

GEOPHYSICAL REVIEW
OF
NORTH WEST TASMANIA

March 1983

02-4813

ABSTRACT

The results of the regional aeromagnetic survey carried out by the Tasmania Department of Mines in 1982 over the West Coast of Tasmania, have been interpreted and are presented in this Review.

The survey was flown with a flight line spacing of 500 metres which was sufficient in some areas to enable the identification of a magnetic signature associated with the known mineral deposits of the region. Where possible, detail geophysical survey results or open file data have been integrated into the Review to support the interpretation. The magnetic results show that most of the larger ore bodies have a regional magnetic signature and that similarities can be identified with areas elsewhere. The magnetically anomalous zones include the metamorphosed aureoles or skarns located on the granite contacts. The regional magnetic data over the Mt. Read Volcanics indicate that the Central and Western Sequences are only slightly magnetic in comparison to the Eastern Sequence which has a recognisable magnetic signature. It is possible that the Eastern Sequence magnetic activity may be associated with a rift zone into which the Murchison and South Darwin Peak granitic plutons have been intruded.

The West Coast of Tasmania is one of the few areas in Australia where airborne electromagnetic methods have been used with success to identify an ore body, namely the Que River Deposit. The airborne surveys which have been flown in this area have been summarised in a section of the Review.

The interpretation of the regional gravity data over the West Coast of Tasmania has demonstrated a number of major gravity lineaments with a magnetic expression. An attempt has been made to relate these lineaments to the presently known mineralisation and to indicate other areas with a similar gravity response. The detail gravity survey results have been presented, along with the results from a Tasmania Department of Mines survey recently carried out in the Renison Bell to Zeehan area.

Airborne radiometric methods have not been implemented in the area however, the results of a regional ground survey are presented. This demonstrated how effective radiometric methods can be in identification of potentially tin bearing granites.

ACKNOWLEDGEMENTS

I wish to acknowledge the assistance given by the staff of the Tasmania Department of Mines in Hobart, while I was obtaining open file data. In particular the valuable help of Dr R.G.Richardson, Principal Geophysicist, Tasmania Department of Mines, for making the records, maps and analogue data so readily available.

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INTRODUCTION

The Tasmania Department of Mines carried out an aeromagnetic survey in 1982 over the west coast of Tasmania. The specifications of the survey, which covered an area of 620 square kilometres, are set out in Appendix 1, and by Corbett et al (1982). The aim of the survey was to provide a guide to the distribution of rock types on the west coast and to aid in the structural interpretation. The data has been interpreted by Corbett et al (1982) and the major magnetic zones or provinces have been identified along with the probable sources of the anomalies. This review aims to examine the magnetic signature, and any other available geophysical data, of the major formations and mineral deposits on the west coast. The report will also relate the magnetic results to specific geological features and identify in detail the magnetic expression of various mineral deposits in the area.

Included in the review is a summary of the available gravity, electromagnetic, radiometric and other data which has been integrated into the magnetic interpretation. It is important to include as many results as possible from the previous work carried out in an area when interpreting new results. Although the aeromagnetic survey specifications did not include a radiation spectrometer there is sufficient ground data published (Collins et al 1981) to show that the granite bodies associated with the tin mineralisation have a definite radiometric signature similar to that recognised elsewhere.

Attached to the review are 7 Geophysical Interpretation Maps. These maps, Plates 1 to 7 overlay the magnetic contours plotted at a scale of 1:50,000. An attempt has been made to locate all geophysical anomalies, any specific geological feature discussed in the review, and where possible, the topographic or cultural names. Plate 8 is a Contour Map of the recently released gravity data in the Zeehan and Renison Bell area.

The interpretation of the geophysical results presented in this review is not meant to be considered as final. There is a wealth of confidential data not yet released to open file, some of which will obviously change the interpretation, however the ideas presented should be of assistance to exploration groups interested in the area.

REGIONAL MAGNETIC INTERPRETATION

The regional magnetic interpretation is based upon the aeromagnetic coverage carried out over the West Coast of Tasmania by the Department of Mines. The area surveyed, (Figure 1), extended from a line north of Mt. Bischoff to south of Macquarie Harbour and from the west coast to a north-south line 8 kilometres east of Queenstown. The survey specifications and data presentation requirements are outlined by Corbett et al (1982) and are set out in Appendix 1. The aeromagnetic results were photoreduced from the presentation scale of 1:50,000 to 1:250,000 to overlay the Burnie (Williams and Turner 1973) and Queenstown (Corbett and Brown 1975) Geological Map Sheets. The regional geology has been reviewed by a number of authors including a summary by Solomon (1981), and the structural geology as presented by Williams (1979).

From these summaries the regional geology has been divided into the following formations, (Figure 2).

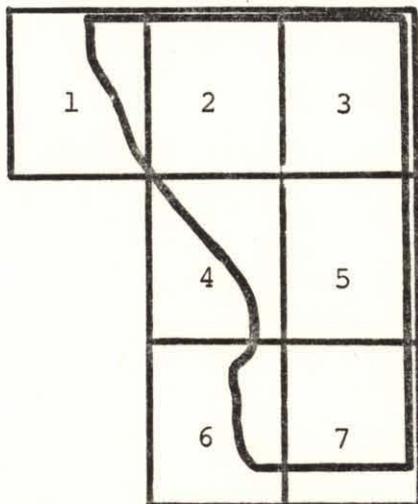
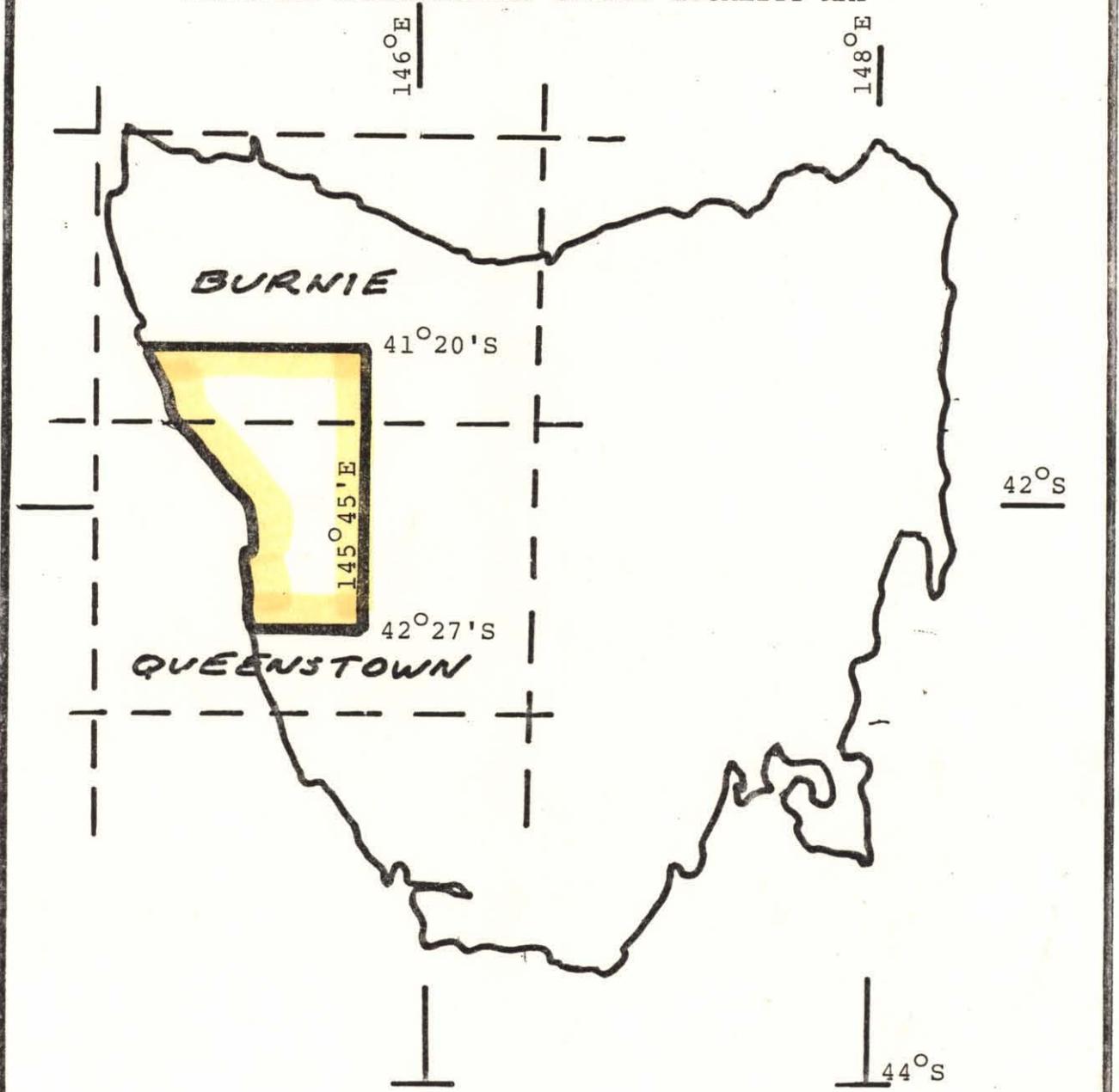
- (1) Tyennan Nucleus
- (2) Siluro-Devonian Sediments
- (3) Mt. Read Volcanics
- (4) Dundas Trough, including the Ordovician, Cambrian and Precambrian Formations
- (5) Arthur Lineament
- (6) Rocky Cape Region
- (7) Basic and Ultrabasic Intrusives
- (8) Plutonic Intrusives
- (9) Tertiary Volcanics

Each category will be discussed separately to demonstrate how the aeromagnetic results may be used to outline formations and identify any anomalous magnetic features. The locations of all magnetic features are shown on the accompanying Geophysical Interpretation Maps, Plates 1 to 7.

TYENNAN NUCLEUS

The aeromagnetic survey only covered a small section along the western boundary of the Tyennan Nucleus. The results show three dissimilar magnetic responses over the western section of this Precambrian formation, (Plates 5 & 7). Over the northern section, east of Rosebery, the results verify the older Precambrian metamorphic rocks to be non-magnetic. The western contact with

REGIONAL AEROMAGNETIC SURVEY LOCALITY MAP



SHEET INDEX



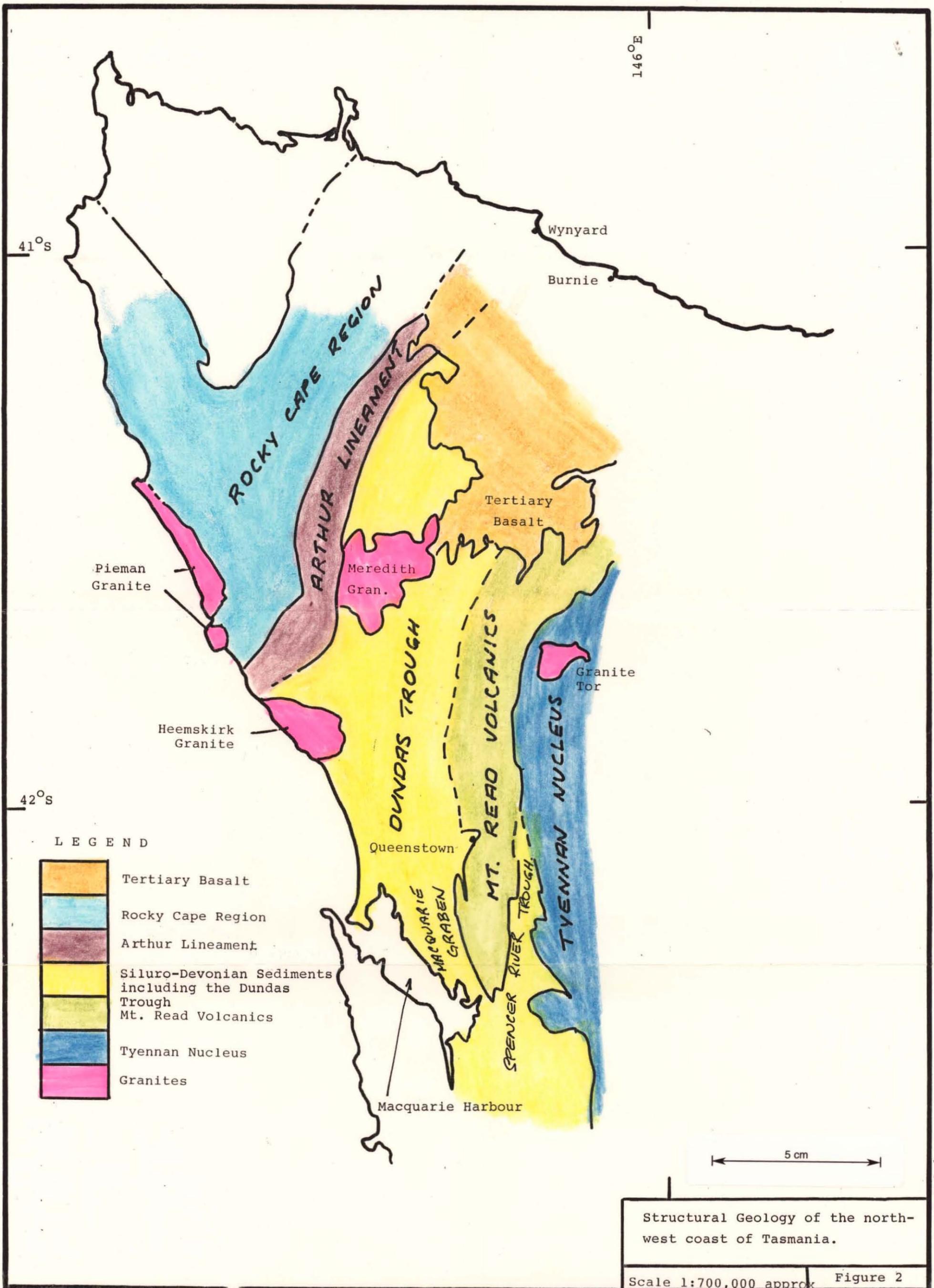
SURVEY AREA

- 1 Rocky Cape Region
- 2 Savage River
- 3 Waratah
- 4 Heemskirk
- 5 Queenstown
- 6 Strahan
- 7 Macquarie Harbour

5 cm

Survey location map and sheet index

Figure 1



146°E

41°S

Wynyard

Burnie

ROCKY CAPE REGION

ARTHUR LINEAMENT

Tertiary Basalt

Pieman Granite

Meredith Gran.

Heemskirk Granite

Granite Tor

DUNDAS TROUGH

MT. READ VOLCANICS

SPENCER RIVER TROUGH

TYENNAN NUCLEUS

Queenstown

MACQUARIE GRABEN

Macquarie Harbour

LEGEND

- Tertiary Basalt
- Rocky Cape Region
- Arthur Lineament
- Siluro-Devonian Sediments including the Dundas Trough
- Mt. Read Volcanics
- Tyennan Nucleus
- Granites

5 cm

Structural Geology of the north-west coast of Tasmania.

Scale 1:700,000 approx Figure 2

702010

the Mt. Read Volcanics is clearly defined as a magnetic gradient with the response increasing rapidly to the west (Figure 3). South of Mt. Romulus is an area of magnetic activity which is probably associated with tertiary basalt. There is a small area of the High Tor Granite intruding into the Tyennan Nucleus with no evidence of a magnetic aureole surrounding the plutonic intrusion, (Plates 3 & 5).

The second area of the Tyennan Nucleus covered by aeromagnetics is south east of Queenstown. Over this section there appear to be two rock types; a non-magnetic unit similar to the area east of Rosebery, and a slightly magnetic unit possibly associated with garnet bearing rocks (Corbett and Brown 1975). In this area the western contact with the younger Ordovician and Devonian rock cannot be traced by magnetic methods. It is possible to identify a number of north-west striking faults parallel to the Adamsfield Gravity Lineament, (Plates 5 & 7).

The south east of the survey area is the most magnetic of the three areas covered and the anomalies are probably due to amphibolites. The western contact with the Ordovician (June Group) and the Devonian (Eldon Group) can be traced magnetically.

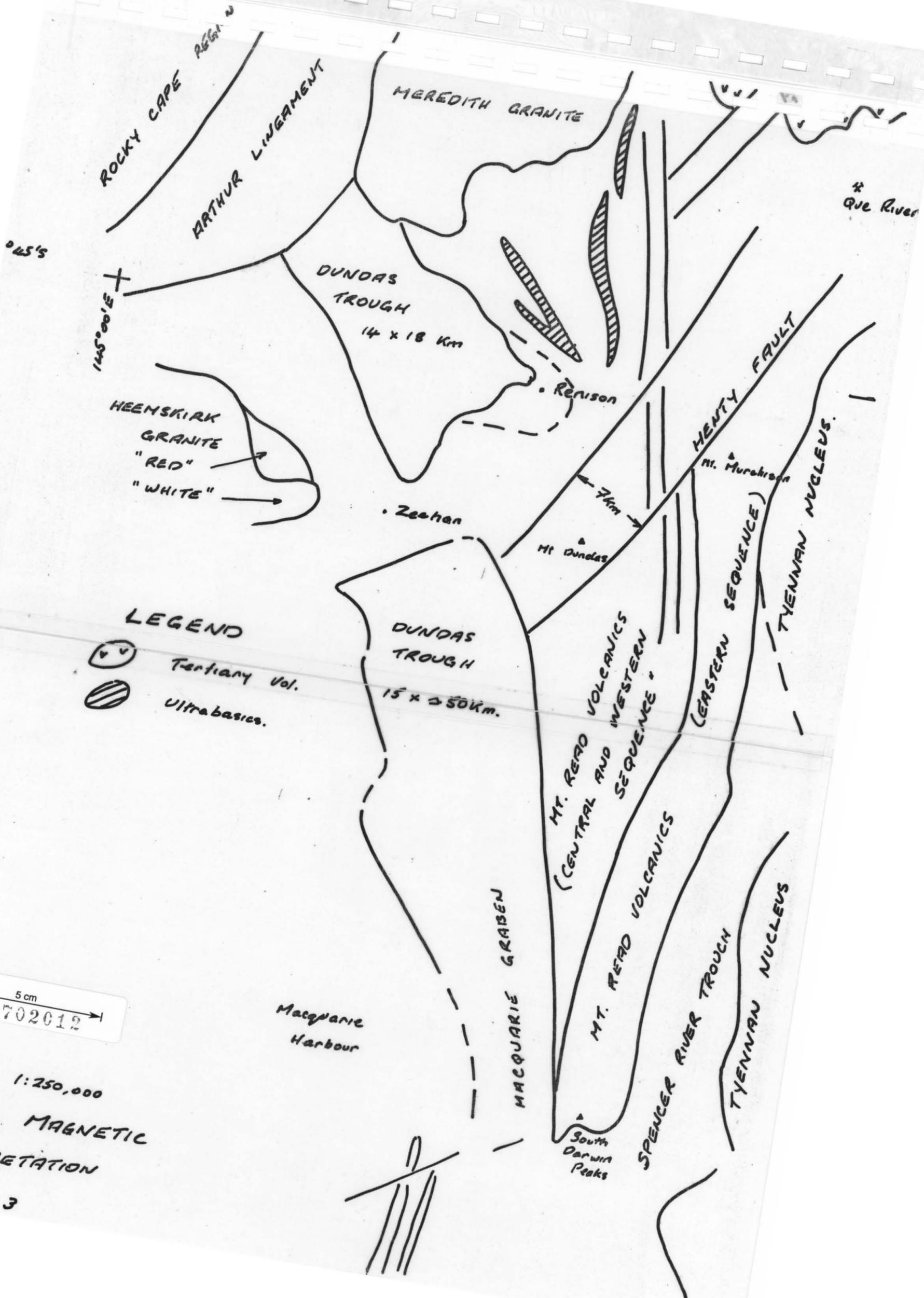
The sources of the two largest magnetic anomalies, which have a similar response, (Anomaly 10, Corbett et al (1982)) have been identified as garnet schist, amphibolite and eclogite.

The author is unaware of any exploration group which has investigated the Tyennan Nucleus for minerals, nor is there any open file data available over this area.

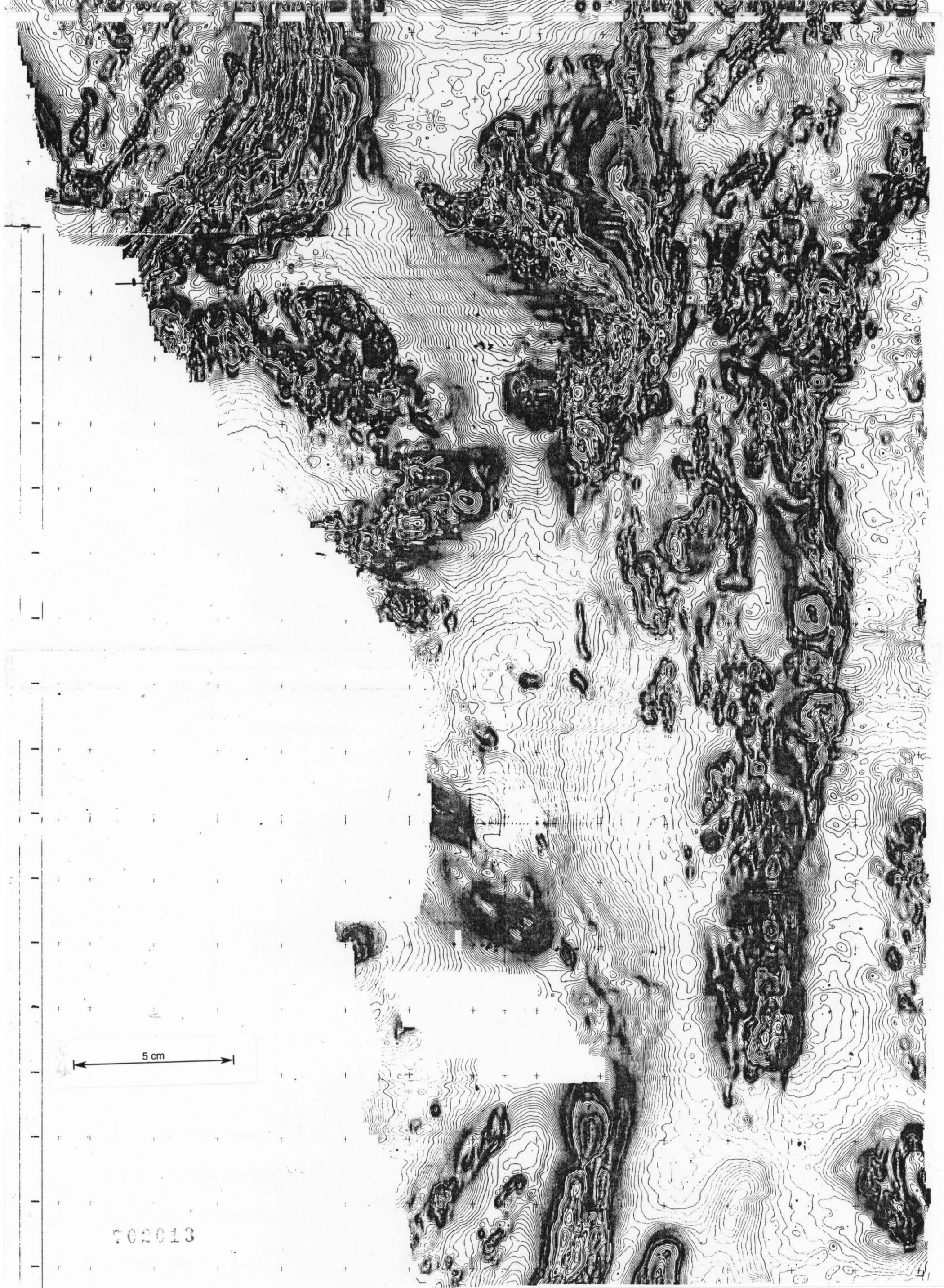
SILURO-DEVONIAN SEDIMENTS

The two main regions of Siluro-Devonian Sediments in the south of the survey area (Figure 2), are a zone east of the Mt. Read Volcanics, identified as the Spencer River Trough (new name), and a larger area west of the Mt. Read Volcanics known as the Macquarie Graben (Figures 2 & 3).

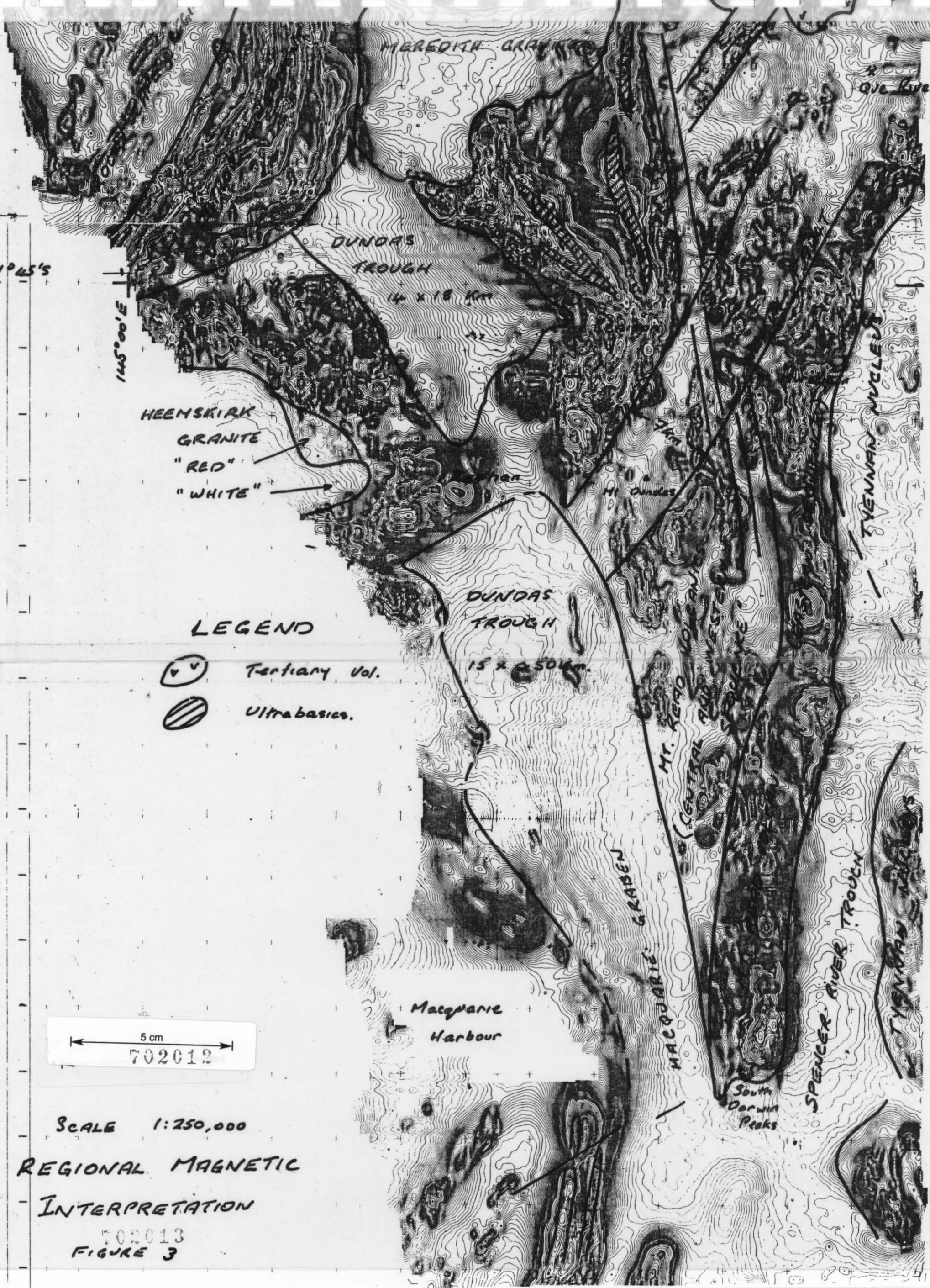
The Spencer River Trough is a non-magnetic synclinal formation or sedimentary trough between the Tyennan Nucleus to the east and the southern extent of the Mt. Read Volcanics to the west, (Plates 5 & 7). This syncline or trough, is composed of the Lower Devonian Eldon Group overlying the Ordovician June Group which includes the Owen Conglomerate. As mentioned previously, the contacts with the amphibolite phases of the Tyennan Nucleus can be defined as a magnetic boundary. Where the Spencer River Trough abuts the Mt. Read Volcanics there is a distinct magnetic gradient (Figure 3). It is not possible to accurately define the basement rock type underlying this formation however it is definitely not Mt. Read Volcanics. One possibility is that the basement is a non-magnetic phase of the Tyennan Nucleus, similar to the zone east of Rosebery.



REGIONAL MAGNETIC INTERPRETATION
 FIGURE 3



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HEREDITH GRABEN

Que. River

DUNDAS TROUGH

14 x 18 km

HEMSKIRK GRANITE
"RED"
"WHITE"

Ht. Dundas

TYENNAN NODULES

LEGEND

-  Tertiary Vol.
-  Ultrabasics.

DUNDAS TROUGH

15 x 50 km

MT. RENO

CENTRAL AUSTRALIAN RANGES

GRABEN

MACQUARIE

SPENCER RIVER TROUGH

TYENNAN NODULES

Macquarie Harbour

South Darwin Peaks

5 cm
702012

SCALE 1:250,000

REGIONAL MAGNETIC INTERPRETATION

702013
FIGURE 3

Corbett et al (1982) did not identify any magnetic anomalies over this area which warranted description.

Although the area is currently held under EL. 9/80 there is no geophysical data available on open file.

The second area of Siluro-Devonian Sediments is part of the Macquarie Graben system, (Figures 2 & 3), where the magnetic data reflects a deep sequence of non-magnetic sediments, (Plates 4, 5 & 7). There are two isolated highs at Rinadeena, Zone 21, Corbett et al (1982), with the only explanation given as possible Ordovician limestone-shale.

