Tasmania Department of Mines programs — MRVP, NETGOLD and AMB

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ABSTRACT

In recent years, the Tasmania Department of Mines (TDM) has embarked on a program of specially-funded research. The first program component, the Mt Read Volcanics Project (MRVP), started in 1985 and has just been completed. Two others — NETGOLD (North East Gold) and AMB (Arthur Mobile Belt) — have been planned for several years but have not yet been successful in attracting additional Government funding. This account of TDM programs is not a comprehensive review of all Geological Survey activities but covers only those projects which have been the subject of special funding arrangements.

MT READ VOLCANICS PROJECT

INTRODUCTION

This scientific project arose from the West Coast Resource Development Program which was a major initiative of the Tasmanian Government in June 1985, in response to the projected closure of the Mt Lyell copper mine in 1989. The project became known as the Mt Read Volcanics Project (MRVP) and had the aim of encouraging mineral exploration and development on Tasmania's West Coast. The detailed objective was to:

- provide industry with scientific databases on the geology, geophysics and geochemistry of the Mt Read Volcanics Belt and associated rocks, which are the major hosts of mineralisation in western Tasmania (fig. 1).

Initial funding of $2 million dollars was approved in August 1985, to be allocated from the Gordon-below-Franklin Dam compensation funds by arrangement between the State and Commonwealth Governments. From 1987 until the project ended in June 1992, operational funding came entirely from the Tasmanian Government.

For the seven-year duration of the project (1985–1992), specially-funded allocations totalled $4.2 million and were distributed among the program activities as follows (fig. 2):

- geological mapping — $1,316K (31%);
- database development — $460K (11%);
- isotopic and alteration studies — $403K (10%);
- exploration geochemistry — $232K (5%);
- mineral maps — $148K (4%), and
- geophysics — $1,644K (39%).

In addition, normal Department resources and services assigned throughout the life of the project are estimated to be close to $1 million, including sub-basalt drilling at $390,000. This represents a total resource allocation to the project of over $5 million.

Up to seventeen temporary personnel were on contract to the Department at any one time, including geologists, analysts, draftsmen, database clerks, technical officers and field assistants. At least nine permanent officers were engaged on the project at various times. Technical and support services were contracted as required, such as geophysical companies, track cutters and helicopter services.

All maps and reports resulting from the project are listed at the end of this review. As the reporting and compilation are expected to continue for several more years, the list is regarded as provisional.

THE PRODUCTS

Geological mapping

Twelve 1:25 000 scale colour geological maps have been produced. These cover about 80% of the Mt Read Volcanics Belt from Elliott Bay in the south to north of the Hellyer Mine (fig. 3). A compilation map at 1:100 000 scale has been published for the Hellyer–Queenstown section, including the operating mines, and a further map at this scale is planned for the Queenstown–Elliott Bay section in southwestern Tasmania.

The geological mapping program, which commenced in 1985, evolved from pioneering work carried out in the Queenstown region in the previous ten years, which demonstrated that careful mapping of the highly altered and deformed Cambrian volcanic rocks could reveal details of stratigraphy, structure, alteration and mineral deposit settings of significance to mineral exploration and mining.

From 1985 onwards, the mapping stages occurred as follows:

- The initial six maps in the series covered the central part of the belt from Mt Charter to the Tyndall Ranges, which contains the most important known mineralisation including the Hellyer, Que River, Rosebery, Hercules and Henty deposits.
- Allocated resources in 1988/89 were such that only logistically accessible areas could be tackled. As a result, field work leading to Maps 7, 8 and 9 was conducted in the north of the belt in the Black Bluff Range to Moina

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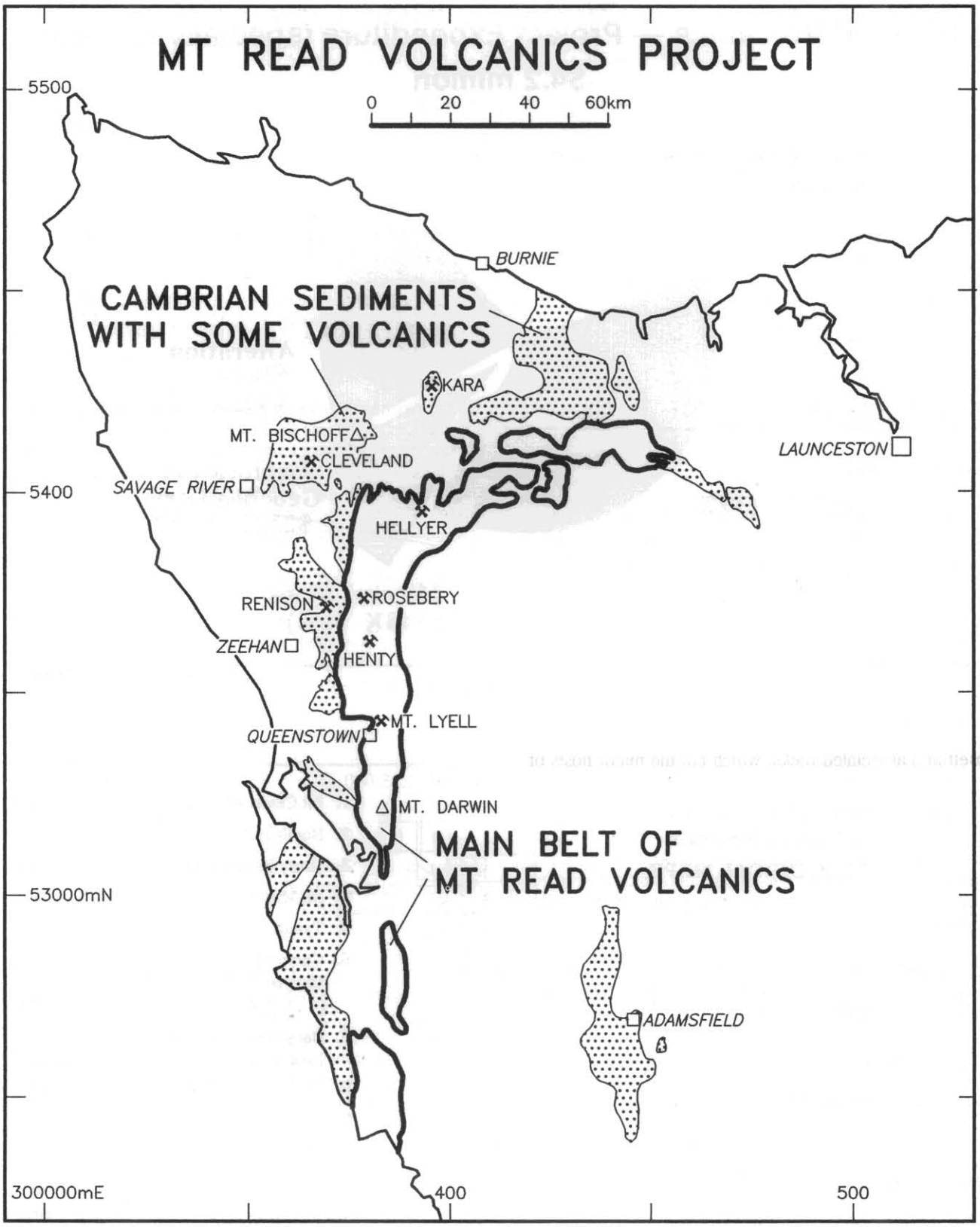

Figure 1

Geological outline of Mt Read volcanic belt.

