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Western Tasmanian Regional Minerals Program
Mount Read Volcanics Compilation

Updating the geology of the Mount Read Volcanics belt

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Contents

Summary

1. This report deals with a series of recently-recognised geophysical and geological features which have been used to update geological boundaries and understanding of the geology of the Mt Read Volcanics belt between the Cradle Mountain Link Road and South Darwin Peak areas. The geophysical features have been identified from the aeromagnetic and radiometric surveys conducted for the Western Tasmanian Regional Minerals Program (WTRMP), and the geological features were compiled from company reports, research theses, and other recent published and unpublished sources.
2. A new compilation map at 1:100 000 scale has been drawn of the Mt Read belt to display the updated geology. Maps of the aeromagnetics and radiometrics (potassium only) over the same area at the same scale are also available.
3. One of the more significant advances has been the recognition of several new areas of Tyndall Group equivalents within the Dundas 'trough', including the Dundas–Black Hill area (the 'lower Brewery Junction Formation' and Razorback Conglomerate of the lower Dundas Group succession), the Rosebery–Primrose area (part of the former 'Primrose Pyroclastics'), and the Huskisson River–Ring River area (much of the 'Huskisson Group').
4. These new areas of Tyndall Group, plus some others recognised within the last few years (e.g. at lower King River, lower Yolande River, Henty Fault Wedge, Howards Road, Silver Falls–Bulgobac), mean that the widespread Middle Cambrian volcano-sedimentary sequences can now be subdivided in virtually all areas into Tyndall Group and pre-Tyndall Group units, a most useful subdivision. An updated biostratigraphic correlation chart has been constructed to show the changes.
5. The known concentration of mineralisation at the base of the Tyndall Group in a number of areas (e.g. the Henty–Comstock line) suggests that at least some of the new areas have exploration potential. The lower King River occurrence suggests that the Tyndall Group may be linked to the Noddy Creek Volcanics of the Sorell Peninsula.
6. Studies undertaken as part of this project have established that the 'eastern sequence' in the Jukes- Darwin area consists mostly of Tyndall Group correlates resting unconformably on Central Volcanic Complex (CVC) rocks, whereas that in the Mt Murchison-Lake Dora area is true Eastern Quartz-Phyric Sequence and is contemporaneous and interfingering with the CVC. A number of good field, petrological and geochemical criteria have been established to differentiate the two, thereby largely resolving a long-time problem of Mt Read stratigraphy.
7. Confirmation of the Tyndall Group sequence at Jukes–Darwin raises the possibility of there being buried Mt Lyell-type deposits along the southern extension of the Great Lyell Fault, with major alteration focussed at the concealed base of the Tyndall Group and appearing 'at the fringes' along the exposed CVC rocks to the west. This scenario provides a completely new exploration 'play', as also discussed by Morrison (2002), but will require release of an appropriately sized land area to make it a viable proposition.
8. A major stratigraphically significant pumice breccia unit is now recognised at the top of the CVC sequence in the Rosebery–Hercules area (Gifkins, 2001), where it forms the footwall sequence to both mines. The unit is also present on the upthrown side of the Mt Black Fault, immediately east of Rosebery, and extends from here to the Mt Kershaw–Pinnacles area, where it apparently passes along strike into the Que–Hellyer stratigraphic sequence (Southwell Subgroup down to Animal Creek Greywacke) in the vicinity of the Hollway Andesite. This raises the possibility of directly correlating between Rosebery and Hellyer.
9. Visits to field localities at Lake Mackintosh revealed that correlates of the Southwell Subgroup of the Cradle Mountain Link Road area (in particular the Murrays Road Greywacke) are present within the Farrell Slates belt. It is suggested that this belt contains a complete, if possibly condensed, sequence of all the Mt Charter Group units, from Animal Creek Greywacke to Southwell Subgroup, and represents the tectonised remnant of a once-continuous basin between the two blocks of CVC 'basement' rocks.
10. The enigmatic 'Rosebery Group' sequence can be re-assigned as mostly marine Owen Group correlates, following the discovery of fossils at Higgins Creek (Jell et al., 1991), and forms a narrow but continuous belt from the Hatfield River to the Dundas–Professor Range area, where it links to the conglomerate and shallow marine sandstone sequence at Mt Zeehan.
11. A new belt of Cleveland–Waratah Association basaltic rocks has been added to the map in the Coldstream River–Boco Road area, based on the aeromagnetic survey and a company drill hole. This belt may well be continuous with the larger belt of such rocks extending from Mt Ramsay to Colebrook Hill. Such rocks probably form a good deal of the basement to the Mt Read Volcanics, and appear in a rare basement window at Miners Ridge near Queenstown.

Introduction

Scope of Study

The Western Tasmanian Regional Minerals Program (WTRMP) has involved the acquisition of high-quality airborne magnetics and radiometric data over much of western Tasmania, and its analysis by personnel from Mineral Resources Tasmania (MRT) and outside contractors. The author was contracted to examine the new data over the Mt Read Volcanics belt north of Macquarie Harbour, and to combine the findings with a review of company exploration data, university research theses, and other work relevant to the area over the last ten years or so, to produce an updated map coverage and improved understanding of the belt. Updating of the maps was to include the 1:25 000 scale series coverage and 1:250 000 scale coverage as necessary, and production of one or two special summary maps at 1:100 000 scale. The mnemonic system used on the maps was to be updated if necessary. A period of approximately 100 days, spread over 5 to 6 months, was allowed for the job.

Initial examination of the new magnetic and radiometric data, mainly in the form of colour images, was undertaken in December 2001 and early January 2002, and features for field follow-up were listed. Company reports on the Mt Read area were then examined (in late January), and a list of advances in knowledge and features for follow-up prepared. Research theses on the area were examined in early February and again a list of features for field checking was drawn up. In many cases, the various field areas coincided to some extent, and several aspects could be checked in the one area at the one time. Some new geological work was also carried out on particular problems which appeared solvable in the time available, with generally very satisfactory results.

Liaison with company personnel was an important component of the project, and several days were spent in discussions and field visits with M. Vicary and T. Callaghan of Goldfields Exploration (later Aurion Gold) and with A. McNeill of Pasminco Exploration, these being the two main companies actively exploring in the area. The time spent with company people, and the information freely provided, was a particularly valuable part of the project.

Field work commenced in mid-February and continued through March and into April (total field time 30 days). Initial studies were in the southern part of the belt, with some concentration on the rocks of the eastern side of the belt between the Jukes–Darwin range and Mt Murchison. This part of the project was conducted as a joint operation with K. C. Morrison, to see if a distinction could be made between Tyndall Group and Eastern Sequence rocks to resolve a long-standing problem which had hindered understanding and mapping. Some petrological-geochemical sampling was conducted as part of this study, to provide some hard data for the comparison. This joint study — seeing the rocks with fresh eyes and concentrating on a single major problem — was very successful in largely resolving this issue and opening up new avenues for exploration (see also Morrison, 2002).

The final field work was in the form of a five-day visit to the Sheffield area , in company with MRT geologists, several company geologists for part of the time, and Ph.D. student Greg Ebsworth. This visit examined most of the major rock units in the Sheffield area, with a view to correlating them with units of the main western belt of Mt Read Volcanics. A much improved understanding of the relationships between the two areas resulted from this visit, but it became apparent that some further field work and other studies would be required before a final definitive report could be prepared for this area.

Results and Status of Project

A large number of changes to the existing maps have been identified as being desirable from the study, as a result of new information from various sources, including the new geophysical surveys. A scoping report by the author to Dr G. Green (14 May 2002) identified ten of the fourteen published 1:25 000 scale maps covering the western Mt Read belt (fig. 1), and three of the nine in the Sheffield area, as needing major to significant revision, as a result of work done or new findings since their initial production.

Three major examples of new work are the complete re-mapping of the Que–Hellyer Volcanics by Aberfoyle Resources since Komyshan's map of 1986, the re-mapping of much of the Rosebery–Hercules–Tullah area as part of a Ph.D. project by Gifkins (2001) and work by R. L. Allen, and the complete re-mapping of the Mt Lyell field by the author in 1996–99 (Corbett, 2001*a, b*). Implementation of these numerous changes adds up to a major program of work, as each 1:25 000 scale map sheet will require two to three days work to re-draw boundaries, revise mnemonics and legends, and add alteration zones where relevant. The revision of boundaries and of stratigraphic terminology and mnemonics also needs to be carried into the 1:250 000 scale series of maps when possible. It was concluded that this program of detailed map revision was beyond the time limit of the present project, which was limited to reporting on the major geological features and revisions recognised.

This report therefore deals only with the main western belt of Mt Read Volcanics, in a N–S strip from near Hellyer mine to South Darwin Peak. This area encompasses eighteen of the 1:25 000 scale series maps, from Ramsay and Charter in the north to Phillips and Engineer in the south (fig. 1). Most of the major changes to the geology identified in this area have been summarised in a new 1:100 000 scale geological map (fig. 4). Maps of the same area showing the new magnetics (fig. 5) and a map of the potassium count from the airborne radiometric survey (fig. 6) are also available. The potassium count was selected, in preference to the combined uranium-thorium-potassium image, because it better reflects the alteration styles relevant to the Mt Read Volcanics.

Acknowledgements

The author acknowledges with pleasure the co-operation and helpfulness of MRT personnel in the project, particularly program manager Dr Geoff Green, Dr Bob Richardson, Dr Marcus McClenaghan, Dr David Green and Ralph Bottrill. Chris Meech, Ken Bird and Joanne Bowerman of the Data Management Branch co-operated cheerfully and efficiently in production of the maps, and Kylie Lau was a wonderful help in the library.

The co-operation and help given by Mike Vicary and Tim Callaghan of Aurion Gold, and Andrew McNeill of Pasminco Exploration, and their generosity in terms of time and information, have been significant factors in this project, and are gratefully acknowledged.

Ken Morrison's cheerful and enthusiastic company during the first part of this project greatly added to the pleasure and quality of the experience, and the good results achieved serve to emphasise the old adage that, even in Tasmania, two good heads are often better than one.

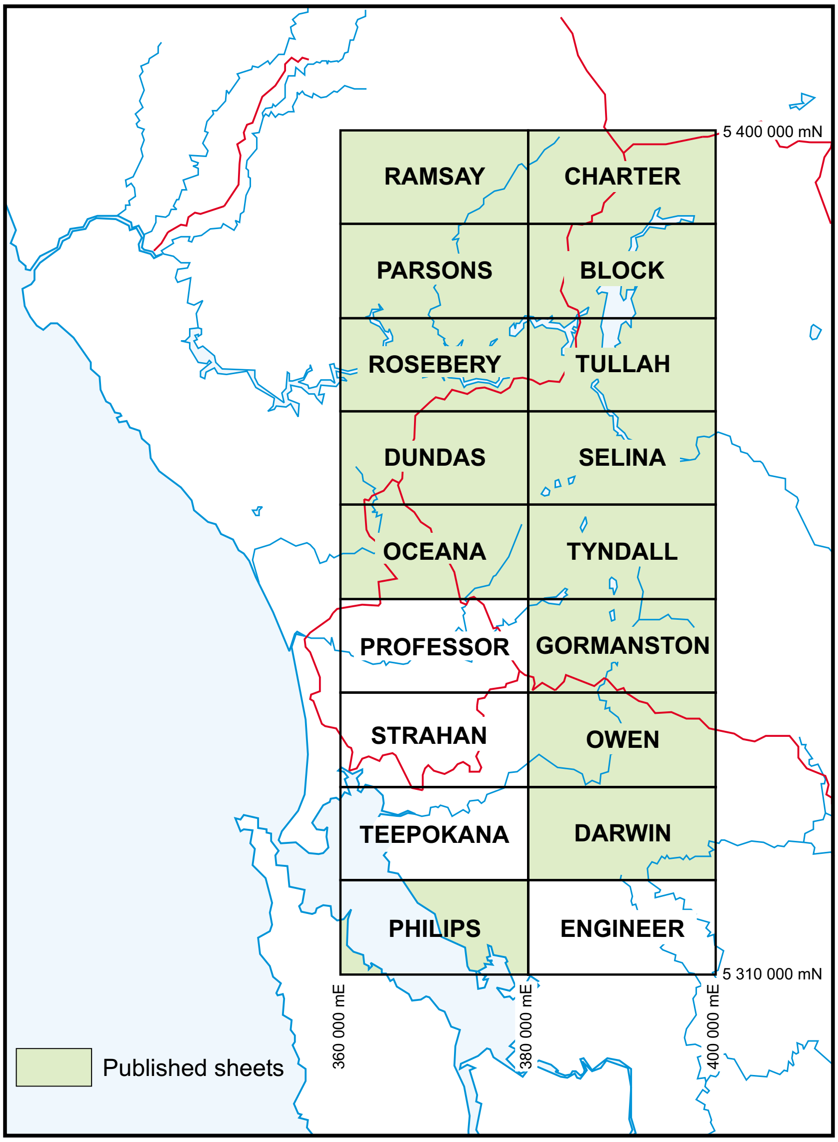

Figure 1

Layout of 1:25 000 scale map sheets covered in this report.

Tabulation of Geophysical Features and Interpretations

The following list of features identified from the magnetic and radiometric coverages, and their geological interpretations where possible, are given in order of the 1:25 000 scale series map sheets, beginning with the Ramsay and Charter sheets at the top. The aeromagnetic features are mostly apparent on Figure 5. Comments on the radiometrics are mostly concerned with the potassium counts as shown on Figure 6. The new geological boundaries are superimposed on the aeromagnetic and radiometric plots for reference.

Ramsay and Charter sheets

1. A major N–S zone of strong 'bumpy' magnetics follows the eastern contact of the belt of Precambrian Oonah-type rocks against Cambrian rocks from the Coldstream River south to the vicinity of the Boco Road (on Parsons Sheet). The zone is about one kilometre wide and 12 km long. As there was nothing in the known geology to indicate a magnetic source (i.e. neither the Oonah nor 'Dundas Group' should be magnetic), a search was made of company reports on the area. This revealed that Pasminco Exploration had drilled one of the magnetic anomalies (from a previous survey) at North Ross Creek in 1996 (Basford, 1997). The hole, NRC1, penetrated a series of basalt flows interlayered with greywacke, siltstone and mudstone. Examination of the core, held at the MRT core library, revealed that several of the basalt flows were notably magnetic, sufficient to explain the aeromagnetic anomaly. The petrology and geochemistry of the basalts, and the interpretation of their significance, are discussed in the next chapter.
2. A zone of NE-trending linear strike-controlled magnetic features crossing the Que River northeast of Silver Falls is considered to represent the Tyndall Group volcaniclastic sequence in a synclinal structure. The nose of the syncline is on the adjacent Parsons Sheet, crossing the Silver Falls track. The magnetic lines suggest that the Tyndall Group is intersected by a large quartz-feldspar porphyry body near Bulgobac Falls, but whether this intrudes the sequence, or is onlapped by it, is uncertain. The magnetic signature is similar to that for the Tyndall Group in the Mt Cripps area.
3. A very large circular magnetic feature is centred on the Bulgobac River near the junction of Charter and Block sheets, and appears to have a diameter of about 10 km (fig. 5). It lies over Southwell Subgroup rocks where two large quartz-feldspar porphyry bodies occur, but is almost certainly related to a deeper-seated cause — possibly a large ultramafic mass in the basement complex. The influence of the body extends under and beyond the Tyndall Group zone to the northwest.
4. There are small magnetic features corresponding to both the Hellyer and Que River mines, even though most (but not all) of the ore bodies are mined out.
5. A strong double spot magnetic anomaly at the northwest corner of the Sharks Fin unit of Owen Group rocks, east of the Que River mine, remains unexplained. It is possibly due to an iron oxide body on the basal Owen contact. A somewhat similar double anomaly is present at the southeast margin.
6. Within the radiometrics plot, areas of high-K response are present around the Hellyer and Que River mines, reflecting the known alteration. A strong K anomaly in the Southwell River gorge, 1.5 km east of Hellyer, on a felsic intrusive body, is unexplained, as is a strong response over upper Southwell Subgroup and Tyndall Group rocks just southwest of Mt Cripps.