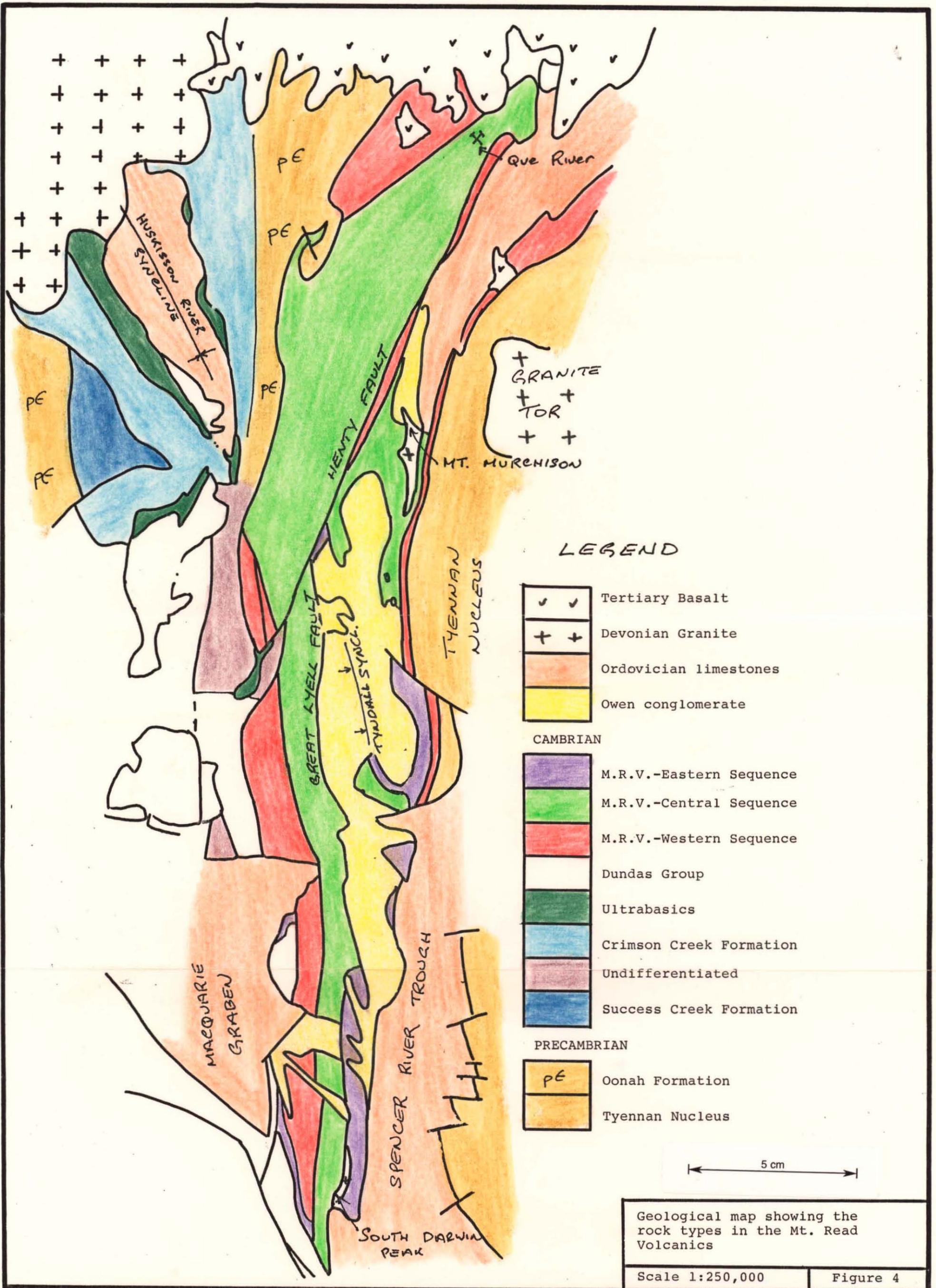
MT. READ VOLCANICS

The Mt. Read Volcanics have been described by Corbett (1979 & 1981).

"The general distribution of volcanic rock types in the belt between South Darwin Peak and Que River is now fairly well known from recent mapping. A broad subdivision can be made into three major groups or lithofacies, namely: a main central volcanic belt, 9 to 12 km. wide; a flanking belt of volcanic-sedimentary sequences on the western side; and a belt of mixed volcanics and volcanoclastic conglomerates (the Tyndall Group) which overlies the central belt and is best developed along its eastern flank in the southern half of the belt", (Figure 4).

"The central belt consists dominantly of massive rhyolites and dacites, with lesser andesites and only minor sedimentary rocks. It contains the bulk of the volcanics and most of the known mineralisation. Although locally the belt is very complex, the rocks show considerable uniformity on a regional basis."

The regional magnetic data over the Mt. Read Volcanics (Figures 3, 15 & 16), shows that the subdivision into Eastern, Central and Western Sequences is too simplistic, (Plates 3, 5 & 7). On a regional basis there are two distinct magnetic provinces; the first, north and north-west of the Henty Fault and the second south of the fault. This subdivision may be important as the majority of the lead-zinc ore bodies are north of the fault with the major copper deposits south of the linear. The northern zone is a relatively non-magnetic belt, 7 kilometres wide and extending from Que River to Mt. Dundas. There are a number of small magnetic anomalies in this zone which do not correlate with the known mineralisation. It is not possible to recognise a magnetic distinction between the Central and Western Sequences in this area. There are no Eastern Sequence rocks mapped north of the Henty Fault. South of the Henty Fault the Mt. Read Volcanics



have a different magnetic signature. Over this zone the subdivision into Eastern, Central and Western Sequences can be partially recognised in the aeromagnetic data.

The area mapped as Eastern Sequence (Corbett 1981), (Figures 3 & 4) can be traced as a magnetic high zone with large amplitude anomalies often exceeding 3000nT over a 3 kilometres wide belt, (Plates 5 & 7). The magnetic zone is more extensive and can be traced under the non-magnetic Owen Conglomerate.

Corbett et al (1982) identified seven zones of magnetic activity warranting discussion:

Zone 22 South Darwin Peak to King River; correlates with Central Sequence rhyolite which has associated magnetite-hematite veins and patchy copper sulphides. A secondary peak to the east of the main anomaly correlates with the eastern margins of the Darwin Granite. It has been concluded that the main sources of the anomalies are magnetite-hematite volcanics and epiclastic rocks. This area will be discussed in detail at a later stage integrating the airborne magnetics, electromagnetic data and I.P. data, Ruddock (1974).

Zone 27 Mt. Owen to Mt. Lyell; correlates with two large Owen Conglomerate bodies forming Mt. Owen and Mt. Lyell. Elsewhere the Owen Conglomerate is non-magnetic therefore it is difficult to accept the explanation that the source of the magnetic response is volcanoclastic conglomerate. The source of these anomalies is possibly beneath the conglomerate and similar to Zones 22 and 28.

Zone 28 Mt. Sedgwick; has been identified as a magnetite-hematite felsic volcanic rock. The smaller anomaly to the south of the Zone was identified as Darwin type magnetite veins. The larger anomaly in the north correlates with a quartz-feldspar porphyry sequence. The younger dolerite dyke in the area did not give a recognisable response however this may have been masked by the larger anomalies. The Mt. Sedgwick anomaly has been interpreted as having a source at depth and no association with the Owen Conglomerate.

Zone 29 Lake Dora to Rolleston; a magnetic zone identified as either magnetite-hematite veins or an intrusive porphyry east of Lake Dora.

Zone 34 Lake Julia to Red Hills; is a magnetic zone west of the main axis of the Eastern Sequence however it has a similar response to Lake Dora and warrants inclusion in this area. The source of the anomalies at Red Hill has been identified as magnetite bearing rhyolite.

Zone 35 Lake Selina to Mt. Murchison; is a magnetic region identified as a felsic volcanic rock or granitic intrusions.

Zone 36 Mt. Murchison to Mt. Farrell; has a series of magnetic highs which follow a belt of Murchison Granite. North of Mt.

Murchison the source of the anomalies is attributed to magnetite-bearing rhyolites. The arcuate magnetic anomaly south-east of Mt. Farrell is interpreted as granitic in origin. These two anomalies are similar in character and the source of the Mt. Murchison response could be identical to the Mt. Farrell anomaly.

In the author's opinion there is a common source for the magnetic anomalies associated with the Eastern Sequence of the Mt. Read Volcanics. The explanation given by Corbett et al (1982) for many of the anomalies is volcanoclastic conglomerate, but it is unusual for magnetic conglomerates to have clean magnetic anomalies. A large amount of noise would normally be associated with the remnant magnetic components retained in the rocks which are randomly orientated throughout the conglomerate. The second source of magnetic anomalies has been identified as a Darwin type rhyolite, with detail mapping by Ruddoch (1974) supporting this interpretation. The third source is magnetite-hematite veins. The final source is the presence of an intrusive body, such as the porphyry body at Lake Dora or a magnetic granite as is the case at Mt. Murchison.

The magnetic data over this belt stretching from Mt. Farrell in the north to South Darwin Peak in the south is extremely consistent. It is broken up into discrete zones however, the breaks correlate with major faults identifiable in the magnetics striking north-west (eg. the Adamsfield Gravity Lineament). The width of the magnetically anomalous zone is consistent at 2.5 kilometres and the anomalies all have a similar amplitude. If the sources of these anomalies are similar then the model proposed is based upon a younger intrusive system, either a granite (eg. Murchison or Darwin Granites) or a porphyry system (eg. Lake Dora) intruding this belt. These intrusive bodies are the source of the quartz-magnetite-hematite veins.

The Central Sequence of the Mt. Read Volcanics is not as magnetic as the Eastern Sequence although there are small amplitude and short wavelength anomalies present. These responses may be of importance as they coincide with part of the currently recognised mineralisation. One of the larger amplitude magnetic anomalies in the Central Sequence correlates with a basic to intermediate intrusive at Great Lyell Mines, Corbett (1979). A similar source is located at 382000E and 346000N, 7.5 kilometres north of the Lyell anomaly, (Plate 5).

Five anomalous Zones were identified by Corbett et al (1982).

Zone 24 Mt. Huxley to Whip Spur; has a number of small amplitude anomalies generally described as felsic-intermediate volcanic rocks. Further to the south near Mt. Jukes are similar magnetic anomalies in the Central Sequence correlating with quartz-feldspar porphyry dykes.

Zone 26 Queenstown to Lake Margaret; incorporates a zone of small

amplitude magnetic anomalies identified as various volcanic and intrusive units.

Zone 33 Mt. Geikie to Mt. Read; has a variable magnetic response with no large amplitude anomalies. The source of the responses has generally been described as various volcanic units plus a number of shale lenses north of the Hercules Mine.

Zone 38 Rosebery, Tullah and Bastyan Dam Area; includes a number of small anomalies, the sources of which have not been identified.

Zone 41 Que River Mine; is a small, isolated magnetic high identified as the contact between the Owen Conglomerate and the Mt. Read Volcanics. This explanation is highly unlikely as the contact has not been evident elsewhere. It is probable that the source of the anomaly is an outlier of tertiary basalt.

The Western Sequence of interbedded volcanic and sedimentary rocks is sporadically magnetic. The typical response is a linear magnetic anomaly with a strike length of several kilometres. This region abuts a non-magnetic formation and the termination of the linear anomalies can be used to trace the contact between the western Mt. Read Volcanics and the Dundas Trough.

East of the Great Lyell Fault, (Plate 5), is a non-magnetic zone which correlates with the Owen Conglomerate or the Tyndall Anticline, (new name-Plate 5). The magnetic data shows that east of the anticline axis there is a steep magnetic gradient associated with the Eastern Sequence. West of the anticline axis the magnetic data is free from any disturbance and is characteristic of a graben structure filled with non-magnetic sediments. Qualitative estimates of this interpreted graben indicate the depth of sediments to be considerable.

Corbett (1979) proposed a volcanic model in the South Queenstown area based upon a series of roughly circular caldera similar to the San Juan area in North America. Although this model has some geological basis there are no supporting magnetic structures such as ring dykes, which could be interpreted as being associated with a caldera model. This model may fit the Eastern Sequence and explain the consistent magnetic signature which has been interpreted as an intrusive system in a rift zone 2.5 kilometres wide.

Four magnetically anomalous zones were identified over this area by Corbett et al (1982).

Zone 23 Lower Queen River; has been identified as mafic-intermediate volcanic rock possibly including basalt.

Zone 25 Lynchford; is an isolated magnetic high correlating with Comstock Tuff. This anomaly warrants investigation as it is representative of a number of anomalies at the margins of the Macquarie Graben.

Zone 39 Mt. Kershaw-Boco Area; is a series of linear features striking north-east which have been identified as either andesite or a folded sequence which includes a magnetic horizon.

Zone 40 Mt. Block and Mt. Charter; has been attributed to andesite however, it was pointed out that the same andesite at Que River had no magnetic response and that the younger dolerite at Mt. Charter also failed to give a magnetic anomaly. The source of these anomalies should be grouped with Zone 38.

To summarise, the magnetic results over the Mt. Read Volcanics have a close relationship with the geology. The Eastern Sequence is the most magnetic and can be traced as an almost continuous belt 2.5 kilometres wide extending from South Darwin Peak in the south, to where it is terminated by the Henty Fault. North-west of the Fault the magnetic signature of the Mt. Read Volcanics changes and there are no large amplitude anomalies similar to the Eastern Sequence recorded over this area. The Central and Western Sequences are less magnetic and the boundaries cannot be traced accurately from the magnetics. A model has been proposed to explain the magnetic anomalies over the Eastern Sequence and this should only be considered as a possible alternative.

THE DUNDAS TROUGH

The Dundas Trough has been described by many authors including a review by Solomon (1981).

"The Dundas Trough system developed along the northern and western margins of the Tyennan Geanticline by extension of the Precambrian crust. The trough was initially filled with a sandstone-shale-carbonate sequence (Success Creek Group), then by mudstone, lithic wacke, and basalt (Crimson Creek Formation) and finally by a succession including mudstone, lithic wacke conglomerate and minor volcanic rock (the Dundas Group, of early Middle to late Cambrian age). The early phase of extension probably produced rift structures floored by basalt crust (oceanic crust) and mantle, and during later movements (Dundas Group time) dismembered and serpentinized ophiolitic material was thrust into the sediments of the trough and locally eroded."

The eastern boundary of the trough is an interbedded sequence of Mt. Read Volcanics and sedimentary rocks. The western boundary of the trough is not clearly defined in the literature. Solomon (1981) shows the Arthur Lineament as the western boundary whereas Hutchinson (1979), extends it further to the west to the Rocky Cape Region. For the purpose of this discussion the western boundary will be the Arthur Lineament, (Figures 2 & 3), (Plate 2).

In this review the Dundas Trough basically includes the Ordovician, Cambrian and Precambrian systems which form a belt of

rock extending from Macquarie Harbour to the southern boundary of the Meredith Granite. Also included are a number of small areas, such as the wedge of Precambrian east of Mt Ramsay and the area surrounding Mt. Bischoff.

The magnetic results over the Dundas Trough (Figure 3) show the composition to be basically non-magnetic. Two main non-magnetic areas have been mapped; a block 14 x 18 kilometres extending north-west from a line joining Renison and Zeehan, which includes the triangular wedge of the Success Creek Group west of Renison and the older Precambrian Oonah Quartzite. These two rock types make up the base of the Dundas Trough. The second non-magnetic block is a larger area 15 x approximately 50 kilometres from Zeehan to the southern end of Macquarie Harbour. This block includes the youngest formation in the Dundas Trough, the Dundas Group. Elsewhere, the Dundas Trough is overlaid by Ordovician Gordon Limestones and Siluro-Devonian Eldon Group all of which are non-magnetic.

The only slightly magnetic formation in the Dundas Trough is the Crimson Creek Formation where it abuts the Success Creek Group near Renison. The magnetic data over the Crimson Creek Formation is confused by the presence of large amplitude anomalies due to serpentinites in the adjoining areas. Where the Crimson Creek Formation is in contact with the Meredith Granite near Mt. Lindsay, (Plates 2 & 3), there is an area of intense magnetic activity which has the appearance of a number of highly metamorphosed arcuate aureoles or skarns similar to those along the northern contacts of the granite. The area surrounding Mt. Lindsay has been mapped in detail by Brown (1982) and no lithological units are shown which could explain the magnetic activity. The contact between the Crimson Creek Formation and the Success Creek Formation, the red chert and mudstone subgroup of the Renison Bell Formation, can be traced magnetically as a small amplitude anomaly extending from Renison Bell to Mt. Lindsay, (Plates 2 & 5). The magnetic activity in the area near Mt. Lindsay could be described as a skarn-type response and if this is the case the granite probably extends under the Mt. Lindsay portion of the Crimson Creek Formation. Corbett et al (1982) did not identify any magnetic features in the area warranting description.

The mapping by Brown (1982) has identified a belt of Crimson Creek Formation east of the Meredith Granite and extending to the south, west of Rosebery. The portion of Crimson Creek Formation east of Mt. Ramsay has a similar magnetic response to the Mt. Lindsay area and could be interpreted as a skarn type response, (Plate 3). In this area Corbett et al (1982) identified Zone 48, east of Mt. Ramsay, and the source of the magnetic response was attributed to Devonian hornfels or skarn in a Cambrian Sedimentary Sequence.

The wedge of Precambrian east of Mt. Ramsay has no magnetic signature although the contact with the newly mapped Crimson Creek Formation is clearly defined. The small belt of Precambrian

formation surrounding Mt. Bischoff, (Plate 3), is non-magnetic however this area is too small for the author to be certain that there is not some activity which is masked by the anomalies associated with the enclosing formations. The tertiary basalt to the north-east could confuse the magnetic interpretation of the area.

There are eight magnetic anomalies over this area which Corbett et al (1982) have described.

Zone 11 3 km north of Kelly Basin; an isolated magnetic high in the Gordon Limestones with a probable source of a buried extension of Western Sequence of the Mt. Read Volcanics.

Zone 12 Pine Cove Creek; an oval shaped magnetic high which correlates with a basalt outcrop.

Zone 15 Tully River; a cluster of anomalies which have been interpreted as dolerite boulders in Tertiary beds. These anomalies should be identified on the ground as the dolerite boulder explanation is difficult to accept.

Zone 16 Badger River; a circular region of magnetic activity which correlates with a younger dolerite. The area was equated to Zone 54 Northridge Creek and Pieman River; which have a similar magnetic response over a dolerite.

Zone 17 Bottle Creek; was not positively identified. This anomaly should be located on the ground.

Zone 18 Melody Creek; was identified as a felsic volcanic rock. This anomaly is similar to Zone 19 and both warrant field investigation.

Zone 19 Professor Range; has not been identified however, detrital magnetite in sandstone has been suggested. A Turair electromagnetic anomaly was recorded over the south of this linear feature, Howland-Rose (1973), however the response was not investigated. The magnetic anomaly turns back on itself to the north suggesting a possible anticlinal structure, (Plate 5). Parallel to the magnetic anomaly and displaced 500 metres to the north-east, a Turair electromagnetic conductor was recorded during the same survey. These conductors were rated poorly although it is possible that the survey flight line direction, which was east-west, did not couple with the conductors to give a good response. The anticlinal interpretation of the magnetics would infer a shallow dip to the north-east. This area may warrant reviewing.

Zone 50 North-west of Melba Flats; an area of poor outcrop and at present the source of the magnetic anomalies has been tentatively interpreted as basalt or gabbro. This Zone has a dissimilar response to the ultrabasics at Serpentine Hill and Razorback, and although the area has been held by numerous exploration groups the source has not been tested.

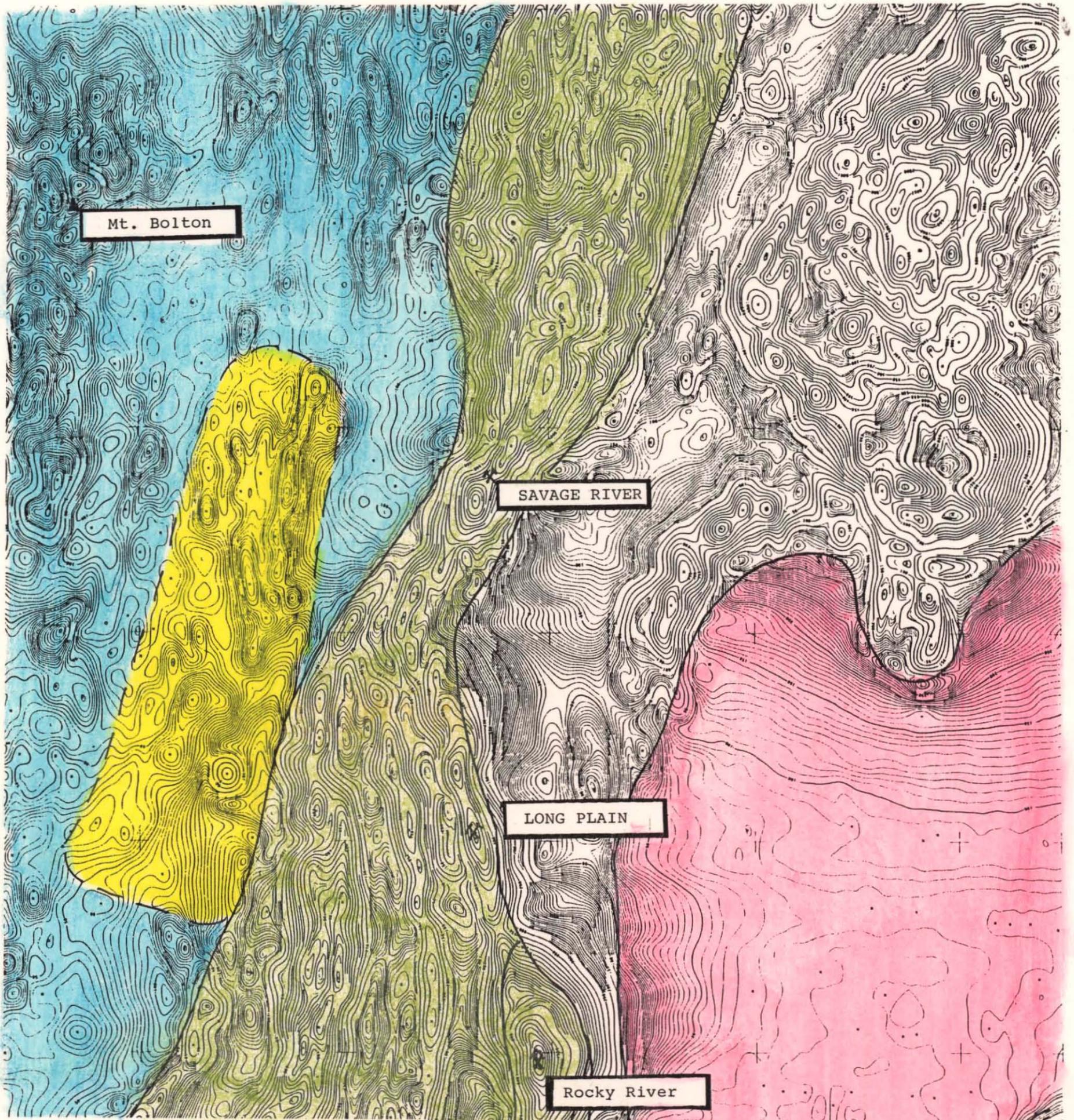
It is interesting to note that there are a number of isolated magnetic anomalies, including Zones 11, 12, 15, 17, 18, 19 and 21, around the edge of the Siluro-Devonian basin south-west of Queenstown, which have not been adequately explained. One or two of these should definitely be investigated on the ground. These results should be compared to those from Zone 25, the Queenstown Lynchford anomaly, as both responses are located on the margins of the Macquarie Graben.

ARTHUR LINEAMENT

The geology of the Arthur Lineament has been described by Williams & Turner (1974) and Williams (1979), as a sequence of metamorphic rocks 8 to 15 kilometres in width, extending from near Wynyard on the north coast, to the south-west. It consists mainly of pelitic schists and amphibolites which reach metamorphic grades of middle greenschist facies. The Arthur Lineament parallels the north-east fold trend of the Rocky Cape Region and is considered to be the result of shearing and associated metamorphism caused by the eastward movement of the western orthoquartzite-mudstone units during the Penguin Orogeny.

The magnetic data over the Arthur Lineament (Figure 5), demonstrates a series of characteristic magnetic linears, striking 30 degrees east of north, which are assumed to be due to amphibolites in the formation. Over the magnetite mineralisation at Savage River the amplitude of the magnetic response is greatly increased and this anomaly can be traced 9 kilometres to the north. The boundary of the Arthur Lineament, as defined from the magnetic data, varies slightly from the boundary mapped geologically, (Plate 2). The magnetic boundary shows the Arthur Lineament to pinch into a sequence 1 kilometre wide at Savage River. East of Savage River the rock types change from magnetic to non-magnetic. The large amplitude magnetic anomalies can be traced from Savage River, through Long Plains to the Rocky River Prospect.

The author's preliminary interpretation defines a synclinal structure, of relatively symmetrical linears either side of an axis through the centre of the zone. The symmetry may be associated with an old folded system. There are a number of magnetic features which can be recognised in the synclinal model, eg. estimates of the dip indicate that the magnetic sources have a near vertical inclination. A zone of major tectonic activity is located 2 kilometres south of the Savage River mine which is in the keel of the syncline. The tectonic activity has uplifted the keel of the syncline almost to the surface and it was sheared by



- Meredith Granite
- Arthur Lineament
- Rocky Cape Region
- EM Conductive Zone, Neale (1974), black graphic shales

5 cm

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Aeromagnetic data over the
Savage River and Rocky Cape
Formations

Scale 1:100,000	Figure 5
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a tensional stress in a north-easterly direction. A secondary shear zone can be recognised north of the Rocky River Prospect which correlates with the Cleveland Gravity Lineament. This probably indicates a correlation between the tectonic event and the emplacement of the Meredith Granite.

Corbett et al (1982) made no attempt to identify any specific magnetic feature over this area and included all responses in Zone 55, Lower Pieman and Savage River. It was noted that the peak amplitude exceeded 10,000nT and that the sources of the anomalies were magnetite lenses, amphibolites and basic volcanics.

ROCKY CAPE REGION

The geology of the Rocky Cape Region has been described by Williams & Turner (1974), as comparatively unmetamorphosed laminated mudstones, with occasional pyrite-rich horizons and orthoquartzite sequences of super-mature pure quartz sands. The deformation of the Rocky Cape Region is attributed to the Penguin Orogeny of Upper Proterozoic age. This produced a series of north-east striking folds intruded by sodic dolerite dykes.

The aeromagnetic data over the Rocky Cape Region (Figure 5), consists of a series of approximately northerly striking small amplitude anomalies superimposed on a relatively non-magnetic background (Plates 1 & 2). The magnetic anomalies correlate with the dolerite dykes which have been mapped at Mt. Bolton and it is probable that the remainder of the anomalies over the Rocky Cape Region are due to dolerite intrusives. One of the most pronounced magnetic linears in the Rocky Cape Region is an anomaly striking slightly west of north coincident with the Lindsay River or Balfour Trend. There are no dolerites mapped in this area at present. The western contact of the Rocky Cape Region, where it abuts the Pieman Granite, is defined by the cessation of the magnetic linears, (Plate 1).

Two magnetic anomalies were identified by Corbett et al (1982). The first was Zone 56 Pieman Heads, which was attributed to hornfels at the margin of the Pieman Granite; and the second, Zone 57 Interview Rock and Norfolk Range area, is typical of the entire Rocky Cape Region. The sources of the anomalies were identified as either siltstone sequences or dolerite dykes. This area was flown by INPUT, Neale (1974), and a number of EM anomalies were recorded. The majority of these were located between the Donaldson River and the Arthur Lineament. The follow-up of the anomalies identified approximately 50% of the conductors and all were due to black graphic shales. Neale (1974) concluded that the remaining 50% of the EM conductors would have a similar source. The concept behind this survey was sound however, it would appear to have been poorly implemented. The flight line spacing was too large (750 metres), in areas the aircraft was at an altitude of 200 metres (120 metres specified) and the control of the flight navigation and recovery was over uncontrolled mosaics with bad joins. All these miscalculations

obviously combined to create problems when identifying the EM conductors in the field. The results of the survey should not be seriously considered when evaluating the area.

BASIC AND ULTRABASIC INTRUSIVES

A number of ultrabasic and basic complexes have been emplaced within the area extending from Cleveland to south of Macquarie Harbour. The largest complex occurs near Mt. Cleveland and Bald Hill and consists of orthopyroxenite, peridotite and dunite, with interstitial plagioclase, (Plate 2). The ultrabasic rocks are associated with basaltic and dacitic volcanic rocks which are intruded by dolerite dyke swarms. The magnetic data over this area is extremely complex (Figure 6), and although the major rock types can be outlined it is not possible to trace individual features, such as dykes or sills. In some areas the ultrabasic bodies tend to follow the contact of the Meredith Granite and at times could be interpreted as contact aureoles or skarns (Figure 7). The aureole-type ultrabasic bodies cut across the radial dykes which are believed to be associated with the Mt Bischoff porphyry system, thereby masking any response which could be interpreted as a magnetic link between the Meredith Granite and the Mt. Bischoff porphyry (Plate 3).

