting of coarse-grained pyrite and chalcopyrite as well as variable arsenopyrite, cassiterite, and variable amounts of quartz. These intervals are summarised in the following table. The remaining core should be accessed from MRT's core store in Hobart and sampled and assayed for copper as well as gold.

Hole_ID	From (m)	To (m)	Interval (m)	Visual Sulphide (%)	Intersection Angle to Core Axis	Description
BJV002	43.2	43.5	0.3	100%	85°	Massive sulphide vein. Coarse grained pyrite-chalcopyrite and arsenopyrite. Minor coarse cassiterite.
BJV002	53.8	54.1	0.3	80%	85°	Massive sulphide vein. Coarse grained pyrite-chalcopyrite and arsenopyrite. Minor coarse cassiterite. 20% white quartz.
BJV002	130	135.1	5.1	80%	10°	Massive sulphide vein. Coarse grained pyrite-chalcopyrite and arsenopyrite. Minor coarse cassiterite. 20% white quartz, minor muscovite. Scheelite? Low angle to core axis, drilled down vein. Vein cuts bedding at high angle. i.e. Discordant to bedding.
BJV002	206.8	207.8	1	80%	85°	Massive sulphide vein. Coarse grained pyrite-chalcopyrite-arsenopyrite. Minor coarse cassiterite. 60% white quartz, minor muscovite. Scheelite? High angle to core axis, brecciated.
BJV002	209.6	210.4	0.8	80%	60°	Massive sulphide vein. Coarse grained pyrite-chalcopyrite-arsenopyrite. Minor coarse cassiterite. 60% white quartz, minor muscovite. Scheelite? High angle to core axis, brecciated.
BJV003	119.3	119.6	0.3	80%	75°	Massive, coarse grained pyrite-arsenopyrite-quartz-chalcopyrite-carbonate-cassiterite vein. Cross cutting bedding at high angle.
BJV004	129.4	131	1.6	80%	?	Massive, sulphide rich vein. arsenopyrite-pyrite-chalcopyrite with lesser quartz-carbonate and cassiterite. 0.8m core loss.

Callaghan (2009) concluded that whilst “it is unlikely that significant quantities of mineralisation exist near surface to operate a viable open pit mine. The Balfour Field does host significant Sn and WO₃ mineralisation between the west dipping Balfour Shear and the east dipping thrust bounding the Cassiterite Creek Sandstone and the Skinners Flat Siltstone (and) the confluence of these two structures is a potential target.”

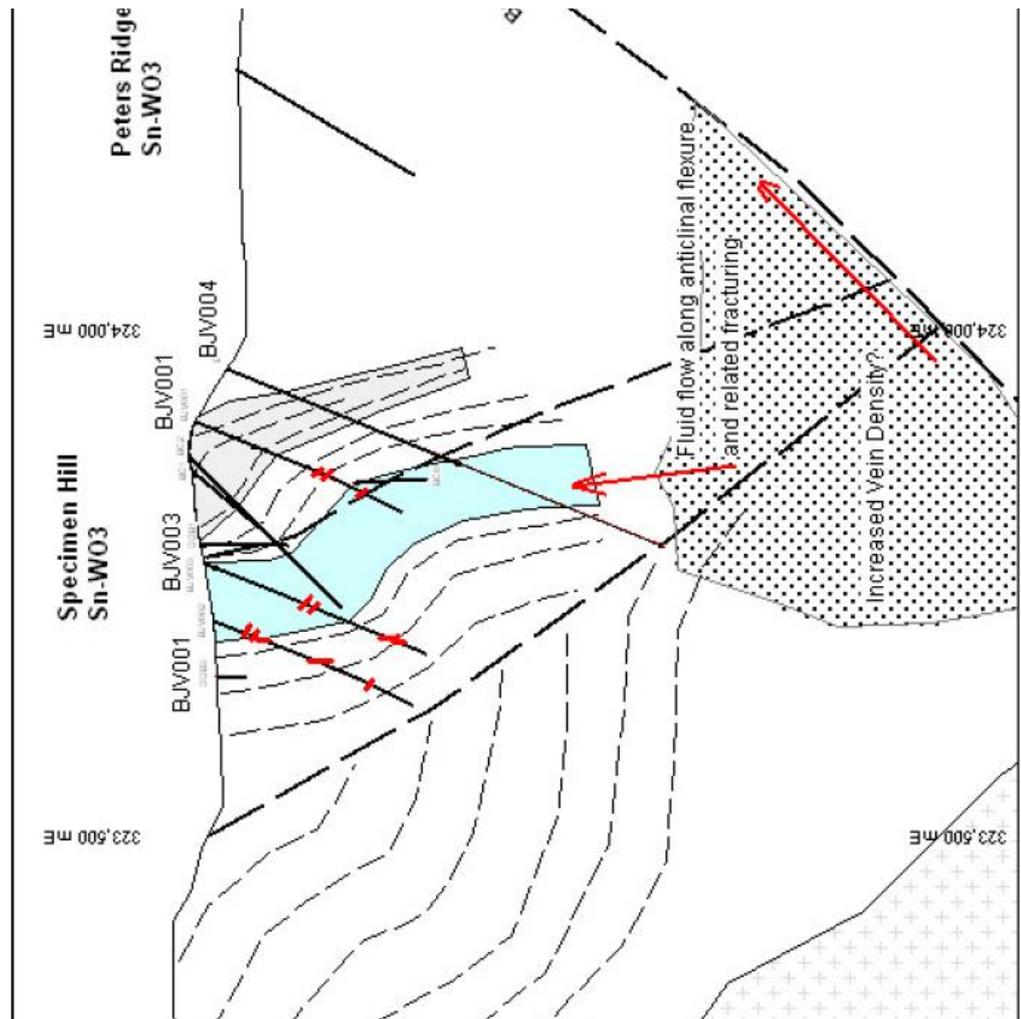


Figure 4.3.28.2: Interpretative geological cross-section on northing 5,429,350mN MGA94 from figure 9 “interpretive section 5429350” in Callaghan (2010; 10_6024). Section is through Specimen Hill and Murrays reward and shows thrusting and sub-surface granite as well as suggesting target zone for tin and/or tungsten mineralisation.

The Roaring 41 South prospect was recognised from the combined gravity and magnetics interpretation (Blissett, 2009c: TCR 10_6024c) as “a single point gravity and magnetic high associated with a broader low level gravity and magnetic feature constrained by the dominant NW strike of the NE dipping Rocky Cape Group.” (Callaghan, 2009)

The prospect is located on the far northwestern extent of the survey where data spacing was much broader with a line spacing of 250m and data collected on 50m stations, however, the magnetic anomaly was described as a “very strong bulls-eye magnetic anomaly” and the gravity anomaly as “anomalously high” (Callaghan, 2009).

Ground mapping and rock chip (5 rocks) geochemical sampling identified a prominent quartzite ridge, however, whilst the ground magnetic survey (600m x 600m, 100m spaced lines, GP856 magnetometer and base station with handheld GPS) confirmed and refined the aeromagnetic anomaly, a source for the coincident gravity-magnetic anomaly was not determined. One of the 5 rocks assayed returned 300ppm As, 246ppm Pb and 121ppm Zn.

It was concluded that the Roaring 41 South anomaly may represent either a mafic intrusive or diatreme, a magnetite bearing palaeoplacer at the base of the Lagoon River Quartzite, or a buried magnetite sulphide body. A soil geochemical sampling survey followed by a drilling program was proposed to test the anomaly (Callaghan, 2009).

The gravity and magnetics interpretation also drew correlations between the geophysical setting of the Furious 50's (Sluiced Flat) and Specimen Hill regions and that the magnetic unit immediately east of Sluiced Flat showed the best potential for discovering a repeat setting of mineralisation similar to that discovered at Specimen Hill (Blissett, 2009d: TCR 10_6024d).

In the 2009/2010 reporting year work remained focused on the Roaring 41 South prospect where the target model of Tennant Creek style Proterozoic hosted IOCG magnetite+copper+gold was proposed. (Callaghan, 2010: TCR 11_6214)

Modeling of the ground magnetic data suggested a potential target consisting of a 100m by 100m wide, steeply southwest dipping prism of 10% magnetite at 60m depth. A botanical and archaeological survey was completed before a drilling permit was granted with no significant archaeological features observed but one threatened plant species (Northwest Heath *Epacris curtisiae* - listed as rare, P. Milner 2010 in Callaghan, 2010: TCR 11_6214) identified in the work area.

Two diamond drill holes (for 511m) were drilled as a scissored pair.

Drillhole details are included in Appendix A.

Drillhole R41S_01 intersected 5m @ 0.9% Cu and 0.01g/t Au from 54m depth associated with fault/breccia hosted magnetite-siderite-pyrite mineralisation whilst drillhole R41S_02 intersected 1.0m @ 0.5% Cu and 0.1g/t Au from 208m but did not intersect a source of the magnetic anomaly despite being drilled through the centre of the modelled anomaly to a depth of 259.8m.

Both holes were lined with pvc and a down hole electromagnetic and 3 component magnetic survey conducted by Outer Rim Exploration using a Crone PEM system measuring the B-field with readings at 10m spacings brought in to 2m spacings in areas of interest. R41S_01 had a very strong conductive response between 40 and 55m, however, no significant off hole response was noted in R41S_02. Similarly R41S_01 also had a very strong magnetic response between 40 and 55m whilst R41S_02 is lacking any real anomalous response.

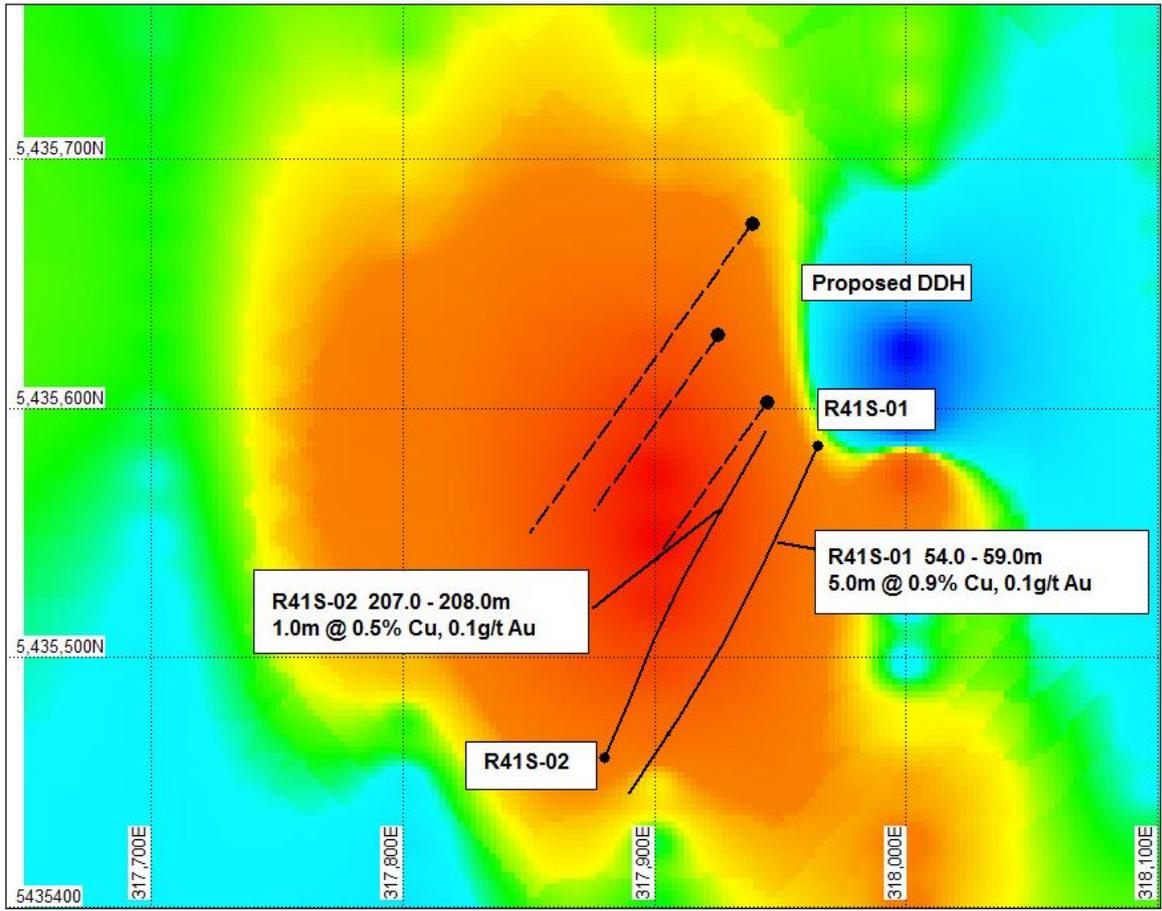


Figure 4.3.28.3: Roaring 41 South prospect showing existing drillholes R41S01 and R41S02 as solid lines, and proposed holes as dashed lines, superimposed on a ground magnetic image “Figure 8. Proposed follow up DDH, R41S” in Callaghan, 2011)

Modelling of the DHEM and magnetic data suggests the mineralised body is of limited extent being located near surface (not extending below 100m depth) and plunging to the northwest with limited strike extent.

It was concluded by Callaghan (2010) that the Roaring 41 South deposit is one of a number of similar magnetite+siderite bodies which are well known in the Temma district 10-15km’s west and north of Roaring 41 South of which one, Nelson Bay River, has recently been exploited by Shree Minerals Pty Ltd for iron. Other examples are Rebecca, Strickland and Possum Creek.

“Exploration models for Geopeko and Pacific Nevada were based on Proterozoic Iron oxide copper-gold deposits, principally Tennant Creek Style replacement ironstones and breccia pipes”. (Callaghan, 2010).”

“The Temma ironstones consist of magnetite-siderite-quartz, Fe-rich amphibole, pyrite and chlorite bodies with a wall rock assemblage of biotite and garnet often replaced by retrograde chlorite alteration. The bodies are considered to be a pyrometasomatic replacement of mafic intrusives and host sediments (Weber, 1983, Newnham, 2000)” (Callaghan 2010)

Callaghan (2010) concluded that Tennant Creek style iron-oxide copper-gold mineralisation is a feasible exploration model for the Roaring 41 South prospect and other ironstones of the Temma district but cautions that small tonnage deposits will need to be of high grade within the Arthur-Pieman Conservation Area.

Further drilling was recommended at Roaring 41 South with 500m including shallow holes along strike and a deep hole testing for the northwest plunge. (Callaghan, 2010).

In a review of the tenements potential (Callaghan, 2011b; TCR 11_6240) concluded that “drilling for tin-tungsten at Specimen Hill to date, whilst intersecting veins of high grade, has not intersected these veins at sufficient density near surface to define an economic orebody in the top 100m at the price of the day, however, “despite the thin and sporadic mineralisation at surface, the drilling results from all three programs cannot be regarded as insignificant.”

“It is possible that the surface expression is the distal margins of a larger system and the possibility of a substantial deposit at depth remains.”

“The strike extent of the magnetic anomaly and associated anomalous geochemical anomalies/prospects has not been tested, particularly at depth.”

“The interpreted granite intrusion associated with the residual gravity low west of Specimen Hill remains untested.”

“There is a high probability that mineralised granite is located within 1km of the prospect and all gravity surveys suggest it is located just west of Specimen Hill.”

“The tin mineralisation is associated with a prominent magnetic high that is probably attributable to disseminated pyrrhotite in host sediments. Alternatively the strong magnetic anomalies may represent a deeper pyrrhotite rich body, possibly associated with the tin-copper mineralizing system.”

“Finding economic tin-tungsten mineralisation near surface is unlikely as the area has been extensively explored to 100-200m. However the geological, geophysical and geochemical evidence all suggest a tin-tungsten rich granite body is located nearby. Deep exploration drilling targeted below and west of the Specimen Hill/Balfour mineral prospects is the only way of exploring. Exploration will be high cost with no guarantee of success, but the amount of mineralisation present at surface, and the presence of world class deposits (Renison Bell, Mt Bischoff and Dolphin) associated with the Tasmanian granites suggest the reward could be great.”

Regarding copper (Callaghan, 2011b; TCR 11_6320) lists and briefly summarises the copper prospects before concluding that;

“Mineralisation is hosted in NNW trending, steeply west dipping thin shoots that are depth persistent. The small size and tonnes per vertical meter of the known near surface deposits suggest they are not likely to be commercially viable under current economic and cost structures.” and that

“The current level of exploration suggests there is little potential for significant copper mineralisation within 200m of surface. However, the depth potential remains untested. The Balfour Shear is obviously a conduit for mineralisation, most probably granite related. There is a possibility of Sn-WO₃ and Cu mineralisation increasing in intensity closer to the granite source.” (Callaghan, 2011b)

In their final year of activity a field visit was made to the Waratah adit and Sluiced Flat areas and two rocks collected from each (Callaghan 2011c; TCR 11_6345)

4.3.29 Regalpoint Exploration Pty. Ltd. 2008 – 2010 (EL 57/2007)

Regalpoint Exploration Pty. Ltd (Regalpoint) selected the Horton River area along the westernmost margin of the Balfour Project area for its uranium potential based on a conceptual and empirical, Australia-wide uranium prospectivity analysis that was commissioned by Regalpoint and undertaken by the Centre for Exploration Targeting and which highlighted the potential of the area (Kreuzer, O., 2009).

Reconnaissance rock sampling was carried out with a very limited number rock samples collected within the BPA from brief reconnaissance visits and analysed for uranium with no anomalous results reported (Gauci, M., 2009).

4.3.30 Torque Mining Pty. Ltd. 2011 – 2012 (EL 6/2011 and EL 21/2011)

Torque Mining Pty. Ltd. (Torque) pegged the ground in 2011. Torque had existing geophysical data enhanced as well as digitising soil and rock sampling on the Kennys and Cooneys grids (Farrell and MacDonald, 2011) but relinquished the ground to focus on their open pit gold mine at Stormont near Moina.

4.3.31 Zebs Minerals Pty. Ltd. 2014 – today (EL 10/2014, EL 12/2015, EL 13/2015, EL 9/2021, ML 1M/1976)

Zebs Minerals Pty. Ltd. (Zebs) engaged G.H.D. as exploration consultants in order to compile and process existing open-file geophysical data and complete a series of reports, initially on ML1M/1976, and then incorporating recently acquired EL 10/2014. (Hansen, 2015)

GHD assessed existing datasets and completed a desktop review, initially focussing on the immediate area of ML 1M/1976 then expanding it to include the newly acquired EL 10/2014. (Anderson, 2015)

GHD considered potential models for mineralisation to be

1. “Proterozoic sediment hosted/stratiform Cu-Pb-Zn,
2. Cambrian VHMS (Cu-Pb-Zn), and
3. Devonian granite intrusive related Sn-W”

The desktop review (Anderson, 2015) summarises a number of aspects of the geology and geophysics of the area noting that known mineralisation styles present in the Balfour region in general consist of

- copper lodes (structurally hosted)
- tin and tungsten veins and stockworks
- zinc and lead anomalous geochemistry
- cupriferous transgressive magnetite-dominated lodes

Regarding the geophysical datasets GHD note that ML 1M/1976 lies on the eastern fringe of a large gravity (high) anomaly with low gravity values adjacent to the high due to an interpreted shallow granitic intrusive. GHD conclude that the gravity high “may represent faults with associated mineralisation for metalliferous hydrothermal fluids.” (Anderson, 2015)

Magnetically the lease is situated in an area containing no obvious magnetic anomalies but to the west high magnetic values are likely the result of documented magnetite and pyrrhotite mineralisation.

GHD also note that the mine lease is situated in an area of low airborne EM response (from MRT’s 2002 WTRMP frequency domain hummingbird survey) with linear anomalies correlating with faults and geological units, whilst IP shows a high response over the site corresponding with known copper mineralisation, and extending to the north of the ML. GHD also note further moderate sized high IP responses directly west of the ML and coincident with a gravity anomaly (but no coincident magnetic anomaly), a characteristic shared by high IP responses in the Murrays Reward area which could warrant further investigation. (Anderson 2015)

GHD consider that the high-density anomaly appeared to bear the same structural control on mineralisation at Murrays Reward and that it is possible that “it may depict mineralised fluid pathways and/or the presence of volcanic intrusives down-dip to the southwest at significant depth. On this basis, further investigation of this gravity anomaly is warranted.” (Anderson, 2015)

For the Murrays Reward copper lode deposit GHD recommended (Anderson, 2015)

- detailed structural mapping,
- drilling to define strike extent of mineralisation

For the deeper Proterozoic copper VHMS/SEDEX model GHD recommended

1. extension of the mine lease
2. collection of petrophysical data (density and magnetic susceptibility) allowing 2D forward modelling,
3. and, “with good outcomes from recommendations 1 and 2 ... (drill) a deep diamond drill hole in the vicinity of previous workings at Murrays Reward ... to provide important geological and structural information, and may identify mineralisation at greater depths than previously investigated” (by the generally <200m deep drilling to date). GHD proposed the hole be drilled in a west-southwest orientation. (Anderson, 2015)

With the subsequent acquisition of EL 10/2014 the focus of work shifted to the potential of the gravity high anomalies to the immediate west and southwest of ML 1M/1976) and GHD were commissioned to carry out further analysis of these anomalies.

GHD commenced with 3D potential field unconstrained modelling (inversion) of the gravity and magnetic data (Summers and Hansen, 2015a).

No isolated high magnetic susceptibility bodies were generated by this modelling with observed magnetic data of a relatively low intensity interpreted to be due to magnetite content. Gravity inversion produced four discrete high density bodies, two of which correspond with moderate intensity IP anomalies from CRAE’s 1996 reinterpretation of earlier surveys.

These two smaller bodies to the west and northwest of the ML 1M/1976 are adjacent to areas of known tin mineralisation and are near surface. They were interpreted as more likely due to hydrothermal alteration than the source of copper at Murrays Reward.

The two larger bodies to the southwest of the mine lease were considered to be the more prospective and to potentially satisfy the model for vein/lode style mineralisation at Murrays Reward being sourced (remobilised in the Devonian) from a copper bearing VMS-style orebody down-dip on the thrust fault which hosts Murrays Reward.

GHD recommended work to evaluate the four anomalies with the shallower anomalies for copper lode/vein mineralisation, and the two larger bodies for VMS style mineralisation (Summers and Hansen, 2015a). In particular GHD recommended

- geological structural mapping and collection of further petrophysical samples,
- carry out multi-scale edge detection analysis (MSED) of the gravity and magnetic data
- perform 2D forward modelling of the gravity anomalies, and
- investigate IP surveying, particularly over the two deeper bodies which do not appear to have an IP response, but which may be a product of the limited ability of IP systems used to acquire this data

MSED analysis was completed (Summers and Hansen, 2015b) on both gravity and magnetics data.

High amplitude magnetic worms trend north to northwesterly and correspond in part with mapped thrust faults with the Balfour Copper Belt showing a strong spatial correspondence with worms of this orientation. These are cut by lower amplitude east-west structures.

Gravity worms showed some correspondence with the major western magnetic worm, however, a high proportion of gravity worms trend west or west-northwest and are often located on fault intersections. (Summers and Hansen, 2015b)

It was concluded from the work that “magnetic MSED worms indicate an alternative geometry for the Balfour Shear Zone with two major sub-vertical to slightly overturned faults striking approximately north-south and extending to depths of several kilometres appear to define the western and eastern boundaries of the modelled density anomalies.” (Summers and Hansen, 2015b)

“Gravity MSED worms indicate that a series of smaller more shallowly westward dipping thrust faults trending approximately north-south run parallel to and terminate against the eastern fault of the Balfour Shear Zone. These faults appear to constrain the strike location of copper lode and supergene mineralisation between the Clump in the north and Murrays Reward to the south.” (Summers and Hansen, 2015b)

“Gravity MSED worms also indicate that a series of east-west oriented, NNE dipping faults (possibly syntectonic to the Balfour Transform) transect the eastern most splays of the Balfour Shear Zone. Copper mineralisation at Murrays Reward, Emmet’s, Central, Development, Blocks and Clump all appear to be coincident with transform faults that intersect the major eastern fault of the Balfour Shear Zone.” (Summers and Hansen, 2015b)

These conclusions concur with the model created for mineralisation generated by CRAE (Tear and Russell, 1998; 98_4115).

Finally, “the consistent association of cupriferous and tin-tungsten mineralisation at the intersection of transform faults with the Balfour Shear Zone and associated fault splays is anticipated to represent a valuable targeting tool to identify additional zones of mineralisation along the strike extent of the Balfour Shear Zone.” (Summers and Hansen, 2015b)

Aside from the recommendations noted earlier GHD recommend IP and/or EM surveys to investigate the deeper density bodies, and the development of a deeper drilling programme.

GHD also carried out 2D forward modelling on the deeper density anomaly more immediately southwest of the Murrays reward workings on two sections, 5,429,535mN and 5,429.240mN (Summers and Hansen, 2015c).

Unfortunately close petrophysical specific gravity data for potential mineralisation (2.846) and the spatially associated Chloritic Mudstone unit (2.745) meant that a non-unique interpretation was possible introducing much subjectivity to the modelling of the gravity anomaly closest to Murrays Reward. Conversely, magnetic petrophysical data was unable to explain the magnetic high and coincident gravity anomaly further west beneath Specimen Hill. Here the magnetics profile required the addition of a steeply west dipping magnetic anomalous body (300×10^{-3} SI) compared to the other rock units which are all less than 0.363×10^{-3} SI. The modelled magnetic body has dimensions of 120m thickness, 2.5km deep, dips to the west at -85° but only comes to within ~ 380 m of the surface.

The nearest drillhole to this body is BJV004 (collared 280m to the north of the northern section but angle back towards it) in which disseminated pyrrhotite gives magnetic susceptibilities up to a single reading of 34×10^{-3} with next highest values up to 9.7×10^{-3} , considered by Callaghan (2009; 10_6024) as adequate to explain the Specimen Hill magnetic anomaly, particularly once remanence (Koenigsberger ratio of 20-24) is included.

In order to test the density anomaly immediately southwest of the Murrays Reward workings diamond drill holes 15BA001DD was drilled to a depth of 863.4m Hansen, 2016). The hole intersected chloritic siltstones (mudstones) for its entire length. Specific gravity measurements were taken at ~ 4 m intervals for the entirety of the hole and no significant differences in density were observed though the data was not reported. The hole was on target and is regarded as having adequately tested the interpreted gravity high.

The hole was downhole EM surveyed using Zebs Minerals owned DigiAtlantis EMIT system with three loop layouts. No anomalous responses were recorded. (Williams and Bishop, 2017 in Hansen, 2017))

Hansen (2018) summarises the work to date on the prospect, noting that GHD’s gravity modelling had failed to incorporate the effects of the likely granitic intrusion at depth to the west, and that the gravity highs may well be the ‘background’ with the lower gravity zones the actual anomalies.

In 2020 MacDonald (2020) and revised in MacDonald (2021) (to include references to surface costeaning in the previous exploration section) generated in-house estimates of the (non JORC-2012 compliant) total tons and grade (quantum of mineralised material) for the overall Central Mt. Balfour/Murrays Reward lode interpreting the NW trending structure between the two mines, described by McIntyre as a separate structure to the main lode, as a continuation of the same mineralised structure based on 3D modelling of the Central Mt. Balfour mine and the results of Rio Tinto’s drilling.

The ‘quantum of mineralised material’ was based on historical results from historical drilling by ACI and CRAE and underground channel sampling by ACI.

It was modelled to lithological boundaries or a nominal 0.1% copper cut-off.

Within these downhole intersections are higher grade zones which in some instances can be seen to continue along strike between drillholes, however, drilling density/resolution disallowed the modelling of these for the resource estimation with sufficient confidence. Future drilling may well resolve this and allow for modelling of high grades zones within the overall resource.

The estimation was based on the original assays of 21 diamond drill holes and a historic channel sample in the No3 adit with no new data. Data quality is moderate to poor with limited QA/QC on most of the data set (ACI samples). DD97BC9 (17.3m @ 1.06% Cu) was drilled as a twin to DDH16 (20.74m @ 1.44% Cu) indicating good repeatability at the field duplicate level.

Data, from the Access database was wireframed in Surpac and a block model created with blocks oriented north-south with block dimensions 2.5m East x 5.0m North x 5.0m RL with sub-blocking allowed). The model’s name is *MRCMB_copper_lode_082020.mdl*

Estimation was by ID² with minimum 3 and maximum 18 samples and a spherical 250m search ellipse. 2X x 3Y x 3Z discretization points were used. An approximation for lode width for each intersection was also estimated into blocks by ID².

The total quantum of material, at a 0% copper cut-off, was estimated by adding an approximation of the remnant mineralisation in the Murrays Reward mine (i.e. 108,236t @ 0.54% Cu) to the total estimated for the rest of the lode (i.e. 6,116,657t @ 0.5% Cu). The total at 0% copper cut-off and bulk density of 2.7t/m³ is given in Table 4.3.30.1.

Table 4.3.31.1: Total (non JORC-2012 compliant) Quantum of Mineralised Rock including Murrays Reward Remnants

Cu% Cut-off	Volume (m3)	Ore Tons	Cu% Grade	Cu metal tons
0	2280181	6,224,893	0.50	30996

The remnants in the Murrays Reward mine cannot be quantified at higher copper cut-off grades but will be increasingly less than 108,236 tons at increasing copper cut-off grades. At the 0% copper cut-off grade the Murrays Reward remnant adds 1.8% to the total. At increasing copper cut-off grades this addition will be less.

The total quantum of material (excluding additional remnant tons from the Murrays Reward mine at higher cut-off grades) was given at a series of cut-off grades in Table 4.3.30.2.

Table 4.3.31.2: Tons and Grade Murrays Reward/Central Mt. Balfour Copper Lode Excluding Murrays Reward Remnants

Cu% Cut-off	Volume (m3)	Ore Tons	Cu% Grade	Copper Metal Tons
0	2240534	6,116,657	0.5	30412
0.25	1384558	3,779,842	0.74	27889
0.5	997115	2,722,124	0.88	23933
0.75	438067	1,195,923	1.235	14775
1	290679	793,555	1.41	11190
1.25	216897	592,128	1.5	8882
1.5	105908	289,129	1.65	4771

An estimate was also quantified for the McIntyre Shoot at a number of cut-off grades in Table 4.3.30.3.