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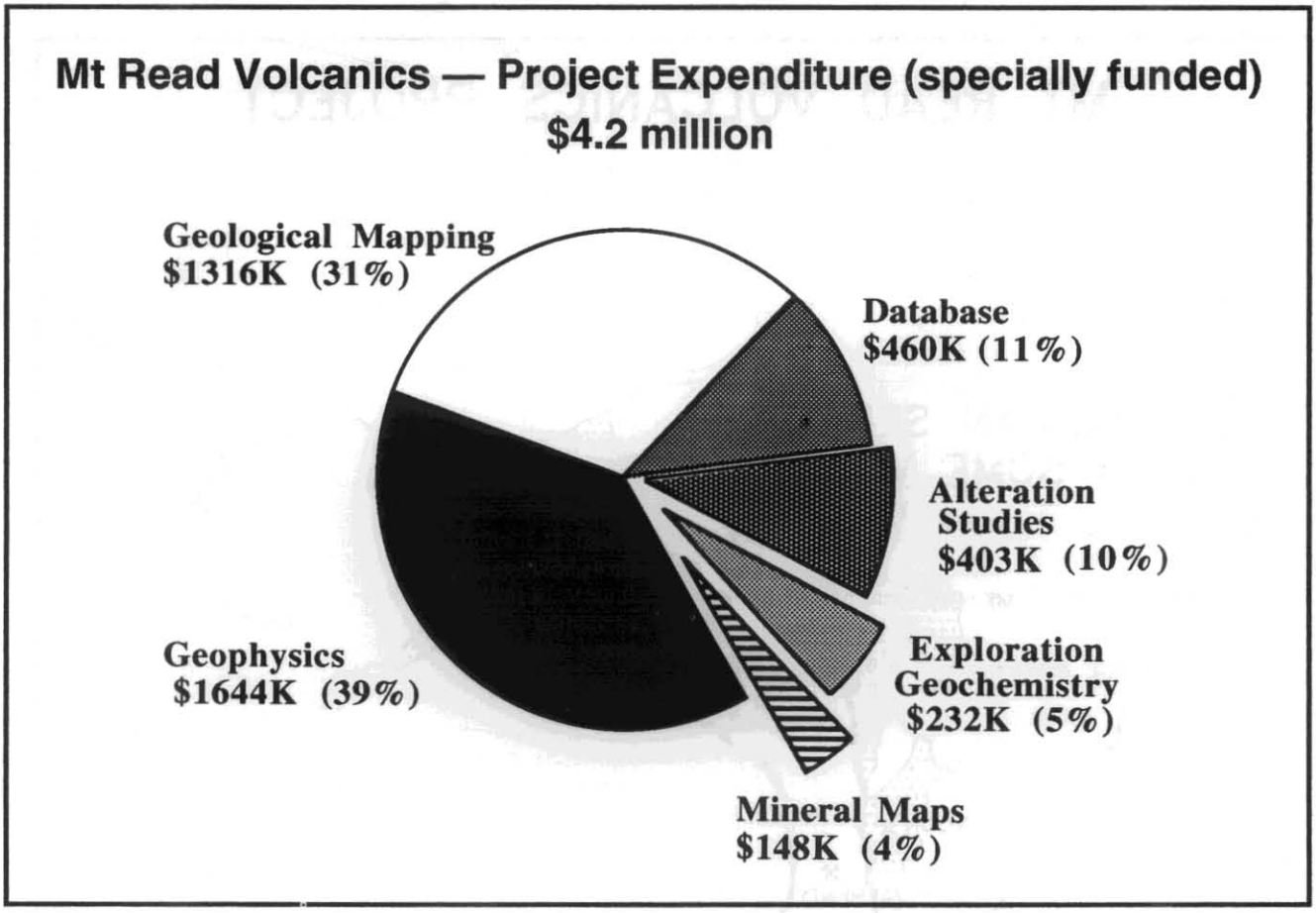