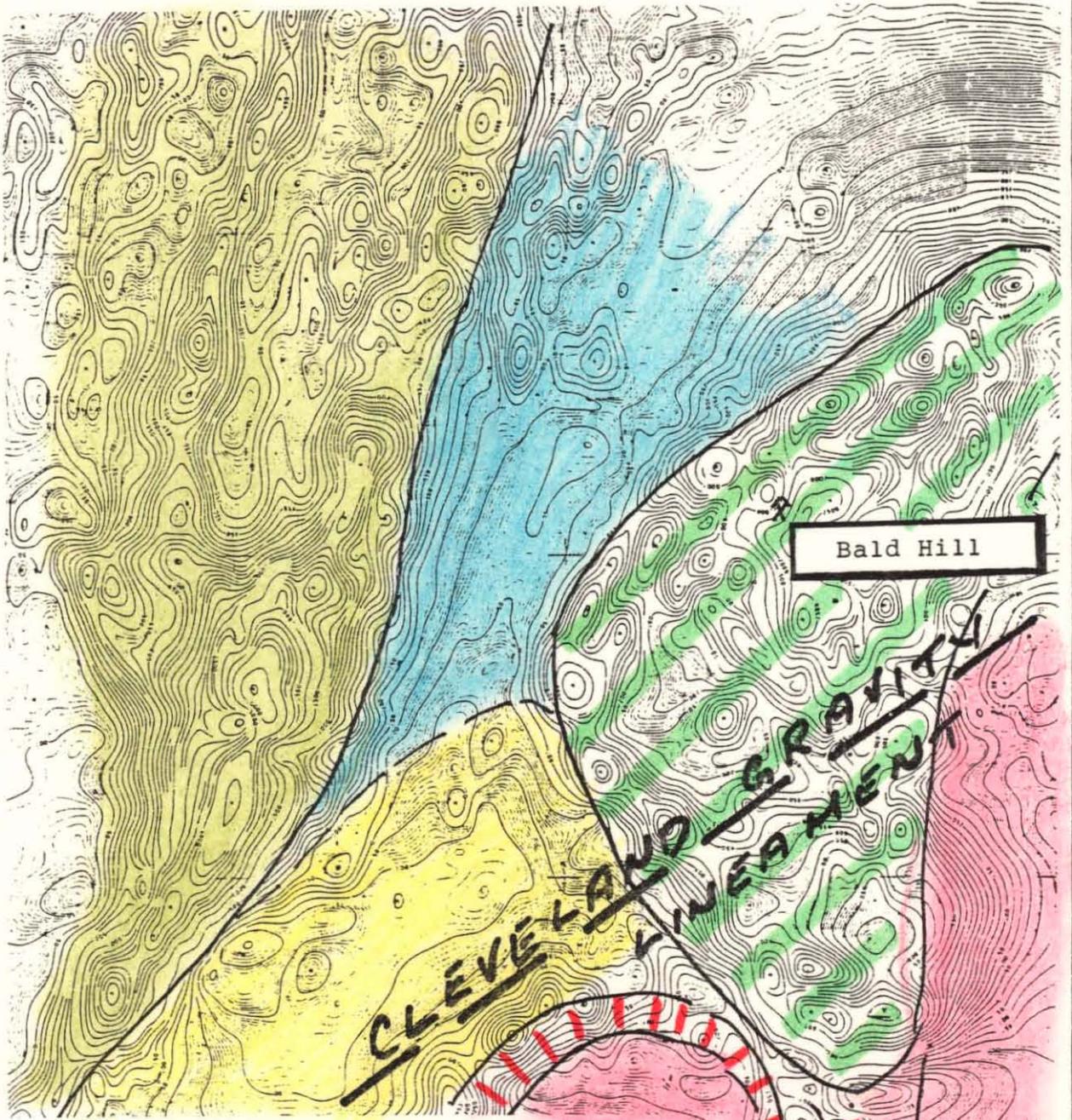
Over this area Corbett et al (1982) have described five magnetic features:

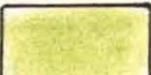
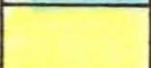
Zone 58 Bald Hill area; is a large, complex, magnetically active zone in which the sources of the larger anomalies have been attributed to ultramafic bodies.

Zone 59 Lower reaches of the Whyte River; is a 5 kilometre belt described as Devonian hornfels. This anomaly has the Meredith Granite to the east and a belt of non-magnetic Arthur Lineament to the west. The area is magnetically similar to Mt Lindsay and the source of the magnetic anomaly may also be a skarn. The non-magnetic portion of the Arthur Lineament is similar to the area surrounding Mt. Bischoff and Cleveland. The gravity data over this region, to be discussed at a later stage, shows that the area is located on the intersection of two major gravity lineaments (Plate 2). Such sites are ideal for the intrusion of granitic bodies. This area definitely warrants following up, firstly to identify the source of the magnetic anomaly, and then to map the area west of the magnetic linear.

Zone 60 Mt. Stewart; is a complex area and without more detail data it is difficult to positively identify any structures. The presence of ultramafic rocks in the area explains the larger anomalies, which may mask the more subtle effects.

Zone 61 Luina area; a large amplitude anomaly which has been identified as basalt. The magnetic survey carried out by Keunecke and Tate (1954) isolated a number of large amplitude anomalies (greater than 2500nT vertical field) on the ground directly associated with the mineralisation. In the area near Cleveland it

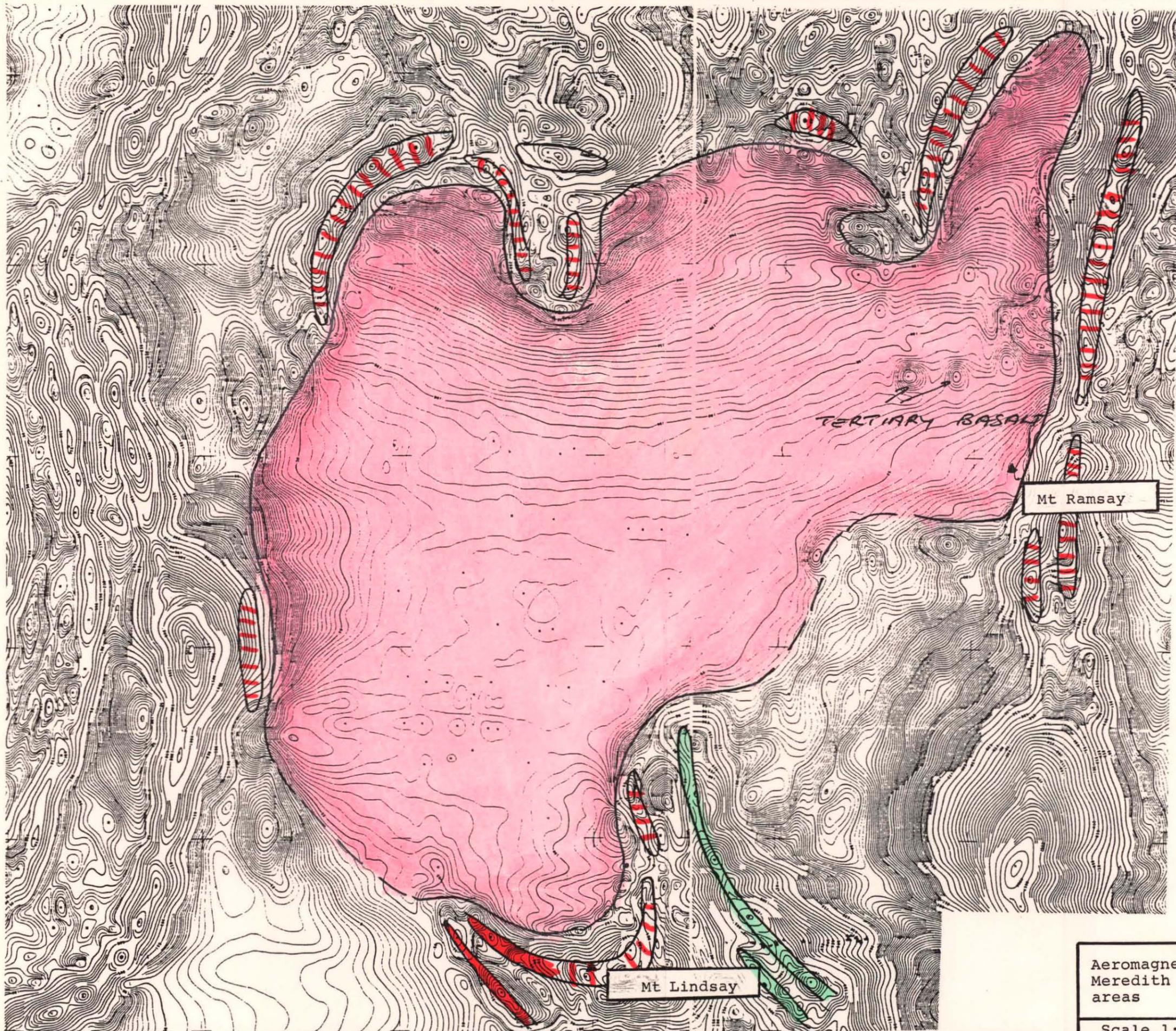


-  Bald Hill-Cleveland Ultrabasic complex
-  Arthur Lineament
-  Magnetic Skarn
-  Dundas Trough
-  Prospective area
-  Meredith Granite

Aeromagnetic data over the Bald Hill-Cleveland Ultrabasic Complex

5 cm

Scale 1:100,000 | Figure 6



- Meredith Granite
- Ultrabasic Aureole
- Wilson River Serpentinite
- Stanley River magnetic and EM zone

5 cm

Aeromagnetic data over the Meredith Granite and surrounding areas

Scale 1:100,000 Figure 7

would be remiss to assume that all anomalies were due to basalt. The smaller magnetic features around the edge of the non-magnetic zone north of Cleveland may warrant investigation.

Zone 62 Magnet Dam, Wombat Flat and Mt. Ramsay area; has a large amplitude, arcuate magnetic anomaly due to hornfels or Cambrian basalt surrounding the contact of the Meredith Granite. The source of this anomaly will probably never be identified as the area is covered by magnetic Tertiary basalt.

The Serpentine Hill Complex, (Figure 8), 8 kilometres north-east of Zeehan, is representative of a number of ultrabasic bodies in the Zeehan and Renison area (Plates 4 & 5). The Serpentine Hill Complex, previously worked for asbestos, consists of orthopyroxenite, harzburgite, serpentinite, gabbro, dolerite and basic volcanic rocks. The area has been mapped in detail by Brown (1982) who identified a number of fragmented serpentinite and gabbroic bodies in this area which are confirmed by the magnetic data.

Corbett et al (1982), included all the magnetic anomalies in one group, Zone 43 Dundas to Pieman River. The sources of the magnetic responses were assigned to ultramafic rocks, Devonian mineralisation and hornfels. The 500nT magnetic anomaly over the Renison Bell mineralisation has been interpreted as massive pyrrhotite. This may be over simplifying the interpretation as the anomaly is probably part of a larger source 1.5 kilometres long striking south-west from Renison Bell. In this area it will be important to identify the source of the airborne anomaly and to establish the relationship with the mineralisation.

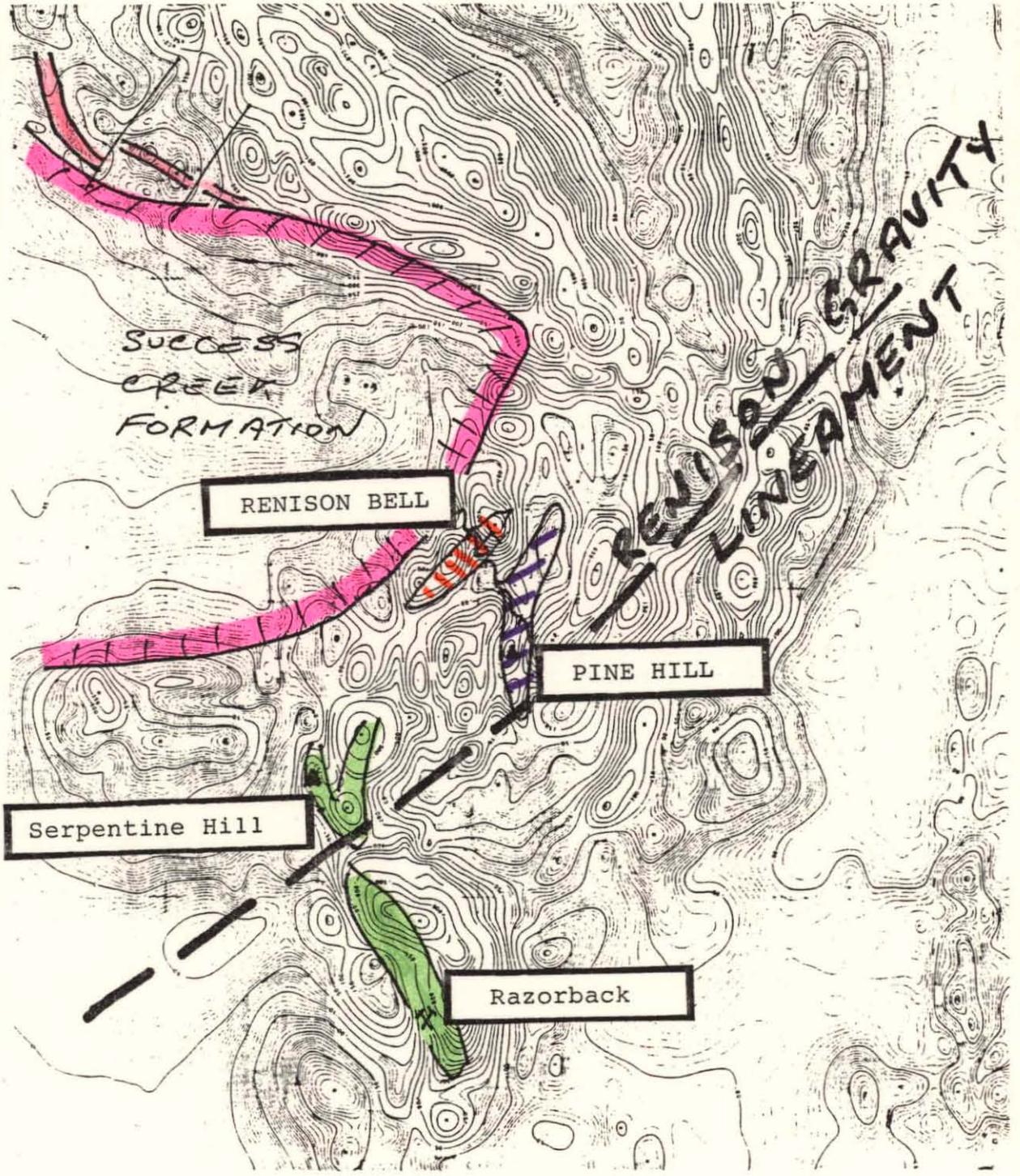
North of Renison Bell a major magnetic contact has been plotted (Plate 5). This contact separates the normally magnetised ultrabasic bodies in the Huskisson River Syncline from the remnantly magnetised ultrabasics south-east of Renison Bell.

The ultrabasic bodies west of Zeehan, (Figure 9), have similar large amplitude magnetic anomalies however, in this area it would appear that the ultrabasics are far more extensive than the outcrop indicates (Plate 4). Corbett et al (1982) identified Zone 51 Trial Harbour to Zeehan area; as an anomalous zone. This area is composed of a wide variety of complex rock types including Precambrian, Cambrian, Ordovician and Siluro-Devonian, plus an intrusive granite, ultramafics and basalt. The larger anomalies are obviously due to the ultramafics while the smaller responses could be due to any number of sources.

The magnetic anomaly at Razorback (Figure 8) shows a crescent shaped feature coincident with the mapped outcrop of ultrabasics.

Further to the south the Macquarie Harbour serpentinites indicate a northerly striking magnetic zone coincident with the mapped ultrabasics. This zone extends to the north under Macquarie Harbour and then swings west under Strahan (Figure 10). The

5 cm



Renison magnetic high
Pine Hill magnetic low



Serpentine Hill ultrabasic.

~ ~ ~ Bassett-Federal Fault

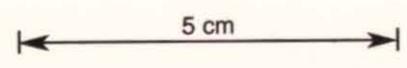
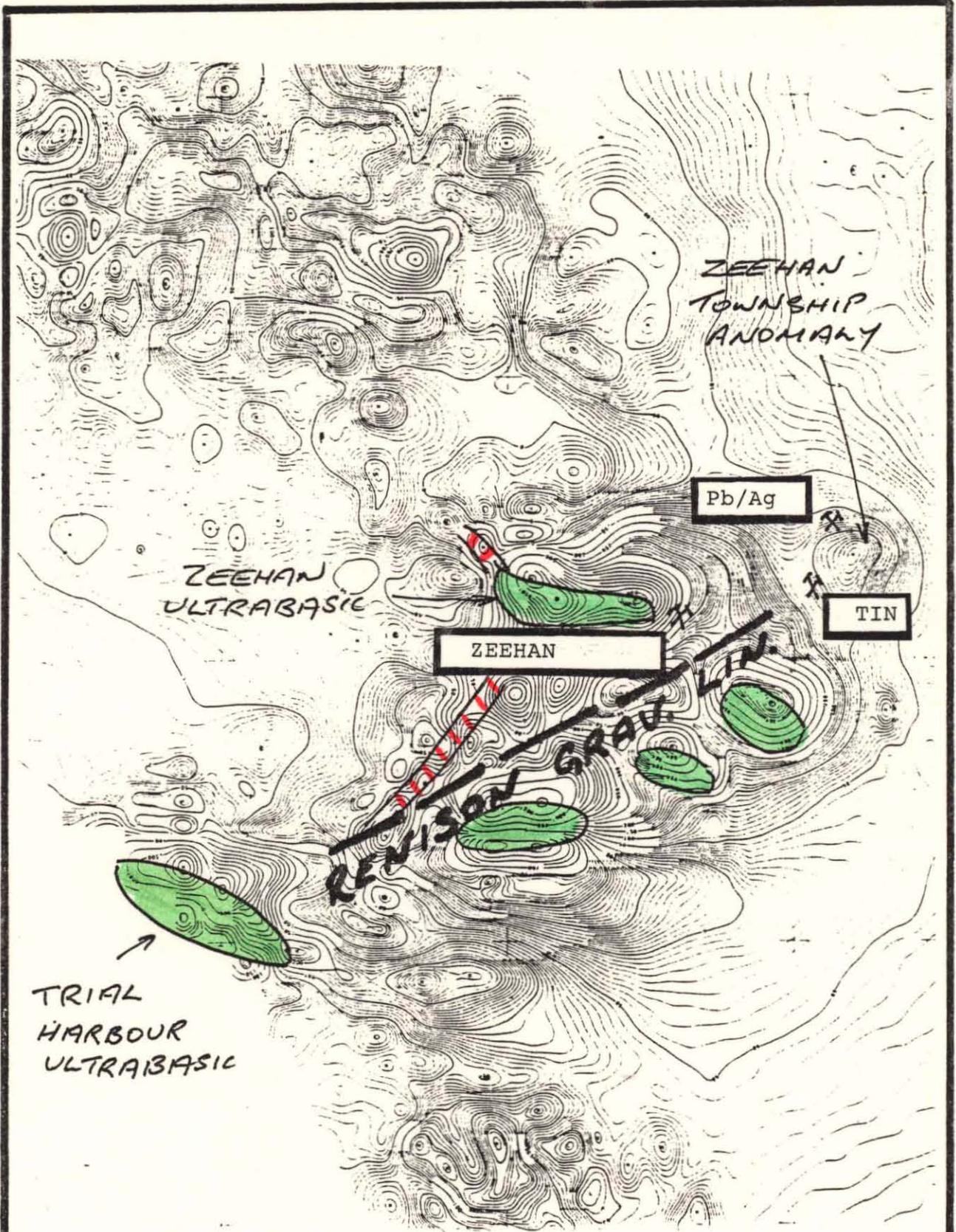


Crimson Creek / Success Creek contact
Success Creek red cherts and mudstone

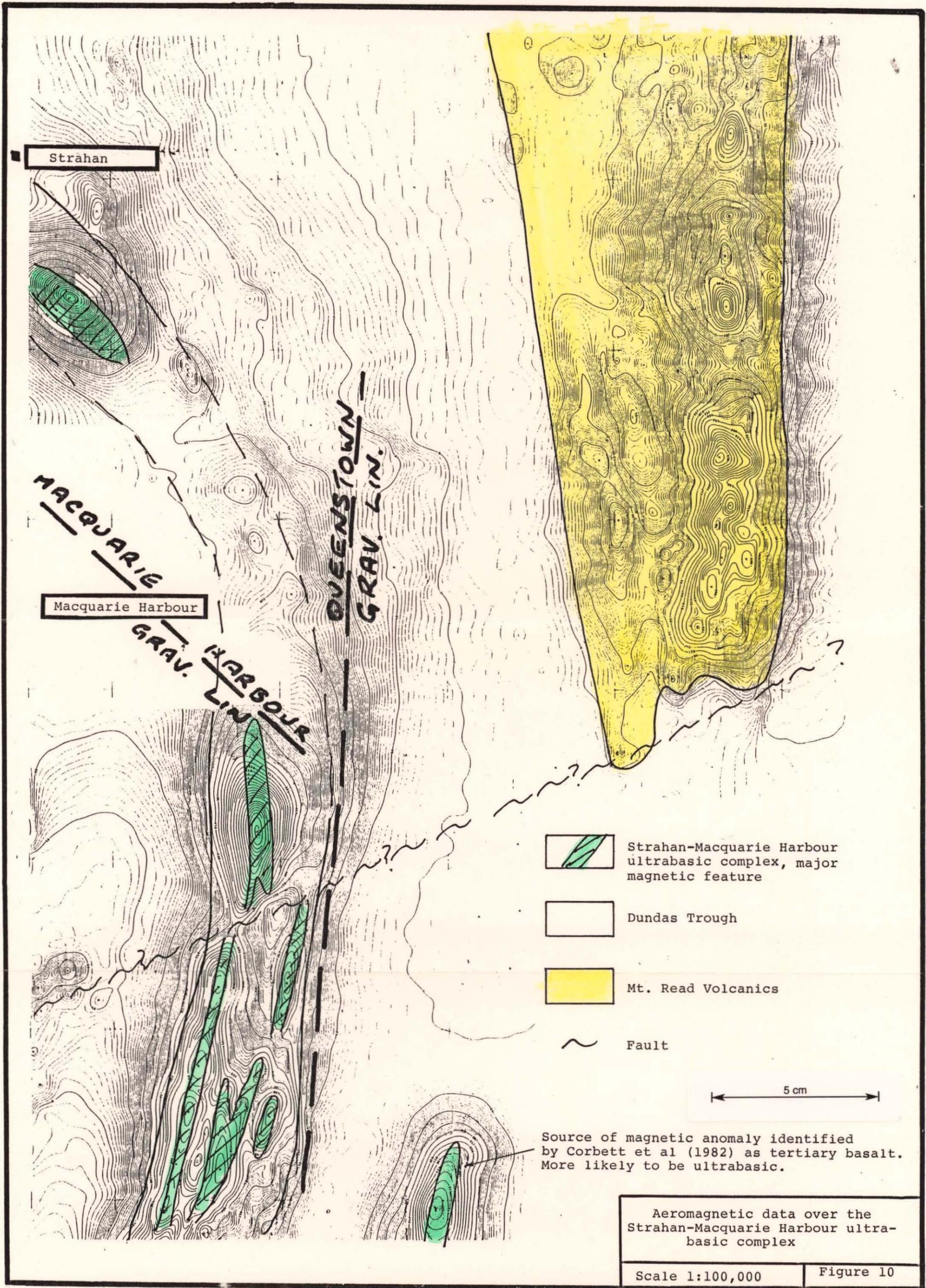
Aeromagnetic data over the Renison Bell tin deposit

Scale 1:100,000

Figure 8



Aeromagnetic data over the
Zeehan Area
Scale 1:100,000 | Figure 9



Strahan

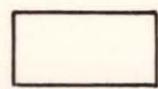
MACQUARIE

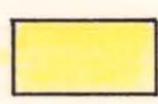
Macquarie Harbour

MACQUARIE GRAV. LIN.

QUEENSTOWN GRAV. LIN.

 Strahan-Macquarie Harbour ultrabasic complex, major magnetic feature

 Dundas Trough

 Mt. Read Volcanics

 Fault

5 cm

Source of magnetic anomaly identified by Corbett et al (1982) as tertiary basalt. More likely to be ultrabasic.

Aeromagnetic data over the Strahan-Macquarie Harbour ultrabasic complex

Scale 1:100,000

Figure 10

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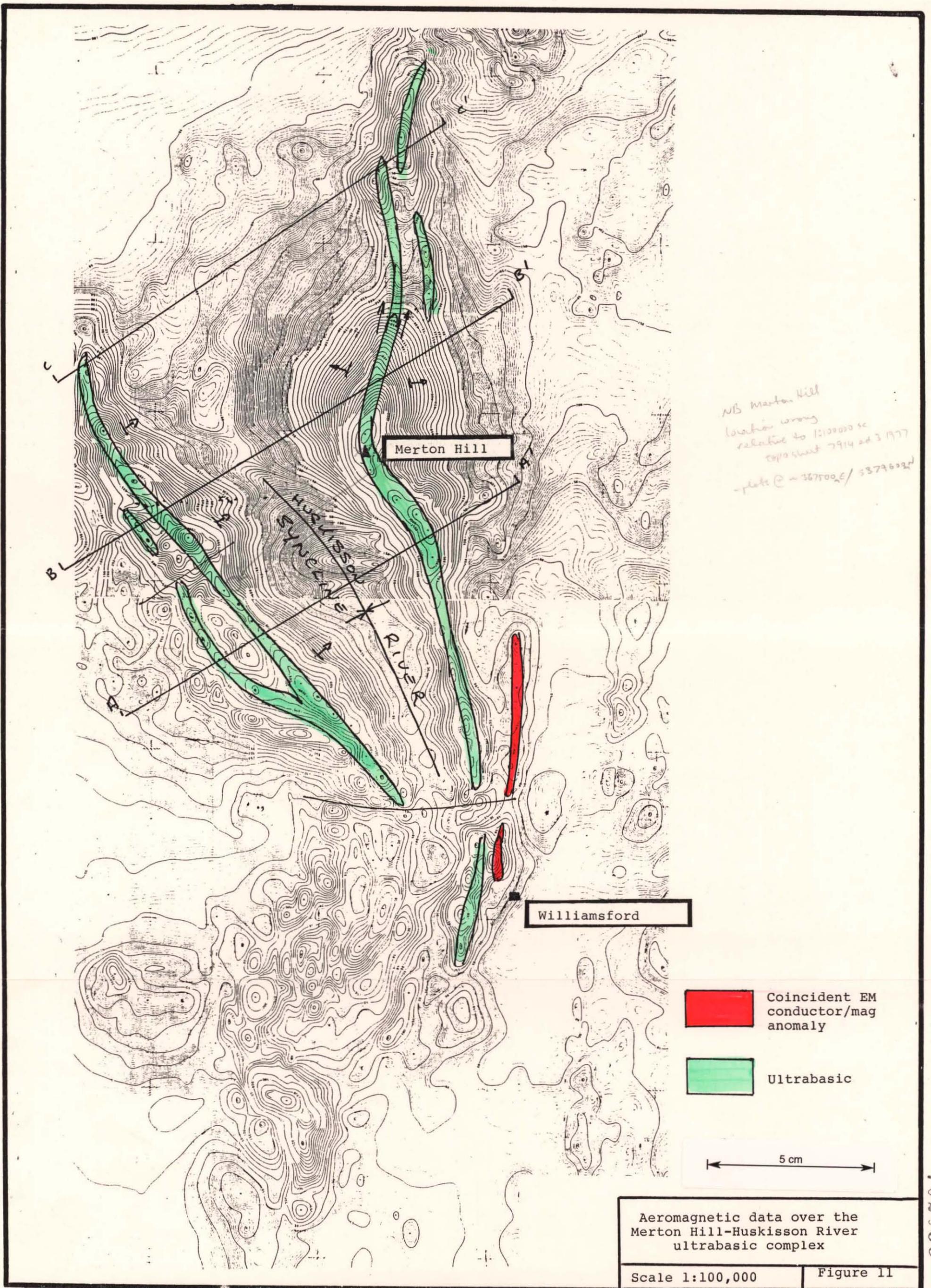
source of the magnetic anomaly at Strahan is at considerable depth and of no interest. The anomalies recognised by Corbett et al (1982) include Zones 8, 9, 13 and 14. Zone 8 Asbestos Point to Nobby Creek area; is due to ultramafic, intermediate to acid volcanic rocks and gabbros. Zone 9 Birch Inlet; is assigned to basalt however the size of the anomaly is typical of serpentinite. Zone 13 Mouth of King River; is most probably due to a buried extension of Zone 8, with the source of the anomaly due to ultramafic or basic volcanics. Zone 14 Ocean Beach; could be similar to Zone 13 but displaced to the north by a large regional fault, e.g. a north-easterly extension of the Henty Fault.