Parsons and Block sheets

1. Features 1 and 2 from Ramsay Sheet extend onto Parsons.
2. A bumpy magnetic zone within CVC rocks immediately southeast of the Hollway Andesite body is unexplained, although there is some correspondence to mapped mafic dykes in the area. Similar bumpy magnetic zones seem to outline the CVC on the Block Sheet.
3. Ultramafic bodies on the east and west flanks of the Huskisson Syncline coincide with large magnetic anomalies. The eastern anomaly is a narrow linear feature to the south but bells outwards dramatically in the concealed northern part. There is a suggestion of a buried connection to the western body under the northern part of the Huskisson Syncline, and possibly to the large circular body at Bulgobac River to the northeast.
4. A zone of strong radiometrics follows the lower gorge of the Que River, with several high spots. This phenomenon is unexplained but appears to be related to the river valley rather than to the local bedrock. Many other river valleys, particularly in rainforest areas, display the same phenomenon, suggesting that the amount of bare rock present, as in riverside cliffs and platforms, is a major factor. Similar features are seen over some roads, probably reflecting the exposed clayey materials in the road base.
5. A zone of strong 'lumpy' radiometrics extends southwest from Burns Pinnacles through the Southern Trenches area into the Marionoak Valley. It probably relates, in part, to the various workings and sericite alteration in the area, but the extension under the Marionoak Valley in the area of Owen

Group correlates is surprising. Detrital deposits derived from the altered rocks may be partly responsible.

6. A second zone of moderate radiometrics extends NE–SW within CVC rocks on the north side of Lake Rosebery from the Bastyan Dam area, apparently cross-cutting several different CVC units. This may in part relate to the railway line and ballast materials.
7. The magnetic signature of the northern part of the CVC on the Block Sheet is distinctively 'busy', with several prominent northeast-trending zones crossing the Murchison Highway and seeming to wrap around the regional anticlinal structure.
8. A coincident magnetic and radiometric high is present on Bulgobac Hill, and was investigated by D. Green (pers. comm.) with indecisive results. The main rock type is a flow-banded feldspar-phyric lava, with much bare rock exposed. The unit shows some k-spar alteration, which probably explains the radiometric response, but had only low magnetic susceptibility, suggesting the magnetic anomaly has a deeper source.
9. The radiometric response over the Granite Tor granite suggests some boundary modification is warranted. Pending ground truthing, the margin has been modified to better fit the radiometrics.
10. Magnetic and radiometric responses indicate that the area of Tertiary basalt northwest of Mt Romulus is larger than previously mapped, and the area has been expanded on the new geological map (fig. 4).
11. An intense radiometric high along the lower reaches of the Brougham River, on the eastern side of Lake Mackintosh, may reflect material eroded from the Granite Tor granite body, and possibly some bare rock exposure of the large porphyry body being transected.
12. An irregular zone of high radiometrics within CVC rocks around the Tullabardine Valley, north of the Mackintosh Dam, is unexplained, but probably relates in part to the large cliffs of felsic volcanic rocks in the area.

Rosebery and Tullah sheets

1. The distinctive magnetic patterns of the Crimson Creek Formation, the two ultramafic bodies, and the belt of Cleveland–Waratah Association rocks, as seen on the Parsons map sheet, are well expressed here.
2. A strong magnetic ridge trends north from just east of Rosebery mine, fading out near Lake Rosebery. It lies close to, and just east of, the Mt Black Fault, but no explanation is obvious. A prominent anomaly at the Dalmeny prospect is possibly a continuation of this ridge.
3. A strong radiometric anomaly extends over the Rosebery footwall zone from about 1.5 km north of the mine portal to the area of Rosebery Lodes prospect to the south. The zone also extends west of the Rosebery Fault onto Tyndall Group rocks younger than the footwall sequence, perhaps reflecting the development of extensive sericite in the shear zone associated with the fault and/or alteration related to Devonian granite intrusion at depth.
4. A strong radiometric high lies within a loop of the Mt Read Road just northwest of Koonya prospect, within CVC pumice breccia rocks, presumably reflecting strong alteration not shown on existing maps.
5. A broad northeast-trending zone of lumpy magnetics extends through Mt Black and Mt Sale, and seems to correspond with part of the feldspar-hornblende-phyric dacite sequence within the Mt Black Volcanics (Gifkins, 2001).
6. The belt of Sterling Valley basaltic-andesitic volcanic rocks is notably quiet magnetically, which perhaps supports Gifkins' (2001) argument that they are not Tyndall Group correlates.
7. A broad zone of lumpy magnetics with a NNE–SSW grain coincides with the 'Murchison Volcanics' between Mt Murchison and Mt Farrell. A particularly high ridge on the west flank of Mt Farrell, with a coincident radiometric high, was investigated by D. Green (pers. comm.), who reports a quartz-phyric rhyolite lava showing magnetite veining and some k-spar alteration.
8. A strong magnetic high, with some internal 'holes', outlines the shape of the Murchison Granite body. The western margin is broadly arcuate in plan, and is marked at surface by small granite apophyses within the host volcanic rocks.
9. A series of strong magnetic highs is subtended off the northern end of the exposed Murchison Granite body, linking up with a similar series of highs along the Bond Range porphyry body to the northeast. Most of these highs appear to shelve westwards.
10. A zone of high radiometrics follows the western margin of the Murchison Volcanics along the boundary with the Farrell Slates, apparently within a unit of quartz-feldspar-phyric lavas and intrusive rocks. The presence of large cliffs and much exposed rock probably enhances this zone.

Dundas and Selina sheets

1. A distinctive lumpy to linear magnetic pattern marks the Cuni sequence southwest of Renison Bell. The strong circular high in the western corner of the Cuni zone may indicate a volcanic centre.
2. Two strong NNE-trending magnetic ridges in the Montezuma Falls–Godkin Ridge area appear to

reflect buried ridges of ultramafic rocks, the eastern one being a continuation of that exposed on Colebrook Hill, as confirmed by RGC drilling (Crossing and Halley, 1990). The eastern belt culminates in an unusual circular structure two kilometres southwest of Williamsford.

3. Subsurface connection between the Serpentine Hill and Dundas ultramafic complexes is indicated by a strong magnetic ridge between the two.
4. A strong lumpy magnetic pattern with N-S grain is evident over the CVC from the northern slopes of Mt Read through to the Henty Fault Wedge. Some possible association with felsic intrusive bodies is indicated.
5. A zone of high radiometric response extends N-S through the Hercules area, with some extension to the east over the Jones Creek shale and around the summit of Mt Read. Much of this no doubt reflects the footwall sericitic alteration at Hercules, but there is also a clear relationship to the large areas of cleared and bulldozed rock.
6. A strong N-S magnetic high follows the inner part of the zone of Eastern Quartz-Phyric Sequence rocks to the east of the belt of Owen Group around Lake Selina. Part of this high zone extends over a moraine-covered section of Owen Group on a southeast spur of Mt Murchison.
7. A zone of high magnetic response corresponds to the CVC rocks at Red Hills, and also extends partway over the adjacent Owen Group rocks, suggesting that a zone of magnetite veining extends beneath the Owen.
8. A NW-SE elongated spot magnetic high 1.5 km east of Lake Sandra, on Mt Murchison, coincides with a radiometric spot high, suggesting that there may be exposure of altered volcanic rocks or volcaniclastic conglomerate (Jukes Formation?) in this valley floor mapped as moraine (A. McNeill, pers. comm.).
9. A large radiometric anomaly lies over the Red Hills CVC rocks, and extends west across Tyndall Group rocks to the Henty Fault. It probably reflects the known k-spar and sericite alteration in the area, as well as the presence of much bare rock.
10. A zone of strong radiometric response lies over the Tyndall Group volcaniclastic conglomerate sequence at Mt Selina, with some extension over the altered EQPS rocks to the east and west.

Oceana and Tyndall sheets

1. A series of spot magnetic highs just south of Zeehan may be largely related to cultural features — the largest corresponds to the slag dump at the old Tasmania Smelters, and an adjacent one to the Zeehan rubbish tip.
2. A strong magnetic pattern with a N-S grain in the western Henty Fault Wedge has been interpreted to be related to Tyndall Group rocks, since the work of Poltock (1992*a, b*). The signature is stronger and more compact than for any of the other Tyndall Group occurrences in the general area, possibly reflecting the more proximal nature of the source volcanic-intrusive rocks. The area of igneous rocks is probably much larger than shown on the geological map (fig. 4), but there is virtually no mapping in the moraine and scrub-covered northern part of this zone.
3. A linear pattern of magnetic ridges between Mt Dundas and Howards Road is also interpreted to be a Tyndall Group response, the group lying to the west of the main part of the White Spur Formation, below the Owen Group correlates at Farrell Rivulet.
4. Much of the central and eastern parts of the Henty Fault Wedge are occupied by a large magnetic high, with its western edge formed by a N-S fault along which ultramafic rocks are exposed in the head of Hall Rivulet. The magnetic anomaly may be partly due to the known andesitic rocks exposed at Hall Rivulet, but must mainly reflect a large mass of buried ultramafic rocks, shallowing northwards to their exposure on the North Henty Fault.
5. Two sharp linear magnetic ridges in the Late Cambrian sequence east of Professor Range appear to relate to particular north-striking units, presumably carrying some detrital magnetite.
6. A moderate to strong radiometric anomaly is present along the south side of the Henty Gorge, extending for about eight kilometres upstream of where the South Henty Fault leaves the gorge. This area is mainly underlain by 'vitric tuffs' of the Yolande River Sequence, and the radiometric response probably reflects the sericitic nature of these fine-grained rocks. A similar response from the same rocks is evident along the Anthony Road and in the Langdon River gorge in this general area.
7. A zone of strong magnetics follows the Tyndall Group sequence down the western side of the Tyndall Range, becoming narrower and more broken up to the south of Whitham Bluff, in accord with the geology of the area.
8. A zone of strong magnetic response follows the EQPS from the Selina area to the Lake Dora area, extending partly over the adjacent Owen Group rocks at Walford Peak, and partly over Tyndall Group volcaniclastic rocks at the south end of Lake Dora. The northwest-trending Lake Rolleston fault is clearly visible.

9. A very large rounded magnetic anomaly extends under Owen Group rocks west of Lake Spicer and east of Mt Sedgwick, reflecting a major magnetic source in the underlying volcanic rocks. Similar anomalies are present along the belt to the south, as discussed later.
10. A zone of strong radiometrics follows the EQPS through the Lake Dora area, extending over Tyndall Group volcaniclastic rocks to Lake Spicer. The zone has an abrupt western boundary against Owen Group rocks, and reflects the extensive exposures of kspar- and sericite-altered felsic volcanic rocks and their derivatives.

Professor and Gormanston sheets

1. Several strong magnetic highs west of the Queensberry mine indicate an unmapped extension of the Tyndall Group volcaniclastic sequence into the area south of Professor Plateau, possibly with some associated mineralisation. An additional fault-bounded strip has been shown on the new map, but field checking is warranted.
2. A tongue-shaped magnetic feature in the southwest corner of the Professor Sheet is almost certainly due to an extension of the Tertiary boulder beds, with dolerite clasts, mapped nearby. The radiometric image also indicates this.
3. A linear northwest-trending low-level magnetic feature within Bell Shale south of the lower Henty River (367 000 mE, 5 342 000 mN) is almost certainly due to an intrusive dyke of some kind — possibly Devonian lamprophyre or Jurassic dolerite.
4. A prominent Tyndall Group magnetic signature is present in the corner formed by the junction of the South Henty and Firewood Siding faults. The pattern indicates the presence of a northeast-trending fault along the Yolande River causing some sinistral displacement of the sequence.
5. Magnetic ridges correspond to the intrusive porphyry bodies in the Yolande River–Madam Howards Plains area, and to several of the andesite intrusive rocks in the Lake Margaret Road area. The 'Horse Paddock Andesite' has a prominent magnetic signature, and has been drilled by RGC as the 'Penghana prospect'.
6. The large sub-Owen magnetic high east of Mt Sedgwick continues south over exposed CVC and Tyndall Group rocks. The magnetite-veined rhyolite body to kilometres southeast of Mt Sedgwick obviously contributes to this anomaly, but there is probably also a contribution from Tyndall Group rocks with detrital magnetite. The Tyndall Group volcaniclastic rocks southwest of Lake Beatrice form a second strong magnetic anomaly.
7. Several small magnetic highs near the southwest foot of Sedgwick Bluff, in the vicinity of the Tyndall Group–Great Lyell Fault–Owen Group contact, are of economic interest because of their proximity to the West Sedgwick prospect.
8. A very strong magnetic response is evident over the Tyndall Group rocks at the eastern end of Mt Lyell, with a similar response along their continuation on the eastern flanks of Mt Owen. This is no doubt partly due to the detrital magnetite in the Tyndall rocks, but the similarity to the large anomaly east of Mt Sedgwick also suggests a deeper source is involved. The positions of the North Lyell Fault, a northeast-trending fault near the Burbury prospect, and a major northeast structure just 'offshore' in Lake Burbury, are clearly apparent. A strong radiometric response is also evident over these rocks, particularly the upper Tyndall conglomerates.
9. A strong radiometric response is evident in the Tyndall Group rocks on the slopes west of Lake Beatrice, extending around to Mt Sedgwick. There is also a strong response over the exposed CVC and Western Sequence volcanic rocks at Mt Sedgwick.
10. A large zone of high radiometrics blankets the Mt Lyell workings area, extending west to Queenstown township, north through Cape Horn to the Lyell Comstock area, and south over Little Owen Spur. The sensitivity of the response is reflected by the presence of 'holes' over the Comstock Chert body and adjacent moraine patch, and over the Tharsis Ridge Owen inlier.

Strahan and Owen sheets

1. A zone of busy magnetics with N-S grain follows the CVC belt south from the Mt Lyell field, with stronger highs over some andesite bodies (e.g. Little Owen andesite). The response is stronger over the Tyndall Group conglomerates east of Mt Huxley. The King River gorge is evident as a trough in the CVC magnetic signature, suggesting possible altitude control problems in data acquisition.
2. The strong magnetic response over the Tyndall Group at Lynchford is contrasted by the 'flat' response over the adjacent Lynch Creek basalt body. Most of the magnetic 'life' in the Yolande River Sequence is due to the quartz-feldspar porphyry intrusive rocks, with some response also from the Miners Ridge Basalt body.
3. A small spot magnetic anomaly two kilometres east of Lynchford (379 600 mE, 5 334 500 mN) was closely investigated by Goldfields, and two holes were drilled with inconclusive results (Stockwell, 1998). Later mapping indicated that the anomaly was due to a poorly outcropping andesite body in a synclinal core (M. Vicary, pers. comm.). Other similar spot highs just to the southwest probably also correspond to small andesite bodies.

4. The Jukes Proprietary area of magnetite-altered CVC rocks is covered by a strong magnetic high with some of the character of the large highs at Mt Sedgwick and the Burbury prospect area.

5. A strong but somewhat patchy radiometric response follows the CVC through the Whip Spur–Mt Huxley area to the King River gorge and Jukes Proprietary. The intense response along virtually the full length of the King Gorge, and up Diorite Creek, across a variety of rock types, is quite startling, and emphasises the effect of greater rock exposure on the radiometrics.

Teepookana, Phillips, Darwin and Engineer sheets

1. A strong magnetic high lies over the basaltic rocks mapped by Cox in Pine Cove Creek, near Macquarie Harbour (Baillie *et al.*, 1977), with a smaller anomaly over similar rocks at Beehive Creek north of the King River. These highs lie at the eastern edge of a broad northwest-trending zone of very high magnetics related to buried ultramafic-mafic rocks (Corbett *et al.*, 1982).

2. Linear magnetic trends are present in the Cambrian volcano-sedimentary sequence of the lower King River (masked somewhat by the strong gradient from the ultramafic belt to the west), and lend some support to correlation of the sequence with the Tyndall Group.

3. A NNW-trending zone of strong magnetics and coincident radiometrics in the Mt Sorell–Garfield River area relates to Tyndall Group and basal Owen Group volcaniclastic conglomerates.

4. The King River delta stands out as an intense radiometric high, presumably reflecting the high proportion of fine sericitic material, derived from the Lyell Schists, in the mud. Some similar response is evident upstream along the river.

5. A broad zone of very high magnetics follows the CVC rocks over Intercolonial Spur and Mt Darwin, and along South Darwin Plateau, with strong gradients to the west. The zone partly encompasses the Darwin Granite body, although the main high zone is over the flanking CVC lavas at South Darwin. The zone has much the same character as the high zone extending through Mt Sedgwick and the Dora–Selina area to the Murchison Granite, and it is difficult not to see a correlation to the granites and associated magnetite alteration.

