

**EL14/2006 “Dove River”**

**Annual Report 2008**



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## Summary

This report is the second Annual Report for the Dove River exploration licence (EL14/2006) and is submitted in accordance with the Mineral Resources Development Act (1995) by Pluton Resources Limited (Australian Stock Exchange Code: PLV) on behalf of its subsidiary Dove River Pty Ltd.

The Dove River exploration licence contains a number of mineral occurrences, old mines and a goldfield (Five Mile Rise). Areas of hydrothermal alteration within the licence commonly yield anomalous metal values. The tenement has not been systematically explored for gold, more particularly no work has previously been conducted on the source of gold below the Ordovician rocks that host the Five Mile Rise goldfield. A review of previous literature confirmed the lack of activity exploring the Cambrian basement where exposed and concealed under cover.

The region shows similar characteristics to that of the copper-gold, high-sulphidation and porphyry districts in New South Wales, including the Cadia and Goonumbla deposits. These include the setting and chemistry of the host rocks, as well as the styles of mineralisation and related alteration.

Pluton's primary focus is to add value to the Dove River licence by demonstrating the potential for large-scale porphyry-style mineralisation in proximity to the Cambrian Dove Granite. Work to date has primarily focussed on three main areas of historic mineralisation within the tenement: the Devon Mine area, the Powerful Mine area and the Five Mile Rise Goldfield.

Work completed during the 12 months up until November 2008 includes reconnaissance sub-regional-scale rock chip sampling to ground truth historical mapping and diamond drilling at the Devon Prospect. Results from the drilling at the Powerful prospect in the previous 12 month period were also received and are reported here.

The focus of the program was on drilling under the Devon Mine workings. The Devon Mine is one of the larger historic workings in the area, known mainly for producing very clean galena ore from multiple veins. The age of mineralisation at the Devon Mine remains controversial, however drilling suggests the timing is likely to be a Cambrian porphyry related alteration system with an epithermal carbonate-base metal overprint.

Variations in rock-type and alteration are subtle. New geological maps and conclusions about the setting and origins of Cambrian rocks in the Dove River area are likely to evolve further with processing of geochemical data over the coming year.

Drill core from diamond holes (DR1 and 3 and DEVD1 and 2) is being assessed by a petrologist to gain a better understanding of both the mineralisation history and the alteration characteristics with respect to their possible proximity to porphyry mineralisation.

Location data referred to in this report are referenced to the AGD66 geodetic datum.

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## **Introduction**

Pluton Resources Limited is an Australian Stock Exchange listed mineral exploration company exploring for metallic minerals within EL14/2006 (Dove River) by way of its subsidiary company Dove River Pty Ltd. Pluton intends to assess the tenement primarily for porphyry style alteration systems and mineralisation with a primary objective of identifying potential for bulk tonnage copper-gold mineralisation. The tenement was attractive for exploration due to similarities in aspects of the geology to porphyry-style copper-gold districts on mainland Australia and possible hybrid porphyry-VHMS systems in Tasmania.

## **Tenure**

A tenement application (EL14/2006) for an area of about 36.5km<sup>2</sup> was made by Southern Ocean Science Pty. Ltd. in 2006. It was successfully partnered and transferred to Dove River Pty. Ltd., and Dove River Pty Ltd subsequently vested as a wholly owned subsidiary into Pluton Resources Ltd. in October 2006. Pluton Resources successfully listed on the ASX in December 2006

The exploration licence is located in the Mt Read Strategic Prospectivity Zone. This provides for security of exploration tenure by way of compensation of reasonable cost of work conducted (or resource defined) if a change in the tenement's land status results in the licence being revoked.

## **Location and land classification**

The licence is located about 35km south of the township of Sheffield (pop approximately 1000) and about 60km from port facilities at Devonport (figure 1). The licence land classification consists of State Forest, MDC informal reserves, the Dove River Forest Reserve, approximately 15% private land and sits adjacent to Lake Cethana (a Hydro-Electric lake) and the Lemonthyme power station.

## **Topography**

The topography of the licence is variable with a dissected plateau on the North of the licence and deeply incised creeks and (partially flooded) deep gorges of the Dove and Forth River valleys in the south (figure 2).

## **Vegetation and Soil**

Vegetation comprises wet and dry eucalypt forest typically dominated by *Eucalyptus Obliqua*, *Delegatensis*, and *Amygdalina* spp. On wetter south facing slopes and near river banks there are occasional patches of rainforest, dogwood scrub and *Acacia Dealbata* forest. Undergrowth is dependent on how dry the site is, but typically consists of spiky heath or ferns.

A variable soil profile is developed throughout the tenement with outcropping bedrock generally restricted to road cuttings, ridge tops, cliffs and creek/river beds.



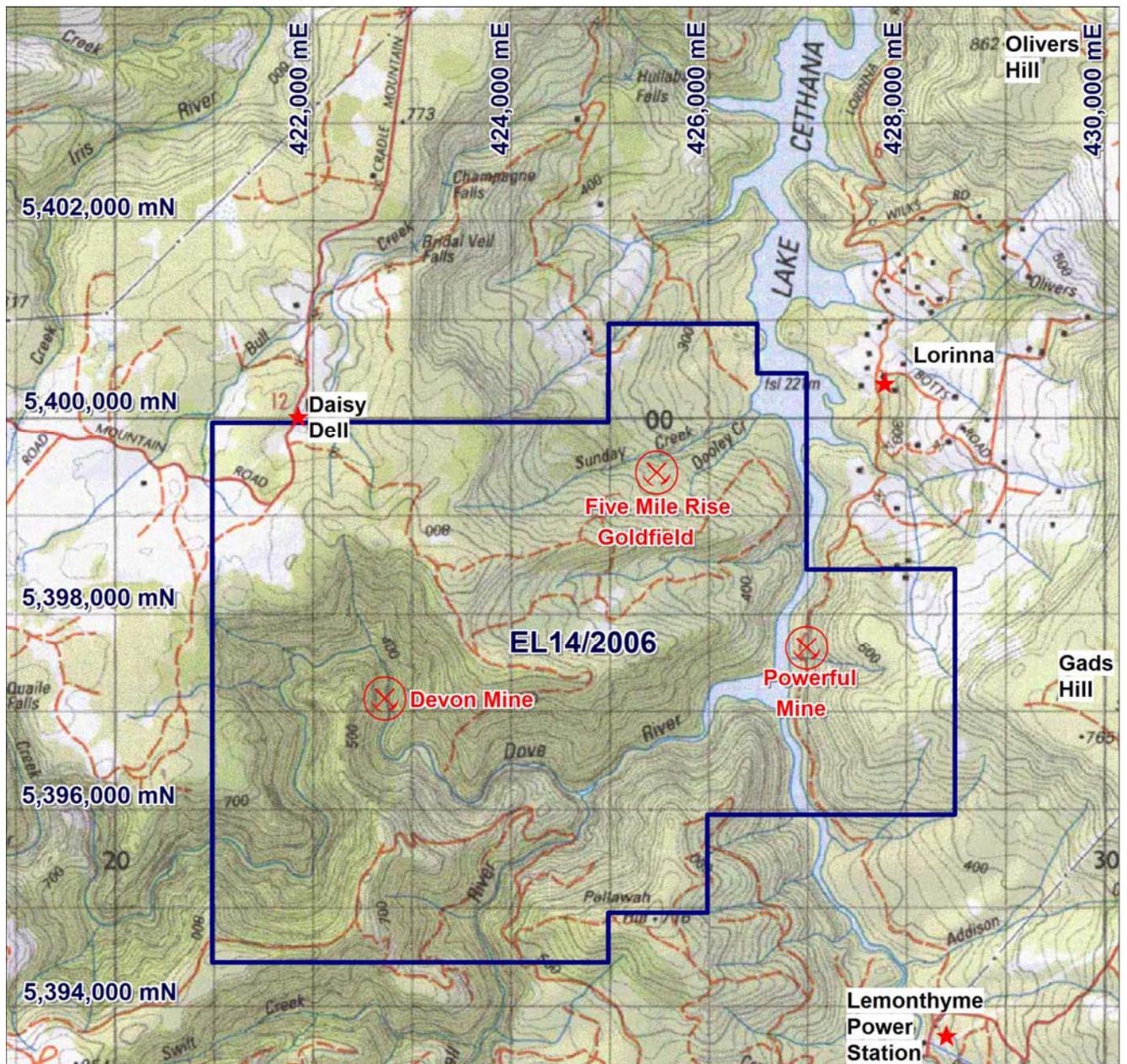


Figure 2 – Exploration Licence 14/2006 Dove River location and prospects on modified 1:100,000 Tasmanian government topographic base map.

### Geology

EL 14/2006 (Dove River) is contained within the northern portion of the c500Ma Cambrian Mt Read Volcanic belt (MRV). The MRV comprises mainly acid and lesser mafic volcanics and associated intrusive rocks. The MRV unconformably overlies Proterozoic metasedimentary rocks and, itself is unconformably overlain by Cambro-Ordovician siliciclastics and limestones. Rocks to the north of the Dove River Licence are intruded by the Devonian Dolcoath Granite.

Palaeozoic and Proterozoic rocks may be covered by outliers of Permian sedimentary rocks and there is a variable veneer of Tertiary basalt, sedimentary rocks and sediment.

The Mt Read Volcanic belt is highly mineralised. It contains numerous and some very large polymetallic VHMS-style deposits (e.g. Hellyer, Que River, Rosebery) and volcanogenic porphyry-VHMS hybrid copper-gold deposits (eg. Mt Lyell, Henty).

The Dove River area is dominated by Proterozoic schists in the south with younger Cambrian, Ordovician, and Tertiary rocks typically progressively exposed northwards. Very little detailed work has been undertaken in the current licence area. A description of the known lithologies and observed variations within the licence and potential correlations are summarised below.

### ***Precambrian schist***

The oldest rocks in the area are Proterozoic schists of the Tyennan block. The schists are typically light grey and strongly deformed. They are strongly foliated with a typically finely spaced crenulation cleavage evident as alternating mica rich and quartz rich lamellae. Bedding is rare but where observed in cut hand-specimen is isoclinally folded. Fold limbs are sheared parallel to the spaced cleavage. Kink banding is common. Bedding is rare in outcrop and then typically only visible on water-worn surfaces. Metamorphic grade is variable but not well defined. Very fine garnet of metamorphic origin is rare but indicates an amphibolite metamorphic grade. Reid (1967) describes these rocks as quartz-sericite schists and quartzites and indicates that there are areas of minor sulphide mineralisation and moderate alteration (typically hematitic).

Proterozoic schist borders the Powerful prospect and was intersected in the upper parts of the DR2 drill hole. The schists here are hematite and potassium feldspar altered; alteration clearly related to intrusion of the hornblende-biotite Dove granite and associated dykes. An intrusive contact between older Proterozoic schists and younger quartz-phyrlic granitic rocks is exposed upstream and west of the Devon mine in the Dove River.