Rampore & King 1968, Geol Soc Aust Trans 1962 p 129, 327

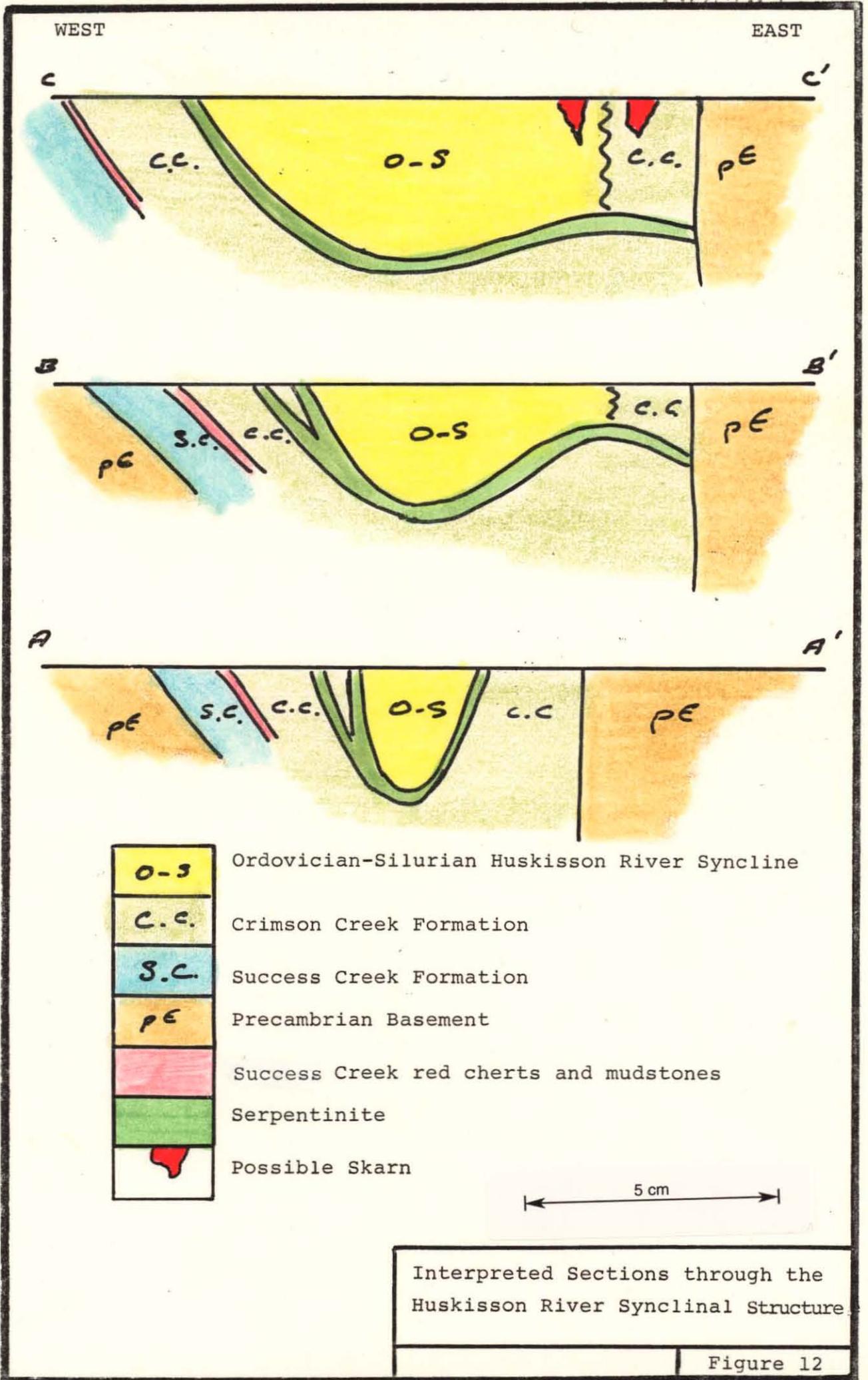
The other main area of ultrabasic rocks is located either side of the Huskisson River Syncline (new name - Figure 11 & Plates 3 & 5), and has an intense coincident magnetic anomaly. The mapping of the area by Brown (1982) showed that wherever Eocambrian or Cambrian serpentinites or amphibolites were mapped there was a coincident, large amplitude magnetic anomaly. The Wilson River serpentinite, Zone 45 Pieman River to Parsons Hood; is actually two magnetic linears due to layered pyroxenite-peridotite-serpentinite. The anomaly on the eastern side of the syncline, Zone 44 Pieman River to Webb Creek; has a similar source. The qualitative interpretation of the western serpentinite belt is consistent with an intrusive sill dipping to the north-east. The inclination varies from steeply dipping to the south-east of the Alfred Fault, to a shallow dip north-west of the Fault, (Figures 12 A, 12 B & 12 C). The interpretation of the eastern serpentinite is not as simple. The source of the magnetic anomaly could be interpreted as a magnetic sill intruded into an anticlinal structure, which outcrops as far north as the Huskisson River and then plunges further to the north. South of 380000N the eastern limb of the anticline has been removed. To the north, the Mt. Ramsay skarn-type magnetic anomalies are relatively shallow compared to the serpentinites at depth (Figure 12 b). This model is far from perfect and is open to major variation, however it matches the ideas presented by Zarzavatjian (1965). The main difference between the two models is that the recent mapping of the area has identified Precambrian basement either side of the Huskisson Syncline.

PLUTONIC INTRUSIVES

During the mid-Devonian Tabberabberan Orogeny the region was intruded by a number of post tectonic granites. These are mainly contact aureole biotite granites and hornblend-biotite granodiorites including S and I types, which appear to have been emplaced at relatively low pressures largely by diapiric intrusion and roof lifting, (Solomon 1981). The granites vary greatly in size from the Meredith Granite in the centre of the area to the smaller granitic bodies intruded in the Mt. Read Volcanics. The magnetic expression of each of the plutons will be discussed separately.



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- O-S Ordovician-Silurian Huskisson River Syncline
- C.C. Crimson Creek Formation
- S.C. Success Creek Formation
- PE Precambrian Basement
- Succ. Creek red cherts and mudstones
- Serpentinite
- Possible Skarn

Figure 12

(1) Meredith Granite

The Meredith Granite is the largest granite body in north-western Tasmania. It is composed predominantly of fine to medium grained, equigranular biotite adamellite and medium grained porphyritic biotite granite/adamellite, (Collins et al 1981). Emanating from the northern margin of the granite are quartz-feldspar porphyry dykes similar to the dykes at Mt. Bischoff. The relationship between the Meredith Granite and the tin mineralisation at Mt. Bischoff, Cleveland and Renison will be discussed in the section "Detail Magnetics Over Known Mineralisation".

The magnetic data over the Meredith Granite indicates the igneous body to be non-magnetic, (Figure 7 & Plates 2 & 3). This is confirmed by the magnetic susceptibility results presented by Collins et al 1981. The general samples described as porphyritic biotite adamellite had a magnetic susceptibility of $0 \times 10E-6$ S.I. units. Over the northern half of the massif the magnetics are dominated by a deep low associated with the serpentinite or skarns along the northern contact. The magnetic low, which corresponds to the mapped boundary of the Meredith Granite, may imply some aureole effect along this contact. The two small magnetic highs 8 kilometres north-west of Bulgobac correlate with Tertiary basalt and are of no interest.

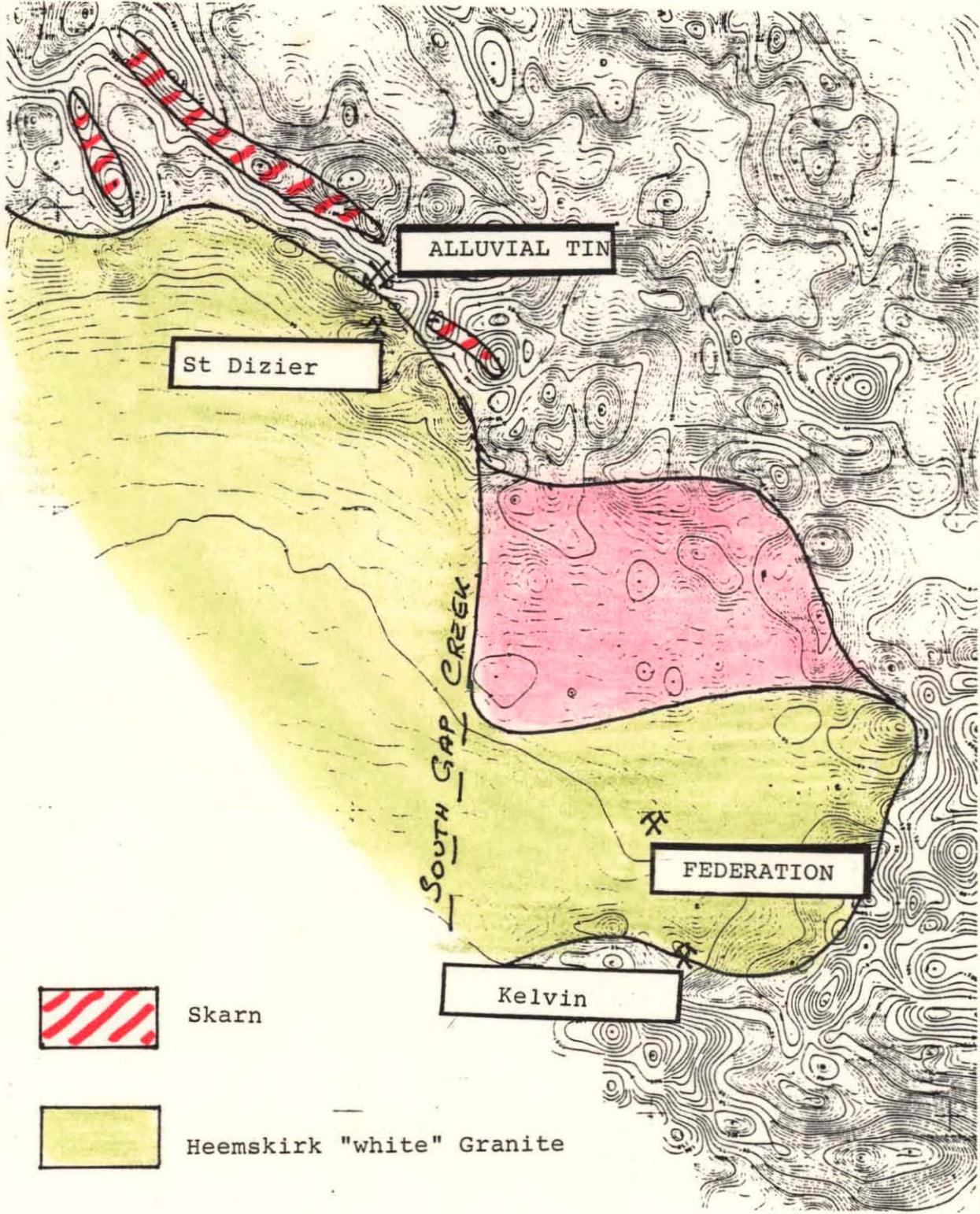
(2) Heemskirk Granite

The Heemskirk Granite outcrops as a large, stock-like, complex intrusion on the west coast of Tasmania. It consists of two main granite types: an older "red granite" which varies from coarse-grained biotite granite/adamellite to medium-grained, porphyritic biotite adamellite; and a younger, more alkaline, "white granite", which is predominantly a yellow to white, fine to medium-grained, equigranular biotite granite/adamellite, (Collins et al 1981). The boundary between the two rock types is a north-south line through South Gap Creek with the "white granite" to the west of this line and the "red granite" to the east (Plate 4).

The magnetic data over the western half of the Heemskirk Granite, (Figure 13), is similar to the Meredith Granite. This area is basically non-magnetic and correlates with the "white granite". The magnetic data over the "red granite" shows some magnetic relief. The anomalies are small in amplitude and strike length with a random strike direction. The contacts of both granite types can be traced due to the abutting magnetic formations or metamorphosed contacts. This magnetic differentiation between rock types was not evident in the magnetic susceptibilities which were all $0 \times 10E-6$ S. I. units. This indicates that the source of the magnetic activity over the "red granite" is probably associated with an altered quartz-topaz-chlorite tourmaline rock as is the case near the Federation Prospect.

(3) Pieman Granite

The Pieman Granite is located on the west coast, north of Pieman



Skarn



Heemskirk "white" Granite



Heemskirk "red" Granite



Prospect



Alluvial working



Aeromagnetic data over the Heemskirk Granite.

Scale 1:100,000

Figure 13

Heads. There is little literature available and the magnetic data over this granite is similar to the "white granite" of the Heemskirk Granite suite. The contacts with the Rocky Cape Formations are not clearly defined as this formation is also non-magnetic with a similar magnetic background. There is no magnetic aureole surrounding the granite and the contacts are only evident as a slight increase in activity due to interpreted dolerites.

(4) Granite Tor

A small western section of the Granite Tor was covered by aeromagnetics which identified this granite as non-magnetic and lacking a magnetic aureole.

(5) Porphyry Dykes at Mt Bischoff

In the Mt Bishcoff area the quartz porphyry dykes are adjacent to a dolomitic unit which hosts metasomatic, massive pyrrhotite-cassiterite bodies. There is a "Y" shaped anomaly, (Plate 3), coincident with the porphyry dyke however, this anomaly is more extensive than the ore body. Magnetic susceptibility measurements by Collins et al (1981), indicated the Mt. Bischoff porphyry dyke to be non-magnetic. It has been assumed by some authors that there is a link between these porphyry dykes and the Meredith Granite. The magnetics between the Meredith Granite and the Mt. Bischoff area are confused by a basic or ultrabasic body along the contact of the granite. In the author's opinion, no magnetic link is apparent.

(6) Pine Hill Porphyry

The Pine Hill Porphyry is a small, composite cupola at Pine Hill, 2 kilometres south of Renison Bell. This consists mainly of porphyritic and equigranular sodaclase adamellite, which is extremely greisenised and tourmalinised, (Collin 1981). Radiating from the porphyry are numerous quartz porphyry dykes which have been extensively greisenised. One of these dykes links the mineralisation at Renison Bell to the Pine Hill Porphyry, (Patterson et al.1981). The area has been mapped in detail by Brown (1982), and the magnetic data shows that the porphyry can be identified only as a relatively non-magnetic unit in an extremely complex area. The feeder dyke under Commonwealth Hill traverses a number of magnetic features and is not connected magnetically with the main anomaly recognised as the pyrrhotite ore body at Renison Bell. The magnetic susceptibility data showed one sample of the porphyry to be highly magnetic due to secondary iron however, the remainder of the samples failed to register.

(7) Murchison Granite

The Murchison Granite is an elongated body trending north-south and outcropping in the Murchison River east of Rosebery. It consists of biotite-hornblende adamellite occurring as a sub-volcanic body within the Mt. Read Volcanics. This is probably

similar to the two outcrops north-east of Mt. Tyndall and the South Darwin Peak. All are small outcrops which the magnetics indicate may be part of an almost continuous trend from Mt. Murchison to South Darwin Peak, (Plates 5 & 7). Magnetic susceptibility samples from the Murchison biotite adamellite gave between 25,000 to 40,000 x 10E-6 S.I. units, making it by far the most magnetic granite on the west coast. The small granite outcrops east of Lake Selina have coincident magnetic anomalies and are probably part of the same suite of rocks. Initially the South Darwin Peak Granite would appear to be magnetic however, the survey carried out by Ruddock (1974) showed the magnetic activity in this area to be due to the formations immediately west of the granite and only a small section of the granite is relatively magnetic (Figure 16).

(8) Nevada Creek Granite (366000E & 365400N)

This is a small outcrop of granite recognised by Brown (1982), (Plate 5). The area is relatively free of magnetic disturbances and neither the granite nor an aureole can be identified.

(9) Huskisson River Granite (372500E & 390000N)

This granite consists of two small outcrops either side of the Huskisson River, (Plate 3). Both bodies are located in a magnetically active belt which has been interpreted as a skarn response east of Mt. Ramsay in the Crimson Creek Formation. It is not possible to confirm whether the magnetic activity is due to the granite or, as is more likely, skarns.

Summary

From the above review it is possible to subdivide the granitic bodies into four magnetic classifications.

- (a) Non-magnetic Granites
 - Meredith Granite
 - Heemskirk Granite - "white granite"
 - Pieman Granite
 - Granite Tor
 - Nevada Creek Granite
 - South Darwin Peak
- (b) Slightly Magnetic Granites
 - Heemskirk Granite - "red granite"
- (c) Magnetic Granites
 - Lake Selina
 - Murchison Granite
- (d) Unknown
 - Mt. Bischoff Porphyry
 - Pine Hill Porphyry
 - Huskisson River Granite

The classification of 'unknown' applies to granitic bodies which are located in areas of intense magnetic activity although the magnetic susceptibility samples show the bodies to be non-magnetic.

The classifications will be compared to the gravity results and any radiometric data which is available.

TERTIARY VOLCANICS

The north-east corner of the area, recently covered by regional magnetics, has been mapped as Tertiary basalt. The magnetics are extremely confused with little or no correlation between flight lines. In this area the magnetic data may be of assistance in tracing deep lead placer deposits provided the thickness of basalt is extremely thin. One of the main problems working in the area is that the basalts have a large magnetic remanence with a Koenigsberger Ratio as high as 20.0 which renders any interpretation doubtful.

The Tertiary basalts, (Plate 3), have been divided into three classifications. Firstly into areas where the anomalies are predominantly magnetic highs. In these regions there may be a remnant field retained in the basalt however, it is either small or aligned with the existing field. The second category are zones in which there are large remnant magnetic components opposed to the existing field. These areas are shown as per the legend and can be identified on the contour maps as areas of magnetic lows. The final classification are zones in which the magnetic responses appear to be randomly orientated.

DETAIL MAGNETICS OVER KNOWN MINERALISATION

The aeromagnetic data over the known mineralisation on the North-West coast of Tasmania has been reviewed to determine whether it is possible to recognise a magnetic response which could be associated with the deposits and then used to locate other similar magnetic features. The location of each occurrence is plotted on the accompanying Geophysical Interpretation Maps along with an interpretation of the data. This presentation will examine four major types of deposit. It will review the aeromagnetic data, other the tin deposits and the tinfields, including Renison Bell, Cleveland, Mt. Bischoff, Zeehan, and the deposits associated with the Heemskirk Granite. The data over the Mt. Read Volcanics sulphide deposits will be presented including Mt. Lyell, Queenstown and the smaller prospects identified by Reid & Meares (1981). The third appraisal will be of the results over the lead-zinc-(copper) deposits in the Mt. Read Volcanics. Most of these ore bodies are non-magnetic however, it is worthwhile including the results to complete the presentation. The deposits assessed include Que River, Rosebery, Zeehan and some of the smaller prospects in the Zeehan-Renison area. Finally, the aeromagnetic data over the Savage River magnetite deposit and associated areas will be discussed.

The ultrabasic related mineralisation, which is the small occurrences of either nickel, asbestos or chromite will not be reviewed in detail. Ultrabasic bodies are coincident with large amplitude magnetic anomalies. Should this type of occurrence be of interest, magnetic methods can be used to define a number of potential areas.

Tin Deposits

There are three major tin deposits on the west coast of Tasmania plus a number of small occurrences or prospects which warrant discussion. Although work presented by Hutchinson (1979) suggested the origin of the tin to be exhalative, this cannot be supported magnetically, therefore it is assumed by the author that the traditional granitic source still applies. Taylor (1976) summarised the tin areas as follows:

"The Devonian granitoids occur as small isolated stocks which appear to be associated with margins of the Precambrian blocks. They are multiphase granites with adamellite as the major rock type and several cupolas are associated with porphyritic dykes. The major mineralisation styles include:

(a) Isolated sulphide cassiterite ore bodies which occur principally as replacement of dolomitic sediments related to the underlying granitoid cupolas i.e. Renison Bell.

(b) Minor quartz-tourmaline fissure veins in the Heemskirk Granite, which relate to sulphide rich lead-zinc veins with a zonal pattern in the surrounding sediments.

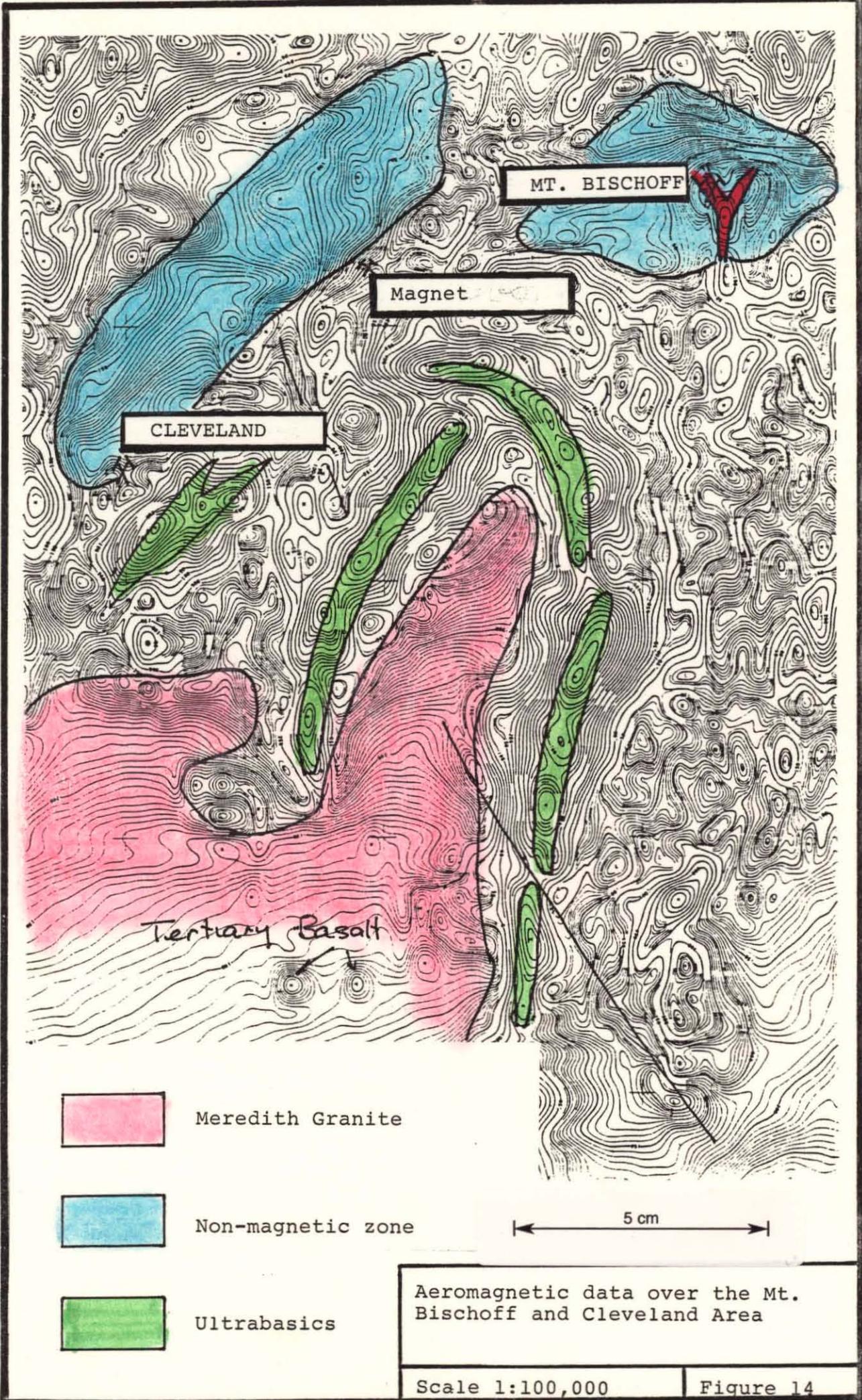
All the deposits appear related to Devonian granitoids, and it is probable that a major batholith underlies much of the region, with only the upper levels visible as a series of stocks. The intrusion level of the batholith appears to be epizonal, with the dominant control of mineralisation relating to brittle fractures and favourable replacement horizons in the sediments."

The geophysical recognition of potentially tin bearing granites has been presented by Webster (1982), Collins et al (1981) and Slade (1982). The data presented by Webster examined the magnetic and gravity expression of tin bearing granites in central N.S.W.; Collins et al (1981) assessed the ground radiometric and magnetic susceptibility of Tasmanian granitoids including the west coast tin granites; and Slade discussed how regional airborne magnetic and radiometric data can be integrated with gravity results to identify the tin granites in the New England area of N.S.W. Unfortunately the regional aeromagnetic survey over the west coast of Tasmania was flown without the inclusion of a radiation spectrometer, therefore the presentation of radiometric data will depend upon open file data plus the results of Collins et al (1981). The gravity and radiometric results are discussed separately. For this section of the review only the magnetic data has been interpreted.

Mt. Bischoff

The regional aeromagnetic data over the old Mt. Bischoff workings (Figure 14 & Plate 3) show a "Y" shaped magnetic high coincident with the mine. The source of the high has been interpreted as dolerite dykes which are associated with the mineralisation. The magnetic susceptibility tests carried out by Collins et al (1981) showed the porphyry dykes to be non-magnetic. The porphyry dykes originate from the Meredith Granite, 7 kilometres away and cut across a major skarn-type anomaly at the granite contact. It was anticipated that over so long a distance there would be evidence of this feeder system however, as the porphyry bodies are non-magnetic and located in a magnetically active area, (skarn and basalt anomalies dominating the region), it was not possible to identify a magnetic link between the Meredith Granite and the Mt. Bischoff mineralisation. The "Y" shaped magnetic anomaly is located in an area of relatively non-magnetic host rocks which have been mapped as undifferentiated sediments in the Dundas Trough.

A second possible interpretation of this non-magnetic zone surrounding the Mt. Bischoff anomaly would be the existence of a non-magnetic granite at depth, as per Taylor (1979), and the source of the tin mineralisation.



Cleveland

The Cleveland tin deposit was initially a series of small prospects however, the B.M.R. (Keunecke and Tate 1954) showed there to be a coincident magnetic and self potential anomaly over the ore body and that the lode could be extended. The deposit is located in near-vertical sequence of sedimentary and mafic volcanic rocks correlating with the Crimson Creek Formation and has been intruded by dolerite-gabbro of early Cambrian age. The mineralisation is in the Halls Formation, a sub group of the Crimson Creek Formation, and includes cassiterite, stannite, chalcopyrite and pyrrhotite. The source of the magnetic anomaly detected by Keunecke and Tate was probably pyrrhotite. The coincident magnetic and self potential anomalies indicated outcropping or shallow sulphides and from this it can be concluded that other electrical or potential field methods should also give a response over the mineralisation.

At Cleveland no porphyry dykes or granitic sources have been identified. The majority of the literature indicates the assumed source to be associated with the Meredith Granite. The regional magnetic data at Cleveland (Figure 14) locates the ore body on a north-easterly trending magnetic feature with a large amplitude magnetic anomaly to the south associated with the Cambrian basic volcanics. This has the effect of masking any magnetic link which could be traced between the Meredith Granite and the ore body.

The area to the north of Cleveland is a zone of non-magnetic rocks similar to the zone identified at Mt. Bischoff. This zone has been mapped as undifferentiated sediments in the Dundas Trough. Magnetically it is similar to the area surrounding Mt. Bischoff. Any exploration over the non-magnetic region north of Cleveland should concentrate near the margins of the zone and initial targets would include the small but intense magnetic anomalies. If geochemical and geological mapping indicate possible mineralisation, electrical methods should be used to define drilling targets.

Renison Bell

The geology of the Renison Bell mineralisation has been reviewed by Patterson et al (1981). The ore body is associated with a porphyry dyke originating from the Pine Hill Porphyry, 2 kilometres south east of the mine. Recent drilling has intersected similar fresh and altered granites between Pine Hill and Renison Bell. The tin ore bodies occur in the transitional zone between the Success Creek and Crimson Creek Formations and have been divided into two classifications: stratabound deposits of massive pyrrhotite with minor amounts of cassiterite; and fault-controlled replacement deposits of massive pyrrhotite with minor cassiterite veins.

As noted in the section describing the regional magnetic results, the Success Creek Group is non-magnetic, whereas the Crimson

Creek Group is slightly magnetic, and the red cherts and mudstones of the upper Success Creek Formation which host the mineralisation can be traced (Figure 8). The magnetic pattern in this area is unfortunately confused by the presence of basic and ultrabasic intrusives to the south-east. The ore body is located on a 1.5 kilometre long magnetic high striking north-east (Figure 8). The 500nT anomaly at the northern extent of the feature was interpreted by Corbett et al (1982), as the massive pyrrhotite at Renison Bell. Detail mapping of the area, Patterson et al, established the local strike direction to be north-west, including the Bassett-Federal Fault and the porphyry feeder dyke from Pine Hill. From this it is concluded that the magnetic anomaly recorded over Renison Bell is not entirely due to the pyrrhotite associated with the mineral lode. To the south-east of the mine there is a magnetic low which could correlate with the Pine Hill system however, the area also contains basic volcanics which confuse the interpretation. The regional magnetic data did not positively identify the mineralisation at Renison Bell, however it should be possible to identify locations with a similar regional magnetic expression along the Success Creek-Crimson Creek contact. Detail aeromagnetic data may be of use to trace the porphyry feeder dykes and to locate other potential dyke systems.

The B.M.R. carried out geophysical tests in the early 1950's over the mineralisation and structures to the north-west which host lead-zinc occurrences. These tests, Blissett (1962), showed there to be a coincident magnetic and self potential anomaly over the tin deposit similar to Cleveland. The area was tested with I.P. and anomalous responses were recorded over both types of mineralisation. The better results were from the lead-zinc areas to the north-west of Renison Bell.

The association between the Pine Hill Porphyry body, the Renison mineralisation and the Renison gravity and magnetic lineament should be established. This could include the Nevada Creek igneous intrusion as well as it is located on the same lineament.

Zeehan

In the township of Zeehan there are two small tin prospects which have been worked for tin at some stage. They are located on the margins of a magnetic anomaly which would appear to be at considerable depth (Figure 9). This area was flown with detail magnetics by Abminco, Sise (1983), and the results indicate that the response over the Zeehan township has some features associated with shallow sources and appeared to form an arcuate anomaly enclosing the main deeper source. The tin prospects were all located on this crescent. Unfortunately the feature does not show on the regional magnetic contours or on the stacked profiles. The analogue records were checked to determine whether the response was removed by filtering or terrain effects but the aircraft's terrain clearance was within acceptable limits and the anomaly could only be recognised as shoulders on the side of the main response. To enhance this anomaly it would be necessary to

reprocess the data and to prepare second derivative maps similar to the recent work by Stewart and Boyd (1983).

Heemskirk Tin Field

There are two main tin prospects on the Heemskirk Granite, the Federation Mine to the south and the St. Dizier Prospect on the northern contact, (Figure 13). There are a number of smaller workings described by Blissett (1962), however it is unlikely that these would have a magnetic signature recognisable in the regional magnetics. The Federation Mine is located in an area typical of the "white granite", Collins et al (1981), with no magnetic response which could be correlated with the ore body however, there appears to be a minor magnetic aureole surrounding the granite. This could be equated to some of the tin granites in the New England Block N.S.W Slade (1982). The St. Dizier deposit is located on an intense magnetic linear striking south-east, (Figure 13 & Plate 4). This magnetic anomaly is on the contact between the Heemskirk Granite and the undifferentiated sediments in the Dundas Trough and has been interpreted as a skarn. The area has been flown by helicopter electromagnetics, Sise (1983), and there is a coincident magnetic and electromagnetic response over this zone. The northern contact of the Heemskirk Granite was the source of the Tasman River alluvial cassiterite which was a major producer in the area.