Figure 2

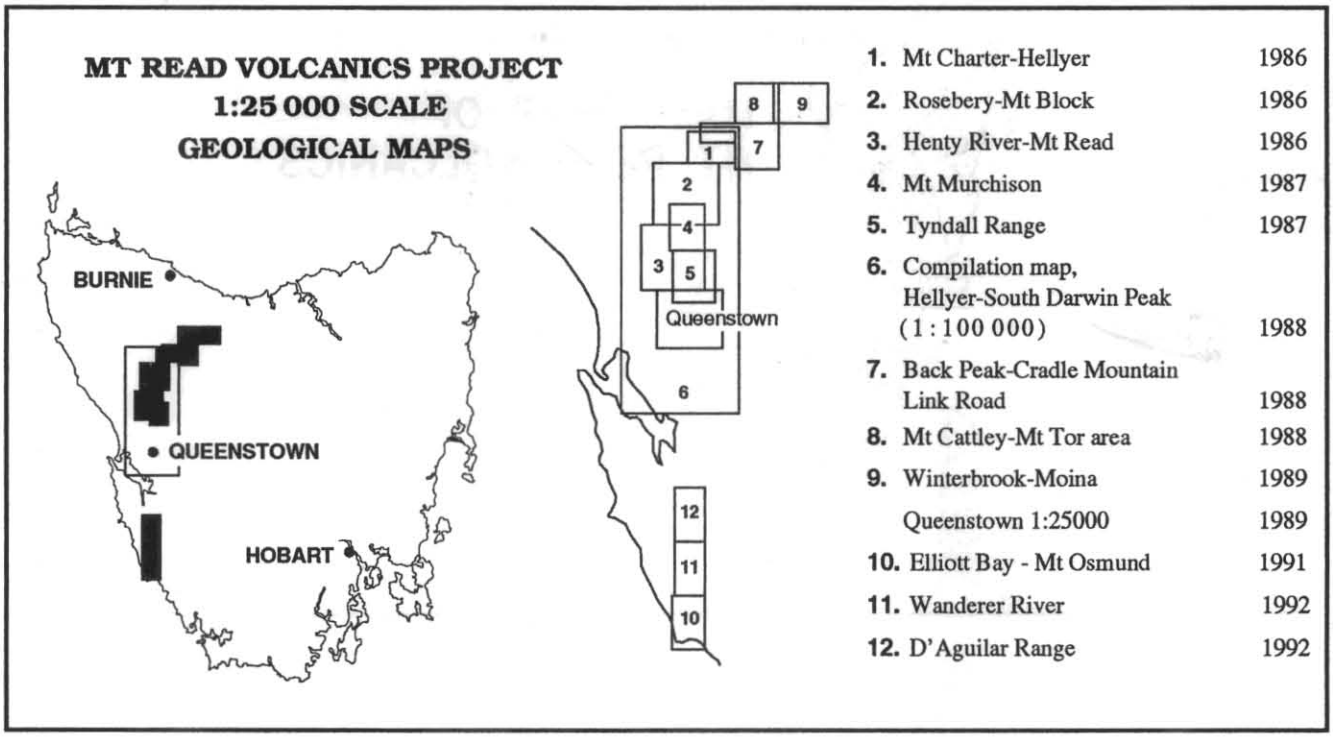

Figure 3

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areas. Also, at this time, a collaborative effort with the Regional Geological Mapping Branch, involving some remapping, produced a 1:25 000 scale map of the area around Queenstown, including the Mt Lyell deposits.

- In 1989, a two-year allocation of funds allowed a campaign to be planned in SW Tasmania, with helicopter-supported field camps and traverses. Over two field seasons, with an enhanced number of mapping crews (4), the three southern maps (10, 11 and 12) were successfully surveyed, covering the region from Elliott Bay to the D'Aguilar Range.
- The final 1991 season was carried out in the Jukes–Darwin area south of Queenstown, and the map (13) is currently being drafted.

Future mapping studies are planned over the next several years to complete coverage of the Mt Read Volcanics Belt in the Sheffield–Deloraine–Devonport region using normal Department resources.

This program has resulted in several significant outcomes:

- a set of high-quality, coloured geological maps at 1:25 000 scale containing detailed stratigraphic, structural, alteration and mineral deposit information;
- a standard set of maps with uniform mapping style and presentation along the entire length of the belt, on which companies can base their exploration planning and strategies;
- geological correlation along the entire length of the belt, thereby allowing companies a geological framework within which to rate and grade their prospects and targets for further investigation;
- more immediate results have been the recognition that the Que–Hellyer Volcanics extend from the type area, both to the southwest for 9 km through the Sock Creek area, and to the northeast for up to 10 km under Tertiary basalt.

This is an example of successful mission-oriented, mineral province mapping in which a core departmental program was escalated by special funding. On average, two maps were produced each year, with the field work to map production phase taking place within twelve months. Some delays were experienced when field mapping and compilation overran the ability of the draftsmen to draw the map and the Department to pay for the printing. While the maps were released progressively each year, the map notes were unable to be produced on a similar schedule. Four volumes of map notes have been published, representing about half of the mapping, with the remainder currently being written up. The geological mapping was supported by ten diamond-drill holes totalling 3652 m and some costeaning.

Mineral deposit maps

The main part of the Mt Read Volcanic Belt is covered by eight 1:50 000 scale mineral deposit maps as shown in Figure 4. The maps were initially produced on a monochrome geological base but later members of the series were presented on a full-coloured geological base. These maps represent the first systematic charting of mineral deposits in Tasmania.

The maps show deposits displayed in their geological setting, with commodities keyed by colour, deposit style by symbol shape, strike by bar symbol, and size by *in situ* dollar values.

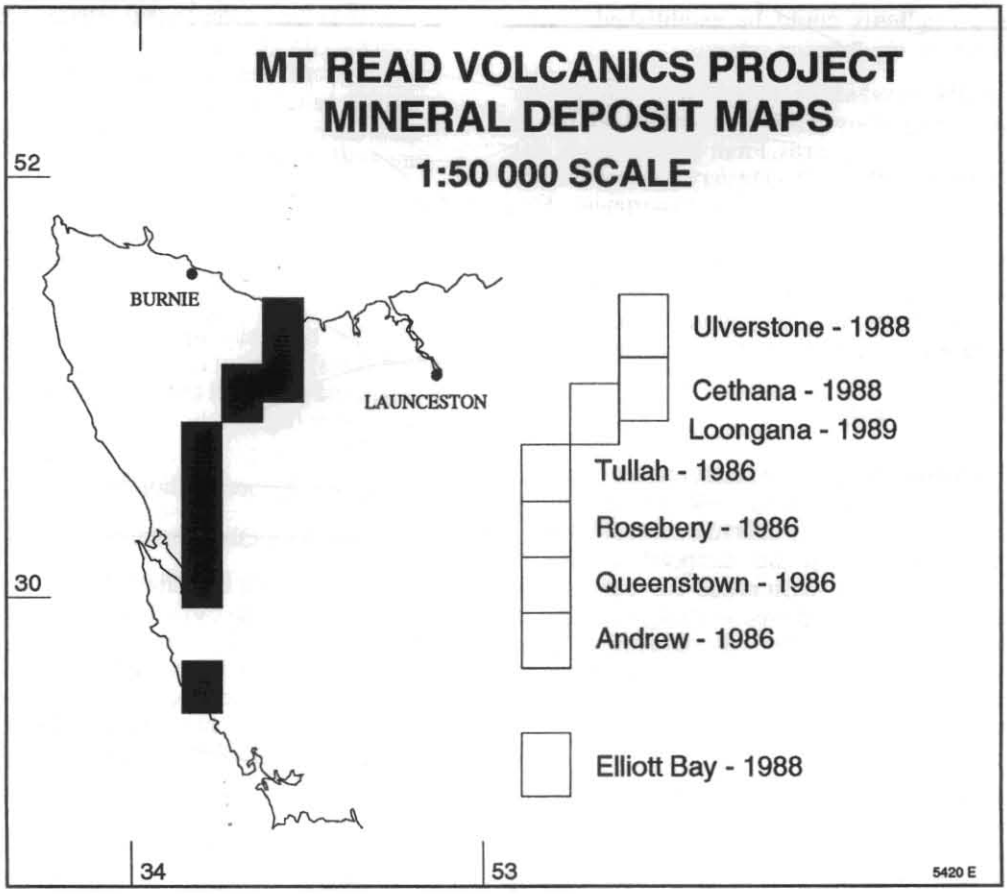

Figure 4

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Details of all deposits on the maps are contained in the MIRLOCH data base. In addition to their scientific and mineral exploration uses, these maps provide an essential data source for land-use planning.