### ***Cambrian volcanics***

The Cambrian volcanics within the Dove River licence area have not been assigned a formal correlation with the Mt Read Volcanic stratigraphy. It has been inferred they should be grouped with the Eastern Quartz Phyrlic Sequence (Corbett, 2003) or the Tyndall Group (Herrmann, 1989 in Fleming and Castro, 1989). More recent work by Pluton suggests that correlation with any one part of the MRV may be simplistic.

#### *Lower felsic volcanics (vitric tuff ?)*

The oldest Cambrian rocks in the Dove River area comprise fine-grained silica-rich (possibly shard-rich), massive bedded and cliff-forming sedimentary sequences. These rocks do not come into contact with the Proterozoic in the Dove River area, with the two packages separated by intermediate and felsic granitoids (Dove Granite). The lowermost part of this unit is exposed in cliff section west of the Devon Mine where more typical massive beds overlie a 20m thick unit of finely laminated siltstone.

Beds adjacent to quartz-porphyry exposed at the Devon Mine are fine grained and cream or grey coloured. Dark-grey diffuse round spots to 15mm indicate hornfelsing. Bedding is more clearly evident in contact-metamorphosed rocks with concentration of spots subtly indicating beds of up to about 75cm. The unit was originally mapped by Jennings (1963) as Precambrian schist. However, the unit lacks the foliation and folding evident in Precambrian schists to the south. A generally northerly dip is, however, consistent with that observed in nearby volcanoclastic rocks to the north. As such, the unit is almost certainly of Cambrian age. The unit was intersected in drilling DEVD1 and DEVD2 and samples have been sent for petrography.

Correlation of this unit with rocks elsewhere is uncertain. Based on gross lithological character of probable vitric material derived from a more volcanic origin, it is similar to vitric tuffs of the Back Peak Beds described by Herrmann (in Fleming and Castro, 1989).

#### *Mixed volcanic and volcanoclastic rocks*

A progressively coarsening quartz-rich volcano-sedimentary sequence gradationally overlies the vitric tuff (?) to the north. This unit was mapped as Lorinna Greywacke on regional maps by Jennings

(1963). This sequence comprises angular clast rich poorly sorted sandstone, pumecious sandstone, and quartz rich volcanoclastic sandstones. Fine 'grain flow' greywackes and possible volcanics of near identical composition to the quartz rich volcanoclastics were observed in core from DR1. Based on reconnaissance mapping and drill core, there may be an increasing lithic component up stratigraphy. Beds may be laminated but are typically massive in outcrop. Differentiation between quartz-phyric volcanoclastics and quartz-porphry can be difficult, particularly in areas of hydrothermal alteration. The unit is thought at this stage to be largely derived from water-supported mass-flow, preserving finer and more delicate biotite alongside much larger quartz and sometimes angular lithics. The prevalence of rounded quartz and biotite indicates a proximal origin, with material possibly derived from an extrusive form of the quartz-phyric porphyry exposed to the south.

### ***Dove Granite***

The Dove Granite is regionally mapped as three occurrences, one in each of the Mersey, Forth and Dove valleys. Montgomery (1893) remarked on the similarity between granite east of the Dove River licence (at Gads Hill) with Devonian Dolcoath Granite located north of the Dove River licence. In contrast, on visiting the Five Mile Rise Goldfield, Twelvetrees (1913) concluded that the granite showed greater affinity with other Cambrian age granites of the West Coast. In producing the last geological map and explanatory notes of the area, Jennings (1963) described a relationship of granite intruding what he thought to be Ordovician rocks. He concluded that the Dove Granite was Devonian. Radiometric K-Ar and Rb-Sr ages determined by McDougall and Leggo, (1965) firmly suggested the Dove Granite is Cambrian, albeit with some outlying Ordovician ages that were attributed to argon loss. Unfortunately, Jennings interpretation persists in citation through much of the literature and company reports until the 1980's.

The reality is that few workers completed little if any work on the Dove Granite. Pluton is the first company to systematically map and sample the granite, mainly to determine if the Dove Granite is of the right composition to produce copper-gold porphyry deposits. Work has yet to be completed on examining the geochemistry of granitic rocks in the Dove River area. This will be reported in subsequent years. However, based on macroscopic petrography only, there are several different granitic rocks that can be identified. These are tentatively subdivided into:

1. Porphyritic and in places equigranular felsic quartz-biotite granite or porphyry.
2. Equigranular (quartz)-biotite-hornblende granite or granodiorite.
3. Hornblende granodiorite and/or quartz diorite.

### ***Felsic quartz-biotite granite or porphyry***

This rock is the oldest of the granitic rocks and would appear to bare the greatest affinity with the Cambrian volcano-sedimentary sequence exposed in the north of the licence. It is the 'granite-porphry' of Smyth (1981) at Devon and is best exposed in the vicinity of the Devon Mine, forming much of the hill to the west and south. It crops out as a potassically altered porphyritic rock in the Dove River downstream from the Devon Mine and probably (based on quartz content) as a fine-grained equigranular quartz (possibly marginal contact phase) granite upstream and west of the Devon Mine. It may correlate with the coarse grained quartz-rich granite at the Powerful Mine. However, the level of potassic and propylitic alteration in this necessitates a close look at the rock on geochemical grounds before any conclusions can be drawn with confidence.

Where unaltered, the porphyritic granite comprises a pale grey to white fine-grained groundmass. Crystal components comprise ubiquitous rounded to hemi-pyramidal quartz up to about 8mm, typically strongly sericitised euhedral zoned plagioclase to 4mm, euhedral variably chloritised biotite, and rare well rounded potassium feldspar to 15mm. The rocks typically contain >70% silica. More equigranular versions of this porphyritic rock are known only from upstream of the Devon Mine,

proximal to the contact with volcanoclastic rocks. Here, they are yellowish-white in colour, layered or fractured, and comprise interlocking equigranular quartz and plagioclase, with interspersed finer-grained biotite.

A common trait of this rock is the well-rounded quartz phenocrysts. The rounding is possibly due to increased silica solubility with decreasing depth of intrusion, consistent with intrusion of the porphyritic rock at shallow levels within the Cambrian sequence.

The porphyry unit adjacent to the Dove Granite at the Devon Mine is typical of porphyries mapped elsewhere in the tenement. The inference has been made by Herrmann 1989, M.Vicary (pers. Comm.) that the porphyry at the Devon Mine correlates with the quartz-feldspar porphyries that intrude the Sticht Range Beds, the Back Peak Beds and the Precambrian units near Back Peak (figure 3). Such an association would suggest Cambrian Granite at depth in this location if the porphyry at Devon is a marginal phase of the Dove Granite as suggested by Herrmann 1989 and Jennings 1963.

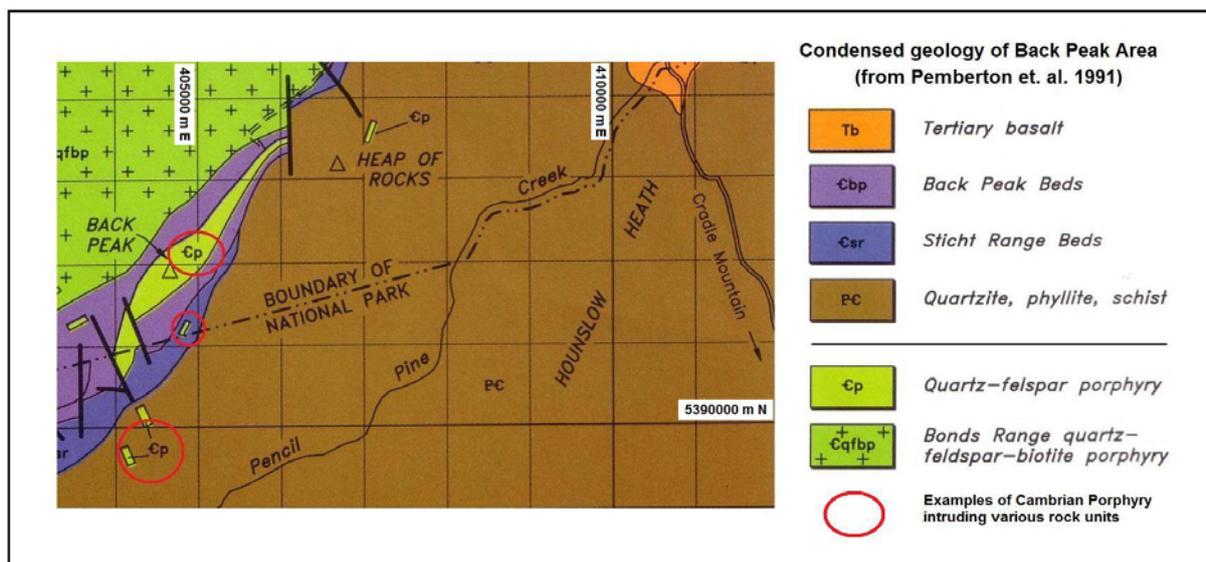


Figure 3 – Examples of Cambrian Porphyry intruding various units in the vicinity of Back Peak (modified from Pemberton et. al. 1991). \*Coordinates in AMG Zone 55, datum AGD66.

The porphyritic granite is commonly altered proximal to the hornblende/biotite-hornblende granite(s) and is also of a more felsic composition. The quartz-feldspar-biotite porphyry phase may be an expression of partial melting of the felsic granite with very high silica.

#### *Equigranular (quartz)-biotite-hornblende granite or granodiorite and the Hornblende granodiorite and/or quartz diorite.*

These two granitic rocks can be differentiated on the basis that one is dominated by biotite with lesser or little hornblende, whereas the other is dominated by hornblende as the mafic mineral. The hornblende-rich rock typically occurs within the biotite-rich granite and the two may be a progression of the one rock unit. Potassic alteration of surrounding rocks is common proximal to these granites, in particular close to the hornblende granodiorite. The contacts with the quartz porphyry are commonly sharp and the quartz porphyry is commonly altered indicating the granite may be intruded later.

The biotite (-hornblende) granite crops out on the access track to the Devon mine and in the river downstream of the Devon Mine. It comprises grey equigranular quartz-feldspar-biotite with rounded dark-grey biotite rich clots (possible xenoliths) to 20cm. Inclusions of laminated and altered rock (Proterozoic xenoliths) are rare.

The hornblende-rich rock crops out south of the Powerful Mine (but also possibly south of the Devon Mine) and in drill core from Powerful (DR3). The rock is medium grained, equigranular and visually similar to the biotite granite except for the prevalence of hornblende as the primary mafic component. The hornblende 'granodiorite' is commonly perceptibly magnetic in hand specimen which is consistent with classification as an I type magnetite series 'granite'.

Both rock types tend to be massive and xenoliths are potentially recognised in both units. More hornblende rich dioritic xenoliths were commonly identified in the hornblende granodiorite in the DR3 drill core, the origin of these xenoliths is unknown. There is also a perceptible concentration of sulphides within the more mafic clots in hand specimens of the biotite (-hornblende) granite, possibly indicating an as yet unrecognised mineralised intermediate magmatic phase within the granite suite.

