

North Lorinna (Cethana) Annual Report 2010 – EL 29/2006



View of Cethana Magnetic Anomaly area from the western shore of Lake Cethana

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## Summary

This report is the third Annual Report for the North Lorinna (Cethana) exploration licence (EL29/2006) and is submitted in a Mineral Resources Development Act (1995) compliant format by Dove River Pty Ltd a wholly owned subsidiary of Pluton Resources Ltd. (Australian Stock Exchange Code: PLV, hereafter Pluton). Pluton also submits the report on behalf of joint venture partners Gujarat NRE Minerals (ASX code: GNM) and SOSM (John McDougall and Southern Ocean Science Pty Ltd.)

Pluton's primary focus is to add value to the Cethana licence by demonstrating the potential for large-scale porphyry-style mineralisation in close proximity to the Cethana magnetic anomaly. The potential for other bulk tonnage mineralisation styles is also being considered.

The licence covers ground that has similar characteristics to copper-gold districts in New South Wales including the Cadia and Goonumbla deposits. These characteristics include the setting and chemistry of the host rocks, as well as the styles of mineralisation and related alteration.

The tenement has not been systematically explored for gold by modern exploration; more particularly no diamond drilling had previously occurred on the licence and a limited suite of elements had been investigated.

Work by Pluton and the preceding holders for the period up until March 2010 included geochemical comparison of drilled lithologies to Dove River field samples. A review of key field locations and drill core was conducted with Dr Greg Corbett who did an independent assessment of Pluton's tenements.

Dr Corbett's review concluded that Cethana warrants immediate continued exploration as a high priority and additional drilling should attempt to identify any apophyses to the Cambrian granitic source for the aeromagnetic anomaly which might represent a setting for the concentration of hydrothermal fluids responsible for porphyry style Cu-Au mineralisation.

Access assessments have been undertaken in preparation for further drilling and a work program has been submitted to MRT. Rock chip sampling scheduled in this work program has been completed, however samples are yet to be sent for petrology and assay.

Approximately \$400,000 dollars has been spent on exploration with the majority of this on previous drilling. Follow up drill testing is focussed on one of the previously identified chargeability anomalies. No reduction in the current licence area is requested.

Note – all coordinates referred to in diagrams are AGD66, zone 55.

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## **Introduction**

Pluton Resources Limited is an Australian Stock Exchange listed mineral exploration company managing and conducting exploration on EL 29/2006 (Cethana) for metallic minerals by way of its wholly owned subsidiary Dove River Pty Ltd on behalf of its joint venture partners. 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 (ELA 46/2004) for an area of about 15km<sup>2</sup> was made by John McDougall and Southern Ocean Science Pty. Ltd. (SOSM) in 2004. The licence application was subsequently joint ventured with Gujarat NRE Minerals (Gujurat). A new application (a joint venture between Gujarat and SOSM) over a portion of this area was then approved as EL 29/2006 (9 km<sup>2</sup>) on the 4<sup>th</sup> April 2007.

EL29/2006 was then partnered with an earn in period for Pluton Resources (Pluton). Currently Pluton is still earning 60% in to the project with Gujarat contributing 33.3% and Pluton contributing 66.6% after the earn in amount is reached. SOSM hold a free carried interest of 10% to bankable feasibility.

The exploration licence is located within 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.

A new application (Oliver's Creek – ELA16/2008) has been made to cover the area previously applied for to the south of the current licence. The licence covers private land and is a joint application between all joint venture partners.

### **Location and land classification**

The licence is located about 15km 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, Regional Reserve, lakeside Hydro land and sits adjacent to Lake Cethana (a Hydro-Electric lake).

### **Topography**

The topography of the licence is variable with a relatively flat area in the centre of the tenement and Lake Cethana covering the incised topography of the hydro dam flooded Forth River, contours range from 230m at the lakes edge to 680m on Olivers Hill. The slopes above the Lorinna Road are steep with areas below (west of) the road mostly moderately steep. A 'point' extending into the Lake in the west of the licence is moderately steep.

