Tasmanian Geological Survey
Record 1999/01

Porphyry and sedimentary-hosted gold deposits near Cygnet

New styles of gold mineralisation in Tasmania

By Jafar Taheri and Ralph Bottrill

Tasmania
MINERAL RESOURCES TASMANIA

Tasmania

Tasmanian Geological Survey

Record 1999/01

Porphyry and sedimentary-hosted gold deposits near Cygnet:

New styles of gold mineralisation in Tasmania

Jafar Taheri and Ralph Bottrill

CONTENTS

APPENDICES

FIGURES

TABLES

Abstract

Gold and base metal mineralisation occurs at a number of sites in an arcuate belt running from Oyster Cove through Cygnet to Wheatleys Bay in southeast Tasmania. The mineralisation is spatially and temporally related to the intrusion of the Cretaceous alkaline porphyries and occurs both within the porphyries and the intruded Permian sedimentary rocks.

Both silica-saturated and silica-unsaturated (feldspathoidal) felsic intrusive rocks occur within the complex. Silica-saturated porphyries (quartz monzodiorite to alkali feldspar syenite) are the major hosts for gold mineralisation.

Tectonically, the Cygnet porphyry complex falls amongst the alkaline complexes which occur 'within-plate' or in rift systems (Müller and Groves, 1997), provinces which are poorly studied for gold mineralisation compared with arc-related complexes. The alkaline porphyries appear to have been formed during the initial stages of opening of the Antarctic–Australian rift, some 97 Ma. It is suggested that the Cygnet mineralisation is a member of an unusual class of gold deposits associated with alkaline rocks intruded in a rift setting. Mount Dromedary, in southeast NSW, is possibly an analogue and is also of Cretaceous age.

The potassic igneous rocks and the overlying sediments have been affected by a variety of hydrothermal alteration types including potassic, silicic, calc-silicate, phyllic, propylitic and argillic. The known alteration and associated mineralisation occurs in several separate areas and do not exhibit any distinct mineral zoning.

There are two major types of mineralisation:

(a) porphyry-hosted gold mineralisation where the gold occurs in:

- hydrothermally-altered porphyries as disseminations;
- siliceous and pyritic breccias;
- quartz veins; and
- pyritic veinlets.

(b) sedimentary-hosted gold mineralisation, with the Truro Tillite, Woody Island Siltstone and fossiliferous mudstone (Bundella Formation) being the main host rocks. Mineralisation occurs as:

- disseminations (replacing calcareous fossils and pebbles);
- in small pyritic veinlets; and
- in quartz veins;

The sedimentary-hosted gold mineralisation is related to the intrusion of the porphyries, but appears to have been formed at a late stage and at lower temperatures.

The fluid inclusions in quartz from hydrothermal breccias and quartz veins exhibit a wide range of homogenisation temperatures and salinities. Highly saline fluid inclusions appear to have been formed directly from exsolved magmatic fluids rather than by phase separation. Spasmodic brecciation, with repeated fracturing and resealing of the rocks (i.e. lithostatic-hydrostatic pressure fluctuations), appear to be the main cause for the fluid inclusions showing a variety of salinities and homogenisation temperatures.

The early-formed mineralising fluids appear to be dominantly of magmatic origin and are characterised by high oxidisation states, temperatures and salinities of 300 to >500°C and up to 53 wt.% NaCl equivalent. The magmatic fluids were responsible for the formation of disseminated gold in porphyries, quartz veins and the hydrothermal breccias. Magmatic water and sulphur sources for the early stages of hydrothermal alteration are also indicated by oxygen and sulphur isotopes.

The magmatic-dominated mineralising fluid was diluted and cooled as it mixed with convecting meteoric water. This stage of hydrothermal activity was responsible for the formation of gold-bearing pyritic veinlets, disseminated mineralisation in the overlying sediments and the formation of pervasive zinc-rich clay alteration (smectite) with associated gold, lead and arsenic.

The latest stage of alteration is of supergene origin and includes the formation of gold-bearing limonite and jarosite (after pyrite and pyrrhotite) in veinlets, clasts and fossils, and possibly the redistribution of gold in both the sedimentary rocks and porphyries.

Sulphides, with the exception of pyrite, are not common (but include chalcopyrite, galena, sphalerite, arsenopyrite and covellite), indicating that the mineralising system in Cygnet was low in sulphur and/or metals.

Hydrothermally altered rocks are variably anomalous in As, Pb, Cu, Au, Zn and Mo, with each mineralisation/host-rock type association exhibiting different geochemical signatures.

The occurrence of similar styles of mineralisation in other areas, such as Granton and Snug, together with the multiple, relatively shallow intrusive (<5 km) nature of the porphyries, clearly indicates that there is potential for the discovery of further and possibly larger porphyry-Au type deposits in southeast Tasmania. The Cretaceous Cape Portland alkaline complex in northeastern Tasmania also has untested mineral potential.

Introduction

Although the style of gold mineralisation, host rock types and age of mineralisation in the Cygnet area are distinctly different to other known mineralisation types in Tasmania, the mineralisation has attracted little attention in recent decades. This is despite some detailed geological and petrological investigations of the porphyries themselves (e.g. Edwards, 1947; Ford, 1983; Farmer, 1985). As a result, the nature and genesis of the mineralisation have not been well understood, and this has probably acted as the main disincentive for exploration companies to actively explore the area for gold.

The purpose of this preliminary study is to investigate the nature and origin of gold mineralisation through field work (particularly around larger workings in the Cygnet area), drill core re-logging, and petrological, geochemical, fluid inclusion and stable isotope studies.

Previous exploration and mining

The history of gold exploration and mining in the Cygnet–Kettering area was documented by Bottrill (1995*a*), from which a brief summary is given below. The early gold prospects are listed in Appendix 1, with the more important sites visited being described in Appendix 2.

Early prospecting and mining

Gold was discovered near Cygnet in about 1852 (Stephens, 1869) and was mined from about 1877; the district had produced about 3000 oz (100 kg) of gold by 1902 (Twelvetrees, 1902; 1907). Production was mostly from Quaternary placers, particularly at Lymington (Forsters Rivulet) and Wheatleys Bay (Riseleys Creek). Other alluvial areas included Nicholls Rivulet, Little Oyster Cove Creek, Petcheys Bay and Agnes Rivulet (Thureau, 1881; Twelvetrees, 1907; Figures 1, 2).

In 1892 some 'lode gold' (hard-rock) mining occurred on some contact zones between some of the Cretaceous intrusive rocks and the hornfelsed Parmeener Supergroup sequences. Gold values up to 100 g/t in sediments and 6 g/t in the intrusive rocks were reported, with significant silver (to about 180 g/t), and minor pyromorphite and base metal sulphides (Smith, 1899; Twelvetrees, 1902; 1907; Henderson, 1936). Quartz veins were small and uncommon. The major workings were the Mt Mary gold mine and the Livingstone mine, with other significant workings on Kings Hill, Black Jack Ridge, Little Oyster Cove and other areas (Smith, 1899, Twelvetrees, 1902; 1907; Henderson, 1936). The total value of this lode gold production is not known, but was probably small.

Many old workings, especially those in the Oyster Cove area, are now hard to find, being obscured by scrub, agriculture or development.

Recent mineral exploration

BHP conducted a small orientation program for porphyry-hosted gold on the Cygnet peninsula, mostly over the Mt Mary and Livingstone mines. The surveys included soil and rock-chip sampling, analysis of samples collected by Ford (1983) and some petrography. There appeared to be an association of gold with silver, arsenic, copper, lead, zinc and possibly barium, but the results are poorly recorded (Bottrill, 1995*b*).

The Golden Apple Mining Syndicate of Cygnet held an Exploration Licence and two mining leases for gold over the Cygnet peninsula from 1980 to 1982, conducting minor mapping, gridding and geophysical surveys at Tobys Hill, Mt Mary and Black Jack Ridge (Wall, 1980; 1981). Some rock-chip sampling was undertaken; one sample assayed 25g/t Au. One diamond hole was drilled at Mt Mary, and was logged and assayed by both the syndicate and Cyprus Minerals, but the results are poorly recorded, despite reporting 11 m @ 0.23 g/t Au (Jones, 1985; P. Jones, *in* Bottrill, 1995*c*).

More recent gold exploration by Cyprus Minerals (1985–1988) focussed on the potential for 'Carlin style' and porphyry-hosted gold deposits, (Jones, 1987*a*; 1988). Limited diamond and percussion drilling and regional stream-sediment, soil and rock-chip geochemistry in the Cygnet–Kettering area failed to delineate a viable gold resource but suggested that gold and base metals are erratically enriched in shear zones. The best intersection was 17 m at 1 g/t, but grades of up to 24 g/t were noted (Jones, 1987*a*, 1988). The exploration program was terminated before completion, due to the company refocusing its activities outside of Tasmania.

The economic potential of the rare-earth elements in some of the porphyries was assessed by Cyprus Minerals using random sampling of some percussion and diamond drill samples in the Mt Mary area. The results were anomalous; samples assayed in excess of 0.07 wt.% total REE and Y, but were not considered sufficiently encouraging to warrant additional work (Jones, 1988). In comparison, the Brockman REE deposit, near Halls Creek in Western Australia, contains an estimated four million tonnes of reserves with 0.12 wt.% Y_2O_3 and 0.07 wt.% heavy rare earths (Highley *et al.*, 1988).

Geological setting

The geology of the Cygnet area (fig. 3) is dominated by essentially flat-lying Permo-Triassic sedimentary rocks of the Late Carboniferous to Triassic Parmeener Supergroup (Leaman and Naqvi, 1967; Farmer, 1981, Farmer, 1985; Clarke and Forsyth, 1989). The basement probably comprises Precambrian metasedimentary rocks, as found in the Woodbridge DDH1 (Farmer and Clarke, 1985) 30 km to the east, but Cambrian and Ordovician rocks are also exposed in areas further to

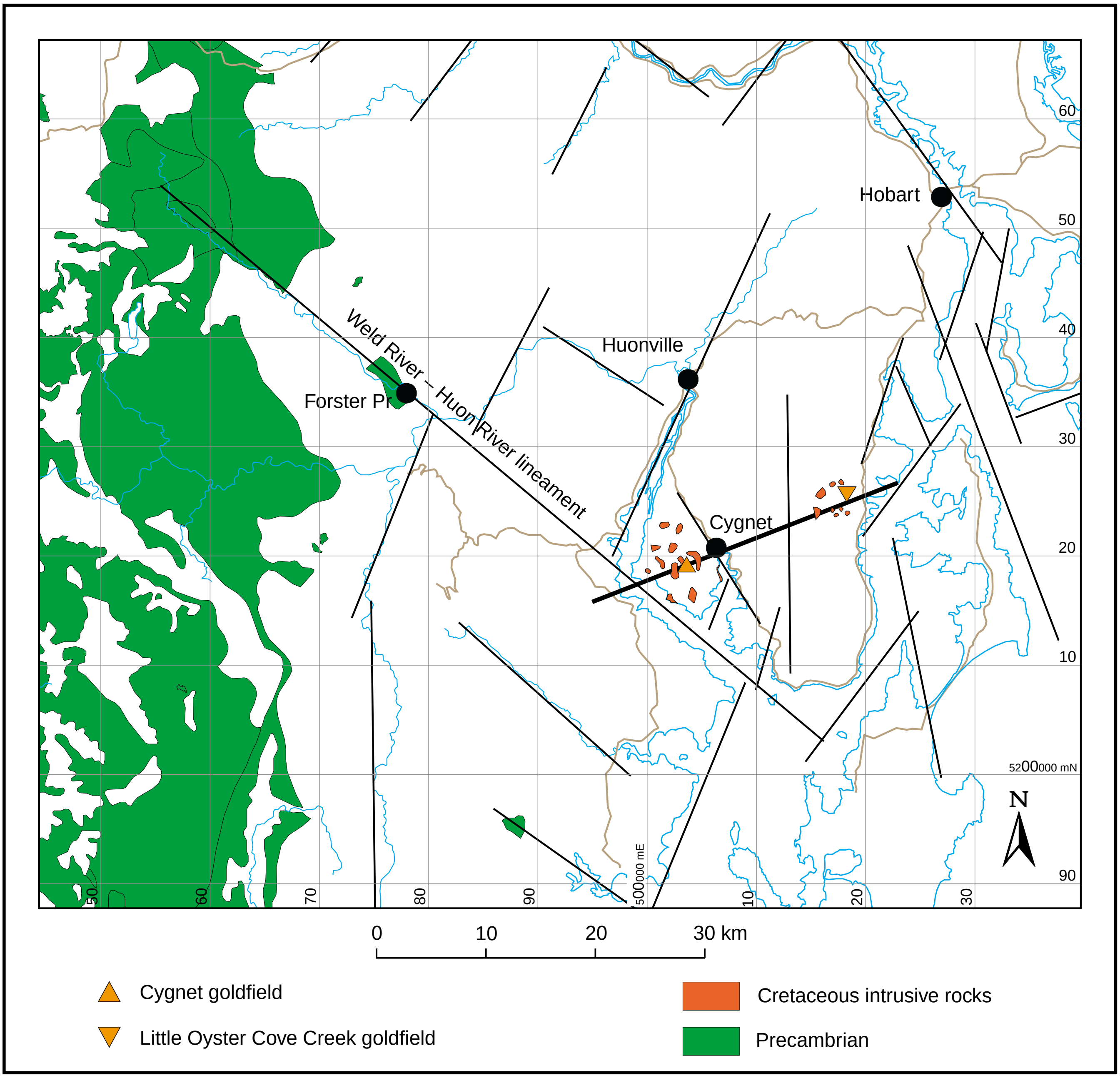


Figure 1

Location map, showing Cygnet and Little Oyster Cove Creek goldfields, and possible lineaments defining controlling structures.

the south and west. The basement rocks are mostly moderately to highly deformed by the Late Devonian Tabberabberan Orogeny. The Lower Parmeener Supergroup is a sequence of variably fossiliferous fluvioglacial/marine, shelf-deposited mudstone, siltstone and minor silty limestone.

The Late Carboniferous Truro Tillite, which forms the basal unit of the Parmeener Supergroup in southeastern Tasmania, is prominent in the area and is mostly represented by a glaciogene diamictite (the units are described further below), more than 450 m thick (Farmer, 1985). The Woody Island Siltstone transitionally overlies the Truro Tillite, and consists of ~120–140 m of thick-bedded siltstone and sandstone, of Late Carboniferous/Early Permian age. The Bundella Mudstone conformably overlies the Woody Island Siltstone, and is mostly represented by richly fossiliferous marine siltstone and mudstone, over 100 m thick in places (Farmer, 1985). Overlying this are other Permian units, including the Deep Bay, Minnie Point and Abels Bay Formations, all locally intruded by Cretaceous porphyries, but with no known mineralisation. Triassic sedimentary rocks overly the Permian sequences and comprise mostly non-marine sandstone and coal measures. They are apparently not gold-mineralised nor intruded by the Cretaceous porphyries.

These sedimentary rocks are intruded by tholeiitic Jurassic dolerite, which occurs as very extensive dykes and sills over much of Tasmania, and can be correlated with similar rocks in Antarctica (Hergt *et al.*, 1989). Dolerite is not common around the gold-mineralised

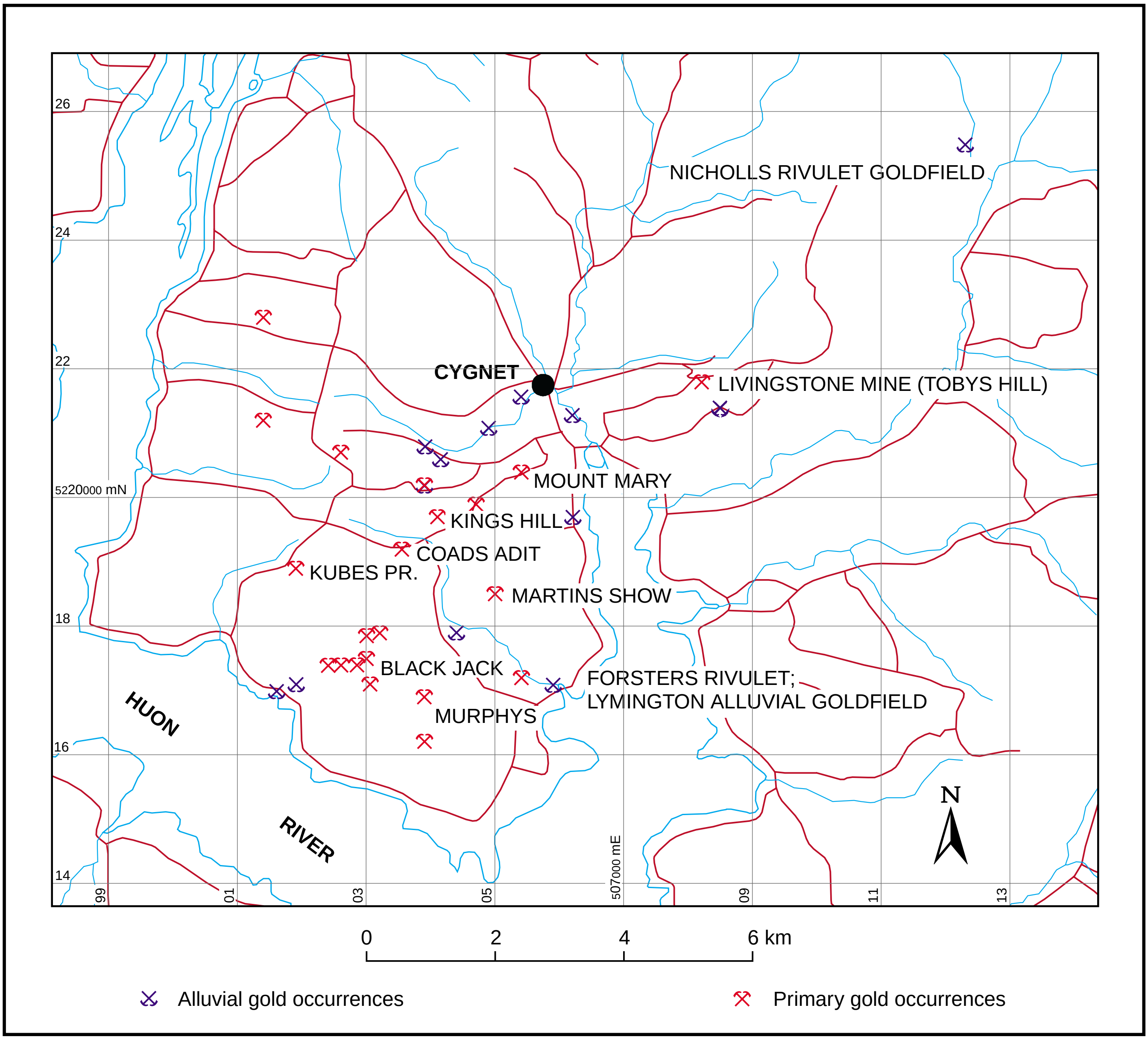


Figure 2

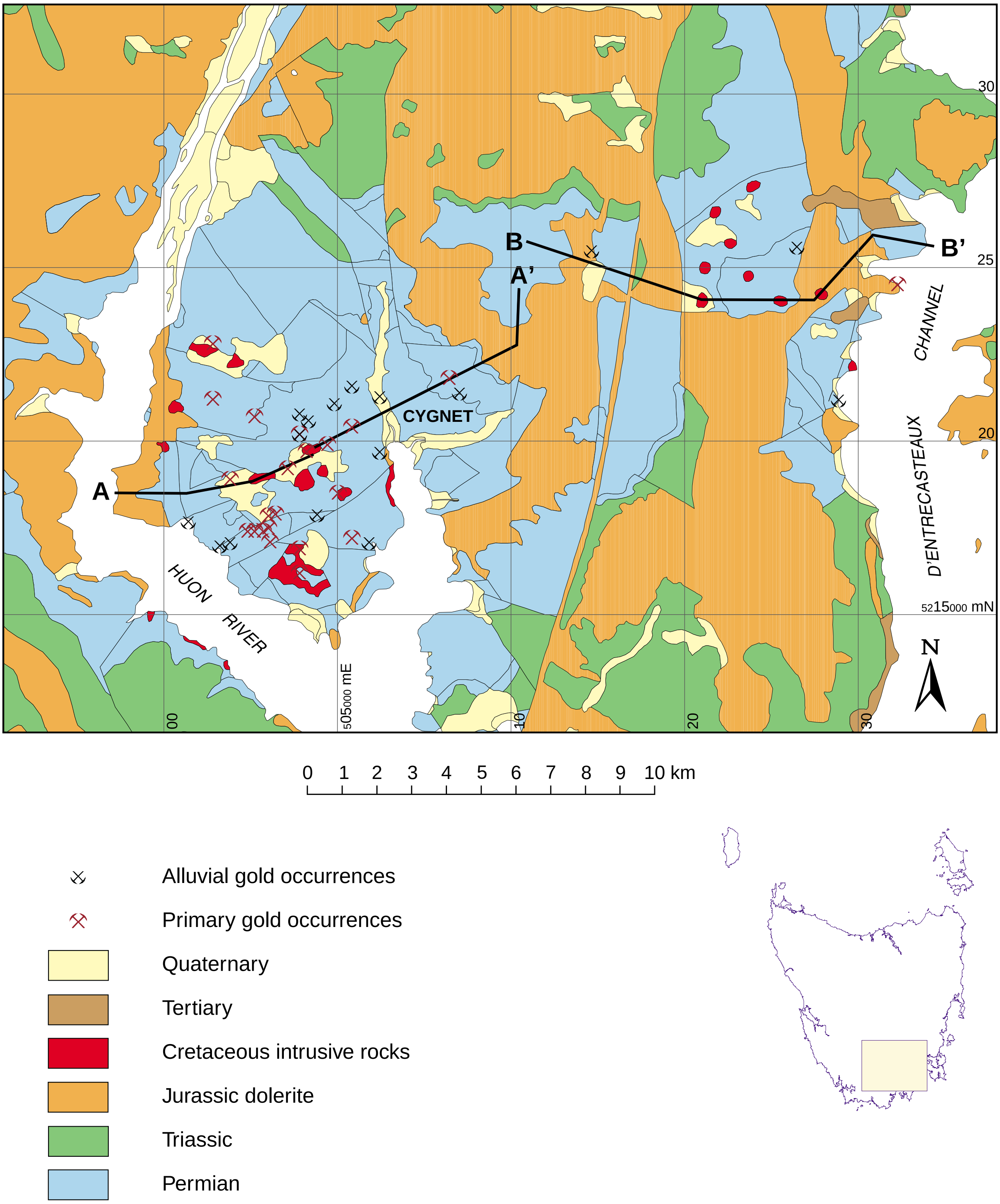
Locations of alluvial and primary gold deposits, Cygnet area.

areas at Cygnet but appears to surround the main area of alkaline intrusive rocks. To the east of Cygnet there is an extensive sill about 100 m thick just below the Upper Permian–Triassic boundary, and a narrow dyke following a major NNE-trending fault. This sill thickens to the north (to ~200 m near Tobys Hill and ~700 m near Grey Mountain) and east (~300 m near Woodbridge Hill). South of the Huon River another thick sill (>150 m thick) occurs, this sill thickening to ~400 m further south. Yet another sill (~100 m thick) is exposed near Wattle Grove in the west of the area, but this appears to have a sharp vertical (fault-related?) eastern cut-off. The sill is more than 400 m thick west of the river. North-trending dykes about 200 to 500 m wide occur near Lymington and Regatta Point (fig. 3). The geological relationships are indicated in the schematic cross sections (fig. 4).

The nearest dolerite sills to Cygnet and Kettering thus appear to be little more than 100 m thick, but further away (i.e. about 5–10 km from the centres of doming and Cretaceous alkaline igneous activity at Kings Hill and Little Oyster Cove Creek), they reach thicknesses of about 300 to 700 metres. In the Kettering area, the relationships between dolerite and Cretaceous porphyries are more complex, with many alkaline porphyries intruding a dolerite body (probably a dyke ~600 m wide) and a sill (~100 m thick).

The dolerite intrusions in the Cygnet area were followed by a large number of small to medium sized (<1 km) Cretaceous alkaline to intermediate intrusive rocks (Ford, 1983; 1989).

As discussed above, the alkaline intrusive rocks have been emplaced in areas of relatively little Jurassic dolerite. These intrusive rocks occur in gently domed structures centred about Mt Mary (near Cygnet) and Little Oyster Cove Creek (near Kettering). The alkaline rocks are complex and variable in composition but



Geological Map of the Cygnet Area

(after Farmer, 1985)

MINERAL RESOURCES TASMANIA

Tasmania

Figure 3

consist of both silica saturated ('syenite porphyry', commonly monzonitic) and silica unsaturated ('sanidine porphyry', commonly feldspathoidal) felsic rocks, described in more detail below. They occur in numerous small dykes, sills and laccolith bodies, with one probable laccolith cropping out over an area of one square kilometre or more in the Kings Hill–Mt Mary area. A probable sill in the Mt Windsor area is over 60 m thick and crops out over nearly two square kilometres. Hornfelsing is common near the contacts, and gold mineralisation occurs within and adjacent to some intrusive rocks.

Tertiary and later sedimentary rocks occur in small patches in the area but are not mineralised, except for some alluvial gold, and are not described here.

Geochemistry and geophysics

The area has been reasonably well covered by regional stream-sediment surveys, regional and detailed rock-chip surveys and some localised soil surveys (Hourdin, 1971; Croft, 1970; Wall, 1980, 1981; Jones, 1985, 1986, 1987*a*, 1987*b*, 1988). Gold content appears to be low in most of the stream sediments, probably due to clearing and cultivation, but still delineates anomalies.

Geophysical surveys (regional gravity and ground magnetics) were conducted by Leaman and Naqvi (1967) and Leaman (1975). Other limited geophysical surveys were reported by Wall (1980, 1981). A very prominent magnetic anomaly in the Port Cygnet inlet remains unexplained (Leaman and Naqvi, 1967). The magnetic anomaly in this area is near the base of the Parmeener sequence and it may be conjectured that it reflects magnetic units in the pre-Carboniferous stratigraphy. These magnetic rocks could include magnetite-rich Cambrian mafic-ultramafic complexes or Proterozoic or Ordovician carbonate sequences containing magnetite or pyrrhotite due to alteration by the Cretaceous intrusive rocks.

Tectonic setting and possible structural controls

Most alkaline intrusive complexes are non-orogenic, but may be rift or arc-related, and are usually related to crustal arches and intersections of major faults in tectonically quiet areas. They are commonly genetically associated with other igneous rocks, particularly ultrabasic and basic rocks and alkali granites or rhyolites, and may be preceded by dolerite and alkaline basalt. The typical igneous rock association in orogenic belts, where they mostly occur in rigid blocks, is gabbro-monzonite-syenite (Sørensen, 1974).

Practically all known Au-mineralised alkaline porphyries are in arc-related settings, almost all in the Circum-Pacific Belt (Müller and Groves, 1997). The rock associations in this belt are mostly extrusive and shoshonitic, and include latites, trachybasalts, trachytes and andesites, with intrusive monzonites, diorites and quartz monzonites. These rocks are generally more basic than the Cygnet intrusive rocks.

A similar gold-mineralised Cretaceous alkaline intrusive complex is found at Mt Dromedary, on the south coast of New South Wales (Herzberger, 1974; Brown, 1930). Purvis (*in* Pontifex and Associates, 1985) suggested that there may be an island arc connection between the Cretaceous igneous rocks of Cygnet, Mt Dromedary (NSW), and southeastern Queensland, but there is no evidence supporting this hypothesis. Some other Cretaceous alkaline igneous rocks (lamprophyres, and andesitic and basaltic lavas and intrusive rocks) occurring at Cape Portland, in northeastern Tasmania, are dated at ~100 Ma (Ford, 1989). These rocks are poorly studied and have not been explored for gold or other mineralisation.

The Monchique alkaline complex in Portugal, although apparently not gold mineralised, contains mostly nepheline syenite and is in a similar geological and tectonic setting to Cygnet. It is thought to be related to the opening of the Atlantic Ocean (Rock, 1978). The Cygnet complex (dated at about 95–109 Ma; Evernden and Richards, 1962; McDougall and Leggo, 1965) is probably related to the initiation of the Antarctic–Australian rift, at about 97 Ma (Veevers and Eittreim, 1988). The Cretaceous alkaline intrusive complex at Mt Dromedary, on the south coast of NSW (Brown, 1930; Herzberger, 1974) is probably similarly related to the rifting associated with the formation of the Tasman Sea at about 65–70 Ma (Falvey and Mutter, 1981).

On a more local scale the complex may be related to major faults, expressed as topographic lineaments, and in particular to the Lake Gordon–Weld River–Huon Island NW-SE lineament. Other possible lineaments in the area are shown on Figure 1. The area about the intrusive rocks is characterised by doming, as is common about such complexes (Bailey, 1974). The Kettering area lies in a small horst block controlled by major north-trending faults. As noted above, the alkaline intrusive rocks appear to have intruded principally into areas with relatively little Jurassic dolerite, and dolerite sills may have added rigidity to the surrounding rocks, which precluded ready passage of later intrusive rocks (see model in Figure 4).

The depth of emplacement of the intrusive rocks is uncertain but was estimated, from considerations of probable stratigraphic thicknesses, as about 1000–1500 m (J. Everard, pers. comm.). A similar depth for intrusion of the Jurassic dolerite was estimated by Sutherland (1977), from zeolite-prehnite assemblages. This, however, is in conflict with the current fluid inclusion studies, which indicate burial of about five kilometres (see fluid inclusion section). The mineral assemblages in the sedimentary rocks (epidote-albite-K feldspar-muscovite-chlorite-actinolite-zeolite-smectite-prehnite-tremolite; see rock type section) and composition of amphiboles in contact aureoles also suggest about 3–6 km burial and temperatures up to about 700°C, but more work is needed to refine these estimates.

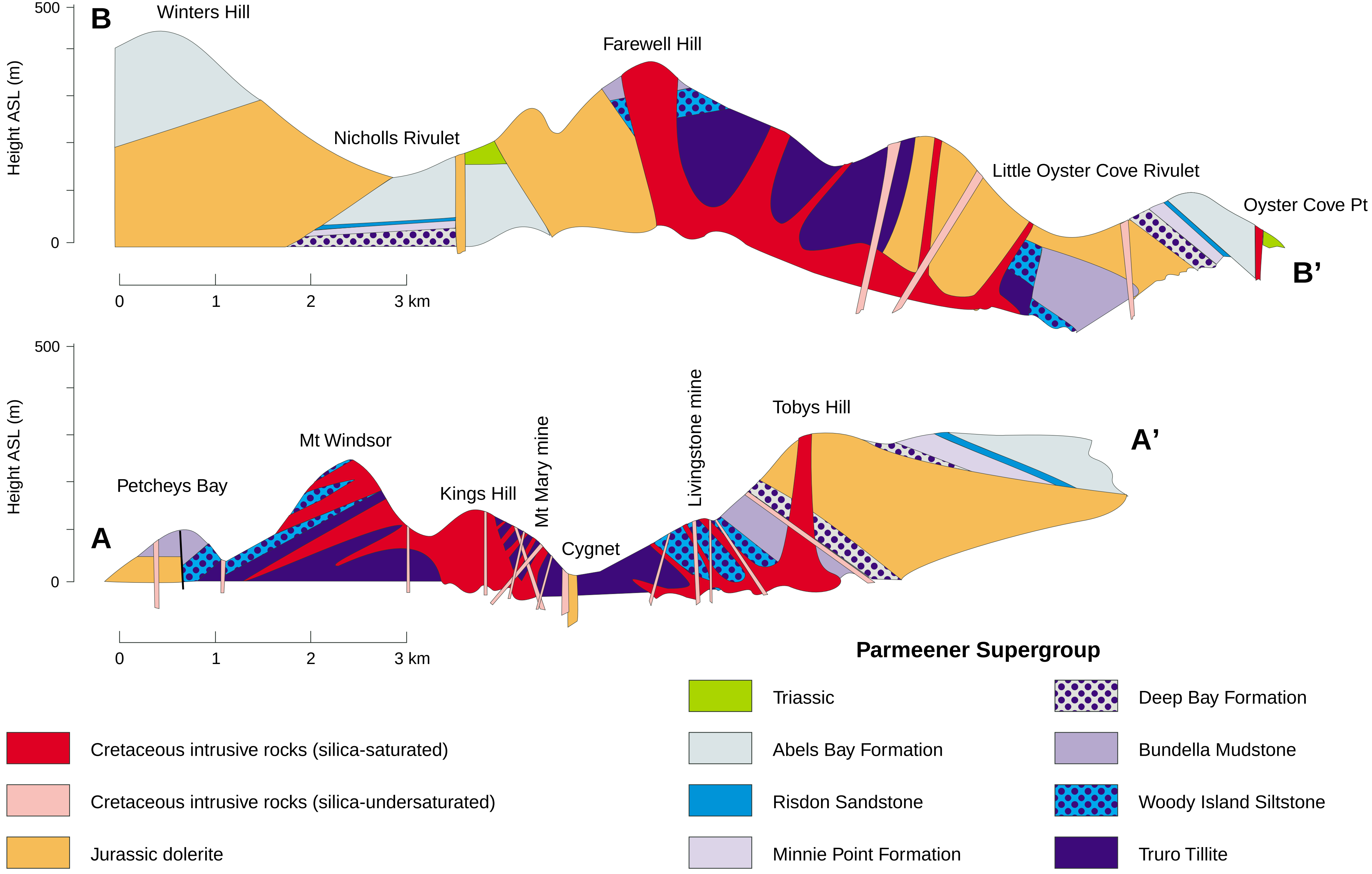


Figure 4. *Schematic, highly interpretative, geological cross sections: (a) Cygnet; (b) Kettering. Section lines are shown on Figure 3.*

Rock types

The rock types in the Cygnet area have been studied by Twelvetrees and Petterd (1899), Edwards (1947), Ford (1983), Farmer (1985), Jones (1986, 1987*a*) and the authors in the present study. A summary of the host rocks to mineralisation is presented below.

The rocks collected in this study are listed in Appendix 3, while the petrology and supporting XRD and microprobe analyses are summarised in Appendices 4–6. Drill logs are summarised in Appendix 11. The rocks hosting gold mineralisation, plus the Jurassic dolerites, are briefly described below.

Lower Parmeener sedimentary rocks

The main sedimentary hosts for gold at Cygnet are the Upper Carboniferous to Middle Permian formations; the Truro Tillite (the basal unit in the area), the overlying Woody Island Formation, and the Bundella Mudstone, which overlies both.

The Truro Tillite consists mostly of a glaciogene diamictite with some conglomerate, sandstone, mudstone and rhythmite sequences. It is generally poorly sorted and matrix supported, with angular to well-rounded clasts to 300 mm consisting of various Precambrian and lower Palaeozoic rock types (including carbonate rocks; Farmer, 1985). The tillite is commonly hornfelsed, as indicated by a flinty nature and reaction haloes about some clasts. In thin section the matrix is poorly sorted, fine-grained rock flour, containing quartz, feldspar, sericite and chlorite where unmetamorphosed. Hornfelsed equivalents are mostly feldspathic (altered?) and cherty, and commonly hydrothermally altered. Alteration minerals include K-feldspar, quartz, chalcedony, opal, smectite, amphibole, sericite, epidote and hematite. Scapolite alteration was reported by Pontifex and Associates (1985). Some clasts (probably originally dolostone?) are altered to zoned assemblages of adularia, quartz, sulphide minerals (pyrrhotite, pyrite, sphalerite and chalcopyrite), ± actinolite/ ferro-actinolite, chlorite and smectite. Veining and brecciation are also common but usually narrow and include most of the above alteration minerals. Pyrite veining (mostly auriferous) is widespread, but is mostly altered to limonite and jarosite.

The Woody Island Siltstone in this area consists of blue-grey, bioturbated, pyritic siltstone with locally abundant glendonites (calcite pseudomorphs after ikaite: $CaCO_3.6H_2O$, a low temperature carbonate), rare dropstones and few fossils (Farmer, 1985). Calcite concretions and pyrite nodules are also locally common. The matrix consists of clay and silt-sized quartz and sericitic lithic material with some quartz sand-sized grains. It is locally hornfelsed, possibly to andalusite grade, but is usually highly sericitised. In the vicinity of the Livingstone mine, the rock is hornfelsed and highly altered to granular K feldspar-quartz and hematite, with some fine quartz veining and some weakly anomalous gold values (<0.4 g/t).

The Bundella Mudstone is represented by fossiliferous, grey, pyritic siltstone and mudstone (Farmer, 1985). Some diverse, polymict dropstones occur, with rock types similar to the Truro Tillite. The matrix is also similar to the Truro Tillite and includes hornfelsed equivalents. The fossils are commonly replaced by calcite and sulphide minerals (pyrite and pyrrhotite), or by actinolite, clay, adularia, quartz and sulphide minerals where hornfelsed by syenites. Wollastonite, tremolite and prehnite were also reported in altered fossils south of Mt Windsor and near Cygnet (Leaman and Naqvi, 1967). Some minor carbonate (siderite) alteration and veining is present in unweathered rocks. Adularia-quartz-actinolite- sulphide patches (altered carbonate clasts?) occur near syenite contacts. Granular K feldspar-quartz-pyrite rocks near the contacts may represent fenite-like alteration (K-metasomatism) by the alkaline porphyries. Other alteration minerals include cherty quartz, chalcedony, smectite, amphibole, sericite, and hematite.

Jurassic dolerite

The dolerite is mostly fine to medium grained, with locally granophyric and pegmatoidal zones, and local hornfelsing of contacts (including rare skarn-like zones in calcareous rocks). The rocks are of quartz tholeiite composition, containing mostly plagioclase, augite and pigeonite with minor alkali feldspars, quartz, hornblende, zeolites and biotite. At Groombridges Road, Kettering, alteration accompanying the intrusion of porphyritic syenites has caused amphibolitisation of the dolerite. Syenite intrusions in the Regatta Point area at Cygnet have caused complex fenitisation of dolerite, with the formation of some unusual nepheline, garnet and biotite-bearing rocks (Edwards, 1947; Ford, 1983).

Cretaceous intrusive rocks

The Cygnet alkaline intrusive complex has been long renowned as having rocks of unusual mineralogy, including some described as hauyne trachytes, melanite trachytes, jacupirangites (pyroxene-nepheline rocks) and tinguaites (a nepheline-sanidine-aegirine porphyry) (Twelvetrees and Petterd, 1899; Edwards, 1947). However the majority of the intrusive rocks are mineralogically much simpler, more siliceous and relatively less alkaline. Many contain minor quartz rather than feldspathoids, and only minor mafic minerals. The rocks range from feldspathoid-bearing alkali syenite through quartz syenite to quartz monzodiorite (fig. 5) with minor diorite, biotite-pyroxenite, lamprophyre, aplite, pegmatite and orthoclasite (Twelvetrees and Petterd, 1899; Twelvetrees, 1907; Edwards, 1947; Ford, 1983; Pontifex and Associates, 1985). Other reported compositions include phonolite, dacite, trachyte and latite, but these lava-related terms are probably inapplicable as no true extrusive rocks are known in the area.

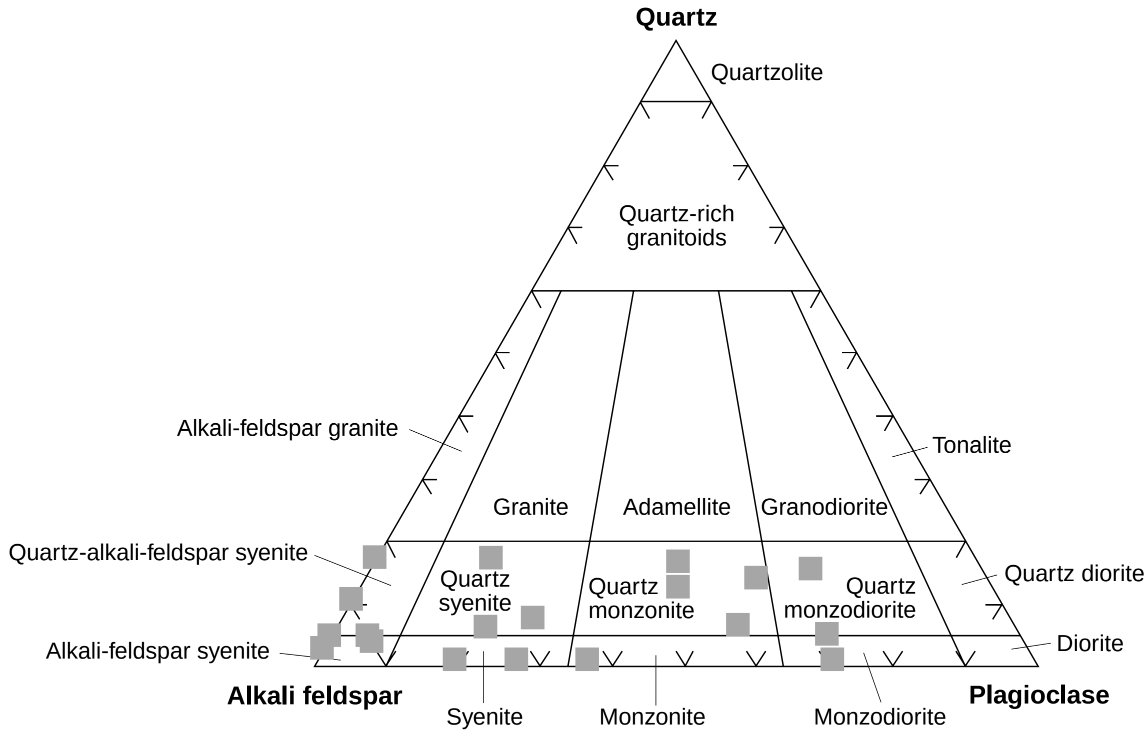


Figure 5

Modal analyses of silica-saturated porphyries from Cygnet, using the IUGS classification (Streckeisen, 1973) and visual modal estimates and semiquantitative XRD.

The rocks are typically highly felsic, medium grained and porphyritic. Heterolithic xenoliths (amphibolite, biotite-pyroxenite, schist, limestone and quartzite) are locally present. Ford (1989) suggested that some anomalous Pb and Zn values in the igneous rocks have resulted from the incorporation of mineralised carbonate sequences during intrusion. Some phenocrystic minerals, amphibole for example, may in fact be xenocrysts.

The intrusive rocks can be classified into two main groups; a silica-saturated group and an unsaturated group (Table 1). The undersaturated syenites are equivalent to the 'sanidine porphyries', 'tinguaites', 'trachytes' and various other quartz-free porphyritic rocks of Twelvetrees and Petterd (1899), Ford (1983), Farmer (1985) and Edwards (1947).

The most abundant rock type in the complex, and a major host for gold mineralisation, is a silica-saturated, highly porphyritic syenite (the 'syenite porphyry' of Ford, 1983, or the 'banatite' of Edwards, 1947 and Farmer, 1985). This rock type is abundant in the Kings Hill–Mt Mary area. The groundmass has a granular texture, with fine-grained sanidine, plagioclase and ~5-10% quartz. Phenocrysts (<20 mm) are mostly sanidine (10–30%) and plagioclase (oligoclase-andesine, ~10–40%) with variable (<5%) green-brown hornblende and (<5%) green clinopyroxene (aegirine-augite). Many of the primary minerals have undergone variable degrees of alteration, particularly the pyroxenes. Other primary phases include trace sphene, apatite, allanite, biotite, magnetite and colourless clinopyroxene. In places the rocks are almost equigranular or aplitic (e.g. Kings Hill). Alteration is represented by K-feldspar overgrowths on plagioclase, small polycrystalline patches of quartz and sericite, sericitised plagioclase, smectite alteration of mafic minerals and minor secondary amphibole and biotite, plus epidote and pyrite.