Preliminary investigations indicate the granites (and associated extrusive rocks if present) to be high-K calc-alkaline to shoshonitic in composition. This composition is consistent with their forming at a convergent plate margin in an environment prospective for formation of porphyry-style copper-gold deposits. Detailed geochemistry is yet to be properly examined.

### ***Owen Group***

Conglomerate and sandstone sequences are regionally unconformable on Middle Cambrian volcanic rocks, however no true conglomerates occur at the base of the Ordovician on the licence. At Five Mile Rise the basal unit was observed in drill core and is a bioturbated coarse to pebbly sandstone. Overlying this is pale yellow fissile siltstone interbedded with fine and pebbly sandstones and minor shale. The sequence has been identified by several previous workers as Moina Sandstone. The sandstone dips gently (15-20 degrees) to the north-northeast forming a veneer over the Cambrian stratigraphy.

Several kilometres northeast of the Dove River licence, the Moina Sandstone is underlain by thick sequences of Roland Conglomerate. The absence of the conglomerate units on the licence may indicate extension north of Five Mile Rise in the late Cambrian. The structures controlling this facies variation may be coincident with northwest-trending aeromagnetic linears north of the licence.

Gordon Limestone conformably and gradationally overlies the Moina Sandstone just north of the licence near Lorinna. Both this and the Moina Sandstone were faulted during the Devonian Tabberabberan Orogeny.

### ***Tertiary Basalt***

The Tertiary Basalt at the Powerful prospect was intersected by diamond drill hole DR2 in the previous drilling program. The basalt is a fine-medium grained vesicular dark rock with occasional zeolites and calcite veins. At Powerful, it is underlain by approximately 11 metres of probable Tertiary lake sediments. Herrmann in Fleming and Castro (1989) estimated Tertiary Basalt flows over much of the region to be only a few tens of metres thick.

### ***Quaternary Glacial and Fluvial Deposits***

Although not prominent in the main part of the licence there are surficial deposits of questionable fluvial origin on flatter parts of the Forth River valley that could be attributable to glacial action. These deposits are small and initial assessment suggests the sediments cover an area of minimal prospectivity.

## **Exploration History**

The Dove River licence area was prospected for gold and silver-lead until the mid 19<sup>th</sup> Century.

James 'Philosopher' Smith discovered alluvial gold in the Forth River in 1859 near Golden Point approximately three kilometres north of Lorinna (Jennings 1963). Malcolm and Alex Campbell opened the first hard rock mine, Campbell's Reward, in the early 1880's on the east side of the Forth River. It was not until 1887 that a discovery at Five Mile Rise (previously termed the Middlesex Goldfield) was made by J Aylett at the "Great Caledonian" Mine (Reid, 1919).

A number of leases at Five Mile Rise were pegged around the initial discovery in the following year. However, the alluvial prospects proved of little worth to the early miners. Montgomery (1893) described the alluvial workings as shallow, suggesting that no great depth to the auriferous wash probably accounted for the quick demise. Hard rock sources were soon located and developed by underground workings on the auriferous lodes. The lodes were gold rich in the oxide zones near the surface with gold not recoverable from the sulphide lodes at depth using techniques available at the time. By 1891 work had all but ceased on the gold field due to the rush at Bell Mount to the north (outside the licence area) and only three mines returned to production before work again ceased in 1901 (Jennings, 1963).

James Smith later discovered a galena lode SW of the site of the Devon Mine and Malcolm Campbell located the Devon Lode in 1897 (Reid, 1919). The Devon Silver-Lead Mining Company NL acquired the lease from Campbell later in 1897 (Jennings, 1963) in the form of four sections covering 40 acres. The Devon Mine and Five Mile Rise mines were operated at several times in the 19<sup>th</sup> Century with the most advanced activity at Devon, a detailed description of workings is given below.

## ***Description of Workings***

### *Five Mile Rise Goldfield*

Six prospects on the Five Mile Rise mineral field constitute the main hard rock workings. These are the Great Caledonian, Glynn, Thistle, Golden Hill, Golden Cliff and Union Mines all of which were originally developed between 1887 and 1901. There are other workings mentioned in the area, although details of these prospects are uncertain. The only form of exploration on these prospects as individual targets has been by prospecting via adits and shafts. All but the Great Caledonian were accessed by adits, with the flat ground around the Great Caledonian only allowing access by a shaft.

All the lodes in the goldfield are said to occupy small faults that strike at approximately 140 degrees. The lodes outcropped as gold rich rubbly gossans and passed into mixed sulphide ores at depth containing silver-lead and pyrite with accessory chalcopyrite, arsenopyrite, gold, sphalerite and sometimes bismuthinite. The veins are irregular in width and extent and only enriched as gossan at surface. They occupy tension cracks which are sympathetic in width to, but do not generally cause replacement of, the variable lithology within the Moina Sandstone (Jennings, 1963).

Mineralisation is reported to extend below the Moina Sandstone host rock in several cases, for example Johnson's Reef is said to be approximately 300m south of the Great Caledonian workings and the host rock is described as being decomposed greenish "granite" and the main outcrop as "largely dense haematite". The description of the host rock in the deepest levels of the Great Caledonian is the same. At the Union Mine the lodes are said to pass into haematitic quartz lodes at depth. At Golden Cliff the bottom adit was driven into the sub-Ordovician country rock, however the lode was never met with.

Twelvetrees re-examined the Five Mile Rise Goldfield in 1913. The workings were abandoned, however by 1919 when Reid visited Five Mile Rise the Thistle mine was once again being worked for galena ore and alluvial gold was also being intermittently taken from O'Rourke's 'Hydraulic' lease.

Deposit Name	Size(tonnes)/ Production(oz)	Deposit Form ; Strike and Dip	Max. Width	Commodities Recovered	Gangue Minerals	Comments on development, history and sub-Ordovician mineralisation
Great Caledonian	Small ~200t crushed/ ~100oz	Several ferruginous veins of 'rubbly sandstone' / Unknown	30cm?	Gold	'Cellular silica' (Twelvetrees, 1907), limonite and quartz	Accessed by shaft with a cross-cut and winze, possibly driven by O'Rourke from cliffs to the south, dewatering attempted once (1933 – Nye). Mineralisation reported in Ordovician host and Cambrian 'Granite' deeper in the workings (confirmed presence in mullock, Reid, 1919). Considered sub-greywacke of the 'Lorinna Formation' (Robinson pers. comm. in Jennings, 1963).
Glynn	Probably a little over 100t / 19oz+	Vein; Strikes west of north and dips steeply west (Harcourt Smith, 1898)	90cm	Gold	Silver	An open cut near the head of Sunday Creek (tributors workings of Smith, 1898) and separate shaft later connected by a winze from the tributors workings. An adit 7.5m below the open cut intersects the lode at 15m. A five head battery was established 7.5m above big creek. The gold is argentiferous and there is no mention of connection to the Cambrian basement.
Golden Cliff	Small/ Unknown, probably <50oz	One main vein, possibly others ; 330/-40W (Twelvetrees, 1913)	10cm	Gold	Arsenopyrite, manganese, quartz (MRT deposits database)	Narrow vein with grades to 42 g/t Au as free gold in oxide and in pyrite at depth. One shaft adjacent to Winspears Rd sunk from an open cut 4 foot wide 30 foot long and deep. Two adits, the upper of which is 18m and extends 9m beyond the lode. The lower adit 30m below is 36.5m long and has a short drive and rise at the end but did not intersect the lode. The lower adit is in 'dark mica granite' (Twelvetrees, 1913).
Golden Hill	Smallish >60t/ >20 oz	Three veins; Approx 140/80E	60cm and 90cm as gossan	Gold	Pyromorphite, quartz, pyrite and sphalerite (Smith, 1898)	An open cut and adit were constructed in 1898. The adit intersects three thin quartz-sulphide veins which pinch and swell along fault zones within the Moira Sandstone, The No.3 vein carries grades to 23g/t Au (Waller, 1901). A 15 head stamper battery originally located at the Great Caledonian was located at the end of a tramway below the mine and was used for crushing. Sulphides possibly replacing bedding adjacent to lodes. Silver and Lead reportedly extracted from lower levels of the mine (Askins, 1980).

Union	Smallish	One vein plus disseminated mineralisation 162/-75E	60cm	Gold	Chlorite, quartz, galena, sphalerite (main lode) Hematite and pyrite (porphyry hosted lodes)	Established pre-1893 by the Campbell Brothers, worked by E.C James again in 1917. 3 shafts and an 80m adit with the last 18m reported to be porphyritic Cambrian rocks with sparse hematite veins containing up to 0.1% Cu. The main lode occurs on the faulted Cambrian – Ordovician contact at depth.
Thistle	Smallish	Three fracture filling veins / No.1 NNW/-80W, No.2 NNE/-85E, No.3 (largest) NNW/-65W	30cm	Gold, Silver, Galena	Quartz, sphalerite, arsenopyrite, pyrite and minor chalcopyrite (Askins, 1980)	Discovered by the Campbell Brothers and originally worked for gold on the rich gossanous 'joints'. Later worked for small amounts of galena in the unoxidised portion of the lode (Reid, 1919). Galena was argentiferous and included trace gold and a peak of 14.5g/t in No.1 lode. Two adits (upper and lower - longer) and a number of shallow shafts and trenches (Askins, 1980). Lodes numbered 1-3 (E to W).
O'Rourke's Hydraulic	Significant proportion of gold from the field (>100oz?)	An area of wash approximately 155 metres long, 3-3.75 metres deep and 40-60 metres wide.	Alluvial (see form)	Gold	Quartz (sometimes attached to gold)	Coarse angular talus worked over three creeks 'in the vicinity of the Union mine' (Jennings, 1963) and east of Glynn Mine (Harcourt Smith, 1898). A dam on 'Big Creek' and water race then piped water to site with less than hydraulicking pressure. Instead water was used to wash the gravel in a long sluice. The area had been worked to within twenty metres of the small dam feeding the 'pressure main' in an attempt to locate the source reef (Waller, 1901). The angular nature of the gold suggested short deposition distances, however no source had been located (Harcourt Smith, 1898)

Table 1: Summary details of individual prospects in the Five Mile Rise Goldfield

### *Devon Mine*

The Devon Mine was mined for galena from clean 7 to 40cm veins producing high grade hand picked argentiferous lead. Consequently the Devon Mine has long been considered and reported as a lead-silver deposit, however appreciable gold and copper grades accompanied the lode material and the mixed sulfide portion of the lodes and any associated disseminated sulphide was never recovered. The mine was the only prospect in the district to pay it's way despite the restrictive location and associated transport costs of horse-packing it's clean galena ore to market.

Reid (1919b) reported that 172 tons of galena ore was produced from the Devon Mine to May 1899 and Twelvetrees indicated that 290 tons of silver-lead ore was produced since 1899 suggesting a total production of 462 tons to June 1907 including production of 25 tons since November 1906. Production at the mine continued sporadically until 1912 however dates overlap for the final production with 134 tons reported from March 1907 until December 1908, so  $134 - 25 = 111$  tons more, so 573 tons as a maximum total to Dec 1908. This disagrees with assessment of Nye who appears to have missed some of the production between September 1902 and June 1907 and suggests a 397 ton total. Neville McCoy held a mining lease over the Devon workings in 1980 and may have made more recent production.