Ore genesis studies

These studies were designed to determine the nature and extent of the geochemical haloes around massive sulphide deposits. The techniques were stable isotopic (particularly oxygen) determinations, whole-rock geochemistry, mineral chemistry (using microprobe analyses), together with petrographic work to control the interpretations.

The concepts were derived from similar work carried out a decade ago on the alteration patterns associated with the Tertiary Kuroko deposits of Japan. Difficulties were envisaged in application of the concept to the Mt Read Volcanics, considering the increased metamorphism and tectonic disturbance of these Cambrian volcanic sequences.

As a test of the concept in Tasmania, studies were conducted at Hellyer and in the Rosebery–Hercules area as examples of base metal-rich systems and compared with the Boco area, a base metal barren alteration zone. These case studies are now being fully written up.

It was found that using these techniques:

- enlarged alteration haloes could be detected, increasing the target for exploration;
- low temperature, barren, alteration zones could be distinguished from higher temperature base-metal associated alteration zones;
- temperature gradients could be established giving possible vectors to ore-forming systems.

These investigations produced a demand from industry for isotope-based investigations which were carried out by the Department on a consultancy basis. From 1988 onwards, this coincided with a period of severe budgetary constraint which involved a phase of cost recovery by the Department. Also within this period, two more complete ore genesis investigations were carried out, including fluid inclusion studies on gold mineralisation at the Lakeside and Henty deposits. Of these studies, only the report on the Lakeside deposit is available as Mount Read Geological Report 5.

Exploration geochemistry

The Huminex System involves the measurement of metals complexed by organic compounds in soil and water in the natural environment. The activity of humic substances in the degradation of minerals in the wet temperate climate of western Tasmania causes difficulties for exploration geochemistry, by producing extreme leaching of metals in the weathering environment. The concentration of these migrating humic substances and examination of their metal content provides clues to metal dispersion and eventual location of the source.

The soil application of the system has been tested at Waratah, Wart Hill and Elliott Bay, and obtained similar anomaly patterns compared to "C" horizon sampling. In addition, peak to background ratios were improved and the sampling of the "A" horizon is less expensive and destructive than "C" horizon sampling. The range of elements measurable by the system is copper, lead, zinc, silver, gold, arsenic, bismuth and molybdenum.

The method for using the organic content of waters is not yet fully developed. Initial orientation studies provided the incentive to sample creek and river water on a regional basis between Low Rocky Point and Que River. A trial batch of waters from the Cape Sorell to Elliott Bay region, analysed by solvent extraction and carbon furnace AAS, produced some anomalous values consistent with known geology and mineralisation. Since then a new analytical scheme has been devised and, in the last several years, has been tested commercially in mineral exploration in northwest Tasmania. However, the results were variable and indicated that further development of the system is required before it can be considered fully operational and effective.

Exploration databases

The object of this project was to provide industry with electronic databases relevant to mineral exploration and mining in the State. Three significant outcomes of this program component were:

- a computerised database of all mineral exploration reports produced since the beginning of the century — TASXPLOR — has been established (about 4000 entries) and is capable of being searched for a wide variety of keywords, such as author, company, tenure, dates, title, tenement number, map area and subjects;
- all reports were microfilmed, and microfiche of open file reports are available for purchase;
- DORIS, a drill hole data base, includes information on all drilling, whether company or Government, carried out in Tasmania (just under 15,000 entries). Gradual integration with the GIS system will allow display of drill holes with geology and tenement information, for example, and provide valuable detail on the focus of mineral exploration on a State-wide basis. Microfiche of open file drill logs are available for purchase.

Geophysics

AEROMAGNETICS

In 1985/86, two areas were covered by aeromagnetics (and radiometrics) as part of the MRVP, using a flight line spacing of 500 m and a nominal terrain clearance of 150 m. The areas covered were (fig. 5):

- Macquarie Harbour–Elliott Bay, and
- Sheffield–Deloraine–Devonport

These surveys were in addition to aeromagnetic surveys of similar specifications carried out in western Tasmania by the Department of Mines in 1981 (with Commonwealth Callaghan financial assistance), and in northwestern Tasmania by the Bureau of Mineral Resources, with some Tasmanian Government funding. Collectively these surveys gave an almost complete coverage of the exposed Mt Read Volcanics Belt.

Interpretation reports were produced for the new surveys. The funding also allowed reprocessing of the TDM data for the removal of terrain effects, and reports were commissioned on both previous surveys.

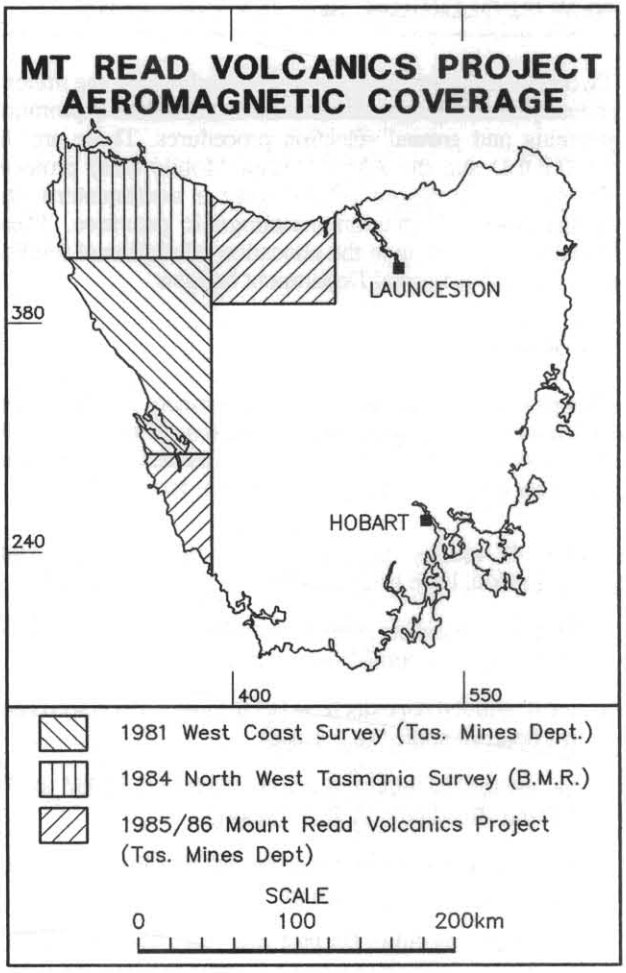

Figure 5

Regional aeromagnetic surveys produce large amounts of information which:

- contain anomalies of direct significance to mineral exploration;
- reveal major structures and lithological divisions not necessarily recognisable in geological mapping;
- allow, in conjunction with gravity surveys, the formulation of geophysical models able to predict subsurface rock distributions.