Good examples of the undersaturated rocks occur near the Livingstone mine, Wheatleys Bay and Langdons Point. The groundmass is mostly trachytic and flow-banded, with fine-grained sanidine, acicular sodic clinopyroxenes (aegirine-augite) and granular to equant feldspathoids (including cancrinite, analcime, nepheline, 'pseudoleucite', hauyne and sodalite; Edwards, 1947; Ford, 1983). Phenocrysts include garnet (melanite; dark brown titaniferous andradite, or rarely orange spessartine), coarse sanidine (<100 mm), hornblende (green-brown), plagioclase (oligoclase) and finer phenocrysts of feldspathoids, apatite, sphene, allanite, magnetite, eudialyte, and other minerals. Alteration minerals include calcite, pectolite, zeolites (mesolite, mordenite, scolecite and natrolite) and scapolite (Edwards, 1947; Ford, 1983). The undersaturated syenites are locally associated with gold mineralisation (e.g. at Mt Mary; see sections on mineralisation and geochemistry), although associated alteration may, in part, obscure their identity.

The non feldspar-phyric, hornblende-bearing porphyries (e.g. from Petcheys Bay) appear to be distinct from either group and may be approaching lamprophyric compositions. These porphyries contain abundant hornblende phenocrysts, no phenocrystic feldspar, and minor green sodic clinopyroxene phenocrysts and biotite in a trachytic groundmass.

Table 1

Summary of mineralogy of porphyry rock types

	Silica-saturated	*Silica-undersaturated*
Quartz	groundmass, <20%; rare phenocrysts	absent
K-feldspar	phenocrysts, <25%, and groundmass	phenocrysts, <10%, and groundmass
Plagioclase	phenocrysts, <45%, and groundmass	phenocrysts, <5%, and groundmass
Clinopyroxene	phenocrysts, <10%, and groundmass	aegirine-augite, diopside; green phenocrysts, <5%, and groundmass
Hornblende	phenocrysts, <10%; and groundmass	phenocrysts, <10%, and groundmass
Garnet	absent	melanite and spessartine phenocrysts, <10%
Biotite	uncommon, <5%	uncommon, fine grained, <5%
Feldspathoids	absent	<20%, nepheline, hauyne, cancrinite; mostly groundmass
Total phenocrysts	40–100%	<15%
Groundmass	granular feldspars and quartz	trachytic, fine-grained feldspars and feldspathoids, ± aegirine
Main alteration minerals	quartz, orthoclase, sericite, chlorite, smectite, epidote	clays, calcite, zeolites, scapolite, smectite
Magnetite	rare, <2%	rare, <1%
Sulphides	common, <5%	rare, <1%
Epidote	common, <10%	uncommon, <5%

Mineralisation and associated alteration

The only important metallic mineral produced in the area has been gold, most of which was found in Quaternary alluvial sediments in relatively young gullies and valleys, from where it can still be recovered. Primary gold mineralisation was also mined in the 1890s to early 1900s (Twelvetrees, 1902; 1907). Early descriptive studies, and those resulting from more recent exploration, are summarised below, followed by results from our studies. The main prospects are shown in Figures 1, 2, and 3, and are listed in Appendix 1 and described in Appendix 2.

Primary gold and associated alteration occur at a number of sites in an arcuate belt running from Little Oyster Cove (near Kettering) through Nicholls Rivulet and Cygnet to Wheatleys Bay. One of the problems studying the hydrothermally altered rocks is the lack of sufficient outcrops or major workings in the area. Field observations and sampling are mainly limited to the major prospects and a few road cuttings. The rocks cropping out along the coast are mostly fresh but unmineralised. Every attempt was made to locate gold grains petrographically, but this was unsuccessful.

Previous mineralisation studies

Smith (1899) described the gold lode at Mt Mary as a fine-grained, hematitic zone in a 'fragmental volcanic or tuff'. Smith (1899) and Twelvetrees (1907) noted the presence of visible gold in this red rock, and a high Au content was confirmed by Wall (1981), although the exact nature of the rock was not understood. Scott (1927) noted the presence of erratically gold-bearing, ferruginous quartz veins (not noted in our studies) up to several feet thick, assaying up to 5 oz/ton Au, at the Mt Mary mine.

Thureau (1881) described a vein of 'moderately mineralised quartz' in sandstone near Lymington and another auriferous quartz vein at a porphyry contact at Little Oyster Cove. We could not relocate these sites.

Twelvetrees (1907) described the ore zone in the Livingstone mine: 'The reef here is apparently a contact development ... it is the only lode found entirely in porphyry', and noted that it contained arsenopyrite, pyrite, chalcopyrite, sphalerite and galena. It was considered likely to be a favourable gold host. The reef appeared to be a narrow (<1 m) zone of sheeted quartz veining.

Wall (1981) noted that gold mineralisation is also present in the somewhat similar Cretaceous alkaline igneous rocks at Mt Dromedary, NSW. The mineralisation there is present as narrow, late-stage pyrite veins, averaging >1 oz/ton Au, in quartz-diorite and monzonite (Wall, 1981; Herzberger, 1974; Brown, 1930).

Recent drilling and costeaning in the Cygnet area for gold exploration indicated that the gold appears to be distributed within both the intrusive and contact rocks (Jones, 1986; 1987*a*). Hydrothermally formed minerals were reported as quartz, K-feldspar, carbonate minerals (zeolites?), epidote, clay minerals, pyrite and hematite. Anomalous gold was found in ferruginous and fossiliferous Bundella Mudstone; ferruginous and weakly stockworked intrusive syenomonzonites, and brecciated pebbly mudstone. Visible gold was described from jarosite and limonite-rich zones in a sedimentary breccia (Jones, 1986). The intrusive rocks contain disseminated and stringer sulphides, including pyrite, chalcopyrite, pyrrhotite, marcasite and chalcocite, with magnetite and hematite (Jones, 1986). Disseminated pyrite present in the sedimentary rocks was considered to be partly syngenetic. Pyrite was also reported in rare quartz veins in the sedimentary rocks. Cinnabar was reported as possibly present in mudstone by C. Hine (*in* Bottrill, 1995*c*) in the Golden Apple drillcore from Mt Mary (now lost). This has not been confirmed. Jones (1986) considered the gold mineralisation to be partly of the 'Carlin-style', i.e. a carbonate-hosted replacement deposit, and partly of a porphyry-hosted style.

Alteration

The alteration study described here, determined largely by petrography (Appendix 4), X-ray diffraction (Appendix 6) and electron microprobe analyses (Appendix 7), is based primarily upon several diamond drill holes at the Mt Mary mine, plus one at the Black Jack prospect, and some surface and underground sampling in other areas (limited by mostly poor outcrop).

Hydrothermal alteration is widespread and variable in intensity, but is relatively pervasive in some areas (e.g. Mt Mary mine), and fracture controlled in others (e.g. Livingstone mine). Regional zoning is not well defined at present. The alteration zones in and around mineralised areas include potassic, silicic, calc-silicate, propylitic, phyllic, carbonate, zeolitic and argillic (smectite). Scapolite, calcite and pectolite as alteration minerals were noted in coastal exposures of porphyries by Ford (1983), but may not be directly related to gold mineralisation. The alteration assemblages are described below as observed in the field and petrographically, and the minerals present in any assemblage may not be formed in the same paragenetic stages.

Suggested mineral parageneses are shown in Table 2.

Table 2

Paragenesis of alteration minerals

	Early → Late
K-feldspar	——
Epidote	—
Andradite	–
Quartz	——— ———
Actinolite	—
Biotite	—
Albite	—
Illite-sericite-muscovite	— ——— –
Pyrrhotite	—
Pyrite	—— ———
Base metal sulphides	—? ——?
Hematite	— — —
Siderite	—?
Opal	—
Smectite	—? —
Kaolinite	—? —
Plumbogummite	—?
Jarosite	—
Limonite	—

Potassic alteration

This is one of the earliest and most widespread alteration types at Cygnet, and is particularly represented by the assemblage K-feldspar (adularia) ± quartz ± biotite ± chlorite ± actinolite ± magnetite with variable sulphide concentrations. Magnetite is mostly rare and unimportant.

The occurrence of adularia was confirmed by microprobe analysis (Appendix 5). Adularia can be seen at the Kings Hill, Mt Mary, Black Jack and Livingstone workings, in varying forms, including K-feldspar rims on plagioclase, feldspathisation of hornfels groundmass, sedimentary clast replacement by K-feldspar, adularia-bearing veins, adularia replacement of sedimentary clasts and fossils, and formation of hydrothermal biotite.

K-feldspar overgrowths occur on plagioclase phenocrysts in some porphyries (fig. 6) and, although late magmatic, this can be considered to be a very early form of alteration.

In some hornfelsed sediments the groundmass is altered to very fine to medium-grained K-feldspar, plus quartz, siderite, hematite and limonite (fig. 7); K-feldspar may comprise up to ~40% of the groundmass. At the Mt Mary and Black Jack workings, these granular adularia-quartz-pyrite-hematite rocks near contacts appear to be the result of intense potassic alteration (fenitisation).

Adularia is relatively common as rhombic crystals forming the rims of altered sedimentary clasts (probably altered dolomite, now consisting mostly of variable proportions of adularia, quartz, actinolite, clinopyroxene, sulphide minerals, chlorite- vermiculite (altered biotite?), and clays; e.g. Mt Mary; fig. 8 and 9). Fossils are locally altered in a similar manner (e.g. the Black Jack workings). The sulphide minerals include pyrrhotite and pyrite, with rare chalcopyrite and sphalerite (fig. 10).

Adularia veinlets occur in some hornfels near porphyry contacts.

Biotite is not well preserved but there are numerous occurrences in both mudstone and porphyries of limonite/mica/chlorite/clay aggregates which appear to represent vermiculite or chloritised and smectite-altered biotite, probably of hydrothermal origin (fig. 8).

Hematite is locally common and probably can be ascribed to this alteration zone. It occurs at the Mt Mary, Black Jack and Livingstone workings, mostly as disseminated fine-grained bladed aggregates with adularia, pyrite and quartz, commonly in altered, gold-bearing hornfelsed sedimentary rocks. It partly replaces magnetite and mafic minerals in some porphyries (fig. 11). Coarser bladed hematite occurs in silica-saturated porphyries in the Woodbridge drill hole, and in silica-undersaturated porphyries at

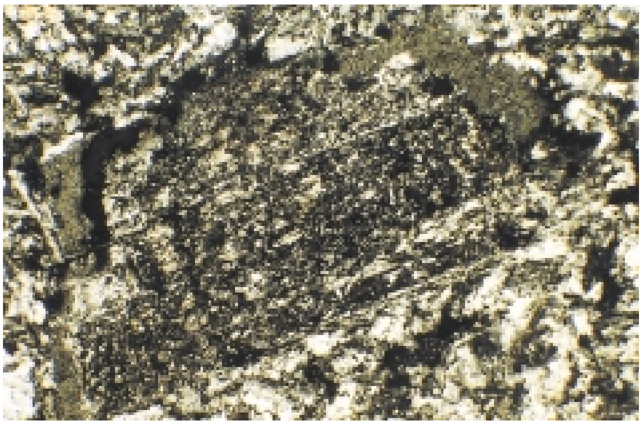


Figure 6

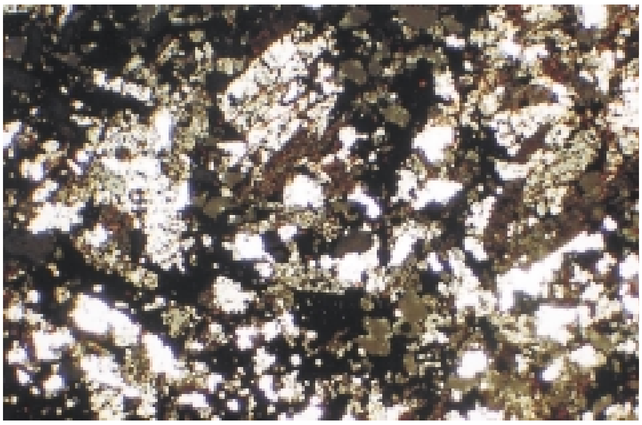


Figure 7

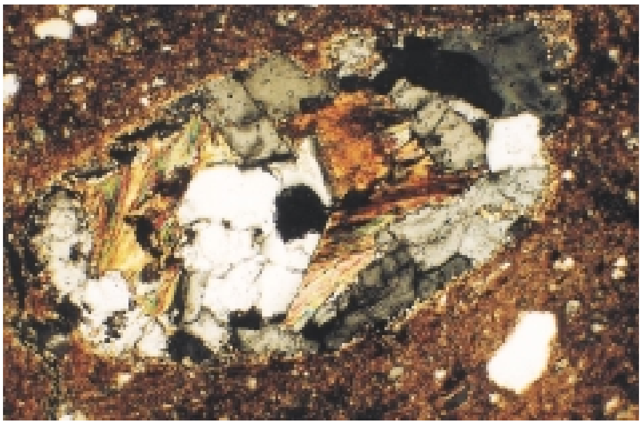


Figure 8

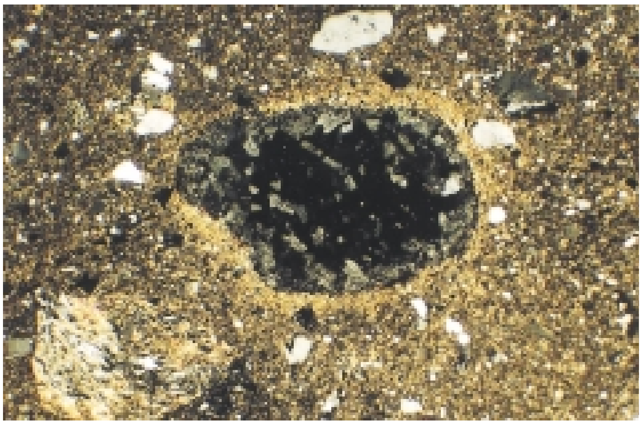


Figure 9

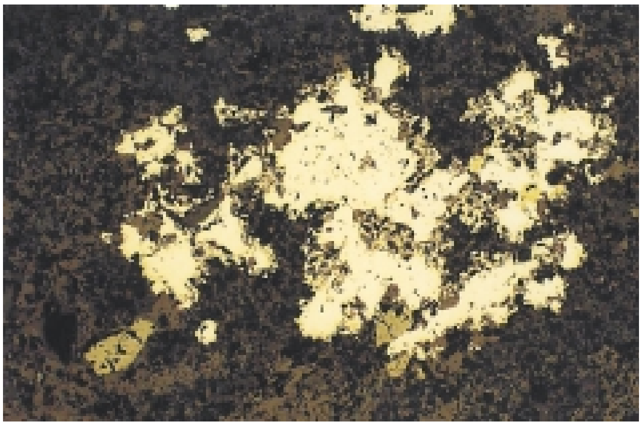


Figure 10

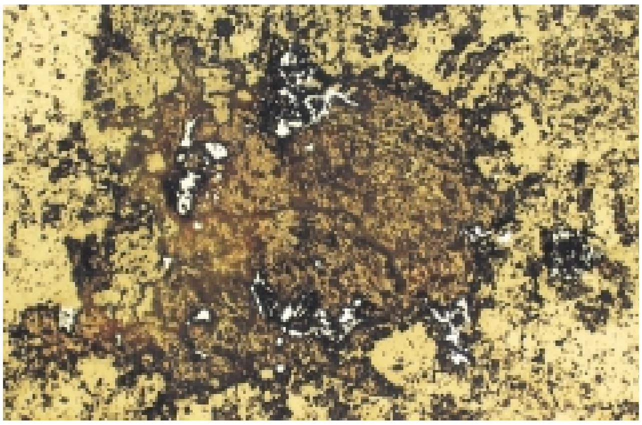


Figure 11

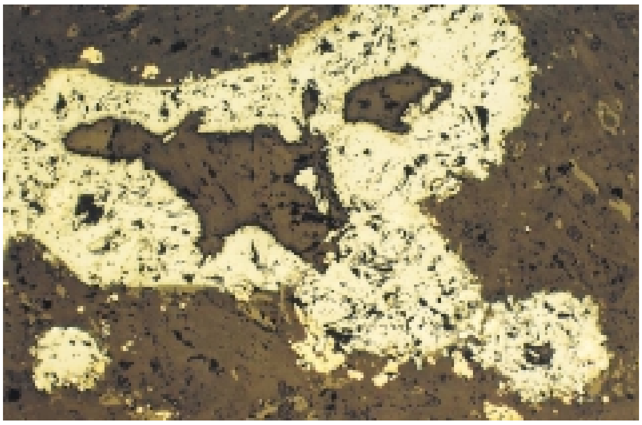


Figure 12

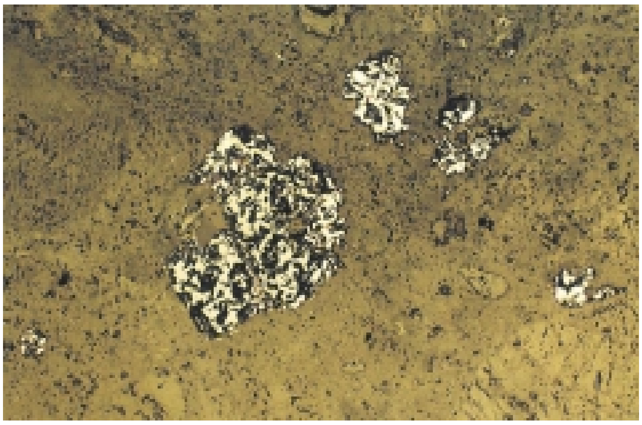


Figure 13

Captions, Figures 6–13

Figure 6. *Adularia overgrowth on sericitised plagioclase phenocryst; C107919, Mt Mary. Crossed polars. Field of view: 1.7 × 1.1 mm.*

Figure 7. *Adularia (blocky), quartz, hematite and limonite replacing mudstone; C107944, Black Jack. Crossed polars. Field of view: 4.3 × 2.8 mm.*

Figure 8. *Adularia (rhombic, grey), quartz, and altered biotite replacing a clast in pebbly mudstone; C107918, Mt Mary. Crossed polars. Field of view: 1.7 × 1.1 mm.*

Figure 9. *Adularia (grey) and pyrrhotite (opaque) replacing a clast in pebbly mudstone; C107927, Mt Mary. Crossed polars. Field of view: 4.3 × 2.8 mm.*

Figure 10. *Pyrite (pale yellow), chalcopyrite (dark yellow) and sphalerite (pale grey) in actinolite (dark grey) replacing a clast in mudstone; C107744, Black Jack. Reflected light, uncrossed polars. Field of view: 1.1 × 0.7 mm.*

Figure 11. *Altered mafic phenocryst (brown), partly altered to hematite (white); C107617, Kings Hill. Reflected light, uncrossed polars. Field of view: 2.2 × 1.4 mm.*

Figure 12. *Hematite (pale blue grey) and carbonate (dark grey) filling an amygdule in porphyry, and partly altered on the rim to chalcopyrite and pyrite; C108018, Wheatleys Bay. Reflected light, uncrossed polars. Field of view: 2.2 × 1.4 mm.*

Figure 13. *Magnetite (pale grey), partly altered to pyrrhotite (yellow), in porphyry; C107923, Mt Mary. Reflected light, uncrossed polars. Field of view: 1.1 × 0.7 mm.*

Wheatleys Bay. Some of this hematite may be early hydrothermal or late magmatic in origin, formed at higher temperature than that found in the altered sedimentary rocks described above. At Wheatleys Bay hematite is partly altered to pyrite and chalcopyrite (fig. 12).

Magnetite is uncommon as disseminated grains in both silica-saturated and silica-undersaturated porphyries, and may be magmatic rather than hydrothermal in origin (fig. 13).

Gypsum occurs in some veins in surface samples of pyritic quartz syenites at Kings Hill. This may be an alteration product of anhydrite veins (common in potassic alteration zones elsewhere), but the occurrence of anhydrite itself has not been confirmed.

Silicic alteration

This alteration type is widespread and commonly observed in and around most workings, where it occurs as breccia-infillings, replacement and veins. Quartz, chalcedony and opal are all locally abundant. At Kings Hill quartz is especially important in and around the breccia pipes, as small veins and breccia filling (fig. 14). The host porphyries are silicified, with up to about 40% cherty quartz in the groundmass, and K-feldspathised and/or albitised.

Silicified, limonitic and pyritic cherty breccias containing minor gold, and cherty veinlets in pyritic, sericitic porphyries (fig. 15) occur near the radio tower at Mt Mary. Silicified, pyritic opal and chalcedony-bearing cherty breccias, replacing mudstone (fig. 16), occurred at the base of one Mt Mary drill hole. At the Black Jack prospect, silicified (cherty) mudstone containing some minor quartz veins occurs sporadically near the intrusive contacts. At the Livingstone mine the groundmass to some porphyries is highly silicified in proximity to some quartz veins.

Calc-silicate alteration

This alteration is characterised by the occurrence of actinolitic amphiboles and secondary andradite.

Actinolite/ferro-actinolite is an uncommon but widespread form of alteration in the district. In some mudstones near porphyry contacts it may, with sulphides, almost totally replace some of the sedimentary (carbonate?) clasts (e.g. sample C107744, Mt Mary mine; fig. 17), and partly replace siliceous clasts (sample C107922, fig. 18). It may locally almost totally replace the mudstone matrix (e.g. sample C107761, Mt Mary). Calcic amphiboles are also abundant as alteration in some dolerite intruded by the porphyries, where it may be both pervasive replacement and in veinlets (e.g. sample C107687, Groombridge Road, Kettering). Some microprobe analyses are given in Appendix 5.

Relatively pure andradite (Appendix 5) occurs in some epidotised porphyries as a coarse-grained secondary phase replacing mafic minerals (e.g. samples C107722 and C107759, Mt Mary). It is colourless in thin section, in contrast to the dark brown primary melanitic garnet.

Propylitic alteration

This alteration type is widespread and is most commonly observed as the assemblage epidote-quartz-pyrite in the saturated porphyries in the Livingstone mine and Mt Mary workings. Coarse-grained epidote aggregates partially replace feldspar and mafic phenocrysts, and epidote also occurs in veinlets (fig. 19) and in quartz-pyrite-epidote aggregates in the groundmass, but is mostly not texturally destructive. Sericite, zeolites and smectite may also be associated, but are probably of a later paragenesis. Epidote, pyrrhotite and actinolite are disseminated in hornfelsed mudstone at Martins Point, well away from any known mineralised areas, but may represent this alteration zone.

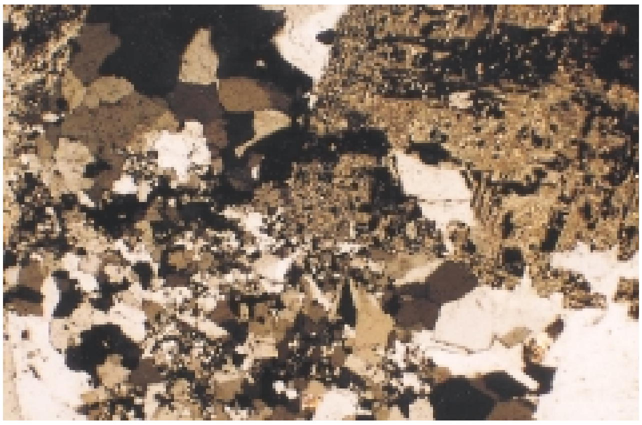


Figure 14

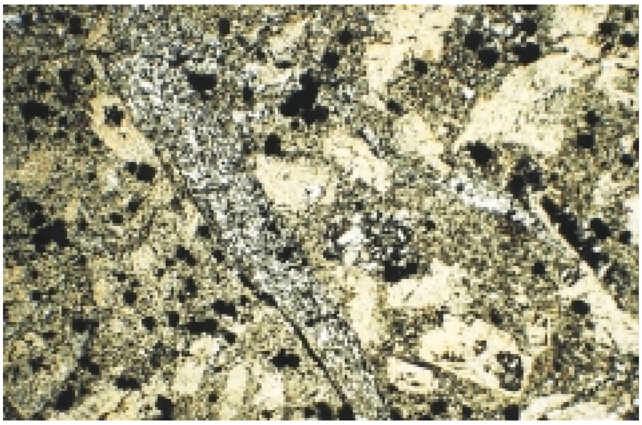


Figure 15

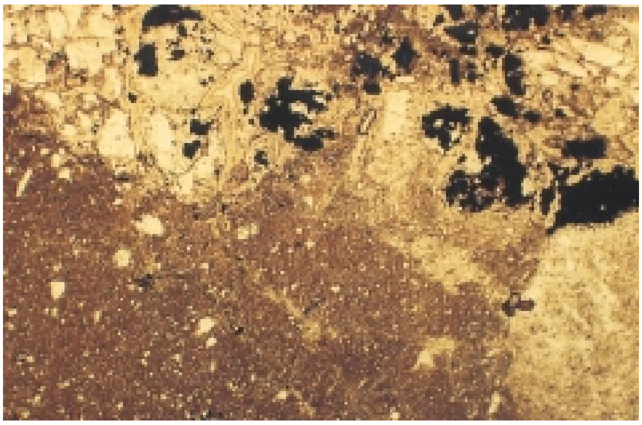


Figure 16

Figure 17

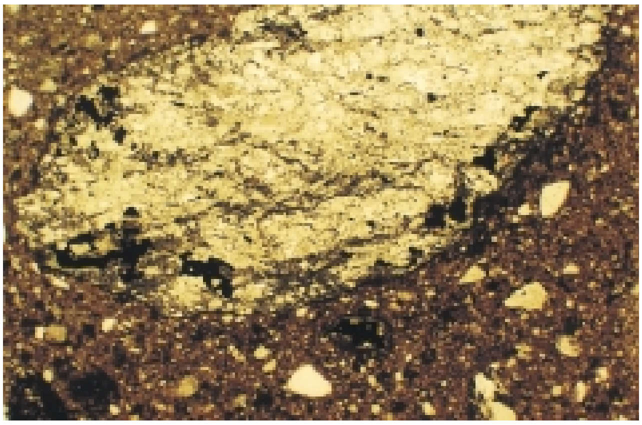


Figure 18

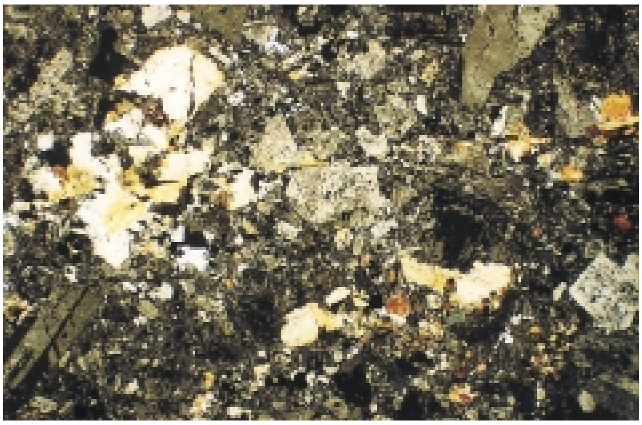


Figure 19

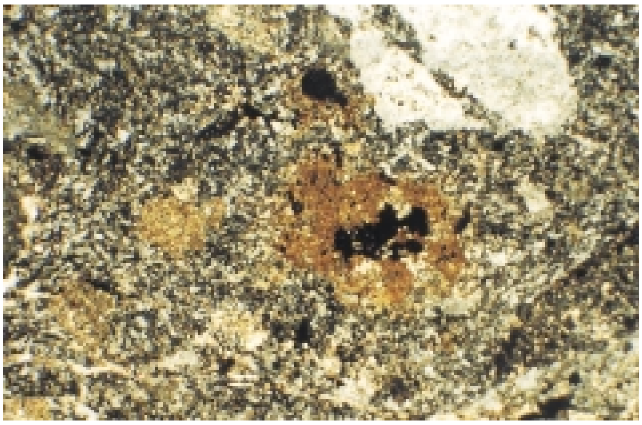


Figure 20

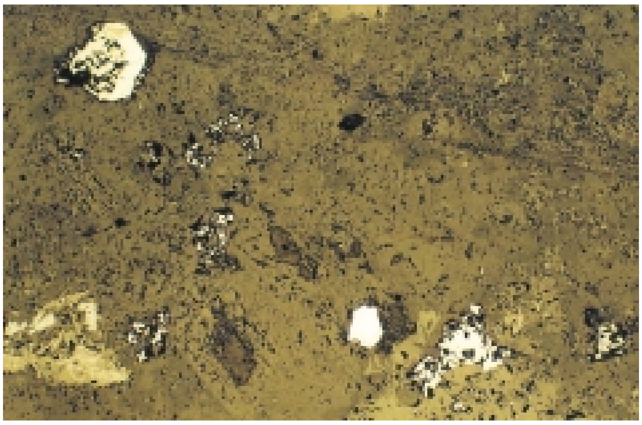


Figure 21

Captions, Figures 14–21

Figure 14. *Coarse albite (polysynthetically twinned) in a quartz-rich breccia; C107928, Kings Hill. Crossed polars. Field of view: 4.3 × 2.8 mm.*

Figure 15. *Sericitised, pyritised feldspar porphyry, with cherty quartz veins and opaque pyrite; C107649, Mt Mary. Crossed polars. Field of view: 11 × 7 mm.*

Figure 16. *Siliceous alteration of mudstone, showing opal/chalcedony veining, and pale areas of recrystallisation/replacement of pelitic groundmass, with introduction of pyrite (opaque). C107624, Mt Mary. Crossed polars. Field of view: 11 × 7 mm.*

Figure 17. *Calc-silicate alteration of carbonate clasts in mudstone, showing diopside-pyrrhotite cores and actinolitic amphibole coronas; C107744, Mt Mary. Crossed polars. Field of view: 11 × 7 mm.*

Figure 18. *Calc-silicate alteration of quartz arenite clast in mudstone, showing replacement by pyrrhotite (opaque) and actinolitic amphibole (green). C107922, Mt Mary. Uncrossed polars. Field of view: 11 × 7 mm.*

Figure 19. *Epidote alteration of porphyry, showing replacement of phenocrysts, veining, and partial replacement of feldspathic groundmass by epidote (white to yellow birefringence). C107787, Black Jack. Crossed polars. Field of view: 11 × 7 mm.*

Figure 20. *Carbonate alteration of mudstone, showing siderite (brown) and pyrite (opaque) replacement of mafic minerals; C107786, Black Jack. Crossed polars. Field of view: 4.3 × 2.8 mm.*

Figure 21. *Disseminated pyrite (white) and pyrrhotite (yellow), altering to pyrite, and magnetite (pale grey) in porphyry, Mt Mary. C107744, reflected light, uncrossed polars. Field of view: 1.1 × 0.7 mm.*

Sericitic alteration

Sericitisation is common but not extensive or highly developed. It is abundant as partial alteration of both feldspars (especially plagioclase) and groundmass in many porphyries, and whilst not extensive may be locally highly developed (e.g. Mt Mary and Livingstone workings; fig. 15). It is sometimes represented as coarse muscovite-quartz aggregates in the groundmass of some porphyries (e.g. Kings Hill). It also commonly occurs in weakly foliated hornfelsed mudstone, where it appears to partially replace the groundmass.

Carbonate alteration

This assemblage is uncommonly preserved at Cygnet, and is represented only as a disseminated, fine-grained replacement of groundmass and some fine veining in mudstone at the Black Jack prospect (fig. 20). Limonitic adularia-rich zones may, however, partly represent this alteration, as the carbonate rocks weather readily. Microprobe analyses indicated siderite (Appendix 5).

Sodic alteration

This alteration type is rare at Cygnet, but has been observed in the Black Jack workings as coarse-grained quartz-albite breccias at some porphyry-mudstone contacts (fig. 14).

Argillic alteration

This is not the classic argillic alteration found in many porphyry deposits, rich in kaolinite, dickite, pyrophyllite and other highly aluminous minerals (Barnes, 1979; Stanton, 1972), but is characterised at Cygnet by abundant smectite (zincian nontronite and montmorillonite; Appendix 5). It has been observed in the Mt Mary drill holes as extensive zones (over 100 m) of zinc-rich smectite ± limonite ± pyrite ± kaolinite ± sericite alteration. This resembles weathering, but may actually represent a widespread late, low temperature alteration type within the area, with high Zn, variable to high Pb, and mostly minor gold, arsenic and copper. It probably contains Pb mostly as plumbogummite ($PbAl_3(PO_4)(PO_3OH)(OH)_6$), and was confirmed by microprobe analysis (Appendix 5).

The clay mineral is mostly nontronite (an iron-rich smectite), but includes some montmorillonite, both with up to 5% Zn (Appendix 5). Such zincian clays are rarely described in the literature, but are not uncommon in some Zn deposits elsewhere (Seamon, 1890; Ross, 1946). Nontronite is characteristic of altered basic rocks, but is also a common constituent of mineralised veins, especially occurring with opal and quartz (Deer *et al*., 1963), as in many Ag-Pb mines of Arizona (Anthony *et al*., 1995). Montmorillonite is common in argillic and propylitic alteration zones of porphyry and epithermal deposits (Stanton, 1972; Thompson and Thompson, 1996; Barnes, 1979), and forms much of the outer zone of alteration about Kuroko deposits (Shirozu, 1974).

The kaolinised syenite at Surges Bay (Bacon, 1992) is overlain by silcrete and appears to be the result of deep Tertiary weathering rather than hydrothermal alteration.

Mineralisation

There are two major types of mineralisation.

Porphyry-hosted

Porphyry-hosted gold ± copper ± molybdenum mineralisation appears to be one of the most common types in the area and was observed in the Mt Mary, Livingstone, Kings Hill and Coads Adit workings. It mainly occurs as:

(1) *Disseminations in hydrothermally altered porphyries*. This mineralisation contains only sporadic weak gold values up to 0.09 g/t, and is characteristic of Mt

Mary and Kings Hill, where it occurs in quartz-bearing syenitic porphyries. The alteration is mostly characterised by the occurrence of disseminated and replacement pyrite, pyrrhotite, quartz, sericite and epidote (fig. 12, 13, 15, 21).

(2) *Siliceous and pyritic breccias*. This mineralisation is characteristic of the Kings Hill workings, where it occurs in breccia pipes within xenolith-rich, quartz-bearing, brecciated syenitic porphyries (possibly intrusive igneous breccias?; Appendix 2). The pyrite and quartz infill spaces between large blocks of porphyry in the stockworks. The size, distribution and extent of the breccia pipes is unknown, as outcrop in the area is relatively poor. The alteration is characterised by the occurrence of abundant K-feldspar (perthitic orthoclase) replacing plagioclase, pyrite and quartz, with minor blue-green amphibole and chalcopyrite. This association is mostly gold poor but is anomalous in molybdenum (see geochemistry section; Table 6).

(3) *Quartz veins*. This mineralisation style is not common in the area but is moderately mineralised where found at the Livingstone mine and Coads Adit. The veins are up to 200 mm thick, mostly massive to laminated, vuggy in places and weakly pyritic. They may be sheeted at quartz porphyry contacts (e.g. Livingstone), or lie within massive quartz monzonite porphyry bodies (e.g. Coads Adit). The veins are texturally relatively simple and consist mostly of quartz, but fine-grained stringers of pyrite, with minor arsenopyrite, sphalerite, chalcopyrite and covellite, occur at the Livingstone mine, where veins in porphyries are characterised by the occurrence of selvages with locally intense silicification and sericitisation. Wall-rock alteration appears to be absent at Coads Adit.

(4) *Pyritic veinlets*. This mineralisation is widespread in the Mt Mary drill core. The veins are up to 5 mm thick, sometimes occur in small breccia zones, and are relatively gold rich. They are fine grained and usually altered to limonite (goethite?) and jarosite. Some limonitic veinlets appear to be associated with zinc-rich clay (see alteration section), and many contain variable to high lead, gold, copper and arsenic values (see geochemistry section).

Sedimentary-hosted

Sedimentary-hosted gold mineralisation occurs within the Truro Tillite, Woody Island Siltstone and the Bundella Formation. It is generally richer in gold and base metals, and more widespread than the porphyry-hosted mineralisation. Similar mineralisation has been found during a reconnaissance study by the authors in stratigraphic drill holes at Granton and Snug Tiers, suggesting that the real extent and potential for this type of mineralisation has not been evaluated in other favourable Permian sequences within Tasmania. The mineralisation is common in the Black Jack, Livingstone and Mt Mary workings, and occurs as:

(1) Disseminated mineralisation, in the Truro Tillite and Bundella Formation. This is commonly, but not always, associated with replaced calcareous fossils and pebbles. The Truro Tillite at the Mt Mary mine contains locally abundant sedimentary clasts, to a few centimetres in diameter. Some of the clasts contain variable amounts of diopside, biotite, sulphide minerals, adularia and actinolite, presumably being altered carbonate (dolomite?) pebbles (fig. 8, 9, 10, 17, 18). These are mostly weakly gold bearing and are limonitic where weathered. Sulphide minerals include pyrrhotite, partly altered to pyrite, with minor chalcopyrite and sphalerite (fig. 9, 10, 17, 18).

In the Black Jack workings, abundant fossils (and possibly sedimentary clasts) in the Bundella Formation are altered to pyrite, pyrrhotite, quartz, adularia and actinolite. These are also mostly limonitic and gold bearing.

This style of mineralisation is also present in the Snug Tier drill hole, where fossils are altered to pyrrhotite and contain trace gold.

Because of problems with weathering and possible groundwater remobilisation, and the mostly low gold values, the actual sites of gold grains are uncertain, but do not appear to be restricted to altered pebbles and fossils. Two gold grains (about 10 micrometres in diameter) were located in limonite-clay-jarosite altered rocks at the Mt Mary workings by Pontifex and Associates (1985), but none were observed in this study.

(2) *Small pyritic veinlets*. Some highly pyritic, gold-bearing veins and breccias are hosted by altered, hornfelsed sediments at the Mt Mary mine and the Black Jack prospect. These veins contain moderate to high gold values (up to 20 g/t) and anomalous Cu and, at Mt Mary, anomalous As, Pb and Zn (see Table 6), and may be associated with abundant adularia, quartz, chert, limonite and hematite. The veins commonly occur near porphyry contacts but the extent of these breccias is unknown. The host rocks appear to have been fenitised (potassium-metasomatised, adularia- rich) and pyritised sediments, with some local cherty silicification and numerous irregular cross-cutting quartz veinlets. Similar mineralisation is observed in the porphyries. The zinc-rich clay alteration is more advanced in the sediments (see alteration section), with higher lead, gold, and arsenic values (see geochemistry section). In the Granton drill hole some pyrrhotite veinlets in the Woody Island siltstone are also gold bearing.

(3) *Quartz veinlets*. This is most important at the Livingstone mine, where it occurs in hematitic, K-feldspar altered hornfelsed sandstone or siltstone

around the main workings (in quartz veins at the porphyry–sediment contact). These contain some gold (up to about 1 g/t) with pyrite and hematite.

High values of gold and base metals are found in some hematitic 'gossanous' samples derived from pyritic rocks, described in the genetic section.

Fluid Inclusions

The aim of this preliminary study was to collect sufficient data to characterise the general features of the hydrothermal fluids responsible for gold mineralisation and also to compare the general characteristics of mineralising fluids in porphyry Au-Cu systems with those observed in the Cygnet area.

Quartz samples from the Livingstone, Mt Mary, Kings Hill, Coads Adit and Black Jack prospects were studied for fluid inclusions. The quartz occurred as veins, hydrothermal breccias and partial replacement of clasts and fossils. The veins are mostly very low in sulphide content but some are anomalous in gold. Petrographically, there is no evidence to indicate that gold and sulphide minerals were introduced at a later stage of hydrothermal alteration than the formation of the quartz veins from quartz.

Microthermometric data were obtained on a modified Fluid Inc. gas-flow type heating-freezing stage. The stage was calibrated with synthetic H_2O and CO_2 inclusions and inclusions with known salinities. The measurements have errors of about ± 0.2°C.

In general, fluid inclusions in quartz samples from different gold prospects appear to have very similar features and are described as one mineralising system. The quartz samples dominantly contain liquid and vapour inclusions, with a small proportion of fluid inclusions containing liquid + vapour + daughter minerals. Some inclusions also contain opaque minerals and accidentally trapped solid inclusions. No suitable fluid inclusions were located in Mt Mary quartz samples, which were mostly fine grained to chalcedonic.

The size of fluid inclusions ranges from 3 to 20 μm and they vary in shape from irregular to negative crystals. The distinction between primary and secondary fluid inclusions is not always possible. In general, isolated to randomly-distributed three-dimensional or negative crystal shape fluid inclusions may be primary and those along irregular lines terminating within a single quartz grain are considered to be pseudo-secondary.

Based on observed phases at room temperature, fluid inclusions have been divided into two populations (Table 3).

Vapour-rich, low salinity type 1 inclusions contain L + V_{H_2O} ± V_{CO_2} ± opaque daughter minerals, and may homogenise to liquid or vapour; some exhibit critical behaviour. Type 1 fluid inclusions are subdivided into two subpopulations according to their behaviours upon cooling and heating. Type 1A inclusions contain no detectable CO_2 whereas Type 1B inclusions contain CO_2, which may only be identified upon freezing. It is not clear whether inclusion types 1A and 1B are of the same generation and represent fluids with varying CO_2 contents or whether they actually represent different batches of hydrothermal fluid.

Table 3

Fluid inclusion classification, Cygnet area

Type 1:	2 phase vapour-rich, low salinity; L + V ± O
Type 1A:	L_{H_2O} + V_{H_2O} ± O
Type 1B:	L_{H_2O} + V_{H_2O} + V_{CO_2} ± O
Type 2:	Multi-phase, liquid-rich: L + V + halite ± other daughter minerals
Type 2A:	L + V + H ± O
Type 2B:	L + V + H + S ± O
Type 2C:	L + V + more than 3 solid daughter minerals

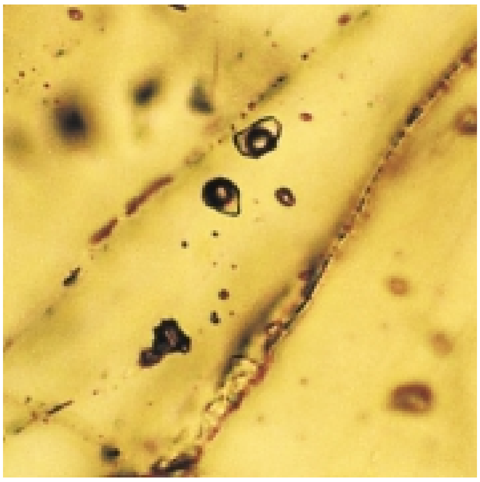
L = liquid V = vapour H = halite
O = opaque mineral S = sylvite

The former is more likely, as type 1 fluid inclusions are closely associated with each other and there is no petrographical observation to suggest that they represent two different generations of fluids. Type 1 fluid inclusions mostly contain no daughter minerals, however inclusions with one opaque solid may also be observed. The opaque mineral is identified as hematite by its characteristic red colour and may be rounded, angular or anhedral.

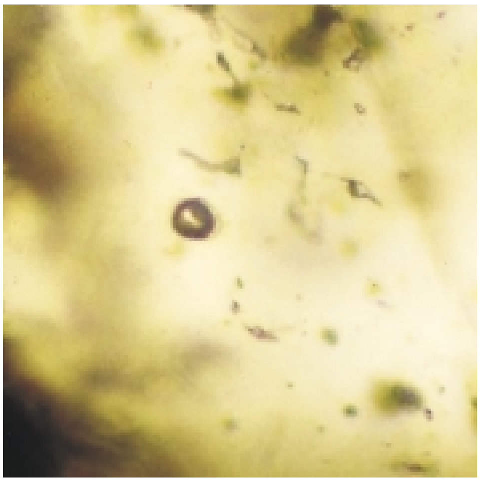
Liquid-rich type 2 fluid inclusions contain halite and may have other additional daughter minerals. They are generally characterised by a relatively small vapour bubble, which occupies between 20 and 30% of the inclusion by volume. Halite, and to a lesser extent an opaque mineral, are the most common daughter minerals. They have been divided into three different subpopulations based on their available solid phases at room temperature (Table 3). Type 2A inclusions (L + V + H ± O) are by far the most common fluid inclusions and are followed by types 2B (L + V + H ± S ± O) and type 2C (L + V + 3 or more solid inclusions) respectively. Sylvite may be identified by being isotropic, commonly rounded, highly soluble and of lower relief than halite. Some rounded to rhombic birefringent minerals may also be present in fluid inclusions of type 2C. There are also some rare fluid inclusions with two or more opaque and up to four translucent minerals (fig. 22).