Harcourt-Smith visited the Devon Mine in 1898 which was then operated by the Devon Silver Mining Company, development at the site was being hampered by poor access. An adit had been driven 26 metres in a westerly direction approximately 7.5 metres above the river, a second adit (approximately 36.5 metres north and approximately 5 to 5.5 metres below the first adit) had been driven 7.5 metres in 1898. Drives were established in the orientation of the intersected lodes (north-south orientation) in the first adit and the second adit was also noted by Waller (1901) and associated workings are described by Twelvetrees (1907).

The lodes reported in the first adit are at the entrance (7.5cm of galena dipping west), at 12 metres (a narrow gossanous vein) and at 15 metres (23cm of galena with a NNE strike and an 80 degrees easterly dip - the Devon lode or No.1 lode). Harcourt Smith reported that the tunnel had been continued for 10.5 metres past the drive on the Devon lode at 15 metres. There was no further development on this main adit in 1901 when Waller visited, however the main lode had been driven south for 25 metres and north for 47 metres (later confirmed by Reid 1919b) and stopped out above the drive. Twelvetrees reported that it had only been driven 7 metres to the north (probably back filled) and 31.5 metres to the south in 1907. A 12 metre rise was put in on the south drive (Twelvetrees, 1907) and this was driven some 55 metres back to the north and stopped in from the 'level 1' adit below.

The Devon (No.1) lode is described as being 60 to 90 centimetres wide, typically with 38 centimetres of clean galena in the centre of the lode. Twelvetrees (1907) had noted the width varied from around 10 centimetres to 90 centimetres in outcrop and that very little galena (<2.5 centimetres) showed in the southern drive, however in the top of the rise from this drive the lode was carrying 10 to 13 centimetres of galena to the south and 7.5 to 10 centimetres going north, he also noted the outcropping lode took a more northerly strike at the northern end and has been proven to extend over 122 metres. Twelvetrees also believed that if the main adit was continued another 10m that it may intersect another parallel lode which takes the form of a gossan approximately 60 metres above the river level, bearing 9 degrees east of north and being sub vertical.

Apparently this development did occur because a second lode is described at 27.5 metres in Reid's account (1919b). This lode (No.2) is driven 9 metres south and 25 metres north where it branches, one vein of 5 to 7.5 centimetres of mixed sulphide ore being followed on 350 degrees for 23 metres and the other vein of 5 to 15 centimetres of good grade galena being followed on 025 degrees for 23 metres. A sample from the face of the north-easterly branch assayed 62.2% lead and 2884 g/t silver.

No stoping had occurred on this vein in 1919. The south drive on this lode exposed a little galena and chalcopyrite in porphyry.

A third poor quality lode is described at 38 metres and is driven on north and south for 6 metres, the gossan of this lode at surface assaying only 12g/t silver. The final length of the main adit was stated to be 52 metres (Reid, 1919b).

Lodes in the northern adit were encountered at 1.5 metres (this is a 7.5cm west dipping vein according to Twelvetrees and it probably equates to the west dipping vein in the entrance of the first adit) and at 7.5m where development was still occurring at the time of Harcourt-Smith's visit (1898). The development had found the lode barren for 3.5 metres to the south, however ore was being encountered again at 6.5 metres from the cross cut with up to 46 centimetres of galena with lesser chalcopyrite, in one place, however the lode pinched out to a "thread" in the drive floor. The lode is described as splitting in two at the end of the south directed drive with each vein only carrying around 10 centimetres of clean galena. The whole drive contains a little disseminated pyrite and stringers of galena in the wall rock (Harcourt Smith, 1898).

Twelvetrees indicated the main lode was cut at 21 metres in the northern adit (which is contradictory, so is either incorrect or is a further lode) and was driven 21 metres north and 44 metres south and that the lode was pyritic (which agreed with Harcourt Smith's description of the lode encountered at 7.5 metres). Reid later (1919) describes the No.1 lode as being intersected at 15 metres with drives north over 30.5 metres and south over 61 metres. The lode was also reported as being stoped out above and below the drive to the south for 30.5 metres before the lode pinches out.

In the northern drive on the No.1 lode a winze was sunk 5 metres from the 'flat sheet' and 5 metres down, the lode showing 18 centimetres of galena to the north, unfortunately water was encountered here. By the end of the northern drive the lode is almost barren of galena with bands of quartz and 'gossan' only (Twelvetrees, 1907).

Reid (1919b) reported that from the end of the second adit a main shaft 2.5x1.25 metres has been sunk 30.5 metres deep on the No.1 lode to open up a third level and a ladder-way shaft 10.5 metres northward has been sunk to 23 metres, drives were reportedly developed north and south at the 18 metre and 30.5 metre levels (Reid 1919b) and a winze joins these levels (Nye, 1928). 7.5 to 18 centimetres of high grade ore was reported from these workings, however these were underwater when visited by Reid (1919b). This main shaft was being operated by means of a pumping and winding plant, the 4 inch pump controlled the inflowing water and was powered by way of flow from the creeks on the opposite bank of the river, however continuous operation was not possible in summer.

The third level is also accessed by a shaft (according to Nye, 1928) which has been sunk some 21 metres deep from surface approximately 33.5 metres (Twelvetrees, 1907; 46 metres according to Reid 1919b) north of the winze. A drive has been directed south from the end of the shaft in an attempt to intersect the lode 12 metres below the bottom of the winze. Water was within 9 metres of the top when Twelvetrees visited (1907), however the lode had been encountered in this drive and apparently widened from 7.5 to 18 centimetres of galena.

Three other adits occur above the No.1 and No.2, two of which had been driven in recent years for prospecting purposes (Nye, 1928).

Despite the intensive work completed to extract lead and silver in the form of galena ore, historic assays for gold from the Devon lodes were very encouraging (Table 2) and made for an interesting target.

Sampler (date)	Sample type	Gold Values
Harcourt Smith (1898)	Selected lode material	Up to 4 pennyweights and 4 grains of gold per ton (~6 g/t)
Waller (1901)	Average gold grades from the 172 tons of hand-picked ore to 1901	5 pennyweights, 4 grains of gold per ton (~7g/t).
Reid (1919b)	Gossanous grab sample	Up to 20g/t Au
Hermann (1989), see modern exploration	Two lode samples (from mullock heap?)	3.6 and 6.3 g/t Au respectively

Table 2 – Assays for gold from various samples from the Devon Mine

The ore bodies are composed of mainly galena, abundant sphalerite and chalcopyrite and subordinate pyrite with a quartz-siderite gangue. The gold appears to increase proportional to the amount of chalcopyrite (Reid 1919b) and the lode in the northern shaft is banded suggesting open fissures with progressive precipitation. Oxidation of the ore down to river level has seen the development of cerussite, azurite and malachite. Gossanous samples may also have enriched gold values similar to the occurrences at Five Mile Rise.

At the time of Harcourt Smith's visit a small open cut on the original discovery some 18 metres above the workings had been developed, he indicated that this too had a bunched appearance with lodes occupying a fault surface with variable dilation. One other lode potentially occurs 61 metres south-west of the mine where Harcourt-Smith reported a manganese gossan which strikes NNW and dips to the east (similar to the Devon lode).

Another lode termed the diagonal lode is present in the northern end of the surface development and apparently runs into the footwall where it may join with the No.2 lode. Further up the hill approximately 15 to 25 metres west of the Devon lode there is a surface outcrop described as the 'big lode'. This may correlate with the No.3 lode in Adit No.1. An adit was also driven in 36.5 metres west during 1922-23 at a point some 15 metres above the No.1 adit. The Devon lode was not cut but a "wall" was passed through at 12 metres and a lode formation at 18 metres (possibly the diagonal lode). The adit must have terminated a short distance from the No.3 lode.

Sporadic production at the Devon Mine continued until 1912 with production ceased in 1913 when Twelvetimes reported on the mine for a second time. In 1916 the lease was abandoned despite the lodes being encountered in both adits and apparently in the northern shaft, this suggests that strike extent of the narrow clean galena shoots was limited. In 1919 Mr G.M.Day was extracting the remaining unstopped sulphidic ore and hoped to remove any gossanous material of commercial value (Reid, 1919b), he was also hoping to de-water the shafts if enough water was available for power generation during the winter.

In 1923 the Mt Farrell Mining Company picked up the lease over the Devon, however no production was recorded to 1924 when the lease was dropped. The workings were abandoned in 1928 (Nye, 1928). A small parcel of ore was then exported in 1937 (Jennings, 1963) and a mining lease at Devon was held by Neville McCoy in 1980, it is believed the area was made accessible by bulldozer track at this time.

#### *Other mines*

The Sirdar Prospecting Association's section was approximately 5.5 miles upstream of the Devon Mine on the Dove River (Waller 1901) and ~1 ½ miles SW of Devon in a straight line (possibly near the licence boundary), one small galena vein reportedly in the Precambrian schists has been driven

on for approximately 12 feet and 60lbs of galena extracted. A 'gossan' apparently outcrops on the north side of the river on this section.

A copper prospect in the schists upstream from the Devon Mine was also reported, these workings were known as the Welcome Home prospect and are located approximately 6 miles south west of the Devon Mine (outside the licence boundary).

The Silver Dove is also located in the licence downstream of the Devon Mine and is described as a 7.5cm pyromorphite vein in the Precambrian schist, this was driven for approximately 46 metres with no further encouragement (Reid 1919b).

The Powerful Mine is first referred to in Bulletin 14 (Twelvetrees, 1913) as Reardon and Days Mine. The mine is located approximately three kilometres south of Lorinna. The lode is in granite opposite the Dove River where it now enters Lake Cethana. The lode is comprised of quartz, specular haematite and pyrite. Two samples produced assays of 1.5 g/t gold and silver and no trace of gold and 6 g/t of silver. A bulk sample produced a trace of gold and 7.5 g/t silver.

Twelvetrees believed the lode was some 40-50 feet wide and strikes NW-SE with a 30 degree dip to the SW, however Reid (1919) considered the lodes to be proven 8-14 feet wide in the cuts. Four cuts or adits were driven on the lodes with 'granite porphyry' described between cuts three and four. The first three cuts are described as being 11, 18 and 25 feet, all of which are probably too short to describe the adit that leaves the Lorinna Road (originally the Pelion Road) south of the township. Pyrite is also said to be more plentiful where quartz is more abundant in the Powerful workings.

D. Davies' show is described as being a haematite lode in the Precambrian schist and is sketched on Twelvetrees' map to the south-east of Powerful. The lode is said to strike northwest and samples from a small pit revealed neither a trace of gold nor silver (Twelvetrees, 1913).

A further prospect probably in the northern half of Lorinna occurs '200m west of G.Sloanes house'. A 30 foot tunnel was driven on a specular haematite formation in quartz porphyry, the specularite attached to quartz said to be gold bearing. The vein is 6-8 inches wide with 2-3 inches of specularite. Granite sub-crop or float appears proximal to the prospect (Reid, 1919).