Table 4.3.31.3: Tons and Grade McIntyre Shoot

Cu% Cut-off	Volume (m3)	Ore Tons	Cu%	Copper Metal Tons
1	256090	691,443	1.41	9749
1.25	193152	521,511	1.5	7823
1.5	92887	250,794	1.65	4138

The total quantum of material was considered to be of inferred standard (subject to satisfaction of RPEEE criteria) due to the following reasons

- Broad drill spacing
- Poor core recovery in instances
- Very limited QA/QC
- Many holes not downhole surveyed in spite of other holes showing significant swing and lift
- Some uncertainty regarding 3DM modelling
- No bulk density measurements
- Potential assay undercalls (ACI samples) and overcalls (CRAE samples)

Limited work was done on assessing the Reasonable Prospects for Eventual Economic Extraction criteria though preliminary pit designs were completed. These show unfortunately that the proposed pits would lie too proximal to the Balfour township and would require the purchase of a number of private properties. This was considered a possibility at the time.

It was concluded that further drilling (and possibly also underground re-sampling of the No.3 adit) would be required to lift the potential non JORC-2012 resource status to Indicated should the RPEEE be satisfied.

It was also considered that the deposit remained open to depth and along strike.

The modelling defined a high grade shoot based on intersections in DDH16, DD97BC9 and the No.3 adit and named the McIntyre Shoot after the ACI geologist. The Murrays Reward mine was named the Laan Shoot after previous owner Marty Laan.

In 2022 EL 10/2014 was transferred to subsidiary D & B Mining Pty. Ltd. who successfully applied for government co-funding for the drilling of two diamond drill holes beneath the Murrays Reward mine,

one beneath the McIntyre Shoot and a second beneath the Murrays Reward mine. Due to difficulties in obtaining a driller and rig only the latter hole was drilled.

The drill hole DBBA1, was collared on a rise on the south side of Cassiterite Creek and drilled obliquely with respect to the strike of the lode due to the location of the creek and swampy ground around the creek. The hole, drilled in HQ3, initially unexpectedly swung against rotation (to the left) due to the acute angle to bedding/cleavage. The swing was controlled but it still meant for a pierce point further north than ideal given the moderate southerly plunge of the Laan shoot.

The hole intersected chloritic siltstones and occasional thin quartz+sulphide tension veinlets until intersecting the main lode structure from 413.25m to 420.9m assaying 7.65m @ 0.81% Cu but with higher grade zones 414.45m to 415.45m, 1m @ 3.24% Cu and 416.1m to 417.15m, 1.05m @ 1.275% Cu. The 'lode' has a strongly faulted hangingwall from 413.25m to 413.45m with milled quartz vein and chloritic siltstone, then a series of massive quartz+sulphide (pyrite and chalcopyrite) veins with intercalated 'horses' of chloritic wallrock and has the appearance of a mineralised fault structure with contrasting hangingwall and footwall and subsequent later reactivation.

A second massive quartz vein with pyrite and minor chalcopyrite was intersected from 457.85m to 465.65m with pervasive silicification extending down to 518.6m with a silicified fault structure from 514.0m to 515.8m.

The hole was intentionally targeted at depth well below previous intercepts to allow for downhole EM surveying. That work is yet to be completed.

The new drillhole result was incorporated into a JORC-2012 compliant resource where mining would be undertaken from underground thus negating the need to buy private properties in Balfour township.

The updated resource involved a check audit of the database which showed that some assay information for the No3 Adit channel sampling assays had been incorrectly reported in McIntyre (1973) due to a typographic error by the original typist and that two channel samples taken by BHP were relevant to the estimate. These changes were incorporated into the revised updated resource.

Wireframing the new intercept in DBBA1 suggested that 15BA001DD may have actually penetrated the Murrays Reward structure near to the holes end. The hole was relogged and the geology seen to be somewhat more variable than the original logs. Quartz veins and an associated fault with chalcopyrite in veins uphole assaying 3m @ 0.43% copper and 0.17g/t gold (from 728m) were noted around the position where the Murrays Reward structure was expected (with silicification further downhole analogous with the position of silicification seen in DBBA1) but it was considered that the interpretation was equivocal. Further the intersection if in fact the Murrays Reward structure was at some depth and over 500m's away from the existing wireframe and so it was not incorporated into the new resource estimated.

It is reasonable to conclude that the Murrays Reward structure may have been intersected in 15BA001DD thus establishing that the structure has continuity, but that the hole intersected this structure away from a high grade shoot.

The new updated resource for the Murrays Reward/Central Mt. Balfour Lode was estimated using the ID2.

Details of drillholes used in the estimation are listed in Appendix A.

Intersections used in the estimation are listed in Table 4.3.30.4 and shown in figures 4.3.30.1 and 4.3.30.3.

Table 4.3.31.4: Drillhole Intersections used in 2022 Resource Estimate

hole_id	from (m)	to (m)	downhole int. (m)	est. hori. thickness	composite grade Cu (%)	Core Diameter
DD97BC11	146.6	159.9	13.50	9.40	0.505	NQ
DD97BC9	55.3	72.6	17.30	10.95	1.06	NQ
DDH10	120.64	138.53	17.89	13.20	0.16	0 NQ 121.9 BQ 179.83
DDH13	71.94	83.52	11.58	6.02	0.72	0 tricone 41.75 NQ 101.04
DDH14	84.43	105.61	21.18	15.72	0.94	0 tricone 70.1 NQ 112.78
DDH15	85.34	94.49	9.15	6.59	0.05	0 tricone 54.86 NQ 94.49 BQ 106.68
DDH16	63.39	84.13	41.29	14.52	0.93	0 tricone 62.48 NQ 111.25
DDH17	30.48	37.64	7.16	3.47	0.95	0 tricone 35.05 NQ 124.03
DDH18	29.57	31.7	2.13	1.07	0.76	0 tricone 29.57 NQ 105.15
DDH19	60.66	73.5	12.84	6.24	0.49	0 tricone 32.6 NQ 79.25
DDH21	42.05	55.2	13.15	6.75	0.62	0 tricone 38.1 NQ 106.68
DDH22	67.67	84.9	17.23	12.51	0.08	0 tricone 39.62 NQ 105.76
DDH23	56.99	60.81	3.82	2.17	2.12	0 tricone 24.38 NQ 63.09 rods bogged in orezone
DDH24	206.7	223.65	16.95	13.57	0.17	0 tricone 48.77 NQ 236.75 rods bogged
DDH25	228.33	242.04	13.71	10.55	0.4	0 tricone 42.67 NQ 112.8 BQ 250.2
DDH26	144.86	158.08	13.22	10.67	0.06	0 tricone 48.77 NQ 169.16
DDH33	118.11	124.35	6.24	3.45	1.33	0 tricone 76.2 NQ 184.73 BQ 254.16
DDH34	136.2	139.42	3.22	1.81	0.26	0 tricone 24.99 NQ 123.73 BQ 173.28
DDH35	143.64	147.5	3.86	2.20	0	0 tricone 45.72 NQ 182.9
DDH36	195.85	221.78	25.93	15.58	0.29	0 tricone 76.2 NQ 237.78
DDH37	204.9	210.04	5.14	3.18	0.234	0 tricone 60.96 NQ 206.98 BQ 222.77
No3Adit ACI	53.4	65.5	12.1	12.1	0.925	Channel sample
DBBA1	413.25	417.6	4.35	2.3	1.4	HQ3

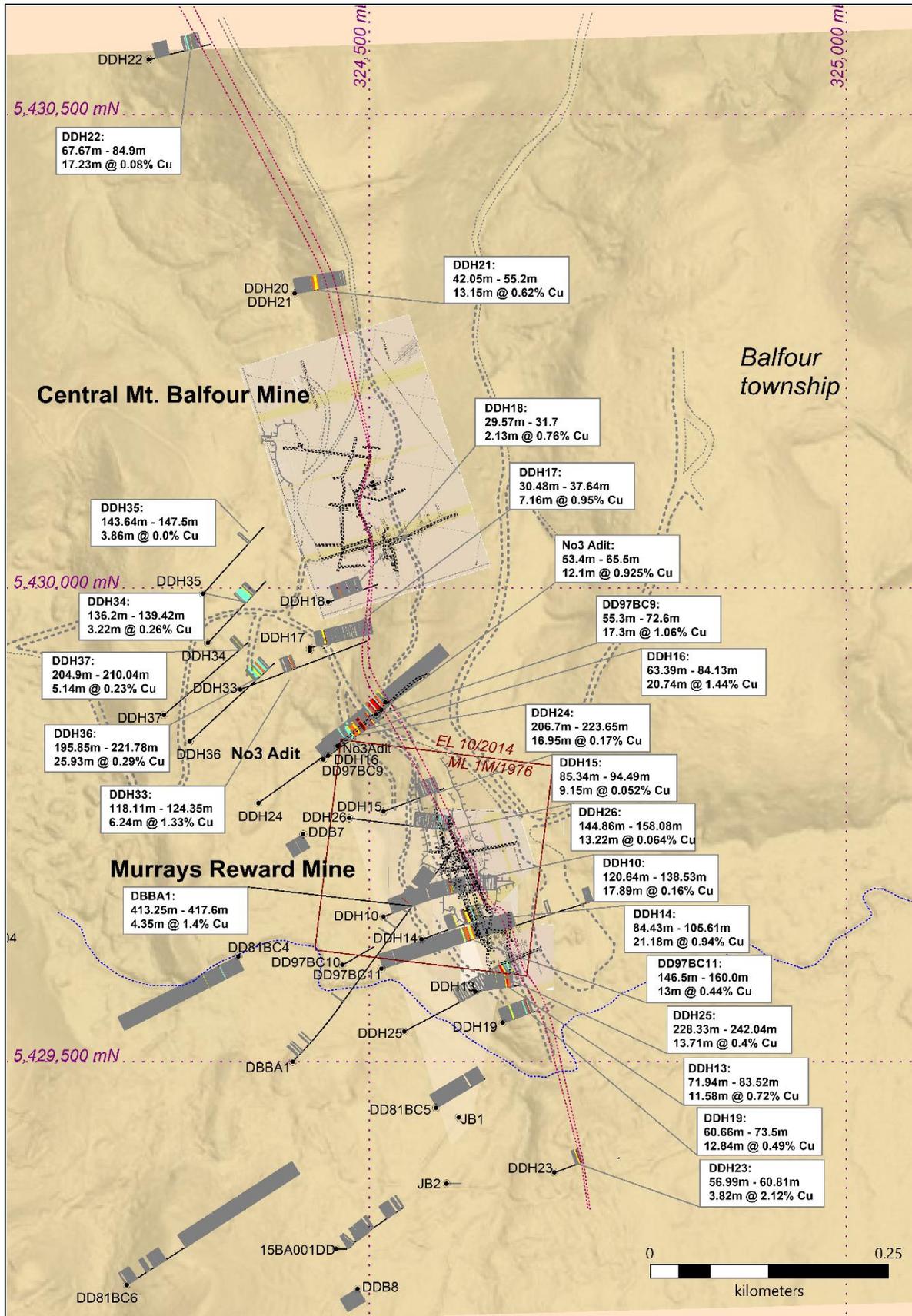


Table 4.3.31.5: Inferred Resource Tons and Grade Murrays Reward/Central Mt. Balfour Copper Lode

Cut-off Grade Cu (%)	Volume (m3)	Tons	Copper grade (%)	Copper Metal Tons
0.25	2,100,156	5,670,422	0.62	35,137
0.5	1,107,625	2,990,588	0.81	24,224
0.75	502,594	1,357,003	1.04	14,113
1	236,219	637,791	1.27	8,100
1.25	86,125	232,538	1.52	3,535
1.5	39,688	107,156	1.75	1,875

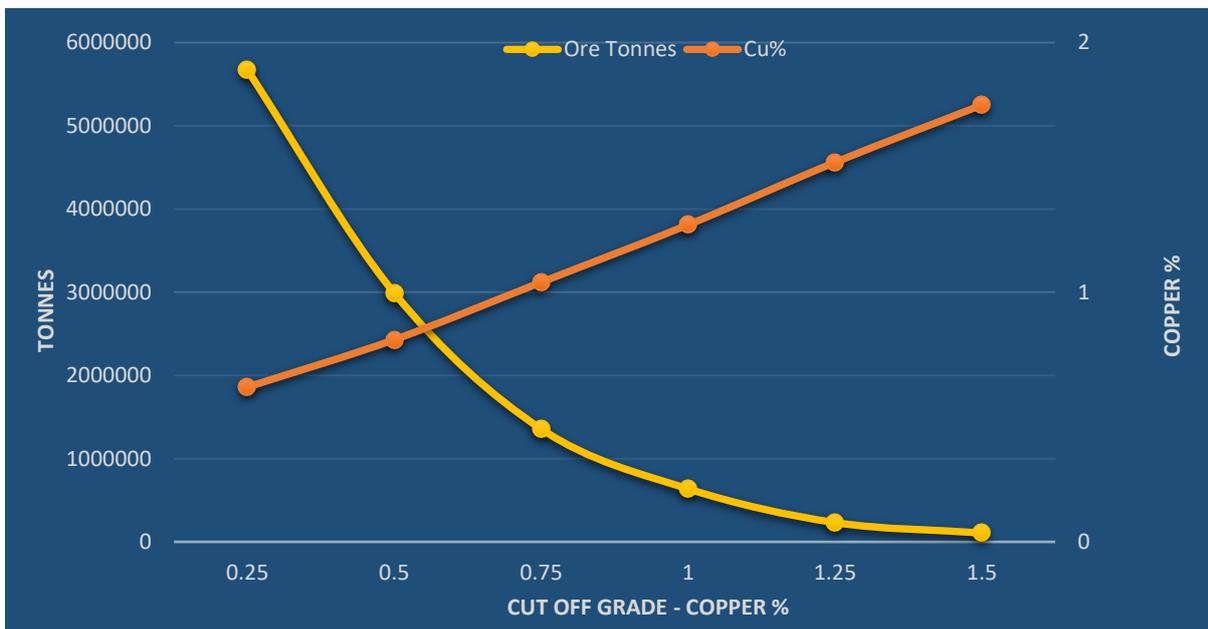


Figure 4.3.31.2: Inferred Resource Tons and Grade Inferred Resource

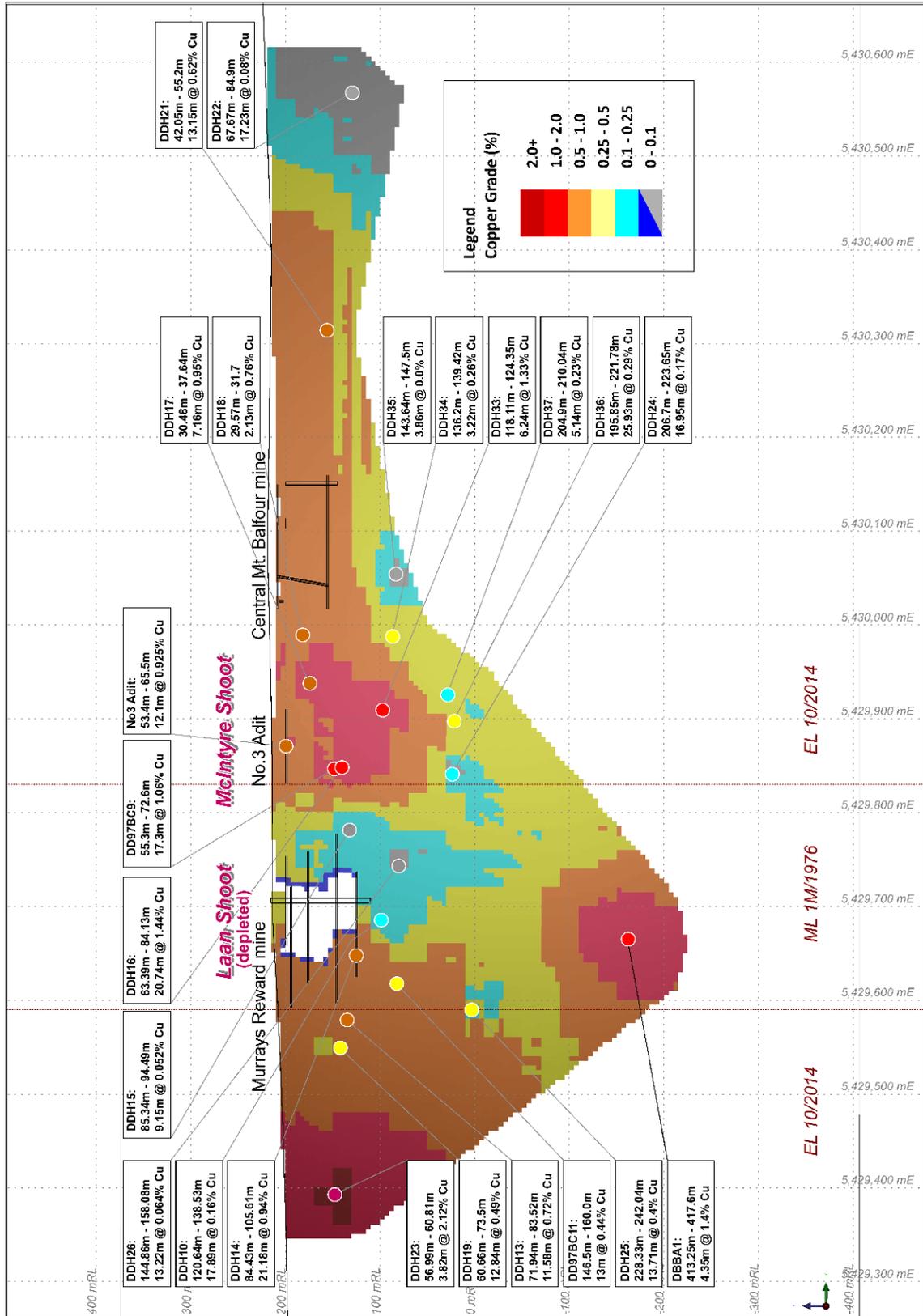
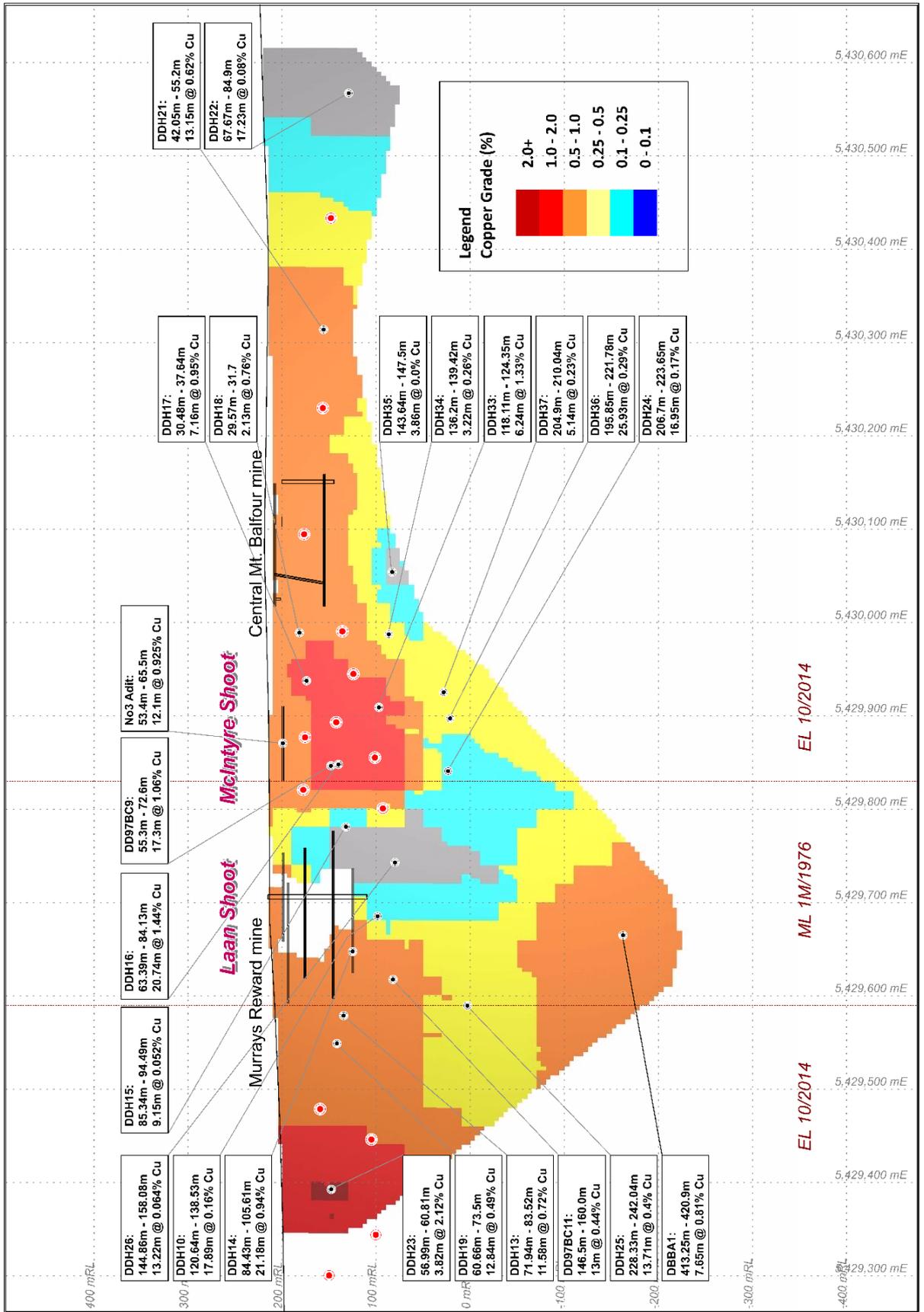


Figure 4.3.31.3: Long section view (looking due west) showing MRCMB_copper_lode_2022.mdl coloured according to copper grade (thus only the easternmost block are visible), drill hole intersection mid-points (black circles), intersections used in modelling, lease boundaries and old workings.



4.3.31.4: Proposed drilling of the Murrays Reward/Central Mt. Balfour resource.

4.4 Government and Academic Work

4.4.1 Introduction

The Balfour Project Area covers a significant area of prospective Tasmanian geology. Whilst the previous section is considered quite thorough, it is possible that this section excludes some more regionally focussed academic work and earlier government work and is not intended to be exhaustive.

4.4.2 Government Work

The Balfour area has been the subject of significant focus by the government geological agency which was originally called the Department of Mines (DoM), but is now known as Mineral Resources Tasmania (MRT), currently a division of the Department of State Growth. In addition the federal agency. Bureau of Mineral Resources (BMR) now Australian Government Survey Organisation (AGSO) have made significant contributions.

A lot of this work has occurred in the last two decades with moneys derived from the Franklin Dam resolution.

Earlier work (pre-2000) has included 1:63,360 mapping and regional airborne magnetics+/- radiometrics geophysical surveys and ground gravity data collection.

Significant airborne surveys include:

- 1981 DoM magnetics survey, fixed wing, 500m line spacing by Geoex over southern portion of BPA
- 1984 BMR magnetics/radiometrics survey, fixed wing, 500m line spacing by BMR over northern portion of BPA
- 1996 AGSO magnetics/radiometrics survey, fixed wing, 200m line spacing by Tesla over whole of BPA

In 2002 MRT initiated the Western Tasmanian Regional Minerals Programme (WTRMP).

Initial work included the flying of a hummingbird EM/magnetics/radiometrics survey over prospective parts of western Tasmania including the more regional Balfour area. This survey covers a significant portion of the BPA

The geophysical data was processed, modelled and interpreted by Webster and Leaman (2002; UR2002_15) whose work forms the back drops to a number of figures in this report.

The survey was followed up with ground fieldwork ground truthing magnetic anomalies in the northern part of the survey (Bottrill and Taheri, 2003; UR2003_18) and southern part of the survey (Taheri, Bottrill and Green, 2011; UR2011_01) as well as quite detailed fieldwork (including mapping and sampling of old workings) laboratory work on the nature and origins of copper and tin-tungsten deposits in the Balfour (and Temma area to the immediate west of the BPA) area (Taheri and Bottrill, 2004; UR2004_05). This report has drawn significantly from their work.

In addition work was undertaken regionally on geophysical aspects of the known mineral deposits of the west coast (Morrison, Reed and Turner, 2003; UR2003_13) and in particular the potential for copper, tin and gold deposits associated with Devonian granites (Turner, Reed and Morrison, 2003; UR2003_15).

The author is also aware of further as yet unpublished work on the nature of the Tayatea Dyke Swarm (of which a number of examples are located within the BPA) and the possibility that lamprophyric/kimberlitic types may be the source of diamonds discovered to the southwest of the BPA (Bottrill pers. comm.).

All of these reports provide strong support for the prospectivity of the Balfour Project Area to host significant deposits of copper (+/-gold), tin and tungsten in particular.

In addition the area has been systematically mapped at 1:25,000 scale with the following figure (taken from MRT's website) showing the relevant mapsheets.

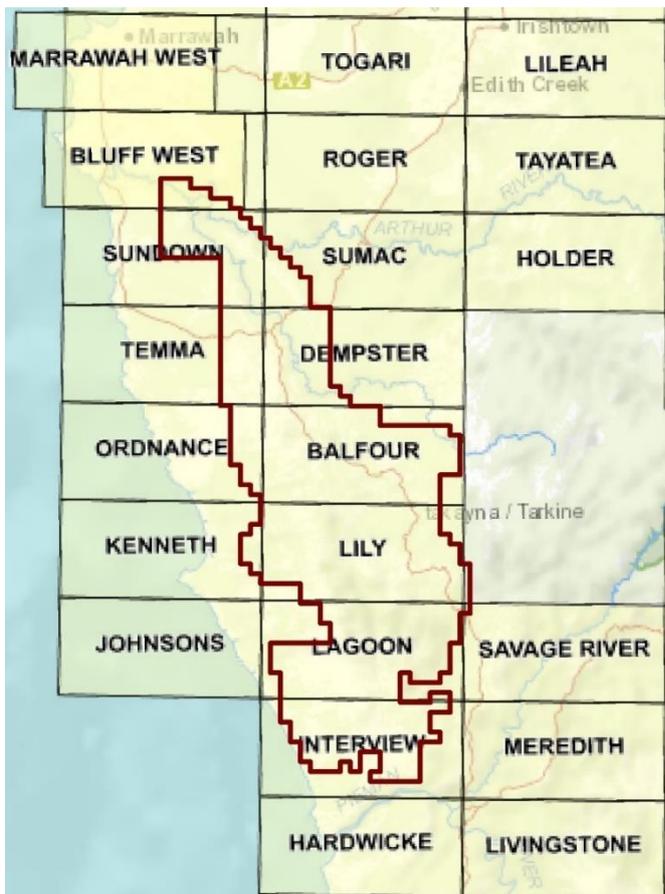


Figure 4.4.2.1: 1:25,000 mapsheet coverage of the Balfour Project Area shown as a maroon outline.

Government work is ongoing with further modelling of geophysical data of the Lily and Lagoon mapsheets in progress (Duffett pers. comm.).

4.4.3 Academic Work

There is certainly academic work undertaken over the geology of the Balfour Project Area which is not referred to herein, however, it is important to note that there have been two Honours theses by University of Tasmania students i.e. Yaxley (1981) (not seen by the author) and Veska (1993) who both studied the geology and mineralisation of the immediate Balfour area, Veska (1993) more specifically studied the copper.

Recent academic work by Halpin *et. al.* (2014) and Mulder, Halpin and Daczko (2015) on the Mesoproterozoic Rocky Cape Group sequence using dating of detrital monazite and zircon and palaeocurrent data provides evidence that this sedimentary sequence was deposited between East Antarctica and North America ~1.45Ga and that the Rocky Cape Group is a correlate of the Belt-Purcell Supergroup of North America.

This is highly significant as the Belt-Purcell Supergroup is host to a number of world class sedimentary hosted copper+/-silver+/-cobalt mineral deposits.

5.0 Exploration Models and Prospects

5.1 Introduction

The historical mining, exploration and academic work in the general Balfour area to date has shown the Balfour Project to have excellent potential for both copper (+/-gold, silver, cobalt), and tin+/-tungsten deposits, the two mineral associations being best seen as having been juxtaposed somewhat coincidentally.

The following exploration models, derived from knowledge gained from these previous miners, explorationists and academic thinkers in the area, combined with knowledge of potential deposit types from similar geological settings both in Tasmania, as well as across the globe, should be used to guide future exploration of the Balfour Project.

A number of drill ready prospects have already been defined which fit these models with the more regional exploration work proposed likely to reveal more.

5.2 Copper (+/- Gold, Silver, Cobalt)

5.2.1 Introduction

The Balfour copper belt is defined by numerous small but often higher grade discrete occurrences of copper (with variably elevated gold) hosted by Rocky Cape Group rocks in regional scale east-northeast verging thrust faults and associated structures in a north-northwest to northwest striking <2km wide zone, with a strike length of 35km and arguably 45km if the Copper Reward occurrences are included (figure 5.1). These deposits are both a potential higher grade target style in their own right as well as being possible indicators (i.e. "smoke") of larger scale deposits (i.e. "fire") down-dip which have been remobilised into these plumbing structures.

Sulphur isotopes clearly favour a sedimentary source (Taheri and Bottrill, 2004) to the sulphur in the copper sulphides in these higher grade occurrences. The source of the copper is less clear with lower grade but potentially extensive sedimentary hosted copper deposits favoured by Taheri and Bottrill (2004), however, they also note other possible sources e.g. native copper bearing Kanunnah Basalt or mafic derived lithic wackes both from the younger Togari Group, or magnetite bearing bodies of the Temma ironstone type.

The correlation of the Rocky Cape Group and the Belt-Purcell Supergroup of North America with its world class sedimentary hosted copper+/-silver+/-cobalt deposits considerably enhances what was a more conceptual model followed by CRAE in the mid 1990's and Pacific Nevada in the 2000's to a potentially more empirical understanding of the likelihood of such deposits existing at depth and being the source of the copper in the higher grade deposits.

However, under this latter model the ultimate source of the copper into these sedimentary hosted deposits remains undefined, with overthrust Kanunnah basalt, mafic sediments or the ironstones still remaining as likely possible original sources.

The main problem cited with sourcing the copper from these Togari Group rocks is that they are younger than the host Rocky Cape Group rocks, however, the location of the high grade copper occurrences along the leading edge of the main thrust fault is where the Rocky Cape Group more likely to overlie these younger Togari Group rocks. The degree of overthrusting shown on MRT's section in figure 3.4.4 may be understating the extent of this.

Additionally the common presence of carbonates (predominantly dolomite) in the copper bearing structures also suggests a source of fluids in the Togari Group where sedimentary dolomites are commonplace. This model would also more simply explain both the extensive earlier chlorite alteration which has affected the Rocky Cape Group rocks and the later stage chlorite which also occurs along with quartz and carbonates in the copper bearing structures.