6. The Tyndall Group along the eastern flank of the range is also marked by strong magnetics, with a more marked N–S grain.

7. The Yolande River Sequence is again mostly flat magnetically, except for a local high marking the Garfield Andesite body.

8. The radiometrics show a large zone of high values extending right across the CVC through Intercolonial Spur, the East Darwin area, and over Mt Darwin to South Darwin Plateau, including the Darwin Granite body. The zone extends east over the Tyndall Group rocks, and west over the Yolande River Sequence rocks in the Garfield Valley, but becomes patchy and less intense in both these directions. Further west, it becomes quite strong again over the Tyndall Group rocks along the flanks of Mt Sorell, with a ‘hole’ where there is moraine cover in the Clarke Valley. Overall, the Mt Darwin–Garfield area is the largest area of high radiometric response on the whole Mt Read belt, a feature partly due to the lack of cover rocks.

Geological features and map changes from company data, research theses and other recent work

Ramsay and Charter sheets

1. **North Ross Creek–Coldstream River area:** As mentioned previously, aeromagnetic anomalies in the upper Ross Creek area were investigated by Pasminco Exploration, and hole NRC1 was drilled in 1996. As well as testing the aeromagnetic high, the hole was designed to intersect the nearby contact of Oonah Formation and 'Dundas Group', thought to be dipping 45° east. Quite unexpectedly, the hole intersected a series of basalt flows interbedded with red siltstone and sandstone. The contact was not intersected. The sequence was ascribed to the 'Crimson Creek Formation', and no further work was done (Basford, 1997).

   Three samples of the basalt were thin sectioned and analysed. All were porphyritic in plagioclase and pyroxene, with well crystallised groundmasses. The chemical analyses are given in Table 1 (Tasrock numbers and brief sample descriptions are given in Table 3). Preliminary assessment indicates that the basalts have close similarities to basalts described by Brown (1986) from the Mt Ramsay area and later assigned to the general group of Cleveland–Waratah Association tholeiitic basalts. This implies that a second smaller strip of these rocks is present on the eastern side of the belt of Oonah Formation rocks, and such a strip is shown on the new map to match the zone of magnetic activity (fig. 4, 5). The attitude of the faulted eastern contact of the Oonah belt remains unresolved, but a shallow westerly dip might explain its partial overlap of the magnetic zone. An outcrop of altered basalt was noted in the vicinity of this contact by D. J. Jennings in the early mapping of the Mackintosh quadrangle (Collins *et al*., 1981, p.26).

2. Recognition that the volcaniclastic sequence in the Silver Falls–Que River area could be partly Tyndall Group was influenced by the distinctive magnetic signature, and probably began with McKibben's (1993) Honours thesis and mapping by Poltock (Poltock, 1994; Poltock and Saxon, 1994) for Pasminco Exploration.

3. **Que–Hellyer area:** Detailed mapping of the Que–Hellyer Volcanics and adjacent rocks by Aberfoyle Resources geologists during the 1980's and 1990's is summarised in a compilation map by S. Richardson (1994), which has been fully adopted here without further field checking. The many small boundary changes do not appear to be related to any significant changes in stratigraphy or relationships from those of Komyshan (1986) and Vicary and Pemberton (1988).

4. An improved understanding of the geology of the Sock Creek to Sock Creek South area has come from drilling in the area by BHP (Wilde and Kerr, 1989), during which a suite of unusual basaltic-andesitic rocks at the level of the Que–Hellyer Volcanics was intersected. Useful petrological-geochemical studies on the basalts and other rocks have been given by Crawford (1989), and in an Honours thesis by Barwick (1991).

5. The Honours thesis by P. Buxton (1997) on the Cambrian sequence in the Bulgobac Falls area has clarified the presence of Tyndall Group in the area, and provided useful data on the occurrence of fossiliferous limestone clasts in the underlying Southwell Subgroup correlates.

Parsons and Block Sheets

1. New mapping in the Boco Road–Burns Peak area has been carried out by Reid (1990) and more recently by McNeill (2002) for Pasminco Exploration, and has identified stratigraphic equivalents of the Animal Creek Greywacke, Que footwall andesites (Hollway Andesite), Que dacites, and Southwell Subgroup from the Sock Creek and Que–Hellyer areas. The finger-like Pinnacles rhyolite body, previously mapped as CVC lava (Corbett and McNeill, 1986), is herein interpreted to be a correlate of the variable group of Que dacites. A thesis by Coutts (1990) has clarified the nature of the Hollway Andesite.

2. The belt of sedimentary rocks exposed along the western part of Boco Road, west of the Marionoak bridge, including siliciclastic sandstone, polymict conglomerate, and fossiliferous siltstone, is now known to be a Late Cambrian Owen Group equivalent from fossils collected by A. V. Brown (Jell *et al*., 1991). This belt includes correlates of the Stitt Quartzite, Salisbury Conglomerate and Westcott Argillite from the 'Rosebery Group' at Rosebery (Corbett and McNeill, 1986), and demonstrates that most of the 'Rosebery Group' is equivalent to the Owen Group.

3. The Ph.D. study of Gifkins (2001) demonstrates that much of the material mapped as CVC in the Mt Kershaw–Hollway Rivulet area belongs to a major pumice breccia unit ('Kershaw Pumice Formation') lying stratigraphically at the top of the CVC and possibly equivalent to part of the Mt Charter Group. This suggests the possibility that the Hollway Andesite and overlying Southwell Subgroup units might pass along strike into the Kershaw Pumice Formation, as shown on Figure 4, thereby linking the Rosebery and Que–Hellyer stratigraphies.

4. The southern extension of the Que–Hellyer Volcanics southeast of Mt Charter has been modified in accordance with the Aberfoyle Resources map of Richardson (1994).

5. Snake Island, in Lake Mackintosh (at 389 500 mE, 5 384 500 mN), was visited by the author in March 2002. It has excellent exposures, on its western side, of a siliciclastic-micaceous pebbly greywacke unit (samples 011005, 006 – Table 3), strikingly similar to the Murrays Road Greywacke in the Southwell Subgroup on the Cradle Mountain Link Road (Vicary and Pemberton, 1988). The greywacke sequence dips and faces to the southeast (bedding 025E55), and has a partly faulted, partly intrusive (?) contact against a felsic to intermediate feldspar-phyric lava unit (samples 011002, 003, 004, Table 3). It was concluded that the rocks were Southwell Subgroup equivalents within the general Farrell Slates sequence.

6. A visit was also made to the shore exposures at the northernmost end of the Mt Farrell range, resulting in slight modification to boundaries (e.g. the northwest-trending cross-fault is not present, and the base of the Owen Group curves smoothly down to the shoreline). The Owen sequence consists of a basal unit of volcaniclastic conglomerate, about 40 m thick, followed by a pink siliciclastic pebble-cobble conglomerate (Middle Owen?) about 10 m thick, followed by a thick Upper Owen Sandstone sequence with mudcrack infills preserved in places. Immediately beneath the Owen is a dacitic lava-like unit (sample 011008 – snowflake-textured CVC-type feldspar-phyric lava or possibly pumice breccia). This is followed to the west by a folded and cleaved Farrell Slates-type sequence of shale, siltstone and micaceous greywacke, including a pebbly siliciclastic unit identical to that on Snake Island (sample 011009).

Rosebery and Tullah Sheets

1. Well-preserved trilobite fossils collected by A. V. Brown (1986) from the Merton Road area of the Pieman Road, from 'Huskisson Group' rocks, indicate that this lower volcaniclastic part of the 'Huskisson Group' is largely of Tyndall Group age, and it is shown thus on Figure 5. The upper part of the 'Huskisson Group', with the *Glyptograptus* shale near the base, is Late Cambrian and equivalent to the Owen Group. The lower boundary of the 'Huskisson Group' further south, in the Ring River area, is considered by Brown (1986) to be marked by the first appearance of significant amounts of felsic volcaniclastic detritus in the sequence.

2. **Colebrook Hill sequence:** The N-S trending belt of mafic greywacke and mudstone, with minor tholeiitic basalt lavas, extending northwards from Colebrook Hill across the Pieman River, was mapped as Crimson Creek Formation by Corbett and McNeill (1986), following previous workers (e.g. Green *et al*., 1981; Campana and King, 1963; Blissett and Gulline, 1962). This correlation, and that of similar sequences in the Cleveland–Waratah area, with the Crimson Creek Formation, has been questioned by Brown (1989), and it is now recognised that a suite of similar units containing tholeiitic basalt and chert may be largely of allochthonous origin (Brown and Jenner, 1989; Seymour and Calver, 1995). These are referred to as 'Cleveland–Waratah Association and correlates', and the Colebrook Hill sequence is included in that group.

3. **'Rosebery Group' sequence west of Rosebery:** This sequence is now considered to be largely equivalent to the Late Cambrian Owen Group, as previously recognised by MRT and shown on the 1:250 000 scale series digital maps (e.g. Brown *et al*., 1995). The presence within the belt of fault-bounded strips of different lithologies, including gabbro (near Westcott Hill), suggests significant structural disruption, presumably in the Devonian, and possibly some interleaving with basement rocks. Carbonate-rich polymict conglomerates are common within the sequence (Salisbury and Westcott Formations and conglomerates around Moores Pimple), and suggest erosion of local intra-basinal sources. The significance of the felsic tuff-like Natone Volcanics unit is uncertain.

4. **Tyndall Group correlates in Primrose area:** The sequence of interbedded volcaniclastic sandstone, siltstone and mudstone lying within the loop of the Rosebery Fault in the Primrose area on the western side of Rosebery township (Corbett and McNeill, 1986) is probably a correlate of the Tyndall Group. The sequence represents the upper part of the White Spur Formation of Corbett and Lees (1987), and has the same relationship to the overlying Stitt Quartzite (Owen Group correlates) as does the upper White Spur Formation at Howards Road, also correlated with Tyndall Group (see Note 3 for Oceana and Tyndall sheets). The sequence around Primrose shows considerable sericitic alteration, and hosts the Devonian (?) mineralisation at Black PA prospect.

5. **Rosebery–Mt Black–Sterling Valley area:** Significant contributions to mapping around Rosebery and Mt Black have been made by Gifkins (2001) and Allen (1991, 1992, 1993, 1994*a, b*, 1997). The Mt Black Fault has been recognised between the Rosebery hangingwall sequence and the overlying rocks on Mt Black, and has been mapped north to Lake Rosebery and south to the Hercules area. Gifkins (2001) has subdivided the northern CVC into three units, younging to the west: Sterling Valley Volcanics (andesitic-basaltic) at the base, Mt Black Volcanics (dacitic-rhyolitic), and Kershaw Pumice Formation at the top, effectively

reversing the previously assumed stratigraphy. The placement of the Sterling Valley basalts low in the sequence has created an interpretation problem, since these transitional–tholeiitic rocks are a good geochemical match for basalts of probable Tyndall Group age in the western Henty Fault Wedge and intruding the CVC along the North Henty Fault (Henty Dyke Swarm) immediately south of the Sterling Valley area (Crawford *et al*., 1992; Corbett, 1992). Some further work to confidently establish the facing and stratigraphic position of the Sterling Valley rocks seems justified.

On the western side of the Mt Black Fault, the Rosebery and Hercules footwall volcanic rocks (thick-bedded pumice breccias) are referred to as the Hercules Pumice Formation, considered to be equivalent to the Kershaw Pumice Formation. The hangingwall sedimentary sequence of shale and quartz-phyric volcaniclastic sandstone at Rosebery and Hercules is considered to be a correlate of the lower part of the White Spur Formation of Corbett and Lees (1987), and possibly of the Southwell Subgroup from the Hellyer–Pinnacles area.

6. The Murchison Volcanics (EQPS) in the area immediately north of Mt Murchison were examined by the author and K. C. Morrison for the purposes of comparison with Tyndall Group rocks in the Jukes–Darwin area. Five samples were collected from a transmission line track, running west from the Anthony Road at 386 000 mE, 5 373 300 mN, for thin section and analysis. Three of these were crystal-rich quartz-feldspar ± biotite ± pyroxene-phyric lavas (011020, 021, 024), one was a probable pumice breccia of similar composition (011023), and one (011022) was a distinctive spherulitic feldspar-phyric lava identical to many CVC lavas elsewhere. A general note on the distinction of Eastern Sequence and Tyndall Group rocks is given later.

7. An examination was made of a controversial exposure of a contact between Murchison Granite and Owen Group sandstone at Tunnel End, on the southern shore of Lake Mackintosh. The contact shows possible interfingering of granite and sandstone, which might be interpreted to indicate an intrusive relationship (i.e. granite intruding older sandstone). However, there is much faulting and associated pyritic mineralisation (presumably Devonian), and a fault-modified irregular sedimentary contact (i.e. younger sandstone on older granite) seems equally plausible.

Dundas and Selina sheets

1. **Cuni sequence:** The sedimentary sequence of interbedded siltstone and sandstone in the vicinity of the Cuni copper-nickel prospects, northwest of Dundas, has traditionally been mapped as Crimson Creek Formation (e.g. Blissett and Gulline, 1962), and assumed to be continuous with that formation in the Renison Bell area. Brown *et al*. (1994), on the remapped Zeehan Sheet, show the sequence as a younger unit, correlated with, but separate from, the lower Dundas Group, on the basis (from their description) of the presence of some minor felsic volcanic rocks and felsic volcaniclastic detritus. The recent Dundas 1:25 000 scale sheet (Seymour and McClenaghan, 2001) also shows it thus, such that it forms something of a misfit 'sore thumb'.

   Greenhill (1995) has examined the age and petrology of the Cuni sequence for an Honours thesis. Comparison with the Crimson Creek Formation at Renison Bell suggests a similarity of composition, particularly in the presence of basaltic clasts and the interbedding with carbonate rocks, but there appears to be less similarity with Dundas Group rocks (e.g. no felsic volcanic detritus was identified). Examination of heavy mineral suites showed MORB-type chromites and other mafic-derived minerals in the Cuni sequence, but no boninitic spinels as might be expected if the sequence post-dated the emplacement of the ultramafic complexes. The apparent lack of conglomerate in the sequence would also seem to mitigate against correlation with the Dundas Group, as conglomerates are an abundant and integral component of that sequence in the immediately adjacent area. Greenhill concluded that the Cuni sequence was most likely an equivalent of the Crimson Creek Formation, a position adopted here pending further definitive work

2. **'Dundas Group' at Dundas:** The 'Dundas Group', in the general type area around Dundas, Mt Razorback and Black Hill, is a complex mixture of sandstone, siltstone, mudstone and conglomerate, with rapid facies changes and considerable structural disruption. Maps of the area tend to be difficult to follow, and to show considerable and confusing generational changes (e.g. Elliston, 1954; Blissett and Gulline, 1962; Brown, 1983; Brown *et al*., 1994; Seymour and McClenaghan, 2001). One confusing change involves the disappearance of several 'lower Dundas Group' units (Judith Formation, Red Lead Conglomerate, and Hodge Slate) from the vicinity of the Red Lead Mine–South Comet Creek (e.g. Brown, 1983, and earlier maps), and their replacement by 'correlates of the Rosebery Group', which turns out to be mainly equivalent to the 'upper Dundas Group' (e.g. Brown *et al*., 1994; Seymour and McClenaghan, 2001).

   Fortunately, a number of good fossil localities are known, and these provide some welcome control on the variable stratigraphy (fig. 4). The fossils indicate an age range from middle Middle Cambrian to late Late Cambrian, covering most of the age range of both the Owen Group and Mt Read Volcanics, suggesting that the term 'Dundas Group' is of limited value if it can be subdivided. Correlates of the Tyndall Group should be present within the sequence, and have been identified in this report after careful analysis of the data (although they were thought to be absent in an earlier study, because of the lack of fossils in the appropriate time range — Corbett *et al.*, 1997).