### ***Modern Exploration History***

Modern exploration began in 1965 when the area was examined by the Mt Lyell Mining and Railway Company Ltd, they were followed by Freeport 1973, Comalco and Shell 1974-1984 (with CRA managing from 1985-1987), RGC 1989-1990 and Rio Tinto Exploration 1995. Activities are summarised below.

Exploration in the Dove River licence area has largely focussed on locating tin, tungsten or fluorine mineralisation associated with the younger Devonian (Dolcoath) granite to the north. With little or no tin or tungsten mineralisation identified, the area has been largely ignored. Some effort went into locating gold mineralisation at Five Mile Rise in the Ordovician rocks, however the Cambrian rocks have not been systematically explored for gold.

Exploration for base metals finished before the discovery of the Cadia and Goonumbla deposits in the 1990's, and the understanding these deposits brought to porphyry exploration in eastern Australia.

#### ***MT LYELL (1965-1971)***

Modern exploration began in 1966-67 when the area was examined by the Mt Lyell Mining and Railway Company Ltd as part of exploration for base metal or tin Mineralisation within EL8/1965.

The Mt Lyell Co. undertook an aeromagnetic survey and a regional -80# stream sediment survey for tin, copper and zinc. A close association between zinc and copper was noted regionally however

individual results were considered doubtful with known anomalous areas not all registering on the survey. Reid (1967) concluded that there could be real interest in the copper and zinc anomalies if it could be confirmed (by resampling) that the tenor of mineralisation at known localities such as Round Mount were not being identified.

Several areas were recommended for follow up stream sediments including the possibly anomalous copper in stream sediments (34ppm Cu) draining from the magnetic anomaly 12 (later aeromagnetic anomaly C) above the Powerful mine.

Particular anomalies were followed up by more detailed exploration consisting of soil geochemistry and geological mapping on grids and reconnaissance geophysical surveys with VHEM equipment and a magnetometer (Foster 1969).

Anomaly C (Powerful) was gridded, with a B-Horizon soil survey and a ground magnetics survey completed. A few high values (probably anomalous) of cobalt and zinc were located on the margins of the magnetic anomaly but were attributed to the breakdown of ferromagnesian minerals in the basalt. The magnetic anomaly was found to correspond well to the outcrop of Tertiary Basalt. The diffuse and variable signature associated with the anomaly was potentially explained by magnetite in quartz-haematite-gold veins, however the restriction to the outcropping basalt was not explainable.

Reid (1967) identified two locations where disseminated chalcopyrite and pyrrhotite occurred in 'granite associated porphyry' upstream from the Devon mine. Reid also located minor disseminated chalcopyrite in the Lorinna Greywacke on the southeast slopes of the Five Mile Rise.

Reid (1967) recognised that there were two ages of granite and therefore a possibility of two phases of mineralisation, the possibility of Cambrian mineralisation being remobilised in the Devonian was not precluded. Reid (1967) also mapped a possible fourth body of Dove Granite in the Dove River west of the current licence.

The part of EL8/1965 containing the current EL was relinquished in 1971. Later in the 1970's they concluded the probability of locating an economically viable deposit of their target type was low and relinquished the whole licence.

#### *FREEPORT (1973)*

Freeport's main target was porphyry copper mineralisation, but considered the chances of finding gold, tin and tungsten or stratabound lead-zinc-copper. They employed consultants Cundill, Meyers and Associates whose activities consisted of mapping, collecting rock chips and stream sediment sampling using -40# and -80#. Freeport's Licence was approximately the same area as the current licence.

Exploration was focused on the flanks and cusps of the granite due to identifying chloritic and kaolinitic alteration in the granite at the Powerful prospect associated with minor disseminated pyrite-chalcopyrite (Walsham, 1973).

Freeport erroneously thought the Dove Granite to be younger (Devonian) in age (Austin and Serim referred to Jennings, 1963) even though the previous tenement holder (Reid, 1967) had indicated a Cambrian age. Austin and Serim (1973) also prefaced their investigation with the assertion that the Five Mile Rise gold-sulphide deposits were related to granite intrusion, another assumption made by Jennings.

Freeport located significant copper anomalism in stream sediments and -80 mesh stream sediment sampling was found to be a reliable method for identifying areas of known anomalism and it was recommended that -40# was not to be used again. Rock chips assayed to 0.16% copper in fractures in the Dove River near the Devon Mine and several regional 600ppm copper samples were collected

from fractured granite and quartzite. One sample in quartzite from the east near the Powerful prospect assayed molybdenum to 160ppm, but despite these anomalous samples no follow up work was done.

Despite not following up the anomalous samples, several other prospective features for porphyry style deposits were identified by Freeport in the brief assessment of their licence. These features include quartz veining in the Precambrian quartz-mica schists that was observed to increase near the granite contact, occasional disseminated pyrite within biotite granite and biotite-hornblende granite and quartz porphyry (Lorinna Greywacke) with considerable chloritic alteration.

Freeport also identified hematite alteration in the "Lorinna Greywacke" and concluded that this was caused by the late stages of the Dove Granite with chlorite veins containing minor gold and base metals (Walsham, 1973). It was also noted that "there are signs at Mt Lyell that haematite gossans preface the existence of acid volcanic ore bodies" (Walsham, 1973) and that the considerable hematite alteration noted in the licence may indicate a similar setting.

The discovery of Eastern Australian porphyry copper-gold deposits came much later than the exploration by Freeport (who in 1973 recently opened and operated the Ertzberg porphyry copper-gold mine in Indonesia) and the features they identified may not have had a context suitable to keep their interest in the project. Based on their understanding at the time, they concluded it was unlikely that a Cu-porphyry ore body of a size that would be suitable for Freeport existed in the licence area. The EL was relinquished in 1973.

#### *COMALCO (1974-1979)*

The main aim of Comalco exploring the Moina area was to locate a fluorite body (magnetite-fluorite skarn) for their aluminium smelting needs, however investigations included the search for Sn, W, Au and Pb-Zn. Askins (1980) focussed on the broader area (488km<sup>2</sup> later reduced to 405km<sup>2</sup>) including 18 km<sup>2</sup> released in 1976 by the Mines Department. This large exploration licence covered the whole of EL14/2006.

Comalco's activities included a literature search, stream sediment sampling, rock chip sampling, colour air photo collection, a reassessment of airborne magnetics, geological mapping and selected prospects were gridded and soil sampled. Follow up work on grids included rock chip collection, ground magnetics and induced polarisation surveys.

Comalco suggested that gold and lead at FMR may be remobilised from volcanogenic base metal deposits and recommended an EM survey, however this was not done. Comalco also mapped the Dove Granite adjoining the Moina Sandstone at the Golden Cliff as previous workers had done. The level of alteration within rocks at this locality had even led Freeport (1973) and Jennings (1963) to conclude that the Dove Granite intruded the Moina Sandstone in this area. This strong alteration highlights the prospectivity of the Cambrian units in this area.

Future work identified by Comalco included follow up of copper and zinc anomalies in Olivia Creek, the Dove River, a tributary below magnetic anomaly 14 (Zaravatjian, 1966) and copper from streams draining magnetic anomaly 12 (Zaravatjian, 1966) above the Powerful Mine.

Significant results include four samples of Dove Granite (rock chips) that contained anomalous Cu, Pb and Zn. Eight other anomalous samples were taken from the Lorinna Greywacke, maximum values for all rock chips in these units were 175ppm Cu, 245ppm Pb, 245ppm Zn and 1500ppm F. Two -20# stream sediment anomalies of 65ppm Cu (60ppm considered anomalous using this mesh size) and one F anomaly of 950ppm were also found to drain the granite at the Powerful prospect. Like Freeport had experienced it was again recommended that a finer mesh size would be a more appropriate technique. Follow up work on select anomalies was then undertaken using -80#.

Stream sediment copper anomalism was defined in the Campbell River (to 375ppm Cu) using -80#, possibly attributable to weathered dykes intruding the schists that contain up to 340ppm in rock chip, this area was later relinquished by Shell in 1983.

#### *SHELL (1980-1984)*

EL7/1974 was joint ventured with Shell in 1980. The licence was still a large 405km<sup>2</sup> holding when Shell became JV manager.

Shell's focus was on cassiterite rich magnetite or pyrrhotite rich skarns. Mineralisation models for targets were wriggilite skarn like Shepherd and Murphy and Renison style skarn. They had ancillary targets of coarse scheelite and stockwork greisens tin-tungsten deposits and sphalerite skarns adjacent to the Shepherd and Murphy Mine. Shell undertook a 250m line spaced helicopter-borne magnetics survey with 100m terrain clearance to explore for their primary target.

Shell also undertook -20# stream sediments (despite the evidence from two previous surveys that a finer mesh is more appropriate) and a more localised survey using -80#. Pb anomalies (65 to 245ppm) in stream sediments south of Five Mile Rise were believed to be sourced from veins or related to 'Devonian' Dove Granite emplacement rather than volcanogenic deposits and were not considered a priority target. Three -20# Pb anomalies were also identified in a tributary of Bull Creek near Daisy Dell in an area mapped as Tertiary basalt (Smyth, 1981).

Shell identified the "Lorinna East" bullseye anomaly adjacent to the Powerful mine as 'possibly a plug with a south dip'. They drilled one 200m long percussion hole into the bullseye anomaly. The lithologies intersected were Tertiary basalt to 58m, Tertiary clays to 80m, Pre-Cambrian schist with minor granitic veining to 200m. Susceptibilities in the basalt were considered too low to explain the aeromagnetic anomaly (Smyth, 1981). Remanent magnetism studies were meant to be done on these basalts. The conclusion was that remnant magnetism caused the anomalies even though the aeromagnetic signal 'could not be formational' according to the report and no evidence was tendered that remnant magnetism studies were done. The drill hole contained elevated Ba, Cu, Zn, however was not assayed for gold, despite being located adjacent to the Powerful gold mine.

The exploration licence area was reduced in 1984 but no work was completed on the prospects within the current Dove River licence area retained in the 7/74 licence.

#### *CRAE (1985)*

In 1985, CRAE became managers in EL7/74 in a three-way joint venture with the Commonwealth Aluminium Corporation (Comalco) and Shell. CRAE embarked on another very widely spaced reconnaissance stream sediment survey north of the current licence and reprocessed and reinterpreted Shell's aeromagnetic data. Exploration licence 7/74 was reduced in 1987 with the Dove River area dropped, with the joint venture maintaining tenure over the Moina fluorite deposit via Retention Licence.

#### *RGC (1989-1990)*

RGC originally picked up the EL8/1988 to look for economically viable gold or Renison-style tin mineralisation in the Moina Sandstone and Gordon Limestone associated with the Dolcoath Granite. During 1989-1990 RGC conducted exploration on the Five Mile Rise area as part of a program that compiled and assessed previous geophysical data and integrated it with new sampling, mapping and ground geophysics. EL8/1988's southern limit was approximately the northing of the Devon Mine.