GRAVITY

Gravity coverage has been substantially increased in western Tasmania since January 1985 with the acquisition during the MRVP of more than 7800 stations by land, boat and helicopter transport (fig. 6). Where possible the new data provide a nominal station density of one station per square kilometre, and cover the Mt Read Volcanics Belt from Elliott Bay in the south to Penguin in the north. This information has permitted both:

- definition of the regional gravity field within which mineralised areas can be further surveyed in detail, and;
- interpretation of the three-dimensional extent of the belt and its tectonic setting.

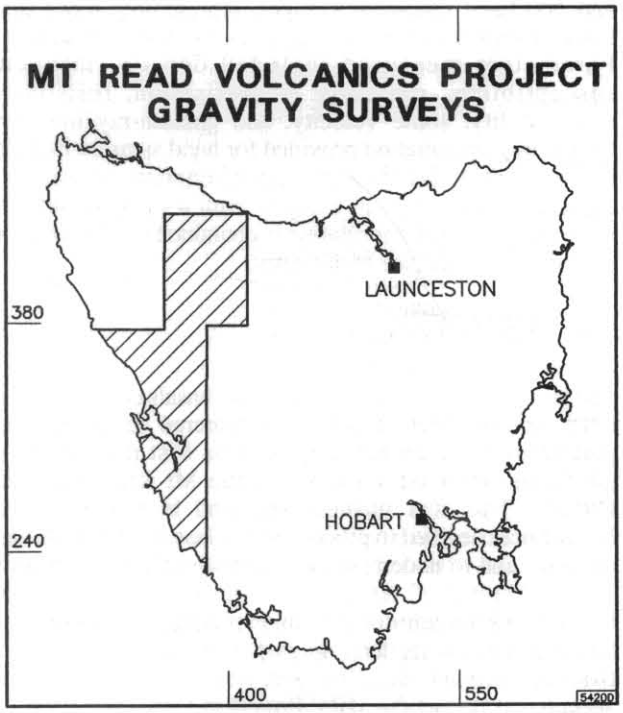

Figure 6

SIGNATURE STUDIES

A large body of geophysical information on western Tasmanian mineralisation was accumulated under this project. The four aims were to:

- determine the geophysical response of known mineralisation, alteration, host rocks, black shales and barren sulphides;
- assess the current geophysical techniques;
- evaluate geophysical detection under areas of concealment by alluvium or Tertiary basalt;
- experiment with new, lesser known or modified methods to increase the effectiveness of geophysics in Tasmania.

The study concentrated on mineral deposits in the Mt Read Volcanics but extended to all major mineral deposits in western Tasmania. It included all operating mines, a wide range of deposit classes and styles, barren mineralisation, common host rocks, and some concealed areas.

The techniques evaluated included gravity, magnetics, IP, SP, CSAMT, several varieties of EM, and seismic methods.

Some surveys were commissioned specifically for this project, but much of the information came from reviews of open file reports in the Department of Mines and from data provided willingly by mining and exploration companies active in Tasmania.

A series of reports records the details of this study.

PHYSICAL PROPERTIES

This project is designed to improve interpretation of geophysical data acquired during exploration programs. Measurements have been carried out on more than 1500 core

5 cm

and 400 hand specimen samples, representing rocks from both mineralised and unmineralised environments. Parameters measured included density, magnetic susceptibility, remanent magnetisation, resistivity, chargeability, sonic velocity, and gamma-ray intensity. Supporting information provided for hand samples includes a petrographic identification and description, as well as a complete major element analysis with a range of selected trace elements. All information is contained in a Department database for reference by industry.

Sub-basalt Drilling

The possibility of pattern drilling the basalt-covered terrain north of Que River had been considered for some years previously but a formal proposal was first put forward in December 1984 for inclusion in the Mt Read Volcanics Project. This was unsuccessful and in mid-1986, the Department decided to proceed with a less ambitious drilling program and to undertake those investigations which could be done "in-house". As most of the area covered by Tertiary basalt had been relinquished by exploration companies and had received no tenders, all available land was exempted from the Mining Act. The modified project then became accepted as part of the MRV Project in December 1986.

The main aims of the project were to record the distribution of Palaeozoic bedrock (particularly Mt Read Volcanics), the thickness of Tertiary basalt, and provide open holes for geophysical surveys and basement core for geochemical surveys.

In all, 13 holes were drilled in the exempt area, mostly to the southeast of Guildford with the best chance of intersecting Mt Read Volcanics correlates (fig. 7). The deepest hole was 750 m and the total program came to 5283 metres. The basalt thickness, including underlying Tertiary sediments, varied from 89 to 375 m, with 2055 m of basement rocks being cored. Of the 13 holes, most of which were precollared, six intersected Mt Read Volcanics correlates (MXRD 1, BTRD 1, SBDP 7, 14 and 15) or associated Cambrian rocks (SBDP 5). The remaining seven recorded Ordovician to Devonian sediments (SBDP 1, 2, 4, 6, 7 and 9), except for one sedimentary section thought to be Precambrian (DDHF 1).

The drilling pattern was nominally on a 4 km square grid positioned to gain the most effective coverage of the basalt terrain and to take account of previous drilling by exploration companies. Down-hole geophysical logging (mainly gamma-ray) was carried out in all holes, with mixed success as expansive clay in the Tertiary sediments under the basalt swelled to block the holes when the casing was withdrawn.

The most significant result of the drilling was from the deepest hole (MXRD1), which was designed to support the 1:25 000 scale geological mapping of the MRVP. The angled hole was sighted and pressed on to 750 m to record a 242 m section of the Que–Hellyer volcanics from the Que River shale to the Animal Creek Greywacke, within which a 0.3 m thick volcaniclastic siltstone is interpreted to be the time-equivalent of the Hellyer mineralisation. A pilot hole (BTRD 1) had previously been drilled to 138 m to obtain an oriented core of bedded greywackes, which confirmed a southerly-plunging synclinal structure. This has extended the area of these highly prospective host rocks north for at least another 10 km beyond the Hellyer Mine.

NEW GEOLOGICAL SURVEY PROJECTS

Two new initiatives have been proposed to give the mineral industry basic regional information to assist their exploration planning and ground selection procedures. These are the NETGOLD and the AMB (Arthur Mobile Belt) projects, designed to promote respectively a northeastern and northwestern Tasmanian metallogenic province. These initiatives depend upon the allocation of additional funding over and above normal Department budgets.

NETGOLD

This project was initiated by the Department in 1988, using existing core funding, with the objective of promoting the prospectivity of the NE region of Tasmania to potential explorers (fig. 8). In doing so, there was recognition that:

- over 42 tonnes of lode gold, or 35% of total State production, have been won from northeast Tasmania;
- mineralising events have been widespread, with over 450 gold deposits recorded throughout the area;
- not all alluvial deposits have been confidently traced back to a bedrock source (e.g. Lisle);
- the geological environment is broadly similar to the Ballarat–Bendigo region of Victoria;
- modern mineral exploration of the belt has been fragmentary and impersistent.