Brown (1986) divided the group into a lower sequence of Middle Cambrian age (up to and including the lower Brewery Junction Formation), and an upper sequence of latest Middle Cambrian and Late Cambrian age (the 'upper Brewery Junction Formation' and above). Lying between the upper and lower Brewery Junction Formations at Dundas Rivulet is a unit of felsic volcaniclastic sandstone, with a faulted lower contact. The lower Brewery Junction Formation is unfossiliferous, but a fossil locality in the upper Brewery just **above** the volcaniclastic unit is of late Boomerangian–early Midyallan age, which is within or just above the Tyndall Group range. It therefore seems highly likely that the volcaniclastic unit belongs to the Tyndall Group in this area.

The first fossils **below** the Brewery Junction Formation are in the Hodge Slate, and are of late Undillan age, only slightly older that the Tyndall Group. It is suggested that the lower Brewery Junction Formation, and much or all of the underlying unfossiliferous Razorback Conglomerate (which also includes a unit of felsic volcaniclastic rocks; Brown, 1986), are Tyndall Group equivalents. Correlates of these units extend across the Black Hill area, north of Razorback mine, and fossil localities from the Grand Prize mine area tend to support the correlation with Tyndall Group (Banks, 1982).

Fossils discovered by the author in a sandstone-siltstone unit at the top of the 'upper Dundas Group', on the western flank of Misery Hill, close to a faulted contact with Gordon Group limestone, are of latest Late Cambrian (Payntonian) age (Jago and Corbett, 1990), and provide useful age control on the upper part of the marine Owen Group equivalents.

3. **Moores Pimple area and the Rosebery Fault:** The Rosebery Fault in this area separates White Spur Formation to the east, consisting of west-facing volcaniclastic sandstone and siltstone, from a sedimentary sequence to the west comprising units of polymict conglomerate within a 'matrix' of dolomitic sandstone and siltstone. The latter sequence is correlated with the marine Owen Group ('Rosebery Group'). An irregular body of quartz-feldspar porphyry, partly intrusive and partly extrusive, lies along the fault zone, and bodies of highly altered ultramafic rock and gabbro/basalt occur within the sequence west of the fault. A. V. Brown (pers. comm.) believes, from geochemical sampling, that the latter rock units include boninitic basalt related to the allochthonous ultramafic rocks elsewhere, suggesting that the present outcrops represent slices of allochthonous basement caught up in younger rocks.

   Some variation is apparent between the map of the Moores Pimple area produced by Corbett (1986) and the later map of Brown *et al.* (1994) and its derivative by Seymour and McClenaghan (2001). The 1986 map shows the fault trace forming a smooth curve from Bather Creek over the saddle east of Moores Pimple and into the head of White Spur Creek to the south, whereas the 1994 map shows the fault lying somewhat west of this and following the irregular boundary of the quartz-feldspar porphyry body up and over the crest of Moores Pimple.

   A drill hole (MP1) was drilled into this fault from the east by the Department of Mines in 1986, and entered the fault zone at 133 m, giving a 45° east dip for the main fault (matching that obtained for the Rosebery Fault in a number of localities to the north, see Corbett and Lees, 1987). Below this was a zone of some 130 m thickness of inter-sheared quartz-feldspar porphyry and conglomerate, with abundant fuchsite (Cr-bearing bright green sericite) as wisps, veins and bands up to a metre thick, and much quartz-carbonate (-minor sulphide) veining. A zone of several metres of fuchsite and quartz-carbonate veining at the base of the shear zone probably corresponds to the fault mapped by Brown *et al.* on the west flank of Moores Pimple. Beneath the fault was a dolomitic siltstone-sandstone sequence, similar to that surrounding the conglomerate units to the west and north of Moores Pimple, and a body of highly altered gabbroic rock. The significance of the fuchsite, which also appears to be present as clasts in some of the conglomerates, is not understood, and there are many features of the complex geology of the Moores Pimple area which require further study.

4. **Geology of the Hercules area:** Gifkins' (2001) thesis and the unpublished work of Allen (1991, 1994*a, b*) have modified the geological map in the Hercules area as follows:

   — The hangingwall sequence is equated with, and connected to, the White Spur Formation, and is separated from the Mt Hamilton pumice breccias by the Mt Hamilton Fault.

   — The Hercules footwall sequence becomes the Hercules Pumice Formation, and is equated with that on Mt Hamilton (the Kershaw Pumice Formation), which incorporates the nearby Jones Creek shale horizon.

— The Mt Black Fault extends into the area, but is apparently displaced on several cross-faults (e.g. Bakers Creek Fault) and is rather poorly defined south of Hercules.

Despite this additional work, there are still a number of puzzling or unexplained features to the geology at Hercules (e.g. how does the Mt Hamilton Fault relate to the strip of hangingwall quartz-phyric rocks which runs around the north flank of Mt Hamilton without apparent displacement?). Some of the simplistic fold and fault structures shown by Gifkins are difficult to reconcile with mapped features.

5. The southern end of the Jones Creek sedimentary unit has been mapped by the author (Corbett, 1998) using exposures along the Henty Canal and the re-routed Howards Road. The unit closes off around a fold closure — probably a syncline-anticline couple.

6. **Glacial erratics at Williamsford and other areas:** A large mass of Siluro-Devonian sandstone, surrounded by glacial deposits, sits near a ridge top one kilometre WNW of Williamsford township. It was examined by the author in 1985 and considered to be a large glacial erratic. The body was shown as an outcrop of Permian sediments on the original Zeehan sheet (Blissett and Gulline, 1962), and appears as an outcrop of Devonian Florence Sandstone on the new Zeehan sheet (Brown *et al.*, 1994) and the digital Dundas sheet (Seymour and McClenaghan, 2001).

   Commonsense suggests that such out-of-place blocks, which are quite misfit in the local and regional context (there are major implications in having an isolated ridge-top outcrop of Devonian sandstone sitting directly on steeply-dipping Late Cambrian beds, with no intervening Owen Group or Gordon Group), but which are associated with glacially transported deposits, should be regarded as large erratics until proven otherwise.

   Three other examples come to mind:

   (a) The large boulder of Devonian granite (10 m+ long) exposed in a costean on the west bank of the Sterling River (McNeill and Corbett, 1992), considered to be bedrock for some time by some exploration geologists;

   (b) The block of Cambrian basalt beside the Zeehan Highway 1.5 km north of the Henty River bridge. This 5–10 m long block is surrounded by bouldery moraine, and is in a position which should be underlain by Gordon Group. The block appeared on the original Zeehan Sheet (Blissett and Gulline, 1962) as a fault-bounded outcrop (200 m across), was removed on the Mt Read Project Map 3 (Corbett, 1986), but has reappeared as a 400 metre wide outcrop on the new Zeehan sheet (Brown *et al.*, 1994) and the digital Oceana sheet (McClenaghan, 2000). This block has been removed from Figure 5.

   (c) The pile of glacially-transported Owen Group conglomerate boulders resting on Silurian rocks just north of the Professor Range (365 300 mE, 5 352 300 mN), shown more or less correctly as Quaternary on Brown *et al.*'s (1994) Zeehan sheet, but transposed as Owen Group outcrop on the recent Oceana sheet.

7. **Henty–Mt Julia area:** Considerable re-mapping and drilling has been done by RGC–Goldfields in the zone between the Henty mine and the Mt Julia prospect, 1.5 km to the south, and by several other companies in the Newton Creek to Basin Lake area. Most of this work has been compiled into updated maps by Goldfields Exploration (now Aurion Gold), and kindly supplied to the author by M. Vicary. The major changes concern the two map sheets to the south, and are discussed in that section.

8. **Red Hills area:** Exploration in this area to 1987 was summarised by McNeill and Corbett (1992). Re-examination of the area by the author and K. C. Morrison in 2002 suggested that an original basal contact to the Tyndall Group sequence north of Gooseneck Hill, in the form of a clastic breccia with clasts up to 300 mm of CVC-type rocks (i.e. feldspar-phyric lavas), was preserved on the main access track at 381 437 , 5 365 880 mN. A major fault crossed the track a short distance to the east. Further consideration of the stratigraphy in the area suggests that the sequence of pumice breccia and black shale overlying the CVC lavas and underlying the Tyndall Group rocks is probably a correlate of the Western Sequence rather than the CVC as shown on previous maps.

   Also well exposed on the Red Hills track, at the junction of a powerline track to the north (380 500 mE, 5 366 300 mN), is a northwest-trending lamprophyre dyke about one metre thick. The dyke (sample 012) is pyroxene-plagioclase-phyric and moderately magnetic (5–7 SI), and possibly accounts for a linear magnetic feature identified in a detailed magnetic survey by Goldfields Exploration as cross-cutting between here and the eastern side of Gooseneck Hill (M. Vicary, pers. comm.).

   The Owen Group sequence on Gooseneck Hill, which appears as undifferentiated on previous maps, was briefly re-examined on the same visit. It was concluded that the sequence of mainly planar-bedded pebble-cobble conglomerate and pebbly sandstone was a correlate of the Lower Owen Conglomerate of the Mt Lyell area.

9. **Selina area:** A significant change since the publication of the Mt Read Volcanics Project maps showing the eastern part of the belt (McNeill, 1987; Corbett and Jackson, 1987) has been the realisation

that the quartz-phyric volcanic sequences in the Selina–Dora area include an earlier sequence contemporaneous with the CVC (EQPS), as well as some later Tyndall Group rocks. This matter is discussed in detail elsewhere. The only Tyndall Group correlate now considered to be present in the Selina area is the large synclinal body of volcaniclastic conglomerate on Mt Selina. This conglomerate is well exposed at the eastern end of Anthony Dam, where it contains boulders of Murchison-type granite up to one metre across, as well as clasts of quartz porphyry, schistose sericitic quartz-phyric volcanic rocks, CVC-type felsic lava, sericite schist (indicating pre-Tyndall alteration), and abundant rounded pebbles of hematite.

Oceana and Tyndall sheets

1. **Professor Range area:** A discordant relationship can be inferred between the folded Owen Group units in the Professor Range–Ewart Creek area and the Gordon Group limestone sequence in the valley immediately to the north. Two discordant contacts have been reported, one just east of the Professor Range between sandstone and the underlying quartzwacke sequence (Corbett, 1984; Corbett and Turner, 1989), and the second between 'Pioneer correlate' sandstone and underlying steeply-dipping micaceous sandstone, some three kilometres further east (370 970 mE, 5 351 460 mN) by Berry (1996). Significant folding of the Late Cambrian sequence prior to the sub-Gordon Group unconformity is implied, and Berry (1996) suggests that the conglomerate sequence at Professor Range accumulated on the flanks of a rising anticlinal structure in the Late Cambrian sequence just to the east. This implies a significant amount of intra-Owen Group tectonism.

2. **Farrell Rivulet–Tom Creek area:** A distinctive sequence of interbedded siliciclastic conglomerate, micaceous quartzwacke, siltstone and mudstone in the Farrell Rivulet–Tom Creek area (Corbett, 1984) can be correlated with the Owen Group. The sequence faces west and has an erosional but generally conformable contact on underlying Tyndall Group correlates. The sequence resembles the 'Stitt Quartzite' of the 'Rosebery Group', and is probably a correlate of it. Correlates of the unit are also present in the sequence west of Ewart Creek (Berry, 1996).

   The Farrell Rivulet sequence is followed to the west, possibly across a faulted contact, by a mixed sequence of calcareous, micaceous and tuffaceous sandstone, siltstone and conglomerate in the Tom Creek–Mariposa Creek area. Fossils at Tom Creek are of early Late Cambrian age, and the sequence overall is correlated with the Owen Group.

3. **Howards Road and Henty Fault Wedge areas:** The western part of the White Spur Formation on Howards Road is correlated with the Tyndall Group on the basis of its stratigraphic position (underlying Owen Group) and its distinctive magnetic signature. The basal contact of the group in this area is yet to be clearly defined. Tyndall Group rocks are also considered to be present in the western Henty Fault Wedge, following work by Poltock (1992*b*). The abundant andesitic and basaltic rocks in this area (Suite IV type of Crawford *et al.*, 1992) appear to represent a major lower Tyndall volcanic centre, and a probable source for the distinctive lower Tyndall detrital mineral suite in the region (Berry *et al.*, 1997; Corbett *et al.*, 1997).

   The remaining lower part of the White Spur Formation is correlated with the general pre-Tyndall volcano-sedimentary sequence, as is the sequence in the central and eastern parts of the Henty Fault Wedge.

4. **Anthony Road–Basin Lake area:** Considerable new mapping and drilling have been carried out in this area through the 1990's, driven partly by the proximity to Henty, partly by similarities to both Que–Hellyer and Rosebery, and partly by Gibson's (1991) discovery of high-grade massive sulphide clasts in a mass-flow unit at the Newton Dam spillway. Pasminco, Aberfoyle, Resolute and Goldfields have all been involved in active drilling programs which have greatly advanced the understanding of the complex geology. A complex stratigraphy involving the large Anthony Road Andesite body, and various interfingered dacite, andesite, basalt, volcaniclastic rocks and sedimentary rocks within and just below the base of the Tyndall Group, has been slowly pieced together from numerous drill holes and surface mapping.

   Mapping, mainly by Goldfields Exploration, has shown that middle and upper Tyndall units occupy an elongate N–S synclinal structure along the Great Lyell Fault south from Newton Creek, with a partial closure at a cross-fault near Whitham Bluff. South of this, a complex sequence of sedimentary rocks and interfingered andesite follows the eastern margin of the Anthony Road Andesite body, probably in a synclinal structure, and is tentatively designated as Lower Tyndall. Drilling indicates that a narrow sliver of CVC-type rocks lies between this and the Great Lyell Fault, buried beneath glacial deposits. Unusual high sulphidation-type mineralisation, with enargite, tetrahedrite and pyrophyllite, occurs within the lower Tyndall zone, and has been studied by Williams (2000).

5. **Lake Dora area:** A re-examination of this area in April 2002 consolidated the belief that the main quartz-phyric volcanic sequence was of pre-Tyndall Group age, and was overlain by a volcaniclastic conglomerate sequence which could be correlated with the Tyndall Group. It was noted

that some of the alteration associated with the copper mineralisation extended across the lower part of the conglomerate sequence, as shown by Corbett and Jackson (1987). One of the pink kspar-altered lavas sampled and analysed (028) was a spherulitic feldspar-minor quartz-phyric lava virtually identical to CVC lavas from the Jukes–Darwin area. Also discovered and sampled was a small outcrop of coarse pink granite (029, 030) intruding the lava sequence (at 387 745 mE, 5 354 004 mN), the host rocks consisting of chlorite-altered quartz-feldspar-biotite porphyry (031). One of several outcrops of andesite in the sequence (at 387 338 mE, 5 355 603 mN), as mapped by Denwer and McNeill (McNeill, 2001), was also sampled and analysed (032), and appears to be a Suite I rock related to the other porphyries in the area.

Professor and Gormanston sheets

1. The volcaniclastic sequence at Queensberry mine, and its probable extension westward into the area south of Professor Plateau (previously discussed), are tentatively correlated with the Tyndall Group, based on lithostratigraphy and magnetic signature.
2. The stratigraphic position of the Owen-type conglomerate-sandstone unit forming the Sisters hills (373 000 mE, 5 346 000 mN) and extending northwards to the Henty River bridge area (Baillie *et al.*, 1977; Baillie and Corbett, 1985), is uncertain. The unit rests unconformably on Tyndall Group correlates to the east, and on the Late Cambrian quartzwacke sequence to the west, and is conformably overlain by Gordon Group limestone. It may be largely equivalent to the Pioneer Sandstone (basal unit of the Gordon Group), as suggested by Corbett (in Baillie and Corbett, 1985), but its considerable thickness (about 500 m) and coarse grainsize (to boulder grade) suggests it may partly include Owen Group correlates. It is something of a misfit unit, being located well 'offshore' from either the Owen Group proximal deposits to the east or the Mt Zeehan conglomerates to the northwest.
3. The position selected for the base of the Tyndall Group in the lower Yolande River area is based on the magnetic data, and is lower in the sequence than that suggested by Selley and Meffre (1997). It actually corresponds to the base of the 'upper Yolande cycle' of those authors. Further field checking seems warranted.
4. **Mt Sedgwick–Itat Creek area:** Considerable exploration work around the 'Beatrice' prospect at Mt Sedgwick by Pasminco, Aberfoyle and Gold Fields has clarified the geology. Drilling indicates that the large quartz-feldspar porphyry body overlies the Itat Creek shale-sandstone unit in a synclinal structure, and has peperitic contacts and intercalations of shale (e.g. Vicary and Denwer, 1997; Halley *et al.*, 1995). This sediment-porphyry relationship is typical of the Western Sequence in many areas, and the stratigraphic position of the sequence above CVC lavas and below Tyndall Group volcaniclastic rocks suggests correlation with Western Sequence, as shown on Figure 5. This small basin of Western Sequence rocks has similarities to that at Red Hills.