A 20.5km grid was established at Five Mile Rise with an east-west base line and 15 north-south lines spaced every 200m easting. Mapping was completed from scarce outcrop and C-horizon soil samples taken every 25m in a north-south direction. Soil sampling was aided by a well developed soil profile



the edge of Lake Cethana yielded low metal values, however one in the creek below Golden Cliff had gold to 0.093ppm.

Further rock samples (M prefix) were also collected but not assayed, these samples are believed to have been destroyed when Placer took over RGC (M.Vicary pers. comm.). 39 of these were taken inside in the current tenement, many of which have been duplicated by rock chip sampling this reporting year.

Results from the C-Horizon soil survey at Five Mile Rise (1989) highlighted geochemical anomalism coincident with IP (chargeability and resistivity) anomalies south of Five Mile Rise. The RGC geophysicist also noted that chargeability highs in part may coincide with Dove Granite at depths of only 100-150m. Drilling was recommended. However because RGC mistakenly thought all mineralisation (including that in the Cambrian rocks) was Devonian, the targets were never followed up. 41 rock chip samples were collected on the FMR grid over the Ordovician sandstones. Wacker bedrock sampling was recommended to follow up soil anomalies in the Ordovician rocks.

Castro and Fleming (1990) indicated that exploration re-focussed on geophysical methods rather than mapping and sampling as this data was previously completed in 1989. Ground magnetics and a gradient IP survey were conducted over the Five Mile Rise grid. Only reconnaissance mapping and sampling was conducted where soil geochemistry had indicated 'slight anomalism'.

A sub-regional magnetic gradient was defined on the Five Mile Rise grid. R.Deakin (in Castro and Fleming, 1990) interpreted the magnetic gradient in the north of the grid to be a slab of weakly magnetic rock with an equivalent intensity to the Dove Granite at approximately 100m depth and approximately 1km thick with superimposed individual 100-200 nT anomalies possibly reflecting basement highs. The ground IP survey did not define anomalous conductors, however several chargeability anomalies were defined at around 100-200m depth. Within Castro and Fleming's report (1990), R.Deakin reported on the survey and identified five chargeability anomalies and 6 drill targets which were never tested. Deakin also made the mistake of referring to the Dove Granite as Devonian.

After the geophysical surveys and final sampling were completed RGC decided that no further work was warranted in the Five Mile Rise area. This is probably due to their stated primary aim of locating economically viable gold mineralisation related to the Dolcoath Granite in the second year of exploration. The data collected was considered to be 'largely sufficient' for the assessment of the licence and the area within the current exploration licence (14/2006) was relinquished.

#### *RIO TINTO EXPLORATION (1996-1997)*

Rio Tinto acquired a new Exploration Licence - EL30/1996 covering 242 km<sup>2</sup> which is approximately eight times larger than the current EL but it included the whole current EL. The target style was sediment hosted fine grained sulphide poor Carlin or Sepon style gold. They were focused on the Ordovician Gordon Limestone and the Moina Sandstone where they are intruded by Devonian Granite

Rio Tinto took 12 -80# stream sediment samples and 12 panned concentrate samples. They found the Five Mile Rise area to be anomalous for gold and lead. Rio Tinto then reviewed RGC's soil and ground geophysical data for Five Mile Rise and decided that existing small workings were not a viable target of this type. The main reason for their withdrawal was the lack of conductors in the RGC survey. The licence was surrendered November 1997.

## Work Completed

A comprehensive literature search has been followed by re-processing Western Tasmanian Regional Minerals Program data and previous exploration maps have been georeferenced for target generation. A large portion of the Dove River area has been mapped at a reconnaissance ~1:10,000 scale, rock chips have been collected at representative localities, however the mapping has not been compiled as yet and will be complimented by petrological work in the forthcoming program.

During the 2006-2007 field season Dove River Pty Ltd drilled three diamond drill holes, collected regional rock chips and systematically assayed the Devon Mine Workings, (see McDougall and Reed 2007).

In this reporting period the results from DR3 (the second hole near the Powerful Prospect) were received from the laboratory with moderately anomalous veined intervals returning the following significant intersections:

Hole_ID	From	To	Interval
DR3	31.00	32.00	1m @ 1.39 g/t Au
DR3	102.00	103.00	1m @ 170ppm Mo
DR3	132.00	133.00	1m @ 0.2 g/t Au, 0.05% Cu, 2g/t Ag
DR3	194.00	195.00	1m @ 0.12% Co, 2.15g/t Ag, Te, Se association
DR3	239.00	240.00	1m @ 93.4ppm Mo
DR3	366.00	367.00	1m @ 0.56% Zn, 0.11% Pb

Table 3 – Significant intersections carried over from the previous drilling season

## Reprocessing Data

The WTRMP magnetic and radiometric data were processed and evaluated. Weak magnetic highs were identified coincident with the two Dove Granite intrusive bodies. A strong magnetic low to the north of Devon Mine was also observed and a broad magnetic gradient increasing to the north of Five Mile Rise was identified as a feature of interest. Strong K-band radiometric anomalies were identified at Devon and SW of Devon, a weaker K band high was located west and south of bullseye magnetic anomaly at the Powerful prospect.

Soil data from the original RGC survey at Five Mile Rise was re-entered and thematically mapped to locate zones of anomalous copper and gold in soils. The data has not been accurately located with respect to the surveyed lines, however points are located on the theoretical 25m spaced sample widths either side of the base line. Broad but significant copper anomalism has been defined in an east west orientation consistent with the mapped emergence of the Cambrian volcanics to the south of Five Mile Rise (Figure 5).

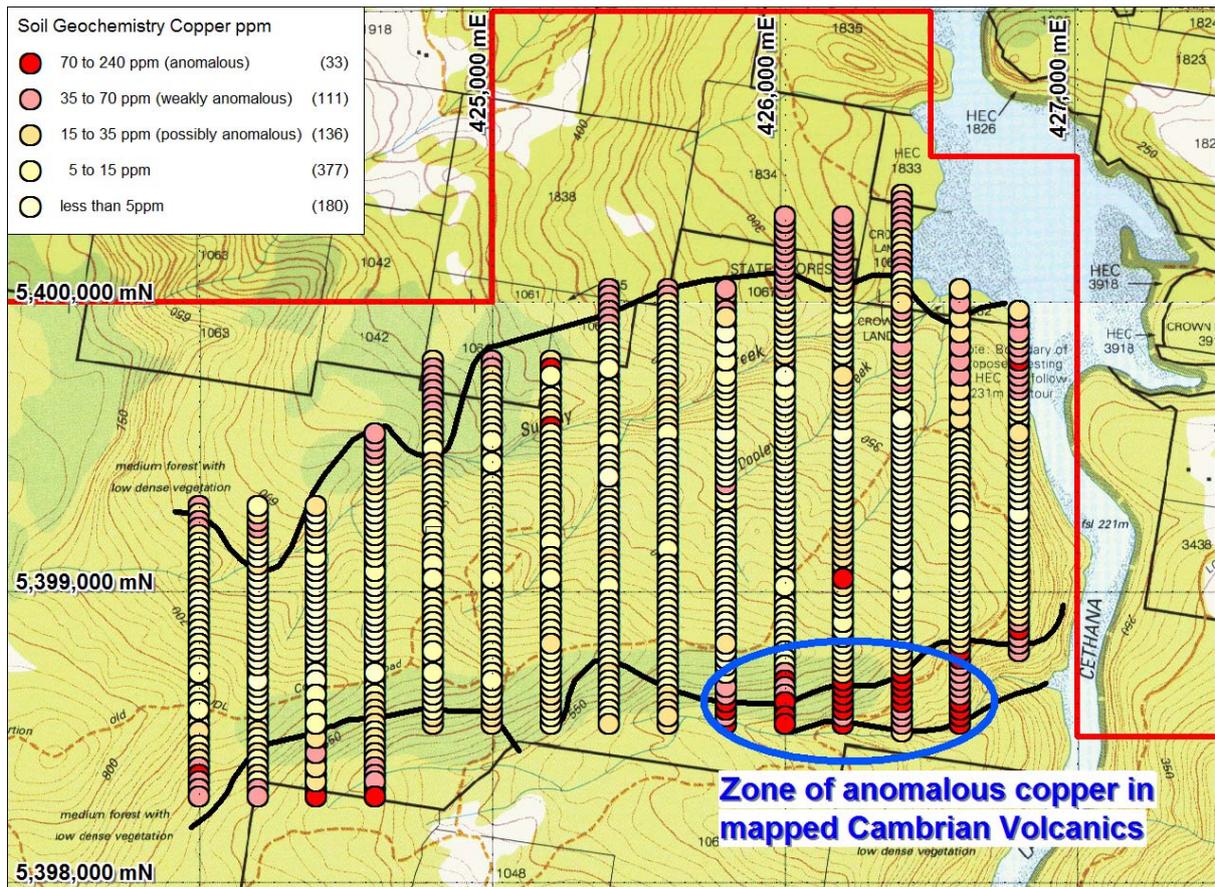


Figure 5 – Reprocessed 1989 RGC soil grid, thematically mapped for copper in soil. Mapped contacts in black show the limit of the less prospective Ordovician sedimentary rocks.

RGC IP contour maps for chargeability, conductivity and apparent resistivity were georeferenced and reassessed with respect to soil anomalies. Ground magnetics were also georeferenced and overlain. The main magnetic gradient north of the VDL Co. track still remains a viable target, however initial testing has been aimed at chargeable zones with adjacent soil anomalism in an attempt to locate disseminated copper-gold mineralisation. Reassessment of Five Mile Rise this year is a priority.

### **Mapping and rock chip sampling**

Mapping within the licence has concentrated on the eastern shore line of Lake Cethana adjacent to the Powerful prospect (Figure 6) and stream and river traverses around the vicinity of the Devon Mine (Figure 7). Rock chip samples were taken at representative locations to allow comprehensive geochemistry and lithological comparison to be undertaken. The geochemical determinations for all hand samples have been received and are presented in Appendix 2. Systematic investigation of the geochemistry, to identify potential variation within the granite and the relationship between the granite and the porphyries, will be undertaken during the forthcoming program.