Heating and freezing experiments

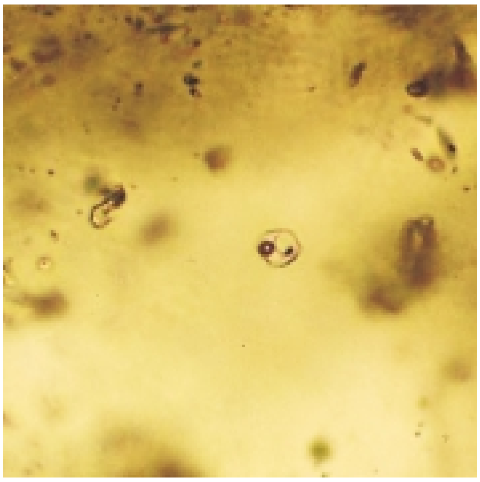
The results of heating and freezing measurements are listed in Appendix 10, and homogenisation data obtained for each prospect and as a whole are shown as histograms in Figure 23.



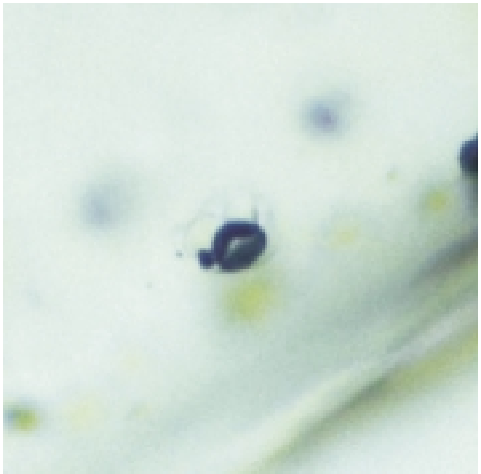
(a) Type 1A: $L_{H2O} + V_{H2O} \pm O$
Field of view: 60 × 60 µm



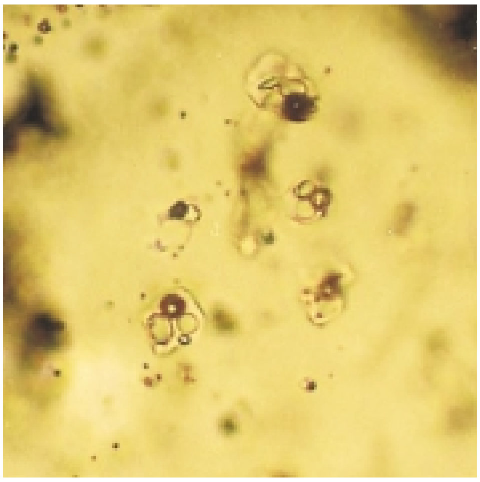
(b) Type 1B: $L_{H2O} + V_{H2O} + V_{CO2} \pm O$
Field of view: 60 × 60 µm



(c) Type 2A: L + V + H ± O
Field of view: 100 × 100 µm



(d) Type 2B: L + V + H + S ± O
Field of view: 55 × 55 µm



(e) Type 2C: L + V + more than 3 solid daughter minerals
Field of view: 55 × 55 µm

L = liquid
V = vapour
H = halite
O = opaque
S = sylvite

Figure 22 (a–e)

Fluid inclusion types, Cygnet area.

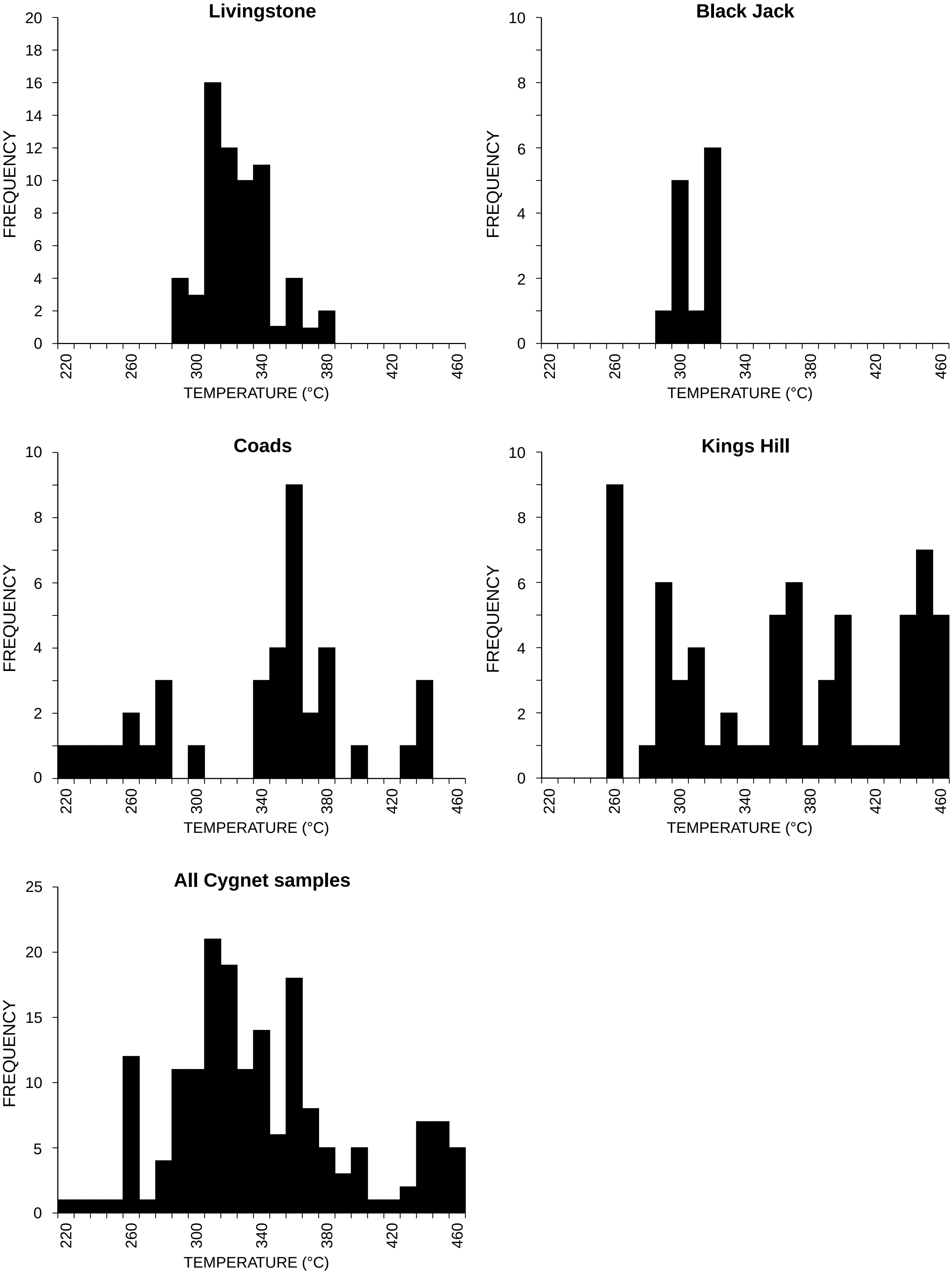


Figure 23

Frequency distribution of homogenisation temperatures for fluid inclusions type 1, Cygnet area.

Type 1 fluid inclusions homogenise to liquid or vapour phase between 256 and >500°C (the fluid inclusions were not heated above 500°C). In general, the majority of fluid inclusions homogenised to liquid in the range 300–370°C. There appears to be two groups of fluid inclusions, the first group homogenising mainly to liquid below 400°C whereas those in the second group had higher homogenisation temperatures (>400°C), with some not even homogenising at 500°C. The higher temperature fluid inclusions homogenise both to liquid and vapour, while a few showed critical behaviour. Initial and final ice-melting temperatures for type 1A fluid inclusions were not precisely determined. This was due to metastability in some fluid inclusions that precluded freezing. The phase change from ice to liquid was uncommonly gradual and it was very difficult to see the initial or final stages of melting. Based on a few measurements, the salinities are likely to be between 11 to 15 wt.% NaCl equivalent. The initial melting temperatures start between -45 and -30°C and indicate the presence of other salts such as calcium or magnesium chlorides in addition to NaCl and KCl. Salinity measurements using the CO_2 melting temperatures for type 1B fluid inclusions may not be accurate, as the presence of other gases is indicated by the depressed final melting temperatures of CO_2 being around -58.5°C compared to the melting point of pure CO_2 of -56.6°C. Melting temperatures of clathrate are between 4.5° to 6.9°C, from which a salinity of around 7 wt.% NaCl equivalent may be estimated (Collins, 1979).

Approximately 70% of type 2 fluid inclusions homogenise by dissolution of halite daughter minerals, with the remainder homogenising by disappearance of vapour bubbles after the dissolution of halite. Sylvite is the first daughter mineral to dissolve in the temperature range of 80 to 125°C. Sylvite daughter minerals were observed in larger fluid inclusions (>10 μm). Dissolution of sylvite is followed by the disappearance of vapour bubbles and finally dissolution of halite in nearly 70% of the inclusions. Dissolution temperatures of halite range from 310 and 441°C, corresponding to salinities of between 39 and 52 wt.% equivalent NaCl in an H_2O-NaCl system (Sterner *et al.*, 1988). The relationship between halite dissolution temperatures and liquid-vapour homogenisation for individual fluid inclusions is shown in Figure 24. The diagonal line separates fluid inclusions which homogenise by halite dissolution (upper left) from those homogenising by the disappearance of vapour bubbles (lower right). Temperatures of disappearance of vapour bubbles for fluid inclusions homogenising by disappearance of vapour bubbles and those homogenising by NaCl dissolution are very similar, although the latter are characterised by higher salinities. In addition, there were five fluid inclusions with high salinities (~52 wt.% equiv. NaCl) in which the vapour bubbles had not homogenised on heating to 500°C.

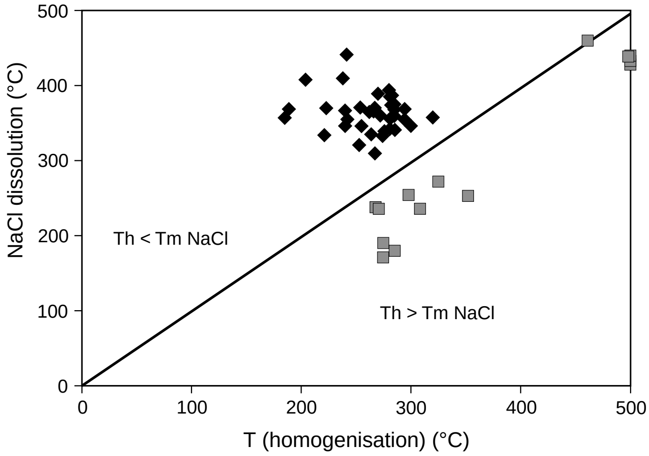


Figure 24

Temperatures of halite dissolution versus temperatures of vapour bubble disappearance for type 2 fluid inclusions.

The higher temperature fluid inclusions displaying critical to near-critical homogenisation characteristics (i.e. homogenising to liquid, vapour or show critical behaviour) provide an estimate of pressure during at least one phase of hydrothermal activity at the Cygnet gold prospects. Assuming the H_2O-NaCl system (Sourirajan and Kennedy, 1962), a pressure of around 400 bars is indicated for the fluid inclusions exhibiting critical temperatures at around 450°C.

Saline (type 2) fluid inclusions homogenise either by disappearance of vapour bubbles or by halite dissolution. Fluid inclusions homogenising by halite dissolution indicate that they have been trapped in the liquid stable, vapour absent field. These fluid inclusions could not have stabley coexisted with vapour-rich fluid inclusions. However, fluid inclusions homogenising by the disappearance of vapour bubble were probably trapped at a different time and could have coexisted with a low density fluid which resulted from fluid boiling or heterogeneous entrapment. There is no spatial relationship between the vapour-rich and saline fluid inclusions to support heterogeneous trapping.

If saline fluid inclusions (type 2) are modelled by the NaCl-H_2O system, as there are no P-V-T data for more complex systems, then temperatures of halite dissolutions may be used to estimate the minimum temperatures and pressures of entrapment. A dense cluster of fluid inclusions homogenising by halite dissolution (fig. 24) show liquid-vapour homogenisation temperatures of 230 to 300°C and halite dissolution temperatures ranging between 320 and 400°C. The salinities for these inclusions range from 40 to 47 wt.% equivalent NaCl. Figure 25 is a pressure-temperature diagram, part of the NaCl-H_2O system, showing the liquid + vapour + halite curve (L + V + H), the liquid vapour curve (L + V) and related liquidi for 40 and 47 wt.% aqueous solutions. The dashed lines represent the isochors (constant liquid-vapour homogenisation temperatures)

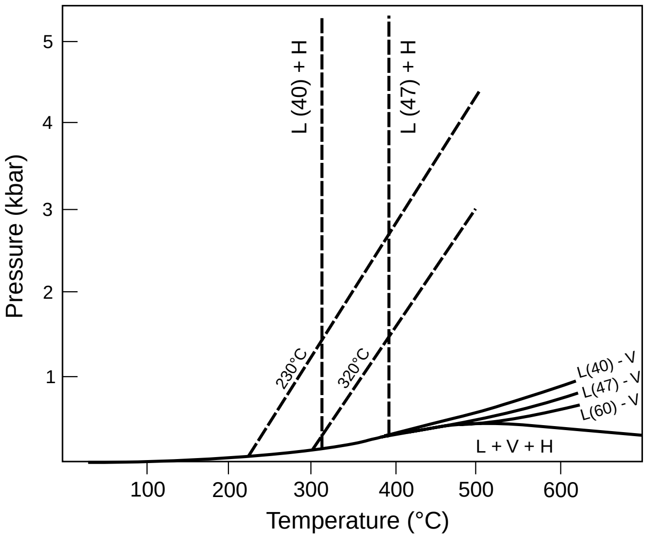


Figure 25

Temperature-pressure diagram for part of NaCl system, showing liquid–vapour (L + V), liquid–vapour–NaCl (L + V + H) and related liquidi (L(40) + H and L(47) + H). The dashed lines represent the isochores extending from the three phase curves at homogenisation temperatures of 230 and 300°C. The liquidi lines, isochor slopes and the (L + V + H) curve are from Bodnar (1993).

extending from the three-phase curve at homogenisation temperatures of 230 to 300°C. The liquidi lines, isochor slopes and the L + V + H are from Bodnar (1993). By extrapolating the experimental data of Bodnar (1993), the corresponding isochor lines for temperatures of 230 and 300°C will intersect the liquidi (L40 + H) and (L47 + H) at temperatures of 320 and 400°C and pressures of 1.5 and 1.3 kbars respectively. These correspond to a depth of about 5 km, assuming a lithostatic pressure. The calculated depth represents relatively deep-seated porphyries and does not agree with the estimated burial depth of ~1500 m at the time of intrusion (J. Everard, pers. comm.). The mineral assemblages in the sedimentary rocks (e.g. epidote-albite-chlorite-actinolite-zeolite-K feldspar-prehnite-tremolite) and the composition of amphiboles (Appendix 5, Appendix 8) in contact aureoles indicate 3 to 6 km burial. A minimum burial depth of around four kilometres is also estimated using fission track data.

There are also few fluid inclusions with $T_{m\ NaCl}$ - $T_{L\text{-}v(L)}$ >100°C. According to Bodnar (1993), in the halite + water field, the slope for isochors of a 40 wt.% NaCl is approximately 23° to 25°/kbar. This suggests that saline fluid inclusions showing $T_{m\ NaCl}$ - $T_{L\text{-}v(L)}$ >100°C have been trapped at very high pressures (e.g. >4 kbar) which may be geologically implausible for the porphyries at Cygnet. An alternative to this explanation is that the fluids were saturated with respect to NaCl and the inclusions contained halite and liquid at the time of trapping. These fluid inclusions will homogenise by dissolution of halite at very high temperatures, thus giving misleading information in regard to homogenisation temperatures and trapping conditions of fluids. However if this were the case, then more fluid inclusions would have been detected showing $T_{m\ NaCl}$ >> $T_{L\text{-}v(L)}$.

A more plausible explanation is that the fluid inclusions were formed at the temperatures described above but at higher pressures, as the system became over-pressurised prior to fracturing. Fluid inclusions with $T_{L\text{-}v(L)}$ > $T_{m\ NaCl}$ show very similar homogenisation temperatures to those homogenising by halite dissolution, and may have been trapped at lower pressures.

Trapping conditions

According to the experimental work of Shinohara *et al.* (1989), the partitioning of chloride into an aqueous phase compared to a melt is favoured by increasing pressure. At deeper levels, below 1.4 kbar, chlorine becomes concentrated in the melt and as the crystallisation of porphyries proceeded, chlorine partitioned into the exsolving magmatic fluid. During fracturing a sudden change of pressure from lithostatic to hydrostatic caused brecciation and veining within the porphyries (e.g. Kings Hill prospect). As the pressure and temperature of magmatic fluid dropped, fluid inclusions with low to moderate salinities in the range of 300 to 370°C (type 1) were trapped. As the brecciation continued and the existing fractures were sealed by the breccia matrix, the pressure increased and more saline fluid inclusions (type 2), homogenising by the disappearance of vapour bubbles, were trapped. The pressure continuously increased with further sealing of overlying rocks, resulting in the trapping of more saline fluid inclusions (type 2), characterised by halite dissolution. Over-pressurising caused further fracturing and pressure reduction and, as a result, reduced the salinity of fluids. If the P-T conditions of the fluids were near critical at some stages, then the trapped fluid inclusions would homogenise to vapour, liquid or exhibit critical phenomenon, features that were observed in vapour-rich fluid inclusions type 1.

It is important to notice that the vapour-rich fluid inclusions are rare and there is no spatial relationship between the vapour-rich fluid inclusions and saline (type 2) fluid inclusions. This indicates that the saline fluid inclusions were probably directly formed from exsolved magmatic fluids rather than by phase separation (boiling). There were also few highly saline fluid inclusions (>50 wt.% NaCl) in which the vapour bubble did not homogenise when heated to about 500°C. These fluid inclusions may have been affected by necking down or may represent an earlier, more saline, higher temperature magmatic fluid. The former is considered more likely as these inclusions were very sparse and the vapour bubbles showed very little change upon heating.

Isotope Studies

Sulphur isotopes

Eleven sulphide samples from quartz veins, porphyries and mudstone were selected for a reconnaissance sulphur isotope study (Table 4).

Sulphur isotope values of pyrite from quartz veins and porphyries range from -2.6 to 2.3‰. However pyrite in mudstone is characterised by distinctly lighter sulphur isotope values, being less than -10‰ (Table 4). The sulphur isotope values of disseminated pyrite in veins and porphyries are either within or very close to magmatic values of 0 ± 1‰ (Ohmoto, 1986). Slightly lighter isotopic values (e.g. sample 107796) appear to have resulted from mixing of magmatic sulphur with lighter sedimentary sulphur. The results indicate magmatic to magmatic-dominated sulphur sources for the mineralisation in the Cygnet area.

Oxygen isotopes

Seven quartz samples from quartz veins and breccias were selected for oxygen isotope analysis (Table 5). The aim was to investigate the possible source(s) of fluids for these samples using fluid inclusion data. Samples were analysed at Monash University using the BrF_5 conversion technique. The reproducibility of the oxygen isotope analyses was within ± 0.20‰.

The oxygen isotope values show a narrow range of 10.6 to 13‰ for all the prospects, with the exception of two samples from the Mt Mary prospect which have values of 16.6 and 18.1‰. The oxygen isotope compositions of water in equilibrium with quartz may be calculated using fluid inclusion data (Table 3) and the quartz-water fractionation factors of Ligang *et al.* (1989). The values fall within the magmatic water range of Taylor (1979), and vary from 5.3 to 6.3‰. The exception is the oxygen isotope values from the Mt Mary prospect, which are heavier by almost 5‰ than those from the other prospects. This may indicate lower formation temperatures for these two samples. However there are no fluid inclusion data for this prospect to confirm this, as quartz is rare and lacking in suitable inclusions. Sample 107941 was studied for fluid inclusions, but only very small (<3 µm) secondary inclusions along fractures were found. More data (fluid inclusion and $\delta^{18}O$) are needed in order to be able to discuss the possible origin of fluids for the formation of the Mt Mary quartz veins.

Table 4

Sulphur isotope analyses, Cygnet area

Sample No.	*Location*	*Description*	*$\delta^{34}S$ (‰)*
107796	Mt Mary	Pyrite vein in clay	3.43
107799	Mt Mary	Disseminated pyrite in clay	10.46
107929	Black Jack	Disseminated pyrite in porphyry	0.28
107931	Black Jack	Disseminated pyrite in mudstone	-3.86
107934	Mt Mary	Pyrite in breccia (hosted by porphyry)	-0.81
107955	Livingstone	Pyrite in porphyry	-1.13
107970	Livingstone	Pyrite veinlet in breccia	2.21
107971	Kings Hill	Pyrite veinlet in porphyry	2.17
107975	Kings Hill	Pyrite in porphyry	2.27
107980	Snug Tier DDH1, 92 m	Pyrite in mudstone	-12.37
107988	Granton DDH1, 281.5 m	Pyrrhotite-calcite vein in altered porphyry	-2.59

Table 5

Oxygen isotope analyses from quartz samples and their equilibrating fluids at indicated temperatures, Cygnet gold prospects

Sample No.	*Rock type*	*Locality*	*Minimum formation temp. (°C)**	*^{18}O‰ (quartz) (SMOW)*	*^{18}O‰ (water) (SMOW)*
107940	quartz vein	Mt Mary	?	16.6	
107941	chalcedony?	Mt Mary	?	18.1	
107943	quartz vein in porphyry	Coads Adit	370	10.6	5.3
107956	quartz vein in porphyry	Livingstone	345	11.5	5.6
107955	quartz vein in porphyry	Livingstone	345	10.9	5.0
107621	quartz stockwork	Kings Hill	370	11.4	6.1
107947	replacement quartz in fossiliferous mudstone	Black Jack	320	13.0	6.3

* Estimated from fluid inclusion data

Geochemistry of mineralised and hydrothermally altered rocks

About 160 samples, including many from the Mt Mary and Black Jack drill holes, plus surface samples from these and the other main prospects and some unmineralised areas, were analysed for Au, Ag, Pb, Zn, Cu, Bi, Sn, As, Mo and many other trace elements (Appendix 7). Locations are given in Appendix 3.

Petrological studies failed to provide sufficient information in regard to the occurrence and distribution of gold in altered rocks. This may be a result of either a nugget effect, or alternatively very fine-sized gold grains. The friable nature of many gold-rich samples (usually weathered, limonitic and clayey) and the generally low content of gold did not favour its microscopic detection. Therefore geochemical analysis was necessary to gain an insight into:

(a) the distribution of metals, including gold, within each prospect;

(b) the relationships between the concentrations of gold and other metals; and

(c) the relationship between mineralisation types and gold content.

Base metal analyses were conducted mostly in the Mineral Resources Tasmania laboratories, by X-Ray fluorescence, and gold and silver by acid leach, solvent extraction and AAS. Some low-level gold analyses were analysed by carbon rod-AAS. Interpretation of the results (Appendices 7, 8) indicated several broad sample categories with different geochemical signatures (Table 6 and Figures 26 and 27).

The zinc-rich smectite, which occurs as an alteration mineral in the alkaline porphyries and sediments, appears to be a hydrothermal product rather than a result of weathering and is discussed in the *Summary of Mineralisation and Ore Genesis* section.

It should be mentioned that anomalous gold and base metals also occur in pyritic and limonitic veinlets in these zones, so geochemical correlations may be poor (fig. 28–29).

It has been suggested that storage of the partly pyritic drill core in galvanised iron trays in wet conditions over several years may have resulted in some oxidation and contamination of the core by Zn from the galvanised trays. This probably has occurred to some extent, but we do know that the original samples were processed and assayed almost immediately (results returned about one to two months from the time of drilling). Comparison of the original assays with our recent analyses show very similar results, except for two pyrite-rich holes which were badly oxidised and the trays highly corroded. The assays of these holes were not used in this study. There is a reasonable correlation of Zn with Pb, Cu, As and Au in the original and new assays, indicating that the base metal distribution is close to original, although Zn results should be treated with care.

Table 6

Distribution of metals in gold-mineralised rocks, Cygnet (median values)

Style	*Au*	*Cu*	*Pb*	*Zn*	*As*	*Mo*	*No.*
Porphyries							
Disseminated (a1)			mod*				54
Quartz-pyrite breccias (a2)			mod			high**	8
Quartz veins (a3)	mod	mod	mod			mod	6
Pyrite/limonite veins (a4)	high	mod	high	high	high		8
Sediment-hosted							
Disseminated, Truro Tillite (b1t)			high	high			30
Disseminated, Woody Island Siltstone (b1w)				high			5
Disseminated, Bundella Mudstone (b1b)		mod					18
Disseminated, miscellaneous (b1 misc)				mod			5
Pyrite veins (b2)	high	mod	high	high	high		8
Quartz veins (b3)	mod	mod	high	high	mod		10

* moderate values: 0.1 < Au < 1 g/t; 60 < Cu < 150 ppm; 50 < Pb < 100 ppm; 150 < Zn < 300 ppm; 10 < As < 50 ppm; 5 < Mo < 50 ppm

** high values: >1 g/t, Au; >150 ppm Cu; >100 ppm Pb; >300 ppm Zn; > 50 ppm As; > 50 ppm Mo

Table 7

Correlation matrix between various trace elements in samples from Cygnet

	Au	*Pb*	*As*	*Bi*	*Ga*	*Zn*	*W*	*Cu*	*Ni*	*Co*	*Ag*
Au	1.000	0.284	0.196	0.697	0.328	0.145	-0.110	0.420	0.073	-0.061	0.373
Pb	0.284	1.000	0.134	0.088	0.974	0.546	-0.213	0.516	0.187	-0.067	0.468
As	0.196	0.134	1.000	0.290	0.122	-0.037	0.238	0.110	-0.110	-0.059	0.137
Bi	0.697	0.088	0.290	1.000	0.139	0.180	0.099	0.362	0.167	0.151	0.173
Ga	0.328	0.974	0.122	0.139	1.000	0.665	-0.181	0.542	0.244	-0.065	0.426
Zn	0.145	0.546	-0.037	0.180	0.665	1.000	0.076	0.465	0.605	0.146	0.154
W	-0.110	-0.213	0.238	0.099	-0.181	0.076	1.000	-0.114	0.350	0.354	-0.053
Cu	0.420	0.516	0.110	0.362	0.542	0.465	-0.114	1.000	0.390	0.239	0.175
Ni	0.073	0.187	-0.110	0.167	0.244	0.605	0.350	0.390	1.000	0.549	0.087
Co	-0.061	-0.067	-0.059	0.151	-0.065	0.146	0.354	0.239	0.549	1.000	-0.052
Ag	0.373	0.468	0.137	0.173	0.426	0.154	-0.053	0.175	0.087	-0.052	1.000

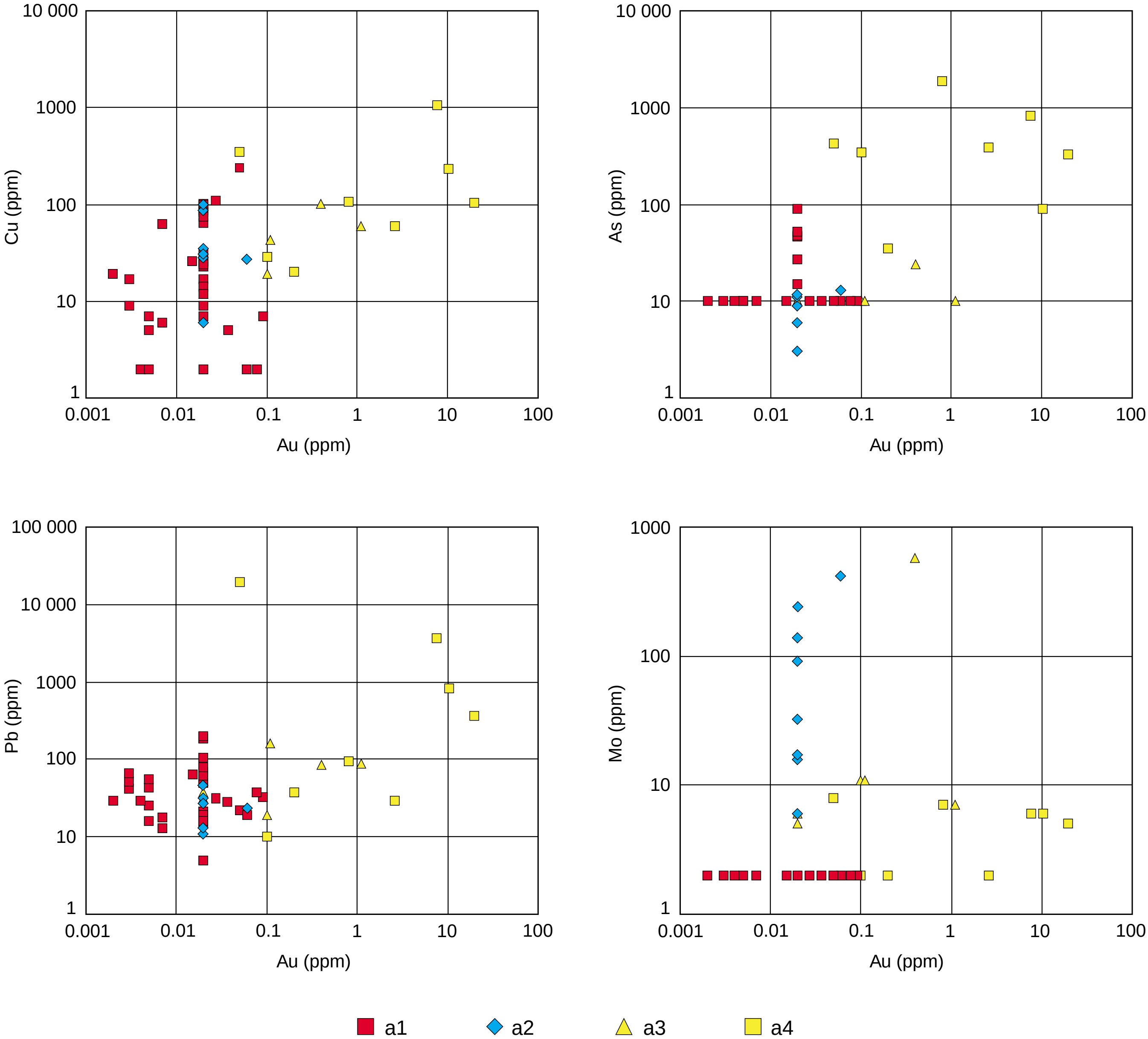


Figure 26

Geochemical relationships between gold and base metals in the porphyries of the Cygnet goldfield: (a) Au vs As; (b) Au vs Cu; (c) Au vs Pb; (d) Au vs Mo. For symbols see Table 6.

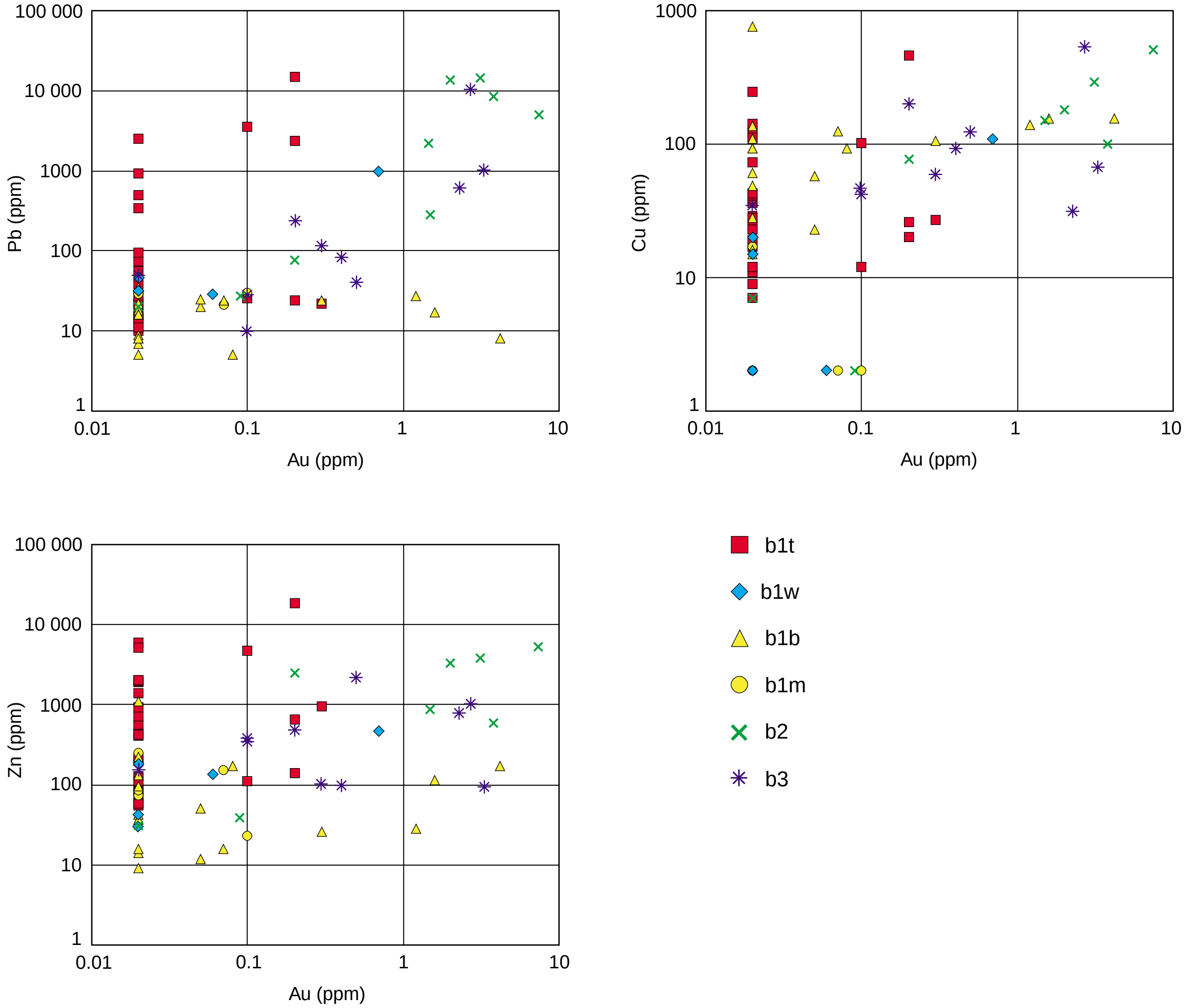


Figure 27

Geochemical relationships between gold and base metals in the sedimentary rocks in the Cygnet goldfield: (a) Au vs Cu; (b) Au vs Pb; (c) Au vs Zn. For symbols see Table 6.

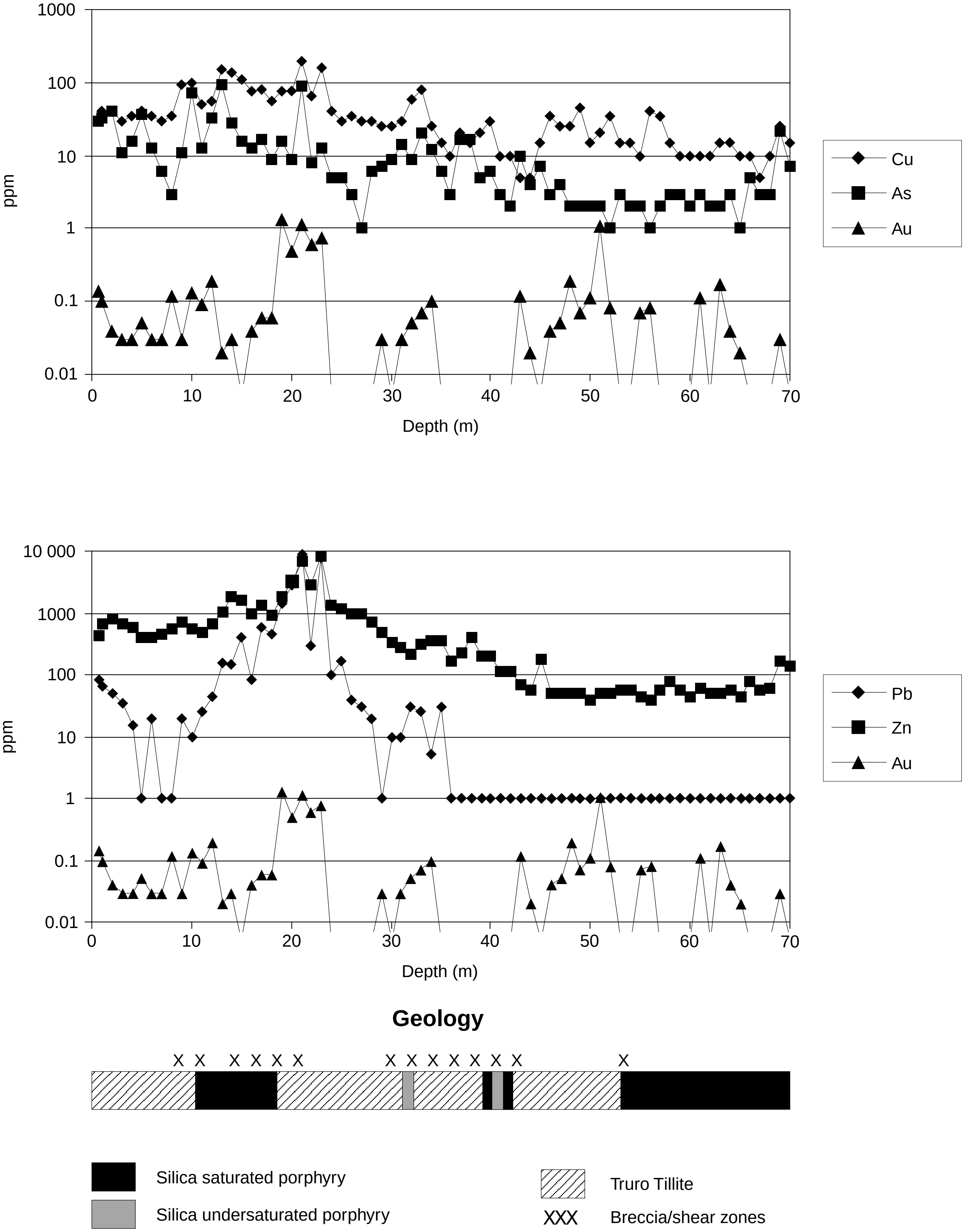


Figure 28

Graphic log and base metal and gold geochemistry of DDH CT87-1, Mt Mary, Cygnet.

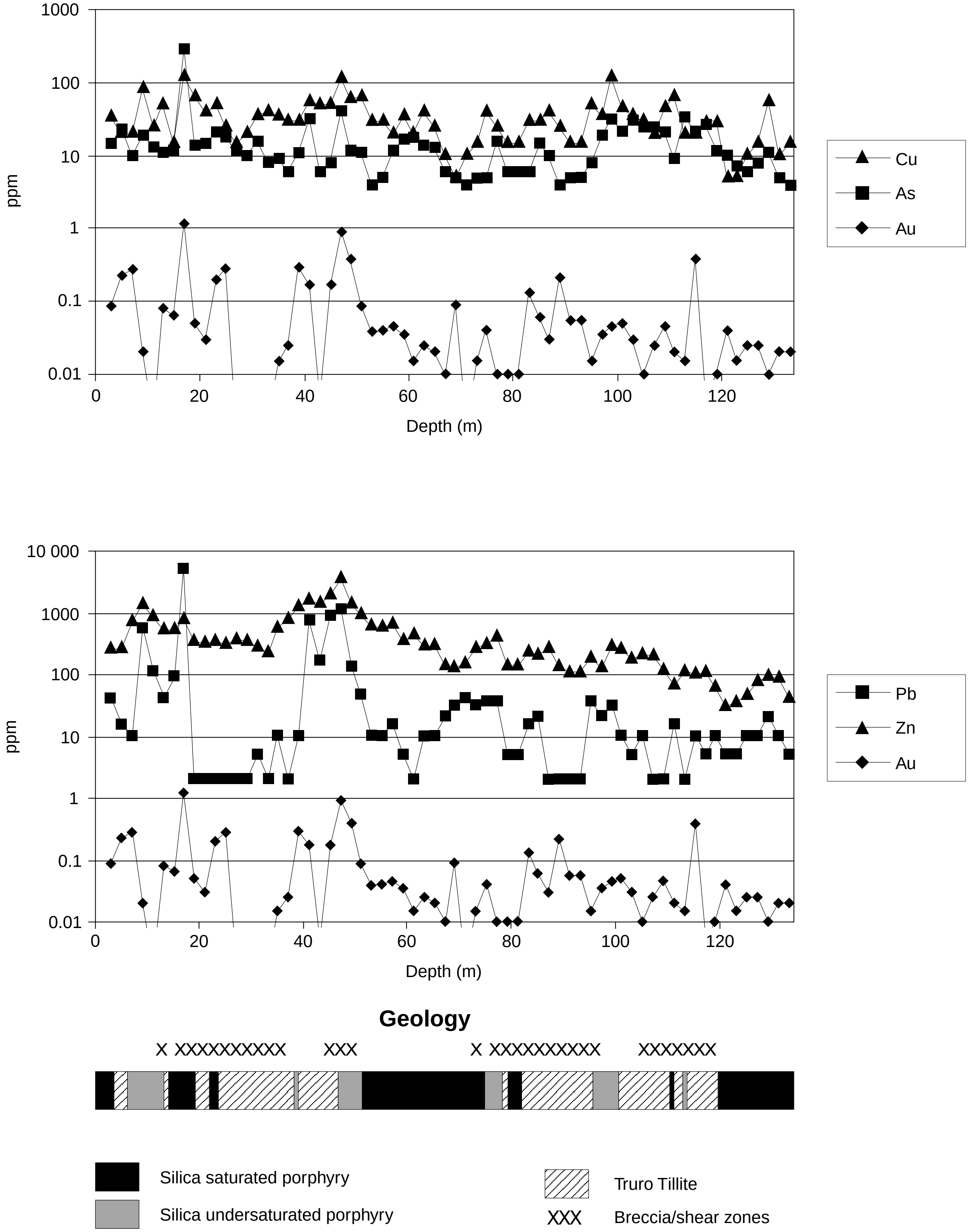


Figure 29

Graphic log and base metal and gold geochemistry of DDH CT87-19, Mt Mary, Cygnet.

Significance of host rock petrology and geochemistry

The geochemistry, petrology and origin of the alkaline complex was the subject of a detailed study by Ford (1983). He concluded that the complex was derived from the partial melting of upper mantle or lower crustal amphibolites at ~20–26 km depth, with subsequent fractional crystallisation and assimilation processes, related to a high heat flow accompanying the breakup of Gondwanaland. The generation of the Cygnet alkaline rocks at ~100 Ma coincided with the separation of Australia from Antarctica (~95–109 Ma; Evernden and Richards, 1962; McDougall and Leggo, 1965; Veevers and Eittreim, 1988).

According to Müller and Groves (1997), potassic igneous rocks occur in a variety of tectonic settings, including continental arc, post-collisional arc, oceanic arc and within plate. They have tried to geochemically and petrographically discriminate between the rocks belonging to different tectonic settings, but the tectonic settings of some potassic rocks are not clear and have been classified differently in the literature. As an example, the Sabitini potassic lava of Italy was assumed to be a within-plate setting by Pearce and Cann (1973) whereas some other authors, including Civetta *et al.* (1981), consider the rocks to be of a continental-arc setting.