5.2.2 High Grade Copper (+/- Gold)

The higher grade discrete style of copper mineralisation occurs in (1) larger quartz+/-dolomite veins as disseminations, irregular splashes and occasionally semi-massive forms commonly associated with pyrite, or (2) in smaller quartz+/-dolomite veinlets within sheared lode slate (the two styles essentially really end members of a continuum) in fault zones and other dilatant structures, both hosted within or adjacent to major structures or associated secondary structures.

In the main part of the belt between The Clump and Poseidon prospects (figure 5.2 and 5.4) these structures appear to be north-northwesterly striking east-northeast verging thrusts and associated back thrusts active in the Middle Devonian Tabberraberran orogeny. At Toner River (figures 5.1 and 5.6) and Copper Reward (figures 5.1 and 5.7) in the southern part of the Balfour Project Area copper bearing structures are generally east-southeasterly striking though Ward (1911) also describes north-northeasterly striking structures, either sub-parallel to or directly exploiting the orientation of mafic dykes at Toner River shown on 1:25,000 mapping.

The most comprehensive early geological report on the field is that of government geologist Ward (1911) who visited the field in 1910. The location of potentially mineralised "lodes" being prospected at the time of Ward's visit are excellently mapped on a series of mapsheets Ward (1911) produced which also show the numerous mine leases ('sections') of the time. These "lodes" are described in text as quartz veins, reefs or formations, the latter including stratiform bodies including quartzite beds. The presence or otherwise of sulphides, predominantly pyrite with variable chalcopyrite and lesser amounts of other copper sulphide species including chalcocite, is not a necessary feature but is described in text. These "lodes" have been digitised from Ward's (1911) georeferenced plans and have been included on many plans herein.

The excellent geological coverage at 1:25,000 scale by MRT geologists shows that such structures in many parts mirror the red "lodes" i.e. quartz+/-sulphide (pyrite+/-chalcopyrite) on Ward's (1911) maps of early prospecting work (figures 5.3 and 5.5). Both can be used in conjunction to map out areas of known and potential fault hosted copper mineralisation for focussed exploration work. Almost all known prospects date from this earlier phase of intensive prospecting.

A striking feature recognised by a number of explorers as well as Taheri and Bottrill (2004) is the common (though not universal) broad spatial relationship between copper lode bearing structures and magnetic highs (figures 3.5.4 and 5.1). On closer examination the spatial association is less precise with magnetic anomalies and copper workings offset laterally some tens to few hundreds of metres.

This relationship between known higher grade copper mineralisation and the northwest to north-northwest striking linear but intermittently discontinuous magnetic high is seen along the Balfour Copper Belt from The Clump to Poseidon on the Norfolk Range, as well as at Toner River and Copper Reward (figures 5.2, 5.4, 5.6 and 5.7). Further south along the east flank of the Norfolk Range the linear magnetic high is not associated with known copper prospects but should not be dismissed as having the potential for copper (and tin+/-tungsten).

Disseminated pyrrhotite, enhanced by remanence effects (Koenigsberger ratio of 20-24), has been shown to be the cause for the magnetic anomaly in the more immediate Balfour area under Specimen Hill (McKay and Flis, 1981; 81_1516) where it does not appear to be directly genetically related to the lode style copper mineralisation (figure 5.15) (though tin+tungsten lodes on Specimen Hill often contain chalcopyrite below the groundwater table). This epigenetic pyrrhotite has been shown by petrology to be of hydrothermal origin (Whitehead and Apthorpe 1964; 64_0374, Whitehead, 1965; 65_0388, Cowan in Heithersay, 1982; 82_1740, Cowan in Dickson, 1983; 83_1933)

and almost certainly associated with the shallow (<1km) granite ridge which has been indicated from gravity modelling (Leaman, 1991; 91_3213) to run parallel to the structural trend.

In this case the magnetic anomalies are likely to be simply reflecting the exploitation of these same deep seated structures by the granites which were emplaced slightly later in the Tabberrabberran Orogeny than the higher grade copper lodes which more likely accompanied faulting which occurred slightly earlier.

Magnetite is noted in drillholes at The Clump, is demonstrably the cause of magnetic anomalies at the Roaring 41 South prospect (and other Temma ironstone type deposits) as well as the most likely cause of the anomalism at Copper Reward and the possible cause at Toner River in the southern part of the Balfour Project Area. Here, again the association may be reflecting the association between structures developed earlier in the orogeny with those exploited by granitic intrusions later in the same orogeny.

However, this empirical relationship between discrete higher grade copper mineralisation and magnetic highs may be used to help guide exploration for these higher grade occurrences.

As demonstrated by the Murrays Reward/Central Mt. Balfour, the higher grade copper deposits are likely to occur as discrete shoots of limited strike extent within more continuous lower grade or unmineralized structures. Locating these shoots will require a commitment to drilling.

As noted by previous explorers, near surface expressions of these deposits are commonly described as cavernous or leached by acidic groundwater with the dolomite almost invariably completely removed, and the copper (predominantly as chalcopyrite) also commonly leached out (or alternatively oxidised to chalcocite which may be lost in drilling sample recovery). In many areas this has occurred to such an extent that surface geochemical sampling, including C horizon soil sampling, as well as bedrock costeaning, have shown themselves to be somewhat unreliable though anomalous copper in C-horizon sampling in the immediate Balfour area does appear to map out two known copper bearing structures (including the Murrays Reward/Central Mt. Balfour line) trend so the occurrence is not universal (figure 5.2).

As recommended by previous explorers as early as Davies (1969b; 69_0599) induced polarisation IP (ground and downhole) is likely to be the most effective geophysical exploration tool given the discontinuous disseminated and veinlet style chalcopyrite mineralisation which characterises most known occurrences to date. EM (airborne, ground and downhole surveys) geophysical methods are more ideal for locating occurrences of more massive chalcopyrite should they be shown to exist more commonly and DHEM at least is recommended for all drill holes.

The various IP surveys undertaken to date have shown the efficacy of the method (figure 5.8). Both IP and EM methods will also unfortunately respond to carbonaceous lithologies, as well as graphitic fault structures, though the latter are also ideal hosts for the structurally controlled style of mineralisation and knowing their location is of value in designing follow-up ground EM, IP and C-horizon/rock geochemical sampling.

A notable feature of the mineralised structures is their surface topographic expression. Massive quartz veins (and formations) commonly form pronounced sharp ridgelines or “razorbacks”, which can be seen clearly in the hillshade layer on MRT’s website which is a greyscale colour enhanced image of LIDAR topographic data. These commonly align with geologically mapped faults on MRT 1:25,000 mapping and red “lodes” on Wards (1911) mapsheets.

However, consideration should also be given to Ward’s (1911) comment that prospecting beneath the massive quartz “lodes” which outcrop along sections of lines of lode may be misguided as such “lodes” are unlikely to change their character at depth, whereas topographic lows may be more likely to represent less resistive rocks in the lode channel such as sheared slate and pug but also

possibly more sulphide rich sections. The low country south of the Murrays Reward is an example of such an area warranting prioritisation.

In addition the relationship between mafic dykes and copper mineralisation noted by Ward (1911) at the Toner River prospect (figure 5.7), and shown quite graphically by Taheri *et. al.* (2011) in their figures 6, 7 and 8, should be considered as whilst the dykes predate copper mineralisation, they may provide structural and/or geochemical traps (iron).

Drilling higher grade copper targets should also employ methods aimed at maximising core recovery i.e. triple tubing, in order to rule out the potential to lose notoriously friable and sand like chalcocite.

The location of more intensive ground exploration should be defined by the location of existing IP anomalies, known copper occurrences from Ward (1911), "razorbacks" from detailed topographic images and mapped structures from MRT 1:25,000 mapping between The Clump and Poseidon.

Ideally a major 3D IP survey should be conducted over as much of this area as possible on line spacings no more than 100m. Whilst EM should not be employed initially DHEM and surface EM should be employed strategically particularly if and where semi-massive copper intersections become more common.

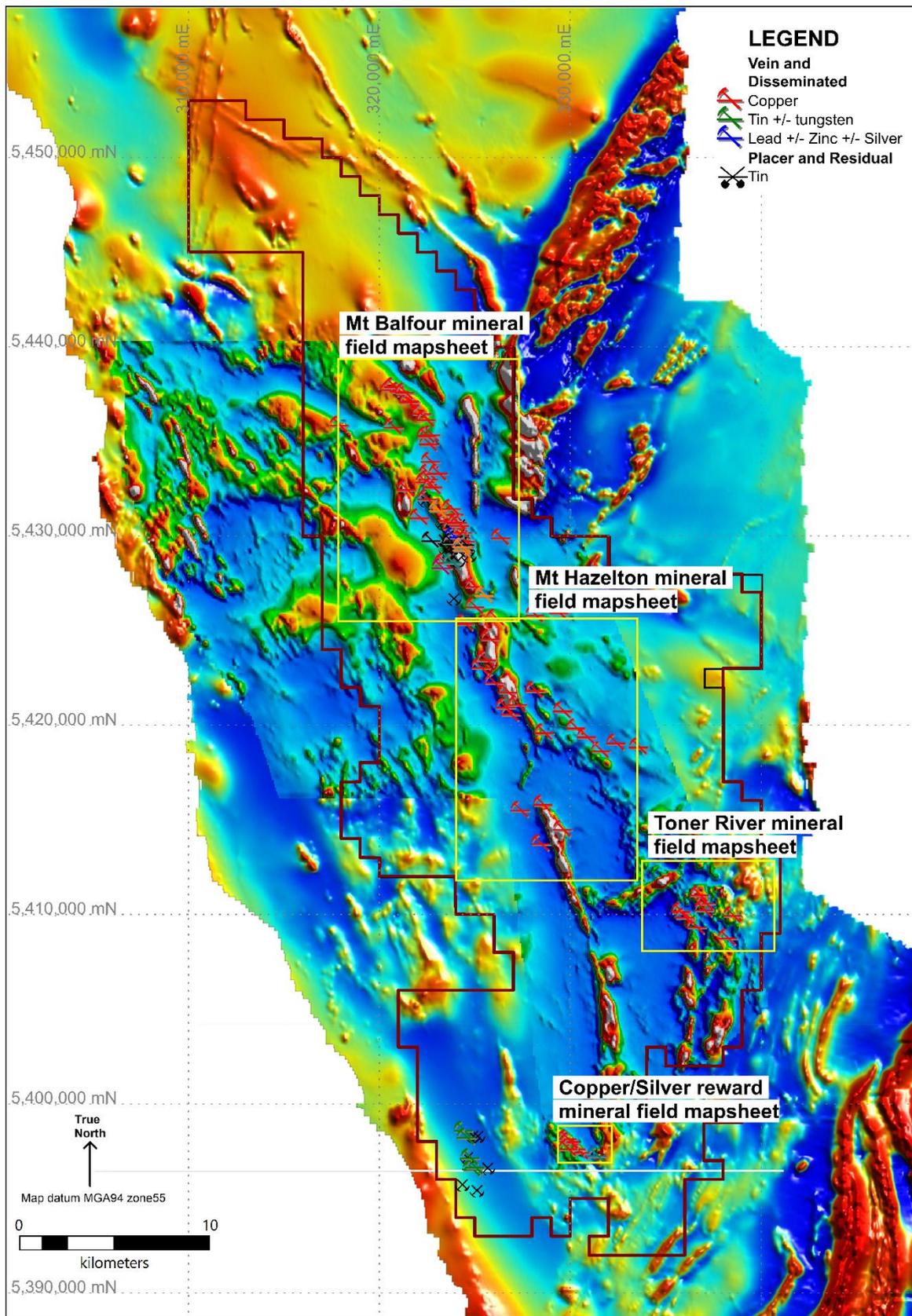


Figure 5.1: Mineral occurrences from Mineral Resources Tasmania's database according to commodity association on background image of Total Magnetic Intensity, also showing the outline of the following four detailed mapsheets. Note broad correspondence between copper occurrences and magnetic highs.

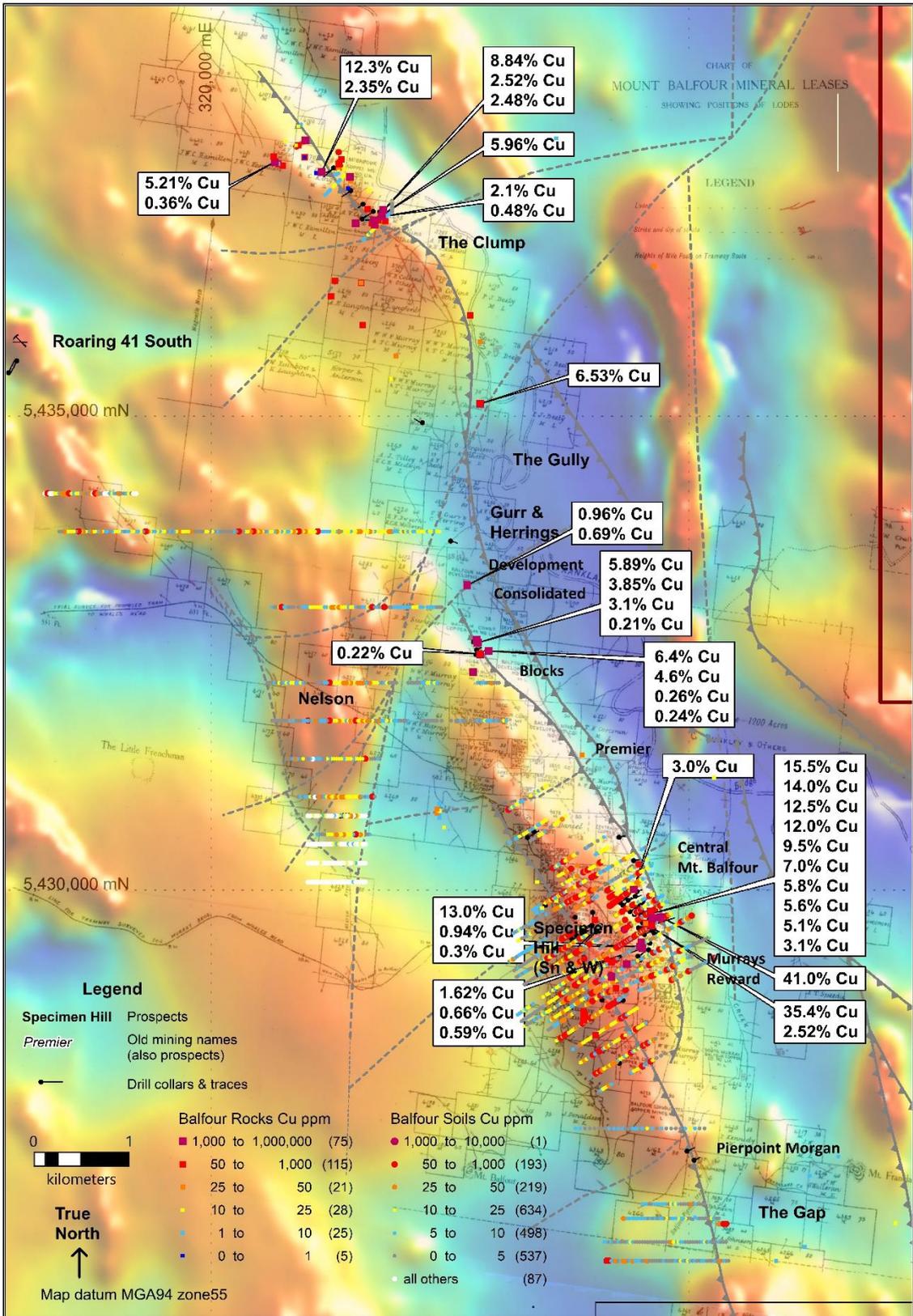


Figure 5.2: Compilation of all historic soil samples and compilation of rock samples from CRAE's extensive and MRT sampling programmes (Mt Balfour mineral field mapsheet) colour coded according to copper grade, on a background of Total Magnetic Intensity and very faint background of historical tenements from Ward (1911), also showing prospects, historic drill collars and traces, and major structural elements as grey linework.

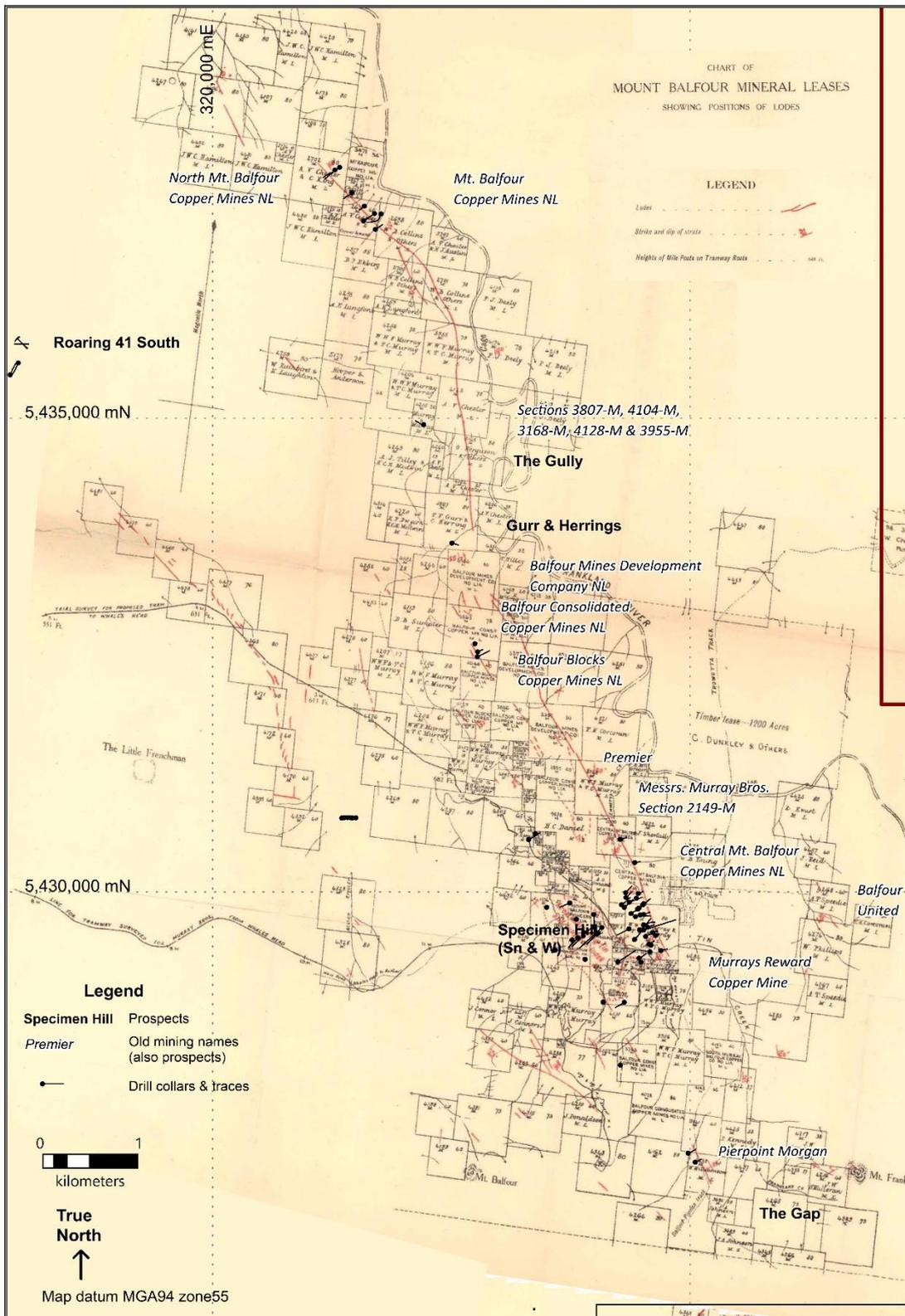


Figure 5.3: Ward (1911) “Chart of Mt Balfour Mining Leases – Plate IV” (northern section of main copper belt) showing mine leases at the time of his visit in 1910. Red lines referred to as “lodges” by Ward (1910) are the quartz veins and fault structures being explored by these early prospectors and do not necessarily indicate the presence of copper mineralisation, however, they may be used as a guide to more detailed exploration. Black dots are drill collars to date.

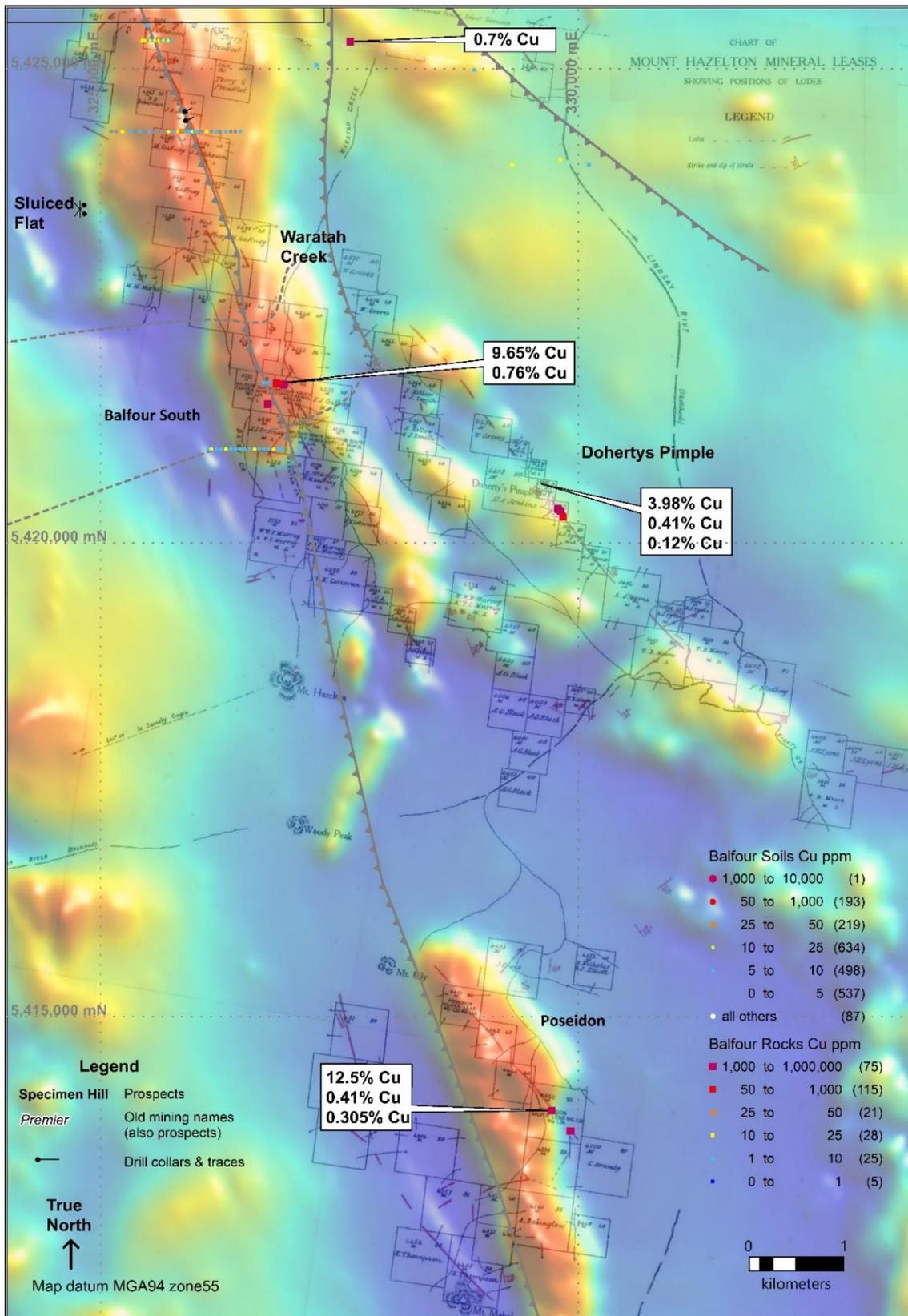


Figure 5.4: Compilation of all historic soil samples and compilation of rock samples from CRAE's extensive and MRT sampling programmes (Mt Hazelton mineral field mapsheet) colour coded according to copper grade, on a background of Total Magnetic Intensity and very faint background of historical tenements from Ward (1911), also showing prospects, historic drill collars and traces, and major structural elements as grey linework.

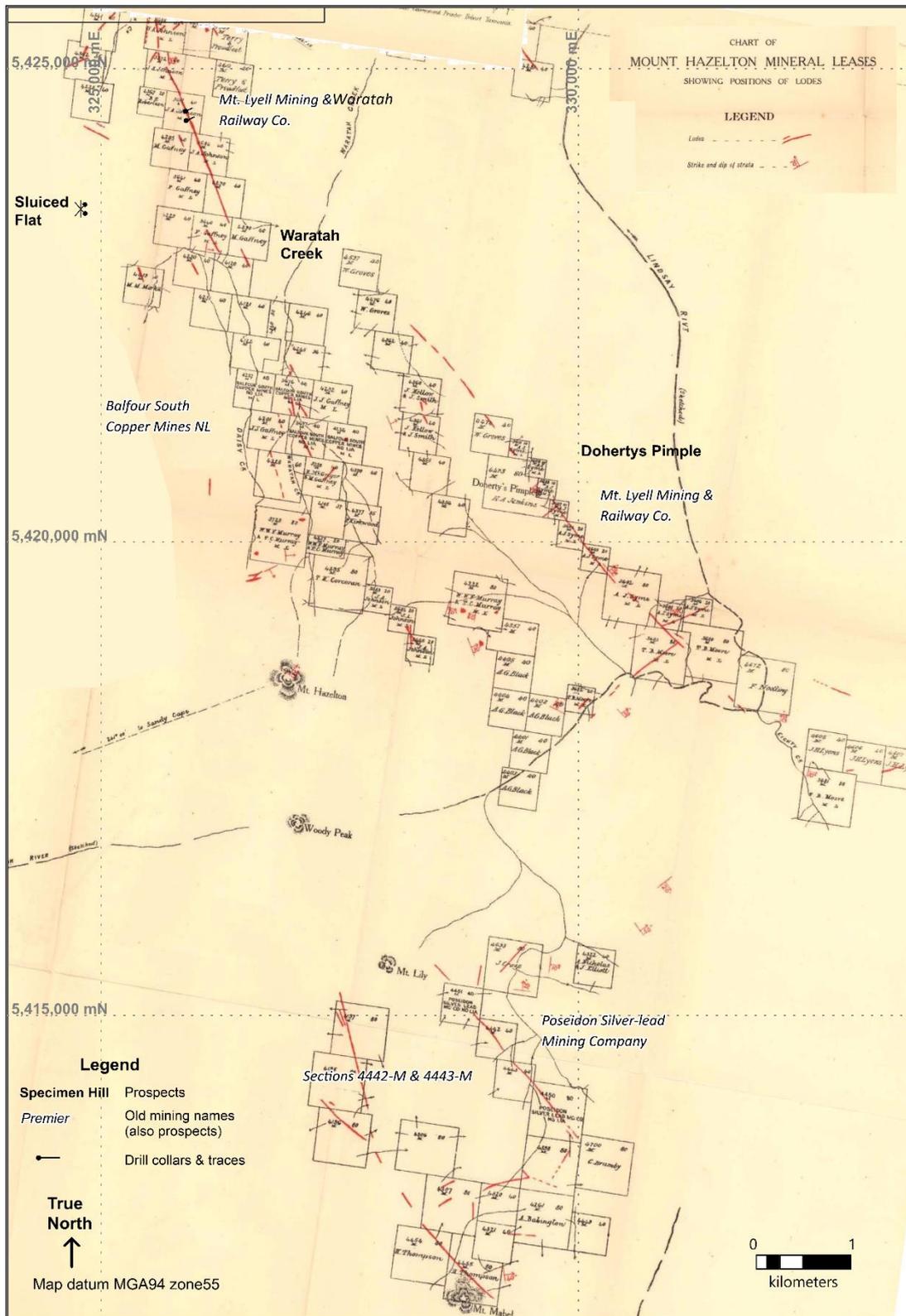


Figure 5.5: Ward (1911) “Chart of Mt Hazelton Mining Leases – Plate V” (southern section of main copper belt) showing mine leases at the time of his visit in 1910. Red lines referred to as “lodes” by Ward (1910) are the quartz veins and fault structures being explored by these early prospectors and do not necessarily indicate the presence of copper mineralisation, however, they may be used as a guide to more detailed exploration. Black dots are drill collars to date.

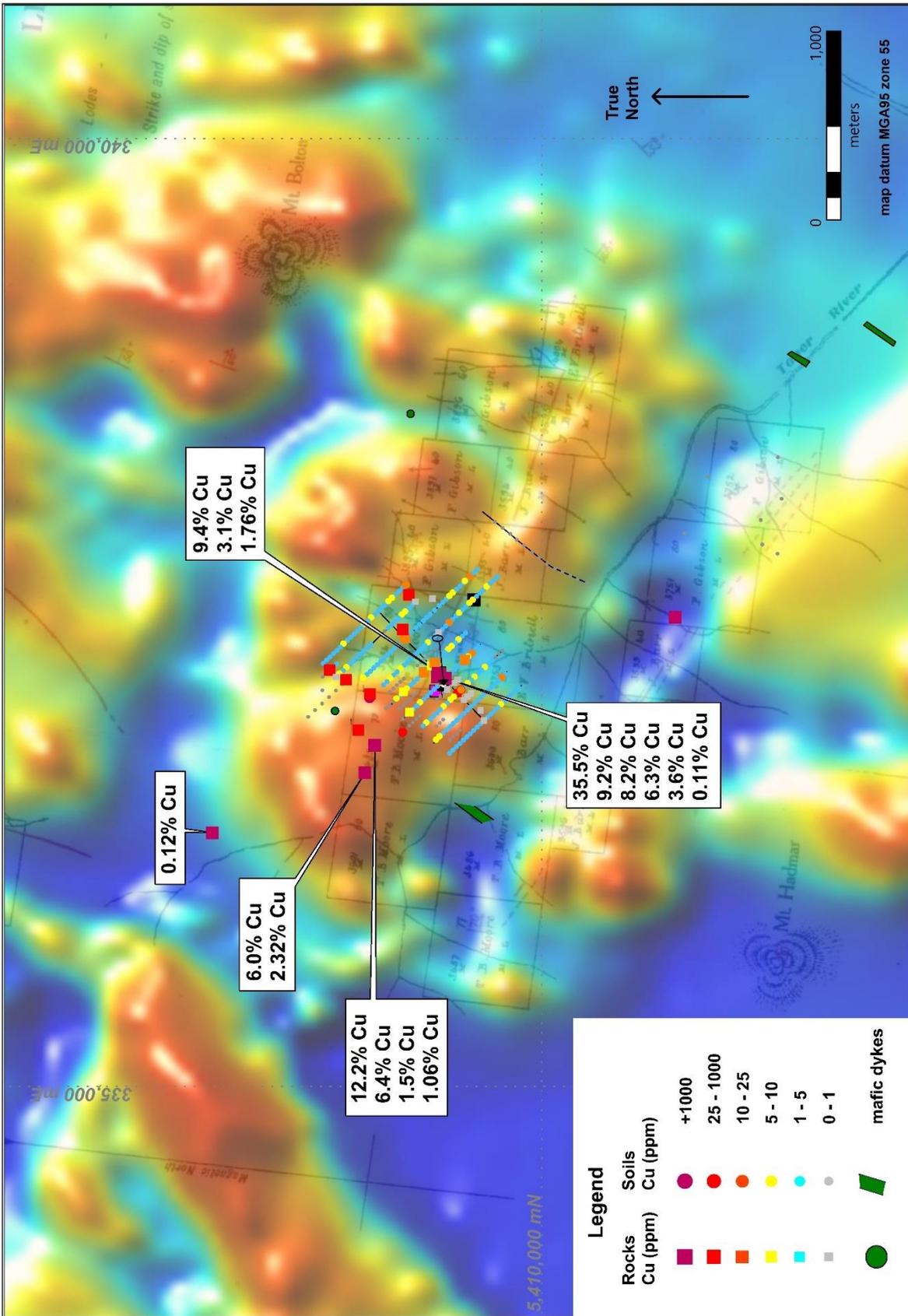


Figure 5.6: Compilation of historic rock samples and soil samples (Toner River mineral field mapsheet) colour coded according to copper grade, on a background of Total Magnetic Intensity and very faint background of historical tenements from Ward (1911).