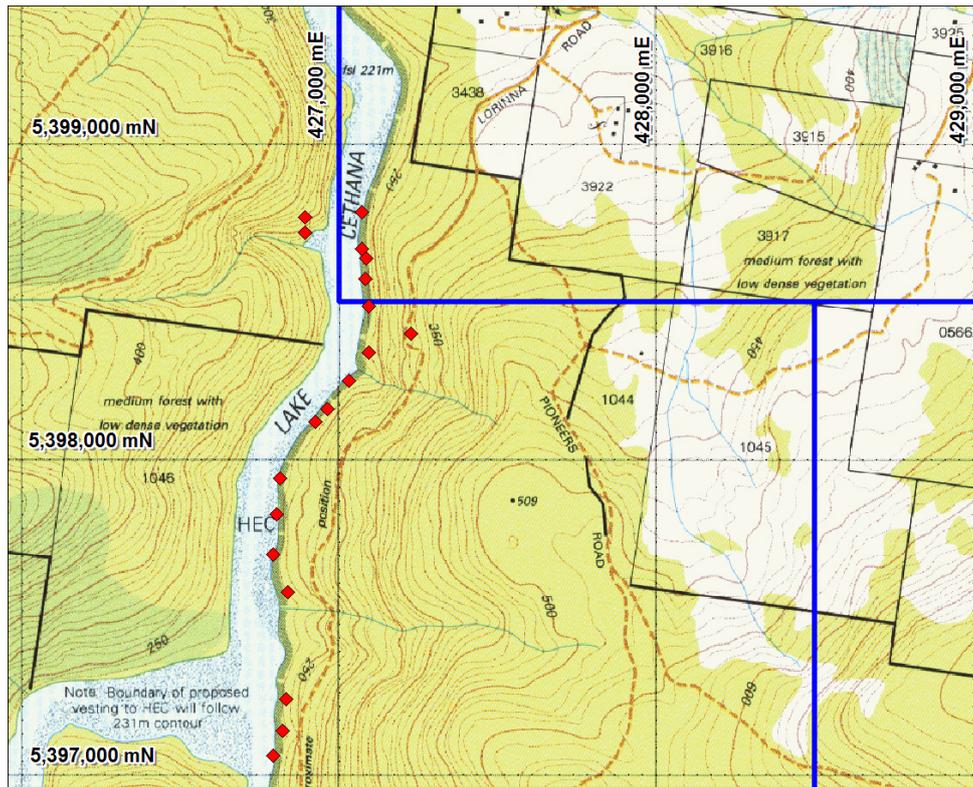


Figure 6 – Rock chip coverage (sample sites = red diamonds) from mapping near the Powerful mine.

Variation within the Dove Granite near the Powerful prospect identified two main variants a medium grained quartz-feldspar-biotite-hornblende granite and a coarse grained granite with abundant large rounded to euhedral quartz (see geology section). Variants of these components have been located near the Devon Mine with porphyry hosting the mineralisation and granite mapped to the south.

Mapping to the north, west and immediate vicinity of the of the Devon workings on the Dove River has indicated that porphyry intrudes the Cambrian sequence at several locations possibly indicating dyke structures related to NNW to NNE trending faults. This relationship is highlighted by contact metamorphic hornfels spotting commonly developed in the felsic unit adjacent to the porphyry at the Devon Mine, this spotting is prominent in drill holes DEVD1 and DEVD2. The Cambrian units dip to the north and appear to thicken to the west side of the faults in the vicinity of the Devon mine, possibly indicating a growth fault environment that controlled sedimentation. The thickness variation is most recognisable in the lower felsic 'vitric tuff' unit. An interpretative map is yet to be compiled.

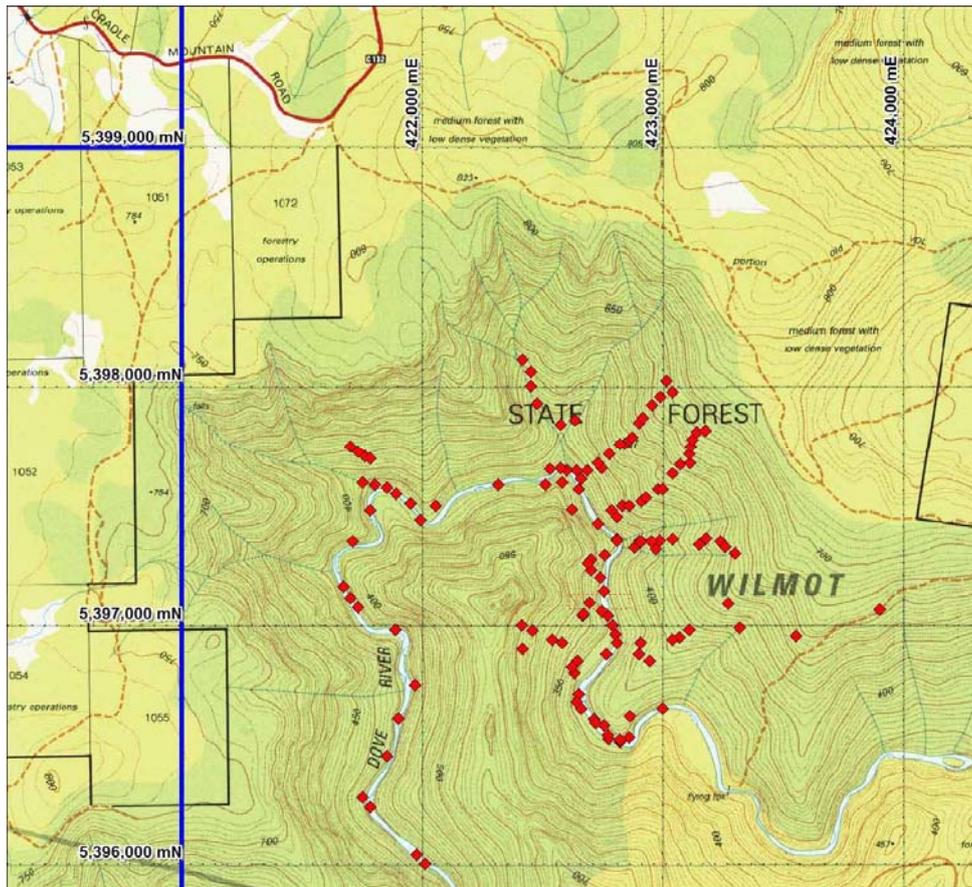


Figure 7 – Rock chip coverage (sample sites = red diamonds) from mapping near the Devon Mine.

The high grade samples taken from the Devon Mine by RGC were followed up by systematic adit sampling of the accessible workings. Rock chips were and also collected for lithological examination at a prospect scale to ascertain the alteration characteristics around the Devon mineralisation. The host rock type was clearly confirmed as porphyry with ubiquitous potassic and propylitic alteration along the length of the main adit (southern adit, approximately 8m above the Dove River). The main alteration assemblage consists of K-feldspar, sericite, chlorite and lesser carbonate.

The highest average grades were obtained from the drives and stopes on the lodes with average lead 2.4-12% and silver 72-500 g/t in the 'seconds' left behind in these workings. These results were accompanied by significant gold of 0.5-4 g/t and copper from 0.06-0.45% (average figures for each lode). Samples taken from the adits which 'cross cut' the lodes were variably anomalous for example the main adit averaged 0.1 g/t gold, 0.09% copper and 77g/t silver albeit influenced by peak values in the lodes themselves. The encouraging grades prompted the two hole drilling program under the workings.

### **Drilling**

Two diamond drill holes were completed on EL14/2006 for ~430m. The drilling site was located next to a 1970's vintage hut on the eastern side of the Dove River. The site was accessed by helicopter for drill rig transportation and by quad bike and walking for personnel movements (see photos of drill pad in appendix).

The existing track to the mine required an upgrade for vehicular access and was made 4WD accessible for approximately six Kilometres by way of light clearing of roadside vegetation, drainage works by a small excavator and removal of large fallen trees which blocked various parts of the track. The re-establishment of access was critical to the accessibility of the site and the excavator was used

to establish 4WD access to the point where the track was to narrow and rocky to be continued. From here, hand clearing using chainsaws and minor drainage works using hand tools provided adequate access for a 2 seater quad bike with 4WD capability.

DEVD1 was collared on an azimuth of 260 degrees and at 45 degrees to aim directly down dip of the main southern adit where vein mineralisation had apparently pinched out. The alteration and fault zone associated with the quartz porphyry contact was encountered at approximately 96 metres with veins intersected typically carbonate rich and sulphide poor. Consequently assays were disappointing for the altered zone which had an apparent width of 40m.

The strongest metal anomalism was associated with a zone of strong potassic alteration from 103.3m – 110.9m with an overprint of hematite-pyrite>>carbonate veins and then carbonate veins with a chlorite selvage. The zone assayed 7m @ 0.08g/t Au, 0.7g/t Ag, 83ppm Co. Another galena vein assayed 0.21g/t Au, 5.7g/t Ag, 0.25% Pb over the broader 1 metre sample interval, confirming that lead ore derived from the lodes was probably quite auriferous.

Given the lack of significant mineralisation in DEVD1, it was decided to target the northern end of the workings where the apparently payable workings were flooded and never successfully dewatered. An implied plunge of 23 degrees to the north for the widest ore shoot and an intersection lineation was unable to be tested from the eastern bank, instead DEVD2 was targeted under the northern workings on an azimuth of 287 degrees and a dip of -45 degrees from the same drill pad, with the drill collars only spaced by a couple of metres. The intersected zone of faulting and alteration would then be at a spacing of around 40-50m which would have allowed for an estimate of grade continuity if the alteration zone had been auriferous.

The contact between the quartz-porphyry and the hornfelsed Cambrian country rock was intersected at 84.2m with the main alteration zone was intersected at 99.6m. The alteration is strongest around veins in the 99.6-103.5m interval. The broader altered interval continued to 143.7m and is variably pyritic over its width. The apparent width of this alteration is 44m and correlates well with the adjacent interval. When the measured strike is considered the likely true width is almost exactly 28m in each case. Only a narrow zone of mineralisation and select veins contained significant metal, significant intervals are listed below:

Hole_ID	From	To	Interval
DEVD2	31.00	32.00	1m @ 63.4 g/t Silver
DEVD2	83.00	84.00	1m @ 0.23% Copper
DEVD2	100.00	112.00	12m @ 0.12 g/t Gold, 6.3 g/t Silver and 165ppm Cobalt
including	101.00	104.00	3m @ 0.33 g/t Gold and 19.6 g/t Silver
and	101.00	102.00	1m @ 0.43 g/t Gold, 17.2 g/t Ag and 208ppm Cobalt
and	103.00	104.00	1m @ 0.39 g/t Gold, 41 g/t Silver, 0.69% Copper, 0.51% Lead and 0.77% Zinc
DEVD2	119.00	120.00	1m @ 103 g/t Silver

Table 4 – Significant intervals within DEVD2

The relationship of veining disparate to the contact suggests that much of the alteration post dates intrusion. The possible paragenetic sequence of alteration is K-feldspar dominant potassic alteration at the time of intrusion overprinted by hematite-pyrite stringers possibly during subsequent dilatant faulting and late carbonate +/- base metal veins (see example in Figure 8) possibly representing a propylitic alteration assemblage with associated seawater convection. The cockade banding present in the best base metal rich vein also suggests an epithermal character which could explain the copper and gold content with mineralised porphyry occurring at greater depth.



Figure 8. Photograph of 10cm wide vein containing abundant sphalerite, galena, pyrite and chalcopyrite (left) within sulphide-rich breccia zone (right) from DEVD2.

#### *Magnetic Susceptibility*

Magnetic susceptibility readings were taken on all drill core, a minimum of 5 and a maximum of 10 samples were measured for every 2m interval of drill core. Taking a minimum 5 readings over 2m instead of every metre allowed even moderately broken core to be assigned a representative reading. The peak susceptibility and the average susceptibility were taken from these readings.\*Note all readings quoted in the drill log herein are  $\times 10^{-3}$  SI units.