The regional magnetic coverage has shown that it is possible to identify a skarn associated with the northern contact of the Heemskirk Granite. This skarn is known to be sporadically mineralised. From discussions with companies working in the area it would appear that a variety of geophysical methods have been used to test the feature however, most of the data remains confidential. The magnetic data indicates the region to be less complex than the Renison or Cleveland areas. Magnetic methods may be one of the quickest approaches to exploring the contact in detail especially as the area is relatively flat along most of the contact.

Mt. Read Volcanic Sulphide Deposits

Exploration for volcanic-hosted sulphide deposits in the Mt. Read Volcanics has been summarised by Reid & Meares (1981).

"The common occurrence of volcanic-hosted massive sulphide deposits on one or more key horizon or volcanic contact in a particular province suggests that a detail knowledge of the volcanic stratigraphy should form the basis for selection of favourable environments in exploration programs. However the lack of marker horizons in the Mt. Read Volcanics and the characteristically rapid variations in volcanic facies, both along and across strike, have resulted in an inadequate understanding of the volcanic stratigraphy

of the Tyndall-Darwin area. Consequently, expensive geophysical and geochemical techniques must be used to delineate these favourable horizons or contacts."

The Mt. Read Volcanics have been identified as a belt with a distinctive magnetic character which could be equated to the copper mineralisation. The geology of the area has been described by Corbett (1976, 1979, 1981 & 1982). The review of the regional magnetic data identified the subdivision of the southern Mt. Read Volcanics into Eastern, Central and Western Sequences, with some of the prospects in the belt located on the contact between the Eastern and Central Sequences. The magnetic results show this contact to have a most pronounced expression and indicate the interpreted source of the magnetic anomalies to be either the Tyndall Formation volcanoclastics or an almost continuous granitic or basic intrusive zone which includes the Murchison and South Darwin Peak Granites.

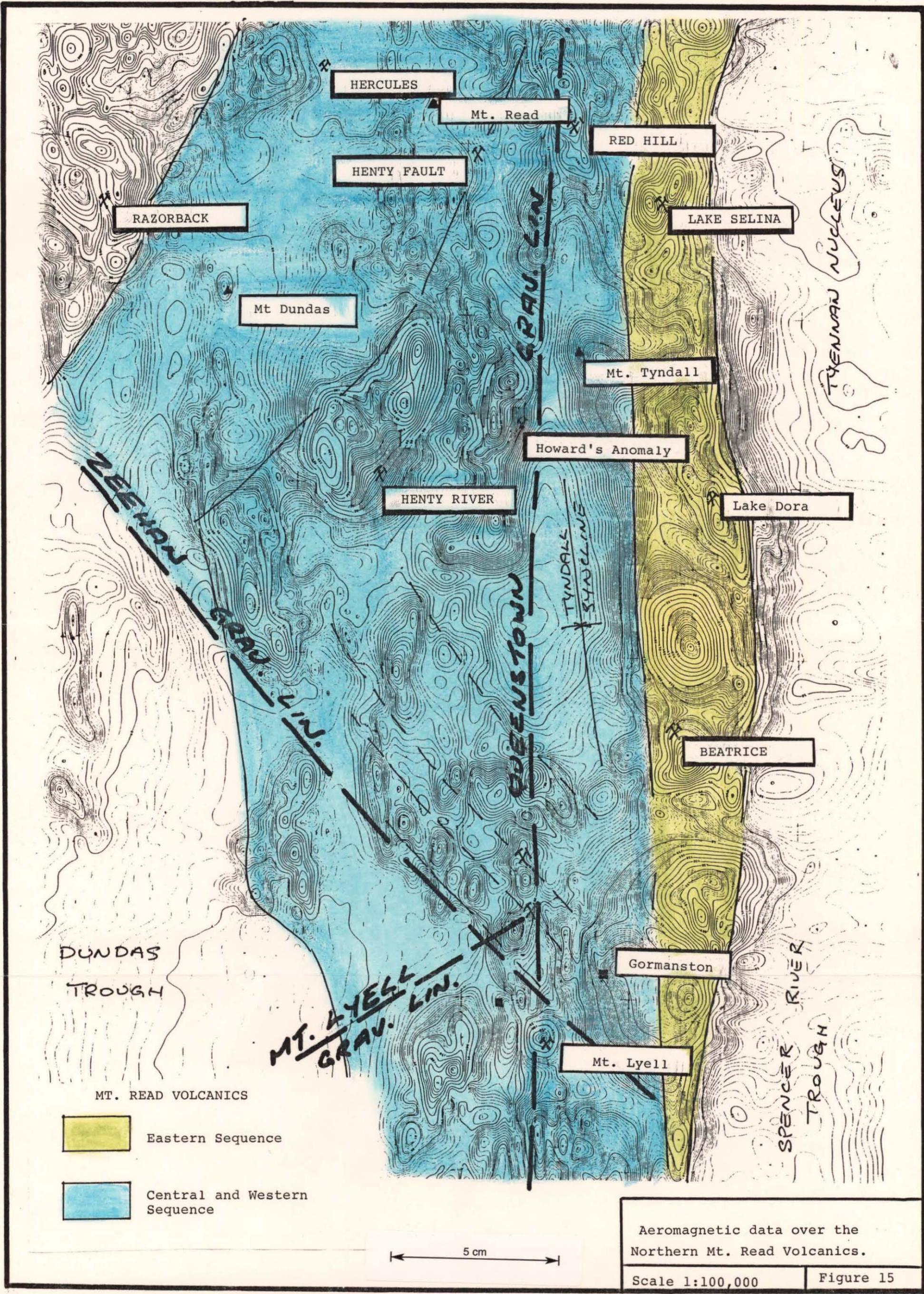
The main mineralisation in the Mt Read Volcanics is the Great Lyell Mines at Queenstown. This area has been mapped in detail by Corbett (1979) and an alternative review has been presented by Reid and Meares (1981). There is a magnetic anomaly coincident with the mineralisation (Regional Magnetic Section), with the source related to the basic to intermediate body which is intruded into the acid to intermediate agglomerate hosting the ore body. The magnetic anomaly is an isolated high, (Figure 15 & Plate 5), with an amplitude of 200nT, and directly over the mine. The response is due to magnetite with little or no pyrrhotite. There is no corresponding magnetic anomaly over the basic body one kilometre north-west of the mine. At 382000E and 346500N, (Plate 5) 7.5 kilometres north of Mt Lyell mine, there is an isolated magnetic high coincident with an area mapped as Comstock Tuff which may warrant checking as it is similar to the Great Lyell anomaly.

It is possible to detect the Great Lyell deposits by I.P. and electromagnetic methods and with no cultural interference, airborne electromagnetics should work.

The Central Sequence mineralisation also includes a number of small and currently uneconomic prospects as outlined by Corbett (1976, 1979, 1981 & 1982), Ruddock (1974) and Reid & Meares (1981).

- (a) Red Hills
- (b) Lake Selina
- (c) Henty Fault Zone
- (d) Beatrice
- (e) Lake Dora
- (f) Proprietary Peak and Adit Knob
- (g) Hyde's Prospect
- (h) Allan's Creek and Findon's Area
- (i) South Darwin Peak

The titles of the last four prospects are based upon local names



HERCULES

Mt. Read

RED HILL

HENTY FAULT

RAZORBACK

LAKE SELINA

Mt Dundas

Mt. Tyndall

Howard's Anomaly

HENTY RIVER

Lake Dora

NANNAN
GRAV. LIN.

QUEENSTOWN
GRAV. LIN.

TYNDALL
SYNCLINE

BEATRICE

DUNDAS
TROUGH

MT. LYELL
GRAV. LIN.

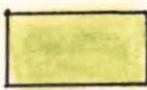
Gormanston

Mt. Lyell

SPENCER RIVER
TROUGH

TYNNAN NUCLEUS

MT. READ VOLCANICS



Eastern Sequence



Central and Western Sequence

5 cm

Aeromagnetic data over the Northern Mt. Read Volcanics.

Scale 1:100,000

Figure 15

702047

or the names used by Ruddock (1974), and may not correspond to the registered name. The similarity of these prospects was noted by Corbett:

"The Red Hills mineralisation consists mainly of disseminations and veinlets of chalcopyrite and pyrite, associated with hematite and magnetite, in chloritized zones in the pink rhyolite. Veins of hematite-magnetite are common and there are obvious similarities with the Mt Darwin mineralisation.

Near Lake Selina a zone of disseminated pyrite about one kilometre long occurs in felsic pyroclastics and lavas adjacent to the Owen Conglomerate contact. At Lake Dora a series of small prospects have explored disseminations and veinlets of pyrite and chalcopyrite, associated with hematite and magnetite, in a sequence of locally altered quartz-pyritic volcanics."

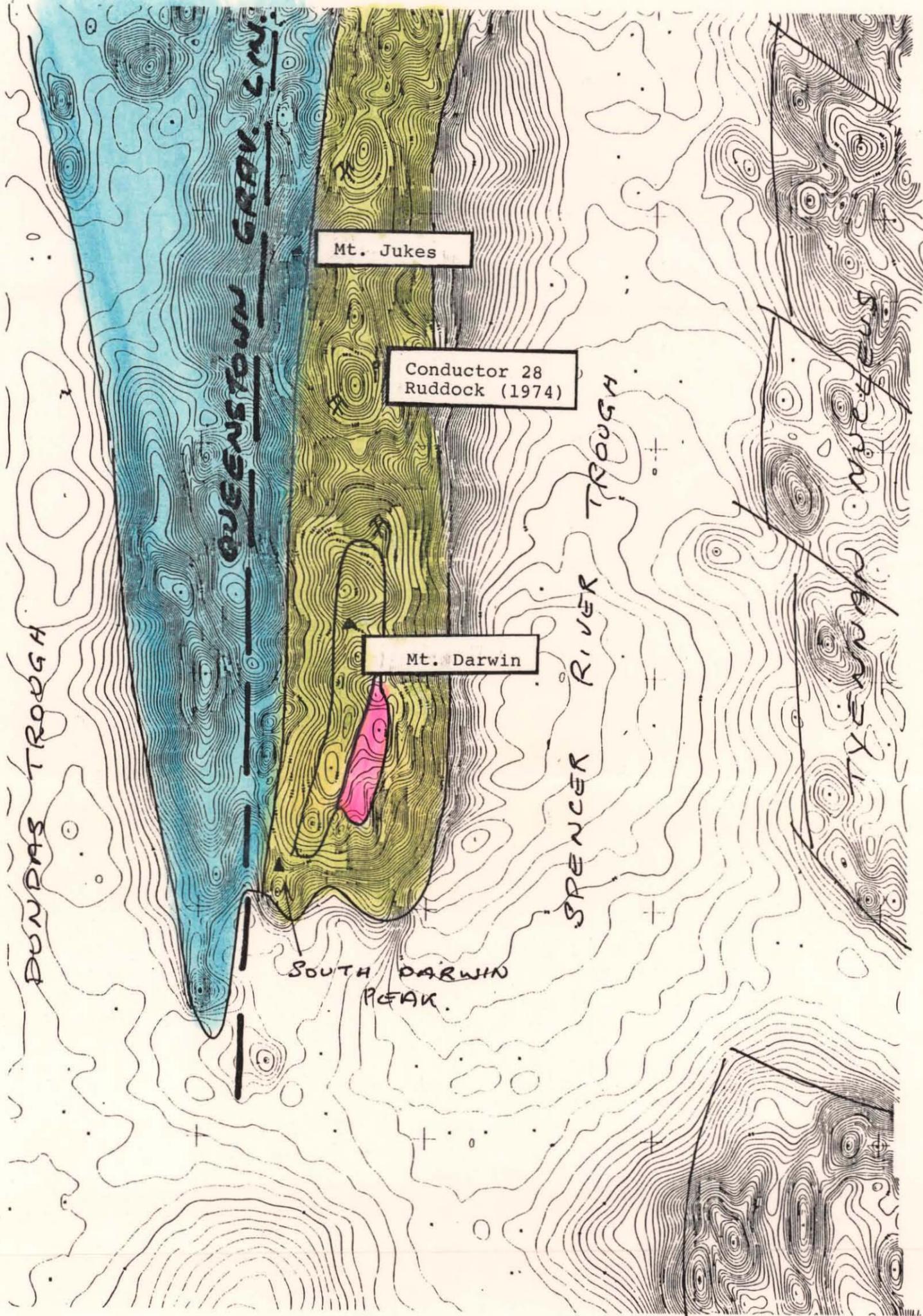
Further to the south between Mt. Lyell and South Darwin Peak there are numerous hematite and quartz-hematite-magnetite veins occurring along the Jukes-Darwin Range and also in the Darwin Granite (Corbett 1981).

The aeromagnetic data over this belt (Figures 3, 15 & 16, Plates 5 & 7), locates a magnetic high zone from Mt. Murchison to South Darwin Peak approximately 3 to 4 kilometres wide. Where granite outcrops there is a coincident or adjacent magnetic anomaly. This is best demonstrated at Mt. Murchison, east of Lake Selina and at South Darwin Peak. As noted previously the magnetic susceptibility samples taken by Collins et al (1981) showed that the Murchison Granite was extremely magnetic which would explain the magnetic activity in this area. There is no other magnetic data available over the Lake Selina area to identify the source of the anomalies however, the response is similar to the Mt. Murchison area and it can probably be assumed that these granitic outcrops are part of the same igneous body. In the South Darwin Peak area there is detail magnetic data on open file, Ruddock (1974). From these results the magnetic anomaly is actually located on the western contact of a relatively non-magnetic granite but with one section which is magnetic (Figure 16). An important point to note in this area is that the most intense magnetic anomaly terminates within one kilometre of the granite. The magnetic anomaly correlates with the chloritic alteration zones in the Central Sequence rhyolite.

The magnetic activity associated with the Eastern and Central Sequences of the Mt. Read Volcanics is related either directly or indirectly to granitic intrusions.

The aeromagnetic data over the Red Hills and Lake Selina areas (Figure 15), locates both deposits on large amplitude magnetic anomalies striking north. At Lake Selina the anomaly is directly over the small outcrops of granite magnetically related to the Mt. Murchison granite. There is no Tyndall Group rhyolite in this

JOINS FIGURE 15



MT. READ VOLCANICS

- Eastern Sequence
- Central and Western Sequence
- Darwin plateau Granite

5 cm

Aeromagnetic data over the Southern Mt. Read Volcanics.

Scale 1:100,000

Figure 16

area to explain the anomaly. The Lake Dora prospect is located on a magnetic high (Figure 15) which can be explained by the presence of the Tyndall Group rhyolite.

The regional and detail magnetic data show that over the Proprietary Peak and Adit Knob area there is an isolated magnetic anomaly coincident with the Proprietary Peak mineralisation. There is no similar anomaly associated with the Adit Knob deposit. The source of the response is related to the chlorite alteration zone in the contact between the quartz -feldspar -phyric volcanics of the Eastern Sequence and the Central Sequence rhyolite. There are porphyry dykes in the area of the Proprietary Peak occurrence which may explain the magnetic anomaly however, a similar dyke near Adit Knob is definitely non-magnetic.

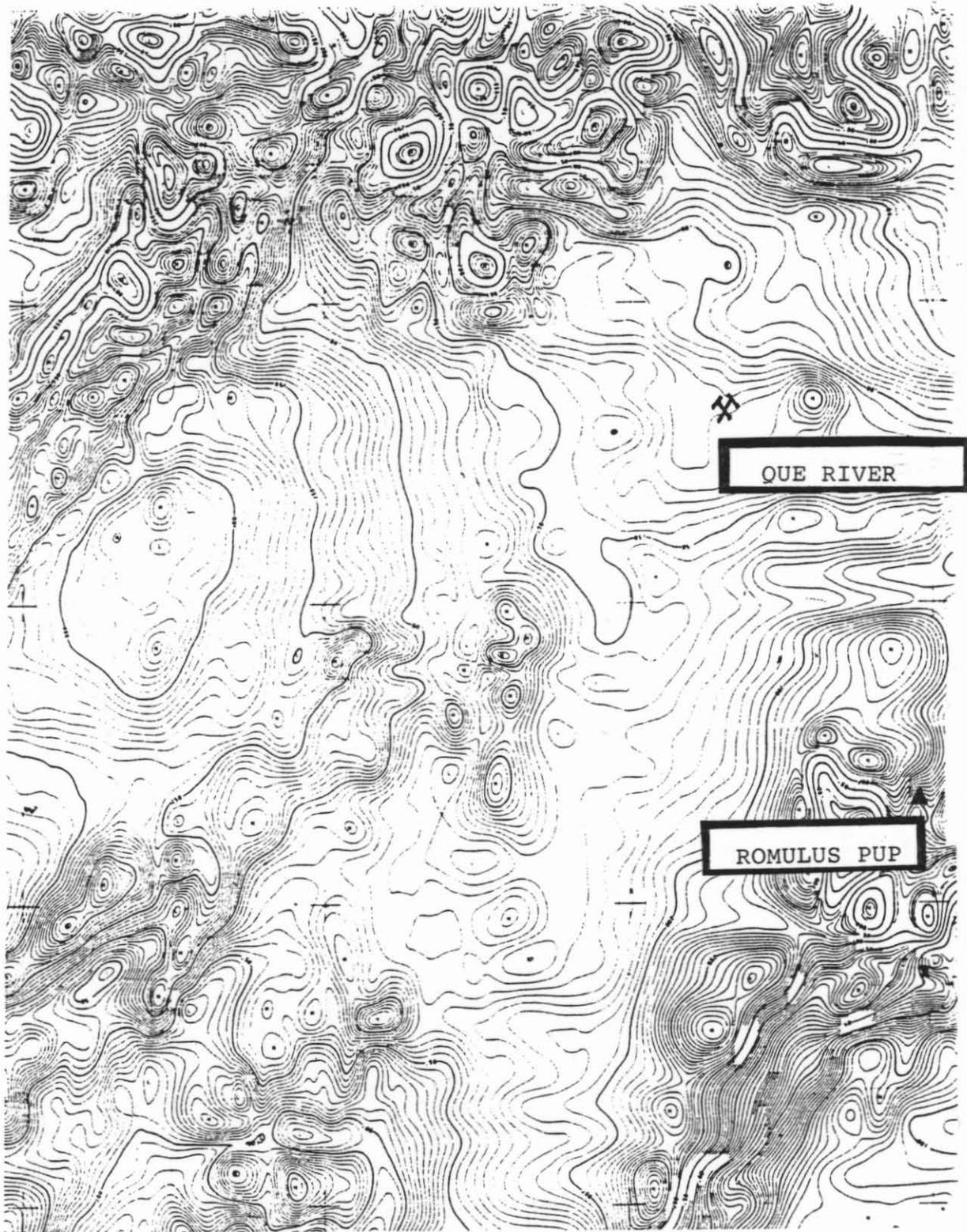
The detail magnetic data over the Hyde's Prospect area (Plate 7), demonstrates a magnetic anomaly similar to Proprietary Peak. In this area the anomaly is located between two mineralised chlorite alteration zone. The western zone was drilled and a 24 metre intersection of 0.50 to 1.25 percent copper was recovered. A gossan from the eastern chlorite alteration zone recorded 6.10 percent copper however I.P. tests indicated that the source was shallow with limited strike extent. An airborne EM anomaly (Conductor 28, Ruddock 1974), was recorded over the northern extent of the eastern chlorite alteration zone with no follow-up work documented.

Allan's Creek and Findon's mineralisation are located on the northern anomalies associated with the South Darwin Peak Granite system. The occurrences in this area do not appear to be related to magnetic features even though they are in a chlorite alteration zone of the Central Sequence rhyolite. Further to the south, the South Darwin Peak occurrences are located in chlorite alteration zones in the same rhyolite sequence with coincident magnetic anomalies.

To summarise, the magnetic data over the southern zone of Mt. Read Volcanics have shown that the majority of deposits located in the contact between the Central Sequence rhyolite and the Eastern Sequence, have a coincident magnetic anomaly. The sources of the anomalies are quartz -hematite -magnetite veins reported by Corbett, (1981). In other areas a similar geological setting failed to give a magnetic anomaly.

North of the Henty Fault the regional data indicates a change in the magnetic signature. There are no large amplitude anomalies which could be due to quartz-hematite-magnetite veins. The area is mainly composed of relatively non-magnetic Central and Western Sequences of the Mt. Read Volcanics.

The magnetic data over the Que River deposit (Figure 17), demonstrates the lack of a regional magnetic anomaly. Webster and Skey (1979) presented ground magnetic data which showed a 200nT response coincident with the "P" lens, however they concluded



5 cm

Aeromagnetic data over the Que River ore body.

Scale 1:100,000

Figure 17

that magnetic methods were of no value in the Que River environment due to the lack of magnetic minerals in the ore and related rock units. The area was thoroughly tested with electromagnetic and induced polarisation methods which showed that while electromagnetic methods relocated the airborne EM conductor, induced polarisation techniques gave a far more detailed representation of the mineralisation.

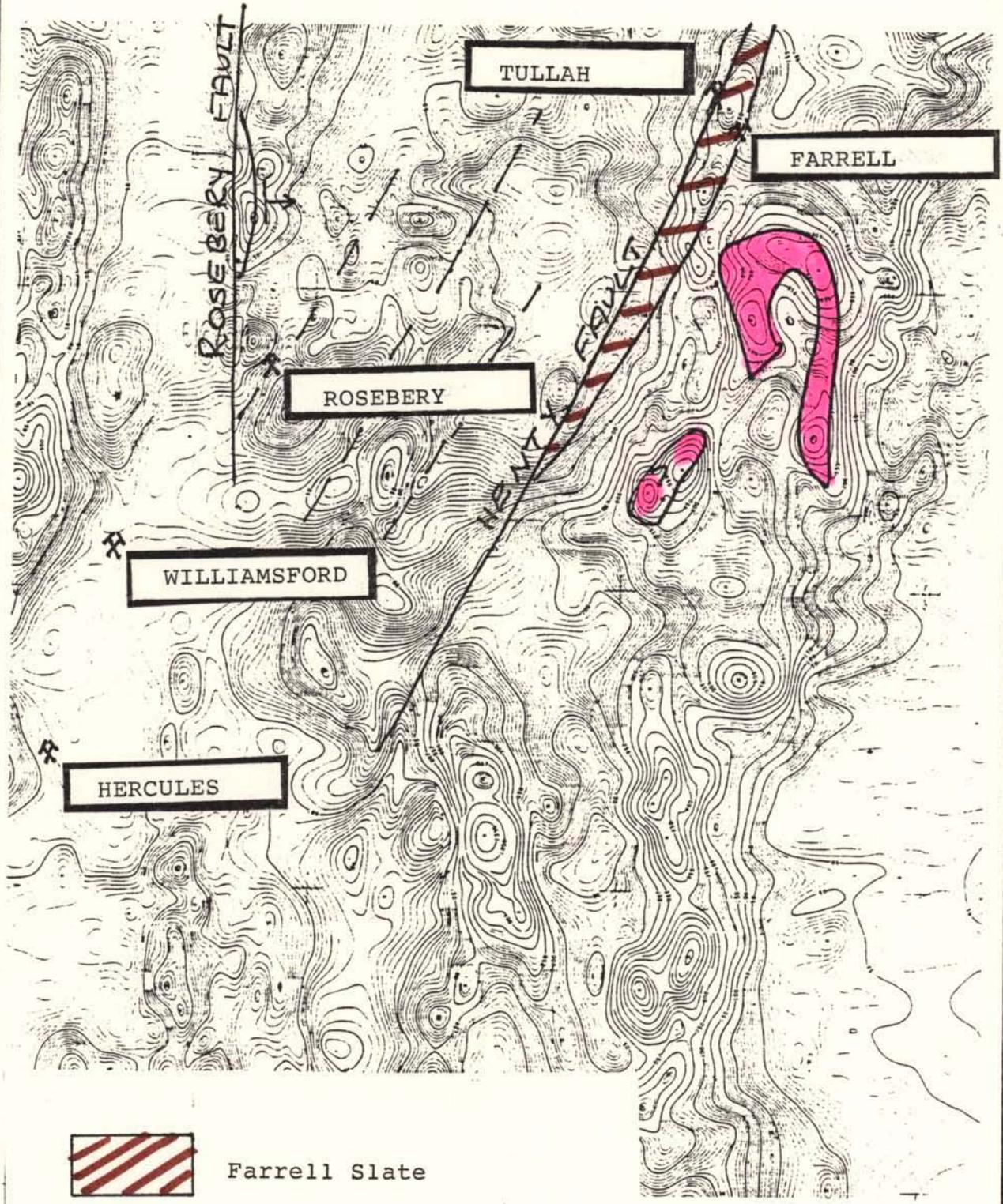
The magnetic data over the Tullah and Mt Farrell mineralisation (Figure 18), locates two deposits, one on either side of a northerly striking linear. The northern extent of the linear feature correlates with the Farrell Slates but to the south the magnetic anomaly becomes part of the Mt. Murchison Granite response. The description of the mineralisation at Tullah and Mt. Farrell does not include any rock types which could explain the anomaly. This magnetic feature may warrant following up due to the ease of accessibility from the highway. If possible the source of the magnetic anomaly should be established and related to the Farrell Slate.

The Rosebery ore body is located in an area where the magnetic data is far from ideal (Figure 18). The main anomaly is a northerly striking, magnetically high response coincident with the Rosebery Fault (new name). North of the mine is the largest amplitude magnetic anomaly in the Mt. Read Volcanics, Central and Western Sequences, and this could be interpreted as a basic body with an easterly dip intruded into the Rosebery Fault. Ground identification of these anomalies is warranted. Two kilometres south of this anomaly and on the same trend is the Rosebery silver lead mine. The interpretation of the magnetic data in this area locates the ore body at the intersection of the Rosebery Fault and the Renison (gravity & magnetic) Lineament, striking north-east. Parallel to the major lineament are a series of secondary faults striking north-east, which appear to displace the northerly trends. The interpretation of the Rosebery area regional magnetics indicates complex structures and detail magnetic surveys will assist in mapping the area.

The Williamsford and Hercules deposits are located in non-magnetic formations (Figure 18) where magnetic methods cannot be used to refine the geological mapping.

Savage River Magnetite Deposits

Airborne and ground magnetic methods were successfully used to outline the Savage River magnetite deposits, Eadie (1970). These ore bodies gave an intense airborne magnetic anomaly of approximately 15000nT over the magnetite at Savage River plus a 5000nT anomaly at Long Plains. Ground magnetic surveys identified the source of the airborne anomalies as either magnetite localised at the contact of an amphibolite mass and metasediments, or magnetite concentrations in the amphibolite. For a detailed discussion of the geology refer to Urquhart (1966).



-  Farrell Slate
-  Murchison Granite
-  Major Fault
-  Minor Fault

5 cm

Aeromagnetic data over the Rosebery Area

Scale 1:100,000 Figure 18

It is noted from the regional magnetic interpretation that the Savage River magnetite deposits are located on the keel of a possible synclinal structure, which has been uplifted along the Cleveland Gravity Lineament by a major tectonic event associated with the emplacement of the Meredith Granite. This interpretation should be reviewed and compared to any recent mapping of the area.

The initial aeromagnetic survey (Eadie 1970) did not adequately cover the mineralised formations in this area. The recent coverage has located the large amplitude anomaly over Savage River plus the smaller anomalies to the south coincident with the Long Plains mineralisation and the Rocky River Prospect. The new data has also defined a large amplitude anomaly, similar to the response over Savage River extending south from Long Plains which is probably associated with the Rocky River amphibolite. The recent aeromagnetic survey has indicated that the anomaly at Savage River is more extensive than previously mapped and can now be traced for a distance of 9 kilometres to the north of the mine.

GRAVITY INTERPRETATION

Regional Gravity Interpretation

The regional gravity data was collected from the B.M.R. and the Tasmania Department of Mines results, and Zadoroznyj, (1975). The results over the west coast of Tasmania, (Figure 19), identify a large amplitude gravity high south-west of Tasmania which has produced a regional gravity gradient parallel to the coast. The source of the high correlates with the top edge of the continental slope and is largely a gravity edge effect caused by the abrupt changes in water depth and crustal thickness, Symonds & Willcox (1976). The interpretation of the regional gravity data, (Figure 20), has identified a number of regional lineaments warranting discussion.

(1) The Mt. Balfour Lineament is a north-easterly striking feature dividing the Smithton Gravity High to the north-west from the Rocky Cape Gravity low to the south-east.

(2) The Arthur Lineament has a coincident gravity high which correlates with the zone of most intense magnetic activity.

(3) The Cleveland Lineament strikes north-east and intersects with the Arthur Lineament at an acute angle, forming the north-west boundary of the Meredith & Husetop Gravity Low.

(4) The Renison Lineament is parallel to the Cleveland Lineament and forms the south-eastern boundary of the Meredith & Husetop Gravity Low. This Lineament can be traced through to the west coast, south of the Heemskirk Gravity Low.