Although Purvis (*in* Pontifex and Associates, 1985) suggested that there may be an island arc connection with the Cygnet, Mt Dromedary (NSW), and southeastern Queensland Cretaceous igneous rocks, it is clear that the Cygnet alkaline complex is formed in a within-plate setting (see *Tectonic Setting* section above).

Most alkaline intrusive complexes are non-orogenic, but may be rift or arc-related, and are usually related to crustal arches and intersections of major faults in tectonically quiet areas (Sørensen, 1974). According to Müller and Groves (1997) and other authors, potassic igneous rocks in a within-plate setting are assumed to have been formed where there is a clear association with rifting, such as with the Sierra Nevada lavas (Van Kooton, 1980). In such settings, magma is formed at much greater depths than for potassic magma formed above subduction zones (e.g. Navajo Province, New Mexico; Rock, 1991).

It should be emphasised that relatively little data is available for potassic igneous rocks forming in within-plate settings and it is almost impossible to establish discrimination diagrams to characterise this group of rocks. The geochemistry of these rocks appears to vary widely and is commonly complex even within a single province. Accordingly, the petrological features may also vary from one rock type to another within the same province.

Re-interpretation of data from Ford (1983) indicates some interesting comparisons with alkaline complexes related to porphyry-style gold-copper mineralisation around the world (Appendix 9; Figures 30–33; Lang *et al.*, 1994; Müller and Groves, 1997). The Cygnet data plot quite differently on the total alkalis : SiO_2 and K_2O : SiO_2 diagrams compared to most alkaline porphyries, especially those related to copper and gold deposits (fig. 30, 31). Based on Al : Ti and Y : Zr relationships (fig. 32, 33), the Cygnet intrusive rocks appear more similar to volcanic arc-related alkaline porphyries (e.g. Ladolam, Porgera, Emperor, and Canadian deposits) rather than within-plate alkaline porphyries. There is no indication of subduction at Cygnet, and it is suspected that the previously compiled data set for within-plate alkalic intrusive rocks is too limited. There is a large spread of data on the plots (fig. 30–33; Appendix 9), suggesting that these intrusive rocks are anomalous in geochemistry, perhaps due to crustal contamination and assimilation. The use of discrimination diagrams to define the tectonic settings of the alkaline rocks may thus be misleading.

As the arc-related model of Purvis (*in* Pontifex and Associates, 1985) is clearly inapplicable, the anomalous geochemistry of the Cygnet suite might suggest that mineralised alkaline complexes are geochemically distinct. This may have important implications for exploration and merits further research.

The Na-K-Si relationships of the alkaline rocks at Cygnet, Mt Dromedary and Cape Portland (northeastern Tasmania) are shown on Figure 34.

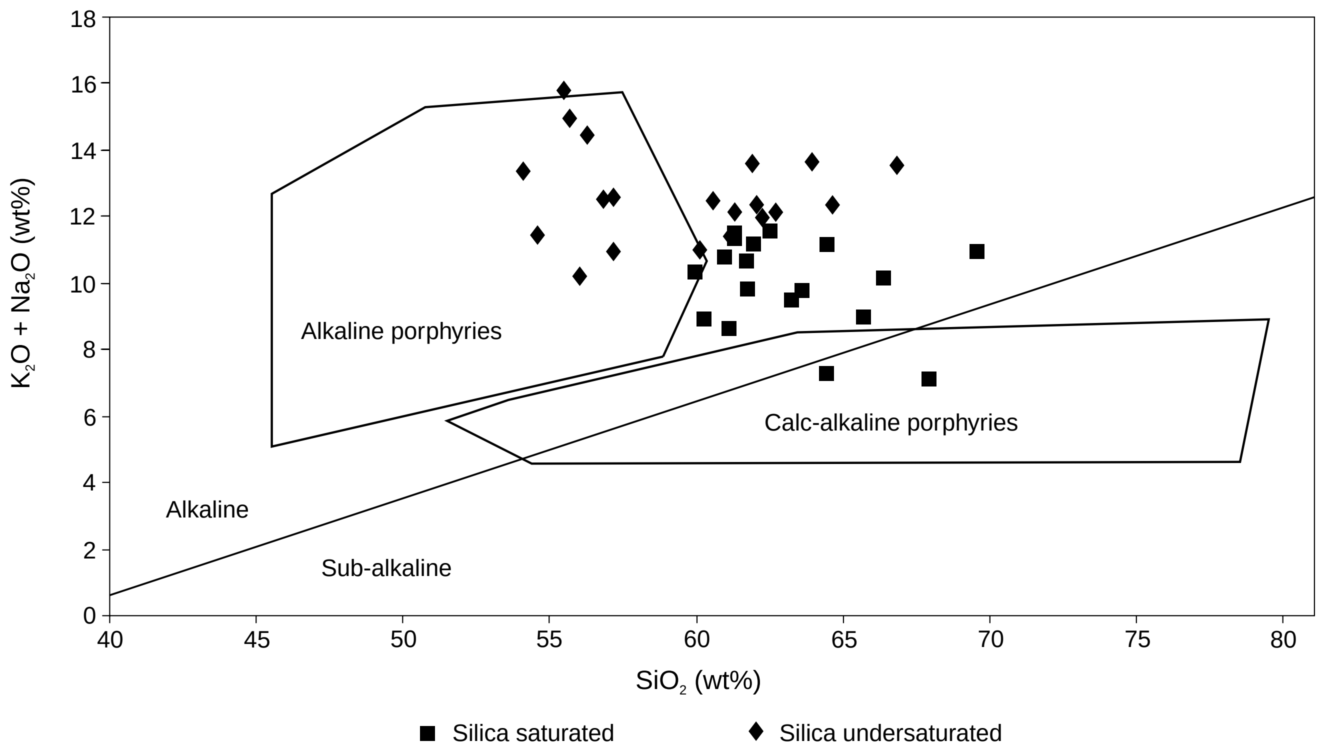


Figure 30

Total alkalis versus silica contents of Cygnet porphyries, from analyses in this report and by Ford (1983). Fields for other alkaline and calc-alkaline porphyries are taken from Lang et al. (1994).

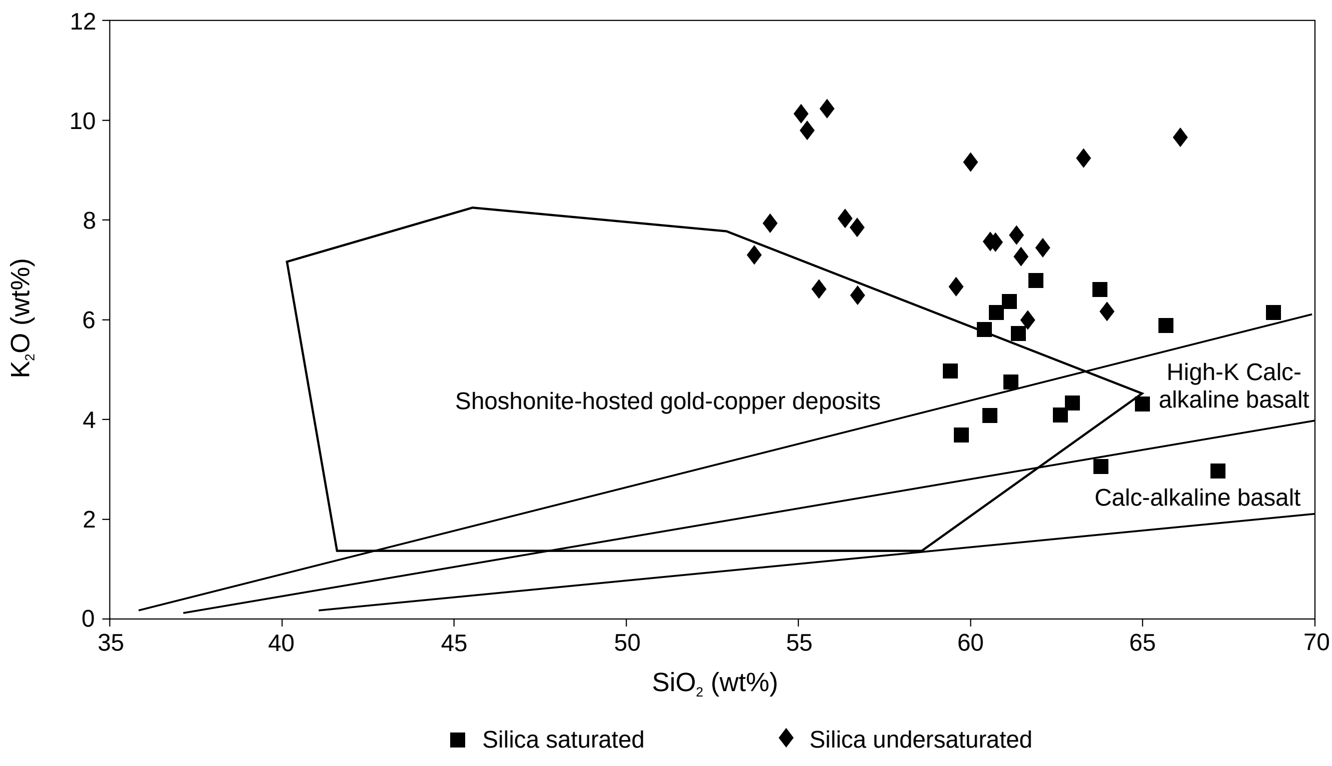


Figure 31

Potassium versus silica contents of Cygnet porphyries, from analyses in this report and by Ford (1983). Fields for other gold-copper-mineralised alkaline and calc-alkaline porphyries are taken from Müller and Groves (1997).

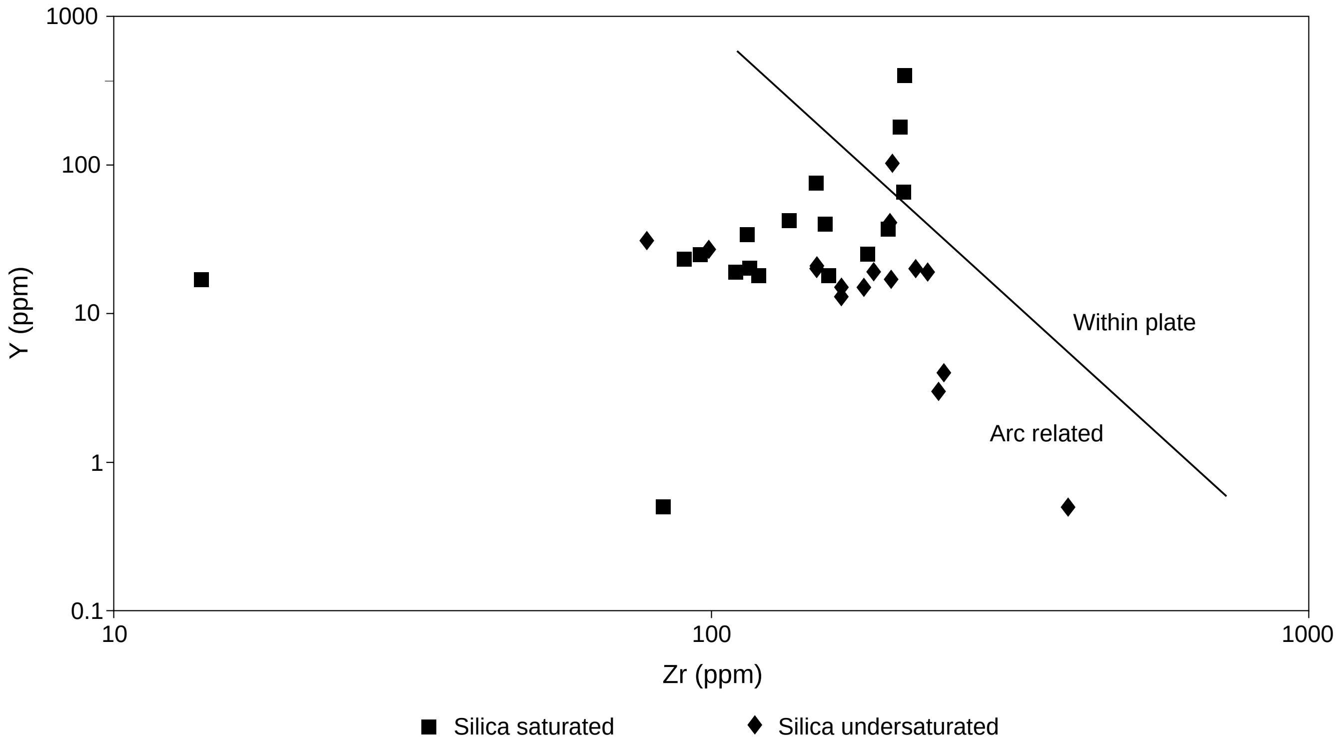


Figure 32

Yttrium versus zirconium contents of Cygnet porphyries, from analyses in this report and by Ford (1983). Fields for other copper-mineralised alkaline and calc-alkaline porphyries are taken from Müller and Groves, 1997.

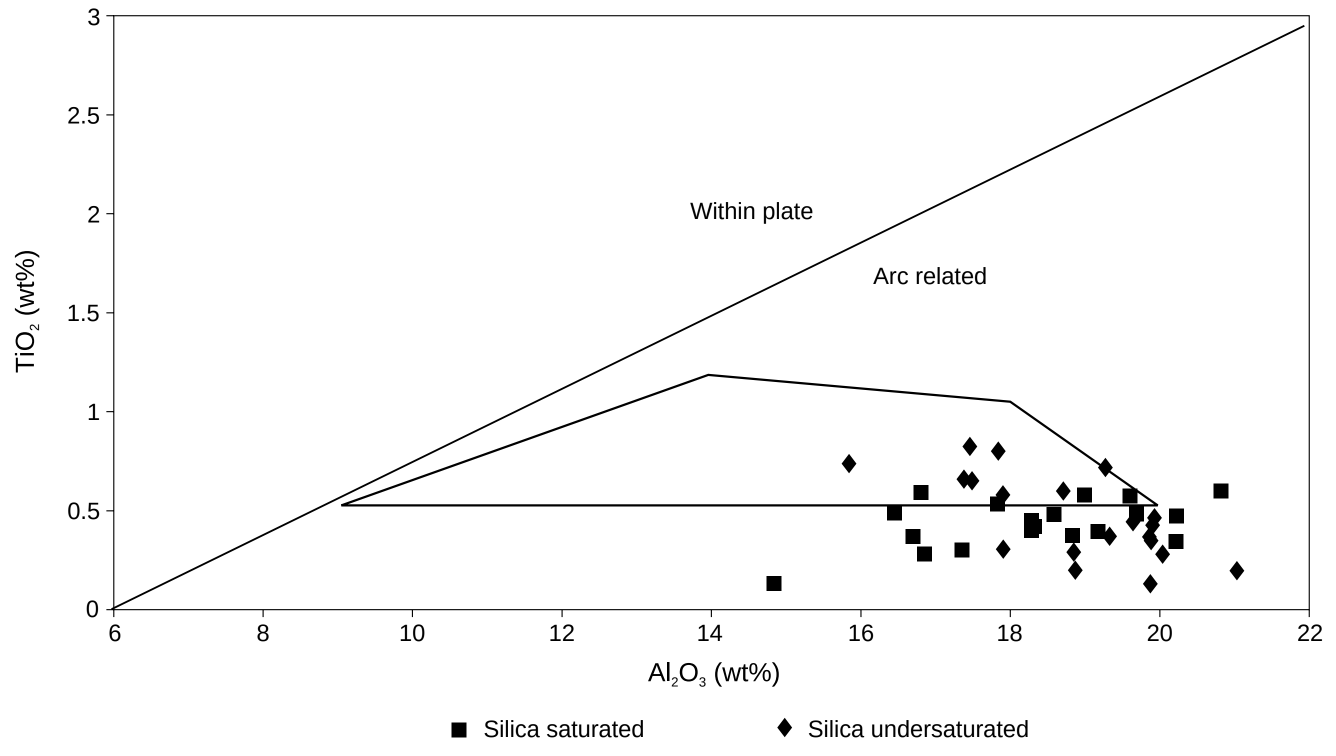


Figure 33

Titanium versus aluminium contents of Cygnet porphyries, from analyses in this report and by Ford (1983). Fields for other copper-mineralised alkaline and calc-alkaline porphyries are taken from Müller and Groves, 1997.

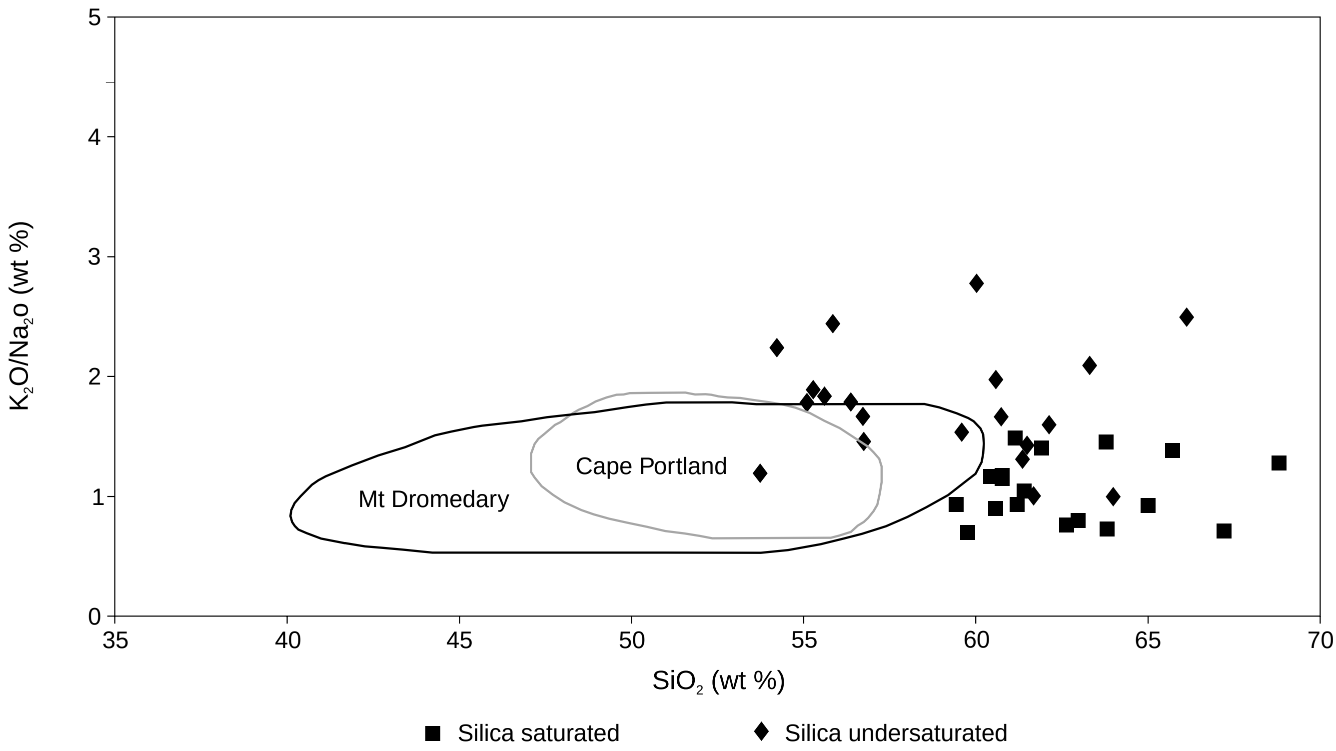


Figure 34

K_2O/ Na_2O versus silica contents of Cygnet porphyries, from analyses in this report and by Ford (1983). Fields for the Mt Dromedary and Cape Portland alkaline complexes are taken from Jacques et al. (1985).

Summary of Mineralisation and Ore Genesis

Metallic mineralisation in the Cygnet area is mostly gold-rich, but lead, zinc, molybdenum, arsenic and copper are all locally highly anomalous. All mineralisation is spatially and temporally closely associated with the intrusion of the Cretaceous alkaline porphyries into lower Permian sedimentary sequences. The porphyries occur as numerous dykes and sills, and probably also as laccoliths. Mineralisation is associated with both quartz-saturated and unsaturated (small, variably feldspathoidal and/or garnet bearing) intrusive rocks, but the saturated intrusive rocks (monzonites) usually predominate.

The mineralisation is probably related in origin to porphyry-hosted deposits in the circum-Pacific area (Lang *et al*., 1994; Müller and Groves, 1997). There are some particularly strong similarities to the Golden Sunlight deposit in Montana, where gold occurs with sub-alkalic lamprophyric intrusions in late shear zones and vein systems in an alkalic-calcic rhyolite/syenite breccia pipe, thought to grade downwards into an alkalic porphyry molybdenum system (DeWitt *et al.* 1996).

Some weak anomalous gold values have also been noted from Permian sedimentary rocks in drill holes at Snug Tiers and Granton. These are not associated with any known alkaline intrusive rock, but feldspathic alteration may be present. The relationship of these gold occurrences to Cygnet is uncertain, but they may indicate the more widespread occurrence of unexposed alkaline intrusive rocks and a possible potential for gold mineralisation over much of southeastern Tasmania. The Cretaceous igneous rocks in northeastern Tasmania have not yet been investigated for gold.

The period of alkaline magmatic activity, and hence the associated mineralisation, is dated at about 100 Ma, and coincided with the separation of Australia from Antarctica (about 95–109 Ma; Evernden and Richards, 1962; McDougall and Leggo, 1965; Veevers and Eittreim, 1988). The main mineralised area is a domal horst block surrounded by thick dolerite sills, and centred about one or two large monzonitic intrusions.

The mineralisation is variable in style, and is classified here as:

(a) porphyry-hosted gold mineralisation where the gold occurs:

- as disseminations in hydrothermally altered porphyries (Pb-rich);
- in hydrothermal siliceous and pyritic breccias (Mo-rich);
- in quartz veins (Au-Cu-Pb-Mo); and
- in pyrite/limonite veins (Au-Cu-Pb-Zn-As).

(b) sedimentary-hosted gold mineralisation, within the Truro Tillite, Woody Island Siltstone and Bundella Formation; mineralisation occurs:

– as disseminations (largely replacing calcareous fossils and pebbles; variably Cu-Pb-Zn rich);
– in pyritic veins (Au-Cu-Pb-Zn-As); and
– in quartz veins (Au-Cu-Pb-Zn-As).

The gold mineralisation in the Cygnet area is relatively low in silica and sulphide minerals (possibly indicating a sulphur and silica deficient system). In places (e.g. the Mt Mary, Livingstone and Black Jack workings) the system was relatively oxidised, as evidenced by localised hematite alteration within the porphyries and sediments. Hematite was also observed in unmineralised porphyries in our reconnaissance study on the Woodbridge drill hole DDH1, and at Wheatleys Bay, so the association of hematite alteration with gold mineralisation might be fortuitous. Epidote and rare magnetite, and andradite occur in some of the porphyries, suggesting locally high oxidation states. However the association of hematite and magnetite alteration with gold-rich porphyry deposits has been documented in the literature (e.g. Sillitoe, 1979; Vila *et al.*, 1991).

The mineralisation is spatially and genetically associated with the intrusion of the alkaline porphyries, and the fluids responsible for the mineralisation appear to have represented a continuum from magmatic fluids to groundwater.

A probable early stage of mineralisation is associated with potassic, calc-silicate, sulphidic, silicic and hematitic alteration, associated with anomalous Au-Cu-Pb-Zn-As. This stage of alteration occurs in both the porphyries and the overlying sediments, and mostly originated from magmatic fluids. This is evidenced by:

(a) quartz veins and breccias within or adjacent to the porphyries containing fluid inclusions trapped at high temperatures (exceeding 500°C) and having high salinity;

(b) a magmatic sulphur source for pyrite suggested by sulphur isotope data;

(c) a magmatic water source indicated from oxygen isotope values of the quartz veins and breccias.

Superimposed alteration, only observed in the Mt Mary drill core, consists of the pervasive development of clay (mainly zincian smectite) and is associated with highly anomalous zinc and lead, and moderately anomalous gold, copper and arsenic contents. The possibility of Zn contamination (e.g. galvanised trays) was discussed and rejected in the geochemistry section. The clay (argillic) alteration is unique in Tasmania, especially with the virtual absence of sulphide minerals. The alteration minerals (hematite, Zn-smectite and plumbogummite) may be either hypogene or supergene in origin or a combination of the two.

There are no fluid inclusion or stable isotope data to constrain formation temperature or the fluid sources for this stage of alteration. The following is an attempt to discuss the likely source of the fluid(s) responsible for this alteration and mineralisation (based on the assumption that the zinc values were not a result of contamination).

Consideration of a supergene origin for the mineralisation implies that there were some original sulphide deposits which have been attacked by an acidic fluid, and subsequently lead, zinc and gold were transported and deposited by low temperature meteoric water. However an entirely supergene origin for this style of alteration is unlikely for the following reasons:

(a) Considering the solubility contrasts between zinc, copper, gold and galena, the zinc and copper should have migrated further away from the site of primary mineralisation than lead and gold because of their much higher solubilities, thus creating a spatial zonation of the metals. Our careful drill core observations (Appendix 11) and geochemical data indicate that the intervals containing high Zn, Pb, As, Cu and Au contents are commonly all correlated (fig. 28, 29) and are associated with extensively fractured, sheared or faulted zones. Gold does not always correlate positively with the other metals. This may be due to the redistribution of gold and metals by later oxidising groundwater or the fact that most gold commonly occurs in limonitic fractures independent of the clay alteration.

(b) The clay mineral associated with the Pb ± As ± Cu ± Au mineralisation is mainly smectite containing substantial amounts of Mg, Zn and Fe, similar to that formed in weathered basalt. Fe in the smectite is probably in a reduced state (i.e. Fe^{2+}). A supergene model would infer the transport of a significant amount of reduced Fe, together with Mg, Pb, Zn and gold by groundwater, which must have already reacted with pre-existing Fe-Mg rich sequences, possibly altered mafic rocks (e.g. basalt or dolerite), to sequester the large amount of Fe^{2+} and Mg precipitated in the pervasive Zn-Fe-Mg rich smectite alteration. However the porphyries are highly felsic and are relatively low in these elements. The supergene model is also highly unlikely as there are no highly carbonaceous rocks within the area to reduce oxidised meteoric water effectively enough to concentrate the metals in the observed smectite-rich rocks.

(c) The smectite alteration, anomalous in lead-zinc and gold, occurs mostly along shear and fault zones at depths down to 130 metres.

(d) Smectite normally forms under neutral to alkaline conditions. In contrast, the supergene model requires the meteoric fluids to have been highly acidic in order, firstly, to carry substantial amounts of gold and base metals, and secondly, to effectively react with surrounding rocks to cause substantial leaching and wall-rock alteration.

It is proposed that the magmatic fluids that evolved from the porphyries were boiled during fracturing of rocks, causing the separation of the fluid into a saline and vapour-rich phase with most of the dissolved gold being fractionated into the brine phase as chloride complexes. Gold may also have been partitioned into the vapour phase, as measurable quantities of gold have been recorded in fumarole gases of active volcanoes (Hedenquist, 1995; Goff *et al*., 1994). Even a low quantity of gold partitioned into the vapour phase may be significant, considering the large mass flux and the high mobility of vapour relative to brine. No experimental work is available to reliably evaluate the importance of the vapour phase in transporting gold in hydrothermal systems.

The association of gold with K-silicate alteration, and the occurrence of high temperature saline fluid inclusions, strongly suggest that the gold was initially transported as chloride complexes by hot magmatic brine. The involvement of magmatic brines in transporting gold in Au-rich porphyry deposits has been discussed by Sillitoe (1990), Sillitoe and Bonham (1995), Gammons and Williams-Jones (1997), and others. The magmatic gold was probably formed during cooling and/or by an increase in pH during boiling, as most of the acidic components such as HCl, SO_2 and H_2S were partitioned into the vapour phase. It is difficult to evaluate the relative importance of cooling or boiling in precipitating magmatic gold. Fluid inclusions results also suggest that the gold-bearing magmatic-dominated fluid also moved laterally into the country rocks in some areas (see *Fluid Inclusion* and *Geochemistry* sections). During boiling, the vapour phase, rich in acidic components, ascended and recondensed by cooling and formed a relatively low salinity, acidic water of mixed meteoric-magmatic origin at higher levels. This fluid was capable of dissolving and remobilising some the pre-existing metals, including gold, into fractures and the country rocks.

As the fluid continued to mix with the surrounding convective meteoric water, it became more diluted and less acidic, causing deposition of lead, zinc and gold. Continuous reactions between the fluid and wall rocks resulted in a further increase in intensity of secondary alteration and eventually the formation of clays, mainly smectite. Zinc was very likely absorbed within the structure of the clays, whilst lead precipitated as lead aluminium phosphates (plumbogummite). Smectites are well known in containing substantial amounts of zinc (see *Alteration* section). The phosphate was probably derived from the dissolution of apatite contained in some abundance in the alkaline rocks, during fluid-wall rock interaction in the late stages of alteration.

The last stage of alteration included the formation of iron oxides and sulphates, mainly limonite and plumbian jarosite. These occur as gossans, fracture-fillings and in selectively replaced clasts and fossils in adjacent sediments. The jarosite and iron oxides appear to have formed from the *in situ* oxidation of pyrite and pyrrhotite, and are commonly high in gold content (>2 g/t) and other metals. This mineralisation type is observed in both drill core and at the Black Jack and Mt Mary prospects. It appears that gold was redistributed by groundwater and formed local enrichments in pre-existing fractures.

In summary, the fluids responsible for the gold mineralisation in the Cygnet area appear to be of an early, magmatic and a later, possibly magmatic-meteoric origin. Weathering and groundwater have also played a role in metal redistribution and local gold enrichment of some sediments overlying and/or intruded by the porphyries.

According to the calculations of Gammons and Williams-Jones (1997) using recently published data, most magmatic fluids are undersaturated with respect to gold at the time of exsolution from the parent magma. Some changes in the physico-chemical conditions of fluid, such as cooling, increase in pH and decrease in Cl^- concentration must occur in order to promote gold precipitation. Gold was probably transported as $AuCl^{2-}$ in highly saline magmatic fluids, formed either directly from an ascending magmatic fluid or by separation of two immiscible phases. Gold was precipitated, together with pyrite and minor chalcopyrite, by cooling within the porphyry system. The magmatic-dominated mineralising fluid also migrated laterally and vertically along fractures to deposit gold with minor sulphide minerals in the adjacent and overlying rocks.

There is potential for the discovery of a relatively large, low-grade gold mineralisation, associated with Pb-Zn-Cu-Mo, in southeastern Tasmania. This is supported by:

(a) The relatively shallow level of intrusion, of about five kilometres. The low pressure of emplacement has resulted in locally intense fracturing and subsequent formation of hydrothermal quartz ± pyrite veins and breccias (i.e. with the change of pressure from lithostatic to hydrostatic) in both the porphyries and the overlying Permian sediments. The increased permeability of the rocks due to fracturing and brecciation facilitated an increased flow of mineralised fluids within both the porphyries and the sediments.

(b) The formation of porphyries in the Cygnet area by multiple intrusive events, which appears to favour the formation of large Au-Cu mineralised alkaline porphyries (Müller and Groves, 1997).

(c) The occurrence of similar styles of alteration and gold mineralisation in other areas of Tasmania, such as at Snug and Granton.

(d) The occurrence of a similar range of host rocks, mineralisation styles and alteration types, to those in other Au-mineralised porphyries throughout the world (Müller and Groves, 1997).

Geophysical surveys suggest that unusually magnetic rocks of unknown nature underlie Port Cygnet. These may well represent Proterozoic or Ordovician limestone or dolostone sequences (as occur in other parts of southeastern Tasmania) containing abundant pyrrhotite due to alteration by the Cretaceous intrusive rocks. A similar alteration type at a small scale is seen in the fossiliferous and dolomite-bearing mudstone in the Parmeener Supergroup. This would be a very attractive target for exploration.

The Cape Portland complex in northeast Tasmania also contains Cretaceous alkaline intrusive rocks and lavas, which have not been tested for mineral potential. Considering that this complex is geochemically similar and of the same age as the Cygnet complex, the potential for gold mineralisation must be high.

Acknowledgments

Les Hey and Richie Woolley are thanked for assistance with chemical, XRF and XRD analyses, Phil Jones for giving us a tour of the prospects, and Geoff Green for critical reviews.

References

ANTHONY, J. W.; BIDEAUX, R. A.; BLADH, K. W.; NICHOLS, M. C. 1995. *Handbook of Mineralogy. Volume 2. Silica, silicates*. Mineral Data Publishing : Tucson.

BACON, C. A. 1992. Industrial minerals in Tasmania — Kaolin. *Report Department of Mines Tasmania* 1992/07.

BAILEY, D. K. 1974. Continental rifting and alkaline magmatism, *in:* SØRENSEN, H. (ed.). *The alkaline rocks*. 148–159. Wiley : London.

BARNES, H. L. 1979. *Geochemistry of hydrothermal deposits (2nd Edition).* Wiley : New York.

BERKMAN, D. A. 1982. Field geologists manual. *Monograph Serial Australasian Institute of Mining and Metallurgy* 9.

BODNAR, R. J. 1993. Revised equation and table for determining the freezing-point depression on H_2O-NaCl solutions. Geochimica et Cosmochimica Acta 57:683.

BOTTRILL, R. S. 1995*a*. A summary of mineral exploration in the Cygnet–Kettering area. *Record Geological Survey Tasmania* 1995/09.

BOTTRILL, R. S. 1995*b*. *A compilation of unpublished reconnaissance mineral exploration data for the Cygnet area, undertaken by BHP*. (Unpublished) [TCR 95-3742].

BOTTRILL, R. S. 1995*c*. *Report on a diamond drill hole (LS2) at the Mt Mary mine, Cygnet*. Geological Survey Tasmania [TCR 95-3743].

BROWN, I. A. 1930. The geology of the south coast of New South Wales. Part iii. The monzonitic complex of the Mount Dromedary district. *Proceedings Linnaean Society NSW* 55:637–698.

BURRETT, C. F.; MARTIN, E. L. (ed.) 1989. Geology and Mineral Resources of Tasmania. *Special Publication Geological Society of Australia* 15.

CIVETTA, L.; INNOCENTI, F.; MANETTI, P.; PECCERILLO, A.; POLI, G. 1981. Geochemical characteristics of potassic volcanics from Mts Ernici (Southern Latium, Italy). *Contributions to Mineralogy and Petrology* 78:37–47.

CLARKE, M. J.; FORSYTH, S. M. 1989. Late Carboniferous–Triassic, *in:* BURRETT, C. F.; MARTIN, E. L. (ed.). Geology and Mineral Resources of Tasmania. *Special Publication Geological Society of Australia* 15:293–338.

COLLINS, P. L. F. 1979. Gas hydrates in CO_2-bearing fluid inclusions and the use of freezing data estimation of salinity. *Economic Geology* 74:1435–1444.

CROFT, P. E. 1970. *Qualitative spectrographic analysis of soil and sediment samples*. Robertson Geotechnical Services Limited [TCR 71-835].

DEER, W. A.; HOWIE, R. A.; ZUSSMAN, J. 1963. *Rock forming minerals. Volume 3: Sheet Silicates*. Wiley : New York.

DEWITT, E.; FOORD, E. E.; ZARTMAN, R. E.; PEARSON, R. C.; FOSTER, F. 1996. Chronology of Late Cretaceous igneous and hydrothermal events at the Golden Sunlight gold-silver breccia pipe, southwestern Montana. *Bulletin US Geological Survey* 2155.

EDWARDS, A. B. 1947. Alkali hybrid rocks of Port Cygnet, Tasmania. *Proceedings Royal Society of Victoria* 58:81–115.

EVERNDEN, J. F.; RICHARDS, J. R. 1962. Potassium-argon ages in eastern Australia. *Journal Geological Society Australia* 9:1-49.

FALVEY, D. A.; MUTTER, J. C. 1981. Regional plate tectonics and the evolution of Australia's passive continental margins. *BMR Journal Australian Geology and Geophysics* 6:1–29.

FARMER, N. 1981. Geological atlas 1:50 000 series. Sheet 88 (8311N). Kingborough. *Department of Mines, Tasmania*.

FARMER, N. 1985. Geological atlas 1:50 000 series. Sheet 88 (8311N). Kingborough. *Explanatory Report Geological Survey Tasmania*.

FARMER, N.; CLARKE, M. J. 1985. A diamond drill hole at Little Peppermint Bay, Woodbridge. *Unpublished Report Department of Mines Tasmania* 1985/24.

FORD, R. J. 1983. *The alkaline rocks of Port Cygnet, Tasmania*. Ph.D. Thesis, University of Tasmania.

FORD, R. J. 1989. Cretaceous alkaline rocks, *in:* BURRETT, C. F.; MARTIN, E. L. (ed.). Geology and Mineral Resources of Tasmania. *Special Publication Geological Society of Australia* 15:381–383.

GAMMONS, C. H.; WILLIAMS-JONES, A. E. 1997. Chemical mobility of gold in the porphyry-epithermal environment. *Economic Geology* 92:45–59.

GOFF, F.; STIMAC, J. A.; LAROCQUE, A. C. L.; *et al.* 1994. Gold degassing and deposition at Galeras Volcano, Columbia. *GSA Today* 4:241–247.

HEDENQUIST, J. W. 1995. The ascent of magmatic fluid: Discharge versus mineralisation. *Short Course Mineralogical Association of Canada* 23:263–289.

HENDERSON, Q. J. 1936. Notes on gold prospects between Petchey's Bay and Lymington. *Unpublished Report Department of Mines Tasmania* 1936:9.

HERGT, J. M.; MCDOUGALL, I.; BANKS, M. R.; GREEN, D. H. 1989. Jurassic dolerite, *in:* BURRETT, C. F.; MARTIN, E. L. (ed.). Geology and Mineral Resources of Tasmania. *Special Publication Geological Society of Australia* 15:375–381.

HERZBERGER, G. A. 1974. Molong–South Coast Anticlinal Zone, southern section, *in:* MARKHAM, N. L.; BASDEN, H. (ed.). *The Mineral Deposits of New South Wales*. 246–262. Geological Survey of New South Wales.

HIGHLEY, D. E.; SLATER, D.; CHAPMAN, G. R. 1988. Geological occurrence of elements consumed in the electronics industry. *Transactions Institution of Mining and Metallurgy* 97:C34–42.

HOURDIN, J. 1971. *EL23/71, Cygnet*. Pechiney (Australia) Exploration Pty Ltd [TCR 71-775].

HUGHES, T. D. 1950. Woodbridge Area School. *Unpublished Report Department of Mines Tasmania* 1950: 83.

JACQUES, A. L.; CREASER, R. A.; FERGUSON, J.; SMITH, C. B. 1985. A review of the alkaline rocks of Australia. *Transactions Geological Society South Africa* 88:311–334.

JONES, P. A. 1985. *Progress report, October 1984 to September 1985, EL36/82, Cygnet, Tasmania*. Cyprus Minerals Australia Company [TCR 85-2481].

JONES, P. A. 1986. *Progress report, October 1985 to September 1986, Cygnet EL36/82, Tasmania*. Cyprus Minerals Australia Company [TCR 86-2601].

JONES, P. A. 1987*a*. *Progress report, October 1986 to October 1987, Cygnet EL36/82, Tasmania*. Cyprus Minerals Australia Company [TCR 87-2743].

JONES, P. A. 1987*b*. *Progress report, 12 months to December 1986, Kettering EL23/83, Tasmania*. Phil Jones and Associates P/L [TCR 87-2638].

JONES, P. A. 1988. *Progress report, October 1987 to October 1988, Exploration Licence 36/82, Cygnet, Tasmania*. Cyprus Gold Australia Corporation [TCR 88-2880].

LANG, J.; STANLEY, C.; THOMPSON, J. 1994. Porphyry copper-gold deposits related to alkalic igneous rocks in the Triassic-Jurassic arc terranes of British Columbia. *Digest Arizona Geological Society* 20:219–236.

LEAMAN, D. E.; NAQVI, I. H. 1967. Geology and geophysics of the Cygnet district. *Bulletin Geological Survey Tasmania* 49.

LEAMAN, D. E. 1975. Magnetic survey, Port Cygnet. *Technical Report Department of Mines Tasmania* 20:134–135.

LIGAND, Z.; GANGS, L.; HUAMBO, Z.; ZHENSHENG, C. 1989. Oxygen isotope fractionation in the quartz-water-salt system. *Economic Geology* 84:1643–1650.

MCDOUGALL, I.; LEGGO, P. J. 1965. Isotopic age determination on granitic rocks from Tasmania. *Journal Geological Society Australia* 12:295–332.

MÜLLER, D.; GROVES, D. I. 1997. *Potassic igneous rocks and associated gold-copper mineralization*. Springer : Berlin.

OHMOTO, H. 1986. Stable isotope geochemistry of ore deposits, *in:* VALLEY, J. W.; TAYLOR, H. P. Jr.; O'NEIL, J. R. (ed.). Stable isotopes in high temperature geological processes. *Reviews in Mineralogy* 16:491–559.

PEARCE, J. A.; CANN, J. R. 1973. Tectonic setting of basic volcanic rocks determined using trace element analyses. *Earth Planetary Science Letters* 19:290–300.

PONTIFEX AND ASSOCIATES, 1985. *Mineralogical Report No. 4571*. Pontifex and Associates Pty Ltd [TCR 86-2601].

ROCK, N. M. S. 1978. Petrology and petrogenesis of the Monchique Alkaline complex, southern Portugal. *Journal Petrology* 19:171–214.

ROCK, N. M. S. 1991. *Lamprophyres*. Blackie : London.

ROSS, C. S. 1946. Sauconite, a clay mineral of the montmorillonite group. *American Mineralogist* 31:411–421.

SCOTT, J. B. 1927. Cygnet gold mine, Cygnet. Preliminary report. *Unpublished Report Department of Mines Tasmania* 1927:168–169.

SEAMON, W. H. 1890. The zinciferous clays of southwest Missouri. *American Journal of Science* 39:38–42.

SHINOHARA, H.; IIYAMA, J. T.; MATSUO, S. 1989. Partition of chlorine compounds between silicate melt and hydrothermal solutions: I. Partition of NaCl-KCl. *Geochimica et Cosmochimica Acta* 53:2617–2630.

SHIROZU, H. 1974. Clay minerals in altered wall rocks of the Kuroko-type deposits. *Special Issue Mining Geology* 6:303–310.

SILLITOE, R. H. 1979. Some thoughts on gold-rich porphyry copper deposits. *Mineralium Deposita* 14:161–174.

SILLITOE, R. H. 1995. The influence of magmatic-hydrothermal models on exploration strategies for volcano-plutonic arcs, *in:* THOMPSON, J. F. H. (ed.). Magma, fluids, and ore deposits. *Short Course Series Mineralogical Association of Canada* 23.

SILLITOE, R. H.; BONHAM, H. F. 1990. Sediment-hosted gold deposits: Distal products of magmatic-hydrothermal systems. *Geology* 18:157–161.

SMITH, J. H., 1899. Report on the discovery of gold at Port Cygnet. *Secretary of Mines Report Tasmania* 1898–99:xiii–xv.

SØRENSEN, H. 1974. Regional distribution and tectonic relations: Introduction, *in:* SØRENSEN, H. (ed.). *The alkaline rocks*. 145–147. Wiley : London.

SOURIRAJAN, S.; KENNEDY, G. C. 1962. The system H_2O-NaCl at elevated temperatures and pressures. *American Journal of Science* 260:115–141.

STANTON, R. L. 1972. *Ore Petrology*. McGraw-Hill : New York.

STEPHENS, T. 1869. Notes on the occurrence of gold at Port Cygnet. *Papers and Proceedings Royal Society of Tasmania* 1869:55–57.

STERNER, S. M.; HALL, D. L.; BODNAR, R. J. 1988. Synthetic fluid inclusions; V, Solubility relations in the system NaCl-KCl-H_2O under vapor-saturated conditions. *Geochimica et Cosmochimica Acta* 52:989–1005.