A hand held Exploranium KT-9 Kappameter was used in “no pin mode” to collect readings from cut drill core. The KT-9 was set to the nearest 1cm diameter setting on uncut drill core to take account of the geometric correction required for true susceptibility readings. Readings were made away from susceptible materials with the drill core removed from the trays and read away from the metal racking. All metal material was removed from the operator eg: watches and magnetic scribes etc.

Magnetic variability was identified in the core alteration zone on cursory examination of DEVD2, however the lack of variability in the detailed capture of DEVD1 susceptibilities downgraded the need for systematic examination of DEVD2. This is consistent with the area being a relative magnetic low.

## **Discussion**

The following is a discussion of the assumptions made in previous exploration regarding the age of source rocks and mineralisation ages. The mineralisation model provides a summary of regional prospectivity indicators and other relevant features within the licence that highlight bulk tonnage copper-gold prospectivity.

### ***Age of the Dove Granite***

The Dove Granite was interpreted by Jennings (1963) to be a Devonian Granite. Subsequent potassium-argon dating undertaken by McDougall and Leggo (1965) gave a Cambrian (Ordovician or older) age. The misconception that the intrusive bodies were Devonian was adopted by many subsequent workers including Austin and Serim (Freeport, 1973) and Smyth (Shell, 1981).

### ***Age of mineralisation***

Mineralisation at Dove River spans two geological events (Cambrian and Devonian). The mineralisation of Ordovician rocks in the Five Mile Rise goldfield has long been considered Devonian due to the obvious emplacement of lodes in typical Devonian trending structures. These lodes were generally considered by explorers to be genetically related to the Dolcoath Granite. The Dolcoath Granite is modelled to be at significant depth (based on sparse gravity stations) and anomalous gold is more typically associated with tin and tungsten anomalism near this granite. Indeed, gold and base metal mineralisation may rather be a product of orogenic remobilisation of metals from the underlying mineralised Cambrian basement rocks. This latter conclusion is consistent with DR1 intersecting copper and weak gold mineralisation associated with Cambrian porphyry-style potassic alteration in Cambrian rocks underlying the Five Mile Rise Goldfield.

### ***Mineralisation Model***

The style of mineralisation targeted in the Dove River exploration licence is a bulk tonnage copper-gold system related to the Cambrian Dove Granite. The granite intrudes and alters (possibly coeval?) Cambrian volcanics and older Precambrian schists and phyllites. The licence includes two of three known granite 'stocks' and porphyritic intrusives have been identified at the margins of both of these granite bodies. This has provided sufficient encouragement to investigate the potential of locating bulk tonnage copper-gold mineralisation of either an Eastern Australian porphyry style (eg: Cadia) or a disseminated style similar to the Mt Lyell deposits in Tasmania.

Mineralisation of porphyry style is usually associated with oxidised magnetite series sub-volcanic intrusions (Wilson et. al. 2002). Pluton has been encouraged by the presence of magnetite series hornblende granodiorite on the licence. The Eastern Australian porphyries are typically moderate grade alkalic systems however mineralisation may also manifest as higher grade smaller tonnage systems. A high-K calc-alkalic porphyry system developed in the apparently more calc-alkalic and shoshonitic Mt Read Volcanics would be a likely scenario given the inferred arc-continent collision setting. A higher grade deposit of this style would be conducive to being developed by block cave mining techniques.

Tasmania has numerous volcanic hosted copper deposits within the Mt Lyell mineral field. Examples of these vary from disseminated pyrite-chalcopyrite VHMS systems to more characteristic high sulfidation style deposits which are commonly associated with large scale faults. More recently, mineralisation at Mt Lyell has been identified as an example of the transitional nature of deposit styles and a hybrid mineralised body should not be overlooked as a possibility.

Within the Mt Read Volcanics there is a recognised break between copper-gold rich deposits to the south and east of the Henty Fault with lead and zinc rich deposits located to the north and west. Located east of the Henty fault, the Dove River exploration licence is in a location recognised as prospective for copper-gold mineralisation.

Potential deep crustal structures have been identified in airborne magnetic data to the north of the licence and are associated with variations in thickness within the basal Ordovician stratigraphy. These deep structures are important conduits that may concentrate fluids or focus the intrusion of stocks. Thickness variations across structures in the vicinity of the Devon Mine indicate activation during sedimentation and these structures are ideal foci for fluid movement during granite intrusion or could focus porphyry intrusion. Other potential major structures include a strong magnetic gradient transecting the Five Mile Rise from northeast to southwest.

Regional geochemical anomalism suggests that a buried porphyry system is a real possibility, with some encouraging anomalism in the region. Stream sediment surveys include several sites of anomalous copper, fluorine and one molybdenum anomaly draining from the Powerful prospect. Fluorine anomalism is typical of porphyry deposits and fluorine enrichment is also known from magmatic fluid input in high sulphidation systems. Copper and molybdenum anomalism may be a direct indication of porphyry mineralisation.

Porphyry copper deposits are almost always associated with a high concentration of iron oxides, typically magnetite and hematite. This is due to I type magmas being high in iron, which is consistent with preliminary indications of the geochemistry of the Dove Granite. Magnetite has been identified in close association with Au bearing sulphide veins (for example in DR1) and hematite alteration and veining is prominent at the Powerful prospect and in volcanics immediately south of Five Mile Rise. Regionally, gold mineralisation is also located marginal to hematite alteration and porphyritic rocks at the Ten Mile Creek prospect (Funnell and von Strokirch, 1987) to the west of the tenement. The presence of these oxide minerals is important because it indicates a high oxidation state of parent magmas that allows greater sulphur solubility in the melt.

Phyllic alteration is a characteristic of the high-K calc-alkalic porphyries and is recognised by abundant quartz-sericite-pyrite. Mapping alteration may identify phyllic and peripheral propylitic alteration adjacent to or above mineralised potassic zones. The phyllic alteration haloes around mineralised porphyries can also be recognised by Induced Polarisation surveys as highly chargeable zones. This peripheral disseminated pyrite mineralisation can be a good indicator for proximity to mineralisation. Narrow zones of disseminated sulphide have already been located in DR1 which targeted a chargeability anomaly.

Anomalous potassium radiometric signatures are present in the WTRMP data both in this and the surrounding Pallawah Hill tenement. Potassic alteration typical of porphyry alteration systems has been identified in the field at Powerful prospect, Devon and elsewhere around the Dove Granite. It is believed the multiple occurrences of this alteration style upgrades the chance of locating a viable porphyry deposit.

## Expenditure

The proposed expenditure to Mineral Resources under the application for the exploration licence was \$30,000 over the first two years, this has been significantly exceeded and the proposed expenditure for the next 12 month period is \$20,000, this may also be significantly exceeded if the IP survey is completed and follow up drilling of generated targets occurs. Statutory requirements mean that this report must be submitted before the anniversary of the exploration licence. As such, the expenditure detailed below is for the 12 month period 30th September 2007 to September 2008 and the total is expenditure to September 30<sup>th</sup> 2008.

Geology	\$ 46,850
Geochemistry	\$ 43,204
Drilling	\$ 202,223
Track Clearing & Rehab	\$ 31,926
Administration	\$ 15,634
	_____
Sub-Total	<u>\$ 339,846</u>
Previous Expenditure	\$ 507,107
Total to date	<b><u>\$ 846,953</u></b>

## **Conclusions**

The Dove River exploration licence has considerable untested potential to host bulk tonnage copper-gold deposits. The alteration styles (potassic and propylitic alteration) and the mineralisation style (disseminated copper in DR1 and gold-sulphide veins DR1, DEVD1 and DEVD2) intersected in drilling provide confirmation that the region is capable of producing mineralisation of interest for porphyry exploration. The challenge is to find geochemical, alteration and geophysical vectors to target such mineralisation.

The drilling program at the Devon prospect was an expensive exercise and is unlikely to be followed up by further drilling in the short term given the low tenor of results compared to the higher grades returned from the workings. Pluton will continue to focus on adding value to the Dove River licence by demonstrating the potential for large-scale porphyry-style mineralisation in proximity to the Cambrian Dove Granite.

The variation of lithologies within the Dove Granite and associated porphyry indicates there are a range of compositions within the intrusive Cambrian rocks. The intermediate 'hornblende granodiorite' phase of the Dove Granite intersected in the lower part of drill hole DR3 and porphyries intersected at the Devon Mine may be a more suitable source rocks than the more granitic phases. A regional geochemical and petrological assessment will be a focus of upcoming work.

## **Future Work**

Ongoing work will concentrate on regional geochemistry of hand samples and drill core to try and place the alteration characteristics into a broader porphyry context. The assessment of geochemical data will be assessed for possible alteration vectors and will aid map compilation.

Five Mile Rise will be re-assessed to see if magnetic phases within the Dove Granite are a possible source rock for mineralisation and the broad copper anomaly in soils mirroring the mapped outcropping Cambrian volcanics south-east of Five Mile Rise. This area may be targeted by a dipole-dipole IP survey and if warranted follow up drilling.

Ongoing mapping and collection of rock chips suitable for whole rock analysis will also hopefully define the continuity of the Dove Granite on the western side of Lake Cethana.

Pluton is engaging the services of an expert with over thirty years experience in the field of porphyry copper genesis and exploration, under his direction and the further assessment of data collected to date, we hope to generate further targets or re-focus on key areas of metal anomalism that have porphyry characteristics.

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## **Appendix 1 – List of digital files**

EL142006\_200811\_01\_Report.pdf

EL142006\_200811\_02\_DrillLogs.pdf

EL142006\_200811\_03\_DrillLogCodes.pdf

EL142006\_200811\_04\_DH\_Collars

EL142006\_200811\_05\_DH\_Survey

EL142006\_200811\_06\_DH\_Assays.txt

EL142006\_200811\_07\_DH\_WholeRock.txt

EL142006\_200811\_08\_DH\_REE.txt

## Appendix 2 – Drill logs and codes

**Appendix 3 – Drill Site and Rehabilitation Photos**



Photo 1 – DEVD1&2 drill site viewed to the North West prior to drilling



Photo 2 – Drill site DEVD1&2 after clearing



Photo 3 – Drill rig mounted on drilling platform (The Universal Drilling Platform is a patented design)



Photo 4 – Drilling DEVD1&2, note banded fuel and port-a-loo



Photo 5 – Drill site immediately after drilling DEVD1&2



Photo 6 – Regrowth of ferns, 6 months after drilling (October 2008)



Photo 7 – Typical obstructions on Devon Track before re-establishing access



Photo 8 – Cutting of light vegetation on track edges (later cleared)



Photo 9 – Typical clearing of obstructions – Mid-Lower Devon Track



Photo 10 – Example of hand dug track drainage at end of program – Lower Devon Track



Photo 11 – Silt collecting in hand dug drains after 6 months (October 2008) Lower Devon Track



Photo 12 – Rehabilitation of DR3 drill site next to River Road (October 2008)