The work carried out in the past two years has comprised:

- a pilot aeromagnetic/radiometric survey in the Alberton–Mangana area;
- three compilation reports (including maps) on the Alberton–Mathinna–Mangana Lineament;
- all lode gold deposits entered on MIRLOCH database;
- two diamond-drill holes in the Lisle area;
- preliminary ore genesis and geochemical studies;
- completion of the 1:50 000 Alberton geological map sheet.

Future programs will depend on the level of additional funding, but techniques to be considered are:

- geological mapping of selected goldfields to demonstrate structural and stratigraphic control of gold lodes (vein orientation, timing and mode of emplacement), either at 1:25 000 scale of main gold lineaments or at a more detailed scale of one main goldfield as a pilot project;
- ore genesis studies involving isotopes, mineralogy, geochemistry and fluid inclusions to determine parentage of mineralising fluids;
- mineral deposit maps showing regional distribution of gold occurrences drawn from new geological mapping and existing compilations;
- geophysics to determine the regional structure with a combination of aeromagnetics / radiometrics and gravity. Physical properties of rock materials would also be determined, to aid geophysical interpretation and

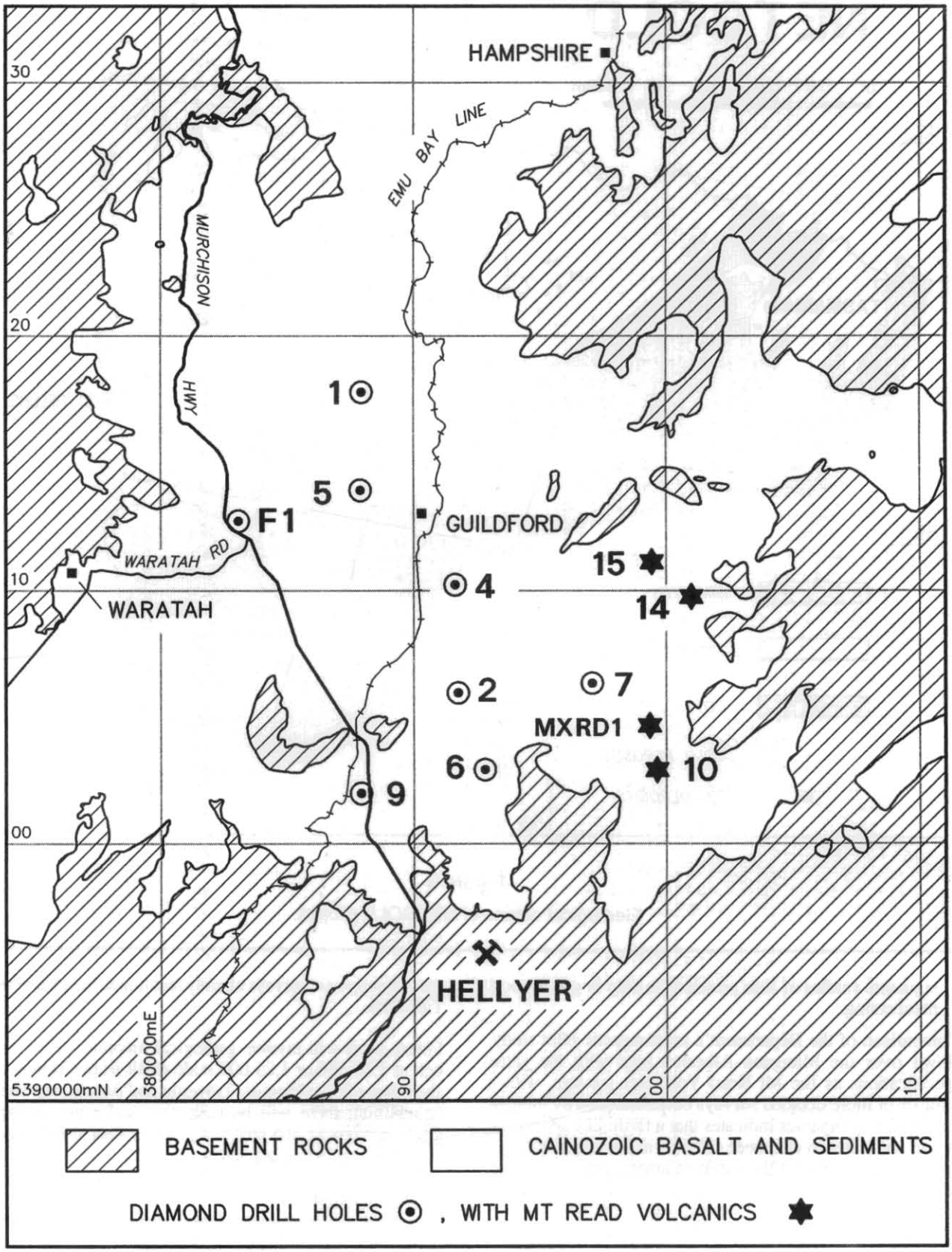

Figure 7

Sub-basalt drilling project.