   Interfingering of quartz-phyric and feldspar-phyric rocks in the area three kilometres southeast of Mt Sedgwick was described by Corbett (1982), and is herein interpreted to be an interfingering contact area between CVC and EQPS rocks, similar to that at Mt Murchison.
5. **Mt Lyell mine area:** The Mt Lyell Mine Lease and adjacent areas to the east have recently been mapped in detail by the author (Corbett, 2001*a, b*). This has resulted in an improvement in understanding of the large alteration system, the relationship of the volcanic sequence to the Owen Group, and the nature of the Great Lyell Fault. The large chert bodies at Lyell Comstock and North Lyell are identified as siliceous alteration products in the upper part of the alteration system, which has an exhalative horizon in the lower Tyndall Group. The core of the alteration system, containing most of the copper ore bodies, consists of intensely altered pyrite-sericite-chlorite-silica schists, with abundant cherty silica bodies in the upper part. This upper part of the system was exposed on to the seafloor during deposition of the middle and upper members of the Owen Group, with consequent oxidation and much erosion of chert and hematite into the Owen beds. Most of the changes to geological boundaries affect the detail of the 1:25 000 scale maps. The general outline of the alteration zone is shown on Figure 5.
6. **East end of Mt Lyell:** Re-examination of the quartz-phyric volcanic rocks in the core of the anticline here suggests that the lavas belong to the Tyndall Group rather than the EQPS (see also Morrison, 2002). Alteration at the Burbury prospect is located near the base of the middle Tyndall (Mt Julia Member). The porphyry body mapped at the contact of the middle and upper Tyndall (Corbett *et al.*, 1989) was sampled (014) and shows probable welded shard textures in thin section, indicating it is probably a correlate of the distinctive ignimbrite unit which occurs at the middle–upper Tyndall contact on Zig Zag Hill and elsewhere (White and McPhie, 1996).

Strahan and Owen sheets

1. The volcano-sedimentary sequence of the lower King River area is considered to be a correlate of the Tyndall Group (Corbett *et al.*, 1997), based on general composition, magnetic signature, and its position underlying Owen Group correlates to the east (see Teepookana notes).

2. The Miners Ridge Basalt, exposed in the core of the Miners Ridge Anticline near Lynchford, represents a small window of the basement rocks to the Mt Read Volcanics — one of very few exposures of basement anywhere along the belt. Crawford *et al*. (1992) suggested that the basalts most resembled some varieties of the Crimson Creek Formation tholeiites, but McClenaghan and Findlay (1993) and Seymour and Calver (1995) suggest a geochemical correlation with the allochthonous tholeiitic sequences (Cleveland–Waratah Association and correlates). This is more likely, particularly considering the low TiO_2 values and depleted LREE.

Teepookana, Phillips, Darwin and Engineer sheets

1. The lower King River volcano-sedimentary sequence, and the associated basaltic-andesitic rocks at Pine Cove Creek and Beehive Creek mapped by Cox (Baillie *et al*., 1977), are tentatively correlated with the Tyndall Group, as previously discussed. Some geochemical comparison work by Berry, Selley, White and Meffre (1997) supports correlation of the basalts with lower Tyndall basalts elsewhere, although some differences are also apparent (e.g. higher Ni, Cr and Th values).

   The quartzwacke-mudstone-conglomerate sequence in the Teepookana area is a good correlate of the Owen Group marine sequences.

2. **Tyndall Group at Jukes–Darwin:** Recent re-examination of the quartz-phyric volcanic sequences along the eastern flank of the Jukes–Darwin range has established, with reasonable certainty, that this sequence belongs to the Tyndall Group in most areas (a small area of genuine EQPS rocks may be present at the northern end of the Darwin Granite body, as suggested by Vicary's mapping in Corbett *et al*., 1993). A good basal breccia-conglomerate is developed in many areas, containing clasts of the underlying CVC and granite lithologies (e.g. at South Darwin Plateau, East Darwin workings, Intercolonial Spur, and Jukes Proprietary area). At Jukes Proprietary, a body of pink quartz-feldspar porphyry intrudes lavas at the eastern margin of the CVC, and is overlapped by a basal breccia of the Tyndall Group correlates containing abundant fragments of the porphyry. Some chlorite alteration overlaps from the CVC into the basal parts of the younger sequence here.

   Several small inliers of CVC rocks are present along the Tyndall Group belt, including two near East Darwin, one at Lake Jukes ('Adit Knob'), and one at Mt Huxley. These appear to represent basement projections through the Tyndall Group cover.

   The Tyndall Group sequence on this eastern side of the belt is noticeably different from that on the western side, in that it seems to lack the input of mafic–intermediate volcanism and detritus.

Overview of revisions to geology

The more significant changes and variations to the geology arising from the examination of the geophysical surveys and reviews of recent data are summarised and synthesised below. A summary of the stratigraphic relationships, as updated for the present study, is given in Figure 2, and a revised biostratigraphic correlation chart is given in Figure 3.

New areas of Tyndall Group rocks identified

The Tyndall Group was originally identified as the upper part of the Mt Read Volcanics sequence, of latest Middle Cambrian age, at Lynchford, Lyell Comstock and in the Newton Creek area by Corbett *et al*. (1974), with correlates at the eastern end of Mt Lyell and at Mt Sedgwick. Subsequent mapping extended the range of occurrence north to the Cradle Mountain Link Road (Komyshan, 1986) and Black Bluff–Winterbrook area (Pemberton and Vicary, 1989), and west to the Henty Fault Wedge (Poltock, 1992*b*) and Silver Falls area (McKibben, 1993). A review by Berry, Corbett and Bull (1997) and Corbett *et al*. (1997) suggested that there were correlates further north in the St Valentines Peak and Dial Range areas, and further west in the lower King River and Mt Dundas areas, but wrongly concluded that the group was absent in the type 'Dundas Group' area because of the lack of fossils of appropriate age.

This study has identified likely new areas of Tyndall Group at Dundas–Black Hill (within the type section of the 'Dundas Group', where it corresponds to the 'lower Brewery Junction Formation' and Razorback Conglomerate), at Rosebery (corresponding to part of the 'Primrose Pyroclastics' or White Spur Formation correlate of previous authors), and in the Huskisson River–Ring River area, where it corresponds to much of the 'Huskisson Group' of Brown (1986).

Taken in conjunction with the previously recognised extensions, these additions indicate a probably continuous sequence throughout the 'Dundas trough', with variations according to local basins and sediment sources. A prominent to dominant source of felsic volcanic detritus (particularly quartz and feldspar crystals) is one of the main distinguishing features, as well as the appropriate fossils. The felsic volcanic detritus was most likely derived from the main Mt Read belt, but there appears to have been major intermediate–mafic volcanic sources in the Henty Fault Wedge and probably on the lower King River. The poorly known Curtain Davis basalts of the Montezuma Falls area (Elliston, 1954; Scott, 1954; Corbett, 1984) appear to lie within Tyndall Group correlates, and may be another such centre. These occurrences indicate that Tyndall Group volcanism was not confined to the main Mt Read belt, but included at least several volcanoes within the dominantly sedimentary basin west of the Mt Read belt.

The lower King River basalt-andesite occurrences lie at the margin of the buried belt of highly magnetic igneous rocks extending across Macquarie Harbour, suggesting that the western Tyndall Group occurrences are linked to the Noddy Creek Volcanics, a separate belt of Mt Read-like calc-alkaline intermediate to felsic volcanic and intrusive rocks on the Sorell Peninsula (McClenaghan and Findlay, 1993)

Distinction between Tyndall Group and Eastern Quartz-Phyric Sequence

The uncertainties caused by the difficulties in distinguishing between quartz-phyric Tyndall Group and Eastern Sequence rocks along the eastern side of the Mt Read belt between Mt Darwin and Mt Murchison were discussed by Corbett (1992), and were tackled in the present project in conjunction with K. C. Morrison (2002). Our joint studies of field outcrops and field relationships, thin sections and chemical analyses have been reasonably successful in producing a set of criteria for distinguishing the two sequences. The major outcomes are set out below.

- Field studies show that the sequence in the Jukes–Darwin area has a basal conglomerate or breccia with fragments of the underlying CVC rock types in many areas. It clearly post-dates both the Darwin Granite and a granite-like quartz-feldspar porphyry intrusive body at Jukes Proprietary workings, and can be assigned to the Tyndall Group in most places.

- The sequence in the Mt Murchison–Lake Dora area, by contrast, is intruded by small to large granite bodies, and numerous quartz-feldspar porphyry bodies, and includes within it at least several flows of CVC-type feldspar-phyric lava, indicating contemporaneity with the CVC.

- Interfingering contacts between CVC and the Eastern Sequence volcanic rocks appear to be present at Mt Murchison and southeast of Mt Sedgwick, again implying contemporaneity of the units in this area.

- Chlorite and k-feldspar alteration and associated copper mineralisation affecting the Eastern Sequence rocks at Lake Dora is very similar to that affecting the CVC rocks in the Jukes–Darwin area, again implying a similar age. By contrast, the Tyndall Group rocks in the Jukes–Darwin area and at the eastern end of Mt Lyell appear to be characterised by mainly sericitic alteration.

- Nine lavas from the Eastern Sequence in the Mt Murchison–Lake Dora area were thin sectioned (011020–024, 011028, 011031–33), as were nine

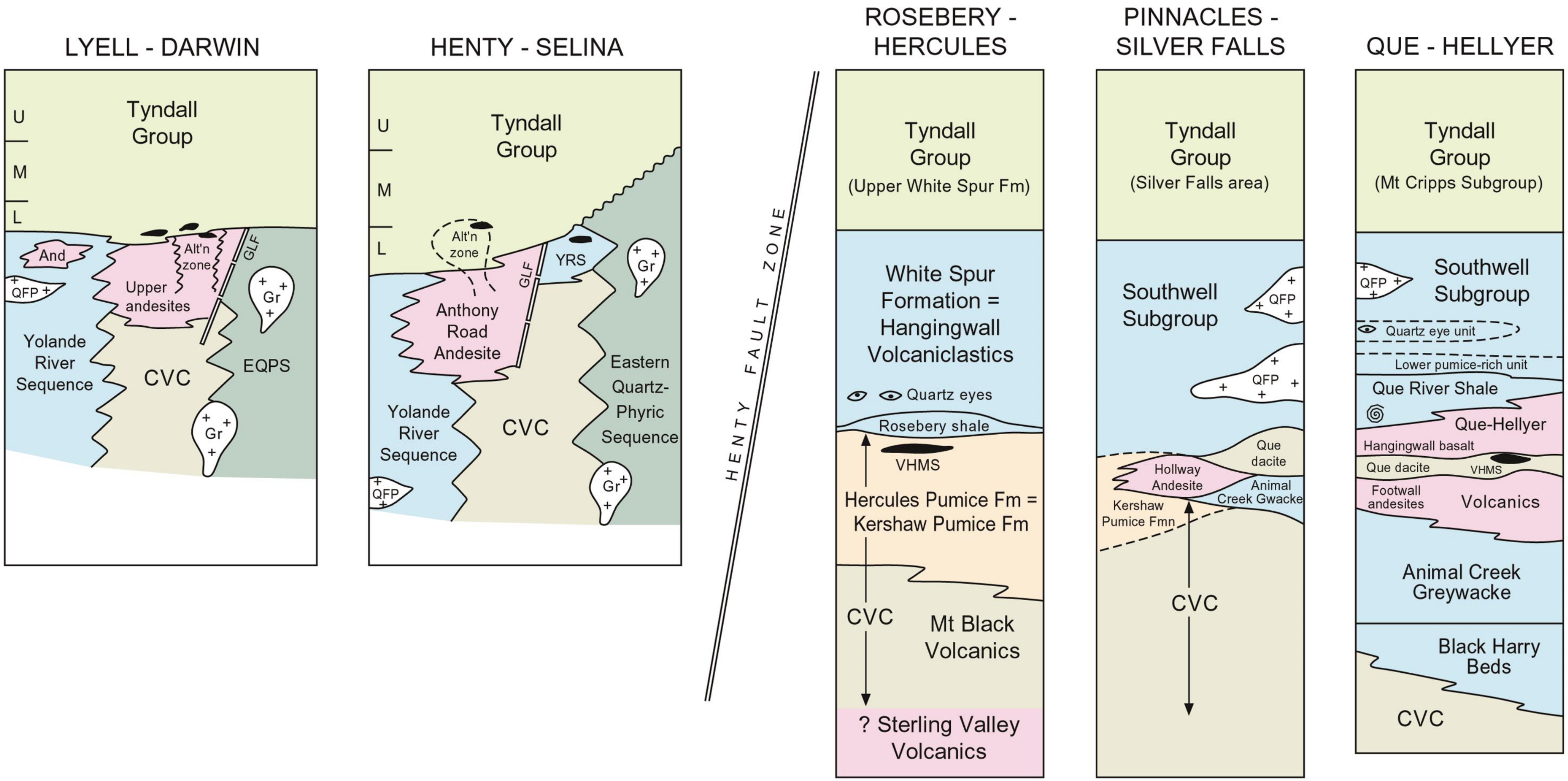

Figure 2. *Correlation diagram for major units of the Mt Read Volcanics*

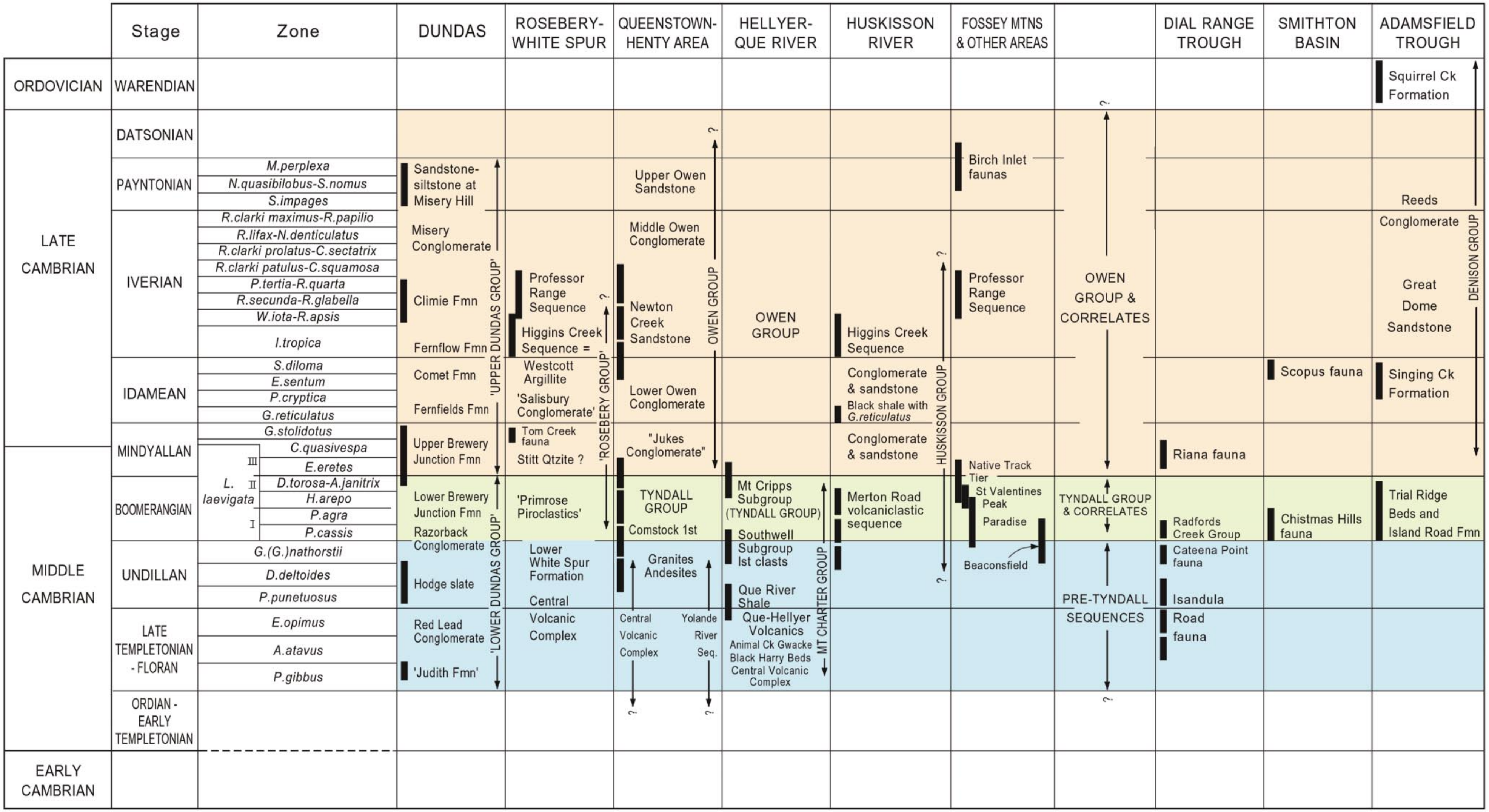

Figure 3. *Biostratigraphic correlation chart for Middle and Late Cambrian sequences, Tasmania*

lava-like units from the Tyndall Group in the Jukes–Darwin area (20020127–131, 20020134–137) and two from the eastern end of Mt Lyell (011013, 20020199). The Murchison–Dora rocks are typically crystal-rich, with quartz, plagioclase, biotite and, in some cases pyroxene, phenocrysts, whereas the Jukes–Darwin rocks generally have relatively sparse quartz and sericite-altered plagioclase phenocrysts only.