STRECKEISEN, A. L. 1973. Plutonic rocks. Classification and nomenclature recommended by the IUGS Subcommission on the Systematics of Igneous Rocks. *Geotimes* 18(10):26–30.

SUTHERLAND, F. L. 1977. Zeolite minerals in the Jurassic dolerites of Tasmania: their use as possible indicators of burial depth. *Journal Geological Society Australia* 24:171–178.

TAYLOR, H. P. Jr. 1979. Oxygen and hydrogen isotope relationships in hydrothermal mineral deposits, *in:* BARNES, H. L. (ed.). *Geochemistry of hydrothermal ore deposits*. 236–277. Wiley : New York.

THOMPSON. A. J. B.; THOMPSON, J. F. H. (ed.). 1996. Atlas of alteration. *Special Publication Geological Association of Canada, Mineral Deposits Division* 6.

THUREAU, G. 1881. Port Cygnet, Oyster Cove and Sandfly: Report on the gold deposits at and in the vicinity of Lymington. *House of Assembly Paper Tasmania* 1881 (109).

TWELVETREES, W. H. 1902. Report on gold and coal at Port Cygnet. *Report Secretary of Mines Tasmania* 1901–02:260–268.

TWELVETREES, W. H. 1903. A geological excursion to Port Cygnet in connection with the Australasian Association for the Advancement of Science, 1902. *Report Secretary of Mines Tasmania* 1902–03:25–32.

TWELVETREES, W. H. 1907. Report on gold at Port Cygnet and Wheatley's Bay, Huon River. *Report Secretary of Mines Tasmania* 1907:xxxiii–xliv.

TWELVETREES, W. H.; PETTERD, W. F. 1899. On haüyne-trachyte and allied rocks in the districts of Port Cygnet and Oyster Cove. *Report Secretary of Mines Tasmania* 1898–99:xix–xxvi.

VAN KOOTON, G. K. 1980. Upper mantle enrichment and generation of ultrapotassic magmas beneath the Sierra Nevada, California. *Abstracts and Programs Geological Society America* 12:157.

VEEVERS, J. J.; EITTREIM, S. L. 1988. Reconstruction of Antarctica and Australia at breakup (95 ± 5 Ma) and before rifting (160 Ma). *Australian Journal of Earth Sciences* 35:355–362.

VILA, T.; SILLITOE, R. H.; BETZHOLD, J.; VITERI, E. 1991. The porphyry gold deposit at Marte, northern Chile. *Economic Geology* 86:1271–1286.

VLASOV, K. A. (ed.). 1966. *Geochemistry and mineralogy of rare elements and genetic types of their deposits. Volume II. Mineralogy of rare elements*. Israel Program for Scientific Translations : Jerusalem.

WALL, J. R. 1980. *Geological report of EL8/80*. Golden Apple Mining Syndicate [TCR 81-1527].

WALL, J. R. 1981. *Final report of EL8/80 to the Director of Mines 1980. Mineral Exploration Licence, Cygnet*. Golden Apple Mining Syndicate [TCR 82-1799].

[8 November 1999]

APPENDIX 1

Gold prospects, Cygnet–Kettering area (adapted from the Mirloch database)

Ref. no	Name and Reference	Main Comm.	Other	AMG-E	AMG-N	Status	Host	Age	Style	Explor.
88001	Agnes Rivulet TCR92-3339, 93-3503	Au		506300	5221400	8	9	9	7	12345
88002	Black Jack Ridge (Central) Thureau (1881); Farmer (1985)	Au, Ag	As, Cu, Zn	502950	5217500	4	78	7	34	1
88003	Coads Adit Jones (1987*a*); Twelvetrees (1902)	Au	Pb, Zn	503650	5219300	6	9	7	3	1235
88004	Forsters Rivulet; Lymington Alluv. Jones (1986)	Au		506000	5217200	8	9	9	7	13
88005	Kings Hill Thureau (1881); Jones (1986); Twelvetrees (1907); Jones (1985)	Au, Ag, Cu	Ba, Pb, Zn, As	504200	5219800	4	9	7	3	13
88006	Little Oyster Cove Creek Goldfield Jones (1987*a*)	Au		518300	5225700	8	9	9	7	1235
88007	Livingstone Mine (Tobys Hill) Jones (1987*b*); Thureau (1881)	Au	Pb, Zn, Cu, As	508300	5221900	4	89	7	23	1
88008	Mount Mary gold mine ; Cygnet GM Jones (1986); Farmer (1985); Farmer (1981); Twelvetrees (1902); Twelvetrees (1907)	Au, Ag, Pb	Zn, Cu, As, Hg	505500	5220500	4	89	7	3	1235
88009	Nicholls Rivulet Goldfield Jones (1986), Jones (1988); Scott (1927); Twelvetrees (1902); Twelvetrees (1907)	Au		512400	5225600	8	9	9	7	1235
88010	Riseleys Creek; Wheatleys Bay Jones (1987*b*)	Au		502000	5217200	8	9	9	7	1
88011	Unnamed Jones (1985); Twelvetrees (1907)	Au		502500	5217500	6	7	7	?	1
88012	Unnamed Jones (1986)	Au		504000	5220300	6	89	7	?	1
88013	Unnamed Jones (1986)	Au		502700	5220800	6	89	7	?	1
88014	Unnamed Jones (1986)	Au		501500	5221300	6	89	7	?	1
88015	Unnamed Jones (1986)	Au		501500	5222900	6	89	7	?	1
88016	Dickers Pr Jones (1986)	Au		503300	5218000	6	8	7	?	1
88017	Golden Valley Creek (Central) Henderson (1936)	Au		505000	5221200	8	9	9	7	1
88018	Kubes Pr Thureau (1881)	Au		502000	5219000	6	8	7	?	1
88019	Kubes Rvt (Kubes Bay) Henderson (1936); Twelvetrees (1902)	Au		501700	5217100	8	9	0	7	1
88020	Forsters Rt B Twelvetrees (1907)	Au		505500	5217300	4	9	7	?	1
88021	Forsters Rt C Smith (1899), p.13; Thureau (1881)	Au		504500	5218000	8	9	9	7	1
88023	Martins Show ML Plans; Thureau (1881)	Au	Pb	505100	5218600	6	9	7	4	1
88024	Murphys Section Smith (1899), Twelvetrees (1902)	Au		504800	5220000	6	9	7	4	1
88025	Petcheys Bay Smith (1899), Twelvetrees (1902)	Au		500800	5217800	8	9	9	7	1
88026	Unnamed Twelvetrees (1907)	Au	Ag	519500	5221300	6	9	7	7	1
88027	Unnamed Hughes (1950)	Au		506300	5219800	6	9	9	7	1

Ref. no	Name and Reference	Main Comm.	Other	AMG-E	AMG-N	Status	Host	Age	Style	Explor.
88047	Black Jack Ridge (S) Farmer (1981)	Au		503150	5217200	6	89	7	34	1
88048	Black Jack Ridge (N) Jones (1987*a*)	Au		503100	5217950	6	89	7	34	123
88049	Black Jack Ridge (E) Jones (1987*a*)	Au		502700	5217500	6	89	7	34	123
88050	Black Jack Ridge (W) Jones (1987*a*)	Au		503100	5217600	6	89	7	34	123
88058	Golden Valley Creek E Jones (1987*a*)	Au		505500	5221700	6	9	9	7	1
88059	Golden Valley Creek W Thureau (1881)	Au		504000	5220900	6	9	9	7	1
88060	Unnamed Thureau (1881)	Au		504000	5220300	6	9	9	7	1
88061	Unnamed Thureau (1881)	Au		504250	5220700	6	9	9	7	1
88062	Unnamed Thureau (1881)	Au		508600	5221500	6	9	9	7	1
88063	Lymington Thureau (1881)	Au		504000	5216300	6	89	7	4	1
88064	Little Oyster Cove Twelvetrees (1907)	Au		521200	5224600	6	89	7	4	1
88065	Murphys Jones (1987*a*)	Au, Ag, Cu		504000	5217000	6	8	7	4	1

Codes and explanation

Status:
0: Operating mine
1: Non-operating mine, reserves known
2: Non-operating mine, reserves unknown
3: Abandoned mine, reserves known
4: Abandoned mine, reserves unknown
5: Abandoned mine, mined out
6: Prospect — explored
7: Prospect — unexplored
8: Mineralised area
9: Mineral occurrence

Host rock:
0: Precambrian sequences
1: Cambrian sedimentary sequences.
2: Cambrian igneous sequences
3: Mount Read Volcanics & correlates
4: Owen Conglomerate, Moina Sandstone & correlates
5: Gordon Limestone, Eldon Group & correlates
6: Mathinna Beds
7: Devonian Granite
8: Parmeener Supergroup
9: Jurassic–Cainozoic sequences

Mineralisation age:
0: Not determined
1: Precambrian
2: Eocambrian–Early Cambrian
3: Mid–Late Cambrian
4: Ordovician–Early Devonian
5: Late Devonian (granite)
6: Permo-Triassic
7: Jurassic-Cretaceous
8: Tertiary
9: Quaternary

Mineralisation style:
0: Volcanic Massive Sulphide
1: Stratiform
2: Vein
3: Stockwork
4: Disseminated
5: Replacement
6: Pipe
7: Placer
8: Residual
9: Other (note in Refs)

Exploration:
0: Nil
1: Prospecting
2: Geological mapping
3: Geochemical survey
4: Geophysical survey
5: Drilling

References:
TCR: Tasxplor report
UR: Unpublished MRT report
OS: Old Series Mines Department report
ER: Mines Department Explanatory Report

APPENDIX 2

Description of individual gold prospects/mines

Livingstone Mine

Workings at the Livingstone mine (dating from 1898) include a shaft to 20 m and two adits, one to 120 m, both of which apparently failed to reach the reef exposed at the shaft (Jones, 1987*a*). Grades of >90 g/t Au were reported, but were inconsistent; some seven tons of ore was reportedly extracted, but this only produced about 30 g of gold (Twelvetrees, 1902).

A small vertical zone of sheeted pyritic quartz veins, ~1 m wide, occurs at the contact of a small quartz syenite body and fine-grained sandstone of the Woody Island Siltstone. The Bundella Formation overlies the Woody Island Siltstone just above the workings. In contrast to the description of Twelvetrees (1907) as "the only lode found entirely in porphyry", some of the mineralisation is hosted in the sedimentary wall rocks. The siltstone/sandstone is hematitic and feldspathic and carries some disseminated gold (in fine quartz veinlets?). The quartz zone is terminated to the northeast by small, later, sanidine-garnet-hauyne syenite and hornblende-sanidine-oligoclase syenite dykes. Its southwestern termination is uncertain, and it may pinch out.

Mt Mary Mine

The Mt Mary or Cygnet gold mine was the largest operation in the area, with ten shafts, one 64 m deep, and drives to 46 m long, over an area of 450 × 60 m (Scott, 1927; Jones, 1987*a*). Grades reported were very erratic, with up to 100 g/t Au and 210 g/t Ag being recorded. The mine was worked intermittently from 1898 to 1927, but no production was reported. The workings are now mostly collapsed or at least partly filled with rubbish.

Gold occurs mostly in sheared mudstone and diamictites of the Truro Tillite, and in steeply-dipping dykes of quartz syenite. These zones contain some small, siliceous, ferruginous breccias and veins, cutting both the tillite and porphyries. These breccias contain variable proportions of chalcedony, quartz, K-feldspar (adularia), opal, hematite, pyrite, plumbian jarosite, goethite and siderite, with up to 20 g/t Au. Exposed in these zones in the drill cores are argillised breccia zones, mostly in mudstone, containing Zn-smectites, kaolinite and plumbogummite.

Some highly siliceous breccias occur near a microwave radio tower south of the Mt Mary mine. These breccias are gold-enriched, and consist of chert, vein quartz and minor limonite after pyrite.

Several drill cores, logged by Jones (1987*a*), are available. These were sampled, re-assayed and re-logged by the authors (Appendix 10).

Black Jack prospect

These workings consist of a large number of pits and small shafts over an area of about 0.5 square kilometres (Jones, 1987*a*). One diamond drill core is available (Jones, 1987*a*), and was sampled, re-assayed and re-logged by the authors (Appendix 10).

Gold mostly occurs in pyritic fossiliferous mudstone of the Bundella Formation, adjacent to a large body of quartz monzonite, dipping steeply to the east. Some small undersaturated sanidine-garnet syenite dykes cutting the quartz monzonite are present. Small patches of gossanous rocks occur in the mudstone, and these contain adularia, hematite, pyrite, quartz, chalcedony and goethite.

Kings Hill workings

These include several shallow shafts and pits near the summit of Kings Hill (Jones, 1987*a*). They are situated near the centre of a large body (a laccolith?) of xenolith-rich coarse-grained quartz monzonite porphyry. The largest workings are in a quartz-pyrite rich breccia pipe which carries little gold. There was no recorded production.

The stockworks consists of veins of quartz ± pyrite ± feldspars ± trace amphibole and phengitic mica. These crosscut a pyritic orthoclase-rich rock, which appears to represent an altered quartz monzonite, sometimes with a completely silicified matrix. Away from the breccia pipes, the host quartz monzonite is porphyritic and pyritic, with plagioclase, sanidine, hornblende and clinopyroxene phenocrysts, quartz-muscovite clots and minor quartz veins. There are locally abundant heterolithic xenoliths of quartzite, amphibolite and granulite (including biotite-pyroxenite rocks) and minor late dykes of undersaturated syenite with coarse sanidine phenocrysts in a fine-grained felsic groundmass.

Minor opalisation accompanying the mineralisation may be due to alteration or weathering. Pyrite is largely altered to jarosite.

Coads Adit

This adit is probably about 25 m long and lies within the same pyritic sanidine-plagioclase quartz monzonite body as the Kings Hill (and perhaps Black Jack) workings. It intersected some small vuggy quartz veins, containing minor gold and some anomalous Cu and Mo. No production was recorded.

APPENDIX 3

Sample details

Reg. No.	Name	Minerals			Modifiers			Unit name	AMG Ref. mE	mN	Locality	Treatment	Keywords	Comments	Au
C107612	porphyry	san	pl	py			Si		503000	5217500	Black Jack	PT			
C107613	mudstone	hem			sand	cherty		Bundella	503000	5217500	Black Jack	PT, XR			
C107614	porphyry	san					Si		504400	5219700	Kings Hill				
C107615	porphyry	san	py	pl	xenl	brec	Si		504350	5219800	Kings Hill	PT, CA		house site	
C107616	porphyry	san			xenl		Si		504350	5219800	Kings Hill			house site	
C107617	vein	qtz							504250	5219780	Kings Hill	PT, CA, FI		in san porphyry	
C107618	gypsum								504350	5219800	Kings Hill			in san porphyry	
C107619	breccia	qtz			syen				504250	5219780	Kings Hill				
C107620	breccia	qtz	am	kf	syen				504150	5219760	Kings Hill	PT, CA		in san porphyry	
C107621	breccia	qtz			syen				504200	5219750	Kings Hill	FI			
C107622	syenite	py	am	cpx	xenl	brec	Si		504100	5219760	Kings Hill	PT			
C107623	gossan	qtz	kf	opl	sx	chert			505500	5220480	Mt Mary	PT, PA, CA, XR	py	float	7.6
C107624	tillite	py	opl		brec	pebb	sifd	Truro tillite	505500	5220480	Mt Mary	PT, CA, XR	chalcedony	float	0.2
C107625	tillite							Truro tillite	505500	5220480	Mt Mary			float	
C107626	porphyry	ep	pl	py	pebb	green	Si		505500	5220480	Mt Mary	PT		float	
C107627	vein	qtz							503600	5219350	Coads Adit	PT, CA		in san porphyry	0.4
C107651	vein	qtz							508300	5221900	Livingstone Mine	PT, CA, FI		in san porphyry	0.3
C107652	mudstone	hem	kf		red	cherty	silic	Woody Island	508300	5221900	Livingstone Mine	PT, CA			
C107653	porphyry	san	hyn				SiUS	Woody Island	508300	5221900	Livingstone Mine	PT			
C107654	mudstone	kaol			silt	sili	vein	Woody Island	508300	5221900	Livingstone Mine	PT, CA, XR			0.4
C107655	mudstone				sili			Woody Island	508300	5221900	Livingstone Mine				
C107656	syenite	san	aeg	bt	glass		SiUS		505500	5220500	Mt Mary Road	PT			
C107657	contact	ep	kf	zeol	altd	cherty			505500	5220500	Mt Mary Road	PT, XR			
C107658	porphyry	hyn	aeg	bt	altd	fgnd	SiUS		505500	5220500	Mt Mary Road	PT			
C107659	chalcedony	qtz	py			vugg			505350	5220400	Mt Mary Mine	PT, CA, FI			2.3
C107660	tillite	hem			red	sand	vein	Truro tillite	505350	5220400	Mt Mary Mine	PT, CA			
C107661	breccia	hem	py	kf	red				505350	5220400	Mt Mary Mine	PT, CA		float	3.8
C107662	tillite				pebb	sand	altd	Truro tillite	505350	5220400	Mt Mary Mine	PT, XR			
C107663	breccia			lim					505350	5220400	Mt Mary	CA			1.5
C107664	breccia	qtz		lim					505200	5220250	Mt Mary	CA		radio tower	3.3
C107665	vein	qtz							505200	5220250	Mt Mary	CA, FI		radio tower	0.1
C107666	pyrite								504200	5219750	Kings Hill	CA		breccia pipe	
C107667	breccia	qtz	py		syen				504200	5219750	Kings Hill	CA, FI		breccia pipe	
C107668	syenite	kaol	san		altd	Si			504200	5219750	Kings Hill	PT	jarosite	breccia pipe	
C107669	breccia	qtz	py	jar	syen				504200	5219750	Kings Hill	CA, FI		breccia pipe	
C107670	granulite	di	bt	hbd	xenl	altd			504120	5219760	Kings Hill	PT, PA, XR		hilltop	
C107671	syenite	py							504120	5219760	Kings Hill			hilltop	
C107672	porphyry	san					SiUS		504250	5219760	Kings Hill				
C107673	mudstone				lim	foss		Bundella	502950	5217550	Black Jack				

Reg. No.	Name	Minerals			Modifiers			Unit name	AMG Ref. mE	mN	Locality	Treatment	Keywords	Comments	Au
C107674	gossan								502900	5217470	Black Jack	CA			2.1
C107675	vein	qtz	lim	hem					502900	5217470	Black Jack	PT, CA	chalcedony		3.7
C107676	syenite				red	brec	Si		504200	5219750	Kings Hill	CA, XR	jar	breccia pipe	0.06
C107677	tillite				hfld	pebb		Truro tillite	518250	5224300	Groombridge Road	PT			
C107678	dolerite	am	bt		vein	altd		Jurassic	518250	5224300	Groombridge Road	PT			
C107679	porphyry	san	pl		wthd		SiUS		518250	5224300	Groombridge Road	PT			
C107680	dolerite	qtz	bt	aeg	altd			Jurassic	506600	5219300	Regatta Point	PT			
C107681	porphyry	san	aeg	adr			SiUS		506900	5217600	Langdons Point	PT	melanite		
C107682	porphyry	san	pl	hbd	xenl				519750	5222100	Helliwells Point	PT			
C107683	porphyry		pl	hbd	xenl				519750	5222100	Helliwells Point	PT			
C107684	porphyry		pl	hbd	xenl				519750	5222100	Helliwells Point	PT, XR			
C107685	porphyry		pl	hbd	xenl				519750	5222100	Helliwells Point	PT			
C107686	dolerite	am	bt	opx	altd	vein		Jurassic	518250	5224300	Groombridge Road	PT			
C107687	dolerite	am	kf	py	altd	vein		Jurassic	518250	5224300	Groombridge Road	PT			
C107688	porphyry	san	pl	hbd			SiUS		518250	5224300	Groombridge Road	PT	melanite		
C107689	porphyry	san	pl	hbd		xenl	SiUS		518250	5224300	Groombridge Road	PT			
C107701	mudstone							Truro tillite	505500	5220480	Mt Mary CT87-20	CA		12-14 m, lim clasts	
C107702	mudstone							Truro tillite	505500	5220480	Mt Mary CT87-20	CA		12-14 m, non lim	0.2
C107703	mudstone							Truro tillite	505500	5220480	Mt Mary CT87-20	PT		22.5, lim	
C107704	mudstone							Truro tillite	505500	5220480	Mt Mary CT87-20	CA		18.4-19.5, limonite	
C107705	mudstone							Truro tillite	505500	5220480	Mt Mary CT87-20	CA		18.4-19.4, non-lim	
C107706	mudstone							Truro tillite	505500	5220480	Mt Mary CT87-20	CA		30-31, lim	
C107707	mudstone							Truro tillite	505500	5220480	Mt Mary CT87-20	PT		43.4, bt clasts	
C107708	mudstone	lim			vein			Truro tillite	505500	5220480	Mt Mary CT87-20	CA		47.5, lim =107795	3.1
C107709	mudstone							Truro tillite	505500	5220480	Mt Mary CT87-20	CA		47.5, bleached	
C107710	mudstone				brec			Truro tillite	505500	5220480	Mt Mary CT87-20			47.5, lim	
C107711	porphyry	san	py				SiUS		505500	5220480	Mt Mary CT87-20	PT		51.2, Si-undersat	
C107712	porphyry	san	py				SiUS		505500	5220480	Mt Mary CT87-20	CA		51.2, Si-undersat	
C107713	porphyry								505500	5220480	Mt Mary CT87-20	CA		56.3, no lim	
C107714	porphyry	san	adr	hbd			SiUS		505500	5220480	Mt Mary CT87-20	PT, XR		64.2, Si-undersat	
C107715	hornfels				pebb			Truro tillite	505500	5220480	Mt Mary CT87-20			65 m	
C107717	mudstone	ep	hem	sme	pebb			Truro tillite	505500	5220480	Mt Mary CT87-20	PT, XR		69 m	
C107718	mudstone	zeol						Truro tillite	505500	5220480	Mt Mary CT87-20	XR		67 m	
C107719	mudstone	zeol						Truro tillite	505500	5220480	Mt Mary CT87-20	CA		68 m	
C107720	mudstone							Truro tillite	505500	5220480	Mt Mary CT87-20	CA, XR		80.7, non-lim	
C107721	porphyry	py			Si				505500	5220480	Mt Mary CT87-20	PT, CA		83 m	
C107722	porphyry	san	pl	py					505500	5220480	Mt Mary CT87-20	PT	adr	83 m	
C107723	porphyry	san	pl	ep	sx				505500	5220480	Mt Mary CT87-20	PT	allanite	88 m	
C107724	porphyry				sx				505500	5220480	Mt Mary CT87-20	CA		88 m	
C107725	porphyry				sx				505500	5220480	Mt Mary CT87-20	CA		87 m	0.2
C107726	porphyry	kf	sme	py					505500	5220480	Mt Mary CT87-20	XR		86 m	
C107727	porphyry	san	pl	cpx	sx				505500	5220480	Mt Mary CT87-20	PT, CA		99 m	
C107728	porphyry	san	pl	ep	sx				505500	5220480	Mt Mary CT87-20	PT, CA		105 m	

Reg. No.	Name	Minerals			Modifiers			Unit name	AMG Ref. mE	mN	Locality	Treatment	Keywords	Comments	Au
C107729	porphyry	kf	cpx	ze	altd				505500	5220480	Mt Mary CT87-20	PT, XR		116 m	
C107730	breccia	opl	py	qtz	sili	chert			505500	5220480	Mt Mary CT87-20	PT, CA	chalcedony	124 m	
C107731	mudstone	kaol			sili	brec		Truro tillite	505500	5220480	Mt Mary CT87-20	PT		126 m	
C107732	clay	lim							505600	5220460	Mt Mary CT87-1	CA		2 m	
C107733	mudstone				clay	wthd		Truro tillite	505600	5220460	Mt Mary CT87-1	CA		3 m	
C107734	mudstone	lim				wthd		Truro tillite	505600	5220460	Mt Mary CT87-1	CA		9 m	
C107735	porphyry	lim				wthd			505600	5220460	Mt Mary CT87-1	CA		14 m	
C107736	porphyry				clay	wthd			505600	5220460	Mt Mary CT87-1	CA		15 m	
C107737	clay	lim			green				505600	5220460	Mt Mary CT87-1	CA, XR		22 m	0.2
C107738	breccia	hem	qtz	py	wthd	chert			505600	5220460	Mt Mary CT87-1	CA, PT		22 = 107913	2
C107739	mudstone	sme			clay	whit		Truro tillite	505600	5220460	Mt Mary CT87-1	CA, XR		22.9 = 107914	0.1
C107740	limonite								505600	5220460	Mt Mary CT87-1	CA		34 m	
C107741	porphyry	san					SiUS		505600	5220460	Mt Mary CT87-1	CA		34 m	
C107742	breccia	san	py		porph	must			505600	5220460	Mt Mary CT87-1	PT		43 m	
C107743	mudstone				grey			Truro tillite	505600	5220460	Mt Mary CT87-1	CA		39 m	
C107744	contact	kf	pl	qtz	altd	sx			505600	5220460	Mt Mary CT87-1	PT, XR	sl, cpy, po, am	56 m	
C107745	lamprophyre?								505600	5220460	Mt Mary CT87-1	CA		55 m	0.3
C107746	porphyry	pl	san		sx	Si			505600	5220460	Mt Mary CT87-1	PT	hbd, ep	63 m	
C107747	contact	kf	am	pl		altd			505540	5220480	Mt Mary CT87-19	PT, XR	sid, cpx	8 m	
C107748	porphyry	san			mafic				505540	5220480	Mt Mary CT87-19	PT, XR		9 m	
C107749	porphyry	lim	ser		vein	Si			505540	5220480	Mt Mary CT87-19	CA, PT, XR	jar	17 m	2.6
C107750	mudstone				pebb	brec		Truro tillite	505540	5220480	Mt Mary CT87-19	PT	jar	20 m	
C107751	mudstone				pebb	altd			505540	5220480	Mt Mary CT87-19	PT		33 m	
C107752	mudstone	kaol			blea	altd	hfld	Truro tillite	505540	5220480	Mt Mary CT87-19	CA, PT, XR		37 m	
C107753	mudstone	lim						Truro tillite	505540	5220480	Mt Mary CT87-19	CA		40 m	
C107754	clay				yell				505540	5220480	Mt Mary CT87-19	XR		41 m	
C107755	breccia	hem							505540	5220480	Mt Mary CT87-19	CA		46.1 = 107925	7.4
C107756	clay	sme					whit		505540	5220480	Mt Mary CT87-19	XR		57 m	
C107757	porphyry	san	pl	ms					505540	5220480	Mt Mary CT87-19	PT, XR		76 m	
C107758	clay	sme	qtz				whit		505540	5220480	Mt Mary CT87-19	XR		79 m	
C107759	porphyry	san	pl		sx	Si			505540	5220480	Mt Mary CT87-19	PT	adr, ep	80 m	
C107760	mudstone	kf	am	sme	sx	altd			505540	5220480	Mt Mary CT87-19	CA, PT, XR		82 m	
C107761	amphibolite	am	qtz	py		altd		Truro tillite	505540	5220480	Mt Mary CT87-19	CA, PT, XR	clast?	87 m	
C107762	mudstone	am	kf		altd	hfld	brx	Truro tillite	505540	5220480	Mt Mary CT87-19	PT		82 m	
C107763	breccia	ze			must				505540	5220480	Mt Mary CT87-19	PT	contact	74 m	
C107764	porphyry	san	py	ep	must	xenl	blea	Truro tillite	505540	5220480	Mt Mary CT87-19	CA, PT		110 m	
C107765	mudstone				sand			Truro tillite	505540	5220480	Mt Mary CT87-19	PT		106 m	
C107766	porphyry	adr	san	cpx	sx				505540	5220480	Mt Mary CT87-19	PT	contact	112 m	
C107767	breccia								505540	5220480	Mt Mary CT87-19	CA		98 m	
C107768	fault pug								505540	5220480	Mt Mary CT87-19	CA		47 m	
C107769	mudstone	hem						Truro tillite	505540	5220480	Mt Mary CT87-19	CA, PT		51 m	0.2
C107770	porphyry	lim			vein				502960	5217460	Black Jack CT87-4	CA		6.7 = 107928	0.8
C107771	porphyry	san	pl		sx	altd	Si		502960	5217460	Black Jack CT87-4	CA, XR	latitic?	13 m	

Reg. No.	Name	Minerals			Modifiers			Unit name	AMG Ref.		Locality	Treatment	Keywords	Comments	Au
									mE	mN					
C107772	porphyry	lim							502960	5217460	Black Jack CT87-4	CA		15 m	0.05
C107773	limonite				vein				502960	5217460	Black Jack CT87-4	CA		22.3 = 107929	0.1
C107774	porphyry	pl	san		sx		Si		502960	5217460	Black Jack CT87-4	PT		23 m	
C107775	porphyry	san	pl		sx	altd	Si		502960	5217460	Black Jack CT87-4	PT, XR	zeolites	25 m	
C107776	mudstone	py	kf	sid	hfld	brec	altd	Bundella	502960	5217460	Black Jack CT87-4	PT, XR		28 m	
C107777	mudstone				hfld			Bundella	502960	5217460	Black Jack CT87-4	CA		30.5 = 107931	4.2
C107778	mudstone	py			hfld			Bundella	502960	5217460	Black Jack CT87-4	CA		29.9 = 107930	1.6
C107779	mudstone	pl	kf		hfld	sx	vein	Bundella	502960	5217460	Black Jack CT87-4	CA, PT, XR		33 m	
C107780	mudstone				hfld			Bundella	502960	5217460	Black Jack CT87-4	CA, XR		35 m	
C107781	mudstone	py			hfld			Bundella	502960	5217460	Black Jack CT87-4	CA, XR		40 m	0.08
C107782	mudstone	py			hfld			Bundella	502960	5217460	Black Jack CT87-4	CA, XR		42 m	
C107783	mudstone	py	sid		hfld			Bundella	502960	5217460	Black Jack CT87-4	CA, PT, XR		46 m	
C107784	limonite	kf	qtz	mic	vein				502960	5217460	Black Jack CT87-4	CA, XR		52 m	
C107785	porphyry	pl	san		sx	Si			502960	5217460	Black Jack CT87-4	PT		58 m	
C107786	porphyry	pl	san	sid	sx				502960	5217460	Black Jack CT87-4	PT		61 m	
C107787	porphyry	pl	san	ep	pink	sx			502960	5217460	Black Jack CT87-4	CA, PT	hbd	76 m	
C107788	porphyry	san	cpx		altd				504350	5219800	Kings Hill	PT		house site	
C107789	porphyry	pl	san		Si				504400	5219800	Kings Hill	PT, XR		road cut	
C107790	porphyry	pl	san		Si				503650	5219300	Coads Adit	PT			
C107791	porphyry	san	pl		Si				503650	5219300	Coads Adit	PT			
C107792	porphyry	pl	san	hbd	SiUS				508300	5221900	Livingstone Mine	PT	hauyne?		
C107793	porphyry		san						505500	5220480	Mt Mary CT87-20	XR, PT, CA		17.7 m	
C107794	clay	sme			Zn				505500	5220480	Mt Mary CT87-20	XR, CA		18-19.5	
C107795	mudstone	sme	lim	jar				Truro Tillite	505500	5220480	Mt Mary CT87-20	XR, PT		47.5 m = 107708	3.1
C107796	clay	py			Zn				505500	5220480	Mt Mary CT87-20	XR, IS		88.8-89.2	
C107797	porphyry	ze	san	pl	wthd				505500	5220480	Mt Mary CT87-20	XR, PT, CA		90 m	
C107798	porphyry	py	ep	pl	Sx				505500	5220480	Mt Mary CT87-20	XR, PT, IS		119.5	
C107799	mudstone	py						Truro Tillite	505500	5220480	Mt Mary CT87-20	XR, IS		112-114	
C107866	porphyry	san	pl		phyr				501800	5213500	Brooks Bay	TS			
C107867	porphyry	pl	san		eqgr				501800	5213600	Brooks Bay	TS			
C107868	porphyry	lim							501800	5213600	Brooks Bay	TS, CA			
C107869	clay	kaol	sme		green			Tertiary	499800	5215200	Surges Bay	XR			
C107870	clay	kaol	qtz					Tertiary	499750	5215200	Surges Bay	XR			
C107871	siltstone	kaol	qtz	ill				Tertiary	499750	5215200	Surges Bay	XR, CA			
C107872	clay	kaol	qtz	ill	pebb			Tertiary	499750	5215200	Surges Bay	XR, CA			
C107873	clay	kaol	qtz	ill	pebb			Tertiary	499600	5215200	Surges Bay	XR, CA			
C107874	silcrete							Tertiary	499600	5215200	Surges Bay	TS			
C107875	syenite	kaol	san	ill				Tertiary	499600	5215100	Surges Bay	XR, CA		kaolin mine	
C107876	conglomerate	lim	kaol					Tertiary	499600	5215100	Surges Bay	XR, CA		kaolin mine	
C107877	siltstone	kaol	qtz	ill				Tertiary	499600	5215100	Surges Bay	XR, CA		kaolin mine	
C107878	conglomerate	qtz	kaol					Tertiary	499600	5215100	Surges Bay	XR, TS		kaolin mine	
C107879	dolerite							Jurassic	521200	5224500	Kettering Pt	TS			
C107913	Mudstone	jar	sme		wthd	Zn	Pb	Truro Tillite	505600	5220460	Mt Mary CT87-1	CA, XR	plumbogummite	21-22 = 107737, 738	~1

Reg. No.	Name	Minerals			Modifiers			Unit name	AMG Ref.		Locality	Treatment	Keywords	Comments	Au
									mE	mN					
C107914	Mudstone		sme		wthd	Zn		Truro Tillite	505600	5220460	Mt Mary CT87-1	CA, XR		23-24 = 107739	
C107915	Mudstone	kf			shea	hfld		Truro Tillite	505600	5220460	Mt Mary CT87-1	CA, PT		26 m	
C107916	Mudstone	kf			shea			Truro Tillite	505600	5220460	Mt Mary CT87-1			26 m	
C107917	Mudstone							Truro Tillite	505600	5220460	Mt Mary CT87-1	CA, PT		28 m	
C107918	Hornfels	zeol	kf					Truro Tillite	505600	5220460	Mt Mary CT87-1	CA, XR, PT		30 m	
C107919	Porphyry	pl	ep						505600	5220460	Mt Mary CT87-1	CA, PT, IS		32 m	
C107920	Mudstone				shea	sx		Truro Tillite	505600	5220460	Mt Mary CT87-1	CA, PT		40 m	
C107921	Hornfels	am	kf		altd	sx		Truro Tillite	505600	5220460	Mt Mary CT87-1	CA, XR, PT		52 m	
C107922	Hornfels	am	kf		altd	sx		Truro Tillite	505600	5220460	Mt Mary CT87-1	CA, XR, PT		54 m	
C107923	Porphyry	pl	san	ep	sx				505600	5220460	Mt Mary CT87-1	CA, PT	mt, allanite	60 m	
C107924	Mudstone							Truro Tillite	505540	5220480	Mt Mary CT87-19	XR		45.1 m	
C107925	Porphyry	lim	ser	py	Si	vein	altd		505540	5220480	Mt Mary CT87-19	PT, CA		46.1 = 107755	7.4
C107926	porphyry/clay	sme	san	pl			altd		505540	5220480	Mt Mary CT87-19	CA, XR		46.5-47	
C107927	Mudstone	kf			Sx		altd	Truro Tillite	505540	5220480	Mt Mary CT87-19	XR, PT	apy	23 m	
C107928	Porphyry	lim	py	pl	Sx	Si			502960	5217460	Black Jack CT87-4	XR, PT, CA		6.75 = 107770	0.8
C107929	Porphyry	pl	san		Sx	Si			502960	5217460	Black Jack CT87-4	XR, PT, ISO, CA		22.3 = 107773	0.1
C107930	Mudstone	am	py	kf	pebb		altd	Bundella	502960	5217460	Black Jack CT87-4	XR, PT, CA		29.9 = 107778	1.6
C107931	Mudstone	bt	kf	am	carb	Sx		Bundella	502960	5217460	Black Jack CT87-4	XR, PT, IS, CA		30.4 = 107777	4.2
C107932	Porphyry		py						505700	5220500	Mt Mary Mine	CA			
C107933	Mudstone							Truro Tillite	505700	5220500	Mt Mary Mine	CA			
C107934	Porphyry	ze	ep	py	SiUS				505350	5220400	Mt Mary Mine	CA, PT, IS			0.05
C107935	breccia	hem	qtz	jar					505350	5220400	Mt Mary Mine	CA, XR			0.2
C107936	breccia	jar	qtz	hem	sili				505350	5220400	Mt Mary Mine	CA, PT			19.7
C107937	breccia	jar	qtz						505350	5220400	Mt Mary Mine	CA, XR			2.7
C107938	Porphyry	lim	hem						505350	5220400	Mt Mary Mine	CA, PT			10.3
C107939	hornfels							Truro Tillite	505200	5220250	Mt Mary tower	CA			0.1
C107940	breccia	qtz							505200	5220250	Mt Mary tower	CA, FI			0.1
C107941	chalcedony	lim			vugg				505200	5220250	Mt Mary tower	CA, FI, PT			0.5
C107942	silica								505200	5220250	Mt Mary tower			boxwork	
C107943	vein	qtz							503600	5219350	Coads Adit	CA, FI, PT			0.1
C107944	altd rock	hem	lim	kf					502950	5217550	Black Jack	CA, PT		fenite?	
C107945	chert	lim	qtz		vein			Bundella	502950	5217550	Black Jack	CA, PT			
C107946	mudstone							Bundella	502950	5217550	Black Jack	CA			0.05
C107947	mudstone	lim	qtz					Bundella	502950	5217550	Black Jack	CA, FI			0.07
C107948	cement							Bundella	502950	5217550	Black Jack	PT		artif.	
C107949	mudstone	lim						Bundella	502900	5217500	Black Jack	CA		pit	
C107950	gossan?	qtz	kf	hem	altd				502900	5217500	Black Jack	CA, PT		pit	0.05
C107951	mudstone	lim	kf		altd			Bundella	502900	5217470	Black Jack	CA, PT			1.2
C107952	mudstone	lim			brec	chert		Bundella	502900	5217470	Black Jack	CA, PT			0.3
C107953	mudstone				grey			Bundella	502900	5217470	Black Jack	CA			
C107954	mudstone				red			Woody Island	508500	5221900	Tobys Hill Rd	CA		gate	0.06
C107955	vein	lim	qtz	py					508250	5221900	Livingstone Mine	PT, FI, CA, IS		shaft	
C107956	stockwork	qtz	kf	pl	vein	porph			508250	5221900	Livingstone Mine	FI, PT		shaft	

Reg. No.	Name	Minerals			Modifiers			Unit name	AMG Ref. mE	mN	Locality	Treatment	Keywords	Comments	Au
C107957	mudstone				vein			Woody Island	508250	5221900	Livingstone Mine	FI, CA, XRD		shaft	
C107958	porphyry	san							508250	5221900	Livingstone Mine	CA			
C107959	porphyry	pl	san		Si				508250	5221900	Livingstone Mine	CA, PT			
C107960	porphyry	san	pl	kaol	Si				508250	5221900	Livingstone Mine	CA, PT, XR			
C107961	porphyry								508250	5221900	Livingstone Mine			xen	
C107962	porphyry	san	pl	hem	altd				508250	5221900	Livingstone Mine	CA, PT			
C107963	porphyry	pl	san		Si	vein			508250	5221900	Livingstone Mine	CA, PT, FI		shaft	
C107964	breccia	qtz	pl						508250	5221900	Livingstone Mine	PT		shaft	
C107965	quartz	lim							508250	5221900	Livingstone Mine	CA, FI		shaft	
C107966	Mudstone	hem						Woody Island	508200	5221950	Livingstone Mine	CA, PT			
C107967	porphyry	hem?							508250	5221900	Livingstone Mine	CA			
C107968	porphyry	pl	cpx	ep					508250	5221900	Livingstone Mine	CA, PT, XR	?garnet		
C107969	stockwork	qtz	jar	opl		porph			504200	5219750	Kings Hill	PT, FI, CA		breccia pipe	
C107970	stockwork	py							504200	5219750	Kings Hill	IS		breccia pipe	
C107971	porphyry	kf			Si				504200	5219750	Kings Hill	PT, FI, IS		breccia pipe	
C107972	porphyry								504200	5219750	Kings Hill	FI		breccia pipe	
C107973	porphyry				vein				504150	5219760	Kings Hill			breccia pipe	
C107974	porphyry				vein				504120	5219760	Kings Hill	CA		breccia pipe	
C107975	porphyry	py							504120	5219760	Kings Hill	CA, IS, PT		breccia pipe	
C107976	syenite	san	ne	bt					506650	5219130	Regatta Point	CA, IS, PT	adr, mt	hybrid?	
C107977	mudstone				grey			Woody Island	508500	5221950	Tobys Hill Road	CA			
C107978	mudstone				grey			Truro Tillite	519288	5222568	Woodbridge DDH1	CA, XR		62 m	
C107979	mudstone				grey			Truro Tillite	519288	5222568	Woodbridge DDH1	CA, XR		747 m	
C107980	mudstone	py						Minnie Pt	518060	5228940	Snug Tiers DDH1	CA, PT, IS		92 m	0.1
C107981	mudstone	lim						Minnie Pt	518060	5228940	Snug Tiers DDH2	CA, PT		99 m	0.07
C107982	mudstone							Deep Bay	518060	5228940	Snug Tiers DDH3	CA, XR		241 m	
C107983	mudstone	po			calc	foss		Deep Bay	518060	5228940	Snug Tiers DDH4	CA, PT		263 m	
C107984	mudstone	dol	cal					Truro Tillite	514510	5334870	Tunbridge DDH1	CA, XR		840 m	
C107985	mudstone				black			Quamby	514510	5334870	Tunbridge DDH1	CA		701 m	
C107986	mudstone	py						Woody Island	515614	5266492	Granton DDH1	CA, XR		528 m	
C107987	mudstone	po	py	cal				Woody Island	515614	5266492	Granton DDH2	CA, PT, XR		279 m	
C107988	vein		py	cal					515614	5266492	Granton DDH3	PS, IS		282 m	0.09
C107989	mudstone							Truro Tillite	521230	5236270	Margate DDH1	CA		244 m	
C107990	mudstone				Sx			Woody Island	521230	5236270	Margate DDH1	CA, PT, XR		95 m	
C107994	porphyry	py				Si			505600	5220460	Mt Mary CT87-1	CA		63.7 m	
C107995	porphyry	py				Si			505600	5220460	Black Jack CT87-2	CA		48 m	
C107996	porphyry	py				Si			505540	5220480	Mt Mary CT87-19	CA		132 m	
C107997	porphyry	py				Si			502960	5217460	Black Jack CT87-4	CA		43 m	
C107998	hornfels							Bundella	502960	5217460	Black Jack CT87-4	CA		44 m	
C107999	porphyry	py				Si			502960	5217460	Black Jack CT87-4	CA		65 m	
C108000	hornfels							Bundella	502960	5217460	Black Jack CT87-4	CA		45.9 m	
C108001	porphyry	py				Si			519288	5222568	Woodbridge DDH1	CA		673.5 m	
C108002	porphyry	san	pl	hem		Si	Sx		519288	5222568	Woodbridge DDH1	CA, PT		686 m	