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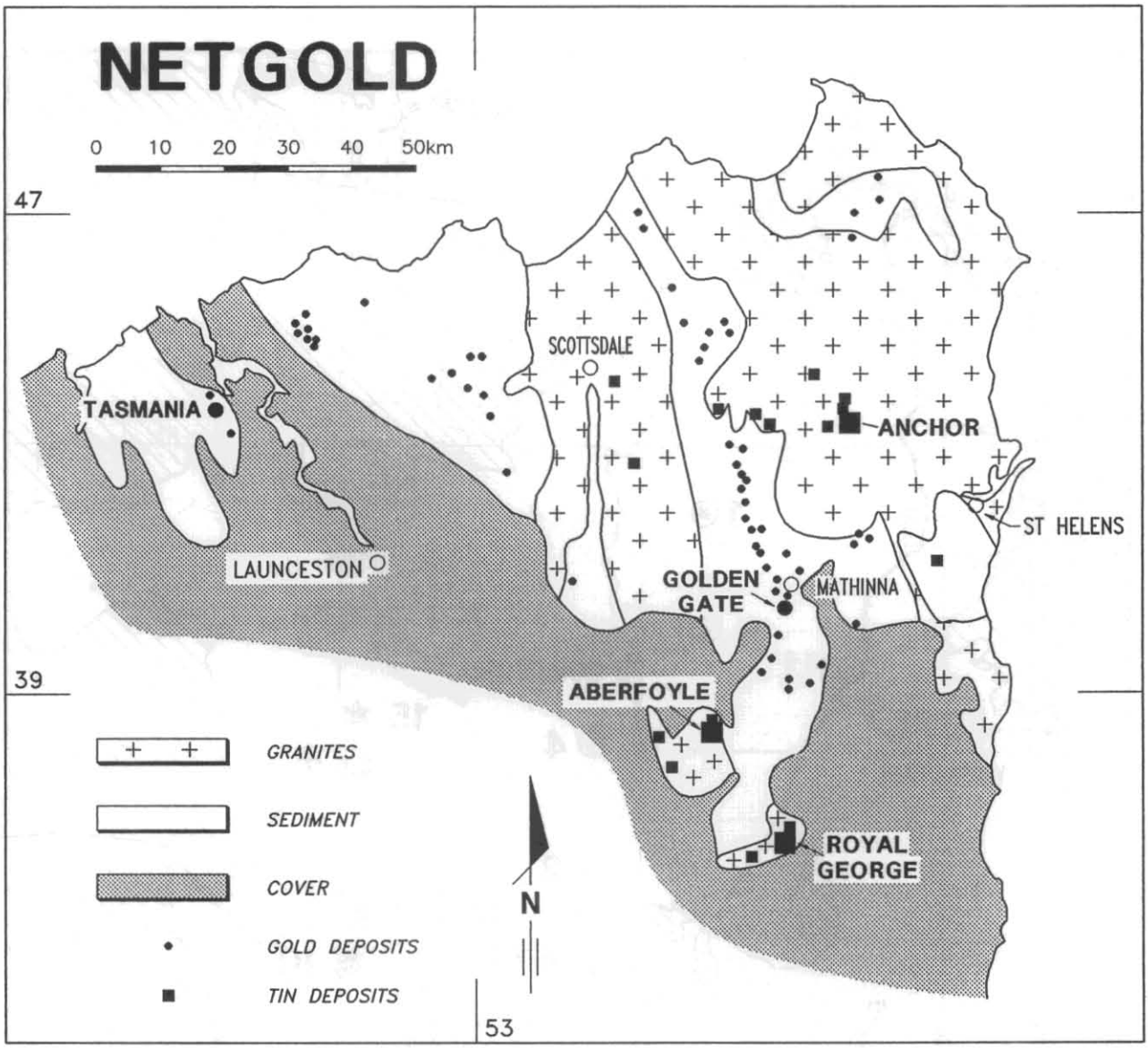

Figure 8
Geological outline of NETGOLD project.

signature studies of lode positions to help in geophysical prospecting.

Comparison of the Department's aeromagnetic pilot study, flown over the Mangana–Alberton area with the same specifications as the Mt Read Volcanics surveys, with a number of more detailed surveys commissioned by mineral exploration companies indicates that a flight line spacing of 400 m and a terrain clearance of 80 m, at the very most, will be necessary to reveal the subtle magnetic character of the Mathinna Beds.

AMB

The Arthur Mobile Belt project is designed to cover an arcuate belt of rocks containing, iron, gold, copper, magnesite, ochre, dolomite, limestone and silica deposits (fig. 9).

Previous work includes the just completed 1:50 000 scale Corinna regional geological map in the south of the belt, and the aeromagnetic surveys already mentioned in northwestern Tasmania.

Future work will involve geological mapping of the entire belt at 1:50 000 or 1:25 000 scale north from Corinna map sheet through the Magnet, Trowutta and Burnie map sheets. In addition, there will be collection and reprocessing of gravity, magnetic and physical property data along selected structural profiles of the belt.

CONCLUSION

The benefits of specially-funded projects are that they build on standard Department activities, but that the extra dedicated funding allows the completion of the surveys within a time scale and over sufficiently large areas to be of immediate benefit to mineral explorers. Also, as these mission-oriented projects employ people who are assigned exclusively to them and are therefore less likely to be diverted by other priorities or events, they are extremely cost effective in producing the required resource information.

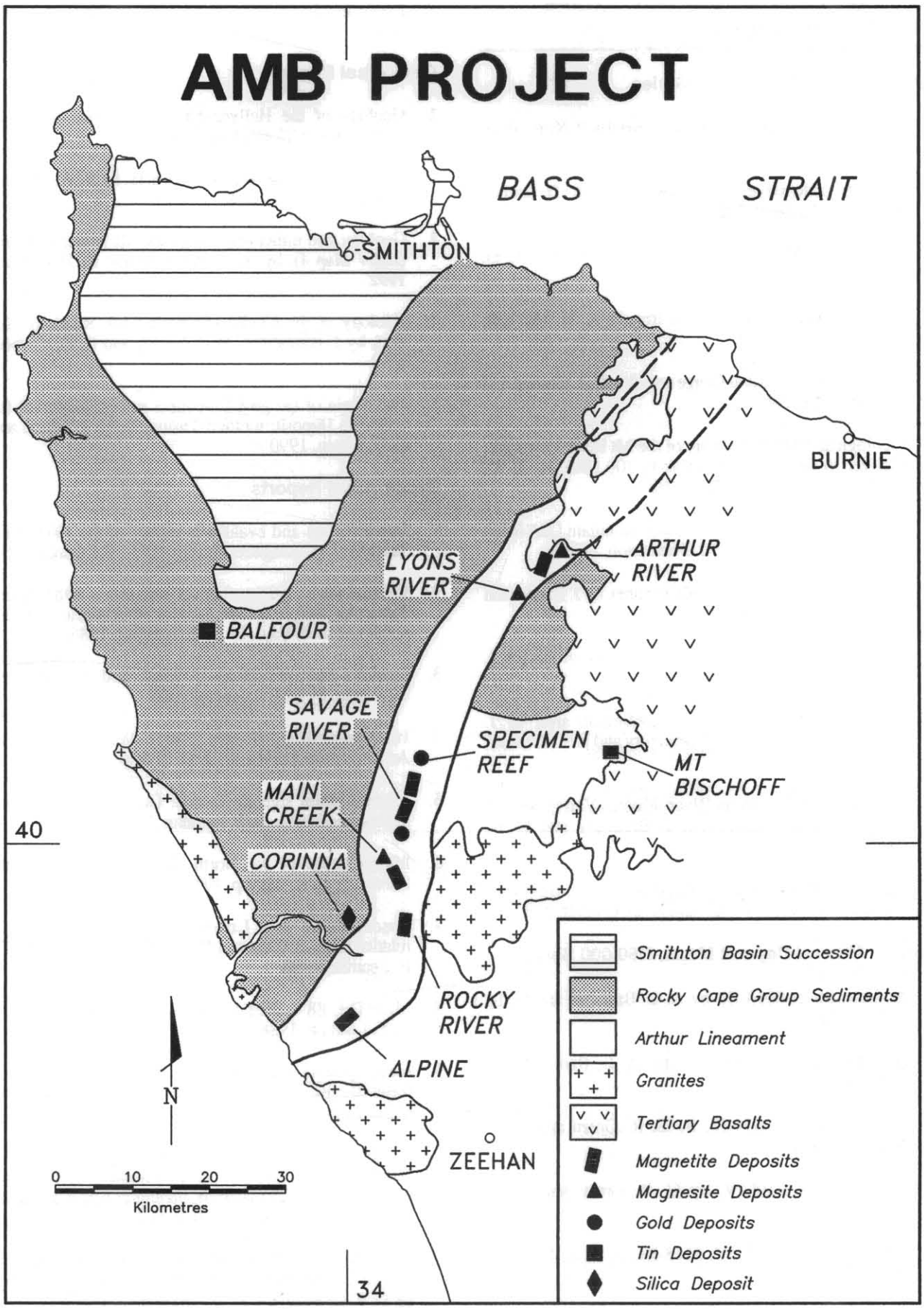

Figure 9

Geological outline of AMB project.