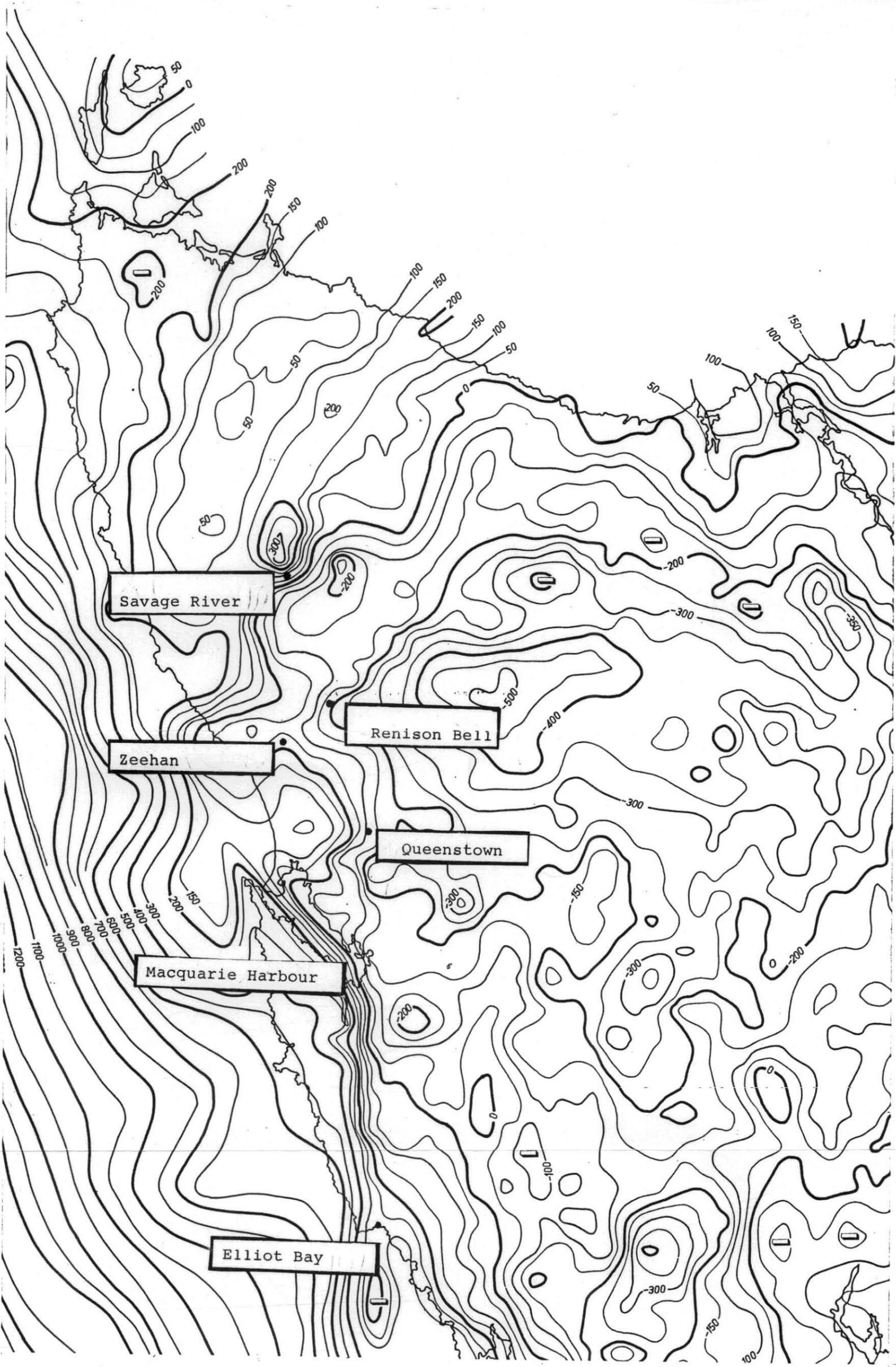
(5) The St. Dizier Lineament is a small strike length gravity lineament on the north-west of the Heemskirk Gravity Low which may be associated with the same line of weakness as the Cleveland Lineament.

(6) The Mt. Lyell Lineament is a short feature striking north-east and forming the southern boundary of a gravity high over a synclinal structure in the Dundas Trough.

(7) The Adamsfield Lineament is a minor feature over the Tyennan Nucleus, but where it intersects the Mt. Read Volcanics it correlates with a magnetic feature interpreted as a major fault.

(8) The Queenstown Lineament is the only northerly striking feature in the gravity data. This can be traced from Elliot Bay in the south to where it is terminated by the Renison Lineament.

(9) The Zeehan Lineament strikes south-east and terminates to the north at the Arthur Lineament High and to the south at the Queenstown Lineament.



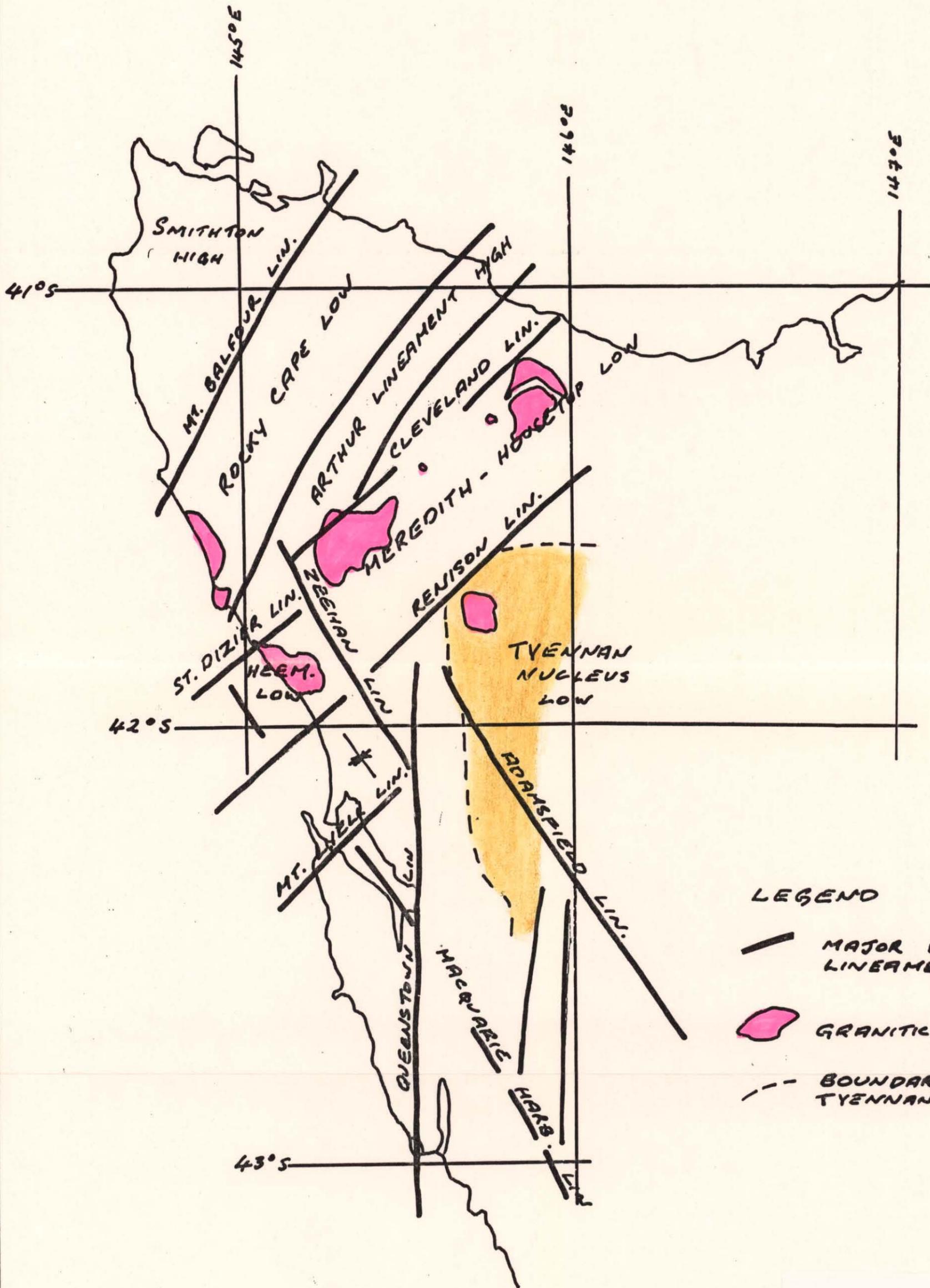
5 cm

Gravity Data over the West Coast
of Tasmania

Scale 1:1,000,000

Figure 19

702056



LEGEND

-  MAJOR GRAVITY LINEAMENTS.
-  GRANITIC BODIES
-  BOUNDARY OF THE TYENNAN NUCLEUS

5 cm

Lineament Interpretation of the West Coast Gravity Data
 Scale 1:1,000,000 Figure 20

702057

(10) The Macquarie Harbour Lineament is parallel to the Zeehan Lineament and although this feature is not continuous it is recognisable south-west of the Heemskirk Gravity Low and coincident with Macquarie Harbour.

These Lineaments can be used to define the following gravity provinces:

(1) The Meredith, Housetop and Heemskirk Granites are all located on a north-easterly striking gravity low feature which is defined by the Cleveland and St. Dizier Lineaments to the north and the Renison Lineament to the south. The majority of the tin deposits are located in this zone and the large deposits, eg. Renison, Cleveland and Mt. Bischoff, are in close proximity to the lineaments.

(2) The Rocky Cape Gravity Low is north-west of the Arthur Lineament with no regional gravity features interpreted as granitic intrusions.

(3) The gravity high over the synclinal structure in the Dundas Trough south of the Heemskirk Gravity Low is similar to the Rocky Cape area and there are no apparent features under the syncline which could be granitic sources.

(4) The Mt. Read Volcanic Sequences do not have a regional gravity expression. The majority of the mineralisation is east of the Queenstown Lineament.

(5) The isolated gravity high west of Luina correlates with the Bald Hills serpentinite and may partially explain the anomaly. This is the only serpentinite body on the west coast which has a coincident gravity high, the remainder have no regional gravity expression. The Savage River mineralisation does not show at this scale.

To summarise, the regional gravity data can be used to identify the zones of granitic intrusive activity such as the Meredith, Housetop and Heemskirk Granites. The major tin deposits are located near the Cleveland and Renison Lineaments and if research by Webster (1982) and Slade (1982) can be applied in this area, most of the prospective tin areas will also be located near the intersection of the lineaments with secondary features. The Whyte River area west of the Meredith Granite is located at the intersection of the Cleveland and Zeehan Lineaments. A synclinal model of the Arthur Lineament has been proposed whereby the Whyte River area has been uplifted by a major tectonic event associated with the emplacement of the Meredith Granite. If this model is acceptable, the non-magnetic zone and skarn anomalies along the contact of the Meredith Granite warrant investigation. This area is similar magnetically to the zone north of Cleveland and the area surrounding Mt. Bischoff.

Detail Gravity Surveys

A number of detail gravity surveys have been undertaken, by the BMR and the Tasmania Department of Mines, mainly in the Zeehan area, except for one survey over the Que River ore body. Detail gravity surveying has not been used to any great extent by the exploration groups working in the area probably due to the high cost of carrying out a gravity survey in mountainous country.

Over the less mountainous area near Zeehan, Loh (1950) and Langron (1966), used gravity methods over known mineralisation. Loh reported that in the Mariposa area east of Zeehan gravity methods defined a 5 milligal anomaly over the mineralisation and that the anomaly extended beyond the then known limit of the ore body. The survey defined secondary anomalies which were previously unrecognised. Loh expressed an opinion that the problem associated with terrain in the area made the interpretation of smaller anomalies difficult.

The Oceana area one kilometre south of the old smelter at Zeehan was tested by Langron. In this area there was a well defined gravity anomaly associated with the mineralised centres. Drilling proved the source of the response to be siderite. Detail gravity surveys over the Silver King and Town Limestone failed to indicate any massive mineralisation.

A survey is being carried out by the Tasmania Department of Mines over the Zeehan to Renison area at present and the results are currently available from the Department. The results of this survey were plotted at a scale of 1:25,000 and contoured, then reduced to 1:50,000 (Plate 8).

Although not included in this review the terrain corrections calculated using the method described by Hammer (1939) and using a density of 2.67 gm/cc, were plotted and proved to be minor with respect to the main anomalies (eg. 2-3 milligals corrections compared to 10-20 milligal anomalies).

The gravity results over this area, (Plates 4 & 5), demonstrate the following features.

(1) A major gravity low east of 368000E and north of 363000N correlates with the Razorback, Black Hill and Commonwealth Hill areas. These results are difficult to explain as the magnetic data and the mapping by Brown (1982) show that the most intense gravity lows (ie -17 milligal) are located over ultrabasic bodies. The terrain corrections in this area are typically 1-2 milligals therefore an error of this proportion would remain small in comparison to the magnitude of the low. Unfortunately the survey did not extend far enough to the east to adequately test the response of the Pine Hill Porphyry body however, the coverage shows an intense gravity low adjacent to the porphyry. This leads to the conclusion that there could be similar, low density, porphyry sources under the entire area. Where this model produces

an inconsistent response is over the Nevada Creek granites, Brown (1982) 366000E & 365400N. These are outside the major gravity low. Further field surveys and data processing are warranted in this area to explain the source of the low.

(2) The second major gravity low correlates with the Heemskirk Granite, west of 355000E, and is roughly defined by the -10 milligal contour which is a response typical of a granitic mass. Over the Heemskirk Granite the elevation and terrain corrections are substantial. Further detail gravity surveys in this area are unwarranted.

(3) North-east of Zeehan and correlating with the Silurian and Ordovician synclinal structure is a gravity low which gives a -6 milligal response over a width of 3 kilometres. Model tests using a program developed by Ogilvy (1979) showed that it was necessary to assume a density difference of -0.20 gm/cc and a depth of sediments of 1000 metres to explain the -6.00 milligal low in this region. The density data presented by Loh (1950) indicates that the Crotty Quartzite has a density of 2.50 gm/cc compared to the 2.70 gm/cc for the Gordon Limestones and country rocks. The depth of the sediments as described by Blissett (1962) shows the maximum thickness of the Crotty Quartzites to be 480 metres (1600 feet). To explain the gravity low it would be necessary to add a second sedimentary sequence with a similar density and thickness. Further density data should be collected from core samples taken from this area to enable a more accurate model to be prepared. At present, although there is some discrepancy between the data and the model, there is probably not a non-sedimentary feature contributing to the gravity low. The regional magnetic data over the Zeehan synclinal structure is extremely flat indicating a deep sedimentary sequence.

(4) There is a gravity low west of Misery Hill at 366000E and 361000N. The geological mapping of the area locates the anomaly on the eastern side of the Zeehan synclinal structure where there would be a minimum thickness of lower density sediments. The gravity data indicates the low to be similar to the response over the Zeehan syncline. The magnetic data does not imply a possible source for the anomaly.

(5) There is a gravity high south-west of Zeehan correlating with the Mt. Zeehan and Trial Harbour ultrabasic rocks. The gravity data in this area is typical of ultrabasic sources.

(6) The remainder of the survey area between the Heemskirk Gravity Low and the Zeehan Synclinal Low is relatively flat with a number of small gravity closures. Although this area contains the majority of small prospects, the magnetic data does not show any magnetic anomaly which could be correlated with the mineralisation. The gravity data is too widely spaced to indicate any response corresponding to the smaller prospects. Detail gravity surveys have been carried out by Langron (1966) and Loh (1950) which proved closely spaced surveys to be most effective in outlining mineralisation. The combination of gravity and

magnetic methods can be used to define a prospective and non-prospective belt in the area.

(7) The two lineaments interpreted from the regional gravity data traverse the area of detail mapping. The most pronounced feature is the Renison Lineament striking north-east through Zeehan with a coincident magnetic response. The second lineament mapped from the regional data is the Zeehan Lineament. However, the coverage over this feature is too limited to recognise any definite character.

The second area where detail gravity methods have been used recently is the Que River region, Leaman and Richardson (1981), This survey was conducted by the Tasmania Department of Mines following an in house survey by Abminco which demonstrated a possible gravity high over the ore body with an extension to the north. The second survey which extensively covered a larger area closed off the anomaly to the north. Terrain effects were removed and after filtering the data an anomaly was defined over the ore body. From this an anomalous mass was calculated.

Summary

Detail gravity surveys have covered a number of areas over known mineralisation with a good deal of success on the west coast of Tasmania. The regional data has been used to define a number of major gravity lineaments which are related to the granitic intrusions. The main problems with using gravity methods are the cost of establishing a survey grid, the control on density information and the application of terrain corrections in mountainous country.

RADIOMETRIC SURVEYS

The regional aeromagnetic survey flown over the West Coast Region of Tasmania was conducted without the support of a radiation spectrometer. This decision was based upon the problems associated with carrying extra weight in the extremely mountainous country, when it was not expected that there would be any radiometric anomalies which could be considered as potential economic mineralisation. This was an unfortunate decision as there are a number of tin bearing granites which may have a radiometric signature similar to the tin granites in New England, N.S.W., Slade (1982) and the Lachlan Fold Belt, Yeats et al (1982). The only radiometric data published (Collins et al 1981) shows tin granitoids to be the most radioactive due to an enrichment of radioactive elements especially uranium.

The data presented by Collins et al (1981), was based upon ground readings taken at selected sites. This data is invaluable as it can be used to equate count rates to percentage concentrations or p.p.m., assuming chemical equilibrium. The main disadvantage of this type of data is that it is very selective and samples are only taken from accessible areas. Airborne data samples a far larger area and usually produces sufficient readings to allow a statistical analysis of the data. The results of the ground survey were plotted on a series of K-U-Th (potassium -uranium -thorium) ternary diagrams, with the count rates adjusted to amplify the uranium contribution. The data from the Meredith Granite, Mt. Bischoff Porphyry, Pine Hill Porphyry, the Husetop Adamellite and skarn, the Murchison Granite, and the Heemskirk Adamellite and greisenised granite have been superimposed (Figure 21). The results shown can be summarised as follows:

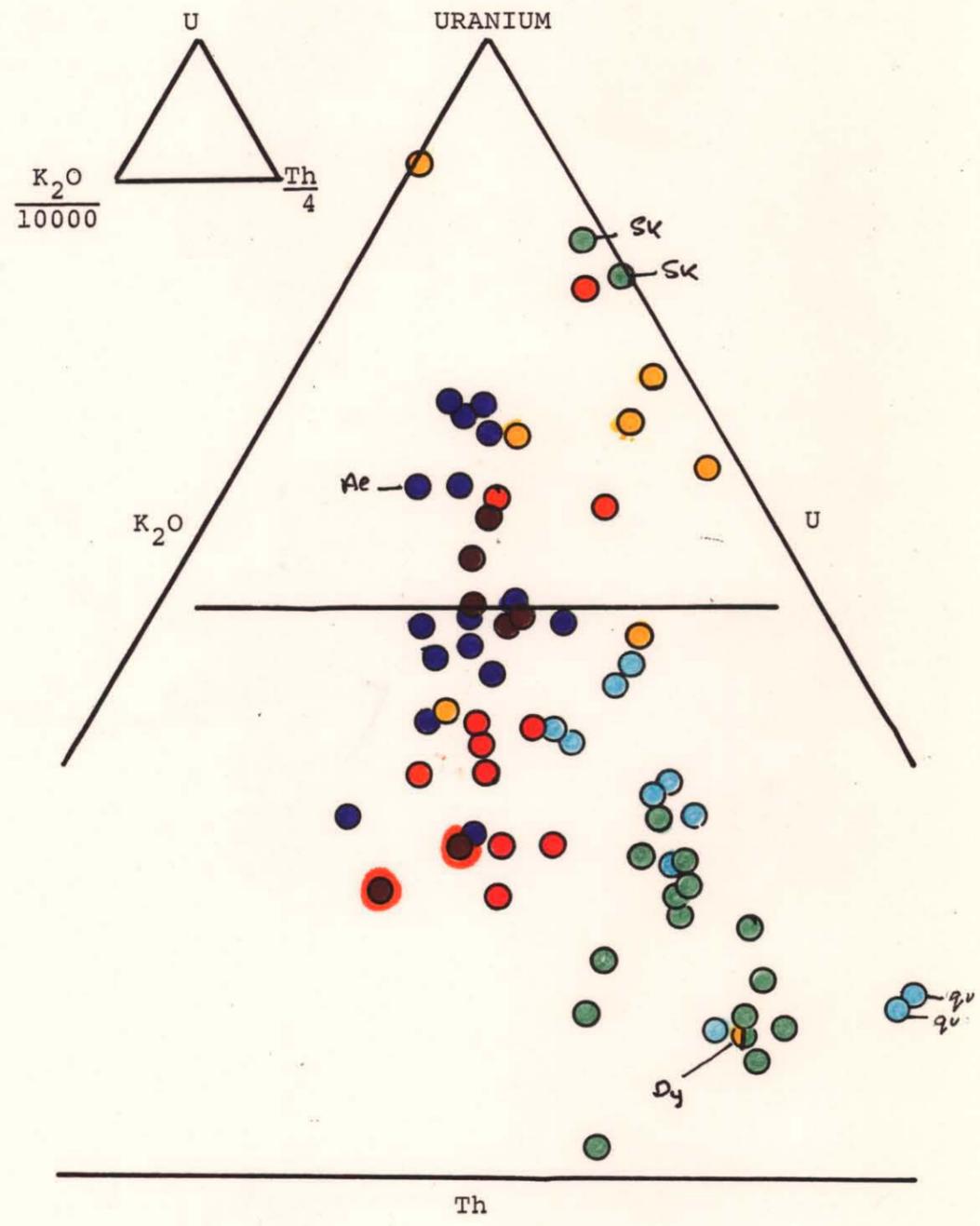
(a) The two samples taken from the Husetop Granite Skarn (Kara Mine - wolfram) have a low potassium and an elevated uranium concentration.

(b) The Pine Hill and Mt. Bischoff Porphyry bodies are similar with a minimum of potassium and an elevated uranium level.

NOTE: These two classifications do not overlap any of the more typical granites.

(c) The Heemskirk Granite has been divided into two categories, "white granite" and "red granite". The ternary diagram classification shows that the "white granite" is located towards the uranium apex while the "red granite" is the more 'typical'.

(d) Superimposed on the Heemskirk field is the Meredith Granite. This shows as a tightly grouped cluster of points between the 'typical' granite and the higher responses of the Heemskirk "white granite". Within the Meredith Granite field it is possible to recognise a secondary subdivision based upon



- Meredith Granite South
- Meredith Granite North
- Mt. Bischoff Porphyry
- Pine Hill Porphyry
- Dy Pine Hill Porphyry Dyke
- Husetop Granite - Adamellite
- Sk Husetop Granite - Skarn (Kara Mine)
- Murchison Granite
- Heemskirk Granite "white"
- Heemskirk Granite "red"
- qu Heemskirk Granite - quartz-topaz-tourmaline chlorite alteration
- Al Heemskirk Granite - Alluvial workings

5 cm

K-U-Th Ternary Diagram for the West Coast Granitoids (Ref Collins et al. 1981)

sample location. The samples from the south of the area have a higher proportional uranium concentration compared to the samples taken in the vicinity of Mt. Bischoff and Cleveland.

(e) The two samples from the Murchison Granite are potassic rock types with a relatively small contribution from uranium and thorium.

(f) The Husetop Granite (outside the regional aeromagnetic coverage) can be described as a 'typical' granite. Most of the data points are located in a tight cluster at the base of the diagram. Note that although the Kara Mine data showed a high uranium content the larger granitic mass is relatively low in uranium.

These ground tests carried out by Collins et al (1981) proved that radiometric methods could be used successfully on the west coast of Tasmania to identify potential tin bearing granites. The northern portion of the Meredith Granite is relatively non-radioactive in comparison to the southern half. The subdivision of the Heemskirk granite into "white" and "red" granites can be recognised in the radiometric data which has highlighted an area near the St. Dizier alluvial workings with the highest proportional uranium levels. The term 'typical' granite has been applied to an area of the ternary diagram along the potassium thorium base line. Most non-tin bearing granites are located in this portion of the diagram.

The data over the granite/adamellites presented by Collins et al (1981) has been reviewed to determine whether there are any further spectrometer anomalies which were not evident in the initial presentation. The results listed on Table 1 (Collins 1981) over the three major granitic bodies on the west coast have been summarised on the tables attached to Figures 22, 23 & 24. These tables list the sample number, the total count radiation in c.p.s. / 1000, the percentage of potassium oxide, the uranium concentration in gm./ton and the thorium concentration in gm./ton. The data for each of the three granites was then plotted on histograms, (Figures 22, 23 & 24).

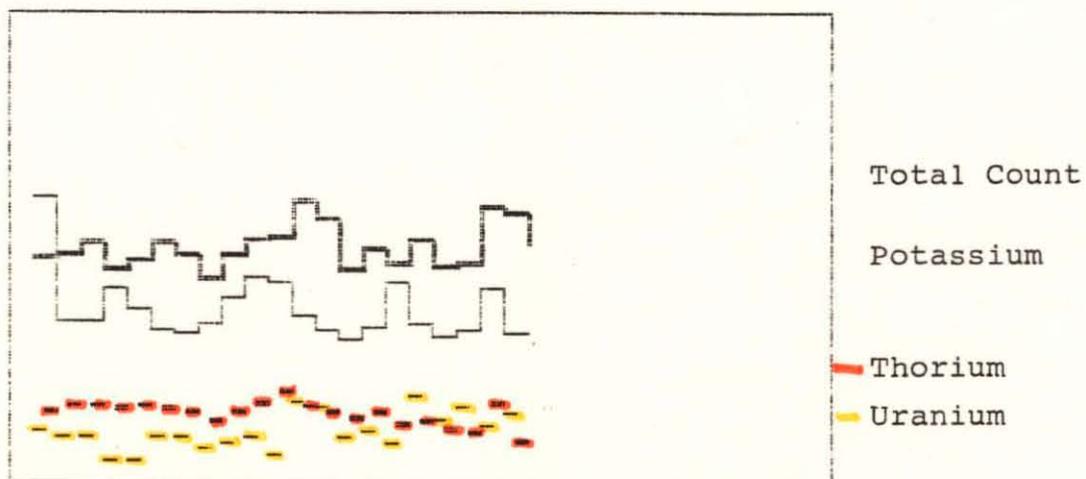
(1) The Meredith Granite (Figure 22) is relatively non-radioactive with the radiation levels at the sample location extremely consistent. There are no samples which could be described as anomalous in either uranium or thorium levels.

(2) The Husetop Granite (Figure 23) shows some variation in radiation levels from sample to sample. There was a range of 75,000 to 135,000 in the total count readings over this granite and it would appear that the majority of the variation is due to thorium radiation. The uranium concentrations are relatively stable and similar to those of the Meredith Granite.