- A chemical comparison of eight Eastern Sequence rocks from the Murchison–Dora area and ten Tyndall Group rocks from the Jukes–Darwin area and Burbury prospect (one only) is given in Table 2. Overall, the two groups of rocks are quite similar chemically. Some possible differences in major elements are in the slightly lower Al_2O_3 levels and generally higher MgO and K_2O levels of the EQPS rocks. In trace elements there is overlap in most elements, although a tendency for the EQPS rocks to have higher Th and lower Nb values, and more variability overall, is apparent.

Importance of pumice breccias and link between Rosebery and Que–Hellyer areas

The difficulty in correlating stratigraphy between the Rosebery and Que–Hellyer areas has been a long-standing problem within the Mt Read belt, but the recent recognition of extensive pumice breccia units at the top of the CVC by Gifkins (2001) gives promise of a breakthrough. The distinctive Que–Hellyer stratigraphy, with a lower sedimentary unit (Animal Creek Greywacke of micaceous sandstone, plus underlying volcaniclastic sandstone-siltstone) followed by lenses of andesite-basalt and minor dacite bearing the massive sulphide mineralisation (Que–Hellyer Volcanics), followed by fossiliferous Que River Shale, followed by Southwell Subgroup volcano-sedimentary sequence with intrusive–extrusive porphyry bodies, has now been followed and mapped as far south as the Burns Peak–Pinnacles area (McNeill, 2002; Reid, 1990). At this point there is a major change of strike, from SW–NE to N–S, the sequence intersects the Rosebery Fault, and the various units (including the Hollway Andesite body) appear to die out or pass along strike into CVC-type rocks. Gifkins' mapping suggests they pass along strike into a thick pumice breccia unit, the Kershaw Pumice Formation, which links up southwards with the pumice breccias of the Rosebery (and Hercules) footwall sequence, and occupies a transitional position between CVC lava sequences below and the shale-bearing volcano-sedimentary hangingwall units of Southwell Subgroup type above.

There are complications because of the Mt Black Fault, which separates the Kershaw Pumice Formation from its probable equivalent, the Hercules Pumice Formation, on the western (footwall) side of the fault, but the general correlation of the Rosebery–Hercules footwall pumice-rich sequences with the middle to lower parts of the Que–Hellyer sequence seems possible and reasonable. McPhie and Allen (1992) suggested that a further link was provided by distinctive 'quartz-eye' bearing mass-flows in the lower Southwell Subgroup at Hellyer and in the hangingwall sequence (and Jones Creek shale unit) at Hercules (fig. 2).

Further mapping is required in the Hollway Rivulet–Pinnacles area to clarify the relationship between the pumice breccia unit and the Que–Hellyer units, and there is scope for mapping out of pumice breccia units generally to 'open up' the CVC and improve our understanding of it, as recommended by Gifkins (2001).

Stratigraphic composition of the Farrell Slates

The recent visits to Snake Island and the northern shore of Mt Farrell have confirmed that correlates of the Southwell Subgroup are present in the eastern part of the Farrell Slates belt, including a distinctive siliciclastic pebbly greywacke seemingly identical to the Murrays Road Greywacke of the Cradle Mountain Link Road–Mt Cripps area (Berry and Corbett, 1996). Units of feldspar-phyric felsic lava and possible pumice breccia cropping out at the above localities are probably interbedded within the slates (like the dacite lava unit at the Mackintosh Dam spillway — McNeill and Corbett, 1989), but could possibly represent the margin of the northwards continuation of the main CVC–Eastern Sequence belt from south of Mt Farrell.

Previous workers have suggested that correlates of the Animal Creek Greywacke, Black Harry Beds and Que River Shale are also present within the Farrell Slates (Corbett, 1992; McNeill and Corbett, 1989). Hence it seems likely that the slate belt represents a complete, but possibly condensed, section of all of the Mt Charter Group units, from Black Harry Beds at the base to Southwell Subgroup at the top. Correlates of the Que–Hellyer andesites-basalts have not been recognised but may be indicated by some very minor andesite occurrences (McNeill and Corbett, 1989).

The Farrell Slates belt appears to be the remnant of an original elongate basin of volcano-sedimentary rocks lying between the southern CVC–Eastern Sequence volcanic mass and the northern CVC mass, and connected to the Henty Fault Wedge sequence to the south and the Que–Hellyer sequence to the north (fig. 4). Compression and closing of the basin, and uplift of the northern CVC on the Henty Fault, probably occurred during both late Cambrian and Devonian tectonic episodes.

Reassignment of the 'Rosebery Group' as mainly Owen Group equivalents

The sequence lying west of the Rosebery Fault at Rosebery and known as the 'Rosebery Group' (Campana and King, 1963) has now been mapped northwards to the Pinnacles–Silver Falls area, where the Late Cambrian fossils collected by Brown (Jell *et al.*, 1991) clearly show its Owen Group age and affinities. The two major rock types within the sequence are a micaceous quartzwacke-mudstone lithology — the Stitt Quartzite and correlates — and a mixed sequence of sandstone, siltstone and mudstone with beds of polymict, commonly carbonate-rich, conglomerate — the Westcott Argillite and Salisbury Conglomerate lithologies. The original eastern part of the group (in part the 'Primrose Pyroclastics' of previous authors) appears to underlie the Stitt Quartzite, and is herein correlated with the Tyndall Group.

To the south, the belt of Owen Group– 'Rosebery Group' has been linked through the Mt Dundas area (Brown *et al.*, 1994, 1995) with the quartzwacke sequence at Farrell Rivulet, and with mixed sandstone-siltstone-conglomerate sequences in the Tom Creek–Mariposa Creek–Misery Hill–Dundas area (the 'upper Dundas Group'). In this area, and further southwest at Professor Range, the sequence is topped with conglomerate and shallow-marine sandstone units, providing a connection to the Mt Zeehan conglomerate sequence. There appears to be considerable scope for comparative studies of stratigraphy, sedimentology and basin tectonics on these extensive and varied, but little studied, Late Cambrian deposits.

Clarification of Tyndall Group stratigraphy in the Henty–Mt Julia–Basin Lake area

Intense exploration over nearly one and a half decades, including numerous deep drill holes, has slowly but steadily clarified the remarkably complex stratigraphy and relationships in the zone of Tyndall Group and sub-Tyndall rocks lying between the Henty mine and Basin Lake. Many unexpected and unpredictable aspects of the geology have been encountered, including such things as 'turnip'-shaped igneous bodies (i.e. bodies which expand and contract abruptly – Tim Callaghan, pers. comm.), and close interfingering of basalt, andesite, dacite and pumice breccia with sedimentary units over short stratigraphic intervals.

Such an amount of intense and variable volcanic activity around the base of the Tyndall Group has made it difficult to clearly define or recognise the base, and suggests that such areas of intense past activity at this stratigraphic level are highly prospective. Multiple exhalative horizons are found within this zone, including one which produced large quantities of red jasper (exposed at the impressive 'Jasper Point' on Lake Newton). Limestone lenses are common, and zones of concentrated barite development are also present. The source of the high-grade massive sulphide clasts in a mass-flow unit at the Newton Dam spillway, several hundred metres below the base of the Tyndall Group, remains undiscovered (as are the sources for several similar occurrences of VMS clasts in mass flows; fig. 4).

The middle and upper Tyndall units appear to close off at a synclinal fold closure about one kilometre south of Howards Anomaly prospect, but a sequence of intercalated sedimentary rocks and andesites, grouped as lower Tyndall here, continues southwards towards Basin Lake, where it hosts some massive pyrite and high-sulphidation mineralisation (Williams, 2000).

Cleveland–Waratah Association rocks between Colebrook Hill and Coldstream River

The mafic greywacke sequence extending from the crest of Colebrook Hill northwards to the Mt Ramsay area, and with a newly-recognised extension in the Coldstream River area (fig. 4), is almost certainly an extension of the Cleveland–Waratah Association allochthonous suite from north of the Meredith Granite (Seymour and Calver, 1995). Analyses of three of the reasonably fresh basalts from the new area are given in Table 1. Considering the number of these allochthonous units now known in western Tasmania, and their importance as regional tectonic units, as potential host rocks for mineralisation, and as basement rocks which may have influenced the composition and metal content of the Mt Read Volcanics, there is an urgent need for a comprehensive account of their geochemistry and petrology to be published or made easily available to users.

The map changes necessitated by the study of the geophysical survey results and company work highlights the paucity of detailed mapping in the upper Huskisson–Coldstream–Hatfield River area, which, although fairly remote, is now served by a network of forestry roads. It is recommended that re-mapping be undertaken to bring knowledge of the area and its potential for mineralisation up to date.

A second probable occurrence of Cleveland–Waratah Association basement rocks is at Miners Ridge, near Queenstown, in a small structural window. These rocks were drilled by MRT in about 1990 to obtain geochemical and petrological data, but again it appears that the data have not been published and are unavailable to potential users.

Some implications for exploration

New Tyndall Group possibilities

Recognition of a number of new areas of Tyndall Group rocks provides scope for discovery of basal Tyndall mineralised zones, such as those along the Henty–Comstock line. New areas of interest could include the lower Yolande River area, the lower King River area, the Henty Fault Wedge area, the Howards Road–Mt Dundas zone, and the Dundas–Black Hill and Huskisson–Pieman zones. The extension of Tyndall Group rocks near the Professor Plateau is associated with several magnetic anomalies in an area of dense rainforest, and warrants further investigation. The area at Rosebery–Primrose has significant alteration associated with it, which may or may not be entirely related to Devonian granite intrusion at depth.

Mineralisation beneath Tyndall Group in Jukes–Darwin area

Recognition that most or all of the quartz-phyric sequence along the eastern flank of the Jukes–Darwin range is Tyndall Group raises the possibility that Mt Lyell-type mineralised systems developed along the southerly extension of the Great Lyell Fault could be buried beneath these rocks. This possibility has previously been raised by Morrison (2002). According to this interpretation, much of the alteration seen along the CVC rocks of the Jukes–Darwin area could represent the fringes of larger alteration zones focussed along the buried base of the Tyndall Group to the east, with the Great Lyell Fault (which surfaces at the foot of the range but must dip westwards under the range) acting as a major plumbing structure. This exploration 'play' would involve use of reconnaissance deep-penetration methods, such as CSAMT, but has the potential to open up a completely new field of mineralisation. A Mt Lyell-type system, with all its ore bodies intact, represents a very attractive gold-copper target.

Successful exploration of this difficult target requires a sufficiently large land holding to cover the area between the King River and South Darwin Peak, and it is recommended that land release by MRT be co-ordinated so as to ensure a viable parcel of land is available.

The Henty–Comstock zone and the Great Lyell Fault

Although this zone has been well explored in parts, there would seem to be scope for deep exploration related to the Great Lyell Fault position. This fault has clearly been a major controlling influence on the alteration–mineralisation system at Comstock and Mt Lyell (Corbett, 2001*a, b*), where the main ore bodies and most intense alteration lie within a zone a few hundred metres wide along the western side of the west-dipping fault. A similar scenario might be expected along the extension of this major regional fault into the Henty area. However, its influence does not seem to have been fully appreciated around Henty, where the adjacent Henty Fault, some 250 m to the west, is the dominant feature at surface. The Henty Fault has greatly modified the local structure and rock arrangements, but it was probably not the plumbing structure for the Henty mineralisation. Its effects may be largely of Devonian age, and it may have overprinted an original Cambrian system related to the Great Lyell Fault, which is buried under Tyndall Group rocks to the east. Consideration needs to be given to exploration along, and related to, the Great Lyell Fault in the Henty area.

The basal Tyndall Group position in the area west of Sedgwick Bluff and north of Zig Zag Hill, where a small area of Tyndall Group has been mapped (Corbett and Jackson, 1987), may warrant further investigation, considering the presence of several small magnetic anomalies in the area and its location close to the West Sedgwick zone of alteration.

The Sterling Valley Volcanics

These represent something of an enigma at the moment, as the best geochemical arguments suggest they are Tyndall Group equivalents. Crawford *et al.* (1992) included an analysis from these volcanic rocks in their Suite IV group with the Henty Dyke Swarm and western Henty Fault Wedge basalts, regarded as typical Tyndall Group tholeiitic volcanic rocks associated with a period of late rifting along the Mt Read belt. However Gifkins (2001) places them at the base of the CVC sequence, in a situation with no other apparent analogues along the belt. There is an urgent need for further work on these rocks to establish their stratigraphic setting, as a Tyndall Group sequence in this area, with active basaltic-andesitic volcanism, has many similarities to the Anthony Road–Henty situation.

Pinnacles–Mt Kershaw zone

It is now well established that the Que–Hellyer stratigraphic sequence extends in a reasonably coherent form to the Burns Peak–Boco Road area (McNeill, 2002), and includes the Hollway Andesite as a correlate of the Que–Hellyer andesites. From here southwards through the Mt Kershaw area, the sequence apparently interfingers with the Kershaw Pumice Formation of Gifkins (2001). The changeover zone is rather poorly mapped and poorly known, and there is scope for further work to clarify the situation and determine if the Que–Hellyer mineralisation style continues, or if there are occurrences related to the Rosebery–Hercules style. It is possible that the Chester pyrite deposit, and its associated large alteration zone, represents the only major system in this general area.