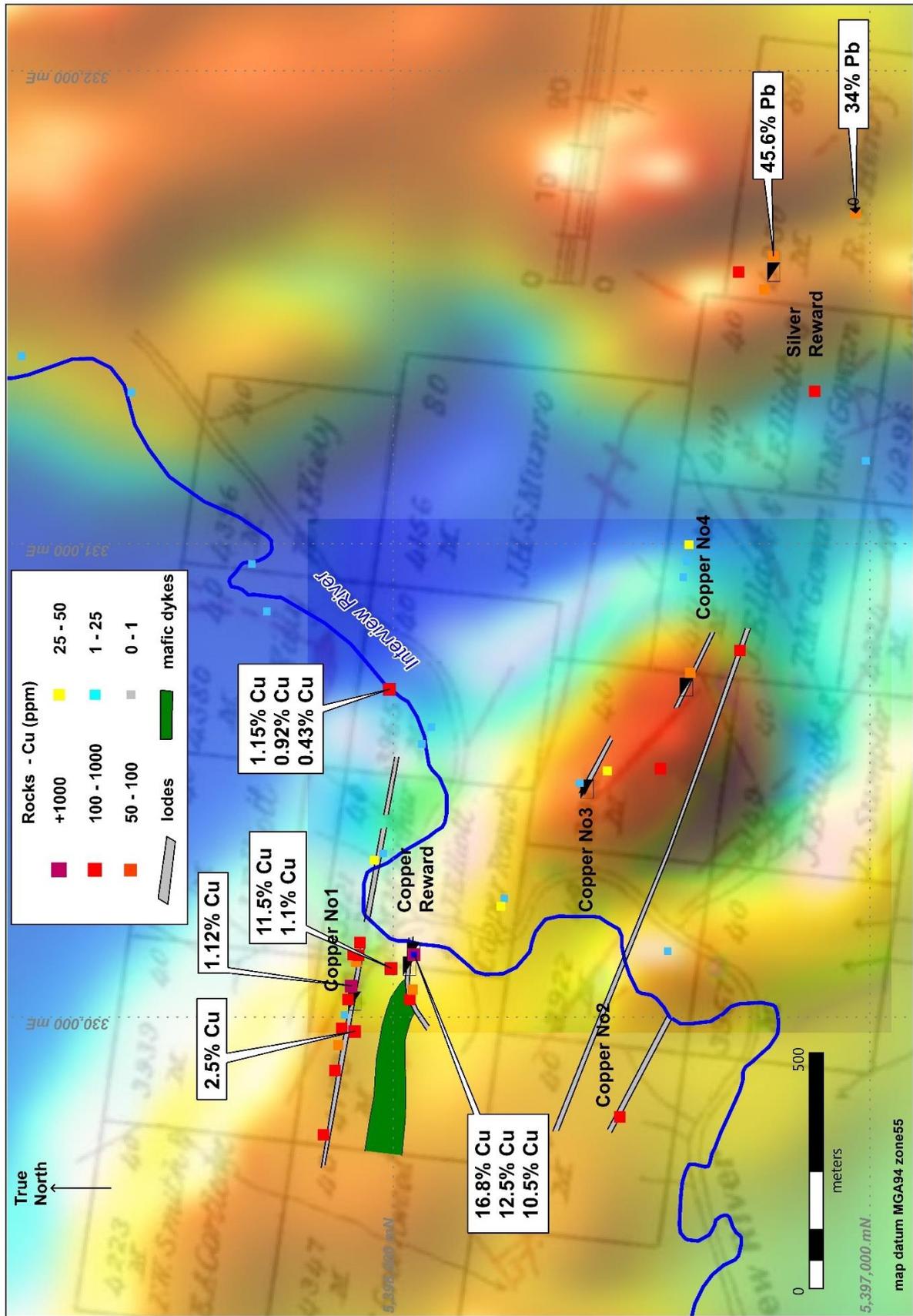


Figure 5.7: Compilation of historic rock samples (Copper Reward mineral field mapsheet) colour coded according to copper grade, on a background of Total Magnetic Intensity and very faint background of historical tenements from Ward (1911).

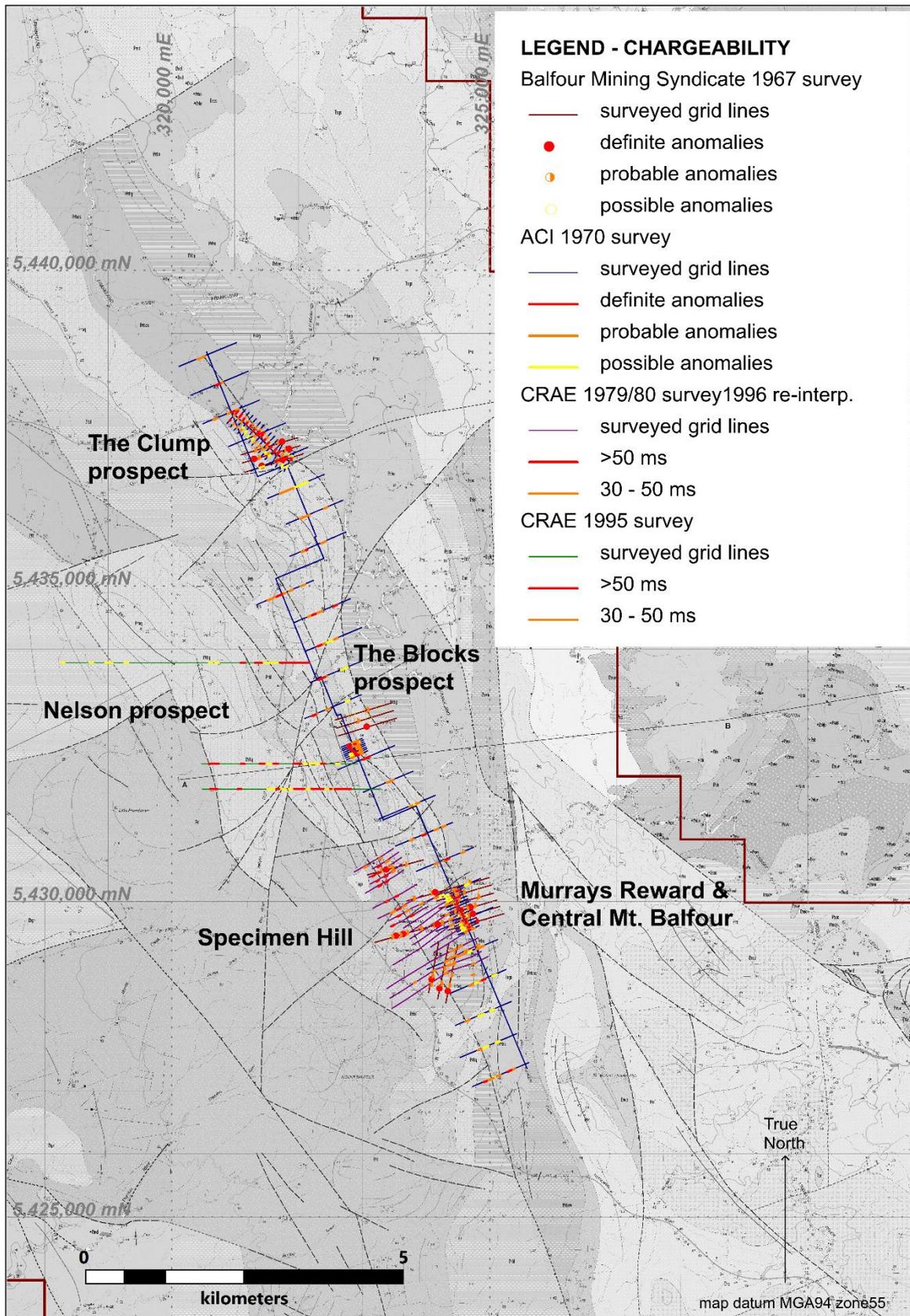


figure 5.8a: Composite of the four dipole-dipole Induced Polarisation surveys conducted over the Balfour area with anomalies as interpreted shown. Positions of surveys and anomalies have potential inaccuracies due to georeferencing. Accuracy is approximately +/-50m for each survey. Backdrop is MRT 1:25,000 mapping in greyscale.

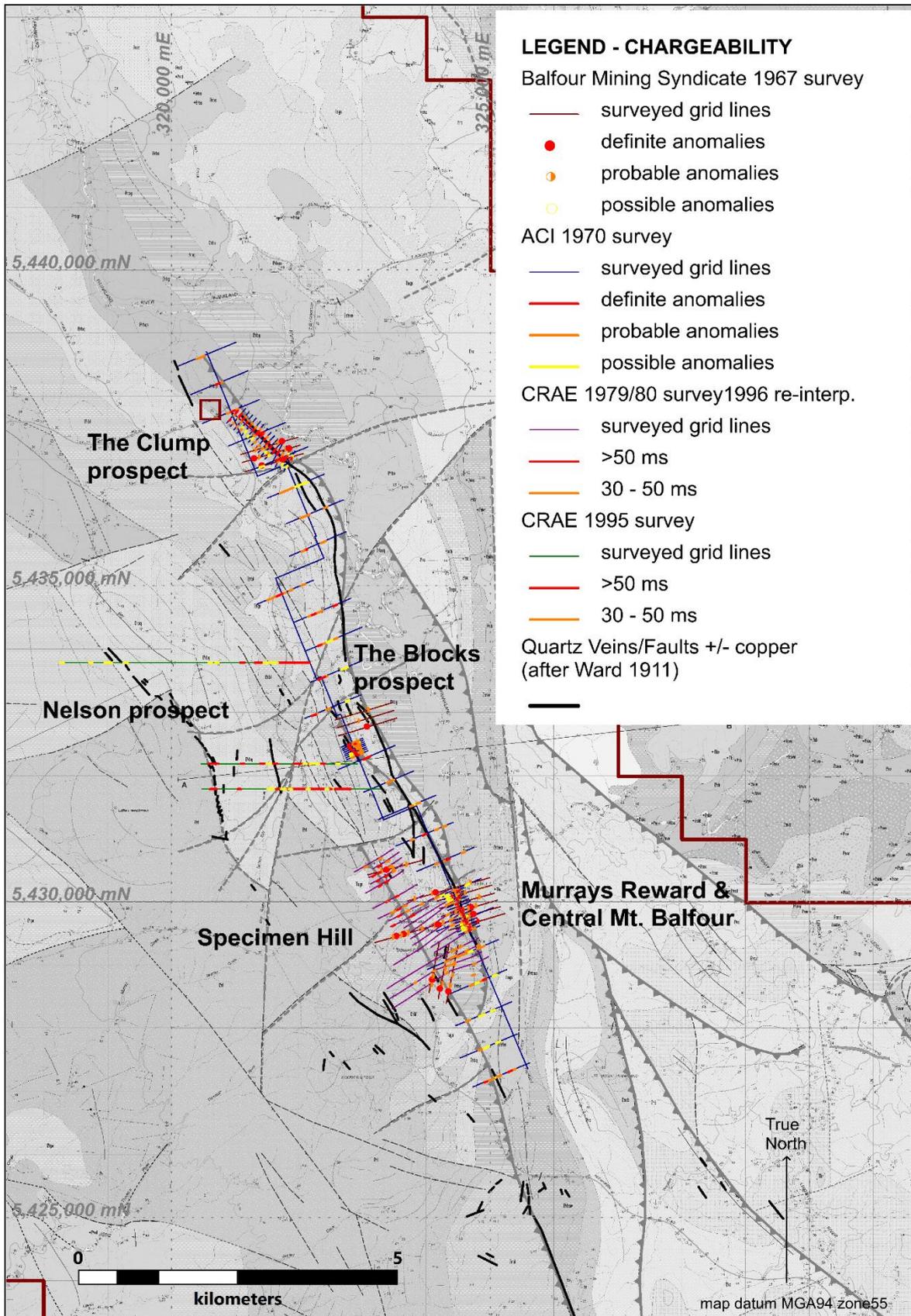


figure 5.8b: Composite of the four dipole-dipole Induced Polarisation surveys conducted over the Balfour area with anomalies as interpreted shown as for figure 5.8 but now with Ward (1911) "lodes" shown as black lines.

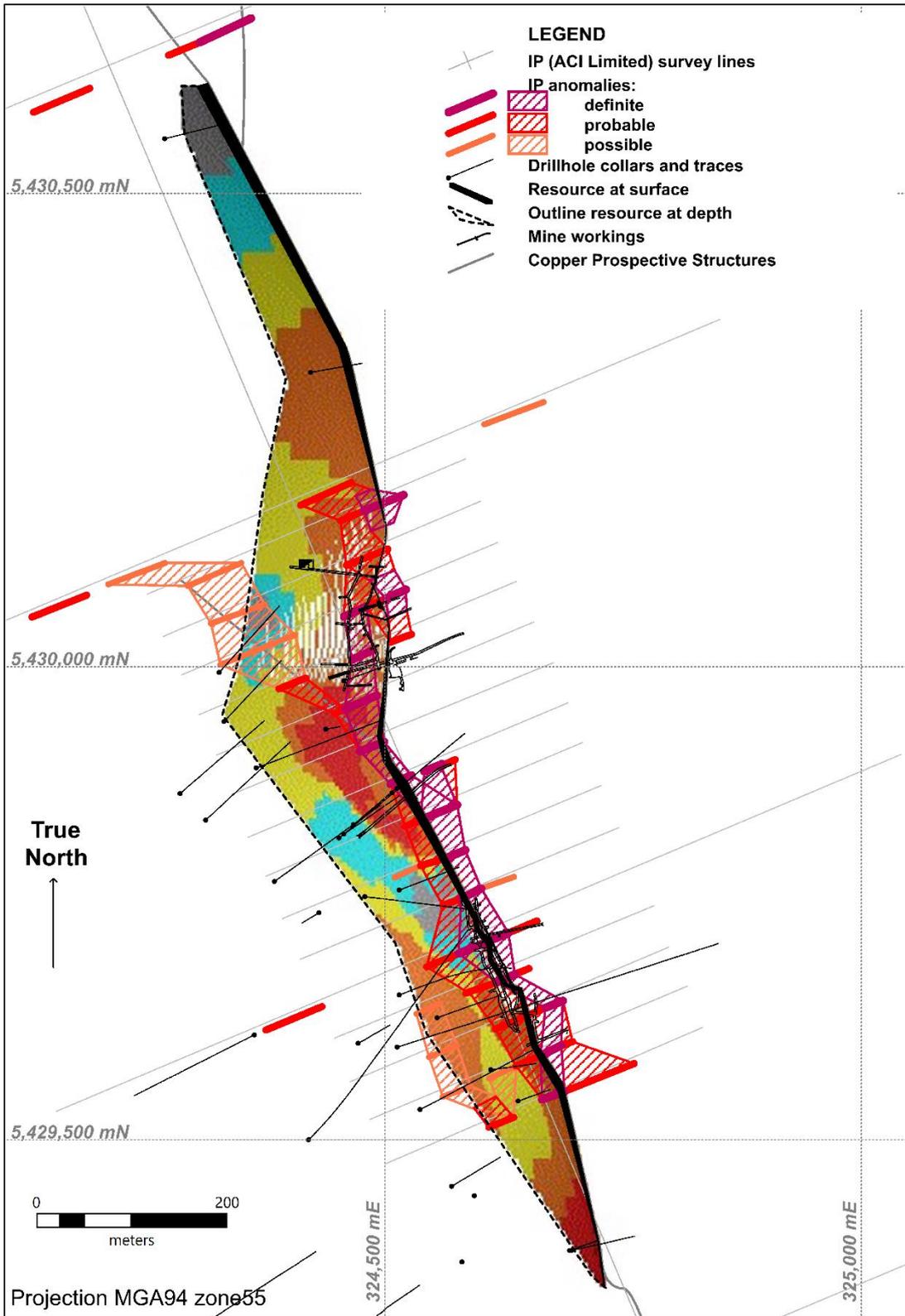


Figure 5.9: Murray's Reward/Central Mt. Balfour copper resource block model with existing IP surveyed lines from ACI survey only showing anomalies coincident with resource.

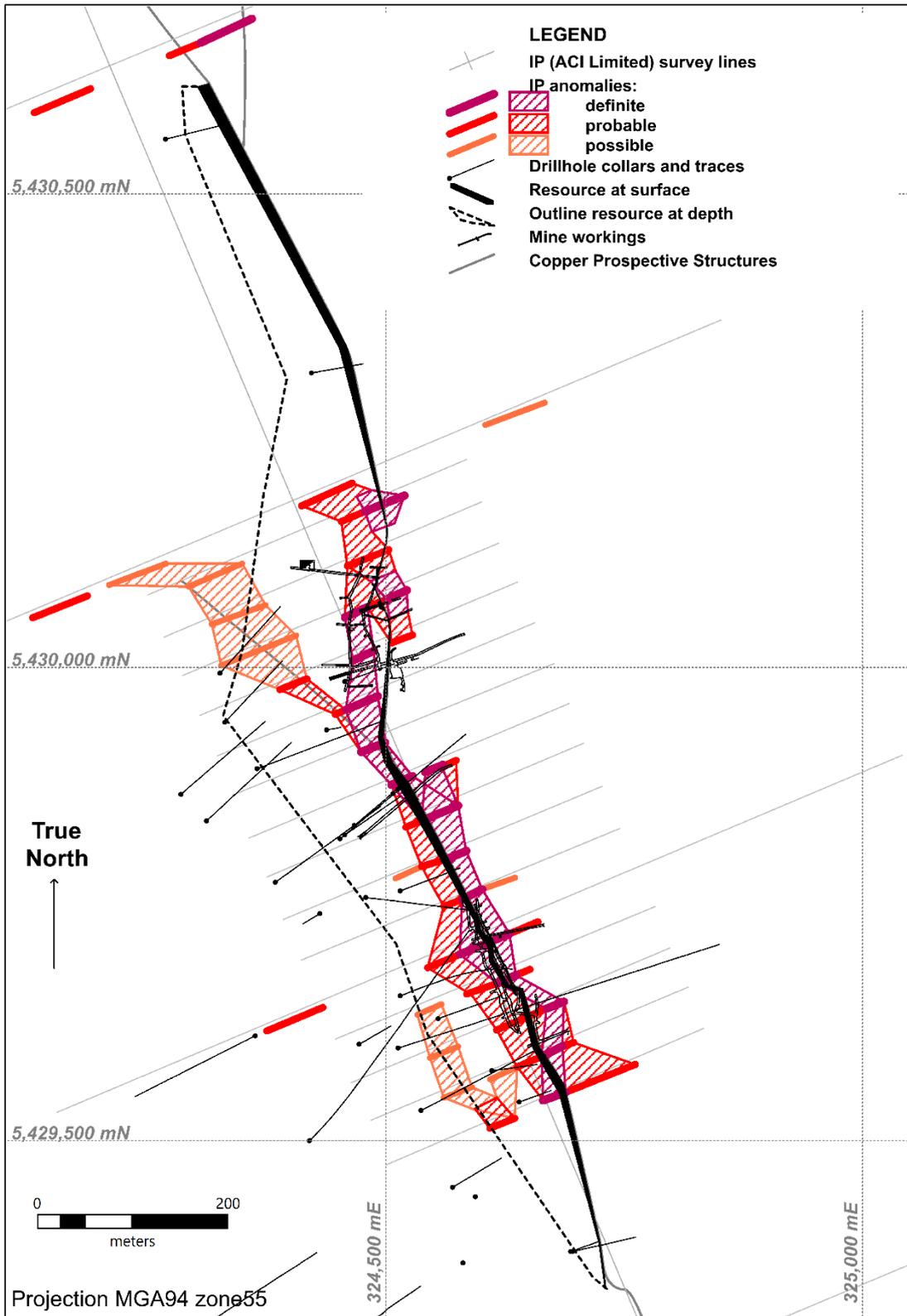


Figure 5.10: Murray's Reward/Central Mt. Balfour copper resource outline with existing IP surveyed lines from ACI survey only showing anomalies coincident with resource.

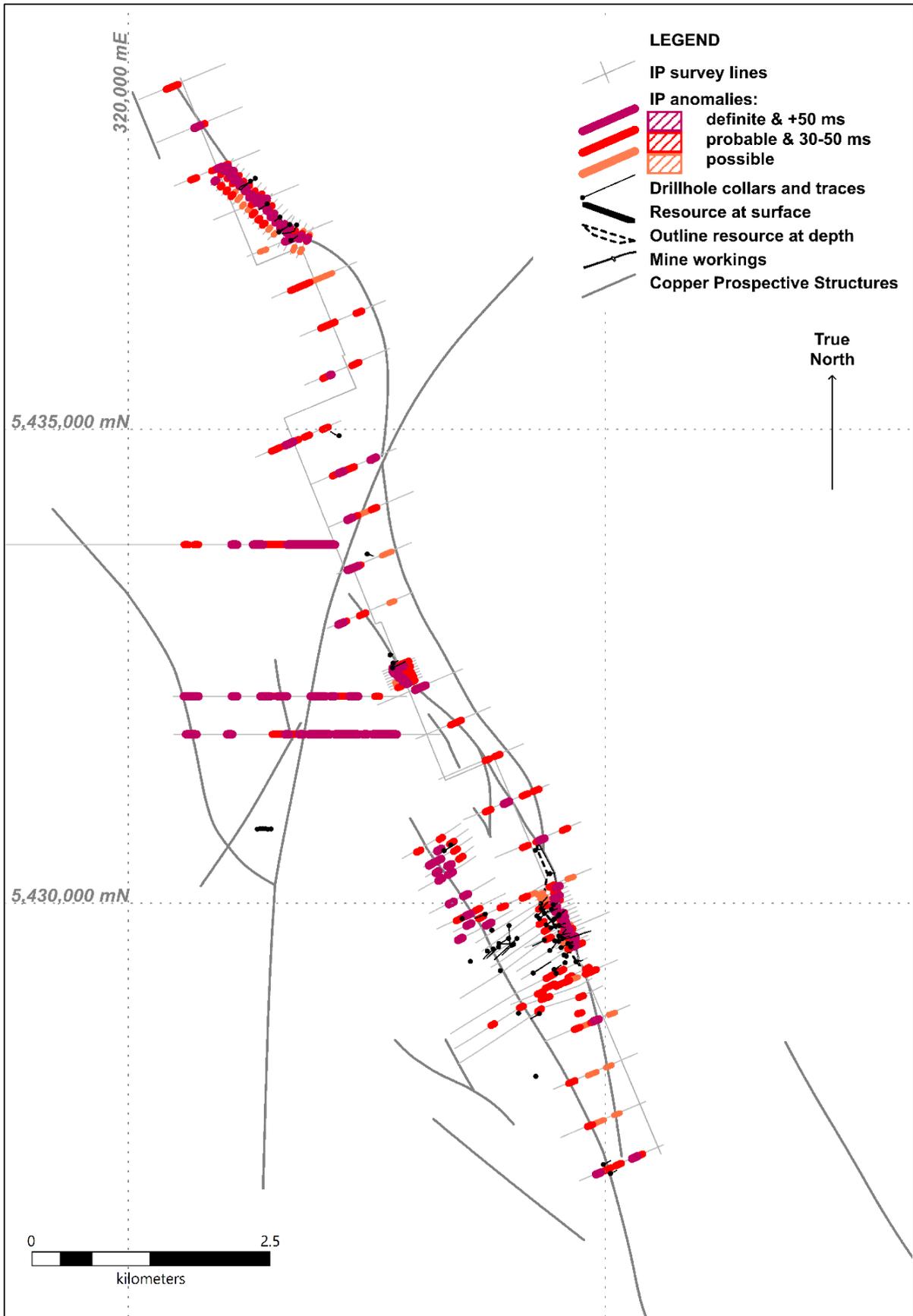


Figure 5.11: Existing IP surveyed grids, anomalies and prospective copper bearing structures.

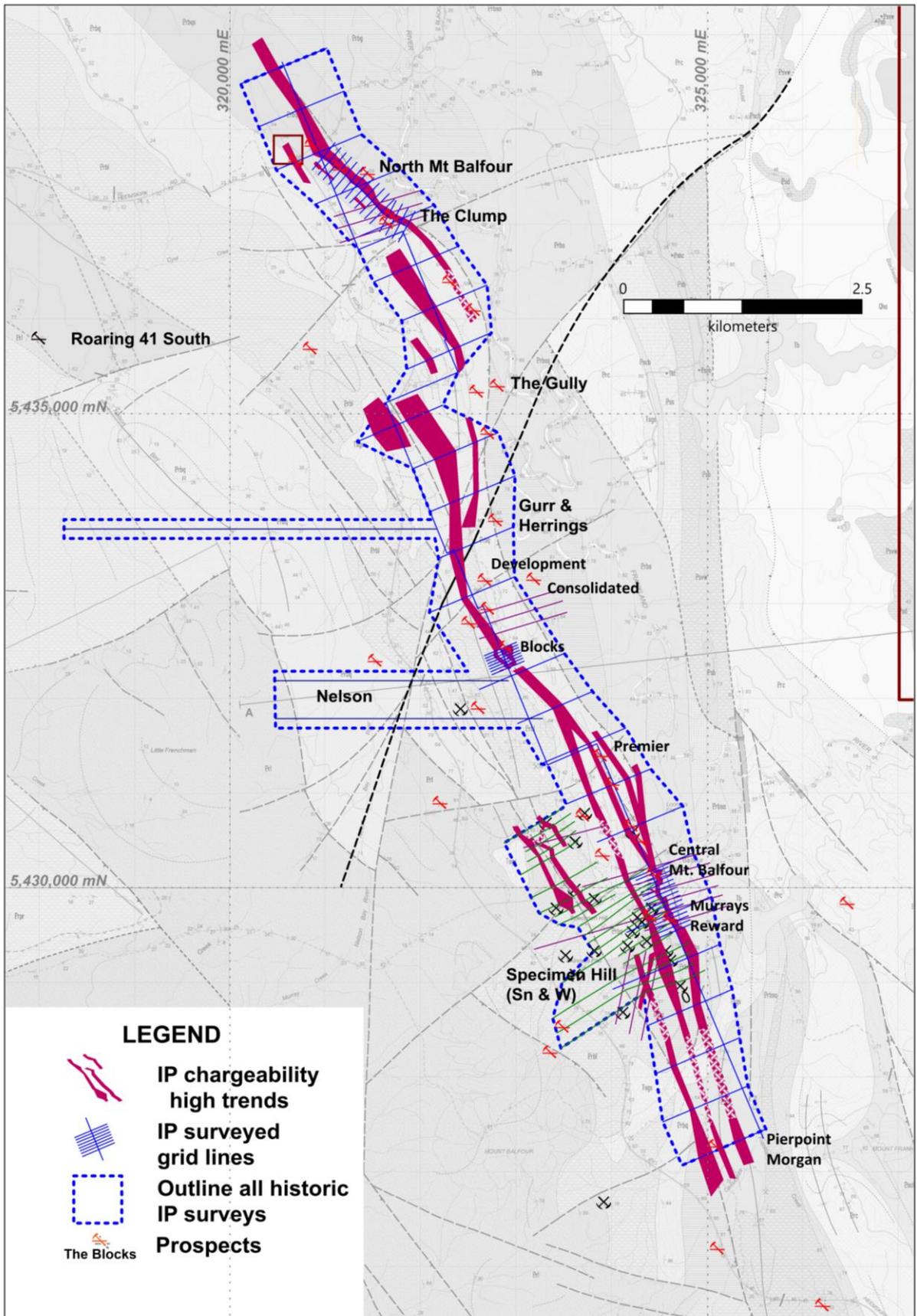


Figure 5.12: Existing IP surveyed grids, anomalies and prospective copper bearing structures with IP anomalous trends interpreted..