(3) The data recorded over the Heemskirk Granite is the most interesting. This shows (Figure 24) a wide variation in radiation

MEREDITH GRANITE

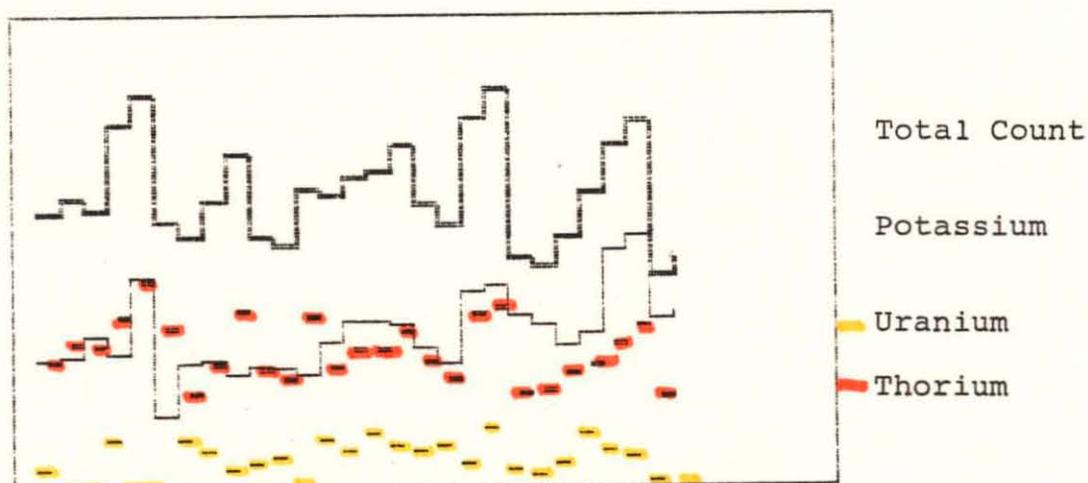
SAMPLE NUMBER	TOTAL COUNT	POTASSIUM PERCENT	URANIUM GM/TON	THORIUM GM/TON
145.1	77	9.6	9	25
145.2	78	5.5	8	27
145.3	82	5.5	8	27
146.1	73	6.6	4	26
146.2	78	5.9	4	27
147.1	82	5.2	8	26
147.2	78	5.1	8	25
147.1	70	5.4	6	22
148.2	78	6.3	7	25
149.1	83	7	8	28
149.2	84	6.8	5	32
151.1	96	5.7	14	27
151.2	90	5.2	13	25
151.3	73	4.9	8	23
152.1	80	5.3	9	25
152.2	75	6.8	7	21
153.1	83	5.4	15	22
154.1	74	5	11	19
154.2	75	5.2	13	18
155.1	94	6.6	10	28
155.2	92	5.1	12	15
156.1	81	5.1	11	23



Radiometric data over the
Meredith Granite

HOUSETOP GRANITE

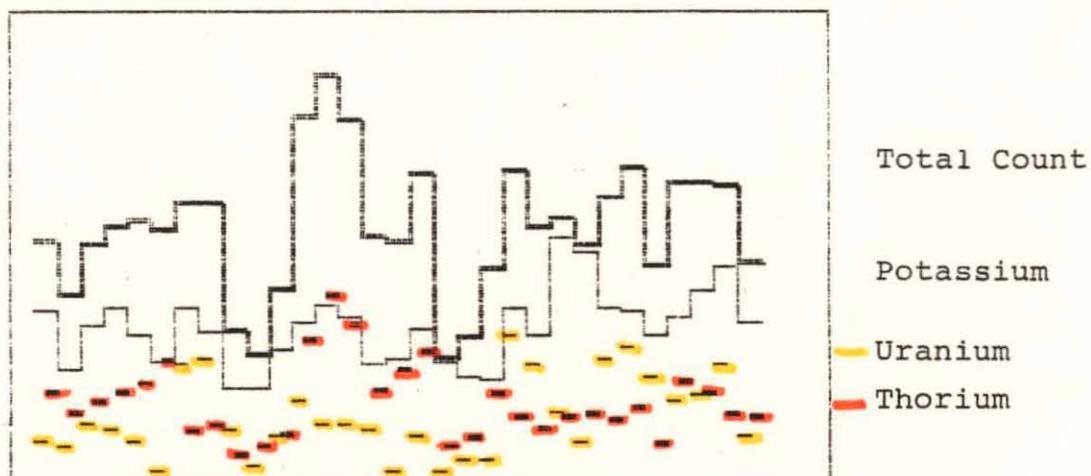
SAMPLE NUMBER	TOTAL COUNT	POTASSIUM PERCENT	URANIUM GM/TON	THORIUM GM/TON
117.1	93	4.3	3	43
117.2	98	4.4	0	49
118.1	94	5.1	0	48
118.2	123	4.5	8	58
119.1	133	7.1	0	70
119.2	90	2.4	0	54
119.3	85	4.2	8	32
122.1	97	4.3	6	42
122.2	113	3.8	3	60
123.1	85	4.1	4	40
123.2	82	4	5	37
124.1	101	3.8	0	58
124.2	99	4.9	8	41
125.1	105	5.6	6	47
125.2	107	5.6	9	47
126.1	116	5.5	7	53
127.1	96	4.7	6	43
127.2	89	4.2	7	37
128.1	125	6.6	4	59
128.2	135	6.8	10	61
129.1	78	5.8	3	32
129.2	75	5.5	2	33
130.1	85	4.8	4	39
130.2	100	5.2	9	42
131	116	8	6	49
131.2	124	8.5	5	55
132.1	72	5.7	1	31
132.2	77	5.9	0	35



Radiometric data over the
Housetop Granite

HEEMSKIRK GRANITE

SAMPLE NUMBER	TOTAL COUNT	POTASSIUM PERCENT	URANIUM GM/TON	THORIUM GM/TON
168.1	82	5.8	7	31
168.2	64	3.8	6	24
168.3	81	5.3	10	28
169.1	87	5.9	9	31
169.2	89	5	7	34
170.1	86	4.1	2	42
171.1	95	5.9	20	18
171.2	95	5.1	21	20
172.1	52	3.2	9	10
172.2	44	3.2	3	13
173.1	66	4.5	8	17
174.1	124	5.4	14	49
175.1	138	6	10	64
176.1	123	5.6	10	54
178.1	84	4	9	32
180.1	82	4.2	2	39
181.1	105	5.2	8	45
182.1	43	4.1	2	13
182.2	50	3.6	4	16
183.1	73	3.5	4	31
185.1	106	5.9	25	23
185.2	87	5	20	19
186.1	90	8.3	12	23
186.2	81	7.8	7	24
187.1	97	5.9	21	22
187.2	107	5.8	23	26
188.1	74	5	18	14
191.1	102	5.6	14	35
192.1	102	6.5	15	31
193.1	101	7.3	20	24
194.1	75	5.4	8	23
194.2	74	5.4	10	22



Radiometric data over the
Heemskirk Granite

sources associated with the granite, part of which has elevated uranium concentrations while other areas have enriched zones of thorium. The potassium percentages remained relatively consistent with the other two granites. The most interesting samples are the elevated uranium concentrations;

(a) Sample 171, collected from the St. Dizier Creek near the St. Dizier Prospect and described as a greisenised tourmaline muscovite granite.

(b) Sample 185, collected from the Granville Harbour Road, 500 metres south of Granite Creek and described as tourmaline biotite granite/adamellite.

(c) Samples 187, 188, 189 and 191, were collected along the Granville Harbour Road in the vicinity of Granite Creek and are all described as biotite granite/adamellite.

(d) Samples 192 and 193 were collected at Granville Harbour and are described as porphyritic biotite granite/adamellite or aplitic granite (at a contact).

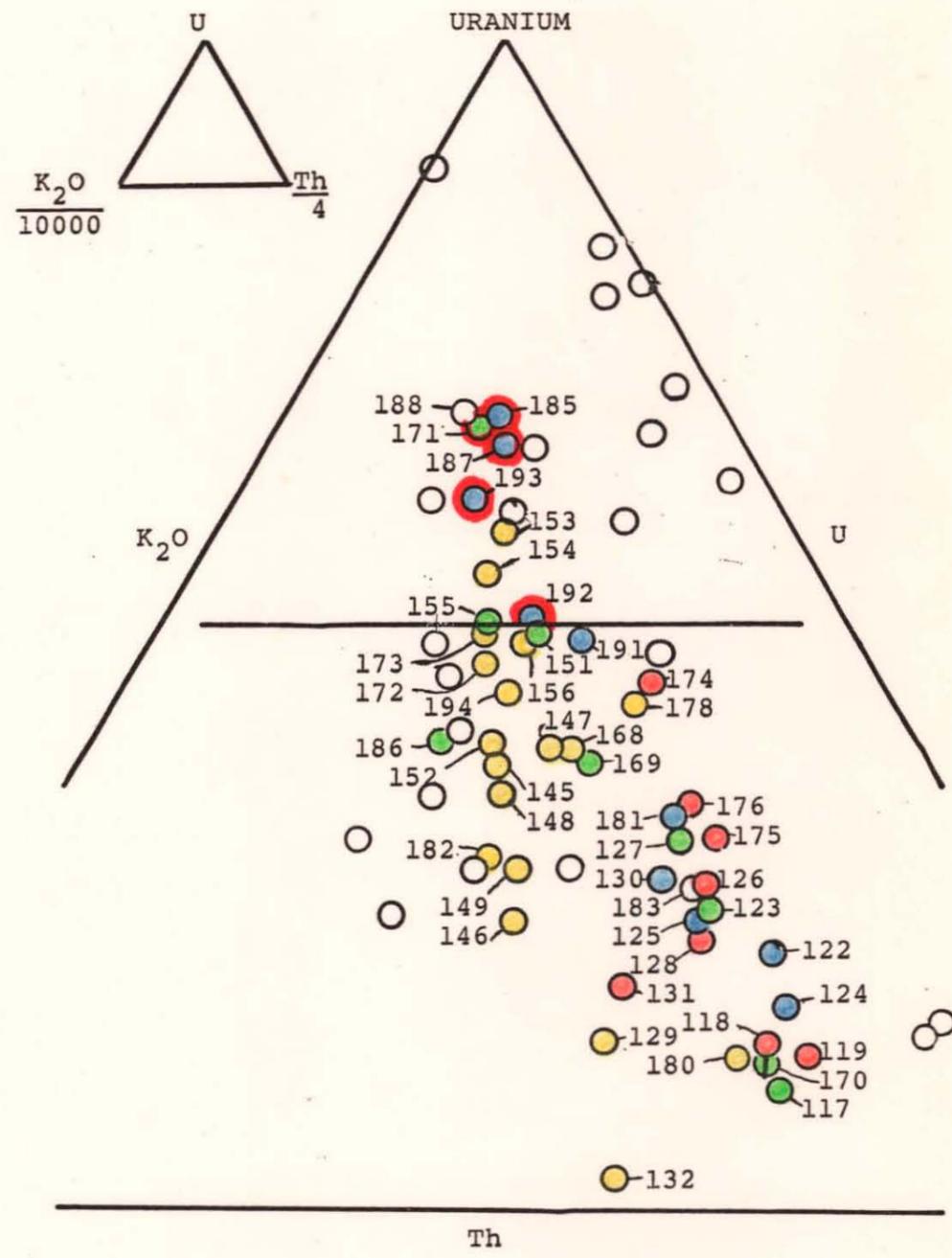
It is important to note that Samples 171, 192 and 193 were collected from the northern contact of the Heemskirk Granite which has a pronounced magnetic signature. This contact is known to be mineralised at St. Dizier and the source of the magnetic anomaly has been confirmed as a skarn, Sise (1983). The second area of interest is located near Granite Creek in the centre of the Heemskirk Granite and at present there is no known mineralisation in this area. The closest recorded tin is 2-3 kilometres to the east at the Federation Mine. The data from this prospect did not give an anomalous response.

To compare the total counts recorded to the relative location on the ternary diagram, the total count at each sample site was plotted on the ternary diagram (Figure 25). This shows that the most radioactive sites need not be the most prospective and that it is more important to assess the relative contribution from uranium with respect to both thorium and potassium.

The only other radiometric survey carried out on the west coast was reported by Richardson (1971). This survey consisted of four road traverses over the Heemskirk Granite with a hand held detector. The results were disappointing with no anomalies of interest (eg. 3 to 4 times background) recorded.

To summarise the radiometric data; to the author's knowledge, the west coast area has not been flown with any radiometric systems which have been reported on open file. The only radiometric data currently available is the work by Collins et al (1981), which consisted of a series of ground radiometric tests at selected locations.

It is understood from Oakes (1983), that part, if not all, of the Husetop Granite has been flown by helicopter radiometric methods



- Total Count greater than 115 X 1000 cps
- Total Count 100 to 115 X 1000 cps
- Total Count 85 to 100 X 1000 cps
- Total Count less than 85 X 1000 cps
- ₁₁₇ Sample Number
- Non-granitic sample
- Prospective Locations

5 cm

Ternary Diagram showing granite samples and Total Count Readings

Figure 25

and that the data was extremely difficult to recover and process. This work is still confidential and it was not possible to compare the airborne and ground results over the Housetop Granite.

Further exploration of this area for tin and tin related minerals should include the use of a regional airborne radiometric survey. The primary areas to be flown would be the Heemskirk Granite and the margins of the Meredith Granite. The available data show the Heemskirk Granite to be a relatively "hot" granite which should include zones of uranium enrichment. One of these will probably be on the northern or St. Dizier contact. The data will need to be interpreted using a ternary diagram type classification system to identify the "hot spots" due to uranium. Ground checking of these anomalies with relationship to potential tin bearing zones should follow. At present it would appear that the Meredith Granite is not a "hot" granite and this body should be flown with airborne radiometrics at the margins of the granite where skarn type magnetic anomalies at Mt. Lindsay and Mt Ramsay have been tested for tin mineralisation.

ELECTROMAGNETIC AND OTHER GEOPHYSICAL SURVEYS

North-West Tasmania is one of the few areas in Australia where the depth of weathering is minimal and where electromagnetic methods can be used with some degree of confidence. The main disadvantage is the mountainous and thickly forested terrain which limits the use of conventional techniques and renders necessary either an expensive helicopter borne system or grid lines to be cut through rain forest. Most groups exploring on the west coast have selected airborne systems with detail ground follow-up surveys.

The earliest reported airborne EM survey was carried out by Scott (1957), for the Lyell - E.Z. Exploration Company. There is little in the literature describing the instrumentation used or overall result. There are however, reports in the name of Scott discussing the follow-up of specific anomalies.

R.T.A.E. and E.Z. carried out a regional exploration program using a helicopter EM system over a wide area of the west coast. This survey was reported by McCarthy (1957) and covered 32 separate areas. A total of 8 first priority anomalies, 20 second priority anomalies and 122 third priority anomalies were recorded. These excluded the anomalies recorded over the known mineralisation at Renison Bell. No details of the type of EM system used were included in the report by McCarthy other than it was an 'in phase' and 'out of phase' system. The 28 higher priority anomalies divide into five main groups.

(1) The first group is a cluster of conductors along the Sophia River alluvial flats east of Tullah and probably due to conductivity changes in the soils.

(2) The second group is a series of conductors west of Rosebery which form two linear features with a strike length of 5 kilometres. These are located on a secondary magnetic anomaly flanking a major feature associated with the Colebrook Hill serpentinite. There is no detail geological mapping in this area, however extending the coverage by Brown (1982) it would appear these anomalies are located in the Crimson Creek Formation. The follow-up of the conductors should be reviewed and if possible the source of the coincident magnetic anomaly established.

(3) The detail geological mapping over the Pine Hill Porphyry complex indicates that there are numerous intrusive bodies all of which could be expected to give some form of EM response. These conductors would be of low priority.

(4) In the area of the Wilson River serpentinite the responses are probably associated with the ultrabasic intrusive. These conductors have coincident magnetic anomalies and it is possible to trace a conductor axis to the south-east along the serpentinite.

(5) Located in the area of the Stanley River west of the Mt. Lindsay magnetic skarn is a group of anomalies with coincident magnetic linears. The detail geological mapping of the area shows the conductors to be located on the contact between the Success Creek and Crimson Creek Formations abutting the Meredith Granite. The trend of the magnetic anomaly follows the granite contact. This area definitely warrants reviewing to identify the source of the conductivity change and the magnetic response.

The next reported airborne EM program was a regional Afmag survey, Sutherland (1966), which covered a number of blocks in the Waratah and Luina area. The survey is most outstanding for the quality of the navigation and flight path recovery which was far too perfect for the author's acceptance. The geophysical results showed little correlation between flight lines and there were no anomalous responses over the known mineralisation.

The successful helicopter H400 EM survey of the Que River area, flown by McPhar for Abminco in February 1972 was summarised by Webster and Skey (1979). An attempt to re-fly the area in 1974, with an improved version of the same EM system, could only confirm the earlier work. No new conductors were located and operational difficulties prevented the system from covering adequately the areas of steep terrain. The area was followed up by a wide variety of geophysical methods of which induced polarisation was probably the most successful.

Turair EM surveys have been reported over two areas on the west coast. The system used over EL 7/68, Howland-Rose (1973) and Discala (1974), covered most of the Dundas Group sedimentary sequences between Mt. Dundas and Zeehan. One group, Anomalies 22, 23, 24, 25, 29 & 30, which were not checked on the ground, were located north of the Professor Range Magnetic Zone 19, Corbett et al (1982). These conductors parallel a magnetic trend interpreted as the nose of an anticline. These EM anomalies were not tested, presumably because of a poor conductivity width, but had the flight line direction been 30 degrees east of north this may have enhanced the response due to better coupling with the conductor. This area may warrant reviewing.

The second area where Turair has been used is the Southern Mt. Read Volcanics, Ruddock (1974). A total of 75 Turair anomalies were detected with all responses classified as weak and within the noise level of the instrumentation. The majority were phase anomalies of low magnitude, indicating poor conductors and of the total, only 8 anomalies were selected for ground investigation. The Turair anomalies were scattered throughout the area with no consistent pattern. Some of the anomalies were located over chlorite alteration zones however only at Proprietary Peak and Hyde's Prospect were there anomalies correlating with mineralisation. No other occurrences within the survey area were detected by the EM system. The conclusion drawn from this survey is that the Turair method did not achieve adequate penetration as most of the anomalies were within the noise level of the

intrumentation. Anomalies 12 & 57, the best two responses could not be located on the ground by I.P. methods.

An INPUT survey was flown over a large area of the Rocky Cape Region, Neale (1974). The specifications were apparently designed to locate massive targets as flight lines were spaced at 1600 metres, (1 mile), with infil in selected areas at 800 metres. Although the survey called for a terrain clearance of 120 metres this was not achieved in the mountainous areas. The survey was followed up and the majority of the anomalies were confirmed as either black graphic slates or where there was no outcrop a black graphic slate was assumed.

A portion of EL 18/74 and a Tasmania Department of Mines Reserve were flown by helicopter McPhar H400 EM in 1975, MacNamara (1976), and mainly covered the older Precambrian Oonah quartzites and slates north-east of Zeehan. The survey involved 450 line kilometres of flying at a spacing of 200 metres. A total of 44 anomalies were detected, the bulk of which were related to black shaley pyritic siltstones. Three of the EM conductors had coincident geochemical anomalies indicating the survey to be a technical success. The magnetic data recorded as part of the survey was not processed as it was extremely flat and this can be seen in the regional coverage.

From discussions with a number of companies and contractors operating in the area it is understood that both Dighem and the Geonic EM 33 systems have been flown on the west coast. The results of these surveys have not reached the open file data, however, the initial indications are that the Dighem system has been used with some success over the potential skarn areas.

Airborne EM methods are now an integral part of exploration on the west coast of Tasmania and were proposed by Reid & Meares (1981) as a primary reconnaissance procedure. The basis for this recommendation was the success of the technique in locating the Que River deposit. The volcanic rocks of the region are typically highly resistive. There is little or no conductive overburden with fresh sulphides often at surface. At present there are probably three airborne systems available in Australia which have been tested and applied in this area; INPUT, a fixed wing system, and Dighem and the Geonic EM 33, both of which are helicopter systems.

The author was involved in the Que River helicopter EM surveys in 1972 and 1974/75 and from this experience makes the following observations. The method located the conductor and the results were repeatable. The system used, the McPhar H400, consisted of a transmitter fitted to the helicopter with the receiver in a towed bird, (similar to INPUT). To maintain the correct geometry between the transmitter and the receiver it was necessary to maintain a minimum forward air speed and this limitation prevented the system from operating in the valleys. The system did not work when the helicopter was in a near vertical climb up the escarpments which limited the coverage to the relatively flat

country or the hill tops. Navigation in mountainous country with dense forest cover proved to be extremely difficult. The flight path map presented by Webster and Skey (1979) demonstrates the problem. The use of INPUT in this area would be restricted by the same limitations and would not be cost effective. Dighem or Geonic EM 33, both of which have the transmitter and receiver mounted in a boom towed under the aircraft, would be far more manoeuvrable provided the installation is in a powerful helicopter. This will be expensive to operate therefore while the helicopter is on site the maximum benefit should be obtained. The first priority would be to ensure the navigation problems are minimised and the additional cost of using a range-range radio transponder system is definitely warranted.

Another major consideration is the flight line spacing. When the decision has been made to carry out a helicopter EM survey the major cost will be the mobilisation, therefore the additional expenditure in closing the line spacing to a minimum would not be proportionally great. This has the advantage of ensuring blanket coverage of the area.

The use of induced polarisation, self potential and ground electromagnetic methods has been reported in many areas, Hallof (1967), Howland-Rose (1971), Keunecke and Tate (1954), Langron (1966) and Williams (1964a & 1964b). This would be a far from complete list of the ground geophysical surveys which have been carried out in north-western Tasmania. In all areas where I.P. was used over known mineralisation there has been a significant response which could be equated to the occurrence.

Induced Polarisation would be the most successful method used in the area and with the improvement in equipment design this technique should be used wherever possible. Self Potential was used over the tin deposits at Renison Bell and Cleveland and showed there to be a consistent relationship between the ore bodies and S.P. anomalies. Although this technique has been applied with success over two larger deposits it should not be the only method used to test potential tin ore bodies. It would be better to use the method in conjunction with an I.P. survey. Ground EM techniques are now being applied elsewhere in Australia where there are problems with conductive overburden and the west coast of Tasmania would be a primary area for using ground EM.

CONCLUSIONS

This review was primarily based upon the aeromagnetic survey carried out by the Tasmania Department of Mines in 1982. These results formed an excellent geophysical data base which was expanded to include as many other geophysical techniques as possible. The specifications of the airborne survey were designed to test both the regional magnetic responses and where necessary, detail data over the known mineralisation. For any group exploring this region there are few areas where additional airborne magnetic surveys would be necessary. Probably the most unfortunate feature of the survey, in the author's opinion, is the omission of a radiation spectrometer. The additional information from the spectrometer results over the tin granites would have been of great benefit.

On a regional basis the magnetic results over the Mt. Read Volcanics warrant attention. Over the Eastern Sequence there is a consistent magnetic anomaly approximately 2-3 kilometres wide extending from Mt Farrell to South Darwin Peak. This anomaly correlates with the Murchison Granite and leads to a possible conclusion that there is a common granitic source. At South Darwin Peak there is also a section of granite which is magnetically similar to the Murchison Granite. The northern extent of the Eastern Sequence magnetic anomaly is terminated by the Henty Fault. The majority of the lead-zinc mineralisation is north of the Fault in non-magnetic areas compared to the copper occurrences south of the Fault which are related to the magnetic features. The majority of copper sulphides are located in chloritic alteration zones in the Central Sequence adjacent to the Eastern Sequence with the coincident magnetic anomalies usually due to quartz-hematite-magnetite veins. Elsewhere over the Mt. Read Volcanics it was not possible to distinguish between the Central and Western Sequences which had similar magnetic responses. There are a number of magnetic anomalies in the Mt. Read Volcanics which are not explained by the current mapping. The most interesting response is a feature similar to the Mt. Lyell anomaly 7.5 kilometres to the north of the mine. A second feature, Zone 30, is located in an area of glacial till with a magnetic response similar to Zone 32 which is a basic intrusive body. Zone 25 which is located over Queenstown and Lynchford, on the contact between the Mt. Read Volcanics and the Gordon Limestone also warrants investigation. The source of the magnetic anomaly 2 kilometres north of Rosebery should be identified by ground follow-up.

There are no regional gravity anomalies associated with the Mt. Read Volcanics. The only gravity feature noted is the Queenstown Lineament which is a northerly striking feature along the western boundary and is terminated to the north by the Renison Lineament. The Mt. Read Volcanics region is one of the few areas in Australia where helicopter electromagnetic methods have been used

with success. Any group interested in exploring these areas would be advised to review all previous airborne electromagnetic surveys over the region to decide which system was most suitable and how effective the system has proved in the past.

The granitic intrusions, with the exception of the Murchison and a section of the South Darwin Peak Granites, are non-magnetic although they appear to be surrounded by highly metamorphosed magnetic skarns. The amplitude of the magnetic anomalies associated with these skarns is larger than normal and in places could be interpreted as ultrabasic bodies. This is most evident along the eastern contact of the Meredith Granite where it is difficult to decipher the end of the ultrabasics and the beginning of the skarns. Collins (1981) has proposed that the Meredith Granite is the source of the Mt. Bischoff and Cleveland tin mineralisation via a system of feeder dykes similar to the Pine Hill Porphyry dyke at Renison Bell. Due to the presence of the highly magnetic aureoles it has not been possible to identify any magnetic feature which could confirm this model.

The larger granitic bodies, with the exception of the Pieman, Murchison and South Darwin Peak Granites, all intruded a belt defined by the Renison Gravity Lineament to the south-east and the Cleveland and St. Dizier Gravity Lineaments to the north-west, with the major zones of tin mineralisation adjoining these gravity features. Airborne electromagnetic methods are being used in the exploration for tin skarns along the granite contacts. The results of these surveys are still confidential, however, it is understood that the method has been used with a good deal of success.

The use of radiometric methods in tin exploration has been recognised and applied only recently, but to date this technique has not been used on the west coast of Tasmania. Ground tests carried out by the Tasmania Department of Mines indicated that the tin granites could be described as 'hot granites' with elevated concentrations of uranium and thorium. The radiometric data currently available indicates that the Heemskirk Granite is the most favourable granite for potential tin mineralisation.

The magnetic results in the Renison Bell area are confused by the presence of a number of ultrabasic bodies. There is a large amplitude anomaly coincident with the mineralisation and a similar feature can be traced to the south-west of the mineralisation. The source of this anomaly warrants identification. The Pine Hill Porphyry body cannot be positively identified in the magnetic data. The Success Creek red chert horizon which hosts the mineralisation can be traced magnetically to the north-west of Renison Bell, with an increase in magnetic activity where it abuts the Meredith Granite near Mt. Lindsay. This is a high priority area for further investigation. Electromagnetic surveys in this area showed a number of conductors in the vicinity of the Stanley River.

The Renison Gravity and Magnetic Lineament passes through the

centre of the Pine Hill Porphyry body and the outcrops of Nevada Creek Granite. Although the magnetic results in the area south of Renison Bell are confused, this Lineament dominates the area with the same pattern repeated west of Zeehan.

A synclinal model has been proposed as a possible alternative interpretation of the Arthur Lineament. This was based upon the symmetrical nature of the magnetic linears which form the Arthur Lineament. The syncline was uplifted by a major tectonic event associated with the Meredith Granite and the Cleveland Gravity Lineament. The Savage River mineralisation is located in the keel of the syncline adjacent to the uplifted area. There are three non-magnetic zones along the Cleveland Gravity Lineament, the area surrounding the Mt. Bischoff Mine, the area north of the Cleveland Mine and the Whyte River area immediately east of Savage River, which are similar in character. If the source of the tin mineralisation at Mt. Bischoff and Cleveland is not associated with the Meredith Granite but with secondary blind granites intruded into the Cleveland Gravity Lineament, (as proposed by Taylor 1979) the Whyte River area will warrant reviewing. This area is favourable as a potential site for a granitic intrusion as it is located at the intersection of two major gravity lineaments.

A number of magnetic anomalies are located around the edge of the Dundas Trough, some of which should be identified on the ground. The response over the Queenstown and Lynchford area has easy access for ground identification.

Although the Que River deposit was detected by geophysical methods there is no regional magnetic expression which could be related to the mineralisation. It will be necessary to use an airborne electromagnetic system to locate this type of mineralisation with ground follow up of detail I.P. or EM.

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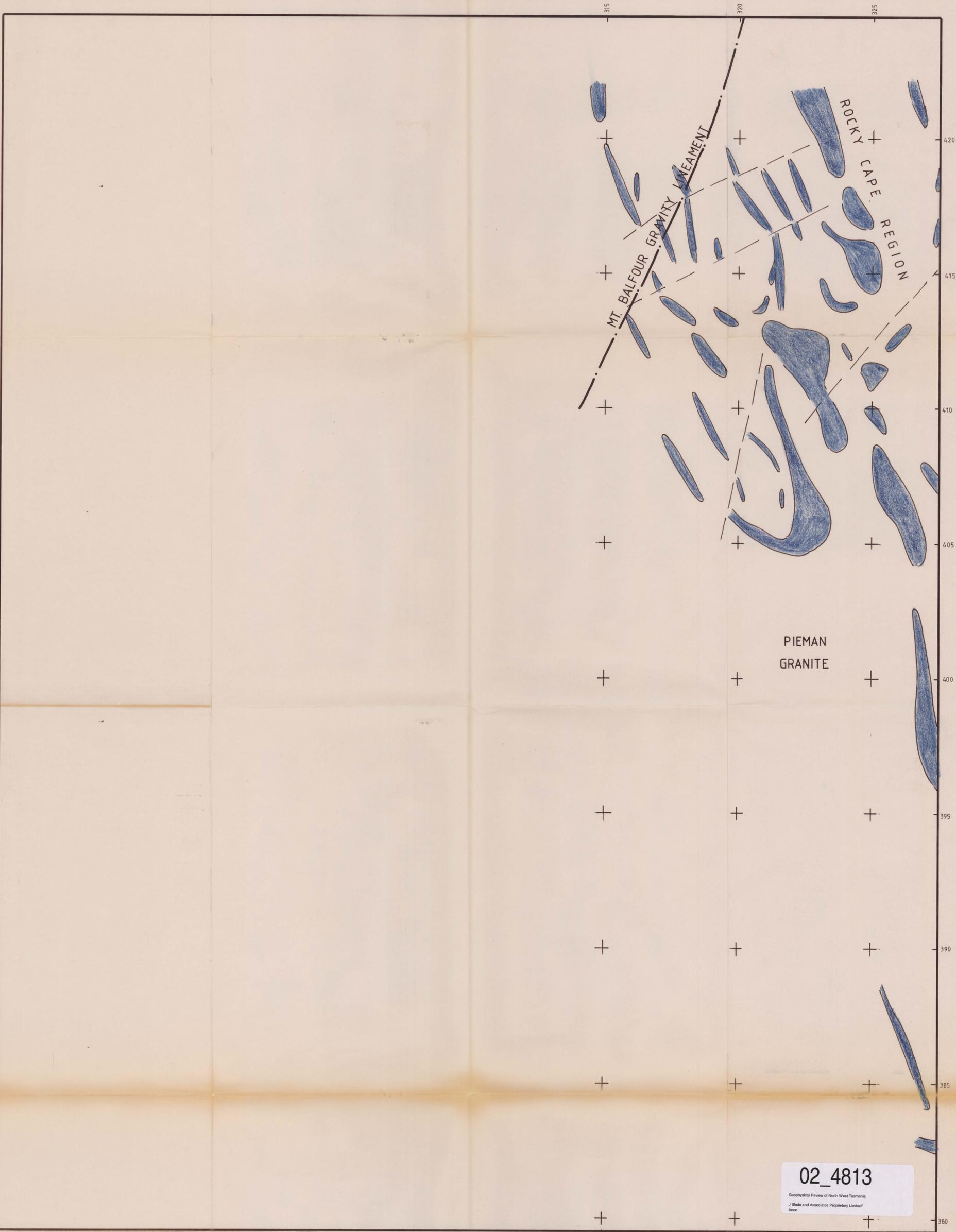
APPENDIX 1

SURVEY SPECIFICATIONS

The airborne geophysical survey carried out by the Tasmania Department of Mines was flown during May 1981. The survey was contracted to Georex Pty. Ltd., Unley, S.A., and covered an area on the West Coast of Tasmania bounded by 41 deg. 20 min. south, 145 deg. 45 min. east and 42 deg. 27 min. south. The western boundary of the survey area was the coast line. This area is located on the Burnie (SK 55-3) and Queenstown (SK 55-5) 1:250000 map sheets. The survey specifications were as follows;

Aircraft.....Cessna 185E
Magnetometer....Sonotek IGSS1 System
Line Spacing....500 metres
Sensor Height...135 metres

Although the notes attached to the maps indicate that a radiometric survey was flown in conjunction with the aeromagnetic coverage this was not the case (confirmed by Georex 1983). The I.G.R.F. was subtracted from the Total Magnetic Field and a three point filter was applied. The data were gridded using a 125 X 125 metre mesh and the results presented as Total Magnetic Intensity Contours using a minimum contour interval of 5nT. The presentation scale was 1:50000 along with photoreductions to 1:100000, 1:250000 and 1:500000.