Reg. No.	Name	Minerals				Modifiers		Unit name	AMG Ref.		Locality	Treatment	Keywords	Comments	Au
									mE	mN					
C108003	porphyry	py				Si			519288	5222568	Woodbridge DDH1	CA		792 m	
C108004	porphyry					Si			519288	5222568	Woodbridge DDH1	CA		795 m	
C108005	porphyry	san	pl	hem		Si	vugg		519288	5222568	Woodbridge DDH1	CA, PT		817 m	
C108006	porphyry					Si			519288	5222568	Woodbridge DDH1	CA		866 m	
C108007	porphyry					Si			519288	5222568	Woodbridge DDH1	CA		977 m	
C108008	porphyry	san	pl			SiUS			506820	5220320	Martins Point	CA, WR, PT			
C108009	mudstone	am		altd	pebb	hfld		Truro Tillite	506850	5220200	Martins Point	PT			
C108010	porphyry					SiUS			506800	5220250	Martins Point				
C108011	porphyry					SiUS			506800	5220250	Martins Point				
C108012	porphyry	san	pl						506850	5220230	Martins Point	CA, WR, PT			
C108013	porphyry	san							506900	5220150	Martins Point	CA, WR, PT			
C108014	porphyry	san	adr	hbd					507040	5220130	Martins Point	CA, WR, PT			
C108015	porphyry	san		ep					507070	5220160	Martins Point	CA, WR, PT			
C108016	porphyry	pl	san	ep					507070	5220160	Martins Point	CA, WR, PT			
C108017	porphyry	cpx	hbd			SiUS			500220	5217620	Petcheys Bay	CA, WR, PT			
C108018	porphyry	can	adr	cpx		SiUS			502960	5215600	Wheatleys Bay	CA, WR, PT	mt		
C108019	porphyry	san	adr			SiUS			504300	5221900	Forster Rt Road	CA, PT			
C108020	syenite	san	pl	hbd		Si			504310	5218880	Forster Rt Road	CA, WR, PT			
C108021	porphyry	san	pl	hbd		Si			504300	5218950	Forster Rt Road	CA, WR, PT	?		
C108022	porphyry	san	adr	cpx		SiUS			506350	5217150	Copper Alley Bay	CA, WR, PT			
C108023	porphyry	san	adr			SiUS			506450	5217250	Copper Alley Bay	CA, WR, PT			
C108024	syenite	san	bt			Si			506660	5219020	Regatta Point	CA, WR, PT			
C108025	porphyry					SiUS			506900	5217600	Langdons Point	CA, WR			
C108026	porphyry					SiUS			506900	5217600	Langdons Point	CA, WR			
C108027	porphyry					SiUS			502850	5215600	Wheatleys Bay	PT			
C108045	porphyry					SiUS			505500	5220480	Mt Mary CT87-20	PT, CA		51.2	
C108046	porphyry					SiUS			505500	5220480	Mt Mary CT87-20			64.5	
C108047	porphyry					Si			505500	5220480	Mt Mary CT87-20			72.5	
C108048	porphyry					Si			505500	5220480	Mt Mary CT87-20			104.8	
C108049	porphyry					Si			505600	5220460	Mt Mary CT87-1	CA		12.6 m	
C108050	porphyry					SiUS			505600	5220460	Mt Mary CT87-1	CA		33.7 m	
C108051	porphyry				Si				505600	5220460	Mt Mary CT87-1	CA		43.0 m	
C108052	porphyry					SiUS			505500	5220480	Mt Mary CT87-20	CA		40.2 m	
C108053	porphyry					SiUS			505600	5220460	Mt Mary CT87-20	CA		45.1 m	
C108054	porphyry					SiUS			505600	5220460	Mt Mary CT87-20	CA		54.5 m	
C108055	porphyry				Si				505600	5220460	Mt Mary CT87-20	CA		78.0 m	
C108056	porphyry				Si				505600	5220460	Mt Mary CT87-20	CA		120.3 m	
C108057	porphyry				Si				505540	5220480	Mt Mary CT87-19			4.5 m	
C108058	porphyry	san	pl		Si				505540	5220480	Mt Mary CT87-19	XR		7.0 m	
C108059	porphyry				Si				505540	5220480	Mt Mary CT87-19			14.6 m	
C108060	porphyry				Si				505540	5220480	Mt Mary CT87-19			21.8 m	
C108061	porphyry	san	pl		Si				505540	5220480	Mt Mary CT87-19	XR		38.2 m	
C108062	porphyry	san	pl	ep	Si				505540	5220480	Mt Mary CT87-19	XR		48.4 m	

Reg. No.	Name	Minerals			Modifiers		Unit name	AMG Ref. mE	AMG Ref. mN	Locality	Treatment	Keywords	Comments	Au
C108063	porphyry	san	pl	ep	Si			505540	5220480	Mt Mary CT87-19			65.9 m	
C108064	porphyry					SiUS		505540	5220480	Mt Mary CT87-19			74.4 m	
C108065	porphyry					SiUS		505540	5220480	Mt Mary CT87-19			75.7 m	
C108066	porphyry				Si			505540	5220480	Mt Mary CT87-19			79.5 m	
C108067	porphyry					SiUS		505540	5220480	Mt Mary CT87-19			97.2 m	
C108068	porphyry	ep			Si			505540	5220480	Mt Mary CT87-19	XR		109.0 m	
C108069	porphyry				Si			505540	5220480	Mt Mary CT87-19			120.0 m	
C108130	syenite				SiUS			508300	5221900	Livingstone				
C108131	syenite	hbd	san					508300	5221900	Livingstone	PT			
C108132	vein	qtz	py	jar				508300	5221900	Livingstone	PT			
C108133	vein	qtz	py	sl				508300	5221900	Livingstone				
C108134	vein	qtz	py	cv				508300	5221900	Livingstone				
C108135	hornfels	po	act				Truro Tillite	506850	5220200	Martins Point				
C108136	fenite?	am	kf	adr			Truro Tillite	506650	5219130	Regatta Point	PT			
C108137	hybrid	cpx	kf	bt				506650	5219130	Regatta Point	PT	adr, ze		
C108138	hybrid	kf	adr	bt				506650	5219130	Regatta Point	PT			
C108139	hybrid	pl	bt	cpx	mafic			506650	5219130	Regatta Point	PT		altd dolerite?	
C108140	syenite							506650	5219130	Regatta Point	PT			
C108141	porphyry	grt	scp	san				506900	5217700	N. Langdons Point	PT	spessartine		
G402001	porphyry	san						514400	5225030	Kruses Creek	TS			
G402002	porphyry	san						509440	5129560	Gardeners Bay	TS			
G402003	porphyry	san						500100	5217580	Petcheys Bay	TS	pectolite?		
G402004	porphyry							508960	5214990	Deep Bay				
G402005	porphyry							508960	5214990	Deep Bay				
G402006	porphyry							500050	5218120	Petcheys Bay				
G402007	porphyry							508120	5218150	Gardeners Bay				
G402008	porphyry							519010	5219670	Birchs Bay				
G402009	porphyry							509410	5217090	Thomas Hill				
G402010	porphyry							520150	5223040	Helliwells Pt				
G402011	porphyry							508490	5216040	Deep Bay				
G402012	porphyry							505850	5216930	Copper Alley Bay				
G402013	porphyry							521940	5225620	Oyster Cove Point				
G402014	porphyry							509190	5216300	Deep Bay				
G402015	porphyry							508420	5216040	Deep Bay				
G402016	porphyry							512020	5218600	Mt Cygnet				
G402017	porphyry							508880	5216670	Deep Bay				
G402018	porphyry							514400	5225030	Kruses Creek				
G402019	porphyry							502350	5215710	Wheatleys Bay				
G402020	porphyry							506030	5216810	Copper Alley Bay				
G402021	porphyry							519920	5224900	Kettering				
G402022	porphyry							519990	5222660	Peppermint Bay				
G402023	porphyry							512400	5220600	Pig & Whistle Hill				
G402024	porphyry							505960	5210240	Police Point				

Reg. No.	Name	Minerals			Modifiers		Unit name	AMG Ref. mE	mN	Locality	Treatment	Keywords	Comments	Au
G402025	porphyry							509820	5216500	Thomas Hill				
G402026	porphyry							519060	5224350	Kettering				
G402027	porphyry							519060	5224350	Kettering				
G402028	porphyry							500860	5217440	Petcheys Bay				
G402029	porphyry							516830	5224870	Kettering				
G402403	dolerite				altd		Jurassic	506600	5219300	Regatta Point	TS			
G402404	porphyry	san						506900	5217600	Langdons Point				
G402405	porphyry	san	adr	cpx				506900	5217600	Langdons Point	TS			
G402406	porphyry	san	cpx	adr	green			506900	5217600	Langdons Point	TS	pectolite?		
G402407	mudstone				hfld		Truro Tillite	506900	5217600	Langdons Point				
G402408	contact				syen	must		506900	5217600	Langdons Point	TS			

Abbreviations

adr	andradite	lim	limonite	aeg	aegirine	MuSt	mudstone	altd	altered
opl	opal	am	amphibole	pebb	pebbly	blea	bleached	pl	plagioclase
brec	brecciated	po	pyrrhotite	bt	biotite	porph	porphyry/tic	brx	breccia
PT	polished thin section	ca	chemical analysis	py	pyrite	carb	carbonaceous	qtz	quartz
chd	chalcedonic	san	sanidine	chert	cherty	sand	sandy	cong	conglomerate
scp	scapolite	cpx	clinopyroxene	ser	sericitic	cv	covellite	Si	siliceous/silca-saturated
di	diopside	SiUS	silca-undersaturated	ep	epidote	sifd	silicified	eqgr	equigranular
silt	silty	FI	fluid inclusion	sl	sphalerite	fgnd	fine grained	sme	smectite
foss	fossiliferous	syen	syenitic	glass	glassy	TS	thin section	grt	garnet
vein	veined	hbd	hornblende	vugg	vuggy	hem	hematite	whit	white
hfld	hornfelsed	WR	whole rock analysis	hyn	hauyne	xenl	xenolithic	is	isotopic analysis
XR	xrd	jar	jarosite	yell	yellow	kaol	kaolinite	zeol	zeolitic
kf	k-feldspar								

APPENDIX 4

Petrological summary, Cygnet metasomatic and highly altered rock types

Reg. No.	Locality	Name	Primary host rock	Hydrothermal minerals	Opaque minerals	Supergene minerals	Other minerals	Textures	Host rock alteration	Au
C107617	Kings Hill	vein	qtz porphyry	qtz	py		perthite		sili	<0.05
C107620	Kings Hill	breccia	qtz porphyry	qtz, ser	py		perthite		sili	<0.05
C107623	Mt Mary mine	gossan	?		py	lim				7.6
C107624	Mt Mary	mudstone	mudstone	chalcedony	py			breccia		0.2
C107627	Coads Adit	vein	qtz porphyry	qtz	py			vuggy		0.4
C107651	Livingstone mine	vein	qtz porphyry	qtz	py			vuggy		0.3
C107654	Livingstone mine	mudstone	mudstone	qtz				vein	sili	0.4
C107659	Mt Mary mine	chalcedony?	?	chd				vuggy		2.3
C107661	Mt Mary mine	breccia	mudstone	kf	py, hem	jar			hem	3.8
C107675	Black Jack	vein	mudstone	qtz, chd	hem	lim				3.7
C107730	Mt Mary CT87-20	breccia	mudstone	chd, opl	py				sili	<0..05
C107731	Mt Mary CT87-20	clay	mudstone	sme				breccia		
C107738	Mt Mary CT87-1	breccia	?	qtz	py, hem?	lim, jar				2
C107749	Mt Mary CT87-19	porphyry	porphyry			lim				2.6
C107755	Mt Mary CT87-19	stockwork	porphyry	ser, qtz	py	lim		veins		7.4
C107760	Mt Mary CT87-19	hornfels	mudstone	kf, aeg		py				<0.05
C107761	Mt Mary CT87-19	calc-silicate	mudstone	am, qtz	py					<0.05
C107762	Mt Mary CT87-19	hornfels	mudstone	kf, am	py			breccia		
C107763	Mt Mary CT87-19	breccia	contact	ze						
C107769	Mt Mary CT87-19	mudstone	mudstone		hem					0.2
C107770	Black Jack CT87-4	breccia	porphyry	pl	py	lim				0.8
C107773	Black Jack CT87-4	porphyry	porphyry	qtz	py		pl			0.1
C107795	Mt Mary CT87-20	mudstone	mudstone			lim				3.1
C107913	Mt Mary CT87-1	breccia	?	qtz	py, hem?	lim, jar				2
C107925	Mt Mary CT87-19	stockwork	porphyry	ser, qtz	py	lim		veins		7.4
C107928	Black Jack CT87-4	breccia	porphyry		py	lim	pl			0.8
C107929	Black Jack CT87-4	Porphyry	porphyry	qtz	py		pl			0.1
C107930	Black Jack CT87-4	mudstone	mudstone		py					1.6
C107931	Black Jack CT87-4	mudstone	mudstone		py					4.2
C107934	Mt Mary mine	porphyry	porphyry							0.05
C107936	Mt Mary mine	breccia	porphyry	qtz	hem	jar			sili	19.7
C107938	Mt Mary mine	porphyry	porphyry	ser	hem	lim				10.3
C107941	Mt Mary radio tower	chalcedony	?	chd						0.5
C107943	Coads Adit	vein	qtz porphyry	qtz						0.1
C107944	Black Jack	fenite	mudstone	kf	py	lim			kf	<0.05
C107945	Black Jack	chert	mudstone	qtz		lim		veins		
C107950	Black Jack	gossan	mudstone	kf, qtz, hem					kf	0.05
C107951	Black Jack	hornfels	mudstone	kf, am		lim		foss		1.2
C107952	Black Jack	breccia	mudstone	qtz		lim		foss	sili	0.3
C107955	Livingstone mine	vein	qtz porphyry	qtz	py	lim				0.11
C107956	Livingstone mine	stockwork	porphyry	qtz, ser, sme				vein		<0.05
C107969	Kings Hill	stockwork	qtz porphyry	qtz, opl	py	jar				<0.05
C107980	Snug Tiers DDH	mudstone	mudstone	kf	py					0.1
C107981	Snug Tiers DDH	mudstone	mudstone			lim			kf	0.07

See Appendix 3 for abbreviations

APPENDIX 5

Microprobe and EDAX analyses, Cygnet

	Amphiboles					Feldspars				
Analysis No.	1	2	3	4		5	6	7	8	9
SiO_2	55.19	50.02	49.79	51.91		63.56	65.09	64.44	56.98	63.45
TiO_2	0.04	0.07	0.12	0.12		0.02	0.00	0.04	0.01	0.00
Al_2O_3	1.27	2.44	4.35	4.27		18.99	18.89	19.15	27.25	19.45
Cr_2O_3	0.02	0.01	0.01	0.08		0.00	0.00	0.00	0.00	0.00
FeO	9.75	21.69	13.65	13.53		0.37	0.02	0.20	0.32	0.12
MnO	0.12	1.02	0.47	0.40		0.00	0.03	0.00	0.00	0.00
ZnO	0.03	0.06				0.00		0.00	0.00	0.00
MgO	18.48	9.27	14.46	15.03		0.06	0.00	0.01	0.01	0.00
CaO	13.15	11.67	12.08	10.97		0.22	0.00	0.14	8.58	0.00
BaO	0.01	0.01				0.26	0.07	0.06	0.00	1.11
SrO							0.23	0.00	0.49	0.00
Na_2O	0.12	0.38	1.82	1.99		0.86	1.20	1.89	6.16	0.63
K_2O	0.07	0.29	0.66	0.78		15.38	13.94	13.94	0.71	15.75
Total	98.25	96.91	97.40	99.08		99.71	99.47	99.89	100.52	100.53
Structural formulae										
No. (O, OH)	23	23	23	23	No. (O, OH)	8	8	8	8	8
Si	7.798	7.651	7.344	7.468	Si	2.955	2.996	2.965	2.556	2.943
Al(iv)	0.202	0.349	0.656	0.532	Ti	0.001	0.000	0.002	0.000	0.000
Tot T	8.000	8.000	8.000	8.000	Al	1.040	1.024	1.038	1.440	1.063
Al(vi)	0.010	0.090	0.099	0.192	Cr	0.000	0.000	0.000	0.000	0.000
Ti	0.004	0.008	0.013	0.013	Fe	0.014	0.001	0.008	0.012	0.005
Cr	0.003	0.001	0.001	0.009	Mn	0.000	0.001	0.000	0.000	0.000
Mg	3.891	2.113	3.178	3.222	Zn	0.000	0.000	0.000	0.000	0.000
Mn	0.014	0.133	0.059	0.049	Mg	0.004	0.000	0.001	0.001	0.000
tot Fe	1.152	2.774	1.684	1.627	Tot T	4.014	4.022	4.013	4.010	4.011
Tot C	5.074	5.118	5.034	5.112	Ca	0.011	0.000	0.007	0.413	0.000
Ca	1.991	1.912	1.909	1.692	Ba	0.005	0.001	0.001	0.000	0.020
Na	0.009	0.088	0.091	0.308	Sr	0.000	0.006	0.000	0.013	0.000
Tot B	2.000	2.000	2.000	2.000	Na	0.077	0.107	0.169	0.536	0.057
K	0.142	0.142	0.142	0.142	K	0.912	0.818	0.818	0.041	0.932
Na	0.022	0.023	0.429	0.246						
Tot A	0.165	0.166	0.572	0.388	Tot A	1.005	0.933	0.995	1.002	1.009
Total	15.239	15.284	15.606	15.500	Total	5.019	4.955	5.008	5.011	5.020
Mg/Mg+Fe"	0.77	0.43	0.65	0.66	Or	91	88	82	4	92
					An	1	0	1	41	0
					Ab	8	11	17	53	6

1. Actinolite, replacing a fossil, Black Jack, C107931
2. Ferro-actinolite, replacing a carbonate clast, Black Jack, C107931
3. Edenite, veining and replacing a clinopyroxenite xenolith, Kings Hill, C107670
4. Magnesio-hornblende, veining and replacing a clinopyroxenite xenolith, Kings Hill, C107670
5. K-feldspar (adularia) replacing a clast in mudstone, Black Jack, C107947
6. K-feldspar (adularia) veining and replacing a clinopyroxenite xenolith, Kings Hill, C107670
7. K-feldspar (adularia) rimming a plagioclase phenocryst in porphyry, Black Jack, C107930
8. Plagioclase core to the above phenocryst in porphyry, Black Jack, C107930
9. K-feldspar (adularia) rimming a clast in mudstone, Mt Mary, C107915

Analysis Details

Analyses 1–16 and 29–30 were conducted on a Cameca SX-50 electron microprobe, using WDS spectrometers, at the University of Tasmania. Analyses 17–28 were conducted on a Philips SEM-EDAX system at the Government Analyst Laboratories, Hobart.

	Siderite	Chlorite	Chl-ser	Chl-ser	Garnet	Pyroxene	Biotite
Analysis No.	10	11	12	13	14	15	16
SiO_2	0.04	28.43	29.43	29.48	35.15	51.28	36.09
TiO_2	0.00	0.02	0.07	0.07	0.00	0.46	1.60
Al_2O_3	0.03	16.53	20.25	21.47	0.16	2.64	15.41
Cr_2O_3	0.00	0.00	0.00	0.00	0.00	0.03	
FeO	48.82	36.33	22.25	21.74	28.79	7.20	16.01
MnO	3.09	0.06	0.00	0.40	0.00	0.15	0.08
ZnO	0.00	0.00	0.00	0.34	0.00		
MgO	0.81	6.41	14.28	14.57	0.06	14.11	15.22
CaO	5.59	0.34	0.11	0.06	33.62	24.15	0.00
BaO	0.00	0.00	0.00	0.00	0.04		
SrO	0.00	0.00	0.00	0.00	0.00		
Na_2O	0.02	0.06	0.10	0.05	0.02	0.30	0.26
K_2O	0.01	0.04	1.21	1.13	0.01	0.01	9.92
Total	58.42	88.24	87.71	89.31	97.86	100.33	94.58
Structural formulae							
No. (O,OH)	1	28	28	28	12	6	11
Si	0.001	6.290	6.075	5.967	3.029	1.883	2.661
Ti	0.000	0.004	0.011	0.010	0.000	0.013	0.089
Al	0.001	4.310	4.926	5.122	0.017	0.114	1.339
Cr	0.000	0.000	0.000	0.000	0.000	0.001	0.000
Fe	0.804	6.722	3.842	3.680	1.866	0.199	0.887
Mn	0.052	0.012	0.000	0.069	0.000	0.005	0.005
Zn	0.000	0.000	0.000	0.050	0.000	0.000	0.000
Mg	0.024	2.114	4.392	4.394	0.007	0.772	1.672
Ca	0.118	0.081	0.025	0.014	3.105	0.950	0.000
Ba	0.000	0.000	0.000	0.000	0.001	0.000	0.000
Sr	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Na	0.001	0.025	0.039	0.021	0.004	0.022	0.037
K	0.000	0.012	0.318	0.292	0.001	0.000	0.933
Total	0.998	19.533	19.271	19.305	8.026	3.936	6.653
Mg/Mg+Fe"	0.03	0.24	0.53	0.54		0.80	0.65
wo						49	
en						40	
fs						10	

10. Siderite vein in mudstone, Black Jack, 107779
11. Chlorite (chamosite) vein in mudstone, Black Jack, 107779
12–13. Chlorite-sericite aggregates (degraded biotite?) in altered clasts in mudstone, Mt Mary, 107915
14. Andradite, late stage replacement of mafics? in porphyry, Mt Mary, 107722
15. Diopside in biotite-clinopyroxenite xenolith in porphyry, Kings Hill, C107670
16. Biotite in biotite-clinopyroxenite xenolith in porphyry, Kings Hill, C107671

Analysis No.	Smectite 17	Smectite 18	Smectite 19	Smectite 20	Smectite 21	Smectite 22	Limonite 23
SO_3	0.00	0.00	0.00	0.00	0.05	0.13	0.00
P_2O_5	0.00	0.00	0.00	0.11	0.07	0.07	4.08
SiO_2	36.57	38.29	37.86	34.56	42.16	36.01	7.60
Al_2O_3	14.54	15.87	9.07	13.79	20.25	8.62	3.40
Fe_2O_3	11.01	26.44	29.59	17.58	13.65	29.05	83.90
MgO	2.99	3.20	2.82	2.16	2.37	3.13	0.33
ZnO	2.49	3.61	6.22	5.23	2.19	5.80	6.60
K_2O	2.89	4.34	0.84	4.58	6.67	1.95	0.00
Na_2O	0.54	0.05	0.27	0.40	0.44	0.78	0.81
PbO	0.00	0.00	0.00	0.00	0.12	0.00	0.00
Total	71.03	91.80	86.67	78.40	87.98	85.54	106.72
Structural formulae							
No. cations	6	6	6	6	6	6	6
S	0.000	0.000	0.000	0.000	0.002	0.006	0.000
P	0.000	0.000	0.000	0.007	0.004	0.004	0.298
Si	3.597	3.150	3.395	3.261	3.378	3.260	0.757
Al	1.130	1.031	0.642	1.028	1.282	0.617	0.268
Fe	0.546	1.097	1.338	0.837	0.552	1.327	4.215
Mg	0.294	0.263	0.253	0.203	0.190	0.283	0.033
Zn	0.121	0.147	0.276	0.244	0.087	0.260	0.325
K	0.243	0.305	0.065	0.370	0.457	0.151	0.000
Na	0.069	0.006	0.031	0.050	0.046	0.092	0.105
Pb	0.000	0.000	0.000	0.000	0.002	0.000	0.000

17–19. Smectite clay minerals (zincian nontronite-montmorillonite), in altered mudstone, Mt Mary, C107914
19–22. Smectite clay minerals (zincian nontronite-montmorillonite), in altered mudstone, Mt Mary, C107913
23. Zincian limonite-zincian aggregate, in altered mudstone, Mt Mary, C107913

	Plumbogummite						Jarosites	
Analysis No.	24	25	26	27	28		29	30
SO_3	0.10	1.20	0.12	0.67	1.93	SO_3	27.75	23.56
P_2O_5	17.33	17.21	17.92	18.31	13.06	Al_2O_3	1.08	1.06
SiO_2	5.41	2.01	4.43	2.04	8.77	Fe_2O_3	47.23	44.90
Al_2O_3	20.23	24.93	20.31	26.44	22.41	K_2O	7.50	8.17
Fe_2O_3	11.06	4.15	11.36	3.99	6.59	Na_2O	0.10	0.26
MgO	0.45	0.17	0.30	0.20	0.87	PbO	3.12	1.04
ZnO	3.15	1.37	2.35	0.50	0.81	Total	86.78	78.98
K_2O	0.60	0.28	0.39	0.24	0.51			
Na_2O	0.23	0.11	0.03	0.00	0.18			
PbO	43.89	35.23	47.43	38.26	26.30			
Total	102.45	86.64	104.64	90.65	81.43			
Structural formulae								
No. cations	6	6	6	6	6	No. (O, OH)	22	22
SO_3	0.01	0.08	0.01	0.04	0.12	S	3.712	3.494
P_2O_5	1.510	1.697	1.582	1.740	1.221	Al	0.227	0.246
SiO_2	0.643	0.270	0.534	0.264	1.119	Fe	6.334	6.676
Al_2O_3	1.901	2.651	1.933	2.710	2.259	K	1.706	2.060
Fe_2O_3	0.663	0.281	0.691	0.261	0.424	Na	0.035	0.098
MgO	0.053	0.022	0.036	0.026	0.111	Pb	0.150	0.056
ZnO	0.185	0.091	0.140	0.032	0.051			
K_2O	0.061	0.032	0.040	0.027	0.055			
Na_2O	0.035	0.019	0.005	0.000	0.029			
PbO	0.942	0.856	1.032	0.896	0.606			

24–28. Plumbogummite, in altered mudstone, Mt Mary, C107913
29–30. Plumbian jarosite, in gossanous breccia, Mt Mary, C107623

APPENDIX 6

XRD analyses, Cygnet

Reg. No.	Locality	DDH Depth (m)	Name	Qtz	Kf	Pl	Am	Chl	Ep	Mica	sme	kaol	ze	opl	mt	py	hem	jar	Gt	gyp	Other	Au (g/t)
C107613	Black Jack		mudstone	***	**	*				*		*					**					
C107623	Mt Mary	float	gossan	***	***									***				*				7.6
C107624	Mt Mary	float	tillite	***	?					**				***		*						0.2
C107652	Livingstone mine		mudstone	***	**	**				**	**	*										
C107654	Livingstone mine		mudstone	***	**	*				**		**					*					0.4
C107657	Mt Mary Road		contact		***	**	**		**	*	***		*				*					
C107662	Mt Mary mine		tillite	***	**	**	?			**	**					?						
C107670	Kings Hill		granulite			*				***							**				cpx	
C107676	Kings Hill		syenite	***	**												**	***				0.06
C107684	Helliwells Point		porphyry	**	**	***	**	*			**		*								cal	
C107714	Mt Mary CT87-20	64 m	porphyry	*	***					**	***		*									
C107717	Mt Mary CT87-20	69 m	mudstone	***	**	**	*			*	***											
C107718	Mt Mary CT87-20	67 m	mudstone	*									***									
C107720	Mt Mary CT87-20	80.7, non-lim	mudstone	***		**		*		***	**											
C107726	Mt Mary CT87-20	86 m	porphyry	*	**	*				*	***		*									
C107729	Mt Mary CT87-20	116 m	porphyry	*	***					**	**	*	**				**					
C107739	Mt Mary CT87-1	22.9 = 107914	mudstone	***	*					**	***		*									0.1
C107744	Mt Mary CT87-1	56 m	contact	**	***	***	*			*	**		*									
C107747	Mt Mary CT87-19	8 m	contact	**	***	**	**			*	**											
C107748	Mt Mary CT87-19	9 m	porphyry		***	**				**	**	?					*					
C107749	Mt Mary CT87-19	17 m	porphyry	***	*			?		***						?		*				2.6
C107752	Mt Mary CT87-19	37 m	mudstone	***	*	**				***		**										
C107754	Mt Mary CT87-19	41 m	clay	***	*					**	***		**									
C107756	Mt Mary CT87-19	57 m	clay	**			**				***											
C107757	Mt Mary CT87-19	76 m	porphyry		***	***					**						**					
C107758	Mt Mary CT87-19	79 m	clay	***						**	***		**									
C107760	Mt Mary CT87-19	82m	porphyry	***	**	*	*			*	***											
C107761	Mt Mary CT87-19	87 m	mudstone	***			***				*											
C107771	Black Jack CT87-4	13 m	porphyry	**	***	**				**						**		*				
C107775	Black Jack CT87-4	25 m	porphyry	**	***	***	*	*		*	*					**						
C107776	Black Jack CT87-4	28 m	mudstone	***	**	*		*		*	**					***				*		
C107779	Black Jack CT87-4	33 m	mudstone	***	**	**		**		*	*					**						
C107780	Black Jack CT87-4	35 m	mudstone	***	**	**		*		**						*						
C107781	Black Jack CT87-4	40 m	mudstone	***	**	**		*		?												0.08
C107782	Black Jack CT87-4	42 m	mudstone	***	**	**		*		**						?						
C107783	Black Jack CT87-4	46 m	mudstone	***	**	**		**		**						?						
C107784	Black Jack CT87-4	52 m	limonite	***	**					**							*				anatase	
C107789	Kings Hill	road cut	porphyry	*	**	***				**	**	*				?						
C107793	Mt Mary CT87-20	17.7m	porphyry		***	*				*	***	*										

Reg. No.	Locality	DDH Depth (m)	Name	Qtz	Kf	Pl	Am	Chl	Ep	Mica	sme	kaol	ze	opl	mt	py	hem	jar	Gt	gyp	Other	Au (g/t)
C107794	Mt Mary CT87-20	18–19.5	clay								***											
C107795	Mt Mary CT87-20	47.5 m = 107708	mudstone	***	*					**	***							**	*			3.1
C107796	Mt Mary CT87-20	88.8–89.2	clay	***	*					**	**					***				*		
C107797	Mt Mary CT87-20	90 m	porphyry		***	**				*	**		*			?						
C107798	Mt Mary CT87-20	119.5 m	porphyry	**	***	***		*	*	*	*											
C107869	Surges Bay		clay	**							**	***									anatase	
C107870	Surges Bay		clay	***						*	*	**									anatase	
C107871	Surges Bay		siltstone	***						**		***									anatase	
C107872	Surges Bay		clay	***						**		***									anatase	
C107873	Surges Bay		clay	***						**		**									anatase	
C107875	Surges Bay	kaolin mine	syenite	*	***					**	?	***										
C107877	Surges Bay		siltstone	***						**		***									anatase	
C107878	Surges Bay		conglomerate	***							**	**									anhydrite?	
C107913	Mt Mary CT87-1	21–22, = 107737, 738	mudstone	***	*					**	***								*		plumbog.	~1
C107914	Mt Mary CT87-1	23–24, = 107739	mudstone	***	*					**	***	*					?				siderite?	
C107918	Mt Mary CT87-1	30 m	hornfels	***	*	**				***	*	*				?						
C107921	Mt Mary CT87-1	52 m	hornfels	***	**	**	**	*		**						*				*		
C107922	Mt Mary CT87-1	54 m	hornfels	***	**	**	**	?		**	*											
C107926	Mt Mary CT87-19	46.5–47	porphyry/clay		***	**				*	***		*									
C107928	Black Jack CT87-4	6.75 = 107770	porphyry	*	***	**				**						*						0.8
C107929	Black Jack CT87-4	22.3 = 107773	porphyry	**	**	***				**						**				*		0.1
C107930	Black Jack CT87-4	29.9 = 107778	mudstone	***	***	**	*	*			**				**	**					siderite?	1.6
C107931	Black Jack CT87-4	30.4 = 107777	mudstone	***	**	**	*	*		*	**					**						4.2
C107935	Mt Mary mine		breccia	**	**					**		*					**	*				0.2
C107937	Mt Mary mine		breccia	***														***				2.7
C107957	Livingstone mine	shaft	mudstone	***	*	*				*	*	*										
C107960	Livingstone mine		syenite	***	***	***				*	*	**					*					
C107968	Livingstone mine		syenite		**	***	*		**	*	*	*										
C107978	Woodbridge DDH	62 m	mudstone	***	**	**		**		**												
C107979	Woodbridge DDH	747 m	mudstone	***	*	**		**		**												
C107982	Snug Tiers DDH	241 m	mudstone	***		***				**			*									
C107984	Tunbridge DDH	840 m	mudstone	***	?	**		**		**						?	?				dol, cal	
C107986	Granton DDH	528 m	mudstone	***	**	**		**		**												
C107987	Granton DDH	279 m	mudstone	***	*	**		**		**			*			*						
C107990	Margate DDH	95 m	mudstone	***		**		**		**												
C108058	Mt Mary CT87-19	7.0 m	porphyry	*	**	***	*				***											
C108061	Mt Mary CT87-19	38.2 m	porphyry		**	***			**	**	***		*				*					
C108062	Mt Mary CT87-19	48.4 m	porphyry		***	**			**	*	***		*									
C108068	Mt Mary CT87-19	109.0 m	porphyry		***	***		*	**	*	**					*				*		
C108137	Regatta Point		porphyry		***					**			*		*		*				** cpx, * ap	
C108138	Regatta Point		porphyry		***								**		*		*					

*** = major ~20%   ** = ~5–20%   * = <~5%   See Appendix 3 for abbreviations

APPENDIX 7

Whole rock geochemistry, Cygnet area

Field No.	Lab. No.	Location	Depth (m)	Lithology	Au	Ag	Pb	As	Zn	W	Cu	Ni	Co	Sn	Bi	Ga	Nd	Ce	La	Ba
C107615	960178	Kings Hill		porphyry	<0.05	-1	13	6	39		35				<5		34	81	46	830
C107617	960179	Kings Hill		qtz vein	<0.05	-1	31	9	34		88				<5		-20	-28	-20	860
C107620	960180	Kings Hill		qtz/porph breccia	<0.05	-1	11	3	17	<10	28	8	<8	<9	<5	14	23	-28	-20	760
C107623	960181	Mt Mary		gossan	7.6	110	3700	820	435	<10	1050	14	<8	16	280	35	-20	32	-20	-23
C107624	960182W	Mt Mary		mudstone	0.2	2	1100	78	800		165						-20	40	28	300
C107627	960183W	Coads Adit		qtz vein	0.4	14	84	24	77		102						-20	41	33	430
C107651	960184	Tobys Hill		qtz vein	0.3	2	120	68	102		60						-20	-28	-20	-23
C107652	960185W	Tobys Hill		mudstone	<0.05	-1	20	11	31		7						20	63	31	790
C107654	960186W	Tobys Hill		mudstone	0.4	-1	83	30	98		93						39	98	55	1050
C107659	960187W	Mt Mary		qtz-chalcedony	2.3	2	610	34	770		32						-20	-28	-20	32
C107660	960188	Mt Mary		mudstone	0.2	2	2400	51	140	<10	20	10	<8	<9	<5	39	30	105	41	700
C107661	960189	Mt Mary		breccia-hem	3.8	3	8500	50	600	<10	100	16	<8	10	<5	84	28	93	40	760
C107663	960190	Mt Mary		breccia-lim	1.5	6	285	52	870	<10	150	14	<8	23	13	51	-20	93	69	99
C107664	960191W	Mt Mary		qtz lim breccia	3.3	4	1030	22	95		68						28	67	43	560
C107665	960192W	Mt Mary		qtz vein	0.1	-1	10	3	336		43						-20	-28	-20	56
C107667	960193W	Kings Hill		qtz/porph breccia	<0.05	-1	11	12	20		6						-20	-28	24	610
C107669	960194W	Kings Hill		qtz/porph breccia	<0.05	1	46	11	17		31				20		-20	71	78	800
C107674	960195W	Black Jack		MuSt/gossan	2.1	3	16	226	64		295				20		-20	95	24	79
C107675	960196W	Black Jack		qtz-lim vein	3.7	2	12	99	24		20						38	140	74	170
C107676	960197W	Kings Hill		porph syenite	0.06	2	24	13	18		27						-20	-28	-20	310
C107701	960439	CT87-20 Mt Mary	13.0 m	MuSt + lim clasts	<0.05	1	496	10	1980	25	123	64	223	<9			105	290	135	700
C107702	960440	CT87-20 Mt Mary	13.0 m	MuSt	0.2	0.5	24	10	656	<10	26	37	<8	<9			24	40	31	830
C107704	960441	CT87-20 Mt Mary	18.9 m	MuSt + lim clasts	<0.05	1	344	10	2030	27	112	58	<8	<9			125	350	145	490
C107705	960442	CT87-20 Mt Mary	18.9 m	MuSt	<0.05	0.5	22	10	917	<10	25	39	<8	<9			-20	48	34	830
C107706	960443	CT87-20 Mt Mary	30.5 m	MuSt + lim clasts	<0.05	0.5	95	10	1400	23	29	74	<8	<9			145	440	220	220
C107708	960444	CT87-20 Mt Mary	47.5 m	MuSt + lim veins	3.1	5	14500	150	3800	<10	290	46	9	<9			-20	75	-20	510
C107709	960445	CT87-20 Mt Mary	47.5 m	MuSt	<0.05	3	925	73	200	<10	73	8	<8	<9			-20	37	21	780
C107712	960446	CT87-20 Mt Mary	51.1 m	Porph	<0.05	0.5	104	10	220	<10	17	12	<8	<9			47	120	64	1950
C107713	960447	CT87-20 Mt Mary	56.3 m	MuSt	<0.05	4	11	10	450	<10	24	36	8	<9			40	84	49	730
C107719	960448	CT87-20 Mt Mary	68.4 m	MuSt	<0.05	0.5	22	10	412	13	23	31	<8	<9			38	84	43	860
C107720	960449	CT87-20 Mt Mary	80.7 m	MuSt	<0.05	0.5	14	10	428	<10	29	33	10	<9			36	75	44	630
C107721	960450	CT87-20 Mt Mary	82.7 m	Porph	<0.05	0.5	23	10	214	<10	43	7	<8	<9			29	61	37	1400
C107724	960451	CT87-20 Mt Mary	87.9 m	Porph	<0.05	0.5	45	10	205	<10	23	8	<8	<9			31	66	35	1650
C107725	960452	CT87-20 Mt Mary	87.2 m	Porph + lim veins	0.2	1	38	35	356	24	20	15	13	<9			21	63	31	1750
C107727	960453	CT87-20 Mt Mary	98.7 m	Porph	<0.05	0.5	12	10	196	<10	32	15	<8	<9			47	76	36	1250
C107728	960454	CT87-20 Mt Mary	104.7 m	Porph	<0.05	0.5	24	10	175	11	23	11	8	<9			36	80	44	1450
C107730	960455a	CT87-20 Mt Mary	124.3 m	MuSt-qtz brx	<0.05	0.5	29	10	130	<10	11	12	<8	<9			48	79	51	140
C107732	960456	CT87-1 Mt Mary	2.0 m	MuSt?-clay	<0.05	1	73	30	2000	<10	36	56	8	<0			26	68	31	600
C107733	960457	CT87-1 Mt Mary	2.8 m	MuSt	<0.05	0.5	38	10	1900	11	17	27	<8	<9			36	87	44	740

Field No.	Lab. No.	Location	Depth (m)	Lithology	Au	Ag	Pb	As	Zn	W	Cu	Ni	Co	Sn	Bi	Ga	Nd	Ce	La	Ba
C107734	960458	CT87-1 Mt Mary	9.4 m	MuSt	<0.05	1	56	85	5900	24	246	119	205	<9			32	135	93	510
C107735	960459	CT87-1 Mt Mary	13.5 m	Porph	<0.05	1	184	52	2300	16	102	56	9	<9			36	77	40	1350
C107736	960460	CT87-1 Mt Mary	15.0 m	Porph	<0.05	0.5	68	15	3150	19	86	57	13	<9			-20	41	-20	1450
C107737	960461	CT87-1 Mt Mary	21.9 m	brx-MuSt?-pug	0.2	2	14950	10	18300	<10	464	79	<8	<9			27	120	38	71
C107738	960462	CT87-1 Mt Mary	22.0 m	brx-MuSt-hem	2	27	13700	155	3300	<10	180	35	<8	<9			27	100	24	28
C107739	960463	CT87-1 Mt Mary	22.9 m	MuSt-clay	0.1	0.5	3500	10	4700	<10	102	43	36	<9			39	99	40	510
C107740	960464	CT87-1 Mt Mary	33.9 m	Porph + lim	<0.05	2	80	46	4060	16	25	28	<8	<9			-20	75	32	1400
C107741	960465	CT87-1 Mt Mary	34.1 m	Porph	<0.05	0.5	35	10	500	<10	16	5	<8	<9			24	70	44	1500
C107743	960466	CT87-1 Mt Mary	38.5 m	MuSt	<0.05	0.5	13	10	570	<10	19	34	17	<9			38	93	49	670
C107745	960467	CT87-1 Mt Mary	55.3 m	Porph	0.3	0.5	22	10	950	12	27	18	<8	<9			-20	40	-20	38
C107746	960468	CT87-1 Mt Mary	62.5 m	Porph	<0.05	0.5	25	10	68	<10	12	7	<8	<9			35	59	37	1150
C107749	960469	CT87-19 Mt Mary	16.6 m	Porph + lim veins	2.6	8	29	390	232	19	60	<5	<8	<9			36	74	38	1650
C107752	960470	CT87-19 Mt Mary	36.8 m	MuSt	<0.05	0.5	10	10	720	<10	41	22	<8	<9			35	61	41	820
C107753	960471	CT87-19 Mt Mary	40.4 m	MuSt-lim	<0.05	2	2500	122	5200	<10	128	68	13	<9			49	145	75	390
C107755	960472	CT87-19 Mt Mary	46.1 m	brx-MuSt-hem	7.4	5	5000	303	5300	<10	504	43	8	<9			27	115	37	110
C107760	960473	CT87-19 Mt Mary	82.3 m	MuSt	<0.05	0.5	34	10	300	<10	25	35	19	<9			35	78	43	730
C107761	960474	CT87-19 Mt Mary	87.1 m	amphibolite	<0.05	0.5	15	35	420	<10	12	9	14	<9			-20	-28	-20	-23
C107764	960475	CT87-19 Mt Mary	110.0 m	brx-MuSt	<0.05	0.5	16	10	59	<10	143	5	10	<9			34	76	33	1650
C107767	960476	CT87-19 Mt Mary	98.0 m	porphyry-pug	<0.05	1	49	48	1050	24	14	8	<8	<9			46	120	71	1050
C107768	960477	CT87-19 Mt Mary	46.9 m	brx-pug/porph/must	<0.05	0.5	202	10	4800	18	75	33	<8	<9			47	105	38	1100
C107769	960478	CT87-19 Mt Mary	51.2 m	brx-MuSt-hem	0.2	0.5	77	10	2500	15	77	37	<8	<9			36	91	49	660
C107770	960479	CT87-4 Black Jack	6.7 m	Porph + lim veins	0.8	2	93	1900	137	21	106	10	<8	<9			48	175	120	640
C107771	960480	CT87-4 Black Jack	13.3 m	Porph	<0.05	0.5	23	89	104	<10	24	5	<8	<9			-20	86	58	1100
C107772	960481	CT87-4 Black Jack	15.3 m	Porph + lim veins	0.05	0.5	19500	430	1600	<10	345	16	<8	19			-20	115	31	195
C107773	960482	CT87-4 Black Jack	22.3 m	Porph + lim veins	0.1	1	10	345	630	18	29	<5	<8	<9			27	81	27	290
C107776	960483	CT87-4 Black Jack	28.3 m	MuSt	<0.05	1	5	10	224	<10	761	46	60	<9			21	52	30	470
C107777	960484	CT87-4 Black Jack	30.5 m	MuSt	4.2	0.5	8	10	171	<10	156	27	15	<9			29	63	32	700
107779B	960486	CT87-4 Black Jack	32.7 m	MuSt	<0.05	0.5	8	10	97	<10	110	24	10	<9			39	47	31	710
107779C	960487	CT87-4 Black Jack	32.7 m	MuSt	<0.05	0.5	9	10	42	<10	16	19	<8	<9			25	49	30	890
C107780	960488	CT87-4 Black Jack	34.8 m	MuSt	<0.05	0.5	7	10	76	<10	28	12	<8	<9			29	42	31	470
C107781	960489	CT87-4 Black Jack	40.4 m	MuSt	0.08	0.5	5	96	170	<10	93	25	20	<9			38	65	39	2905
C107782	960490	CT87-4 Black Jack	42.3 m	MuSt	<0.05	0.5	16	10	133	12	136	30	17	<9			64	135	74	410
C107783	960491	CT87-4 Black Jack	45.9 m	MuSt	<0.05	0.5	8	10	37	<10	93	31	11	<9			33	65	37	300
C107784	960492	CT87-4 Black Jack	51.5 m	MuSt + lim	<0.05	1	18	181	1100	17	49	8	<8	<9			-20	-28	-20	270
C107787	960493	CT87-4 Black Jack	75.5 m	Porph	<0.05	0.5	26	10	125	<10	14	7	<8	<9			32	59	29	1100
C107868	970182	Brooks Bay		Porph	<0.05	1	43	-20	13	-10	7	5	-8	-9	-5	20	35	155	98	1600
C107876	970183	Surges Bay		Cong	<0.05	2	76	40	72	-10	140	6	-8	-9	79	-5	-20	-28	-20	33
C107932	970252	Mt Mary		porphyry	<0.05	~1	61	-20	210	-10	7	5	-8	-9	-5	23	48	105	46	1100
C107933	970253	Mt Mary		MuSt	<0.05	1	28	-20	87	-10	7	28	13	-9	-5	18	31	79	42	680
C107934	970254	Mt Mary		porphyry	0.05	~1	22	-20	360	10	240	9	11	-9	-5	20	50	98	55	1300
C107935	970255	Mt Mary		Hem Brx	0.2	5	240	87	490	12	200	13	-8	13	25	51	30	140	76	640
C107936	970256	Mt Mary		jar-Brx	19.7	11	360	330	200	-10	105	8	-8	24	42	19	-20	48	26	420
C107937	970257	Mt Mary		Brx-sili	2.7	15	10500	85	1050	-10	530	7	-8	-9	83	140	-20	54	-20	24