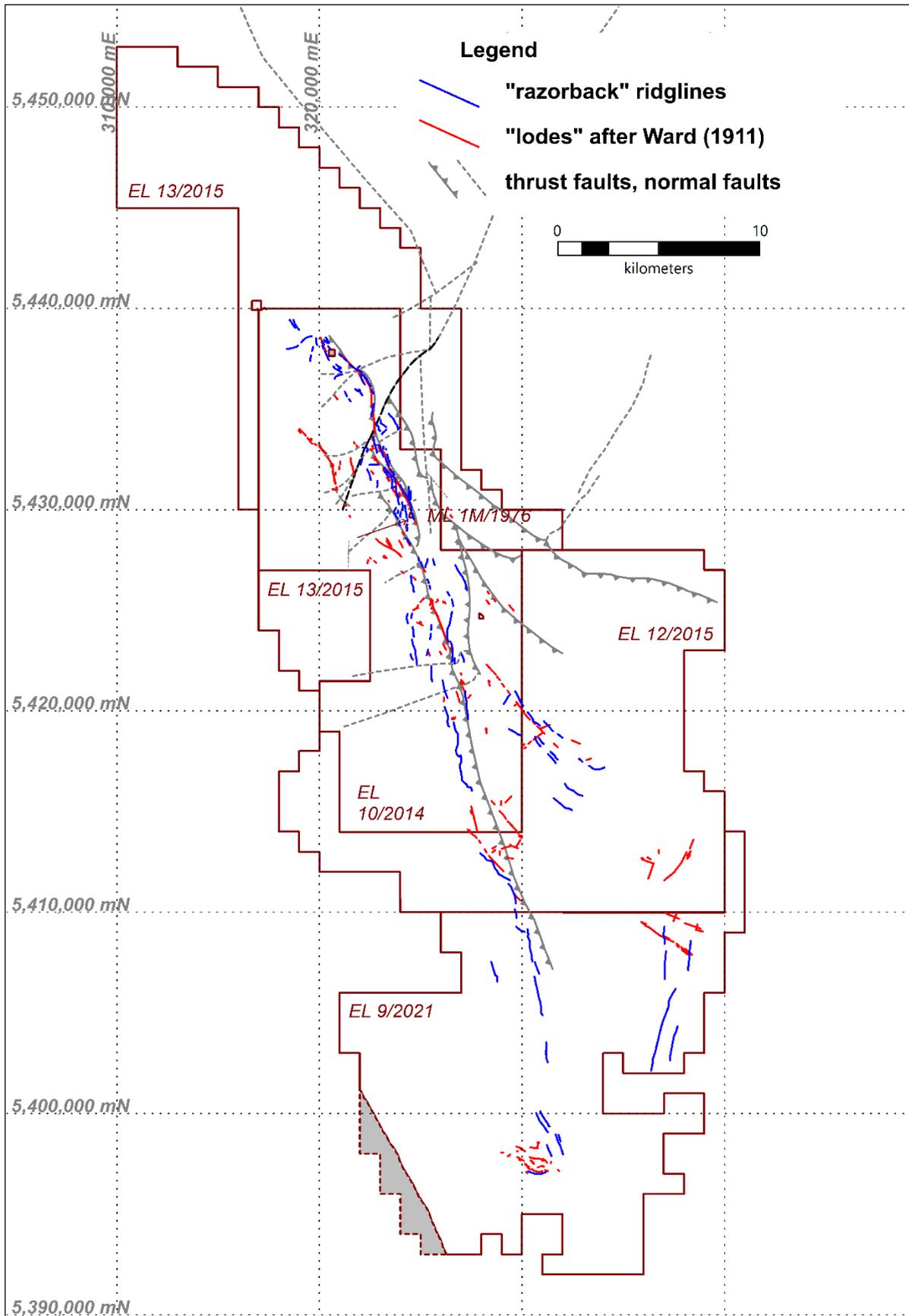


Figure 5.13: "Razorback" ridgelines as traced from LISTmap hillshade LIDAR image (blue lines), Ward (1911) "Iodes" (red lines) and mapped geological structures (grey lines) at regional scale.

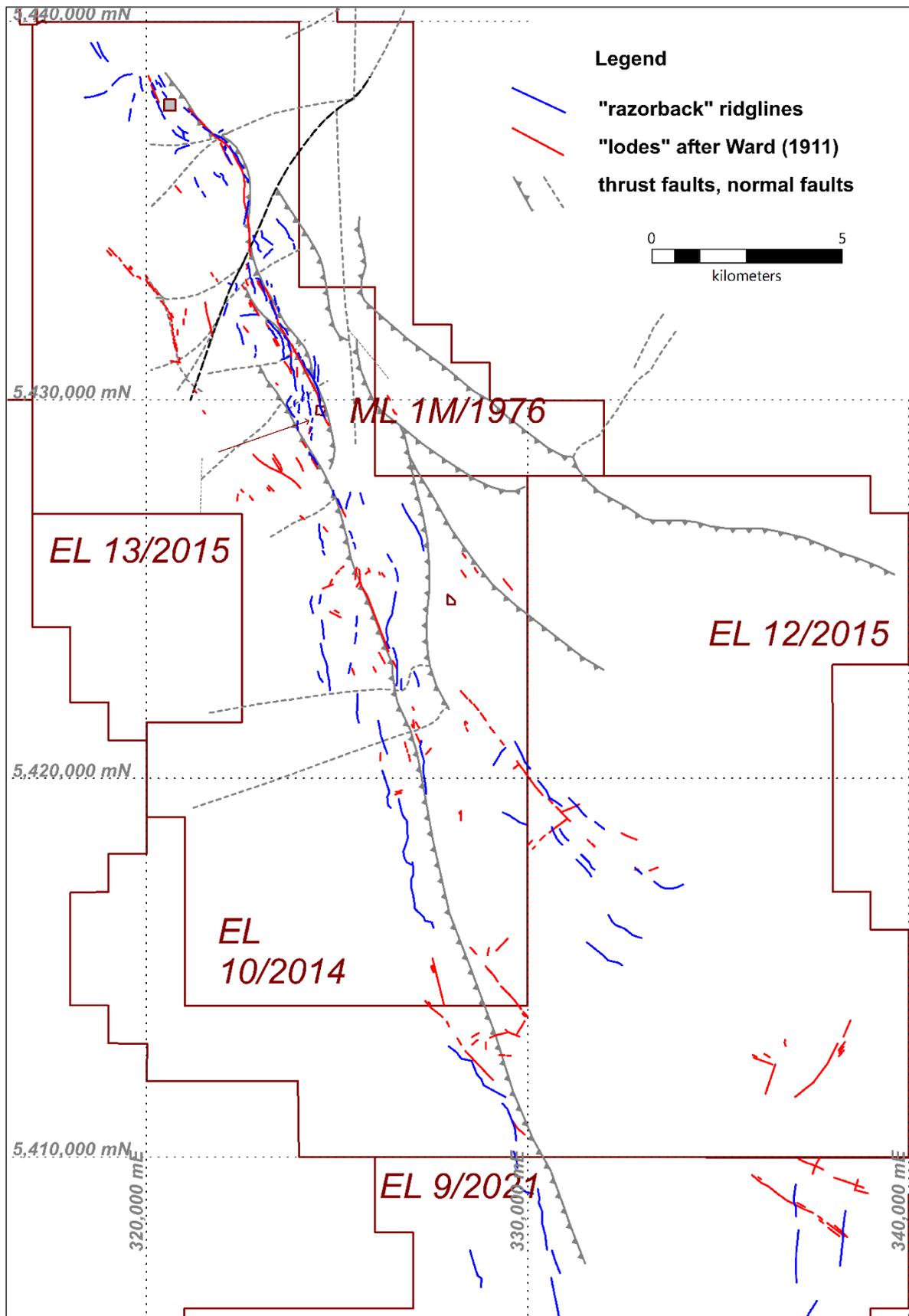


Figure 5.14: "Razorback" ridgelines as traced from LISTmap hillshade LIDAR image (blue lines), Ward (1911) "lodes" (red lines) and mapped geological structures (grey lines) at more detailed scale.

5.2.3 Large Scale Sedimentary Hosted Copper (+/- silver, cobalt, base metals)

Previous explorers such as CRAE and Pacific Nevada recognised the potential for the Proterozoic Rocky Cape Group and Togari Group rocks to form sedimentary hosted copper deposits, considered a possible source of the copper in the high grade deposits detailed in the previous section. The potential correlation of the Rocky Cape Group with the Belt-Purcell Supergroup of North America elevates this target model.

CRAE drew analogies with other sedimentary hosted deposits such as the Zambian Copper belt, Kupferschiefer, White Pine as well as the Belt-Purcell Supergroup. Disseminated copper+silver deposits of the Belt-Purcell Supergroup such as Spar Lake with 125.1Mt @ 0.77% copper and Rock Creek with 354.7Mt @ 0.76% copper attest to the potential for the Balfour Project Area for similar deposits now that there is more supportive evidence for a direct correlation between the Rocky Cape Group and the Belt-Purcell Supergroup (Halpin *et. al* 2014 and Mulder *et. al.* 2015).



Figure 5.15: World-class sedimentary hosted copper deposits.

In sedimentary hosted copper (also silver, lead, zinc, cobalt) deposits brines from deeper in the sedimentary pile leach metals from relatively porous clastic sediments, commonly hematitic red beds but also mafic volcanics, travel up basin margin or other syn-sedimentary faults until reduced facies sediments such as carbonaceous siltstones and shales are encountered where metals are precipitated by redox reactions. Sulphur may be sourced from sedimentary pyrite or sulphates.

Taheri and Bottrill (2004) draw attention to the prospectivity of the Balfour area for sedimentary hosted copper and refer to a number of horizons where previous explorers have shown that there are occurrences of elevated copper (as well as nickel and cobalt) which fit this model.

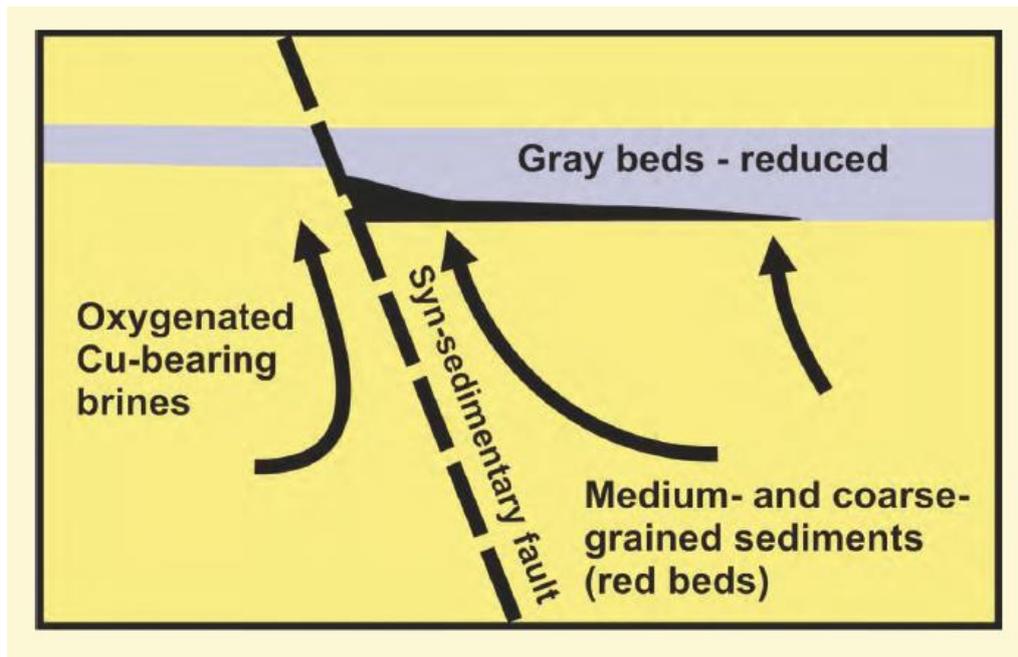


Figure 5.16: Schematic showing the basic sedimentary hosted copper model.

CRAE in particular defined several sedimentary contacts which had the potential to form redox boundary type chemical traps. The first of these is the contact between the Lagoon River Quartzite and the overlying carbonaceous pyrrhotitic siltstone which they referred to as the Balfour Pyrrhotitic Siltstone.

Taheri and Bottrill (2004) describe this magnetic unit as being strongly conductive in the Specimen Hill area as defined by IP and DIGHEM surveys.

In CRAE's model ascending oxidised copper bearing fluids would react with the iron in the pyrrhotite in the reduced facies siltstone precipitating chalcopyrite and thus demagnetising the unit. This model requires the epigenetic pyrrhotite in the pyrrhotitic siltstone to have been formed prior to copper mineralisation meaning that copper was later than the tin+/-tungsten considered to accompany the pyrrhotite alteration. Orebodies formed thus way would appear as magnetic lows along the overall magnetic high trend. The Gap, so named, was selected as the best example of this conceptual target and was soil sampled but not drilled.

The second horizon CRAE defined was the upper contact of this carbonaceous siltstone with overlying chloritic siltstone. This position appears to have been drilled at The Clump prospect.

Taheri and Bottrill (2004) note that this contact has a strike length of eight kilometres between Murrays Reward and The Clump with Turner (1994) reporting anomalous copper in rocks to 1100ppm (and Au to 0.034g/t) in pyritic chloritic siltstones east of The Clump.

Taheri and Bottrill (2004) also refer to Turner's (1994) recognition of a third potentially mineralised contact between carbonaceous siltstones and grey siltstones which also runs from Murrays Reward to The Clump and which outcrops on Frankland Road where it is anomalous in copper, gold and arsenic.

Major structures adjacent to or intersecting these horizons such as the Roger River Fault, as well as reverse faults such as the Balfour Copper Trend Thrust and Balfour Transform, are quite possibly inverted reactivated basin margin structures which could have acted as the required plumbing system in such a model. The intersection between these structures and the east-northeast to northeast set noted earlier by CRAE is also relevant as they may add to the potential for discrete sections of these horizons to be mineralised.

To date exploration for this lower grade sedimentary hosted style has not been successful in locating economic copper grades though exploration for this style cannot be described as exhaustive.

Aside from geophysical methods such as IP, actual field exploration requires somewhat more systematic sampling as such deposits, whilst large scale, exist at lower grades, making visual definition less clear cut. If copper is being remobilised from soils by groundwater leaching near surface other elements may act as proxies such as silver, cobalt and nickel (unless these are being leached out too).

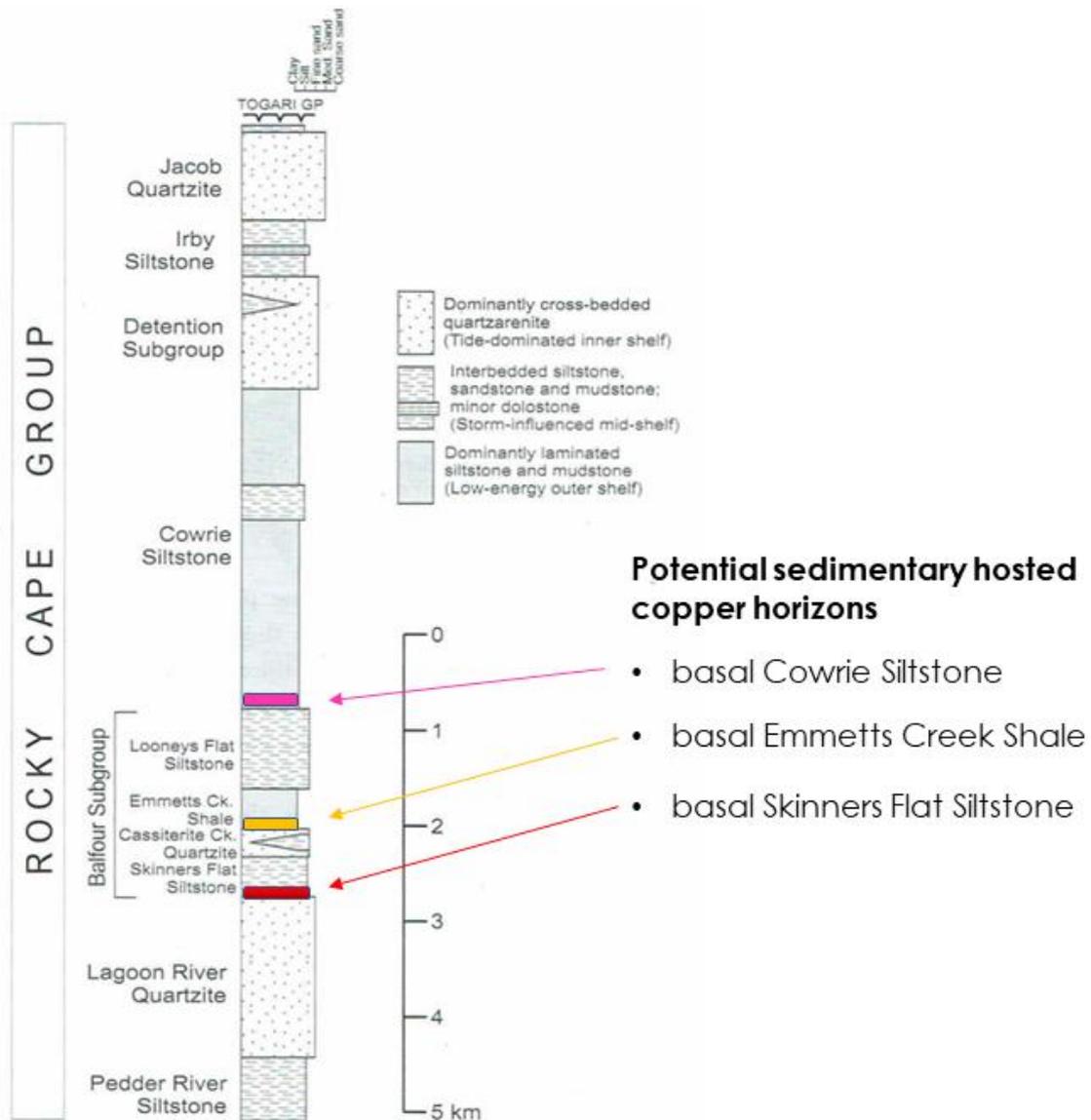


Figure 5.17: Sedimentary hosted copper prospective horizons.

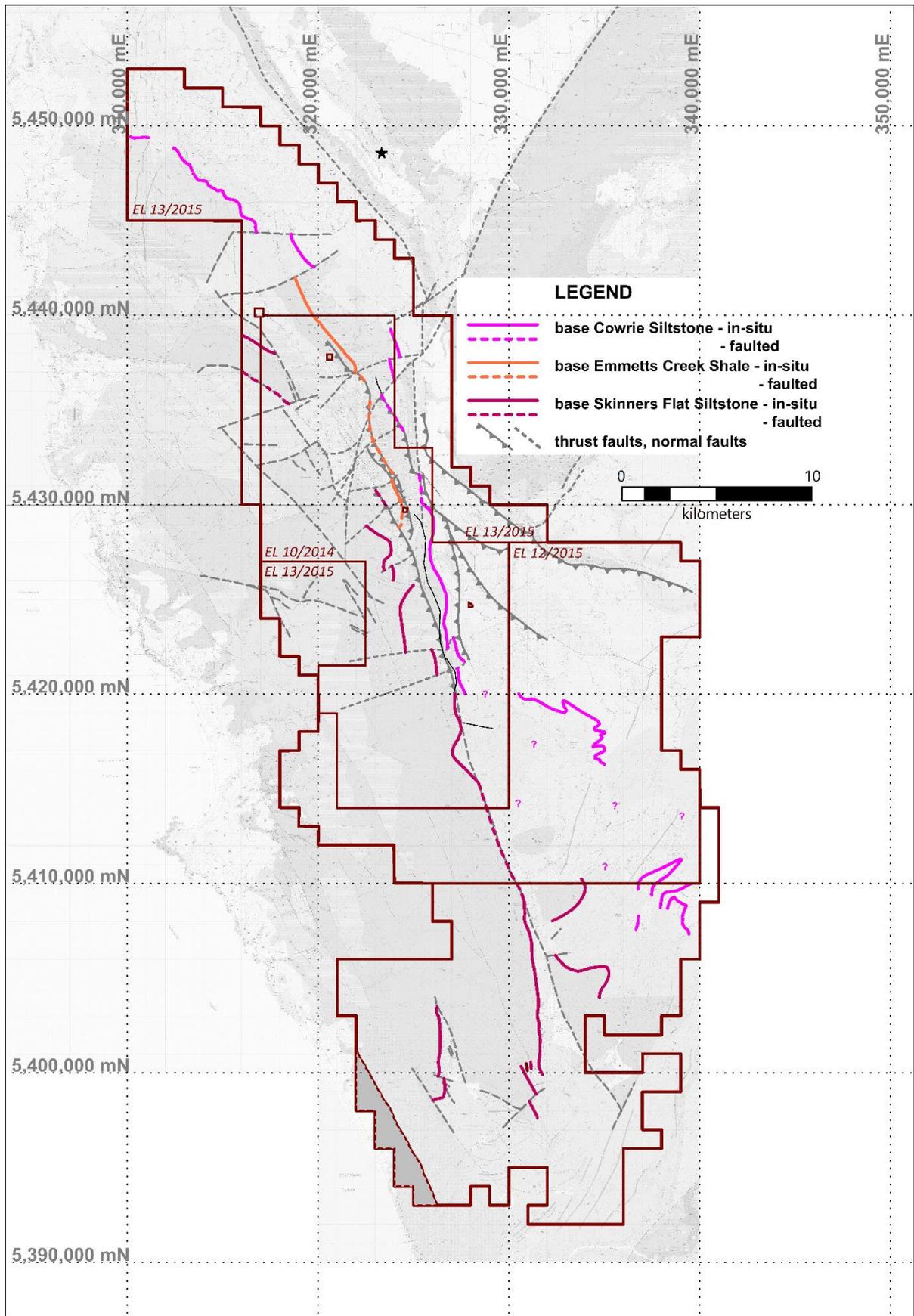


Figure 5.18: Sedimentary hosted copper (+/- base metals) target horizons and structures.

5.3 Tungsten +/- Tin

The Balfour area has proven potential for world class tin+/-tungsten deposits without the need for across the globe correlation for support. World class tin deposit Renison Bell as well as other significant examples such as Mt Bischoff, Cleveland, Queen Hill/Severn/Montana and Kara (tin and tungsten) all lie within a 100km radius of Balfour with the world class tungsten deposit on King Island just a little further away (figure 5.11). Tasmania is a major tin+/-tungsten province in world geology with hard rock tin and tungsten deposits associated with Middle Devonian granites which outcrop in a number of locations and underlie much of the central part of the West Coast.

This regional gravity modelling (Leaman, 1991; 91_3213, Webster and Leaman, 2002) indicates that a granite batholith underlies much of the Balfour Project Area (figures 3.4.2 and 3.4.3) and is continuous with the outcropping Interview Granite (in the southwestern corner of the Balfour Project Area) with its known association with tungsten and tin (and potentially gold) mineralisation also. More detailed modelling indicates that a relatively shallow (< 1km from the surface) ridge of the granitic intrusive occurs immediately west of Specimen Hill (Bissett, 2010a; 10_2064a) and runs in a northwest to north-northwest orientation, coincident or paralleling the magnetic high trend and major thrust faults (figures 5.12, 5.18 and 5.19).

Tin and tungsten veining, tourmalinisation and silicification and epigenetic pyrrhotite alteration outcropping and intersected in drilling at Specimen Hill is considered to reflect the proximity of this granite ridge. Petrological descriptions of this pyrrhotite describe it as rimming authigenic tourmaline (Whitehead 1965; 65_0388) with Cowan (in Dickson (1983; 83_1933) describing the alteration suite as “exhibiting affinities with the low-grade contact-metamorphosed/ metasomatized pelites marginal to, for example, the Renison Bell mineralisation.”

The relationship between the magnetic anomalies and remanent magnetism in pyrrhotite in carbonaceous sediments is highly significant as this association is seen with tin deposits elsewhere in Tasmania (figure 5.13) i.e. Renison Bell, Cleveland and Mt Bischoff.

Further evidence of a proximal granite body includes greisenised veins/dykes reported from Tatlows Shaft (Yaxley, 1981) and from near to The Clump (Turner, 1994) as well as intersected in drilling in BJV04 (Callaghan, 2010; 10_6024) at Specimen Hill.

The potential for high grade tin+/-tungsten has been demonstrated already at Specimen Hill in massive to semi-massive sulphide (pyrite, chalcopyrite, arsenopyrite) veins as intersected in drilling (figures 5.16 and 5.17) and exposed just below the water table, though to date examples are too thin and separated by too much lower grade material to define economic orebodies.

The broad low-grade intersection in DD81BC2 of 92m at 0.1% WO₃ (from 23m) is significant in its scale (figures 5.16 and 5.17).

Drilling has focussed on a relatively small part of the area of anomalous tin and tungsten in the immediate Balfour area with some potentially favourable settings remaining untested. The magnetic anomaly extends for 1.5km both to the north and to the south from the area of drilling with a single hole midway along either direction.

From a mining perspective the use of more advanced rock sorting technology than that envisaged by Dickson (1983; 83_1933) may allow for the discrimination between unmineralized quartzite and mineralised quartz veins, and lower cut-off grades under higher metal prices may justify the definition of orebodies at lower vein densities and/or grades. Further drilling should target favourable structural settings such as fold hinges and fault intersections. Recommendations made in Menpes () for larger diameter drilling and costeaning, in order to account for the nuggety nature of cassiterite and wolframite should be followed.

However, as noted by Callaghan (2010; 10_6024, 2011; 11_6240) it is at depth nearer the granite ridge that the greater potential for a major discovery lies. Proximity to the granite, or indeed

intersecting the likely greisenised carapace of the relatively shallow granite ridge may well see a massive or semi-massive fault hosted mineralisation, a greater vein density of smaller vein, larger lode style individual veins (c.f. Interview River below), greisens or other mineralisation styles. In tin and tungsten systems mineralisation is likely to have precipitated from granitic fluids proximal to the granite.

The suggestion by Callaghan (2010; 10_6024, 2011; 11_6) that holes should target the wedge of country between the Balfour and Specimen Hill Faults is considered a valid target model with the potential for a greater vein density in this structural position. A hole targeted here should continue on to the granite margin.

The tourmaline+silica breccia which outcrops on surface on the immediate east side of a clear fault on Specimen Hill, whilst not quite a breccia pipe but displaying similarities and targeted by essentially a single fence of historical drilling, may continue or be repeated at depth either as a zoned system, or offset on the fault. CRAE suggest this possibility on their section AA' in Parkinson ().

Given the structural complexity involving the thrust faulting favourable carbonate bearing strata from the Togari Group at depth may have formed replacement type deposits.

Further detailed geophysical and geological modelling of the granite, structures, stratigraphy and alteration should be carried out in order to optimise deeper holes targeted nearer the granite ridge, adjacent structures and possibly favourable strata.

Given the amount of tin and tungsten "smoke" near surface there is a quite reasonable chance for a significant tin+/-tungsten deposit to exist in the immediate Balfour area associated with the magnetic anomalies.

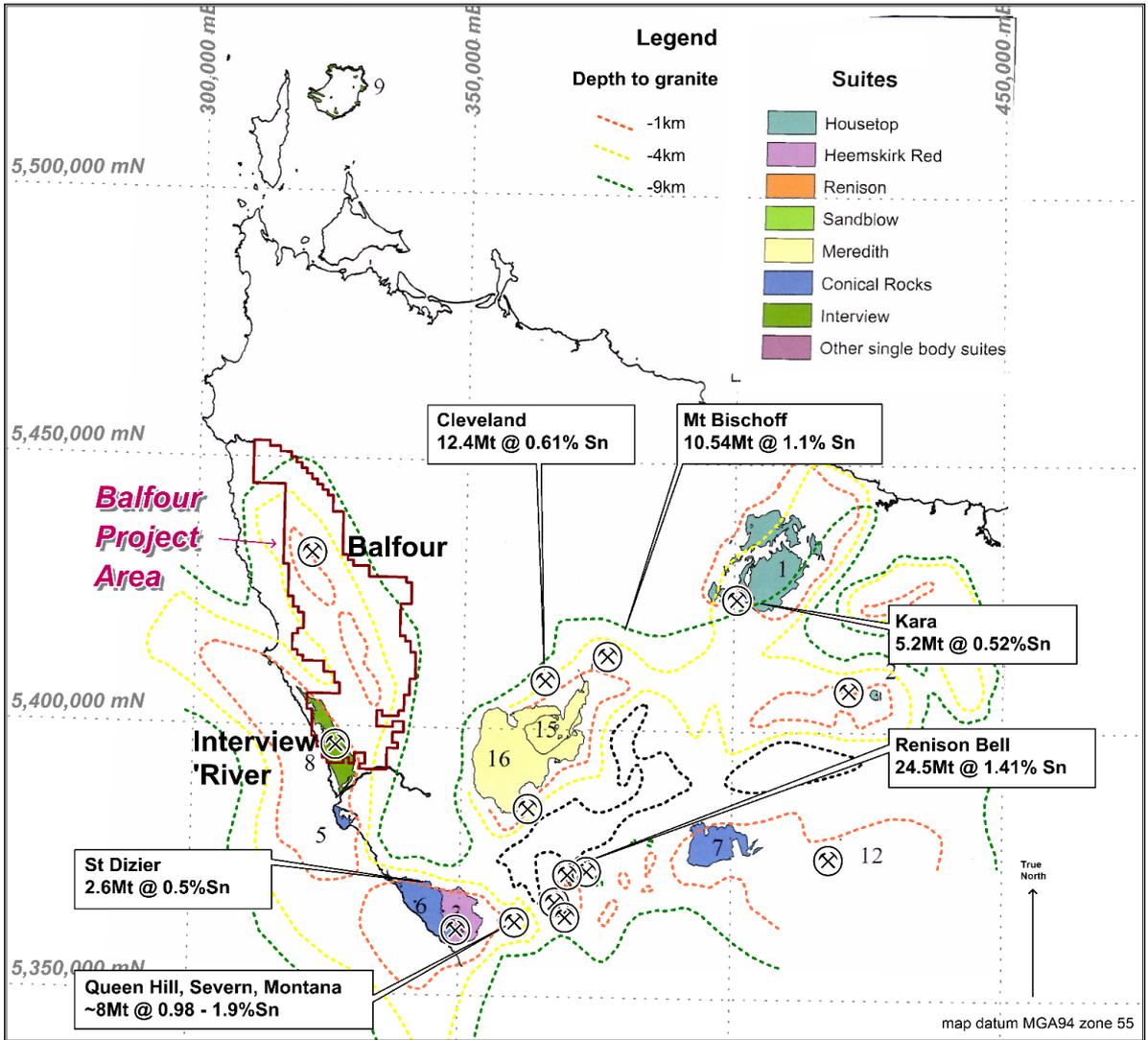


Figure 5.19: Middle Devonian granite outcrop and depth contours with major Tasmanian tin and tungsten deposits. King Island lies to the northwest of this map. Balfour Project Area is shown as a maroon outline.