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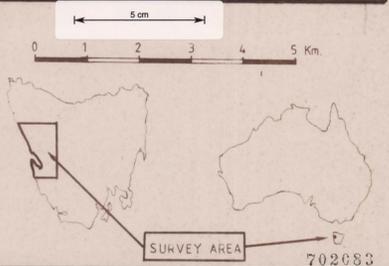
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	Normal Magnetisation		Slightly Magnetic
	Remnant Magnetisation		Non-magnetic
	Random Magnetisation		Magnetic
MT. READ VOLCANICS			Small Porphyry Bodies
	Eastern Sequence		Magnetic Skarn
	Central & Western Sequences		Slightly Magnetic Skarn
	Chloritic Alteration Zones (Ruddock)	INTRUSIVE ROCKS	
OLDER FORMATION			Jurassic Dolerite
	Success Creek - (red chert)		Basic Rocks
	Rocky Cape Region		Ultrabasic Rocks
	Arthur Lineament		Ultrabasic Rocks - Remnant Magnetisation
	Tyennan Nucleus	TOPOGRAPHIC	
	PreCambrian		Township
			Mountain or Hill
			Lake

SYMBOLS

MAGNETIC	
	Magnetic Contact
	Major Magnetic Boundary
	Fault
	Anomaly Number (Corbett et al)
GRAVITY	
	Lineament
	Major Contact
ELECTROMAGNETIC	
	Anomaly
	Conductive Zone
	Mineral Prospect

SHEET INDEX

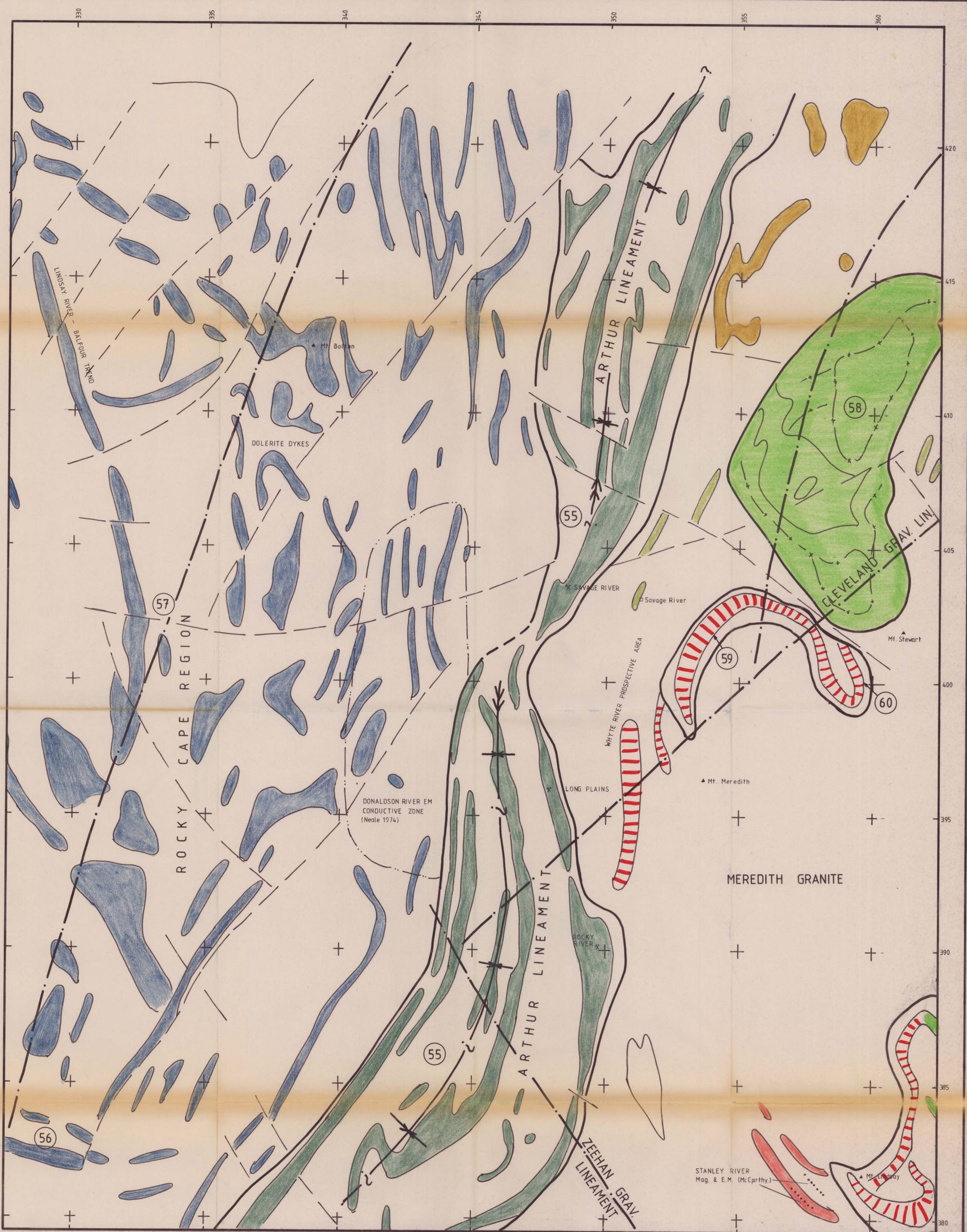
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	6	7



PLATE

1	ROCKY CAPE
2	SAVAGE RIVER
3	WARATAH
4	HEEMSKIRK
5	QUEENSTOWN
6	STRAHAN
7	MACQUARIE HARBOUR

J. SLADE & ASSOCIATES PTY. LTD.
GEOPHYSICAL INTERPRETATION MAP
ROCKY CAPE
WEST COAST OF TASMANIA
 Compiled by J.C. SLADE Date: March 1983 Scale: 1:50,000 PLATE 1



MAGNETIC INTERPRETATION REFERENCE

- TERTIARY BASALT**
- Normal Magnetisation
 - Remnant Magnetisation
 - Random Magnetisation
- MT. READ VOLCANICS**
- Eastern Sequence
 - Central & Western Sequences
 - Chloritic Alteration Zones (Ruddock)
- OLDER FORMATION**
- Success Creek - (red chert)
 - Rocky Cape Region
 - Arthur Lineament
 - Tyennan Nucleus
 - PreCambrian

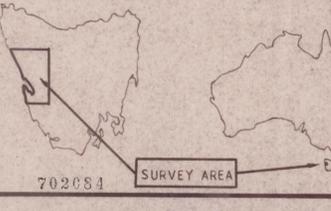
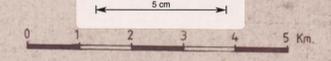
- PLUTONIC ROCKS**
- Slightly Magnetic
 - Non-magnetic
 - Magnetic
 - Small Porphyry Bodies
 - Magnetic Skarn
 - Slightly Magnetic Skarn
- INTRUSIVE ROCKS**
- Jurassic Dolerite
 - Basic Rocks
 - Ultrabasic Rocks
 - Ultrabasic Rocks - Remnant Magnetisation
- TOPOGRAPHIC**
- Township
 - Mountain or Hill
 - Lake

SYMBOLS

- MAGNETIC**
- Magnetic Contact
 - Major Magnetic Boundary
 - Fault
 - Anomaly Number (Corbett et al.)
- GRAVITY**
- Lineament
 - Major Contact
- ELECTROMAGNETIC**
- Anomaly
 - Conductive Zone
- Other Symbols**
- Mineral Prospect
 - Proposed Arthur Lineament
 - Syncline indicating plunge

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6	7	



- PLATE**
- ROCKY CAPE
 - SAVAGE RIVER
 - WARATAH
 - HEEMSKIRK
 - QUEENSTOWN
 - STRAHAN
 - MACQUARIE HARBOUR

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GEOPHYSICAL INTERPRETATION MAP

SAVAGE RIVER

WEST COAST OF TASMANIA

Compiled by J.C. SLADE Date: March 1983 Scale: 1:50,000 PLATE 2

02_4813



MAGNETIC INTERPRETATION REFERENCE

TERTIARY BASALT		PLUTONIC ROCKS	
Re	Normal Magnetisation	+ +	Slightly Magnetic
Re	Remnant Magnetisation	- -	Non-magnetic
Ra	Random Magnetisation	+ +	Magnetic
MT. READ VOLCANICS			Small Porphyry Bodies
Orange	Eastern Sequence		Magnetic Skarn
Yellow	Central & Western Sequences		Slightly Magnetic Skarn
Green	Chloritic Alteration Zones (Ruddock)	do	Jurassic Dolerite
OLDER FORMATION		Green	Basic Rocks
Red	Success Creek - (red chert)	Re	Ultrabasic Rocks
Blue	Rocky Cape Region	Re	Ultrabasic Rocks - Remnant Magnetisation
Green	Arthur Lineament	□	Township
Yellow	Tyennan Nucleus	▲	Mountain or Hill
Blue	Pre-Cambrian	○	Lake

SYMBOLS

MAGNETIC		GRAVITY	
—	Magnetic Contact	—	Lineament
—	Major Magnetic Boundary	—	Major Contact
- - -	Fault	•	Anomaly
(56)	Anomaly Number (Corbett et al)	•••	Conductive Zone
ELECTROMAGNETIC		✱	Mineral Prospect

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6	7	

PLATE

1	ROCKY CAPE
2	SAVAGE RIVER
3	WARATAH
4	HEEMSKIRK
5	QUEENSTOWN
6	STRAHAN
7	MACQUARIE HARBOUR

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GEOPHYSICAL INTERPRETATION MAP

WARATAH

WEST COAST OF TASMANIA

Compiled by J.C. SLADE Date: March 1983 Scale: 1:50,000 PLATE 3

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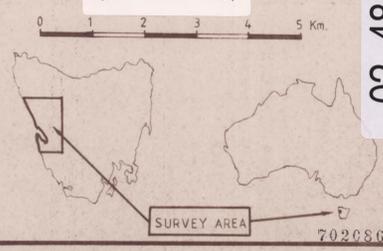
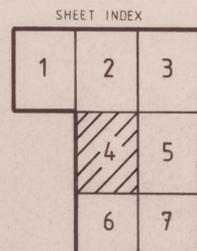
MAGNETIC INTERPRETATION REFERENCE

- TERTIARY BASALT**
- Normal Magnetisation
 - Remnant Magnetisation (Re)
 - Random Magnetisation (Ra)
- MT. READ VOLCANICS**
- Eastern Sequence
 - Central & Western Sequences
 - Chloritic Alteration Zones (Ruddock)
- OLDER FORMATION**
- Success Creek - (red chert)
 - Rocky Cape Region
 - Arthur Lineament
 - Tyennan Nucleus
 - PreCambrian

- PLUTONIC ROCKS**
- ++ Slightly Magnetic
 - - Non-magnetic
 - +++ Magnetic
 - Small Porphyry Bodies
 - Magnetic Skarn
 - Slightly Magnetic Skarn
- INTRUSIVE ROCKS**
- do Jurassic Dolerite
 - Basic Rocks
 - Ultrabasic Rocks
 - Re Ultrabasic Rocks - Remnant Magnetisation
- TOPOGRAPHIC**
- Township
 - ▲ Mountain or Hill
 - Luke

SYMBOLS

- MAGNETIC**
- Magnetic Contact
 - Major Magnetic Boundary
 - Fault
 - (56) Anomaly Number (Corbett et al)
- GRAVITY**
- Lineament
 - Major Contact
- ELECTROMAGNETIC**
- Anomaly
 - Conductive Zone
- Other Symbols**
- Mineral Prospect
 - Syncline



- PLATE**
- 1 ROCKY CAPE
 - 2 SAVAGE RIVER
 - 3 WARATAH
 - 4 HEEMSKIRK
 - 5 QUEENSTOWN
 - 6 STRAHAN
 - 7 MACQUARIE HARBOUR

J. SLADE & ASSOCIATES PTY. LTD.

GEOPHYSICAL INTERPRETATION MAP

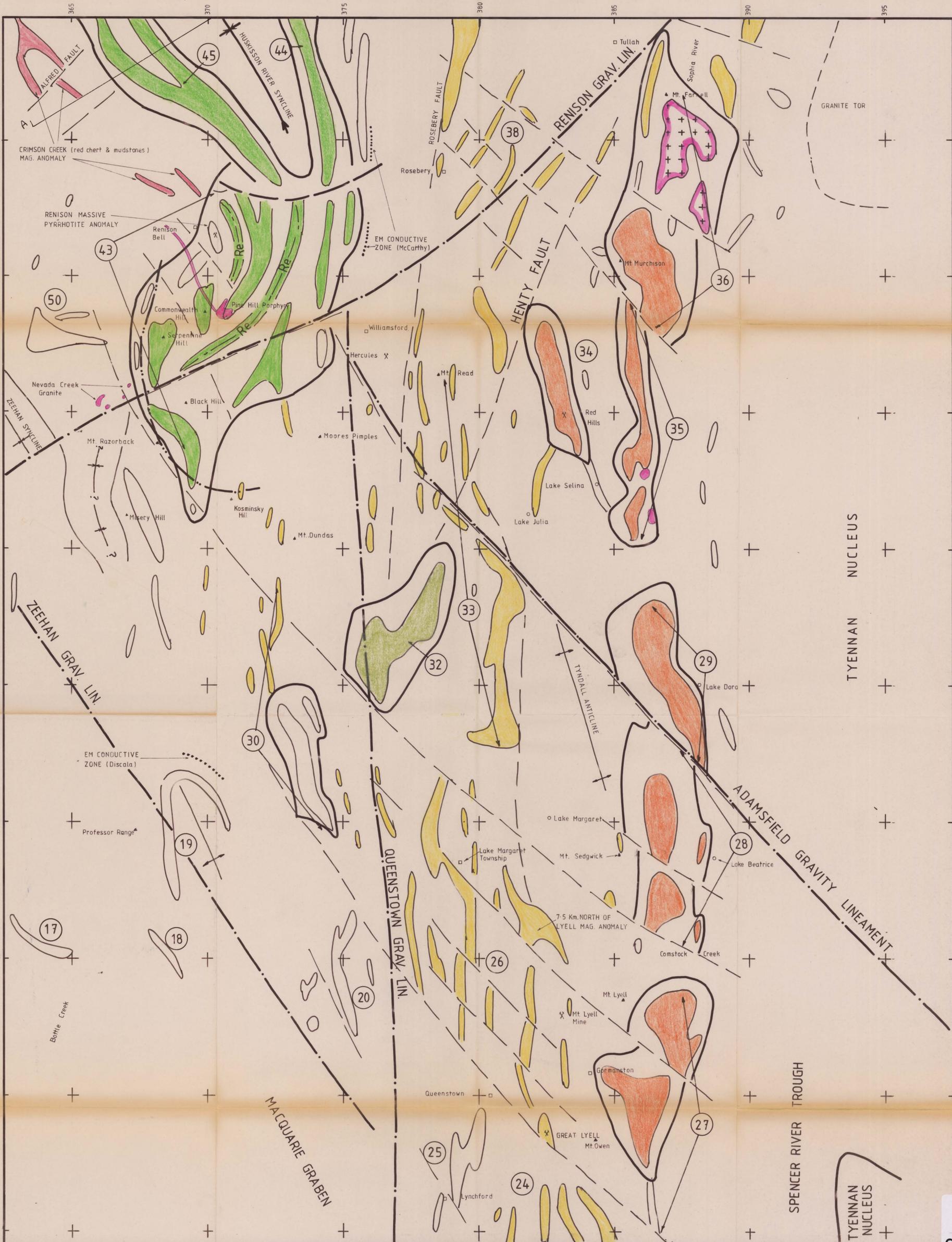
HEEMSKIRK

WEST COAST OF TASMANIA

Compiled by J.C. SLADE Date: March 1983 Scale: 1:50,000 PLATE 4

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Slade and Associates Proprietary Limited
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MAGNETIC INTERPRETATION REFERENCE

- TERTIARY BASALT**
- Normal Magnetisation
 - Remnant Magnetisation (Re)
 - Random Magnetisation (Ra)
- MT. READ VOLCANICS**
- Eastern Sequence
 - Central & Western Sequences
 - Chloritic Alteration Zones (Ruddock)
- OLDER FORMATION**
- Success Creek - (red chert)
 - Rocky Cape Region
 - Arthur Lineament
 - Tyennan Nucleus
 - Pre-Cambrian

- PLUTONIC ROCKS**
- Slightly Magnetic
 - Non-magnetic
 - Magnetic
 - Small Porphyry Bodies
 - Magnetic Skarn
 - Slightly Magnetic Skarn
- INTRUSIVE ROCKS**
- Jurassic Dolerite (do)
 - Basic Rocks
 - Ultrabasic Rocks
 - Ultrabasic Rocks - Remnant Magnetisation (Re)
- TOPOGRAPHIC**
- Township
 - Mountain or Hill
 - Lake

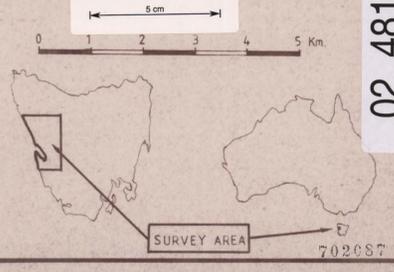
SYMBOLS

- MAGNETIC**
- Magnetic Contact
 - Major Magnetic Boundary
 - Fault
 - Anomaly Number (Corbett et al.)
- GRAVITY**
- Lineament
 - Major Contact
- ELECTROMAGNETIC**
- Anomaly
 - Conductive Zone
- Other Symbols**
- Mineral Prospect
 - Anticline
 - Syncline

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- PLATE**
- 1 ROCKY CAPE
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 - 3 WARATAH
 - 4 HEEMSKIRK
 - 5 QUEENSTOWN
 - 6 STRAHAN
 - 7 MACQUARIE HARBOUR



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GEOPHYSICAL INTERPRETATION MAP

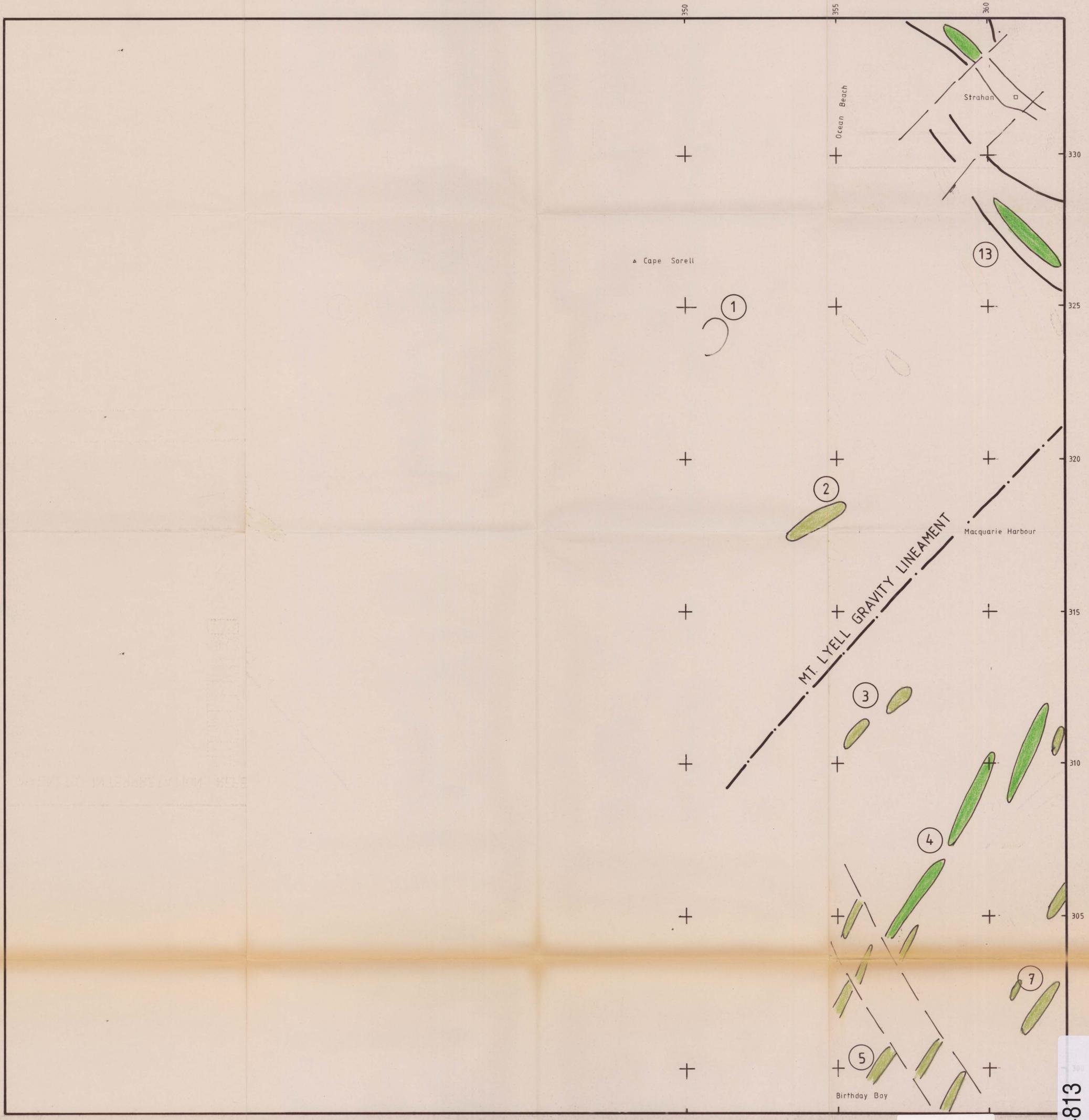
QUEENSTOWN

WEST COAST OF TASMANIA

Compiled by J.C. SLADE Date: March 1983 Scale: 1:50,000 PLATE 5

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Geophysical Review of North West Tasmania
J. Slade and Associates Proprietary Limited
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MAGNETIC INTERPRETATION REFERENCE

TERTIARY BASALT

- Normal Magnetisation
- Remnant Magnetisation
- Random Magnetisation

MT. READ VOLCANICS

- Eastern Sequence
- Central & Western Sequences
- Chloritic Alteration Zones (Ruddock)

OLDER FORMATION

- Success Creek - (red chert)
- Rocky Cape Region
- Arthur Lineament
- Tyennan Nucleus
- PreCambrian

PLUTONIC ROCKS

- Slightly Magnetic
- Non-magnetic
- Magnetic
- Small Porphyry Bodies
- Magnetic Skarn
- Slightly Magnetic Skarn

INTRUSIVE ROCKS

- Jurassic Dolerite
- Basic Rocks
- Ultrabasic Rocks
- Ultrabasic Rocks - Remnant Magnetisation

TOPOGRAPHIC

- Township
- Mountain or Hill
- Lake

SYMBOLS

MAGNETIC

- Magnetic Contact
- Major Magnetic Boundary
- Fault
- Anomaly Number (Corbett et al.)

GRAVITY

- Lineament
- Major Contact

ELECTROMAGNETIC

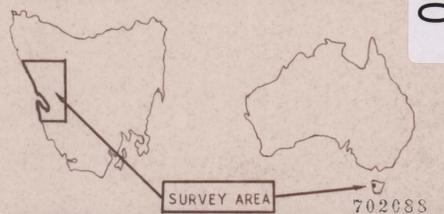
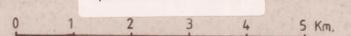
- Anomaly
- Conductive Zone
- Mineral Prospect

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PLATE

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- 2 SAVAGE RIVER
- 3 WARATAH
- 4 HEEMSKIRK
- 5 QUEENSTOWN
- 6 STRAHAN
- 7 MACQUARIE HARBOUR



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GEOPHYSICAL INTERPRETATION MAP

STRAHAN

WEST COAST OF TASMANIA

Compiled by J.C. SLADE Date: March 1983 Scale: 1:50,000 PLATE 6

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Anon



MAGNETIC INTERPRETATION REFERENCE

- | | |
|--------------------------------------|--|
| TERTIARY BASALT | PLUTONIC ROCKS |
| Normal Magnetisation | Slightly Magnetic |
| Remnant Magnetisation | Non-magnetic |
| Random Magnetisation | Magnetic |
| MT. READ VOLCANICS | Small Porphyry Bodies |
| Eastern Sequence | Magnetic Skarn |
| Central & Western Sequences | Slightly Magnetic Skarn |
| Chloritic Alteration Zones (Ruddock) | INTRUSIVE ROCKS |
| OLDER FORMATION | Jurassic Dolerite |
| Success Creek - (red chert) | Basic Rocks |
| Rocky Cape Region | Ultrabasic Rocks |
| Arthur Lineament | Ultrabasic Rocks - Remnant Magnetisation |
| Tyennan Nucleus | TOPOGRAPHIC |
| PreCambrian | Township |
| | Mountain or Hill |
| | Lake |

SYMBOLS

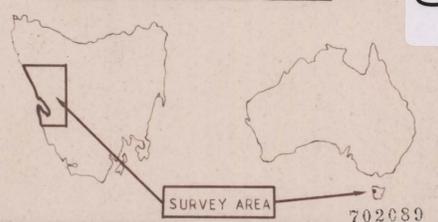
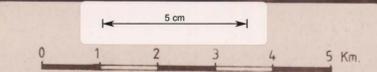
- | | |
|--------------------------------|------------------|
| MAGNETIC | Magnetic Contact |
| Major Magnetic Boundary | Fault |
| Anomaly Number (Corbett et al) | Lineament |
| GRAVITY | Major Contact |
| Anomaly | Conductive Zone |
| Mineral Prospect | |

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PLATE

- ROCKY CAPE
- SAVAGE RIVER
- WARATAH
- HEEMSKIRK
- QUEENSTOWN
- STRAHAN
- MACQUARIE HARBOUR



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GEOPHYSICAL INTERPRETATION MAP

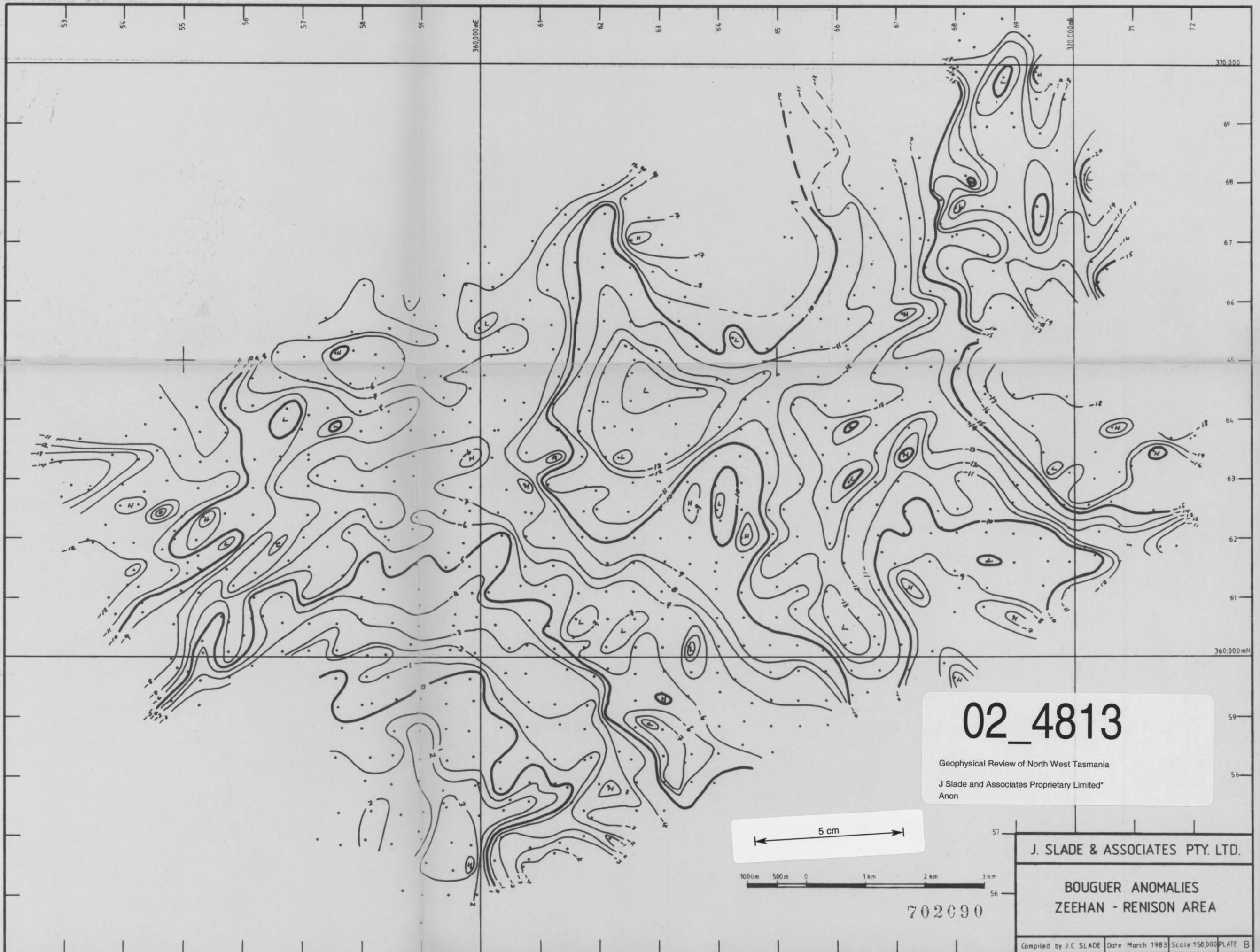
MACQUARIE HARBOUR

WEST COAST OF TASMANIA

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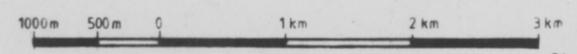
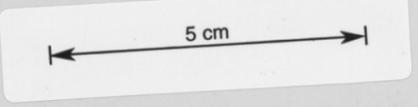
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BOUGUER ANOMALIES
ZEEHAN - RENISON AREA

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