Field No.	Lab. No.	Location	Depth (m)	Lithology	Au	Ag	Pb	As	Zn	W	Cu	Ni	Co	Sn	Bi	Ga	Nd	Ce	La	Ba
C107938	970258	Mt Mary		porph + lim	10.3	26	820	90	610	-10	230	5	-8	-9	16	25	-20	-28	-20	69
C107939	970259	Mt Mary-RT		MuSt	0.1	1	26	-20	110	-10	12	50	14	-9	-5	20	37	87	45	730
C107940	970260	Mt Mary-RT		Brx-sili	0.1	<1	28	-20	390	-10	47	8	32	-9	-5	130	-20	-28	-20	83
C107941	970261	Mt Mary-RT		Brx-sili	0.5	<1	41	-20	2200	-10	125	31	16	-9	-5	78	-20	-28	-20	1200
C107943	970262	Coads Adit		qtz vein	0.1	5	19	-20	60	-10	19	5	-8	-9	-5	-5	-20	-28	-20	87
C107944	970263	Black Jack		fenite	<0.05	2	35	57	14	58	93	9	-8	-9	77	19	-20	59	28	270
C107945	970264	Black Jack		Brx-sili	<0.05	~1	16	-20	9	-10	61	-5	-8	-9	-5	-5				
C107946	970265	Black Jack		MuSt	0.05	~1	25	-20	50	-10	23	7	-8	-9	-5	13				
C107947	970266	Black Jack		MuSt + lim	0.07	1	24	45	16	19	125	5	-8	-9	17	17				
C107950	970267	Black Jack		fenite	0.05	1	20	-20	12	13	58	-5	-8	-9	17	14				
C107951	970268	Black Jack		MuSt + lim	1.2	2	27	-20	28	13	140	21	12	11	800	16				
C107952	970269	Black Jack		MuSt brx	0.3	1	24	34	26	50	105	12	-8	-9	6	12	-20	-28	-20	110
C107953	970270	Black Jack		Brx-sili	<0.05	<1	22	-20	16	-10	15	-5	-8	-9	-5	14	32	49	32	300
C107954	970271	Toby Hill Road		MuSt	0.06	~1	29	-20	135	-10	-5	11	-8	-9	-5	12	-20	35	27	670
C107955	970273	Livingstone		qtz vein	0.11		160	-20	310	-10	43	6	-8	-9	-5	-5	-20	-28	-20	-23
C107956	970274	Livingstone		qtz, porph	<0.05		31	-20	165	11	23	7	-8	-9	-5	15	-20	-28	-20	1050
C107957	970275	Livingstone		qtz, MuSt	<0.05		50	-20	155	-10	35	8	-8	-9	-5	12	26	48	29	570
C107958	970276	Livingstone		Porph	<0.05		39	-20	46	-10	-5	-5	-8	-9	-5	28	-20	49	26	620
C107959	970277	Livingstone		Porph	<0.05		50	27	250	-10	65	5	-8	-9	-5	22	27	46	34	1400
C107960	970278	Livingstone		Porph + qtz vein	<0.05		29	-20	73	-10	6	-5	-8	-9	-5	21	20	-28	-20	1100
C107962	970279	Livingstone		Porph	<0.05		21	-20	43	-10	9	-5	-8	-9	-5	23	23	55	28	1250
C107963	970280	Livingstone		Porph, qtz vein	<0.05		37	-20	50	-10	12	-5	-8	-9	-5	19	-20	-28	-20	1050
C107965	970281	Livingstone		qtz vein	1.1		87	-20	155	-10	60	5	-8	-9	-5	5	-20	-28	-20	280
C107966	970282	Livingstone		hem MuSt	0.7		1000	810	470	-10	110	22	-8	10	8	23	28	98	34	155
107967a	970283	Livingstone		Porph	<0.05		28	-20	66	-10	-5	6	20	-9	-5	22	29	72	45	1200
107967b	970284	Livingstone		Porph	<0.05		27	-20	68	-10	-5	-5	8	-9	-5	21	29	75	46	1200
C107968	970285	Livingstone		Porph	<0.05		33	-20	76	-10	12	5	-8	-9	-5	23	34	57	25	1300
107969b	970286	Kings Hill		Porph-jar brx	<0.05		27	-20	13	-10	100	7	-8	-9	-5	18	-20	53	24	700
C107978	970288	Woodbridge DDH	62.0 m	mudstone	<0.05	1	23	-20	82	270	7	28	30	-9	-5	20	41	89	51	800
C107979	970289	Woodbridge DDH	747.0 m	mudstone	<0.05	1	21	-20	58	-10	28	46	16	-9	-5	17	31	73	45	760
C107980	970290	Snug Tiers DDH	92.0 m	mudstone	0.1	1	30	-20	23	-10	-5	21	-8	-9	-5	6	-20	-28	-20	145
C107981	970291	Snug Tiers DDH	99.0 m	mudstone	0.07	2	21	-20	155	-10	-5	62	-8	-9	5	8	-20	-28	-20	150
C107982	970292	Snug Tiers DDH	241.0 m	mudstone	<0.05	1	29	-20	73	-10	-5	12	-8	-9	-5	24	28	71	30	260
C107983	970293	Snug Tiers DDH	262.5 m	mudstone	<0.05	3	29	-20	85	-10	-5	17	11	-9	-5	13	42	61	45	510
C107984	970294	Tunbridge DDH	840.0 m	mudstone	<0.05	1	27	-20	110	-10	12	43	14	-9	-5	12	33	69	39	480
C107985	970295	Tunbridge DDH	701.0 m	mudstone	<0.05	1	46	-20	250	-10	17	55	30	-9	-5	23	43	99	50	620
C107986	970296	Granton DDH	528.0 m	mudstone	<0.05	1	46	-20	180	-10	20	37	19	-9	-5	28	39	100	45	640
C107987	970297	Granton DDH	278.5 m	mudstone	<0.05	1	30	-20	30	-10	-5	24	10	-9	-5	17	38	66	41	440
C107988	970298	Granton DDH	281.5 m	vein	0.09	2	27	-20	39	-10	-5	29	12	-9	6	9	36	100	43	195
C107989	970299	Margate DDH	243.5 m	mudstone	<0.05	1	20	-20	56	-10	9	25	9	-9	-5	19	33	70	41	810
C107990	970300	Margate DDH	95.0 m	mudstone	<0.05	1	32	-20	43	-10	15	28	11	-9	-5	17	35	63	35	490
C107975	970315	Kings Hill		porphyry	<0.05	1	13	-20	38	-10	100	8	9	-9	-5	20	32	52	34	1100
C107976	970316	Regatta Point		porphyry	<0.05	1	15	-20	60	-10	26	6	14	-9	-5	24	29	61	-20	3300

Field No.	Lab. No.	Location	Depth (m)	Lithology	Au	Ag	Pb	As	Zn	W	Cu	Ni	Co	Sn	Bi	Ga	Nd	Ce	La	Ba
C107994	970317	CT87-1	63.7 m	porphyry	0.09	1	33	-20	125	11	7	6	-8	-9	-5	20	30	67	37	1100
C107995	970318	CT87-2	47.5 m	porphyry	<0.05	1	17	-20	680	-10	83	6	11	-9	-5	21	33	77	50	1050
C107996	970319	CT87-19	131.5 m	porphyry	0.06	1	19	-20	77	-10	-5	-5	-8	-9	-5	20	25	47	27	910
C107997	970320	CT87-4(BJ)	43.0 m	porphyry	<0.05	1	16	-20	79	-10	6	-5	-8	-9	-5	22	35	80	39	1000
C107998	970321	CT87-4(BJ)	43.9 m	mudstone	<0.05	1	18	-20	69	-10	39	24	-8	-9	-5	16	28	58	28	570
C107999	970322	CT87-4(BJ)	64.5 m	porphyry	<0.05	<1	16	-20	105	-10	100	-5	9	-9	-5	22	32	54	42	990
C108000	970323	CT87-4(BJ)	45.9 m	mudstone	<0.05	1	21	-20	29	-10	7	18	-8	-9	-5	18	24	61	31	610
C108001	970324	Woodbridge DDH	673.5 m	porphyry	<0.05	1	15	-20	24	-10	-5	9	8	-9	-5	19	23	46	30	850
C108002	970325	Woodbridge DDH	685.5 m	porphyry	<0.05	1	19	-20	14	-10	-5	-5	-8	-9	-5	21	20	42	30	970
C108003	970326	Woodbridge DDH	792.3 m	porphyry	<0.05	1	15	-20	12	-10	-5	-5	-8	-9	-5	19	-20	-28	-20	1000
C108004	970327	Woodbridge DDH	794.5 m	porphyry	<0.05	<1	-10	-20	14	-10	-5	-5	-8	-9	-5	20	-20	-28	-20	1000
C108005	970328	Woodbridge DDH	817 m	porphyry	<0.05	1	15	-20	12	-10	-5	-5	-8	-9	-5	23	25	40	30	840
C108006	970329	Woodbridge DDH	866 m	porphyry	<0.05	1	14	-20	28	-10	-5	5	8	-9	-5	21	26	48	24	790
C108007	970330	Woodbridge DDH	977 m	porphyry	<0.05	1	16	-20	26	-10	-5	5	-8	-9	-5	21	-20	42	-20	510
C108008	970357	Martins Point		porphyry	0.004	~1	29	-20	68	-10	-5	10	-8	-9	-5	23	32	75	41	1700
C108012	970358	Martins Point		porphyry	0.077	<1	37	-20	60	-10	-5	9	19	-9	-5	21	57	130	78	1450
C108013	970359	Martins Point		porphyry	0.037	~1	28	-20	71	-10	5	8	8	-9	-5	25	43	98	68	850
C108014	970360	Martins Point		porphyry	0.005	~1	44	-20	145	-10	-5	5	-8	-9	-5	26	22	78	56	1700
C108015	970361	Martins Point		porphyry	<0.057	~1	31	-20	54	-10	110	-5	9	-9	-5	23	98	240	125	1400
C108016	970362	Martins Point		porphyry	0.015	<1	64	-20	135	-10	26	48	33	-9	-5	22	105	240	140	1350
C108017	970363	Petcheys Bay		porphyry	0.0008	~1	28	-20	110	-10	58	11	18	-9	-5	21	52	110	55	1950
C108018	970364	Wheatleys Bay		porphyry	<0.003	1	29	-20	110	-10	19	-5	-8	-9	-5	26	40	115	62	1800
C108020	970365	Forster Rivulet Road		porphyry	0.007	<1	13	-20	46	-10	6	-5	-8	-9	-5	21	36	65	41	1200
C108021	970366	Forster Rivulet Road		porphyry	0.005	<1	16	-20	38	-10	5	-5	-8	-9	-5	21	32	72	38	1150
C108022a	970367	Forster Rivulet Road		porphyry	0.003	~1	66	-20	125	-10	9	17	-8	-9	-5	34	-20	92	55	3300
C108022b	970368	Copper Alley Bay		porphyry	0.003	~1	51	-20	210	-10	17	-5	-8	-9	-5	33	29	120	70	3000
C108023	970369	Copper Alley Bay		porphyry	0.003	~1	41	-20	130	-10	9	6	-8	-9	-5	32	-20	100	60	2900
C108024	970370	Regatta Point		porphyry	~0.005	<1	25	-20	41	-10	7	-5	-8	-9	-5	23	-20	-28	-20	760
C108025	970371	Langdons Point		porphyry	~0.005	<1	56	-20	105	-10	-5	8	9	-9	-5	30	31	97	56	3100
C108026	970372	Langdons Point		porphyry	0.007	<1	18	-20	67	-10	63	8	9	-9	-5	24	55	115	67	1700

Field No.	Lab. No.	Location	Depth (m)	Lithology	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
C107615	960178	Kings Hill		porphyry																
C107617	960179	Kings Hill		qtz vein																
C107620	960180	Kings Hill		qtz/porph breccia																
C107623	960181	Mt Mary		gossan																
C107624	960182W	Mt Mary		mudstone																
C107627	960183W	Coads Adit		qtz vein																
C107651	960184	Tobys Hill		qtz vein																
C107652	960185W	Tobys Hill		mudstone																
C107654	960186W	Tobys Hill		mudstone																
C107659	960187W	Mt Mary		qtz-chalcedony																
C107660	960188	Mt Mary		mudstone																
C107661	960189	Mt Mary		breccia-hem																
C107663	960190	Mt Mary		breccia-lim																
C107664	960191W	Mt Mary		qtz lim breccia																
C107665	960192W	Mt Mary		qtz vein																
C107667	960193W	Kings Hill		qtz/porph breccia																
C107669	960194W	Kings Hill		qtz/porph breccia																
C107674	960195W	Black Jack		MuSt/gossan																
C107675	960196W	Black Jack		qtz-lim vein																
C107676	960197W	Kings Hill		porph syenite																
C107701	960439	CT87-20 Mt Mary	13.0 m	MuSt+lim clasts	62.71	0.45	12.16	10.20	0.45	0.30	3.34	0.24	0.66	2.75	0.21	0.08	0.13	5.92	99.60	6.00
C107702	960440	CT87-20 Mt Mary	13.0 m	MuSt	66.15	0.63	15.51	2.48	2.39	0.07	2.82	0.18	0.61	4.34	0.09	0.08	0.22	3.83	99.38	3.79
C107704	960441	CT87-20 Mt Mary	18.9 m	MuSt+lim clasts	60.92	0.41	12.43	11.53	0.39	0.18	2.92	0.24	0.64	3.55	0.15	0.08	0.12	5.97	99.53	6.05
C107705	960442	CT87-20 Mt Mary	18.9 m	MuSt	65.74	0.63	16.02	2.73	1.94	0.07	2.54	0.10	0.86	4.90	0.01	0.09	0.05	3.98	99.65	3.82
C107706	960443	CT87-20 Mt Mary	30.5 m	MuSt+lim clasts	65.74	0.45	12.20	8.87	0.52	0.05	2.51	0.35	0.39	2.77	0.13	0.08	0.22	5.59	99.86	5.76
C107708	960444	CT87-20 Mt Mary	47.5 m	MuSt+lim veins	44.63	0.38	10.19	19.13	0.32	0.02	0.89	0.12	0.34	5.47	0.16	0.55	3.13	10.98	96.32	14.07
C107709	960445	CT87-20 Mt Mary	47.5 m	MuSt	72.60	0.68	14.04	1.34	0.45	0.02	0.84	0.05	0.28	6.45	0.03	0.10	0.22	2.59	99.68	2.76
C107712	960446	CT87-20 Mt Mary	51.1 m	Porph						No Sample										
C107713	960447	CT87-20 Mt Mary	56.3 m	MuSt	69.51	0.63	14.46	1.88	2.39	0.05	2.28	0.20	0.78	4.26	0.11	0.08	0.08	2.83	99.54	2.65
C107719	960448	CT87-20 Mt Mary	68.4 m	MuSt	69.16	0.58	12.86	2.87	0.90	0.04	1.85	1.61	0.76	5.35	0.14	0.09	0.04	3.78	100.03	3.72
C107720	960449	CT87-20 Mt Mary	80.7 m	MuSt	69.00	0.60	14.27	1.52	3.10	0.07	2.71	0.38	0.55	3.93	0.12	0.08	0.00	3.42	99.74	3.07
C107721	960450	CT87-20 Mt Mary	82.7 m	Porph	61.40	0.39	19.17	1.98	0.90	0.02	0.44	1.77	5.46	5.72	0.12	0.11	0.09	1.40	98.97	1.39
C107724	960451	CT87-20 Mt Mary	87.9 m	Porph	61.91	0.37	18.83	2.22	0.71	0.03	0.53	1.57	4.82	6.77	0.12	0.12	0.11	1.54	99.67	1.57
C107725	960452	CT87-20 Mt Mary	87.2 m	Porph+lim veins	52.63	0.28	15.24	14.56	0.45	0.04	0.78	0.42	1.10	9.95	0.13	0.10	0.07	3.21	98.95	3.23
C107727	960453	CT87-20 Mt Mary	98.7 m	Porph	61.20	0.48	18.58	3.18	0.71	0.02	0.52	3.01	5.09	4.75	0.24	0.19	0.00	1.97	99.94	1.8
C107728	960454	CT87-20 Mt Mary	104.7 m	Porph						No Sample										
C107730	960455a	CT87-20 Mt Mary	124.3 m	MuSt-qtz brx	91.03	0.13	3.07	0.97	0.45	0.01	0.33	0.74	0.00	1.01	0.42	0.11	0.04	1.87	100.18	1.86
C107732	960456	CT87-1 Mt Mary	2.0 m	MuSt?-clay	58.44	0.55	14.46	13.80	0.97	0.04	1.79	0.01	0.48	3.76	0.15	0.08	0.36	4.79	99.68	5.04
C107733	960457	CT87-1 Mt Mary	2.8 m	MuSt	65.10	0.71	19.09	2.43	1.23	0.03	1.55	0.01	0.51	5.12	0.01	0.08	0.20	3.91	99.96	3.97

Field No.	Lab. No.	Location	Depth (m)	Lithology	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
C107734	960458	CT87-1 Mt Mary	9.4m	MuSt	51.04	0.53	13.93	18.93	0.32	0.18	0.61	0.28	1.19	3.52	0.70	0.10	0.35	7.12	98.80	7.43
C107735	960459	CT87-1 Mt Mary	13.5 m	Porph	54.58	0.57	17.28	11.33	0.58	0.06	1.00	0.44	3.13	6.94	0.34	0.08	0.15	3.31	99.79	3.40
C107736	960460	CT87-1 Mt Mary	15.0 m	Porph	58.68	0.56	16.88	6.36	0.58	0.09	3.02	0.46	1.51	6.77	0.13	0.06	0.10	4.41	99.62	4.45
C107737	960461	CT87-1 Mt Mary	21.9 m	brx-MuSt?-pug	52.82	0.08	6.52	21.31	0.32	0.06	2.65	0.14	1.11	0.77	1.03	0.08	0.00	7.24	94.14	7.20
C107738	960462	CT87-1 Mt Mary	22.0 m	brx-MuSt-hem	68.89	0.01	1.24	20.62	0.58	0.03	0.30	0.12	0.15	0.08	0.74	0.09	0.33	3.47	96.64	3.73
C107739	960463	CT87-1 Mt Mary	22.9 m	MuSt-clay	68.46	0.45	12.45	3.54	0.32	0.76	1.80	1.51	0.39	4.00	0.95	0.12	0.19	3.35	98.27	3.50
C107740	960464	CT87-1 Mt Mary	33.9 m	Porph + lim	51.42	0.61	15.32	15.54	0.58	0.02	0.88	0.56	1.70	6.90	0.46	0.12	0.30	4.70	99.12	4.93
C107741	960465	CT87-1 Mt Mary	34.1 m	Porph							No Sample									
C107743	960466	CT87-1 Mt Mary	38.5 m	MuSt	69.60	0.61	14.83	0.51	3.42	0.05	2.24	0.22	1.30	3.59	0.14	0.14	0.19	2.66	99.49	2.47
C107745	960467	CT87-1 Mt Mary	55.3 m	Porph							No Sample									
C107746	960468	CT87-1 Mt Mary	62.5 m	Porph							No Sample									
C107749	960469	CT87-19 Mt Mary	16.6 m	Porph + lim veins	51.27	0.23	10.35	18.25	0.45	0.02	0.51	0.06	0.38	4.14	0.55	0.29	2.19	7.45	96.14	9.59
C107752	960470	CT87-19 Mt Mary	36.8 m	MuSt	66.87	0.63	15.81	2.75	1.74	0.05	2.37	0.58	1.40	4.43	0.14	0.09	0.30	2.83	99.97	2.93
C107753	960471	CT87-19 Mt Mary	40.4 m	MuSt-lim	54.75	0.42	10.94	18.85	0.45	0.07	2.01	0.41	0.50	3.40	0.40	0.21	0.33	5.62	98.37	5.90
C107755	960472	CT87-19 Mt Mary	46.1 m	brx-MuSt-hem	54.28	0.26	7.70	25.43	0.19	0.21	1.32	0.28	0.32	1.47	0.32	0.16	0.00	5.79	97.73	5.77
C107760	960473	CT87-19 Mt Mary	82.3 m	MuSt							No Sample									
C107761	960474	CT87-19 Mt Mary	87.1 m	amphibolite	61.20	0.01	1.09	1.72	2.65	0.14	18.48	10.81	0.12	0.10	0.11	0.15	0.20	2.97	99.73	2.88
C107764	960475	CT87-19 Mt Mary	110.0 m	brx-MuSt	56.11	0.70	17.90	4.91	1.87	0.04	1.20	1.81	3.47	7.49	0.16	0.18	0.00	3.27	99.13	3.07
C107767	960476	CT87-19 Mt Mary	98.0 m	porphyry-pug	56.65	0.54	17.38	4.95	1.74	0.05	1.79	0.85	1.17	6.62	0.18	0.49	1.03	6.06	99.50	6.90
C107768	960477	CT87-19 Mt Mary	46.9 m	brx-pug/porph/must	55.39	0.63	18.58	5.52	0.45	0.06	2.24	4.10	1.13	6.08	0.21	0.21	0.14	4.29	99.03	4.38
C107769	960478	CT87-19 Mt Mary	51.2 m	brx-MuSt-hem	65.99	0.61	14.02	5.60	1.23	0.04	2.34	0.65	0.59	4.45	0.13	0.10	0.09	4.05	99.89	4.00
C107770	960479	CT87-4 Black Jack	6.7 m	Porph + lim veins	46.70	0.19	12.00	22.73	0.52	0.02	0.52	0.03	0.71	5.35	0.62	0.25	1.80	7.30	98.73	9.04
C107771	960480	CT87-4 Black Jack	13.3 m	Porph	61.37	0.86	19.67	2.11	0.45	0.01	0.39	0.13	1.32	10.87	0.10	0.10	0.20	2.18	99.75	2.33
C107772	960481	CT87-4 Black Jack	15.3 m	Porph + lim veins	53.94	0.69	17.27	11.51	0.45	0.32	0.34	0.09	1.55	9.33	0.32	0.09	0.32	3.19	99.40	3.46
C107773	960482	CT87-4 Black Jack	22.3 m	Porph + lim veins	24.18	0.12	5.28	53.55	0.19	0.15	0.23	0.33	1.38	1.73	0.49	0.07	0.20	8.74	96.64	8.92
C107776	960483	CT87-4 Black Jack	28.3 m	MuSt	50.68	0.39	8.72	14.84	4.91	0.03	0.37	0.71	0.77	5.40	0.11	0.37	0.73	11.18	99.21	11.37
C107777	960484	CT87-4 Black Jack	30.5 m	MuSt	59.98	0.83	16.58	2.87	2.26	0.05	1.64	2.38	3.76	5.54	0.11	0.15	0.66	2.74	99.54	3.15
107779B	960486	CT87-4 Black Jack	32.7 m	MuSt	66.80	0.60	13.97	2.83	2.78	0.04	1.63	2.63	3.08	3.07	0.11	0.17	0.40	2.26	100.35	2.35
107779C	960487	CT87-4 Black Jack	32.7 m	MuSt	69.66	0.68	15.16	0.19	1.49	0.04	1.46	3.02	3.60	3.66	0.11	0.11	0.38	0.58	100.14	0.80
C107780	960488	CT87-4 Black Jack	34.8 m	MuSt	72.46	0.50	13.02	-0.06	2.39	0.07	1.52	1.84	3.07	2.61	0.08	0.12	0.45	1.10	99.16	1.28
C107781	960489	CT87-4 Black Jack	40.4 m	MuSt	68.12	0.62	13.24	2.56	1.87	0.04	1.04	4.40	2.75	2.39	0.13	0.11	0.36	2.23	99.85	2.38
C107782	960490	CT87-4 Black Jack	42.3 m	MuSt	70.21	0.63	13.63	2.45	0.84	0.01	0.52	2.72	2.39	3.42	0.11	0.09	0.27	2.53	99.82	2.70
C107783	960491	CT87-4 Black Jack	45.9 m	MuSt	67.62	0.58	13.99	1.39	3.16	0.04	2.34	2.00	3.03	2.69	0.09	0.16	1.01	1.97	100.06	2.63
C107784	960492	CT87-4 Black Jack	51.5 m	MuSt + lim	66.91	0.50	12.40	9.84	0.45	0.01	0.40	0.09	0.23	3.98	0.11	0.10	0.30	3.39	98.71	3.64
C107787	960493	CT87-4 Black Jack	75.5 m	Porph							No sample									
C107868	970182	Brooks Bay		Porph																
C107876	970183	Surges Bay		Cong																
C107932	970252	Mt Mary		porphyry																
C107933	970253	Mt Mary		MuSt																
C107934	970254	Mt Mary		porphyry																
C107935	970255	Mt Mary		Hem Brx																
C107936	970256	Mt Mary		jar-Brx																
C107937	970257	Mt Mary		Brx-sili																

Field No.	Lab. No.	Location	Depth (m)	Lithology	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
C107938	970258	Mt Mary		porph + lim																
C107939	970259	Mt Mary-RT		MuSt																
C107940	970260	Mt Mary-RT		Brx-sili																
C107941	970261	Mt Mary-RT		Brx-sili																
C107943	970262	Coads Adit		qtz vein																
C107944	970263	Black Jack		fenite																
C107945	970264	Black Jack		Brx-sili																
C107946	970265	Black Jack		MuSt																
C107947	970266	Black Jack		MuSt + lim																
C107950	970267	Black Jack		fenite																
C107951	970268	Black Jack		MuSt + lim																
C107952	970269	Black Jack		MuSt brx																
C107953	970270	Black Jack		Brx-sili																
C107954	970271	Toby Hill Road		MuSt																
C107955	970273	Livingstone		qtz vein																
C107956	970274	Livingstone		qtz, porph																
C107957	970275	Livingstone		qtz, MuSt																
C107958	970276	Livingstone		Porph																
C107959	970277	Livingstone		Porph																
C107960	970278	Livingstone		Porph + qtz vein																
C107962	970279	Livingstone		Porph																
C107963	970280	Livingstone		Porph, qtz vein																
C107965	970281	Livingstone		qtz vein																
C107966	970282	Livingstone		hem MuSt																
107967a	970283	Livingstone		Porph																
107967b	970284	Livingstone		Porph																
C107968	970285	Livingstone		Porph																
107969b	970286	Kings Hill		Porph-jar brx																
C107978	970288	Woodbridge DDH	62.0 m	mudstone																
C107979	970289	Woodbridge DDH	747.0 m	mudstone																
C107980	970290	Snug Tiers DDH	92.0 m	mudstone																
C107981	970291	Snug Tiers DDH	99.0 m	mudstone																
C107982	970292	Snug Tiers DDH	241.0 m	mudstone																
C107983	970293	Snug Tiers DDH	262.5 m	mudstone																
C107984	970294	Tunbridge DDH	840.0 m	mudstone																
C107985	970295	Tunbridge DDH	701.0 m	mudstone																
C107986	970296	Granton DDH	528.0 m	mudstone																
C107987	970297	Granton DDH	278.5 m	mudstone																
C107988	970298	Granton DDH	281.5 m	vein																
C107989	970299	Margate DDH	243.5 m	mudstone																
C107990	970300	Margate DDH	95.0 m	mudstone																
C107975	970315	Kings Hill		porphyry																
C107976	970316	Regatta Point		porphyry																

Field No.	Lab. No.	Location	Depth (m)	Lithology	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
C107994	970317	CT87-1	63.7 m	porphyry																
C107995	970318	CT87-2	47.5 m	porphyry																
C107996	970319	CT87-19	131.5 m	porphyry																
C107997	970320	CT87-4(BJ)	43.0 m	porphyry																
C107998	970321	CT87-4(BJ)	43.9 m	mudstone																
C107999	970322	CT87-4(BJ)	64.5 m	porphyry																
C108000	970323	CT87-4(BJ)	45.9 m	mudstone																
C108001	970324	Woodbridge DDH	673.5 m	porphyry																
C108002	970325	Woodbridge DDH	685.5 m	porphyry																
C108003	970326	Woodbridge DDH	792.3 m	porphyry																
C108004	970327	Woodbridge DDH	794.5 m	porphyry																
C108005	970328	Woodbridge DDH	817 m	porphyry																
C108006	970329	Woodbridge DDH	866 m	porphyry																
C108007	970330	Woodbridge DDH	977 m	porphyry																
C108008	970357	Martins Point		porphyry	61.68	0.37	19.86	3.15	0.77	0.07	0.47	0.70	5.97	6.00	0.07`	0.04	0.00	1.11	100.26	1.03
C108012	970358	Martins Point		porphyry	60.76	0.48	19.69	1.13	1.10	0.05	0.29	2.18	5.34	6.15	0.14	0.06	0.23	2.07	99.68	2.18
C108013	970359	Martins Point		porphyry	61.48	0.35	19.89	2.46	1.23	0.08	0.40	0.51	5.10	7.27	0.07	0.03	0.00	1.10	99.95	0.96
C108014	970360	Martins Point		porphyry	60.74	0.20	21.03	1.30	0.97	0.13	0.37	1.33	4.55	7.56	0.05	0.04	0.00	1.26	99.54	1.15
C108015	970361	Martins Point		porphyry	59.43	0.60	20.82	2.43	0.77	0.06	0.38	3.08	5.35	4.97	0.17	0.06	0.00	1.96	100.08	1.88
C108016	970362	Martins Point		porphyry	60.76	0.47	20.23	0.92	1.55	0.14	0.56	2.18	5.22	6.13	0.15	0.05	0.24	1.27	99.86	1.34
C108017	970363	Petcheys Bay		porphyry	55.61	0.82	17.46	4.26	2.97	0.16	1.60	4.79	3.60	6.62	0.45	0.05	0.00	1.13	99.51	0.80
C108018	970364	Wheatleys Bay		porphyry	53.74	0.58	17.90	3.74	1.49	0.21	0.53	4.48	6.09	7.29	0.11	0.29	1.14	2.48	100.07	3.46
C108020	970365	Forster Rivulet Road		porphyry	62.97	0.40	18.28	2.00	1.42	0.11	0.67	3.65	5.42	4.32	0.13	0.05	0.00	0.80	100.22	0.64
C108021	970366	Forster Rivulet Road		porphyry	62.63	0.42	18.32	2.19	1.23	0.12	0.70	4.48	5.38	4.09	0.15	0.03	0.00	0.42	100.16	0.28
C108022a	970367	Forster Rivulet Road		porphyry	55.84	0.46	19.93	4.11	0.77	0.15	0.36	1.88	4.20	10.24	0.07	0.04	0.00	1.56	99.62	1.47
C108022b	970368	Copper Alley Bay		porphyry	55.27	0.44	19.64	3.55	0.90	0.19	0.37	2.13	5.18	9.80	0.05	0.04	0.00	1.45	99.01	1.35
C108023	970369	Copper Alley Bay		porphyry	55.09	0.43	19.91	3.78	0.84	0.18	0.45	1.69	5.69	10.13	0.07	0.05	0.00	0.99	99.30	0.90
C108024	970370	Regatta Point		porphyry	63.30	0.20	18.88	1.93	0.84	0.06	0.18	0.85	4.42	9.24	0.02	0.04	0.00	0.33	100.28	0.24
C108025	970371	Langdons Point		porphyry	61.35	0.31	17.91	2.80	0.71	0.15	0.21	1.06	5.88	7.70	0.04	0.13	0.00	1.26	99.49	1.18
C108026	970372	Langdons Point		porphyry	60.59	0.74	15.84	3.07	2.00	0.14	1.03	4.51	3.83	7.57	0.14	0.05	0.03	0.68	100.21	0.48

Field No.	Lab. No.	Location	Depth (m)	Lithology	Cr	V	Sc	Th	Sr	U	Rb	Y	Zr	Nb	Mo
C107615	960178	Kings Hill		porphyry				16	1150	-10	180	22	150	4	17
C107617	960179	Kings Hill		qtz vein				-10	820	-10	145	-5	97	3	32
C107620	960180	Kings Hill		qtz/porph breccia				-10	620	-10	190	5	93	5	16
C107623	960181	Mt Mary		gossan				160	47	-10	21	-5	25	-3	6
C107624	960182W	Mt Mary		mudstone				-10	41	-10	110	23	91	7	-5
C107627	960183W	Coads Adit		qtz vein				20	135	-10	66	7	57	6	570
C107651	960184	Tobys Hill		qtz vein				-10	19	-10	-5	-5	19	-3	7
C107652	960185W	Tobys Hill		mudstone				13	145	-10	180	21	310	11	-5
C107654	960186W	Tobys Hill		mudstone				17	155	-10	240	34	270	15	-5
C107659	960187W	Mt Mary		qtz-chalcedony				-10	38	-10	-5	-5	18	-3	-5
C107660	960188	Mt Mary		mudstone				40	250	-10	220	14	170	14	-5
C107661	960189	Mt Mary		breccia-hem				62	200	-10	195	18	140	9	14
C107663	960190	Mt Mary		breccia-lim				17	470	-10	13	-5	-5	-3	5
C107664	960191W	Mt Mary		qtz lim breccia				21	450	-10	260	22	175	11	-5
C107665	960192W	Mt Mary		qtz vein				-10	31	-10	-5	-5	16	-3	-5
C107667	960193W	Kings Hill		qtz/porph breccia				-10	400	-10	160	-5	92	5	140
C107669	960194W	Kings Hill		qtz/porph breccia				-10	740	-10	195	-5	105	5	240
C107674	960195W	Black Jack		MuSt/gossan				23	26	-10	120	17	82	6	9
C107675	960196W	Black Jack		qtz-lim vein				24	58	-10	75	15	195	9	-5
C107676	960197W	Kings Hill		porph syenite				16	185	-10	87	7	115	9	420
C107701	960439	CT87-20 Mt Mary	13.0 m	MuSt+lim clasts				32	135	-10	145	250	120	13	-5
C107702	960440	CT87-20 Mt Mary	13.0 m	MuSt				25	53	-10	230	29	175	15	-5
C107704	960441	CT87-20 Mt Mary	18.9 m	MuSt + lim clasts				30	84	-10	155	67	130	12	-5
C107705	960442	CT87-20 Mt Mary	18.9 m	MuSt				29	82	-10	270	23	180	15	-5
C107706	960443	CT87-20 Mt Mary	30.5 m	MuSt + lim clasts				28	90	-10	150	105	130	13	-5
C107708	960444	CT87-20 Mt Mary	47.5 m	MuSt + lim veins				91	150	-10	130	5	115	8	5
C107709	960445	CT87-20 Mt Mary	47.5 m	MuSt				18	97	-10	280	17	190	16	-5
C107712	960446	CT87-20 Mt Mary	51.1 m	Porph				24	2200	-10	270	17	135	3	-5
C107713	960447	CT87-20 Mt Mary	56.3 m	MuSt				23	38	-10	220	33	180	15	-5
C107719	960448	CT87-20 Mt Mary	68.4 m	MuSt				20	230	-10	250	64	165	13	-5
C107720	960449	CT87-20 Mt Mary	80.7 m	MuSt				27	38	-10	220	32	185	15	-5
C107721	960450	CT87-20 Mt Mary	82.7 m	Porph				11	1450	-10	190	19	110	-3	-5
C107724	960451	CT87-20 Mt Mary	87.9 m	Porph				12	1400	-10	210	18	120	-3	-5
C107725	960452	CT87-20 Mt Mary	87.2 m	Porph + lim veins				23	470	-10	380	7	140	5	-5
C107727	960453	CT87-20 Mt Mary	98.7 m	Porph				-10	1550	-10	155	23	90	-3	-5
C107728	960454	CT87-20 Mt Mary	104.7 m	Porph				-10	1000	-10	230	20	135	5	-5
C107730	960455a	CT87-20 Mt Mary	124.3 m	MuSt-qtz brx				-10	44	11	54	52	45	5	-5
C107732	960456	CT87-1 Mt Mary	2.0 m	MuSt?-clay				34	30	-10	250	24	140	13	-5
C107733	960457	CT87-1 Mt Mary	2.8 m	MuSt				22	27	-10	270	29	135	16	-5

Field No.	Lab. No.	Location	Depth (m)	Lithology	Cr	V	Sc	Th	Sr	U	Rb	Y	Zr	Nb	Mo
C107734	960458	CT87-1 Mt Mary	9.4m	MuSt				35	470	-10	130	33	130	10	-5
C107735	960459	CT87-1 Mt Mary	13.5 m	Porph				22	710	-10	230	21	165	11	-5
C107736	960460	CT87-1 Mt Mary	15.0 m	Porph				19	730	-10	280	19	160	10	-5
C107737	960461	CT87-1 Mt Mary	21.9 m	brx-MuSt?-pug				65	165	-10	38	29	47	-3	5
C107738	960462	CT87-1 Mt Mary	22.0 m	brx-MuSt-hem				69	68	-10	12	21	40	-3	6
C107739	960463	CT87-1 Mt Mary	22.9 m	MuSt-clay				30	155	-10	175	38	120	8	5
C107740	960464	CT87-1 Mt Mary	33.9 m	Porph + lim				26	1350	-10	210	13	150	3	-5
C107741	960465	CT87-1 Mt Mary	34.1 m	Porph				17	1550	10	200	13	150	6	-5
C107743	960466	CT87-1 Mt Mary	38.5 m	MuSt				18	45	-10	175	37	185	14	-5
C107745	960467	CT87-1 Mt Mary	55.3 m	Porph				-10	260	-10	11	20	155	6	-5
C107746	960468	CT87-1 Mt Mary	62.5 m	Porph				-10	1550	-10	130	22	89	-3	-5
C107749	960469	CT87-19 Mt Mary	16.6 m	Porph + lim veins				25	100	-10	250	27	180	15	-5
C107752	960470	CT87-19 Mt Mary	36.8 m	MuSt				34	270	-10	175	39	120	10	-5
C107753	960471	CT87-19 Mt Mary	40.4 m	MuSt-lim				55	66	-10	93	20	165	7	6
C107755	960472	CT87-19 Mt Mary	46.1 m	brx-MuSt-hem				16	190	-10	170	27	185	10	-5
C107760	960473	CT87-19 Mt Mary	82.3 m	MuS				10	17	-10	-5	-5	17	-3	-5
C107761	960474	CT87-19 Mt Mary	87.1 m	amphibolite				14	1750	-10	220	19	135	-3	-5
C107764	960475	CT87-19 Mt Mary	110.0 m	brx-MuSt				17	530	-10	230	19	190	11	-5
C107767	960476	CT87-19 Mt Mary	98.0 m	porphyry-pug				15	860	-10	165	28	160	11	-5
C107768	960477	CT87-19 Mt Mary	46.9 m	brx-pug/porph/must				28	115	-10	210	39	165	14	-58
C107769	960478	CT87-19 Mt Mary	51.2 m	brx-MuSt-hem				37	770	-10	280	-5	125	-3	-5
C107770	960479	CT87-4 Black Jack	6.7 m	Porph + lim veins				100	65	-10	155	9	145	8	7
C107771	960480	CT87-4 Black Jack	13.3 m	Porph				17	290	-10	81	29	78	5	-5
C107772	960481	CT87-4 Black Jack	15.3 m	Porph + lim veins				-10	210	-10	185	14	125	4	8
C107773	960482	CT87-4 Black Jack	22.3 m	Porph + lim veins				12	460	-10	220	35	210	6	-5
C107776	960483	CT87-4 Black Jack	28.3 m	MuSt				-10	360	-10	88	29	170	5	-5
C107777	960484	CT87-4 Black Jack	30.5 m	MuSt				-10	360	-10	135	28	200	6	5
C107778	960485	CT87-4 Black Jack	29.9 m	MuSt				-10	420	-10	165	29	230	7	-5
107779B	960486	CT87-4 Black Jack	32.7 m	MuSt				10	330	-10	125	26	185	8	-5B
107779C	960487	CT87-4 Black Jack	32.7 m	MuSt				10	340	-10	93	33	230	9	-5
C107780	960488	CT87-4 Black Jack	34.8 m	MuSt				-10	300	-10	135	55	230	10	6
C107781	960489	CT87-4 Black Jack	40.4 m	MuSt				15	320	-10	165	29	200	10	-5
C107782	960490	CT87-4 Black Jack	42.3 m	MuSt				20	87	-10	230	9	175	12	-5
C107783	960491	CT87-4 Black Jack	45.9m	MuSt				11	1500	-10	145	21	95	-3	-5
C107784	960492	CT87-4 Black Jack	51.5m	MuSt + lim				16	1150	-10	180	22	150	4	17
C107787	960493	CT87-4 Black Jack	75.5m	Porph											
C107868	970182	Brooks Bay		Porph	6	75	-9								
C107876	970183	Surges Bay		Cong	29	58	16								
C107932	970252	Mt Mary		porphyry				18	1550	-10	195	28	165	3	-5
C107933	970253	Mt Mary		MuSt				15	195	-10	185	28	175	13	-5
C107934	970254	Mt Mary		porphyry				10	820	-10	260	57	170	8	-5
C107935	970255	Mt Mary		Hem Brx				16	560	-10	180	5	70	3	-5
C107936	970256	Mt Mary		jar-Brx				25	135	-10	34	-5	36	-3	5
C107937	970257	Mt Mary		Brx-sili				93	35	-10	25	-5	39	-3	5