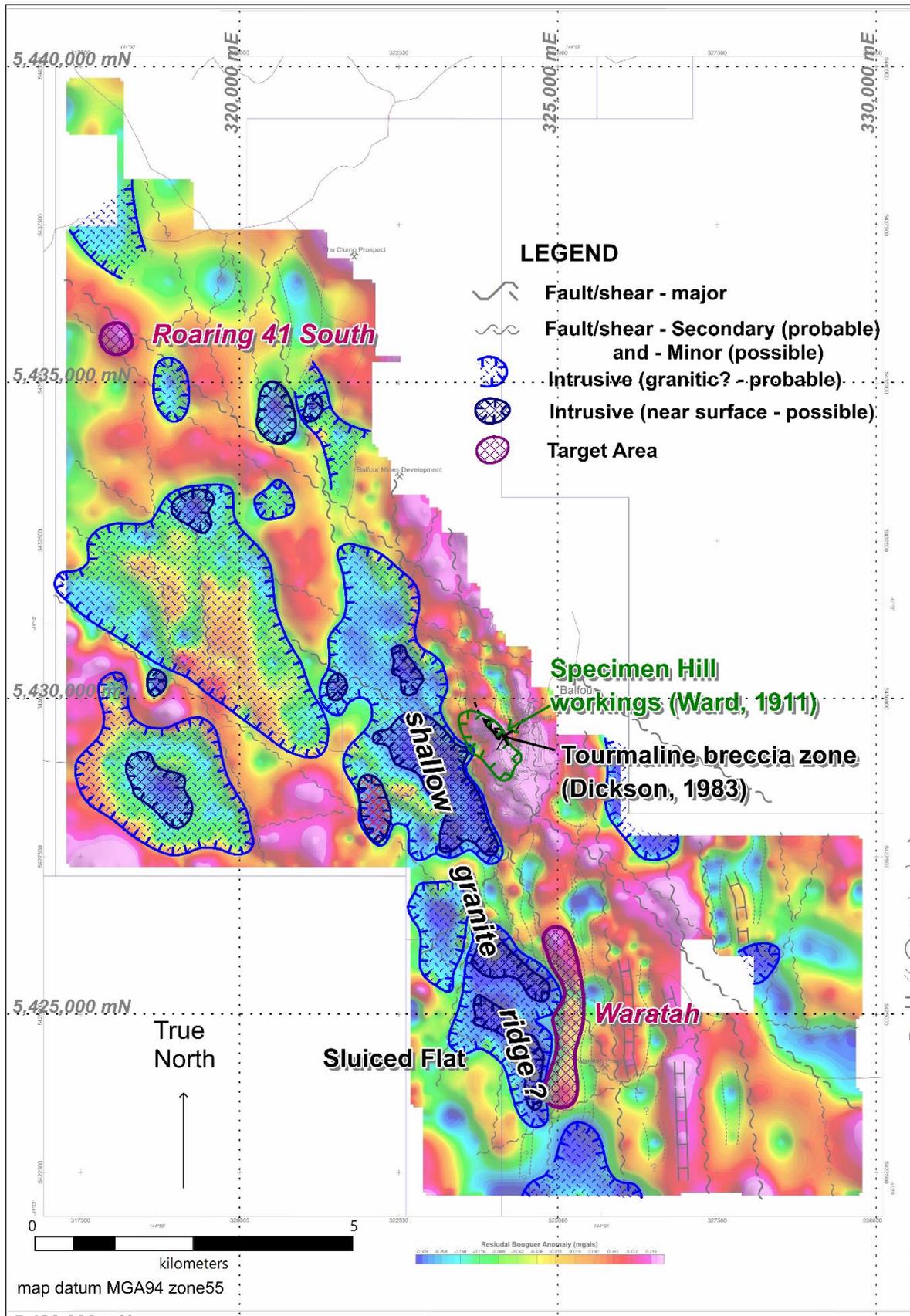


Figure 5.20: Gravity image with superimposed interpretation from Bissett (2009aa; 10_6024a). Also showing outline of shallow granite ridge (solid black linework), outline of Specimen Hill workings (solid green linework), location of Specimen Hill and Sluiced Flat.

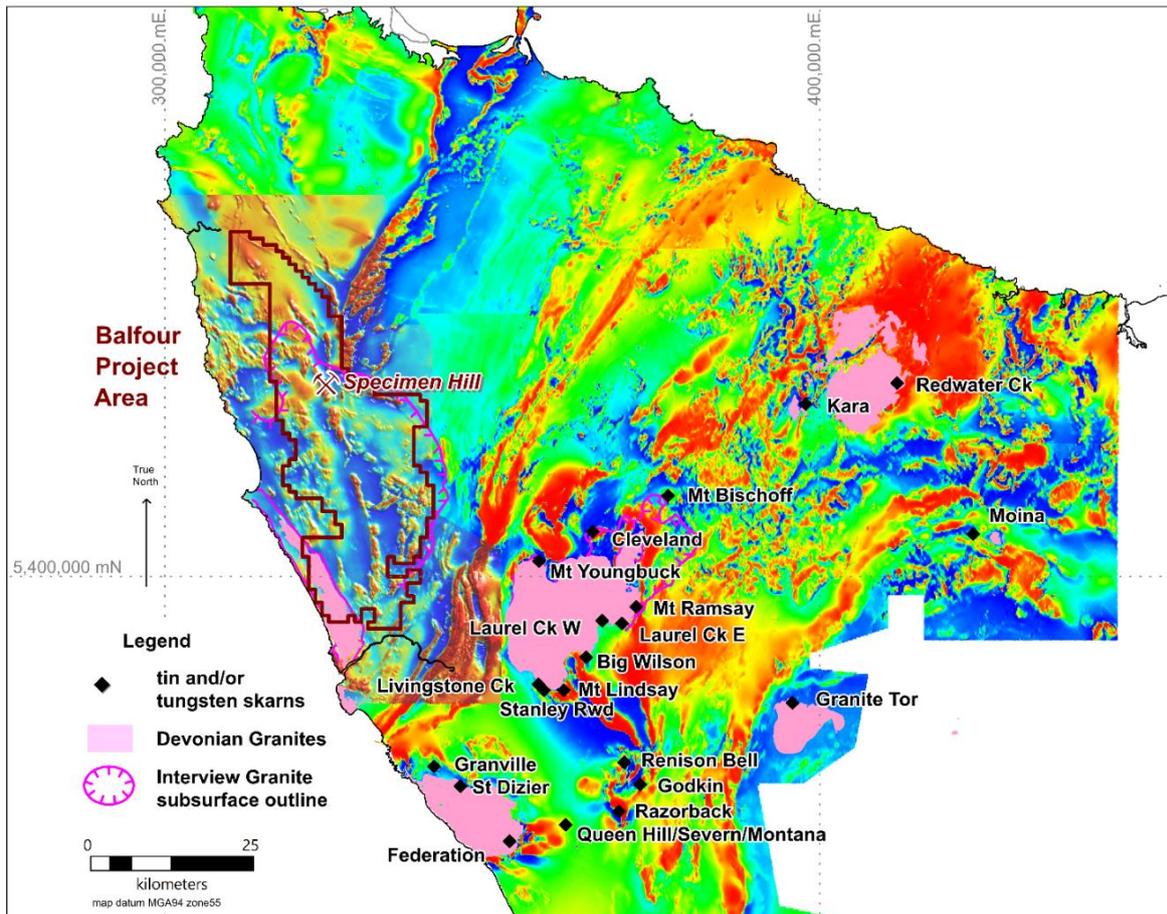


Figure 5.21: Tin and/or tungsten skarn deposits and outcropping Devonian Granites on Total Magnetic Intensity also showing position of Specimen Hill and outline of Interview Granite subsurface outline

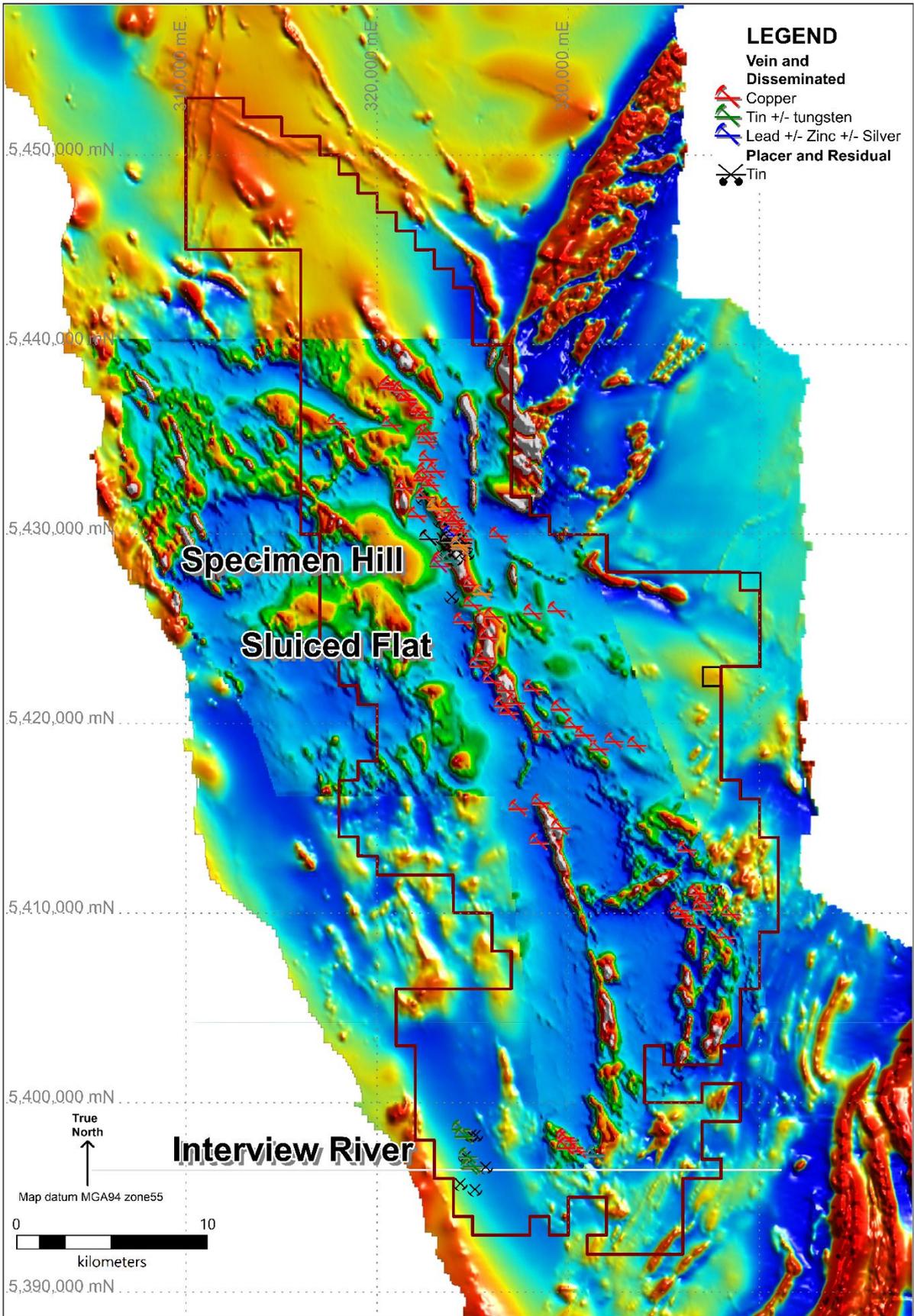


Figure 5.22: Tin and tungsten occurrences on background image of Total Magnetic Intensity.

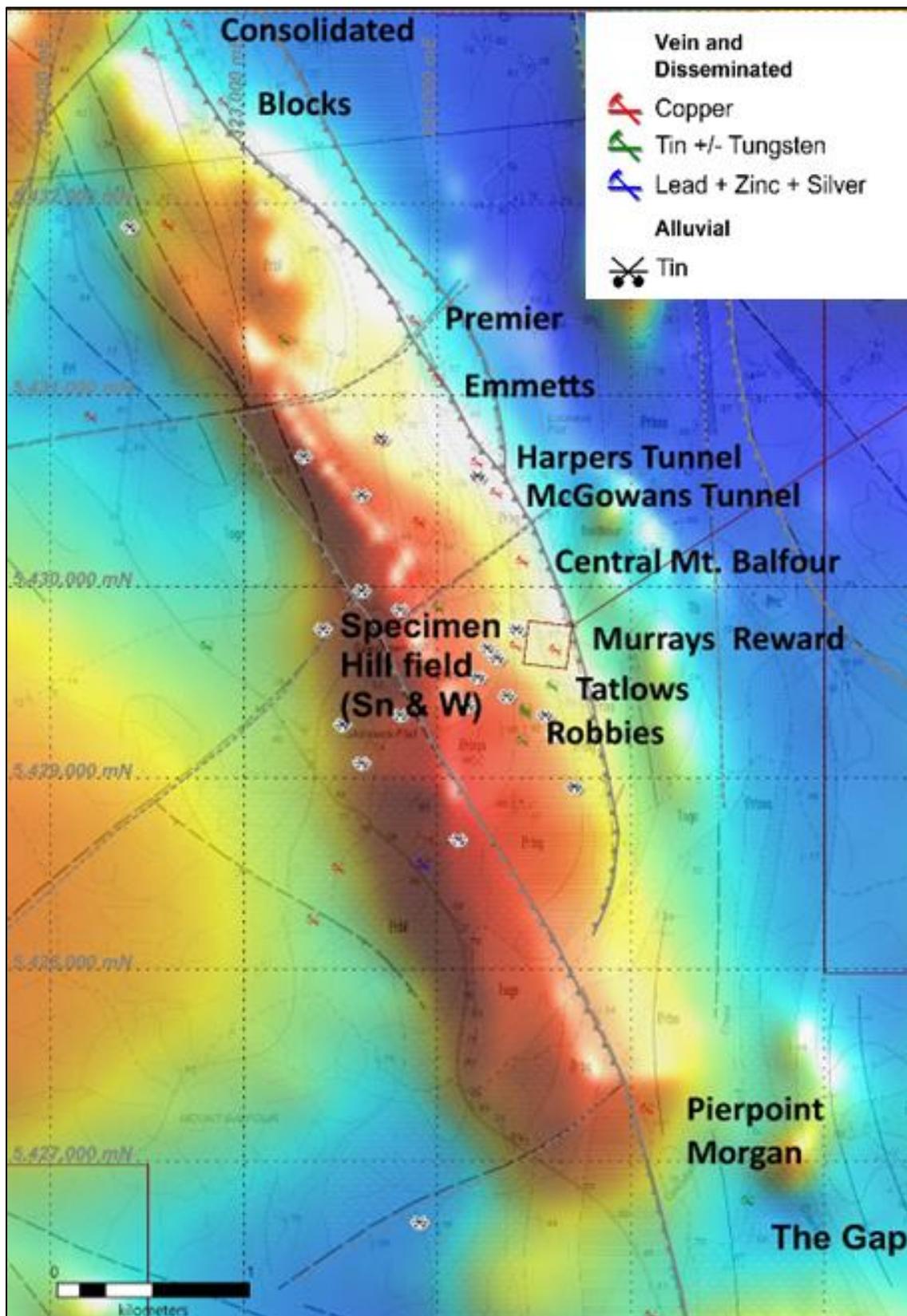


Figure 5.23: Total Magnetic Intensity image in immediate Balfour area showing the location of tin +/- tungsten hard rock and alluvial workings, hard rock copper workings, and major structures (grey linework).

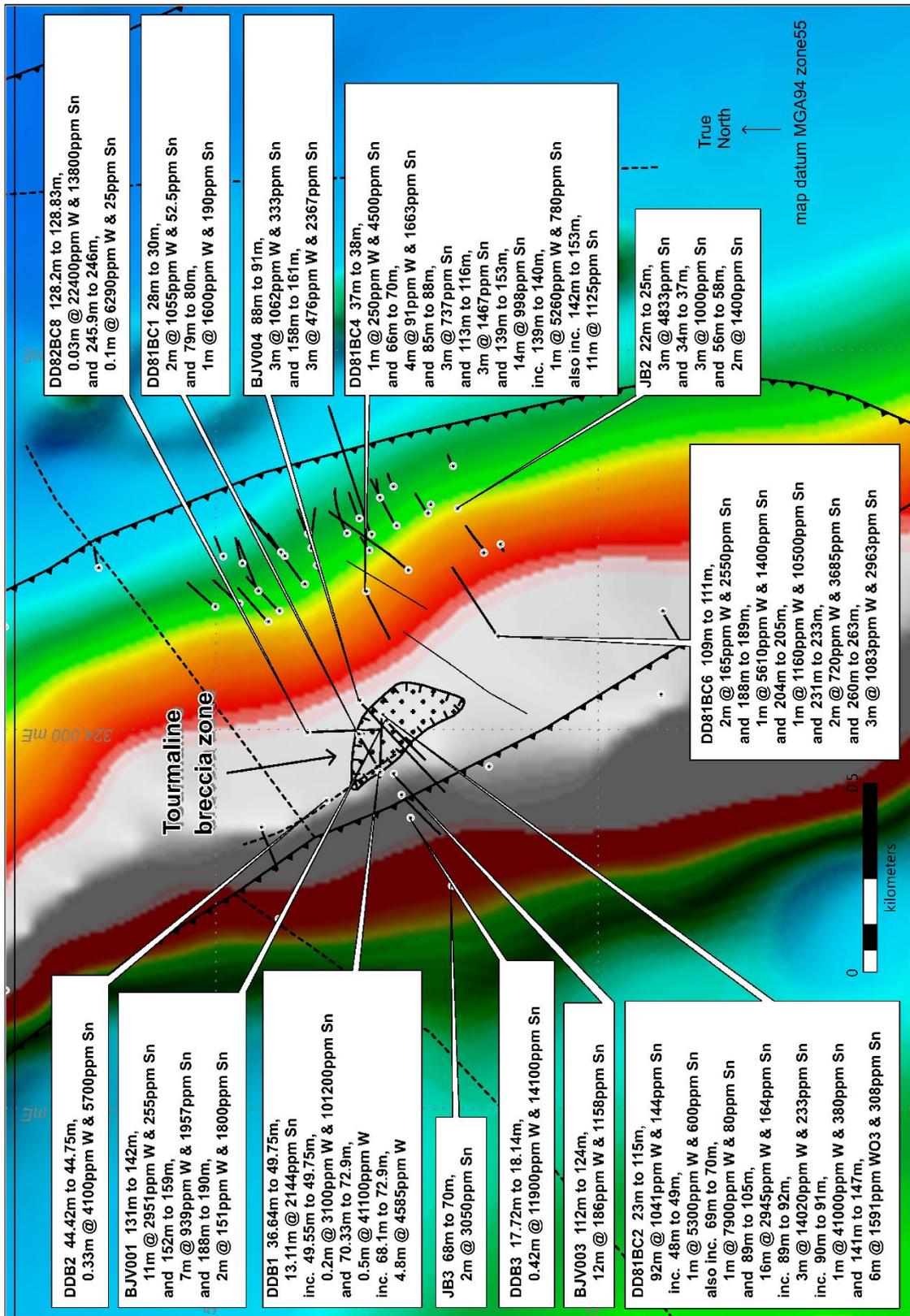


Figure 5.24: Better drillhole tin and tungsten drill results on a backdrop Total Magnetic Intensity image. Drill results are collated from historic company reports.

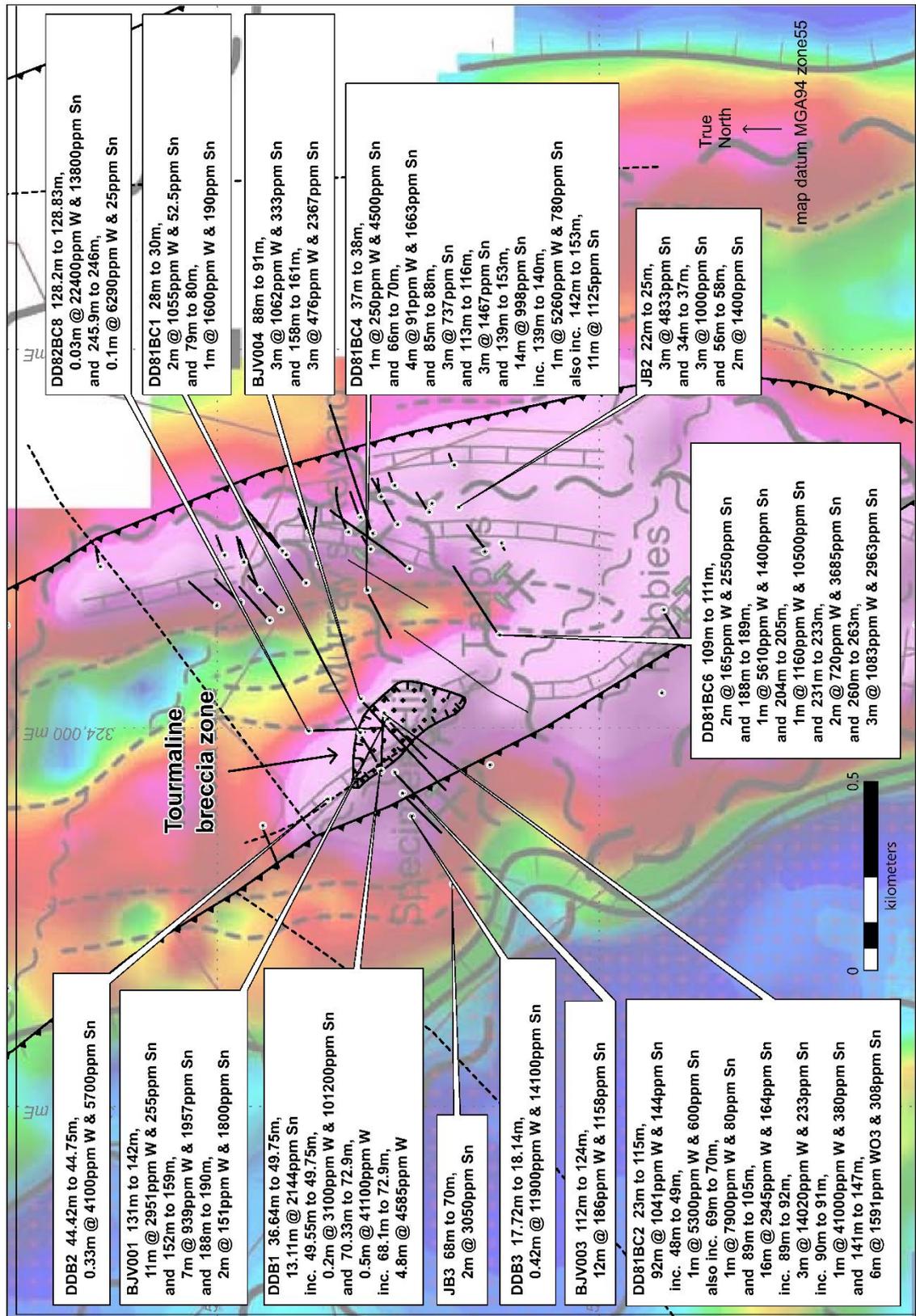


Figure 5.25: Better drillhole tin and tungsten drill results on a backdrop image showing gravity (after "Plan 2 Balfour Project, Balfour Gravity Survey, Interpretation over Residual Gravity Anomaly" in Bissett (2010a; 10_6024a)). Drill results are collated from historic company reports.

The recognition that (1) epigenetic pyrrhotite is responsible for the magnetic high, (2) that the pyrrhotite is due a granitic fluids emanating from a shallow granite ridge, and (3) this granite ridge continues in a north-northwesterly orientation from northwest of the Clump to south of the Norfolk Range makes other similar magnetic anomalies on this trend highly prospective for tin+/-tungsten mineralisation.

The Furious 50's magnetic anomaly beneath the old Waratah copper workings to the immediate east of the Sluiced Flat alluvial tin workings is such an anomaly, considered by Bissett (2010; 10_6024d) to be a Specimen Hill look-alike.

Bissett (2010; 10_6024d) models the anomaly (unfortunately under a time constraint meaning that this work should ideally be revisited) as a series of smaller near surface bodies but significantly notes that modelling the overall anomaly as requiring a larger, high amplitude magnetic body at depth. Such a body is likely to lie near to or immediately against the granite ridge near its crest and is a compelling drill target as it stands.

A similar magnetic anomaly underlies both the South Balfour and Poseidon copper workings and as well further south along the eastern margin of the Norfolk Range. There are no known associated tin workings in these latter areas though CRAE's compilation of stream sediment geochemistry notes streams draining the eastern side of the Norfolk Range to be anomalous in tungsten (Dickson).

The detailed gravity data available for modelling the depth to the granite stops on the northern edge of the Balfour South magnetic anomaly. This detailed data has shown its utility north of here and drill targeting at Balfour South, Poseidon and the other magnetically anomalous areas to the south as well as Toner River and Copper Reward would benefit muchly from a detailed gravity survey.

The magnetic anomaly associated with the Nelson prospect, wedged between two interpreted shallower granite bodies also remains unexplained by the shallow drilling of anomalous base metals in soils. The Roger River Fault which marks the eastern margin of this anomaly is associated with anomalous arsenic in soils, IP chargeability anomalies, and a mapped siliceous limonitic lode (ACI mapping) as summarised in figure 5.19.

Whilst the Rocky Cape Group does not contain any known carbonate bearing rocks conducive for replacement style mineralisation, the over thrust Togari Group does contain considerable thicknesses of dolomite. Whilst this is likely to be at some depth there is room for structural complexity to reduce this, and as noted earlier is favoured as a more simpler explanation for the copper mineralisation and associated chlorite and carbonate alteration in the higher grade lode style copper occurrences.

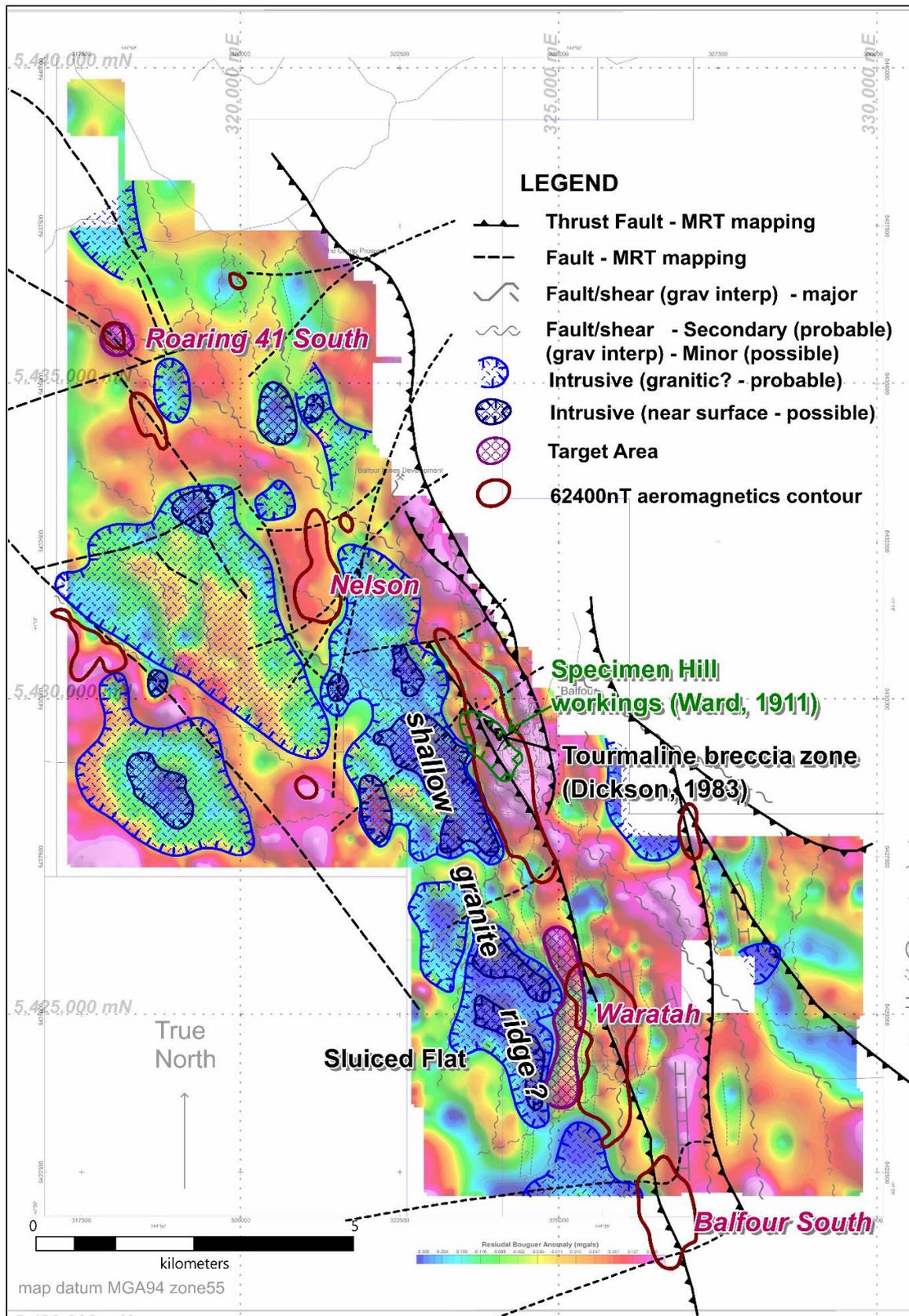


Figure 5.26 Pleiades gravity data image (after Bissett, 2009a; 10_6024a) with gravity anomalies, magnetic anomalies, MRT mapped and Bissett (2010) interpreted structures and prospects overlain.

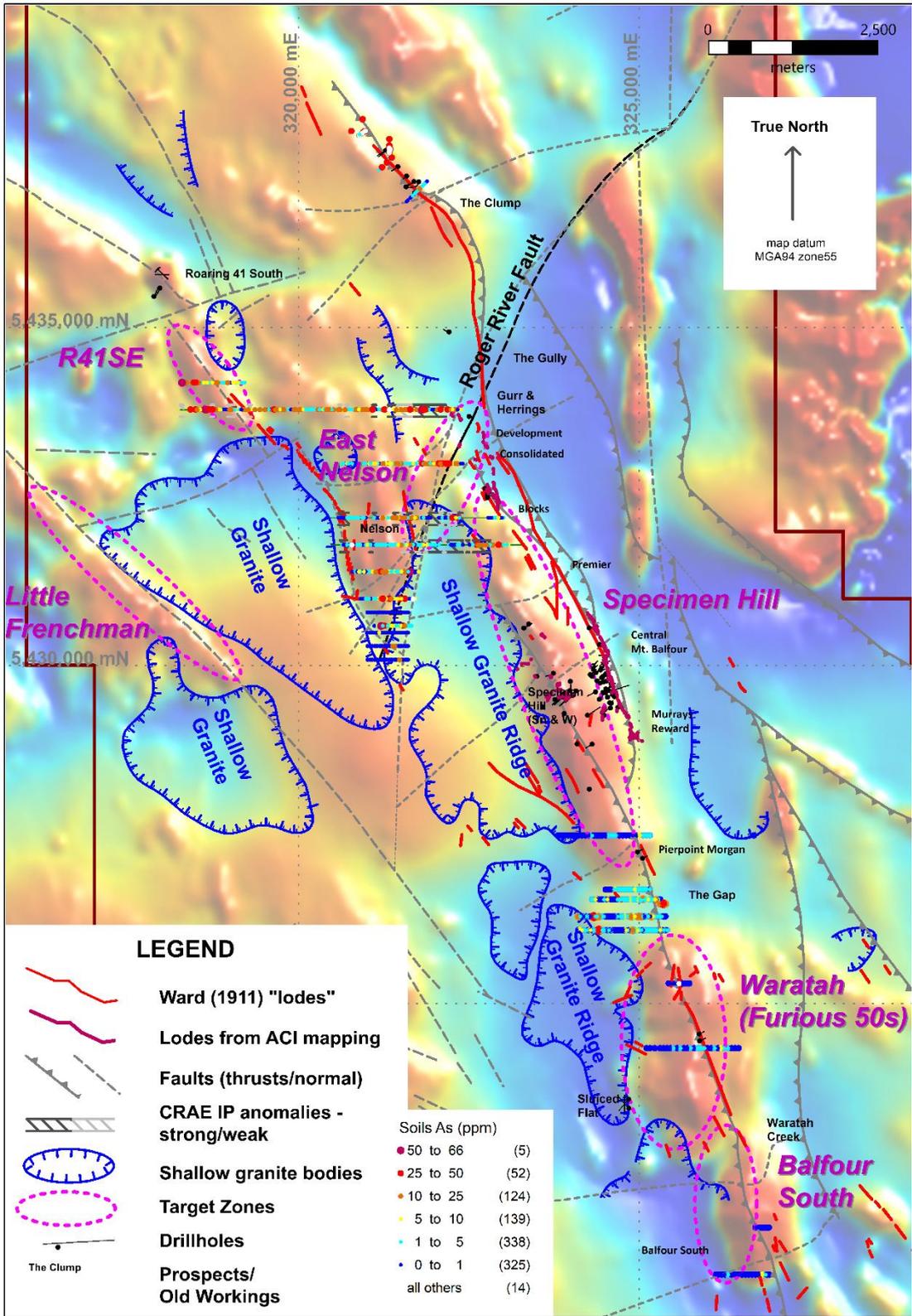


Figure 5.27: TMI image with shallow granite bodies outlined, mapped lodes of ACI, Ward (1911) "lodes" structures (see discussion earlier in text), arsenic soil geochemistry, CRAE's Nelson grid IP survey anomalies (other IP surveys not shown on this figure for clarity), existing drillholes and prospects. Pink ovals and text are the discrete target zones defined by this work and described in text.