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[31 July 2002]

Table 1

North Ross Creek basalts — major and trace elements

Reg. No	20020196	20020197	20020198
TasRock/Field No.	011016/NRC-1	011017/NRC-2	011018/NRC-3
SiO_2	46.09	48.56	45.64
TiO_2	2.12	1.79	1.48
Al_2O_3	14.52	15.42	15.56
Fe_2O_3	2.94	3.42	1.59
FeO	10.5	8.57	9.15
MnO	0.23	0.19	0.15
MgO	6.99	6.19	7.88
CaO	6.01	6.41	6.74
Na_2O	4.04	4.53	3.54
K_2O	0.25	0.27	0.83
P_2O_5	0.25	0.21	0.14
SO_3	0	0	0
CO_2	1.1	0.22	1.32
H_2O^+	4.58	3.88	5.18
TOTAL	99.61	99.66	99.22
L.O.I.	4.51	3.15	5.48
Co	46	43	57
As	<20	<20	<20
Bi	<5	<5	<5
Ga	15	16	18
Zn	135	245	145
W	<10	<10	<10
Cu	160	185	120
Ni	70	81	95
Sn	<9	<9	<9
Pb	<10	<10	13
Cr	110	130	370
V	410	400	46
Sc	43	38	46
Th	<10	<10	<10
Sr	120	170	300
U	<10	<10	<10
Rb	10	7	23
Y	34	31	27
Zr	150	130	98
Nb	12	9	5
Mo	<5	<5	<5
Nd	<20	23	<20
Ce	34	<28	<28
La	<20	<20	<20
Ba	160	87	2000
S (%)	0	0	0.1
Ti/Zr	84.7	82.8	90.5

All samples from drill hole NRC-1 (Pasminco, 1996; core at MRT core library)
Sample NRC-1 from 139.7 m; NRC-2 from 110.2 m; NRC-3 from 77.2 m

Table 2

Geochemical comparison of Eastern Quartz-Phyric Sequence and Tyndall Group

Eastern Quartz-Phyric Sequence

Reg. No.	Field No.	SiO_2	TiO_2	Al_2O_3	Fe_2O_3	FeO	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	SO_3	CO_2	H_2O^+	Total	LOI
20020200	011020/MRV-15	72.1	0.44	13.43	0.31	2.25	0.07	1.26	0.36	2.2	5.34	0.05	0	0.11	1.44	99.37	1.3
20020201	0110121/MRV-16	76.09	0.34	12.73	0.39	1.35	0.06	0.75	0.45	4.82	1.63	0.02	0	0.02	0.95	99.6	0.82
20020202	011022/MRV-17	73.81	0.3	12.89	1.71	1.48	0.03	0.66	0.19	3.11	4.48	0.02	0	0.02	1.03	99.73	0.89
20020203	011023/MRV-18	73.07	0.36	12.68	1.76	1.61	0.07	1.03	0.18	0.8	6.52	0.03	0	0.06	1.41	99.59	1.3
20020204	011024/MRV-19	67.72	0.51	13.24	1.59	4.06	0.05	1.33	0.12	0.01	8.89	0.07	0	0.03	1.65	99.27	1.23
20020205	011028/LM-14	75.77	0.24	9.57	2.91	3.67	0.32	0.86	0.01	0.01	3.65	0.01	0	0.21	2.46	99.69	2.26
20020206	011032/LM-18	61.98	0.63	14.46	2.4	3.16	0.17	2.52	2.7	2.85	4.79	0.15	0	1.48	2.03	99.32	3.16
20020207	011033/LM-19	71.67	0.28	11.85	6.68	0.84	0.04	0.55	0.06	0.71	4.87	0.02	0	0.08	1.79	99.43	1.78

Tyndall Group

Reg. No.	Field No.	SiO_2	TiO_2	Al_2O_3	Fe_2O_3	FeO	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	SO_3	CO_2	H_2O^+	Total	LOI
20020127	010901/MRV-1	70.7	0.46	14.42	2.66	0.7	0.01	0.56	0.09	4.6	4.19	0.05	0.01	0.29	0.96	99.7	1.17
20020128	010902/MRV-2	70.03	0.48	15.34	2.76	0.38	0	0.18	0.06	5.61	3.5	0.02	0.01	0.17	1.11	99.64	1.24
20020129	010903/MRV-3	70.55	0.46	15.13	2.14	0.83	0.01	0.7	0.05	2.31	4.9	0.05	0.02	0.35	2	99.49	2.26
20020130	010904/MRV-4A	72.83	0.49	14.8	1.36	0.7	0	0.25	0.06	3.2	4.67	0.02	0.01	0.19	1.27	99.85	1.38
20020131	010905/MRV-4B	69.78	0.49	14.74	2.45	1.09	0.04	0.85	0.14	5.12	3.66	0.06	0.01	0.21	0.89	99.53	0.98
20020134	010908/MRV-7	71.22	0.48	14.82	1.75	1.35	0.05	0.59	0.58	1.34	3.79	0.07	0	0.68	2.9	99.62	3.43
20020135	010909/MRV-8	69.19	0.43	16.15	2.57	0.9	0.07	0.71	0.51	0.99	4.24	0.03	0.01	0.21	3.65	99.66	3.76
20020136	010910/MRV-9	71.83	0.29	14.56	2.65	0.96	0.04	1.06	0.02	0.08	4.77	0.01	0.01	0.22	3.09	99.58	3.2
20020137	010911/MRV-10	67.38	0.45	17.87	1.63	1.35	0.06	0.82	0.25	0.09	4.09	0.03	0.02	0.41	5.05	99.5	5.31
20020199	011019/B1	68.13	0.46	14.18	2.01	1.73	0.06	0.98	2.62	2.26	3.33	0.06	0	1.69	2.01	99.5	3.5

Eastern Quartz-Phyric Sequence

Reg. No.	Co	As	Bi	Ga	Zn	W	Cu	Ni	Sn	Pb	Cr	V	Sc	Th	Sr	U	Rb	Y	Zr	Nb	Mo	Nd	Ce	La	Ba	S	Ti/Zr
20020200	<8	<20	<5	15	67	<10	5	9	<9	62	24	51	9	15	97	<10	190	37	220	12	<5	37	79	46	1500	0	11.99
20020201	<8	<20	<5	13	61	<10	6	5	<9	<10	14	28	<9	14	98	<10	58	35	240	11	<5	34	80	38	630	0	8.49
20020202	<8	<20	<5	14	79	<10	6	5	<9	20	13	10	<9	14	115	<10	100	41	250	11	<5	54	110	67	1700	0	7.19
20020203	8	<20	<5	14	86	<10	7	7	<9	11	24	43	<9	18	74	<10	200	57	185	13	<5	65	160	95	1400	0	11.66
20020204	<8	<20	<5	14	105	<10	<5	10	<9	<10	40	65	12	16	73	<10	190	24	250	13	<5	24	33	34	3000	0	12.22
20020205	<8	<20	<5	12	150	<10	23	5	<9	13	6	17	<9	16	24	<10	180	34	220	10	<5	21	54	29	980	0	6.54
20020206	12	<20	<5	14	160	<10	5	8	<9	14	28	135	17	18	270	<10	160	23	170	12	<5	31	95	56	1300	0	22.22
20020207	<8	27	<5	13	43	22	12	5	<9	19	10	115	<9	23	80	<10	230	9	135	7	<5	<20	<28	<20	1200	0	12.43

Tyndall Group

Reg. No.	Co	As	Bi	Ga	Zn	W	Cu	Ni	Sn	Pb	Cr	V	Sc	Th	Sr	U	Rb	Y	Zr	Nb	Mo	Nd	Ce	La	Ba	S	Ti/Zr
20020127	<8	<20	<5	13	34	<10	6	5	<9	<10	8	46	<9	<10	98	<10	89	32	210	13	<5	28	76	38	930	0	13.13
20020128	<8	<20	<5	14	21	<10	5	5	<9	<10	13	54	<9	13	66	<10	70	20	230	14	<5	42	100	54	670	0	12.51
20020129	<8	<20	<5	16	27	<10	19	5	<9	<10	7	35	11	<10	105	<10	145	27	240	14	<5	32	53	43	2900	0.1	11.49
20020130	<8	<20	<5	15	46	<10	5	6	<9	12	10	55	11	<10	105	<10	145	35	260	15	<5	45	105	54	1050	0	11.3
20020131	8	<20	<5	15	56	<10	5	5	<9	<10	11	56	10	13	140	<10	90	30	250	14	<5	24	83	26	860	0	11.75
20020134	<8	<20	<5	16	135	<10	8	6	<9	67	7	33	14	23	180	<10	150	30	300	18	<5	35	105	53	1050	0	9.59
20020135	8	<20	<5	17	140	<10	<5	7	<9	42	6	33	11	17	180	<10	145	31	290	19	<5	62	105	58	1300	0	8.89
20020136	11	<20	<5	15	51	<10	34	9	<9	12	13	31	<9	22	8	<10	210	29	185	18	<5	23	28	25	1300	0	9.4
20020137	<8	<20	<5	18	80	<10	13	5	<9	34	<5	36	10	21	78	<10	145	29	280	20	<5	43	125	67	1200	0	9.63
20020199	<8	<20	<5	15	45	<10	7	5	<9	13	11	73	13	11	150	<10	130	35	250	13	<5	32	72	45	900	0	11.03

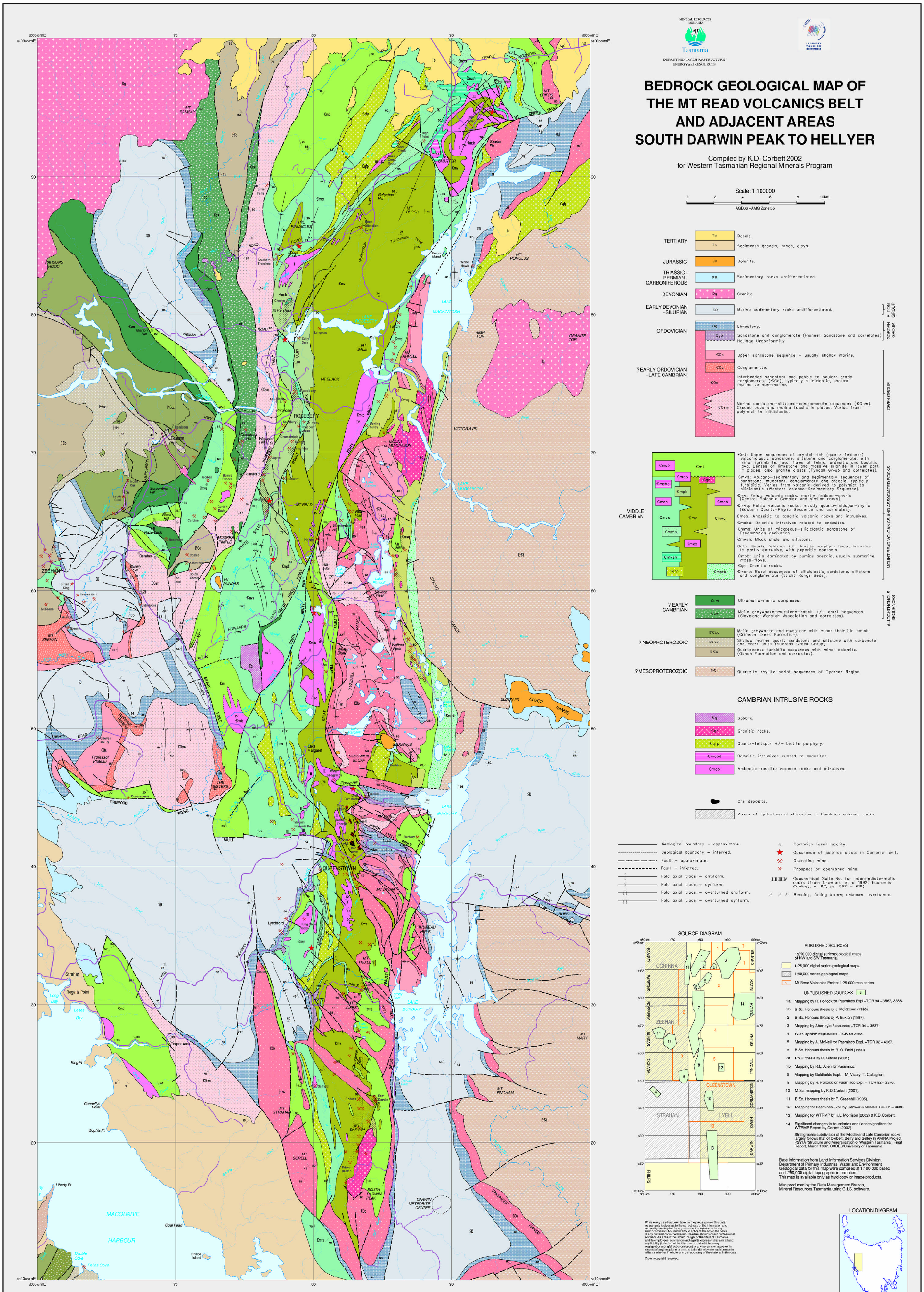
Note: See Table 3 for sample locations

Table 3

Rock samples and descriptions

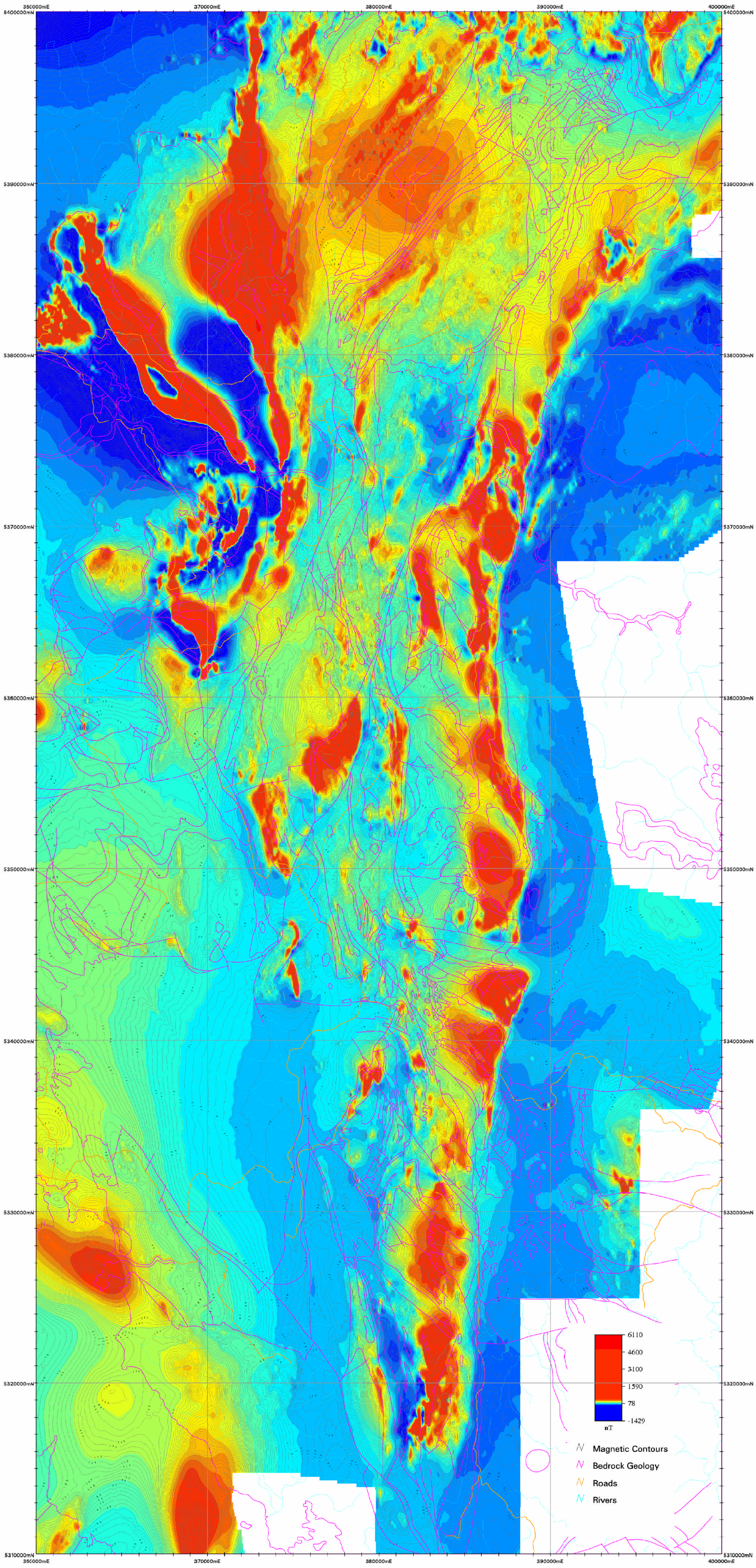
TasRock/ Field No.	AMG East	AMG North	Location	Rock Group	Rock Type	Analysis No.	Description
011002/LM-1	389 350	5 384 350	South end Snake Island	Farrell Slates?	Felsic lava		Abundant plagioclase phenocrysts; sparse small quartz blebs. Looks like a CVC lava
011003/LM-2	389 470	5 384 460	East side Snake Island	Farrell Slates?	Andesitic lava		Feldspar & ferromag phenocrysts. More mafic version of above.
011004/LM-3	389 450	5 384 600	NE corner Snake Island	Farrell Slates?	Felsic lava		Fresh example of plagioclase-phyric dacite like LM-1.
011005/LM-4	389 350	5 384 522	West side Snake Island	Farrell Sl./Southwell Sbgp	Coarse greywacke		Abundant clasts of chert and quartzite, also chlorite clasts and some volcanic quartz
011006/LM-5	389 370	5 384 505	West side Snake Island	Farrell Sl./Southwell Sbgp	Pebbly greywacke		Clasts of chert and quartzite in fairly mica-rich matrix
011007/LM-6	389 100	5 385 400	Island in Lake Mackintosh	Farrell Slates or CVC	Pumice breccia		Flow-textured pumice breccia or lava; feldspar-phyric; sericite-altered
011008/LM-7	389 350	5 382 900	Shore at N end Farrell Range	Farrell Slates?	Felsic lava		Snowflake-textured feldspar-phyric lava, like CVC
011009/LM-8	389 300	5 382 900	Shore at N end Farrell Range	Farrell Sl./Southwell Sbgp	Coarse greywacke		Clasts of chert, quartzite & volcanic quartz — identical to LM-4
011010/LM-11	390 445	5 366 460	Just N of Red Hills track	(Devonian?) dyke	Lamprophyre		Fresh pyroxene & sparse plagioclase phenocrysts in groundmass of intergrown feldspar-pyroxene
011011/LM-12	387 650	5 342 100	East end Mt Lyell	Tyndall Group?	Quartz-phyric lava		Corroded quartz phenos & remnant feldspar phenos in carbonate-sericite-altered groundmass
011014/LM-13	386 808	5 341 690	East end Mt Lyell	Tyndall Group?	Ignimbrite		Crystal-rich feldspar-quartz, abundant pink matrix, probable welded shard texture
011015/NastyNob	383 140	5 337 600	Nasty Nob near Mt Owen	CVC	Felsic lava		Plagioclase phenocrysts & few small chloritised ferromags; partly spherulitic groundmass
011016/NRC-1	375 425	5 390 229	DH NRC1, North Ross Creek	Cleveland-Waratah Assoc'n	Basalt	20020196	Plagioclase-pyroxene-phyric basalt with well-crystallised feldspar-pyroxene groundmass
011017/NRC-2	375 425	5 390 229	DH NRC1, North Ross Creek	Cleveland-Waratah Assoc'n	Basalt	20020197	Plagioclase-pyroxene-phyric basalt with well-crystallised feldspar-pyroxene groundmass
011018/NRC-3	375 425	5 390 229	DH NRC1, North Ross Creek	Cleveland-Waratah Assoc'n	Basalt	20020198	Plagioclase-pyroxene-phyric basalt with well-crystallised feldspar-pyroxene groundmass
011019/B-1	387 520	5 342 270	East end Mt Lyell	Tyndall Group?	Quartz-phyric lava	20020199	Sparse quartz and altered feldspar phenocrysts in carbonate-sericite-altered groundmass
011020/MRV-15	386 152	5 373 055	P'line track off Anthony Road	Murchison Volc's - EQPS	Quartz porphyry	20020200	Crystal-rich quartz-feldspar-ferromag (chlorite) porphyry with pink glassy groundmass
011021/MRV-16	386 020	5 373 078	P'line track off Anthony Road	Murchison Volc's - EQPS	Quartz phyric lava	20020201	Abundant quartz phenocrysts, sparser feldspars, chlorite blebs, probable perlitic texture
011022/MRV-17	385 730	5 373 513	P'line track off Anthony Road	Murchison Volc's - EQPS	Feldspar-phyric lava	20020202	Feldspar porphyry, no quartz phenos; coarse spherulites with quartz cores. Typical CVC lava
011023/MRV-18	385 402	5 373 469	P'line track off Anthony Road	Murchison Volc's - EQPS	Pumice breccia?	20020203	Elongate quartz & feldspars; strong flow texture; large sericite blebs after pumice fragments
011024/MRV-19	385 076	5 373 390	P'line track off Anthony Road	Murchison Volc's - EQPS	Quartz-phyric lava	20020204	Quartz-feldspar-biotite-pyroxene(?)-phyric lava with pinkish glassy groundmass
011028/LM-14	387 888	5 353 999	Near Lake Dora	EQPS	Orange lava	20020205	Small quartz & completely altered feldspar phenos in coarse spherulitic/snowflake groundmass