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INTERIM LIST OF MT READ VOLCANICS PROJECT PRODUCTS

Geological Maps, 1:25 000 Series

1. Geology of Mt Charter–Hellyer area, by P. Komyshan, 1986
2. Geology of Rosebery–Mt Block area, by K. D. Corbett and A. W. McNeill, 1986
3. Geology of Henty River–Mt Read area, by K. D. Corbett, 1986
4. Geology of the Mt Murchison area, by A. W. McNeill, 1987
5. Geology of the Tyndall Range area, by K. D. Corbett and J. C. Jackson, 1987
6. Geological compilation map of the Mt Read Volcanics. Hellyer to South Darwin Peak (1:100 000), by K. D. Corbett and A. W. McNeill, 1988
7. Geology of the Back Peak–Cradle Mountain Link Road area, by M. J. Vicary and J. Pemberton, 1988
8. Geology of the Mt Cattley–Mt Tor area, by J. Pemberton and M. J. Vicary, 1988
9. Geology of the Winterbrook–Moina area, by J. Pemberton and M. J. Vicary, 1989
10. Geology of the Elliott Bay–Mt Osmund area, by J. Pemberton, M. J. Vicary, J. Bradbury and K. D. Corbett, 1991
11. Geology of the Wanderer River–Moores Valley area, by M.J. Vicary, J. Pemberton, J. Bradbury and K. D. Corbett, 1992
12. Geology of the D'Aguilar Range area, by J. Bradbury, J. Pemberton, M. J. Vicary and K. D. Corbett, 1992

Metallic Mineral Deposit Maps, 1:50 000 Series

1. Andrew, Sheet 8013-III, by A. L. Bamford and G. R. Green, 1986
2. Queenstown, Sheet 8013-IV, by A. L. Bamford and G. R. Green, 1986
3. Rosebery, Sheet 8014-III, by G. R. Green and A. L. Bamford, 1986
4. Tullah, Sheet 8014-IV, by G. R. Green and A. L. Bamford, 1986
5. Cethana, Sheets 8114-IV, 8115-III, by A. L. Bamford and G. R. Green, 1988
6. Ulverstone, Sheets 8115-III, IV, by A. L. Bamford and G. R. Green, 1988
7. Elliott Bay, Sheets 7912-II, 8012-III, by J. Taheri and G. R. Green, 1988
8. Loongana, Sheets 8015-II, III, J. Taheri and G. R. Green, 1989

Geological Reports

1. Geology of the Hellyer–Mt Charter area, by K. D. Corbett and P. Komyshan, 1989
2. Geology of the Tullah–Mt Block area, by A. W. McNeill and K. D. Corbett, 1989
3. Geology and mineralisation of the Mt Murchison area (MRV Map 4), by A. W. McNeill and K. D. Corbett, 1992
4. Geology of the Cradle Mountain Link Road–Mt Tor area, by J. Pemberton, M. J. Vicary and K. D. Corbett, 1991
5. The origin of the gold-tin-copper mineralisation at the Lakeside Deposit, western Tasmania, by J. Taheri and G. R. Green, 1990

Geophysical Reports

1. Interpretation and evaluation report on the 1981 West Tasmania Aeromagnetic Survey, by D. E. Leaman, 1986
2. Preliminary interpretation report — 1985 West Tasmania Aeromagnetic Survey (Macquarie Harbour south to Elliott Bay), by D. E. Leaman, 1986
3. Gravity interpretation — West and North-West Tasmania, by D. E. Leaman, 1986
4. Interpretation of the North-West Tasmania Aeromagnetic Survey, by J. R. Bishop, 1987
5. Mineralisation signature study: Geophysics — gravity and magnetics, by D. E. Leaman, 1987
6. Interpretation of the North Tasmania Aeromagnetic Survey, by J. R. Bishop, 1987
7. Precambrian and Lower Palaeozoic structural relationships of West and North-West Tasmania, by D. E. Leaman, 1988
8. MANTLE 88 — Regional gravity field, Tasmania, by D. E. Leaman, 1988
9. Geophysical signatures of western Tasmanian mineralisation. Volume 1. Signatures of mineral deposits, by J. R. Bishop and R. J. G. Lewis, 1988
10. Geophysical signatures of western Tasmanian mineralisation. Volume 2. Electrical properties of western Tasmanian materials, including Appendix: Data listing, by J. R. Bishop and R. J. G. Lewis, 1988
11. The granites of West and North-West Tasmania — a geophysical interpretation. (*Bull. geol. Surv. Tasm.* 66, by D. E. Leaman and R. G. Richardson, 1989

Sub-Basalt Drilling

1. Completion report: Hole 1, by P. W. Baillie (*Unpubl. Rep. Dep. Mines Tasm.* 1987/38)

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2. Completion report: Hole 2, by P. W. Baillie (*Unpubl. Rep. Dep. Mines Tasm.* 1987/40)

3. Completion report: Hole 4, by P. W. Baillie (*Unpubl. Rep. Dep. Mines Tasm.* 1987/61)

4. Completion report: Hole 6, by P. W. Baillie and G. R. Green (*Unpubl. Rep. Dep. Mines Tasm.* 1988/06)

5. Completion report: Hole 7, by P. W. Baillie and G. R. Green (*Unpubl. Rep. Dep. Mines Tasm.* 1990/05)

6. Completion report: Hole 9. by P. W. Baillie and G. R Green (*Unpubl. Rep. Dep. Mines Tasm.* 1988/07)

7. Progress report on Sub-basalt Drilling Project, by P. W. Baillie, G. R. Green and P. L. F. Collins, (*Unpubl. Rep. Dep. Mines Tasm.* 1987/44)

Symposium

The Mt Read Volcanics and associated ore deposits. Geological Society of Australia, Tasmanian Division, Hobart. Edited by R. R. Large, 1986.