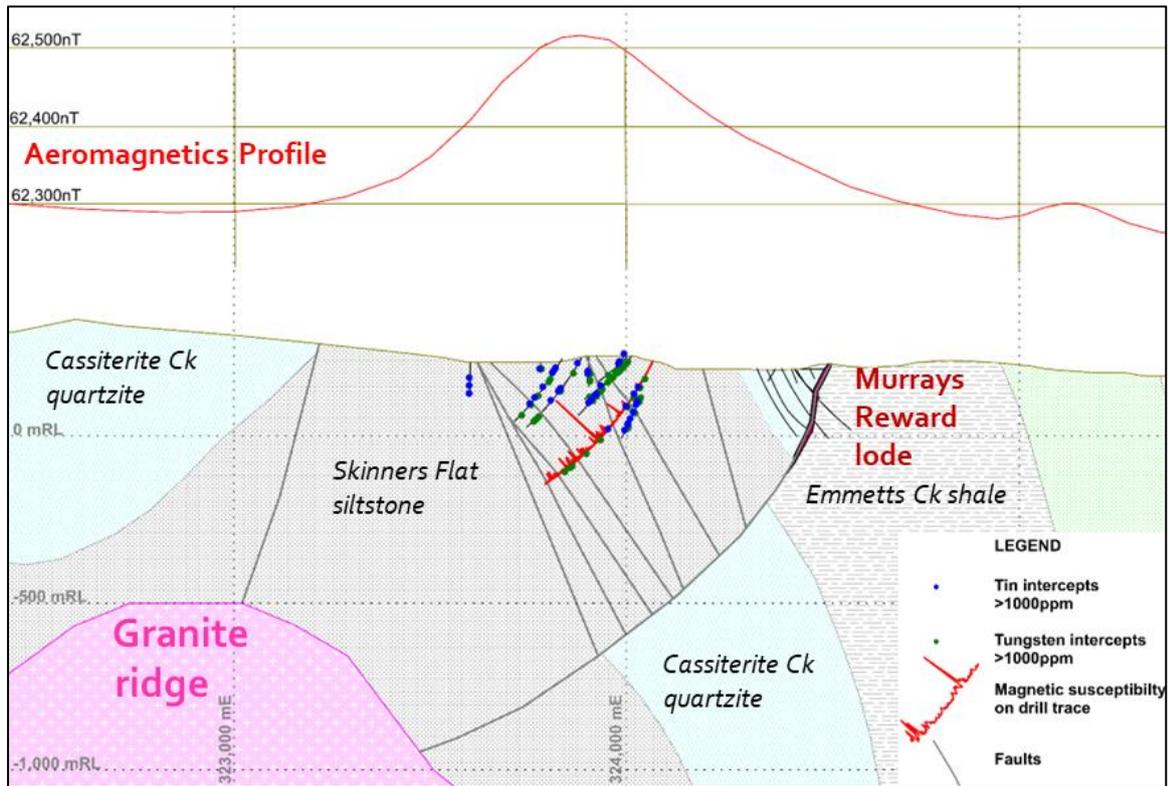


Figure 5.28: Bottom part of figure is cross-section through Specimen Hill showing drill traces, faults, geology polygons, tin and tungsten occurrences. Upper part of figure is magnetics profile from aeromagnetic data.

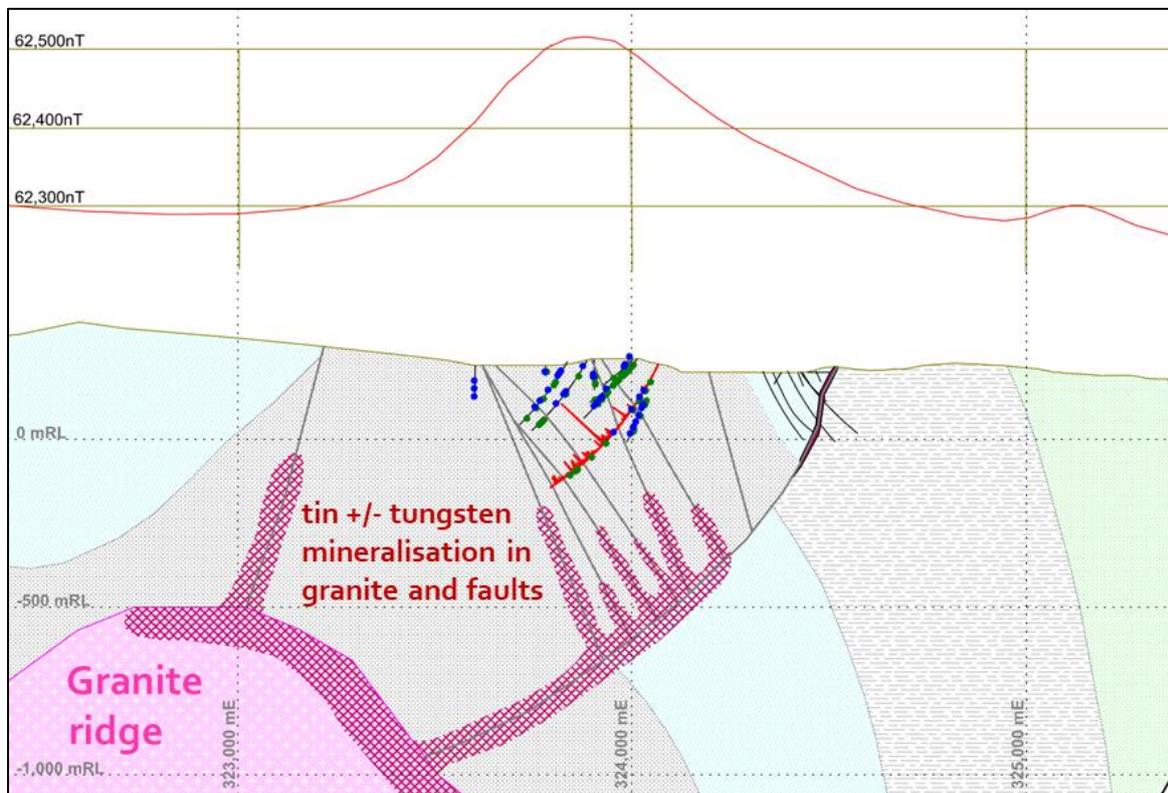


Figure 5.29: Same as figure 5.21 but now with conceptual tin +/- tungsten mineralisation added.

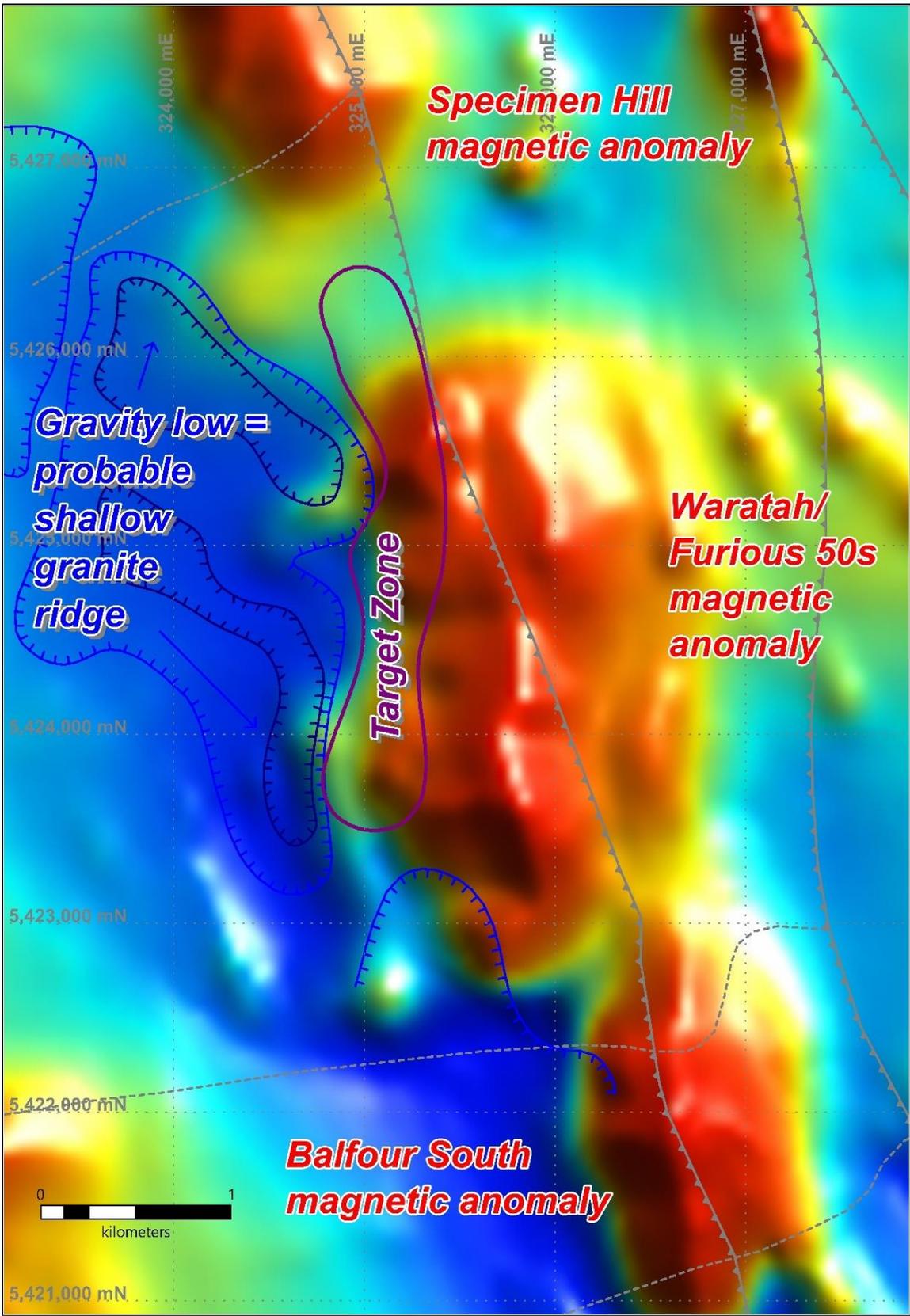


Figure: 5.30: Waratah/Furious 50's prospect TMI showing the gravity interpretation of Bissett (2009d), major structures (see legend for structures in figure 5.20)

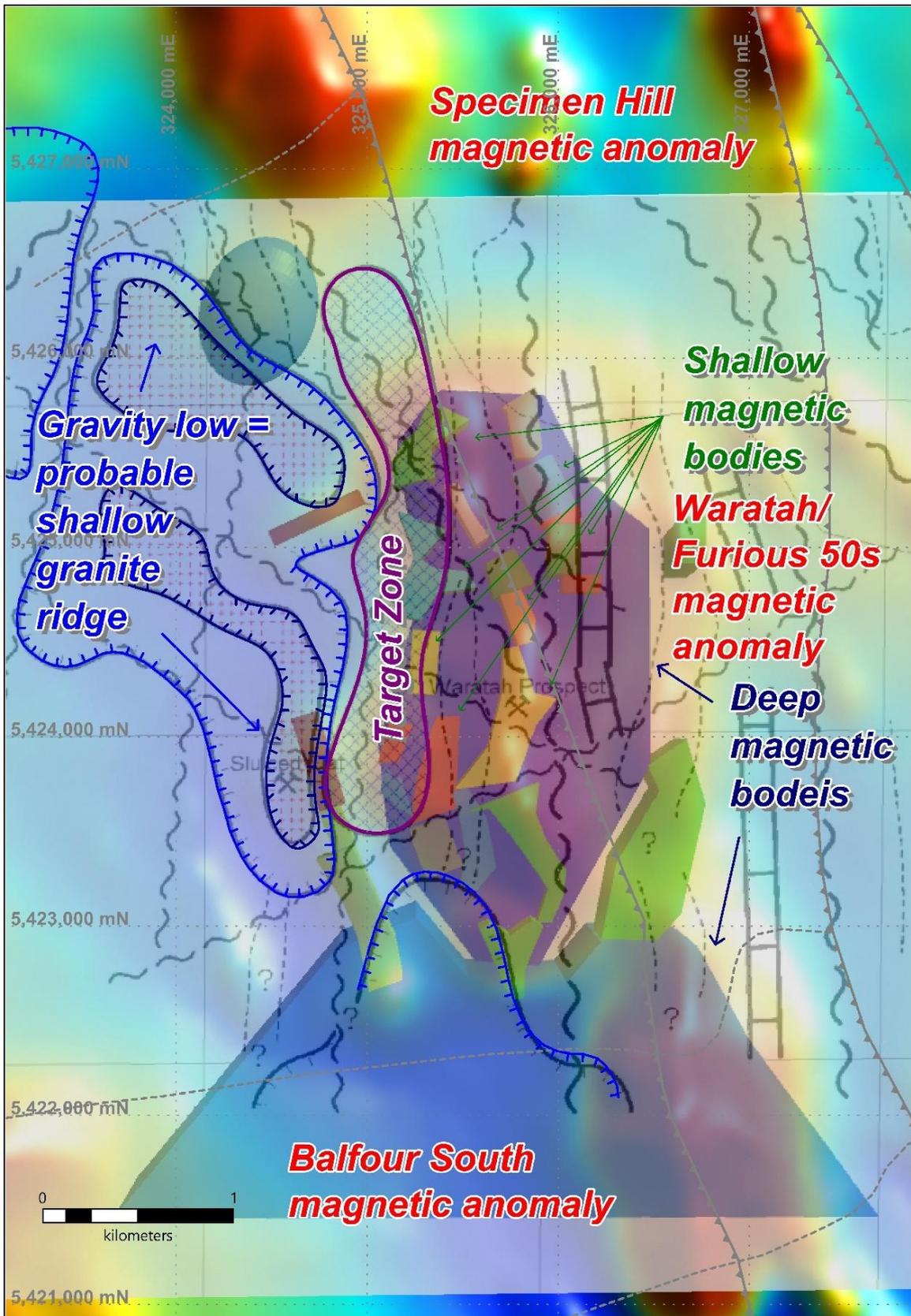


Figure 5.31: Gravity interpretation linework of Bissett (2009a) superimposed on magnetics modelling of the Waratah/Furious 50's magnetic anomaly by Bissett (2009d) showing the shallow magnetic modelled bodies (multicoloured) and deeper magnetic modelled bodies (dark and mid blue) with background of TMI.

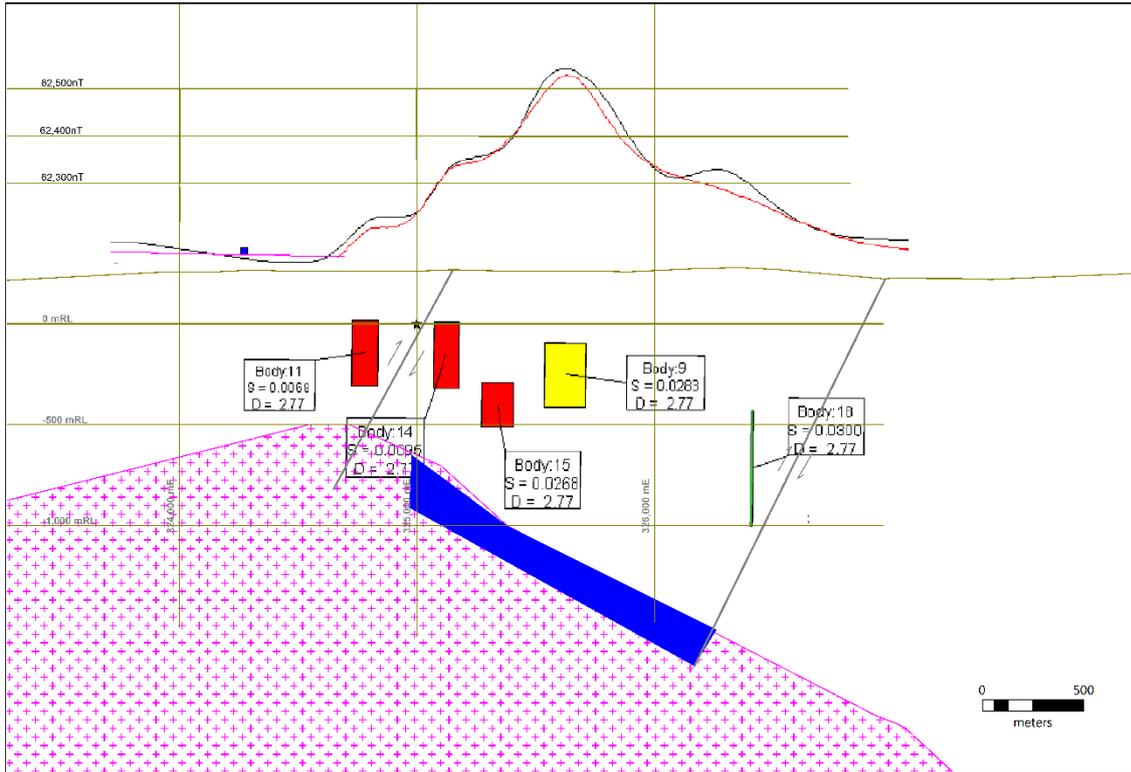


Figure 5.32: Section through the Waratah/Furoius 50's magnetic anomaly showing Bissett's (2009d) interpretation of shallow magnetic bodies (red, yellow and green shapes) required to model the magnetics profile in upper part of figure, with the addition of an approximate possible position of the deeper magnetic body shown in 5.23 against a possible modelled granite body. The deeper magnetic body and granite body models require refinement before drill targeting this anomaly.

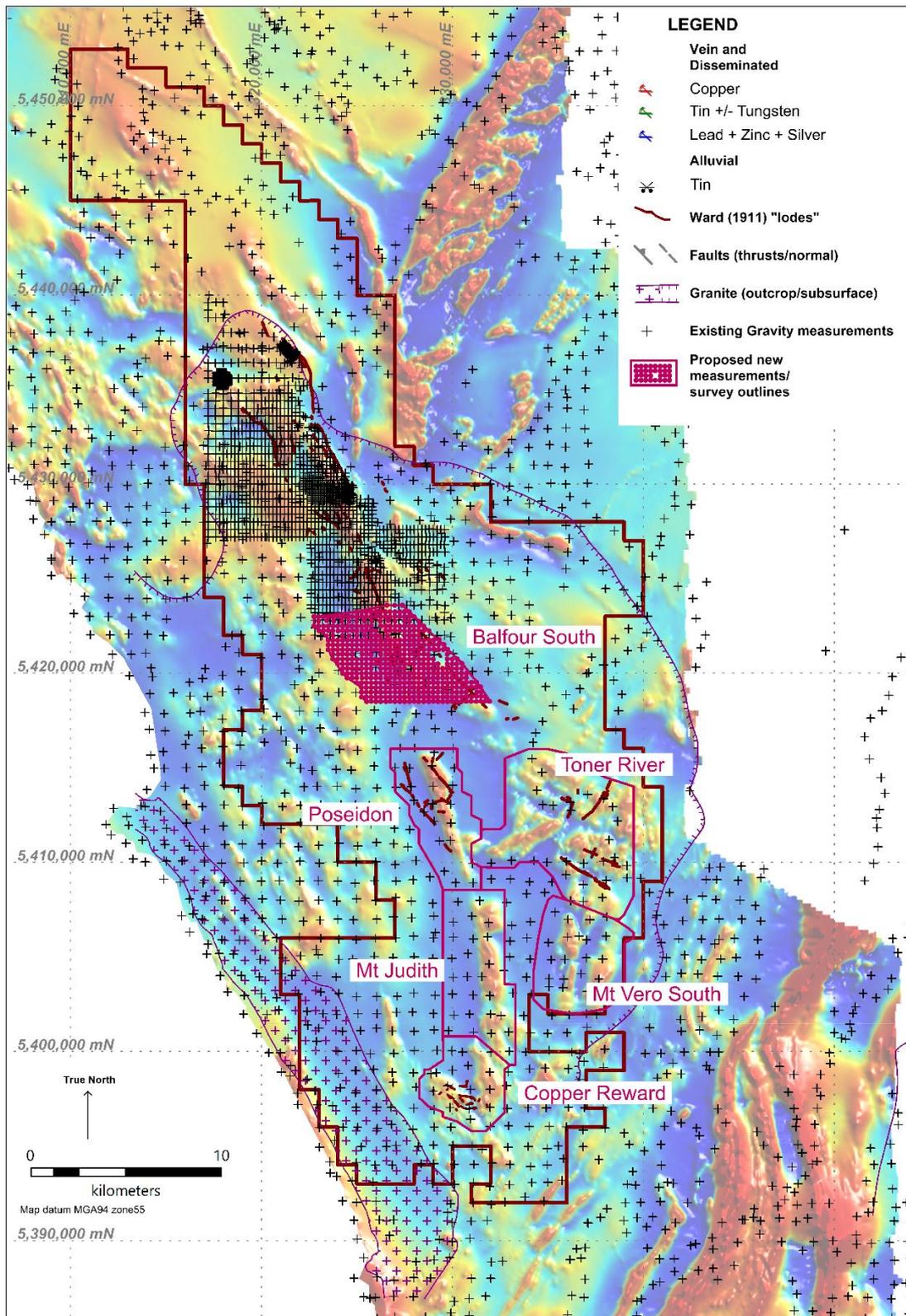


Figure 5.334: Existing gravity data coverage over the Balfour Project Area with the data points for a proposed gravity survey at the Balfour South prospect as well as the outlines of further gravity survey areas should initial results warrant this work. Background is TMI image also showing mineral occurrences from MRT database, gravity interpretation from Leaman (1991; 91_3213), "Iodes" from Ward (1911) and geological structures from MRT 1:25,000 mapping.

5.4 Zinc +/- Lead +/- Silver

There are a number of base metal occurrences within the Balfour Project Area (other than copper), though none yet have approached potential ore grades or volumes. Given the host rocks pedigree in North America, sedimentary hosted base metal deposits are also a reasonable possibility.

Discrete zinc +/- lead +/- silver base metal veins have been reported from a number of locations in the Balfour Project Area.

Anomalous zinc and to a lesser degree lead occur in some tin +/- tungsten veins outcropping and intersected on and near Specimen Hill and is probably part of a zoned system around the granite body at depth. Anomalous zinc and lead in soils to the southwest of Specimen Hill was drill tested by drill hole JB3 which intersected galena and sphalerite in narrow quartz veins and is likely of this origin.

Towards the southern end of the BPA the Silver Reward workings contain argentiferous galena (as sampled from dumps around the shaft). Work by Bottrill *et. al.* (2011) shows that this occurrence is associated with elevated REE, U and Th and unlikely to be granite related. The occurrence is also associated with deeper magnetic anomalies which are apparently unexplained. They recommend more work on resolving the genesis of this style of mineralisation.

High grade veins of silver, lead and zinc are known of elsewhere in Tasmania as part of a zoned system around intrusive granites and have been mined successfully in a number of instances.

Exploration for these higher grade deposits should retain this zoned model with geophysical techniques IP and EM, as well as C-horizon soil sampling all relevant.

Conversely, lower grade occurrences which have formed under the sediment hosted model will also be discovered in exploration for sedimentary hosted copper, so long as samples are also analysed for these elements.

At the Nelson Prospect anomalous lead and zinc in soils was discovered by CRAE chasing a sedimentary hosted model and was drill tested by a fence of shallow drill holes which intersected elevated zinc in a carbonaceous sediment which is considered to explain the anomaly. This anomaly occurs at a significant structural position and remains inadequately tested.

In both cases exploration for higher grade copper, sedimentary hosted copper, as well as higher grade semi-massive sulphide hosted tin +/- tungsten and lower grade disseminated tin +/- tungsten should locate base metal +/- silver deposits so long as assaying includes these elements.

5.5 Magnetite+/-copper+/-gold (+/- base metals) ('Temma ironstones')

Lodes of dominantly magnetite are known from the Temma area to the west of the Balfour Project Area and referred to informally as the 'Temma ironstones'. These bodies strike north-northwest to northwest dipping steeply to the west, cross-cutting the northeast dipping host sediments and are up to 15m wide and 1km long (Dove, 1988). They contain varying amounts of hematite, chalcopyrite, tetrahedrite, galena, sphalerite, pyrite, Fe-Mn carbonates, stilpnomelane and grunerite, but relatively little quartz (Taheri and Bottrill, 2003).

The Nelson Bay River deposit is the largest of these but others include Strickland, Rebecca and Little Eel (all outside of the BPA) (see figure 5.5.1). They have been interpreted as metasomatized mafic or ultramafic dykes (Seymour *et. al.* 2014) probably of the Tayatea Dyke Swarm intrusives and whilst only the Nelson Bay River deposit has been mined for direct ship iron, elevated copper and gold has been reported in cross-cutting veinlets and copper in chloritically altered wallrocks with 10m at 0.47% copper reported from the Little Eel prospect (Dove, 1988) and gold grades up to 2.2g/t gold reported from the Strickland prospect (Newnham, 2000).

Callaghan (2011) interprets the Roaring 41 South prospect, defined by coincident anomalously high magnetics and gravity (single point anomaly high), and containing sub-economic but elevated copper and gold, within the BPA as an example of this type of deposit. Callaghan (2011) also draws parallels between this style of deposit and the Tennant Creek ironstones i.e. IOCG style.

Taheri and Bottrill (2004) included samples from these Temma Ironstones and concluded that they had similar oxygen and sulphur isotopes and fluid inclusions to the copper deposits and suggest that they have a related genesis.

The R41S magnetic anomaly can be seen extending to the southeast (see figure 6.5.2) where it appears to be offset dextrally on an east-northeast structure before extending a further 1.7km to the southeast. Two 400m spaced lines of the Nelson grid extended sufficiently to cover this anomaly with anomalous arsenic and anomalous copper (single point anomaly of 109ppm). Further drilling is warranted on this southeastern section.

A parallel, analogous, linear magnetic anomaly, corresponding to a mapped fault, to the west of the Little Frenchman hill extends for 4km's (within the Balfour Project Area with another 1.75km outside of it) sandwiched between two interpreted shallow granite bodies. It is recommended that a detailed drone magnetics survey, and an initially broadly spaced IP and C-horizon soil sampling programme be conducted over this trend with infill lines once the anomalous structure is pinned down.

Similar north-northwest to northwest magnetic highs can be seen in a number of locations along the western side of the Balfour Project Area (shown as green ellipses on figure 6.5.2). Most of these have been unexplored (Chimney Creek anomaly in the south is an exception which had two broad spaced ground magnetics traverses read across it but the anomaly was somewhat poorly explained).

These anomalies may also reflect similar magnetite bearing lodes.

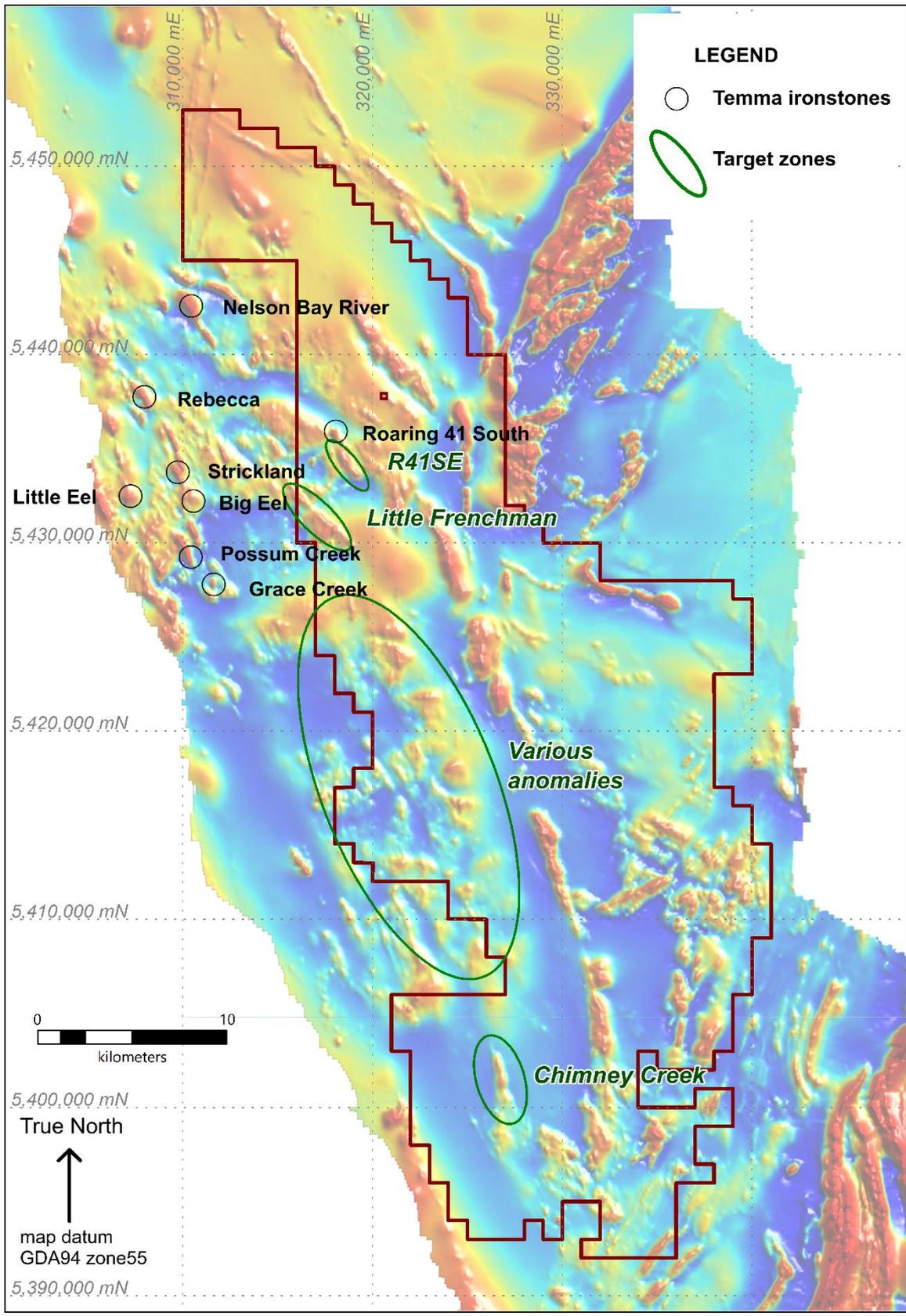


Figure 5.34: Total magnetic intensity image underlying the known ‘Temma ironstones’ occurrences (from MRT’s database of mineral occurrences), the Roaring 41 South prospect, and other potential “look-alike magnetics” target areas.