TasRock/ Field No.	AMG East	AMG North	Location	Rock Group	Rock Type	Analysis No.	Description
011029/LM-15	387 745	5 354 005	West of Lake Dora	Granite intruding EQPS	Granite		Coarsely intergrown quartz & pink kspar with remnants of coarse biotite, much chlorite
011030/LM-16	387 746	5 345,005	West of Lake Dora	Granite intruding EQPS	Granite		Coarsely intergrown quartz & pink kspar with remnants of coarse biotite, much chlorite
011031/LM-17	387 747	5 345 010	West of Lake Dora	EQPS	Lava		Large quartz & feldspar & chlorite-altered ferromag (mainly biotite) phenocrysts; much chlorite
011032/LM-18	387 338	5 355 603	Just NW of Lake Dora	EQPS	Andesite	20020206	Crystal-rich feldspar-minor quartz-biotite-ferromag porphyritic andesite. Some apatite & pyrite
011033/LM-19	385 454	5 363 241	East shore lake Plimsoll	EQPS?	Quartz porphyry	20020207	Fairly numerous quartz phenocrysts, 'ghosts' of feldspars only, no ferromags; very fine groundmass
010901/MRV-1	385 095	5 317 940	South Darwin track	Tyndall Group	Quartz-phyric lava	20020127	Feldspar-quartz porphyry, possible altered hornblendes(?); fine-grained groundmass
010902/MRV-2	385 050	5 318 000	South Darwin track	Tyndall Group	Quartz-phyric lava	20020128	Similar to MRV-1, with more quartz; locally brecciated
010903/MRV-3	384 956	5 318 041	South Darwin track	Tyndall Group	Volcaniclastic	20020129	Sericitised & sheared, some quartz, faint pumice-shard textures
010904/MRV-4A	384 755	5 318 131	South Darwin track	Tyndall Group	Quartz-phyric lava	20020130	Good quartz-feldspar-phyric lava; some large feldspar glomerocrysts; uniform groundmass
010905/MRV-4B	384 436	5 318 284	South Darwin track	Tyndall Group	Quartz-phyric lava	20020131	Same unit as MRV-4A but fresher, with flecks of chlorite
010906/MRV-5	384 075	5 319 114	E margin of Darwin Granite	Basal Tyndall Group	Granite-clast breccia	20020132	Clasts of granite, CVC-type pumice breccia & sandstone in crystal-rich vitriclastic matrix
010907/MRV-6	384 093	5 318 553	Granite margin, S Darwin track	Basal Tyndall Group	Granite-clast breccia	20020133	Clasts of granite, CVC-type lava in crystal-rich sericitised matrix -vitriclastic?
010908/MRV-7	384 446	5 324 517	Intercolonial Spur track	Tyndall Group	Quartz-phyric lava	20020134	Abundant embayed quartz phenos, feldspars all altered to sericite, groundmass also sericitic
010909/MRV-8	385 004	5 322 990	East Darwin track	Tyndall Group	Quartz-phyric lava	20020135	Feldspar-quartz-phyric; all feldspars completely altered to sericite, rather dark groundmass
010910/MRV-9	384 838	5 323 951	East Darwin track	Tyndall Group	Volcaniclastic	20020136	Quartz-rich volcaniclastic sandstone; clasts of mainly quartz-phyric lava; very sericite-rich
010911/MRV-10	384 635	5 322 969	East Darwin track	Tyndall Group	Quartz-phyric lava	20020137	Quartz-feldspar-phyric lava; all feldspars altered to sericite; possible clast of CVC-type lava
010912/MRV-11	383 600	5 331 075	Mt Jukes Road at Jukes Pty	CVC intrusive	Quartz-fspar porphyry		Very altered; large quartz phenocrysts surrounded by fine groundmass rich in kspar, chlorite, sericite
010913/MRV-14	383 639	5 331 099	Below road at Jukes Pty	Basal Tyndall Group	Qfp-clast breccia		Clasts of quartz-feldspar porphyry in quartz-rich matrix



BEDROCK GEOLOGICAL MAP OF THE MT READ VOLCANICS BELT AND ADJACENT AREAS
SOUTH DARWIN PEAK TO HELLYER
Compiled by K.D. Corbett 2002
for Western Tasmanian Regional Minerals Program
Scale: 1:100000
TERTIARY
Basalt.
Sediments-gravels, sands, clays.
JURASSIC
Dolerite.
TRIASSIC - PERMIAN - CARBONIFEROUS
Sedimentary rocks undifferentiated.
DEVONIAN
Granite.
EARLY DEVONIAN -SILURIAN
Marine sedimentary rocks undifferentiated.
ORDOVICIAN
Limestone.
Haulage Unconformity
?EARLY ORDOVICIAN LATE CAMBRIAN
Upper sandstone sequence - usually shallow marine.
Conglomerate.
MIDDLE CAMBRIAN
MOUNT READ VOLCANICS AND ASSOCIATED ROCKS
? EARLY CAMBRIAN
Ultramafic-mafic complexes.
? NEOPROTEROZOIC
?MESOPROTEROZOIC
Quartzite-phyllite-schist sequences of Tyennan Region.
CAMBRIAN INTRUSIVE ROCKS
Gabbro.
Granitic rocks.
Quartz-feldspar +/- biotite porphyry.
Doleritic intrusives related to andesites.
Andesitic-basaltic volcanic rocks and intrusives.
Ore deposits.
Zones of hydrothermal alteration in Cambrian volcanic rocks.
Geological boundary - approximate.
Geological boundary - inferred.
Fault - approximate.
Fault - inferred.
Fold axial trace - antiform.
Fold axial trace - synform.
Fold axial trace - overturned antiform.
Fold axial trace - overturned synform.
Cambrian fossil locality.
Occurence of sulphide clasts in Cambrian unit.
Operating mine.
Prospect or abandoned mine.
Geochemical Suite No. for intermediate-mafic rocks (from Crawford et al 1992, Economic Geology, v. 87, pp. 597 – 619).
Bedding, facing known; unknown; overturned.
SOURCE DIAGRAM
PUBLISHED SOURCES
1:250,000 digital series geological maps of NW and SW Tasmania.
1:25,000 digital series geological maps.
1:50,000 series geological maps.
Mt Read Volcanics Project 1:25,000 map series.
UNPUBLISHED SOURCES
1a Mapping by R. Pollock for Pasminco Expl -TCR 94 -3567, 3568.
1b B.Sc. Honours thesis by J. McKibben (1993).
2 B.Sc. Honours thesis by P. Buxton (1997).
3 Mapping by Aberfoyle Resources -TCR 94 - 3537.
5 Mapping by A. McNeill for Pasminco Expl. -TCR 02 - 4667.
6 B.Sc. Honours thesis by R. O. Reid (1990).
7b Mapping by R.L. Allen for Pasminco.
8 Mapping by Goldfields Expl. - M. Vicary, T. Callaghan.
10 M.Sc. mapping by K.D. Corbett (2001).
11 B.Sc. Honours thesis by P. Greenhill (1995).
13 Mapping for WTRMP by K.L. Morrison (2002) & K.D. Corbett.
14 Significant changes to boundaries and / or designations for WTRMP Report by Corbett (2002).
Stratigraphic subdivision of the Middle and Late Cambrian rocks largely follows that of Corbett, Berry and Selley in AMIRA Project P291A 'Structure and Mineralisation of Western Tasmania', Final Report, March 1997. CODES/University of Tasmania
Base information from Land Information Services Division, Department of Primary Industries, Water and Environment. Geological data for this map were compiled at 1:100,000 based on 1:250,000 digital topographic information. This map is available only as hard copy or image products.
Map produced by the Data Management Branch, Mineral Resources Tasmania using G.I.S. software.
LOCATION DIAGRAM
ROSEBERY
QUEENSTOWN
ZEEHAN
MACQUARIE HARBOUR

Figure 4



MINERAL RESOURCES TASMANIA
Tasmania
DEPARTMENT of INFRASTRUCTURE ENERGY and RESOURCES

WESTERN TASMANIAN REGIONAL MINERALS PROGRAM
Mt Read Volcanics Belt and Adjacent Areas - South Darwin Peak to Hellyer
Total Magnetic Intensity

Scale: 1:100000

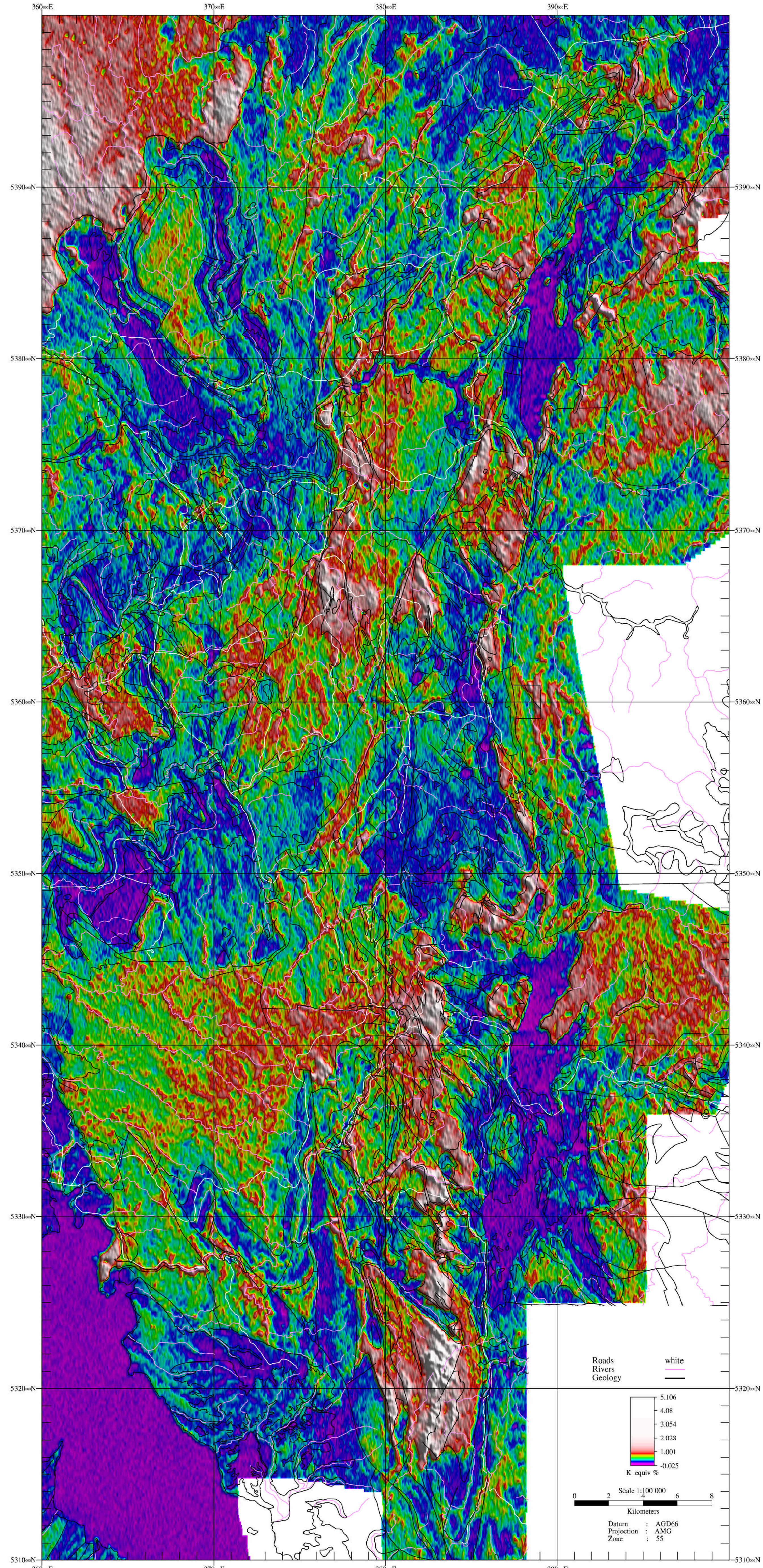
0 2 4 6 8 10km

Grid: Australian Map Grid, Zone 55
Contour Interval: 5nT

INDUSTRY TOURISM RESOURCES

Figure 5

/covers/project/rmp/plotkdc1.aml (kdc1.aml)



WESTERN TASMANIAN REGIONAL MINERALS PROGRAM
Mt Read Volcanic Belt and Adjacent Areas
Airborne Radiometric Data - Potassium
NE Illumination

Figure 6

INDUSTRY TOURISM RESOURCES

/mdata10/wtrmp/kcnm/kdc_k_geol.alg