Field No.	Lab. No.	Location	Depth (m)	Lithology	Cr	V	Sc	Th	Sr	U	Rb	Y	Zr	Nb	Mo
C107938	970258	Mt Mary		porph + lim				10	66	-10	12	6	26	-3	6
C107939	970259	Mt Mary-RT		MuSt				15	230	-10	195	36	165	13	-5
C107940	970260	Mt Mary-RT		Brx-sili				-10	34	-10	-5	12	18	-3	5
C107941	970261	Mt Mary-RT		Brx-sili				-10	38	-10	-5	-5	21	-3	-5
C107943	970262	Coads Adit		qtz vein				-10	29	-10	-5	5	20	-3	11
C107944	970263	Black Jack		fenite				48	75	-10	140	-5	220	9	-5
C107945	970264	Black Jack		Brx-sili				-10	13	-10	12	-5	37	-3	6
C107946	970265	Black Jack		MuSt				-10	92	-10	180	23	240	10	-5
C107947	970266	Black Jack		MuSt + lim				22	230	-10	270	9	180	10	-5
C107950	970267	Black Jack		fenite				19	185	-10	270	13	240	12	5
C107951	970268	Black Jack		MuSt + lim				360	165	-10	230	-5	130	5	-5
C107952	970269	Black Jack		MuSt brx				15	190	-10	340	13	180	6	-5
C107953	970270	Black Jack		Brx-sili				-10	250	-10	155	88	200	9	5
C107954	970271	Toby Hill Road		MuSt				-10	44	-10	115	18	310	11	-5
C107955	970273	Livingstone		qtz vein	-5	-5	-9	-10	8	-10	-5	-5	19	-3	11
C107956	970274	Livingstone		qtz, porph	-5	50	-9	-10	730	-10	120	13	125	3	5
C107957	970275	Livingstone		qtz, MuSt	43	83	-9	-10	80	-10	155	21	175	10	12
C107958	970276	Livingstone		Porph	-5	85	-9	23	500	-10	240	11	270	21	-5
C107959	970277	Livingstone		Porph	7	70	-9	13	610	-10	210	18	185	9	-5
C107960	970278	Livingstone		Porph + qtz vein	-5	63	-9	13	1050	-10	120	12	140	3	-5
C107962	970279	Livingstone		Porph	6	77	-9	17	1250	-10	160	19	160	7	-5
C107963	970280	Livingstone		Porph, qtz vein	-5	59	-9	-10	730	-10	135	9	135	-3	6
C107965	970281	Livingstone		qtz vein	5	24	-9	-10	105	-10	39	5	49	-3	7
C107966	970282	Livingstone		hem MuSt	61	71	-9	27	24	-10	230	17	200	12	10
107967a	970283	Livingstone		Porph	5	66	-9	-10	1700	-10	135	24	130	-3	-5
107967b	970284	Livingstone		Porph	-5	74	-9	12	1650	-10	135	25	130	-3	-5
C107968	970285	Livingstone		Porph	6	140	-9	19	2200	-10	140	20	80	-3	-5
107969b	970286	Kings Hill		Porph-jar brx	14	47	-9	12	510	-10	155	-5	115	4	91
C107978	970288	Woodbridge DDH	62.0 m	mudstone	190	110	14	22	86	-10	200	36	185	15	-5
C107979	970289	Woodbridge DDH	747.0 m	mudstone	100	115	16	22	250	-10	150	33	185	13	-5
C107980	970290	Snug Tiers DDH	92.0 m	mudstone	22	40	-9	-10	43	-10	49	10	98	5	14
C107981	970291	Snug Tiers DDH	99.0 m	mudstone	29	56	9	18	130	-10	60	26	100	6	9
C107982	970292	Snug Tiers DDH	241.0 m	mudstone	25	65	13	20	430	-10	115	36	200	9	-5
C107983	970293	Snug Tiers DDH	262.5 m	mudstone	32	58	-9	25	440	-10	72	48	145	5	-5
C107984	970294	Tunbridge DDH	840.0 m	mudstone	93	100	15	18	105	-10	105	26	210	12	-5
C107985	970295	Tunbridge DDH	701.0 m	mudstone	93	320	19	20	100	-10	195	30	165	13	10
C107986	970296	Granton DDH	528.0 m	mudstone	105	270	19	25	105	-10	230	34	135	15	-5
C107987	970297	Granton DDH	278.5 m	mudstone	59	97	12	20	220	-10	135	32	190	13	-5
C107988	970298	Granton DDH	281.5 m	vein	37	43	-9	16	180	-10	77	71	105	8	-5
C107989	970299	Margate DDH	243.5 m	mudstone	73	105	11	23	74	-10	200	31	190	15	-5
C107990	970300	Margate DDH	95.0 m	mudstone	69	105	14	18	79	-10	160	33	220	13	7
C107975	970315	Kings Hill		porphyry	16	100	-9	-10	1650	-10	93	22	77	-3	6
C107976	970316	Regatta Point		porphyry	5	330	-9	-10	3500	-10	190	17	-5	-3	-5

Field No.	Lab. No.	Location	Depth (m)	Lithology	Cr	V	Sc	Th	Sr	U	Rb	Y	Zr	Nb	Mo
C107994	970317	CT87-1	63.7 m	porphyry	8	89	-9	10	1350	-10	165	22	110	-3	-5
C107995	970318	CT87-2	47.5 m	porphyry	5	115	-9	13	840	-10	290	25	175	4	-5
C107996	970319	CT87-19	131.5 m	porphyry	5	47	-9	-10	1450	-10	110	18	105	-3	-5
C107997	970320	CT87-4(BJ)	43.0 m	porphyry	7	105	-9	18	1500	-10	150	20	160	-3	-5
C107998	970321	CT87-4(BJ)	43.9 m	mudstone	63	110	14	13	340	-10	240	32	230	11	5
C107999	970322	CT87-4(BJ)	64.5 m	porphyry	7	73	-9	13	1700	-10	160	19	130	-3	-5
C108000	970323	CT87-4(BJ)	45.9 m	mudstone	57	100	14	11	350	-10	240	32	240	11	-5
C108001	970324	Woodbridge DDH	673.5 m	porphyry	29	110	9	12	1550	-10	155	15	110	-3	-5
C108002	970325	Woodbridge DDH	685.5 m	porphyry	7	56	-9	10	1600	-10	135	14	95	-3	-5
C108003	970326	Woodbridge DDH	792.3 m	porphyry	7	36	-9	-10	1450	-10	115	9	73	-3	-5
C108004	970327	Woodbridge DDH	794.5 m	porphyry	5	35	-9	-10	3500	-10	100	9	-5	-3	-5
C108005	970328	Woodbridge DDH	817 m	porphyry	6	58	-9	12	970	-10	145	15	155	9	-5
C108006	970329	Woodbridge DDH	866 m	porphyry	13	72	-9	-10	1700	-10	98	21	97	-3	-5
C108007	970330	Woodbridge DDH	977 m	porphyry	8	67	-9	12	980	-10	110	15	99	5	-5
C108008	970357	Martins Point		porphyry	-5	80	-9	17	2200	-10	160	20	150	-3	-5
C108012	970358	Martins Point		porphyry	-5	88	-9	25	1850	-10	185	40	155	3	-5
C108013	970359	Martins Point		porphyry	6	100	-9	27	1400	-10	250	15	180	8	-5
C108014	970360	Martins Point		porphyry	-5	50	-9	23	2300	-10	240	15	165	-3	-5
C108015	970361	Martins Point		porphyry	-5	125	-9	22	1850	-10	150	42	135	5	-5
C108016	970362	Martins Point		porphyry	-5	90	-9	23	1750	-10	170	75	150	4	-5
C108017	970363	Petcheys Bay		porphyry	6	210	13	19	2500	-10	170	31	78	-3	-5
C108018	970364	Wheatleys Bay		porphyry	-5	165	-9	27	3000	-10	210	13	165	3	-5
C108020	970365	Forster Rivulet Road		porphyry	5	62	-9	12	2000	-10	125	25	95	-3	-5
C108021	970366	Forster Rivulet Road		porphyry	5	66	-9	15	2100	-10	100	25	96	-3	-5
C108022a	970367	Forster Rivulet Road		porphyry	5	185	-9	30	3700	-10	240	-5	8	-3	-5
C108022b	970368	Copper Alley Bay		porphyry	-5	185	-9	64	4200	-10	240	-5	-5	-3	-5
C108023	970369	Copper Alley Bay		porphyry	14	185	-9	36	3900	-10	230	-5	-5	-3	-5
C108024	970370	Regatta Point		porphyry	5	69	-9	-10	1350	-10	150	-5	19	-3	-5
C108025	970371	Langdons Point		porphyry	-5	110	-9	45	3700	-10	145	21	150	10	-5
C108026	970372	Langdons Point		porphyry	21	200	-9	17	2100	-10	180	27	99	-3	-5

APPENDIX 8

Statistics for gold and base metals in various rock types, Cygnet, with average values for selected rock types from Berkman (1982)

Sediment hosted

Au, sediments, ppm

	Mean	Max	sd	No.	Median	Geom. mean
b1t	0.05	0.30	0.07	30	0.02	0.03
b1w	0.16	0.70	0.30	5	0.02	0.05
b1b	0.43	4.20	1.04	18	0.02	0.06
b1misc	0.05	0.10	0.04	5	0.02	0.04
b2	2.26	7.40	2.51	8	1.75	0.74
b3	0.99	3.30	1.26	10	0.35	0.37
Average shale	0.004					

Zn, sediments, ppm

	Mean	Max	sd	No.	Median	Geom. mean
b1t	1675	18300	3505	30	439	486
b1w	172	470	178	5	135	108
b1b	130	1100	251	18	46	54
b1misc	117	250	88	5	85	89
b2	2055	5300	1964	8	1685	754
b3	569	2200	655	10	363	333
Average shale	100					

Pb, sediments, ppm

	Mean	Max	sd	No.	Median	Geom. mean
b1t	859	14950	2797	30	25	65
b1w	227	1000	432	5	32	66
b1b	16	35	9	18	17	14
b1misc	31	46	9	5	29	30
b2	5264	14500	6252	8	2643	750
b3	1271	10500	3259	10	102	157
Average shale	20					

Cu, sediments, ppm

	Mean	Max	sd	No.	Median	Geom. mean
b1t	63	464	93	30	28	34
b1w	30	110	46	5	15	11
b1b	123	761	166	18	93	78
b1misc	5	17	7	5	2	3
b2	164	504	167	8	125	67
b3	123	530	152	10	64	80
Average shale	50					

As, sediments, ppm

	Mean	Max	sd	No.	Median	Geom. mean
b1t	21	122	27	30	10	14
b1w	170	810	358	5	10	24
b1b	30	181	44	18	10	17
b1misc	10	10	0	5	10	10
b2	93	303	104	8	51	46
b3	36	87	32	10	26	23
Average shale	15					

Mineralisation types:

b1t	disseminated: Truro tillite
b1w	disseminated: Woody Island Sist
b1b	disseminated: Bundella
b1misc	disseminated: other sediments
b2	Sediment-hosted pyrite veins
b3	Sediment-hosted quartz veins

Abbreviations: Max = maximum
sd = standard deviation
No. = Number of samples

Porphyry hosted

Au, porphyries, ppm

	Mean	*Max*	*sd*	*No.*	*Median*	*Geom. mean*
a1	0.02	0.09	0.02	54	0.02	0.02
a2	0.03	0.06	0.01	8	0.02	0.02
a3	0.29	1.10	0.42	6	0.11	0.11
a4	5.17	19.70	7.03	8	1.70	1.16

Average granite: 0.004, basalt: 0.004

Zn, porphyries, ppm

	Mean	*Max*	*sd*	*No.*	*Median*	*Geom. mean*
a1	394	4800	961	54	92	109
a2	25	39	11	8	19	23
a3	136	310	98	6	116	111
a4	525	1600	471	8	396	396

Average granite: 40, basalt: 100

Pb, porphyries, ppm

	Mean	*Max*	*sd*	*No.*	*Median*	*Geom. mean*
a1	38	202	36	54	28	30
a2	22	46	12	8	19	19
a3	70	160	53	6	61	54
a4	3069	19500	6755	8	227	261

Average granite: 20, basalt: 5

As, porphyries, ppm

	Mean	*Max*	*sd*	*No.*	*Median*	*Geom. mean*
a1	14	89	14	54	10	12
a2	9	13	3	8	10	9
a3	12	24	6	6	10	12
a4	543	1900	598	8	368	314

Average granite: 1.5, basalt: 2

Cu, porphyries, ppm

	Mean	*Max*	*sd*	*No.*	*Median*	*Geom. mean*
a1	26	240	42	54	9	11
a2	52	100	38	8	33	38
a3	43	102	34	6	33	33
a4	243	1050	344	8	106	116

Average granite: 10, basalt: 100

Mo, porphyries, ppm

	Mean	*Max*	*sd*	*No.*	*Median*	*Geom. mean*
a1	2	2	0	52	2	2
a2	120	420	145	8	62	53
a3	102	570	229	6	9	16
a4	5	8	2	8	6	4

Average granite: 2, basalt: 1

Mineralisation types:

a1	disseminated: porphyry
a2	Quartz-pyrite breccias
a3	Porphyry-hosted quartz veins
a4	Porphyry-hosted pyrite veins

APPENDIX 9

Analyses of porphyries, Cygnet (from Ford, 1983)

Sanidine porphyries (silica-undersaturated)

No	cy13-2	cy19-2	cy23-1	cy56-2	cy61-1	cy62-3	cy78-1	cy81-2	x50-2	C107721	C107724	C107727	C107771	108020	108021	108012	108015	108016
SiO_2	56.37	56.72	60.02	56.74	63.99	54.22	59.59	66.12	62.12	61.40	61.91	61.20	61.37	62.97	62.63	60.76	59.43	60.76
TiO_2	0.66	0.29	0.65	0.60	0.13	0.80	0.37	0.72	0.28	0.39	0.37	0.48	0.86	0.40	0.42	0.48	0.60	0.47
Al_2O_3	17.38	18.85	17.49	18.71	19.87	17.84	19.33	19.27	20.04	19.17	18.83	18.58	19.67	18.28	18.32	19.69	20.82	20.23
MgO	0.84	0.13	0.66	1.08	0.27	1.23	0.60	0.16	0.20	0.44	0.53	0.52	0.39	0.67	0.70	0.29	0.38	0.56
CaO	2.42	3.58	2.64	5.12	0.53	5.11	2.02	0.17	0.26	1.77	1.57	3.01	0.13	3.65	4.48	2.18	3.08	2.18
MnO	0.16	0.15	0.08	0.21	0.05	0.22	0.35	0.00	0.02	0.02	0.03	0.02	0.01	0.11	0.12	0.05	0.06	0.14
FeO	1.10	0.71	2.03	1.72	0.09	2.48	3.49	0.10	0.14	0.90	0.71	0.71	0.45	1.42	1.23	1.10	0.77	1.55
Fe_2O_3	4.45	2.33	2.47	3.20	1.82	3.83	2.74	0.37	1.97	1.98	2.22	3.18	2.11	2.00	2.19	1.13	2.43	0.92
Na_2O	4.49	4.71	3.30	4.46	6.19	3.54	4.33	3.87	4.66	5.46	4.82	5.09	1.32	5.42	5.38	5.34	5.35	5.22
K_2O	8.03	7.85	9.16	6.49	6.17	7.94	6.66	9.66	7.45	5.72	6.77	4.75	10.87	4.32	4.09	6.15	4.97	6.13
Loss	3.03	2.52	0.65	3.65	1.79	5.44	4.16	0.97		1.39	1.57	1.89	2.33	0.64	0.28	2.18	1.88	1.34
Total	98.96	99.86	98.36	102.09	100.92	102.80	103.69	101.41	99.03	98.97	99.67	99.94	99.75	100.22	100.16	99.68	100.08	99.86
Y	19	4	19	41	0.5	102	20	17	3	19	18	23	29	25	25	40	42	75
Zr	187	245	230	199	396	201	220	200	240	110	120	90	78	95	96	155	135	150
$Na_2O + K_2O$	12.52	12.56	12.46	10.95	12.36	11.48	10.99	13.53	12.11	11.18	11.59	9.84	12.19	9.75	9.47	11.49	10.31	11.35
K_2O/Na_2O	1.79	1.67	2.78	1.46	1.00	2.24	1.54	2.50	1.60	1.05	1.40	0.93	8.24	0.80	0.76	1.15	0.93	1.17

Syenite porphyries (silica-saturated)

	cy5-1	cy11-1	cy25-1	cy47A-1	cy47B-1	cy47C-1	cy48-1	cy49-1	cy88-1	s4-2	108013	108014	108008	108017	108018	108022A	108022B	108023	108024	108025	108026
SiO_2	59.75	63.81	60.58	63.79	60.42	61.14	65.71	65.00	67.21	68.82	61.48	60.74	61.68	55.61	53.74	55.84	55.27	55.09	63.30	61.35	60.59
TiO_2	0.59	0.37	0.49	0.57	0.58	0.53	0.28	0.30	0.45	0.13	0.35	0.20	0.37	0.82	0.58	0.46	0.44	0.43	0.20	0.31	0.74
Al_2O_3	16.80	16.70	16.45	19.60	18.99	17.83	16.85	17.35	18.28	14.84	19.89	21.03	19.86	17.46	17.90	19.93	19.64	19.91	18.88	17.91	15.84
MgO	0.00	0.72	1.68	0.18	0.10	0.58	0.23	0.44	0.52	0.03	0.40	0.37	0.47	1.60	0.53	0.36	0.37	0.45	0.18	0.21	1.03
CaO	0.35	4.11	4.31	1.79	2.71	3.62	1.93	3.64	1.47	0.70	0.51	1.33	0.70	4.79	4.48	1.88	2.13	1.69	0.85	1.06	4.51
MnO	0.22	0.12	0.17	0.01	0.04	0.19	0.02	0.05	0.02	0.02	0.08	0.13	0.07	0.16	0.21	0.15	0.19	0.18	0.06	0.15	0.14
FeO	2.48	1.74	2.04	0.36	0.18	1.28	0.36	0.91	1.26		1.23	0.97	0.77	2.97	1.49	0.77	0.90	0.84	0.84	0.71	2.00
Fe_2O_3	3.13	1.57	2.44	1.15	3.00	2.01	1.68	1.16	1.71	1.82	2.46	1.30	3.15	4.26	3.74	4.11	3.55	3.78	1.93	2.80	3.07
Na_2O	5.25	4.20	4.54	4.55	4.99	4.28	4.25	4.69	4.16	4.81	5.10	4.55	5.97	3.60	6.09	4.20	5.18	5.69	4.42	5.88	3.83
K_2O	3.68	3.06	4.08	6.60	5.81	6.36	5.89	4.31	2.97	6.14	7.27	7.56	6.00	6.62	7.29	10.24	9.80	10.13	9.24	7.70	7.57
Loss	0.98	4.73	2.51	2.32	2.16	1.32	0.59	0.61	1.98	0.63	0.96	1.15	1.03	0.80	3.46	1.47	1.35	0.90	0.24	1.18	0.48
Total	100.23	101.23	99.52	100.97	99.16	99.24	97.81	98.39	100.18	97.95	99.95	99.54	100.26	99.51	100.07	99.62	99.01	99.30	100.28	99.49	100.21
Y	18	20	17	178	398	37	25		65	0.5	15	15	20	31	13	-5	-5	-5	-5	21	27
Zr	157	116	14	207	211	198	183		210	83	180	165	150	78	165	8	-5	-5	19	150	99
$Na_2O + K_2O$	8.93	7.26	8.62	11.15	10.80	10.64	10.14	9.00	7.13	10.95	12.37	12.11	11.97	10.22	13.38	14.43	14.97	15.82	13.66	13.58	11.40
K_2O/Na_2O	0.70	0.73	0.90	1.45	1.16	1.49	1.39	0.92	0.71	1.28	1.43	1.66	1.00	1.84	1.20	2.44	1.89	1.78	2.09	1.31	1.98

APPENDIX 10

Fluid inclusion data, Cygnet

Sample No.	Deposit	Rock Type	Type	Th °C (L,V)	Tm °C Kcl	Tm °C NaCl	Tm °C clath	Tm °C CO_2	Tm °C Ice	Comments
107956	Livingstone Mine	Quartz vein	1	408 V						
				345						
				406 V						
				308						
			2-B	373	157	210				
			2-A	189		369				No change in bubble sizes up to 490°C. Possible necking.
				185	357					
			2-C	?	200	469				
				?	105	458				
				?	?	458				
107957	Livingstone Mine	Quartz vein in mudstone	1	344						
				296						
107651A	Livingstone Mine	Quartz vein	1	370						
				345						Few with no change in vapour size (up to 400°C)
				367						
				362						
				367						
				337						
				310						
				322						
				320						As a group, secondary?
				320						
				312						
				315						
				320						
				342						
				352						Some l + v + opaque
			2-A	500		428				
				500		433				Heating stopped 500°C
				500		440				
				500		439				
			1	296L						One fluid inclusion with more than six solid inclusions
				291						
				310						
				318						
				320						
				321						
				321						
				332						
				325						
				312						
				304						
				335						
				338						
				344						
				347						
				332						
				339						
				318						
				329						
				315						
				347						
				347						
				345						
				316						
				332						
				332						
			2-A	241		441				Possible necking
			1	316						

Sample No.	Deposit	Rock Type	Type	Th °C (L,V)	Tm °C Kcl	Tm °C NaCl	Tm °C clath	Tm °C CO_2	Tm °C Ice	Comments
107651A	Livingstone Mine	Quartz vein		320						
				318						
				317						
				316						
				319						Few with opaques, only decreased in vapour and solid
				321						
				342						
				341						
				331						
			2-B	461	181	460				
			1	306						
				323						
				295						
				310						
				315						
				362			6			
				330						
107943	Coads Adit	Quartz vein	2-A	308		236				
			1	269						
				287						
				280						
				268						
				256						
				260						
			2-A	267		310				
			1	223		370				
				234						
				246						
				341						
				345						
				380V						
				362						
				363						
				402						
				445						
				368						
				365 V						
				442 CP						
				430 V						
				370						
				440						
			2-A	352		261				
				325		272				
			1	360						
				361						
				361						
				357						
				356						
				360						
				367						
				358						
				357						
				345						
				285					-9	
				278					-8	
				387 V			5.2	-58.5		
				382			6.9	-58.9		
				379			6.7	-58.5		~30 with Th between 220–235°C, with solid inclusions, but leaked at high temperatures (350–400°C)
				385			6.4	-58.4		
			2-A	275		190				
				238		409				
				221		334				
				204		408				
			1	302						

Sample No.	Deposit	Rock Type	Type	Th °C (L,V)	Tm °C Kcl	Tm °C NaCl	Tm °C clath	Tm °C CO_2	Tm °C Ice	Comments
107617	Kings Hill	Quartz vein in porphry		379						Four heated to 470°C, leaked, bubble expansion (3), bubble shrinkage (1)
				337						
				441						
				402						
				365						
				374						
				360						
				360 V						
				410						
107667	Kings Hill	Breccia	1	?			4.5	-58.4		
				?					-11.5	
			2-A	240		367				
				285		375				
				282		-				
				283		387				
				260		-				
				281		385				
				270		389				
				280		394				
				254		371				
				285		-				
				240		346				
				242		355				
				255		346				
				271		236?				Th > Tm
			1	401						
				293						
				295						
				294						Few with expansion of vapour only (up to 500°C). Few with no changes in vapour size.
				296						
				289						
			2-A	282		374				
				274		333				
			1	486						
				450						
				445						
107972	Kings Hill	Breccia	2-A	276		340				
				285		341				
				298		254				
				285		359				
				?		360				
				262						
				285		368				
			1	306						
				296						
				314						
				298						
				301						
				310						
			2-A	253		321				Few vapour rich, no change up to 500°C.
			1	390						
			2-A	266		365				
				294		369				
				267		371				
			1	360 V						
				360						
				354						
				374						
				375 V						
107669	Kings Hill	Quartz vein		320					-6.6	
				389 V			5.5	-58.9		
				441						
				456						
				461						

Sample No.	Deposit	Rock Type	Type	Th °C (L,V)	Tm °C Kcl	Tm °C NaCl	Tm °C clath	Tm °C CO_2	Tm °C Ice	Comments
107669	Kings Hill	Quartz vein		451 V						
				452						
				450						
				456						
			2-A	300						
			2-B	294	122	256				
107621	Kings Hill	Breccia		376						
			2-A	268		238				Few vapour rich, stayed unchanged up to 380°C.
				281		356				
				281		342				
			2-B	320	151	358				
				264		335				
			1	451 V						
				261						
				263						
				265						
				261						
				268						
				265						
				267						
				269						
				261						
				314						
				312						
			1	395 V			5	-58.4		
				397			6	-58.6		
				465				-58.9		
				424 CP						
				470						>470°C
				470						>470°C
				442						
				431 V						
107947	Black Jack	Quartz vein in mudstone		316						
				324						
				307						
				328						
				323						
				321						
				296						
			2-A	285		180				
			1	324						
				320						
				304						
				301						
				302						
				305						
			2-A	275		171				

See text for abbreviations and fluid inclusion types
Homogenisation to liquid unless stated (V = vapour, CP = critical point)

APPENDIX 11

Logs of drill holes, Cygnet

Diamond drill hole CT87-1, Mt Mary

Drilled for:	Cyprus Gold Aust. Corp.	*Drilled by:*	F. Ortner
Logged by:	R. S. Bottrill, 1992	*Project:*	Southgold
For:	Tasmanian Geological Survey	*Date:*	20 October 1998
Bearing:	135° Mag	*Dip:*	-60°
Core Size:	HQ	*Total Length:*	71.3 m
Location (AMG):	505 600 mE, 5 220 460 mN		

Depth (m)	*Description*	*Samples*
0–2.9	Brown to white clay (weathered mudstone), weakly limonitic in patches	2.0 m: C107732 (limonitic clay) 2.8 m: C107733 (white clayey mudstone, non limonitic)
2.9–5.8	Weathered pebbly mudstone, pale grey, non-limonitic, with some clasts (quartzite, slate)	
5.8–6.9	Mudstone, pale grey, with limonitic joints or veins	
6.9–8.5	Mudstone, grey, very pebbly, with little limonite	
8.5–9.5	Weathered pebbly mudstone, highly broken (fault zone?). Increasing limonite towards base	9.4 m: C107734 (mudstone, very limonitic)
9.5–11.0	Mudstone, grey, very pebbly, with some limonite in patches and veins	
11.0–13.3	Porphyry, medium grained, with coarse-grained plagioclase feldspar phenocrysts. Silica-saturated? Weathered and limonitic	
13.3–19.7	Shear zone, brecciated and puggy; mostly porphyry clasts, but some mudstone. Some of the porphyry is probably silica undersaturated, with coarse sanidine phenocrysts. There are some highly limonitic zones	13.5 m: C107735 (porphyry, very limonitic) 15.0 m: C107736 (porphyry, non-limonitic, clayey)
19.7–22.3	Shear zone, brecciated and puggy; mostly mudstone clasts with limonite clasts, yellow-green montmorillonite clays, and bleached mudstone clasts	21.9 m: C107737 (limonitic green clay) 22.0 m: C107738 (hematitic breccia)
22.3–24.0	Mudstone, white, pebbly, very clayey, with little limonite	22.9 m: C107739 (white clayey mudstone)
24.0–29.6	Mudstone, pebbly, dark grey, with little limonite	
29.6–32.9	Mudstone, similar to above, but very broken and limonitic, with clay-limonite veins	
32.9-34.2	Porphyry, similar to that at 11–13 m, but with finer feldspar phenocrysts. Silica-saturated? Small green-black spots and green epidotised(?) phenocrysts. It is very broken and weathered, with limonitic veins, patches and spots	33.9 m: C107740 (limonite from porphyry) 34.1 m: C107741 (porphyry)
34.2–41.6	Mudstone, grey, pebbly, with broken, limonitic patches	38.5 m: C107743 (mudstone, fresh)
41.6–44.8	Porphyry, with medium–coarse grained feldspar phenocrysts in medium–coarse grained, white, feldspathic matrix. There are fine grained, grey veins and patches, epidotised phenocrysts, and limonite veins. There is a small breccia zone near 43 m, with black mudstone xenoliths and abundant pyrite. The porphyry is mostly silica-saturated, but is undersaturated in the breccia zone.	43.0 m: C107742 (breccia, with porphyry and mudstone)
44.8–56.0	Mudstone, grey, pebbly, hornfelsed at top, with small crush zones and limonitic veins. A silica-undersaturated mafic porphyry occurs between 55.2–55.4 m. The bottom contact is a siliceous breccia	55.3 m: C107745 (mafic porphyry)
56.0–110.0	Porphyry, similar to 42–44 m. Feldspar phenocrysts are mostly smaller, some are coarser	56.0 m: C107744 (mudstone-porphyry contact) 62.5 m: C107746 (porphyry)
110.0	EOH	

Diamond drill hole CT87-4, Black Jack Prospect

Drilled for:	Cyprus Gold Aust. Corp.	*Drilled by:*	F. Ortner
Logged by:	R. S. Bottrill, 1992	*Project:*	Southgold
For:	Tasmanian Geological Survey	*Date:*	20 October 1998
Bearing:	90° Mag	*Dip:*	-50°
Core Size:	HQ	*Total Length:*	75.6 m
Location (AMG):	502 960 mE, 5 217 460 mN		

Depth (m)	*Description*	*Samples*	
0–12.9	Porphyry, coarse grained, white, pyritic, with coarser sanidine phenocrysts. Silica-saturated? Relatively unweathered but minor broken zones. Highly veined with limonite.	6.7 m:	C107770 (limonitic veins in porphyry)
12.9–14.9	Felsic intrusive, fine grained, white, very pyritic; few phenocrysts. Silica-undersaturated. Highly veined with limonite.	13.3 m:	C107771 (porphyry)
14.9–15.6	Similar to above, but with coarser sanidine phenocrysts. Silica-undersaturated. Contains xenoliths of the underlying coarser porphyry	15.3 m:	C107772 (limonitic zone in porphyry)
15.6–27.7	Coarse grained, pyritic porphyry, as in 0–13 m. Some limonitic veining. Possible hornfels xenolith at 25 m.	22.3 m: 22.7 m: 25.3 m:	C107773 (limonitic vein) C107774 (pyritic porphyry) C107775 (hybrid zone)
27.7–42.4	Mudstone, hornfelsed, pyritic, with fossiliferous zones; fossils replaced by pyrite and actinolite.	28.3 m: 30.5 m: 29.9 m: 32.7 m: 34.8 m: 40.4 m: 42.3 m:	C107776 (pyritic hornfels) C107776 (non-pyritic hornfels) C107776 (pyritic hornfels) C107779 (variably pyritic hornfels) C107780 (non-pyritic hornfels) C107781 (pyritic hornfels) C107782 (pyritic hornfels)
42.4–43.2	Porphyry, pale grey green, fine grained, with few phenocrysts. Silica-undersaturated. Weakly limonitic. Hornfels xenoliths.	43 m:	C107997 (pyritic porphyry)
43.2–54.1	Mudstone, hornfelsed, pyritic. Very limonitic zone around 51.6 m.	44 m: 45.9 m: 51.5 m:	C107998 (hornfels) C108000 (pyritic, hematitic hornfels) C107784 (limonite vein)
54.1–54.4	Felsic intrusive, fine grained, white, very pyritic. Silica-undersaturated. Weathered.		
54.4–54.9	Mudstone, hornfelsed, pyritic.		
54.9–58.8	Porphyry, coarse grained, white, pyritic, with coarser sanidine phenocrysts. Silica-saturated.	57.7 m:	C107785 (pyritic porphyry)
58.8–65.3	Porphyry, as above but fresher, less broken, less pyritic, with mafic phenocrysts. Silica-saturated? Pyrite disseminated and in veins. Limonite, zeolite and actinolite (?) veins.	61.3 m: 65 m:	C107786 (weakly pyritic porphyry) C107999 (pyritic porphyry)
65.3–70	Porphyry, as above but more pyritic.		
70–73	Porphyry, as above but fresher. Becomes finer grained, less phenocrystic to base.		
73–75.5	Mudstone, hornfelsed, pyritic; very broken.		
75.5–76	Porphyry, pinkish, with sanidine phenocrysts. Silica-saturated?	75.5 m:	C107787 (porphyry)
76.0	EOH		

Diamond drill hole CT87-19, Mt Mary

Drilled for:	Cyprus Gold Aust. Corp.	*Drilled by:*	F. Ortner
Logged by:	R. S. Bottrill, 1992	*Project:*	Southgold
For:	Tasmanian Geological Survey	*Date:*	20 October 1998
Bearing:	135° Mag	*Dip:*	-50°
Core Size:	HQ, NQ	*Total Length:*	132.9 m
Location (AMG):	505 540 mE, 5 220 480 mN		

Depth (m)	*Description*	*Samples*
0–3.5	Talus? Highly broken, gravelly.	
3.5–4.3	Mudstone, dark grey, hornfelsed, hard and pebbly. Some pebbles have rims. Some limonitic joints or veins.	
4.3–4.6	Porphyry, white, fine grained, with few feldspar phenocrysts. Silica-saturated? Weathered and limonitic.	
4.6–6.3	Mudstone, as above.	
6.3–7.3	Felsic intrusive, white, fine grained, with no feldspar phenocrysts. Silica-undersaturated? More limonitic.	
7.3–7.9	Mudstone, similar to above, but highly mottled, with green veining.	7.9 m: C107747 (mottled, veined mudstone/porphyry contact)
7.9–13.2	Felsic intrusive: pale grey-beige, with small mafic and feldspar phenocrysts. Silica-undersaturated? In part highly weathered, limonitic.	8.5 m: C107748 (weathered hornblende porphyry)
13.2–14.0	Mudstone, as above.	
14.0–18.7	Felsic intrusive: white, medium grained, with feldspar phenocrysts (some green, epidotised). Silica-saturated? Very broken and limonitic in places (veins & stockworks). Some green copper staining @~17m.	16.6 m: C107749 (porphyry with limonitic veins)
18.7–21.6	Mudstone, similar to above, with some limonite veining. Very broken, grading into fault zone: 21–21.6m.	19.8 m: C107750 (brecciated mudstone)
21.6–23.2	Felsic intrusive: similar to above, weathered. Silica-saturated? Limonitic veins and patches. Top and bottom contacts at a high angle to core.	
23.2–37.8	Mudstone, grey, pebbly (clasts <10 cm), less hornfelsed than above; with clay-limonite joints. Very broken and sheared, especially at base.	32.6 m: C107751 (clast in mudstone) 36.8 m: C107752 (pebbly mudstone, with bleached zones)
37.8–38.4	Porphyry, grey, with coarse sanidine feldspar phenocrysts. Silica-undersaturated? Mafic xenoliths.	
38.4–38.6	Clay zone (altered porphyry?).	
38.6–46.0	Mudstone, similar to above, with limonitic patches (esp. @40.2 m). Yellow nontronitic clay in joints.	40.4 m: C107753 (clay-limonite zone in mudstone) 41.4 m: C107754 (yellow nontronite clay)
46.0–46.2	Limonitic breccia in mudstone.	46.1 m: C107755 (hematitic breccia in hornfelsed mudstone)
46.2–50.2	Fault zone material: puggy clay, mostly porphyry (some silica-undersaturated, with coarse sanidine feldspar phenocrysts, and epidote), some mudstone (47.6–48.1).	46.9 m: C107768 (fault pug/clay)
50.2–52.5	Mudstone, similar to above, highly broken, with haematitic patches and zeolitic veins and stockworks.	51.2 m: C107769 (hematitic mudstone)
52.5–65.3	Mudstone, similar to above, less altered, minor zeolite veins, some limonitic clasts, clay and limonite patches. Possible porphyry dyke @~62.4 m (altered, chloritised). Bottom contact is limonitic and altered.	56.5 m: C107756 (white smectite clay in hornfels)
65.3–73.8	Porphyry, green-grey, medium grained. Some coarse sanidine @65–71 m. Some mafic xenoliths and limonite veinlets; hornblende and epidotised phenocrysts. Small weathered zones and minor zeolite veins. Silica saturated.	
73.8–74.2	Mudstone, hornfelsed, broken. Top contact steep, broken, weathered.	

Depth (m)	*Description*	*Samples*
74.2–74.8	Porphyry, grey-brown, fine grained. Coarse sanidine and mafic phenocrysts. Silica undersaturated.	74.2 m: C107763 (brecciated porphyry/mudstone contact)
74.8–77.1	Porphyry, pale grey-brown, fine grained. Medium grained mafic phenocrysts. Silica undersaturated? Sharp bottom contact.	75.5 m: C107757 (porphyry)
77.1–78.4	Mudstone, similar to above. Bottom contact is faulted and weathered.	
78.4–81.1	Porphyry: coarse sanidine phenocrysts, epidotised, plagioclase bearing. Silica saturated. Broken zones and zeolite and/or clay zones. Bottom contact @ 45°.	78.6 m: C107758 (white smectite clay in porphyry) 80.3 m: C107759 (epidotised porphyry)
81.1–92.2	Breccia zone, with hornfelsed mudstone and porphyry. Altered zones: mottled and veined (zeolites). Pyritic and limonitic zones.	81.8 m: C107762 (zeolitised, brecciated porphyry) 82.3 m: C107760 (pyritic porphyry) 87.1 m: C107761 (amphibolite xenolith?)
92.2–93.8	Mudstone: hornfelsed/fault material: broken, brecciated, zeolitised.	
93.8–94.2	Fault material: puggy, broken, mostly mudstone.	
94.2–99.2	Fault material: puggy, broken, mostly porphyry (phenocryst poor, with mafics: Silica undersaturated?)	98 m: C107767 (fault breccia)
99.2–102.9	Mudstone: hornfelsed	
102.9–104.7	Mudstone: hornfelsed/fault material: broken, brecciated, zeolitised, sulphidic.	
104.7–107.7	Mudstone: hornfelsed, with limonite and sulphates.	106 m: C107765 (pyritic mudstone)
107.7–108.6	Fault material: puggy, weathered, yellow, sulphidic.	
108.6–109.6	Porphyry. Pyritic, epidotised. Silica saturated?	
109.6–111.5	Mudstone: hornfelsed, brecciated, altered, bleached, pyritic, limonitic.	110 m: C107764 (bleached porphyry/mudstone breccia)
111.5–112.0	Porphyry, relatively dark, with black melanitic garnet and coarse-grained sanidine phenocrysts (1–3 mm). Silica undersaturated.	111.6 m: C107766 (garnetiferous porphyry)
112.0–118.0	Mudstone: pebbly, black, pyritic, soft.	
118.0–132.0	Porphyry, relatively dark, with abundant feldspar phenocrysts (1–3 mm). Pyritic: disseminated and veinlets. Silica saturated.	
132.0	EOH	

Diamond drill hole CT87-20, Mt Mary

Drilled for:	Cyprus Gold Aust. Corp.	*Drilled by:*	F. Ortner
Logged by:	R.S. Bottrill, 1992	*Project:*	Southgold
For:	Tasmanian Geological Survey	*Date:*	20/10/98
Bearing:	135° Mag	*Dip:*	-45°
Core Size:	HQ, NQ	*Total Length:*	130.0 m
Location (AMG):	505 500 mE, 5 220 480 mN		

Depth (m)	*Description*	*Samples*
0–7.0	Weathered mudstone	
7.0–7.2	Quartzo-feldspathic rock, white, coarse grained (?clast)	
7.2–14.4	Mudstone, pebbly, pale grey, with some limonitic, siliceous clasts (<4 cm).	12–14 m: C107701 (limonitic clasts in mudstone) 12–14 m: C107702 (pebbly mudstone, non-limonitic, unveined)
14.4–18.0	Porphyry, very fine-grained groundmass, with coarse feldspar phenocrysts (white & green, <15 mm), silica-undersaturated? Very weathered.	
18.0–40.0	Mudstone, pebbly, pale grey, with some limonitic, micaceous clasts (less towards base). Other clasts include granite, chert, and volcanic rocks. Some parts very weathered, highly broken (fault zone?).	18.4–19.4 m: C107704 (limonitic clasts in mudstone) 18.4–19.4 m: C107705 (pebbly mudstone, non-limonitic, unveined) 22.5 m: C107703 (pebbly mudstone, with limonitic clasts) 30–31 m: C107706 (limonite-clay clasts in mudstone)
40.0–40.7	Porphyry, medium grained, with medium grained plagioclase feldspar phenocrysts, hornblende. Silica-saturated? Limonitic.	
40.7–45.0	Mudstone, grey, very pebbly.	43.4 m: C107707 (biotite-bearing clasts in mudstone)
45.0–45.7	Porphyry, very fine-grained groundmass, with coarse feldspar phenocrysts (<15 mm), silica-undersaturated?, epidotised?	
45.7–47.0	Mudstone, grey, very pebbly.	
47.0–48.2	Mudstone, light grey, pebbly, slightly weathered. Limonite-jarosite veins and stockworks.	47.5 m: C107708 (limonite veins in bleached mudstone) 47.5 m: C107709 (bleached mudstone) 47.5 m: C107710 (silicified mudstone breccia with limonite veins)
48.2–49.1	Mudstone, pebbly, dark grey, with little limonite. Bleached fractures.	
49.1–52.4	Porphyry, fine grained, with feldspar & hornblende phenocrysts, and green spotting. Possible carbonate veining. Silica-undersaturated.	51.1 m: C107712 (pyritic porphyry) 51.2 m: C107711 (pyritic porphyry)
52.4–54.3	Mudstone, similar to above.	
54.3–55.2	Porphyry, similar to that above, but coarser.	
55.2–57.0	Mudstone, grey, pebbly, less broken and limonitic than above.	56.3 m: C107713 (mudstone, non-limonitic)
57.0–64.2	Mudstone, grey, with small crush zones and limonitic veins. Hornfelsed at base. Laumontite veins.	
64.2–65.0	Porphyry: more mafic than above; minor feldspar phenocrysts; some zeolite veins. Silica-undersaturated.	64.2 m: C107714 (porphyry)
65.0–68.4	Mudstone: grey, pebbly, hornfelsed, very hard, highly fractured and brecciated with zeolites and epidote(?). Some pebbles with haloes (epidote?), some with stellate hematite, some large quartzwacke clasts (dark grey, coarse grained).	65.3 m: C107715 (mudstone, hornfelsed, with dark clasts) 66.7 m: C107718 (mudstone, zeolitised) 68.4 m: C107719 (mudstone, hornfelsed, zeolitised)
68.4–69.5	Similar to above, but very broken and puggy.	68.8 m: C107717 (mudstone, with epidote-hematite-altered clast)

Depth (m)	*Description*	*Samples*
69.5–74.0	Porphyry, with medium-coarse grained white and green feldspar phenocrysts in medium-coarse grained, feldspathic matrix. Probably silica-saturated.	
74.0–75.8	Mudstone, as above, very broken.	
75.8–79.3	Porphyry, as at 70–74 m.	
79.3–80.0	Fault gouge and pug, with slickensided base.	
80.0–83.6	Mudstone, brecciated and puggy, with some porphyry clasts and limonitic patches.	80.7 m: C107720 (mudstone, non-limonitic) 82.6 m: C107722 (porphyry) 82.7 m: C107721 (porphyry)
83.6–105.3	Porphyry, with medium-coarse grained white and green feldspar phenocrysts in medium-coarse grained, feldspathic matrix. Probably silica-saturated. Abundant pyrite & limonite, some epidote; some limonite veins. Highly brecciated, with zeolites. Highly weathered near top.	85.5 m: C107726 (porphyry, with smectite alteration) 87.2 m: C107725 (porphyry, with limonite veins) 87.9 m: C107723 (porphyry) 87.9 m: C107724 (porphyry) 98.7 m: C107727 (porphyry, pyritic, limonitic) 104.9 m: C107728 (porphyry, pyritic)
105.3–114.5	Mudstone: grey, brecciated with zeolites. Limonite common on fractures	
114.5–116.8	Porphyry, light grey, fine grained, with mafic phenocrysts <3 mm. Silica-undersaturated? Small xenoliths? Veined with zeolites.	115.6 m: C107729 (mafic porphyry, altered)
116.8–123.7	Porphyry, highly sheared, with fault pug. More mafic than above. Some disseminated pyrite & epidote. Very weathered, with clays, limonite and secondary sulphates. Silica-undersaturated?	
123.7–124.2	Mudstone: as above.	
124.2–125.1	Siliceous breccia, very hard, with some weakly limonitic fractures.	124.3 m: C107730 (siliceous breccia)
125.1–130.0	Mudstone, highly sheared, fractured and brecciated, with fault pug. Some silicified, black zones, and small opal/chalcedony veins at 125.7 m. Very puggy at base.	125.7 m: C107723 (silicified fault gouge)
130.0	EOH	