6.0 Recommendations

Gravity Survey

Detailed gravity data is of great value in modelling granite bodies and regional structures, particularly in looking for tin+/-tungsten and higher grade structurally hosted gold. Relatively high density gravity data exists for the northern section of the Balfour Copper Belt and the subsurface granite ridge down to the northern edge of the Balfour South magnetic anomaly. Below this the gravity data density is 1km x 1km i.e. of regional nature.

Resolving the subsurface shape of the granite body and the depth and shape of magnetic bodies will help in targeting drillholes at these mineralizing systems.

High resolution gravity data and magnetics will be modelled in detail before designing deep drillholes at Specimen Hill and the Waratah/Furious 50's prospects. Should results from this drilling prove encouraging i.e. magnetic anomalies are related to tin+/-tungsten mineralization at depth such that other magnetic anomalies along the north-northwesterly trend become more promising, it will be recommended that similarly detailed gravity data be obtained over magnetically anomalous areas in the southern part of the Balfour Project Area.

Geophysical Modelling/Geological Mapping and Sampling

The existing gravity and aeromagnetics data should be modelled in detail for those areas where it is available in order to optimize targeting of deeper drillholes at Specimen Hill and Waratah/Furious 50', as well as East Nelson, R41SE and Little Frenchman prospects with further stratigraphic/structural geological and petrological data obtained by reconnaissance field mapping/sampling supplied to better constrain this modelling. Knowledge of the remanence factor (Koenigsberger ratio) in siltstone/shales will also allow for better constrained modelling.

Gridding/Soil Sampling/Ground or Drone Magnetics/IP Surveying

IP has shown its utility in historic surveys to date, however, these surveys were either broadly spaced and the data is unavailable (ACI) or poorly located. Anomalous trends could be drilled however anomaly location is broad. New IP surveying is considered to be the best tool for locating higher grade copper mineralisation.

The Murrays Reward to Pierpoint Morgan, North Clump, South Clump and North Central Mt Balfour grids are targeting higher grade structural copper. These areas present as higher prospectivity zones due to either existing broad spaced IP chargeability anomalies, mapped or interpreted major structures, the location of historic "lodes" (as per the usage of Ward 1911), or some combination of the three.

Dipole-dipole IP surveying should be conducted on these latter grids as the principal targeting tool. In addition, whilst previous explorers have downgraded the utility of surface geochemistry due to leaching, it is still considered worth doing.

The East Nelson grid is targeting both structurally hosted copper as well as the contact between the Nelson magnetic anomaly where the regionally significant Roger River Fault crosses the north-northwesterly striking thrusts of the Balfour Copper Trend. This is a quite geologically complex area and ticks many boxes regarding its potential.

Detailed mapping by ACI in the early 1970's on the southern side of Cassiterite Creek shows a north-northeast striking siliceous limonitic gossan coincident with anomalous subparallel bedding

orientation, breaks in magnetic trends, swings in the interpreted strike of the north-northwest striking thrust and strike projection of the Roger River Fault. ACI drilled across this trend ~450m north-northeast of this outcrop targeting structures in the now inaccessible Development Adit (which must be chasing the Roger River Fault or associated structures).

This structural trend is also represented by chargeability anomalies in broad spaced historical IP surveys, anomalous arsenic in soil sampling on the Nelson grid and is considered to be the most prospective area in the Balfour Project Area.

This grid should be cut, surveyed by ground or drone magnetics, dipole-dipole IP and C-horizon soil sampling as a priority.

The R41SE and Little Frenchman grids are over possible examples of the magnetite+/-copper+/-gold Temma ironstone type. The existing Nelson grid extended over the R41SE anomaly and has anomalous As and Cu in soils. These two areas should be surveyed by drone magnetics in order to better define the position of the two magnetic trends before commencing ground work.

C-horizon (auger or wacker ideally) soils should be analysed for Cu, Pb, Zn, Au, Ag, As, Co, Ni, Sn and W in all instances on all grids.

Drilling Higher Grade Copper Targets Generated by Ground Work

The work on the above grids should define drill targets on at least some of these grids.

The R41SE and Little Frenchman grids are quite long and will probably require drilling on at least two positions along the anomalous trend.

The North Clump, North Central Mt. Balfour and Murrays Pierpoint Morgan grids will also required drill testing at a number of positions. In all of these cases relatively shallow drillholes (100-250m deep) should provide adequate tests.

In the case of the East Nelson prospect, some shallow drillholes along this trend will be of value but it is also likely that one or two deeper (500m-1000m) drillholes will be warranted following detailed modelling of the gravity and magnetics akin to the Specimen Hill, Waratah etc. tin+/-tungsten targets. All holes should be DHEM surveyed.

Drilling Murrays Reward/Central Mt. Balfour lode

The Murrays Reward/Central Mt. Balfour resource is currently classified as Inferred in part due to the broad spacing of drill intercepts. A programme of 13 shallow to moderate length drillholes totalling 1,500m's (with a further 500m kept in contingency should results at the northern and southern ends justify it) has been planned. Proposed drillhole pierce points are shown on figure 6.5.

Drilling Deeper Tin +/- Tungsten Targets

The magnetic anomalies along the north-northwest trend along the eastern side of the granite ridge all warrant drill testing, though drilling here will be deep. All of the following proposed holes require more detailed forward modelling of magnetics, gravity and geological structures to more precisely define the depth to granite, granite outlines and the shapes and positions of the targeted magnetic bodies and associated structures.

Two (minimum) deep holes are proposed to test the Specimen Hill granite ridge tin+/-tungsten target. One hole should target the wedge between the west dipping Balfour Copper Trend Thrust and east dipping fault which bounds the western side of the Specimen Hill alteration/mineralized

zone (Specimen Hill Fault?) as envisaged by Callaghan (2010; 10_6024) and proceed towards the granite ridge. Incorporating data from this hole a second hole should more specifically target the upper eastern margin of the granite ridge. Holes should be surveyed by DHEM.

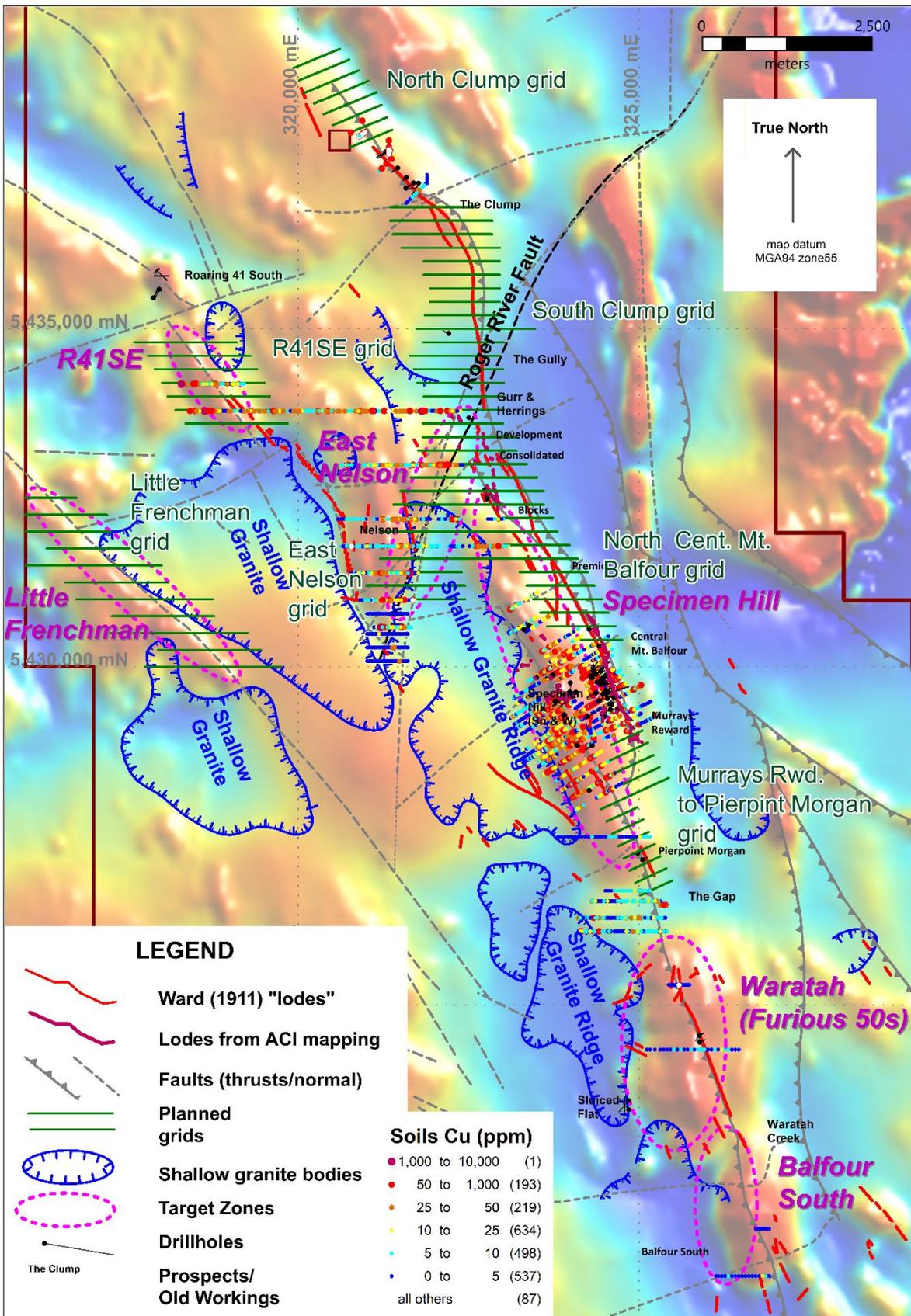
A single deep drill hole is proposed to test the Waratah/Sluiced Flat deep magnetic anomaly adjacent to the granite margin as modelled by Bissett and should also ideally penetrate the margin of the granite before stopping. This hole should be surveyed by DHEM.

If results are favourable (and following the detailed gravity survey and modelling) a similar hole is proposed for the Balfour South tin+/-tungsten magnetic anomalies/structural position to test the magnetic anomaly adjacent to the modelled granite and to continue on to penetrate the granite margin.

The Poseidon magnetic anomaly also presents as analogous with the Specimen Hill, Waratah/Furious 50's and Balfour South targets.

A budget summary is therefore:

• 3D IP Survey	A\$1,000,000
• Geophysical modelling	A\$100,000
• Drilling of conductivity anomalies (4,800m)	A\$1,200,000
• Drilling 2 deep holes granite ridge target below Specimen Hill	A\$600,000
• Deep drilling of Waratah/Sluiced Flat anomaly	A\$300,000
• DHEM surveys	A\$200,000
• IP, soil sampling +/- ground magnetics (50km at A\$15,000/km)	A\$750,000
• Gravity Survey Balfour South	A\$150,000
• Deep drilling of Balfour South anomaly	A\$300,000
• Drill anomalies on Little Frenchman, R41SE, North Clump, North Central Mt. Balfour, Murrays Reward to Pierpoint Morgan, East Nelson	A\$300,000
• <u>Administration/miscellaneous</u>	<u>A\$100,000</u>
• TOTAL	A\$5,000,000



6.1: Summary of prospects and proposed gridding on TMI in the main Balfour area.

8.0 References

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Appendix A – Drill hole details for all drill holes (excluding auger) in Balfour Project Area

Hole_ID	MGA94_E	MGA94_N	Rlmasl	Azi true	Dip	Depth m	Company	Report	Prospect
15BA001DD	324465.371	5429302.252	211.195	90	-85	863.4	Zebs	16_7496	Murrays Reward
B0387	324513	5429871.35	200	49.3231	0	1.06435	BHP	65_0411	Murrays Reward
B0393	324507.5	5429866.55	200	49.3231	0	1.5205	BHP	65_0411	Murrays Reward
B0396	324517.1	5429879.4	200	83.5	0	2.4328	BHP	65_0411	Murrays Reward
BJV001	324023	5429557	250	225	-60	238.5	PL&BM	10_6024	Specimen Hill
BJV002	323827	5429518	232	225	-60	239	PL&BM	10_6024	Specimen Hill
BJV003	323883	5429538	235	227	-60	269	PL&BM	10_6024	Specimen Hill
BJV004	324076	5429627	225	227	-65	501	PL&BM	10_6024	Specimen Hill
DBBA1	324420	5429500	200	43.25	-59	540.2	D & B Mining		Murrays Reward
DD81BC1	323987	5429629	238.355	239	-45	116	CRA	82_1740	Specimen Hill
DD81BC2	324039	5429566	240	272	-45	210.5	CRA	82_1740	Specimen Hill
DD81BC3	324312	5428836	220.063	239	-45	143.1	CRA	82_1743	Specimen Hill
DD81BC4	324363	5429611	200	243	-55	211.4	CRA	82_1730	Specimen Hill
DD81BC5	324570	5429451	200	59	-55	96	CRA	82_1741	Tatlows
DD81BC6	324246	5429264	214.363	57	-47	274.55	CRA	82_1730	Specimen Hill
DD82BC7	323312	5430554	199	59	-46	179.1	CRA	83_1934	Specimen Hill
DD82BC8	323992	5429764	221.79	177.8	-60	300	CRA	83_1935	Specimen Hill
DD97BC10	324472	5429602	200	60	-65	82.1	CRA	98_4115	Murrays Reward
DD97BC11	324513	5429598	205	72	-55	464.5	CRA	98_4115	Murrays Reward
DD97BC9	324452	5429819	200	50	-55	250.5	CRA	98_4115	Murrays Reward
DDB1	323887	5429574	236.445	0	-90	88.6	BHP	64_0373	Specimen Hill
DDB10	323500	5429839	220	239	-55	39	CRA	80_1475	Specimen Hill
DDB2	323812	5429714	220.551	0	-90	73.2	BHP	64_0373	Specimen Hill
DDB3	323767	5429494	219.419	0	-90	30.6	BHP	64_0373	Specimen Hill
DDB4	323902	5429289	220.945	0	-90	167.5	BHP	64_0373	Specimen Hill
DDB5	324092	5428839	220	0	-90	283	BHP	65_0394	Specimen Hill
DDB6	323742	5429884	198.956	248	-55	183	BHP	65_0394	Specimen Hill
DDB7	324431	5429740	200	239	-60	40.1	CRA	80_1475	Specimen Hill
DDB8	324488	5429260	208.386	239	-60	40.3	CRA	80_1475	Specimen Hill
DDB9	323382	5430614	199	59	-60	15.5	CRA	80_1475	Specimen Hill
DDH1	321707	5436994	168.5	55	-50	138.1	ACI	73-0947	The Clump
DDH10	324515	5429653	195.2244	68	-55	179.83	ACI	73-0947	Murrays Reward
DDH11	322212	5434934	199	274	-50	143.03	ACI	73-0947	The Gully
DDH12	322507	5433684	166.4208	108	-49	98.2	ACI	73-0947	Development
DDH13	324611	5429574	205.8	82	-65	101	ACI	74_1070	Murrays Reward
DDH14	324555	5429629	201.2	70	-60	113	ACI	74_1070	Murrays Reward
DDH15	324515	5429764	204.2	69	-60	106.68	ACI	74_1070	Murrays Reward
DDH16	324457	5429823	198.1	55	-60	111.25	ACI	74_1070	Murrays Reward
DDH17	324438	5429937	202.7	77	-60	124.03	ACI	74_1070	Central Mt Balfour
DDH18	324457	5429985	205.8	70	-60	105.15	ACI	74_1070	Central Mt Balfour
DDH19	324640	5429541	201.5	70	-65	79.25	ACI	74_1070	Murrays Reward
DDH2	321582	5437084	151	48	-50	72.2	ACI	73-0947	The Clump
DDH20	324427	5430313	197.5	80	-65	34	ACI	74_1070	Murrays Reward
DDH21	324422	5430311	197.5	80	-65	107	ACI	74_1070	Central Mt Balfour
DDH22	324269	5430558	192	76	-58	106	ACI	74_1070	Central Mt Balfour
DDH23	324694	5429383	205.1	70	-65	63.09	ACI	74_1070	Murrays Reward
DDH24	324384	5429773	198.4	54	-65	237	ACI	74_1070	Murrays Reward
DDH25	324537	5429532	197.5	62	-65	250.2	ACI	74_1070	Murrays Reward
DDH26	324479	5429757	198.1	70	-65	169.16	ACI	74_1070	Murrays Reward
DDH27	321332	5437650	143.5	229	-63.5	325.37	ACI	74_1070	The Clump
DDH28	321766	5437158	134.1	204	-67	354.18	ACI	74_1070	The Clump
DDH29	325887	5424549	199	63	-62	161.54	ACI	73_0950	Waratah

DDH3	321590	5437240	152	232	-60	125.89	ACI	73-0947	The Clump
DDH30	325892	5424449	199	65	-60	154.53	ACI	73_0950	Waratah
DDH31	325056	5427148	199	62	-59.5	123.42	ACI	73_0950	Pierpoint Morgan
DDH32	324982	5427243	199	62	-60	150.24	ACI	73_0950	Pierpoint Morgan
DDH33	324365	5429893	203.376	69	-64.5	254.16	ACI	73_0948	Murrays Reward
DDH34	324331	5429942	207.187	43	-65	173.28	ACI	73_0948	Murrays Reward
DDH35	324326	5429994	210	42	-65	182.9	ACI	73_0948	Murrays Reward
DDH36	324312	5429838	202.842	47	-67	237.78	ACI	73_0948	Murrays Reward
DDH37	324285	5429866	205.85	49	-65.5	222.77	ACI	73_0948	Murrays Reward
DDH4	321460	5437381	198.24192	229	-60	181.05	ACI	73-0947	The Clump
DDH5	322747	5432619	146.9136	72	-60	54.9	ACI	73-0947	The Blocks
DDH6	321695	5437161	200.2536	232	-60	265.14	ACI	73-0947	The Clump
DDH7	322777	5432534	203.97216	63	-60	102.71	ACI	73-0947	The Blocks
DDH8	322772	5432484	200.2536	64	-50	203.63	ACI	73-0947	The Blocks
DDH9	321282	5437621	141.4272	228	-50	206.7	ACI	73-0947	The Clump
INT001	324605	5398605	130	295	-45	71	Abignano	85_2320, 85_2307	Interview River
INT002	324660	5398792	170	300	-45	72.72	Abignano	85_2320, 85_2307	Interview River
JB1	324594	5429441	200	330	-90	76.25	PacificNev	05_5195	Tatlows
JB2	324581	5429371	202.482	270	-90	79.5	PacificNev	05_5195	Tatlows
JB3	323588	5429386	220	270		100.5	PacificNev	05_5195	Skidders Flat
JB4	324272	5428173	199	270	-90	136	PacificNev	05_5195	South Specimen Hill
JBT1	321500	5430784	211	270	-60	32.65	Jaguar	05_5195	Nelson
JBT2	321465	5430782	210	270	-60	49.91	Jaguar	05_5195	Nelson
JBT3	321441	5430785	212	270	-60	49.98	Jaguar	05_5195	Nelson
JBT4	321411	5430785	210	270	-60	50.2	Jaguar	05_5195	Nelson
JBT5	321382	5430785	212	270	-60	46.7	Jaguar	05_5195	Nelson
JBT6	321355	5430781	216	270	-60	50	Jaguar	05_5195	Nelson
No3Adit	324467.042	5429833.036	200	49.3231	0	68.6	ACI	74_1070	Murrays Reward
R41S01	317965	5435585	165	205	-55	251.2	Pleiades	11_6214	Roaring 41 South
R41S02	317880	5435460	172	25	-60	259.1	Pleiades	11_6214	Roaring 41 South

Appendix B - Better Drill Intersections

Hole	Prospect	from (m)	to (m)	interval (m)	Cu (%)	W (ppm)	Sn (ppm)	Zn (ppm)	Au (g/t)
DDH1	The Clump	54.18	76.46	22.28	0.25	na	na	na	na
DDH2	The Clump	60	72.2	12.2	0.19	na	na	na	na
DDH3	The Clump	71.47	84.43	12.96	0.45	na	na	na	na
DDH4	The Clump	19.92	21.27	1.55	0.8	na	na	na	na
and		57.45	58.8	1.35	0.21	na	na	na	na
and		96.44	96.93	0.49	0.19	na	na	na	na
DDH5	Blocks	47.63	48.32	0.9	0.25	na	na	na	na
DDH6	The Clump	170.99	190.84	19.85	0.16	na	na	na	na
DDH7	Blocks	76.1	77.57	1.47	2.1	na	na	na	na
DDH8	Blocks	37.95	40.45	2.5	0.275	na	na	na	na
and		118.05	119.17	1.12	0.3975	na	na	na	na
DDH9	The Clump	175.25	198.92	23.67	mzd zone	na	na	na	na
inc.		197.35	198.92	1.57	1.52	na	na	na	na
DDH10	Murrays Reward	110.39	138.52	28.14	0.129	na	na	na	na
inc.		120.64	126.6	2.48	1.25	na	na	na	na
DDH11	Gully	107.87	111.83	3.9	0.285	na	na	na	na
DDH12	Development	90.35	92.8	2.45	0.073	na	na	na	na
DDH13	Murrays Reward	43.58	83.52	39.94	0.324	na	na	na	na
inc.		43.58	46.02	2.44	1.48	na	na	na	na
also		53.95	56.69	2.74	0.456	na	na	na	na
also		71.94	83.52	11.58	0.72	na	na	na	na
DDH14	Murrays Reward	84.43	86.33	1.9	1.78	na	na	na	na
and		87.39	93.2	5.81	1.41	na	na	na	na
and		96.21	100.88	4.67	1.12	na	na	na	na
and		102.35	105.61	3.26	0.91	na	na	na	na
DDH15	Murrays Reward	85.36	94.49	9.13	0.073	na	na	na	na
DDH16	Murrays Reward	54.87	96.16	41.29	0.93	na	na	na	na
inc.		54.87	63.39	8.52	0.325	na	na	na	na
also		63.39	84.13	20.74	1.44	na	na	na	na
also		84.13	96.16	12.03	0.5075	na	na	na	na
DDH17	Murrays Reward	30.48	37.64	7.16	0.95	na	na	na	na
inc.		36.12	37.64	1.52	3.46	na	na	na	na
DDH18	Murrays Reward	29.57	31.7	2.13	0.7625	na	na	na	na
DDH19	Murrays Reward	60.66	73.5	12.84	0.485	na	na	na	na
inc.		68.37	70.15	1.78	1.73	na	na	na	na
DDH20	Murrays Reward	abandoned at 33.53m				na	na	na	na
DDH21	Murrays Reward	38.1	55.2	17.1	0.57	na	na	na	na
DDH22	Murrays	67.67	84.9	17.23	0.08	na	na	na	na

	Reward								
DDH23	Murrays Reward	56.99	60.81	3.82	2.1	na	na	na	na
DDH24	Murrays Reward	187	232.35	45.35	0.124	na	na	na	na
inc.		206.7	223.68	16.98	0.28	na	na	na	na
DDH25	Murrays Reward	202.9	242.04	39.14	0.245	na	na	na	na
inc		202.9	212.46	9.56	0.359	na	na	na	na
also		228.33	242.04	13.71	0.4025	na	na	na	na
DDH26	Murrays Reward	144.86	145.91	1.05	0.18	na	na	na	na
and		155.69	158.08	2.39	0.23	na	na	na	na
DDH27	The Clump	274.3	295.33	21.03	0.11	na	na	na	na
DDH28	The Clump	304.62	309.09	4.47	0.05	na	na	na	na
DDH29	Waratah	140.32	145.54	5.22	0.0005	na	na	na	na
DDH30	Waratah	135.9	138.96	3.06	0.0036	na	na	na	na
DDH31	Pierpoint Morgan	103.27	111.93	8	0.0037	na	na	na	na
DDH32	Pierpoint Morgan	137.28	142.02	4.74	0.002	na	na	na	na
DDH33	Central Mt Balfour	118.11	124.35	6.24	1.31	na	na	na	na
DDH34	Central Mt Balfour	136.2	139.42	3.22	0.26	na	na	na	na
DDH35	Central Mt Balfour	143.64	147.5	3.86	0	na	na	na	na
DDH36	Central Mt Balfour	189.32	221.78	32.46	0.296	na	na	na	na
DDH37	Central Mt Balfour	204.9	210.04	5.14	0.234	na	na	na	na
DD97BC9	Murrays Reward	55.3	72.6	17.3	1.7	na	na	68	<0.001
and		112.4	112.7	0.3	0.51	na	na	26	<0.001
DD97BC11	Murrays Reward	146.5	160	13.5	0.588	na	na	109	0.012
and		170	172	2	1.46	na	na	300	0.057
15BA001	Tatlows	169.5	170.5	1	0.095	170	1990	200	na
and		171	172		0.007	1030	866	80	na
and		728	731	3	0.41	na	na	na	0.017
DBBA1	Murrays Reward	56.8	56.85	0.05	0.294	100	7200	727	<0.01
and		65.5	65.52	0.02	0.27	200	600	45000	0.18
and		68	68.015	0.015	0.266	<10	1500	71400	0.01
and		413.25	420.9	7.65	0.81	na	na	na	0.017
and		413.25	417.6	4.35	1.4	na	na	na	0.025
No3 Adit	Central Mt Balfour	48.8	68.6	19.8	0.65	na	na	na	na
inc	Central Mt Balfour	53.4	65.5	12.1	0.925	na	na	na	na
R41S01	Roaring 41	53	59	6	0.8	<100	<100	138	0.05

	South								
BJV001	Specimen Hill	131	142	11	na	3720	255	na	na
and		152	159	7	na	1184	1957	na	na
and		188	190	2	na	190	1800	na	na
BJV003	Specimen Hill	112	124	12	na	234	1158	na	na
BJV004	Specimen Hill	32	492	460	na	122	108	na	na
and		88	91	3	na	1339	333	na	na
and		112	127	15	na	368	427	na	na
and		158	161	3	na	600	2367	na	na
DD81BC1	Specimen Hill	28	30	2	0.0165	1055	52.5	85	na
and		79	80	1	0.0745	1600	190	190	na
DD81BC2	Specimen Hill	23	115	92	0.0014	1041	144	112	na
inc.		23	72	49	0.0707	892	129	66	na
inc.		31	44	13	0.0885	1083	162	48	na
also inc.		48	49	1	0.063	5300	600	50	na
also inc.		69	70	1	0.054	7900	80	80	na
and		89	105	16	0.067	2945	164	188	na
inc.		89	92	3	0.0378	14020	233	95	na
inc.		90	91	1	0.0765	41000	380	105	na
and		141	147	6	0.047	1591	308	127	na
DD81BC4	Specimen Hill	37	38	1	0.21	250	4500	1120	na
and		66	70	4	0.1314	91	1663	4238	na
and		85	88	3	0.0441	na	1000	3700	na
and		113	116	3	0.027	147	1467	1573	na
and		139	153	14	0.076	512	998	220	na
inc.		139	140	1	0.0185	5260	780	950	na
DD81BC6	Specimen Hill	109	111	2	0.029	165	2550	1417	na
and		150	152	2	0.022	139	830	608	na
and		159	160	1	0.132	2250	1550	1950	na
and		188	189	1	0.0245	5610	1400	375	na
and		204	205	1	0.215	1160	10500	655	na
and		231	233	2	0.105	720	3685	225	na
and		260	263	3	0.0417	1083	2963	7650	na
DD82BC8	Specimen Hill	42.7	42.72	0.2	1.27	na	124	155	na
and		87.2	87.3	0.1	0.91	135	760	4400	na
and		128.2	128.8	0.03	0.27	22400	13800	145	na
and		157.8	158	0.2	0.98	25	1495	7500	na
and		233.8	234.1	0.3	1.1	na	346	4750	na
and		245.9	246	0.1		6290	25		na
and		252	252.0	0.02	0.525	1020	116	6550	na
DDB1	Specimen Hill	36.64	49.75	13.11	na	na	2144	na	na
inc.		49.55	49.75	0.2	0.19	3100	101200	na	na
and		72.4	72.9	0.5	0.11	41100	200	na	na
DDB2	Specimen Hill	44.42	44.75	0.33	2	4100	5700	na	na
DDB3	Specimen Hill	17.72	18.14	0.42	1.31	11900	14100	na	na
JB2	Tatlows	22	25	3	0.0426	na	4833	1494	na
and		34	37	3	0.045	na	1000	1246	na
and		56	58	2	0.1735	na	1400	1250	na
JB3	Skinner's Flat	45	46	1	0.0303	na	2300	407	na
and		68	70	2	0.0394	na	3050	596	na
JBT2	Nelson	15	16	1	0.0036	0.0002	0.0002	678	na
IR01	Interview River	43	44.15	1.15	0.003	634	300	na	0.13
IR02	Interview River	51.31	52.1	0.79	0.07	396	500	na	na

and		58.6	59.33	0.73	0.03	3330	300	na	na
and		53.3	53.8	0.5	0.52	714	400	na	na