### **Vegetation and Soil**

Vegetation comprises wet and dry eucalypt forest typically dominated by Eucalyptus Viminalis, Obliqua and Amygdalina spp. On wetter south facing slopes and near river banks there is dogwood scrub and Acacia Dealbata forest. Rainforest is occasionally present

adjacent to creeks. Undergrowth is dependent on how dry the site is, but typically consists of spiky heath or ferns.

A thin soil profile <1m is generally developed throughout the major rock units in the tenement with outcropping bedrock generally restricted to steep slopes, road cuttings, ridge tops, cliffs and creek/river beds. A deeper soil profile is developed over Tertiary basalts and Tertiary sediments. A talus is commonly developed over the Ordovician Sandstone and a coarse talus is commonly developed over Cambrian volcanics.

### Access

Access to the tenement is via Lemonthyme Road (C139) and then un-sealed road (locally known as River Road). Internal access within E129/2006 is via Old Lorinna Road, formed roads (eg: Wilks Road) and four wheel driveable fire breaks and tracks. Previous access to the north of Lorinna has been closed by the Kentish Council due to safety concerns with sections of the road north of the licence boundary.



Figure 1 – Location of E129/2006 relative to population centres.

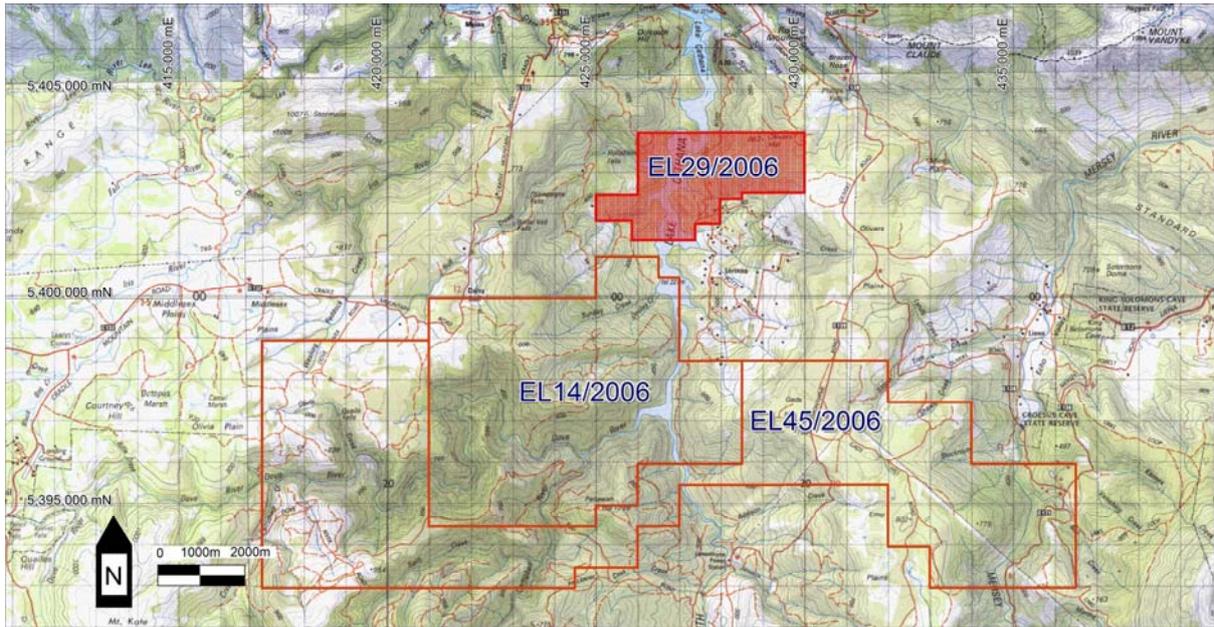


Figure 2 – Location of EL29/2006 relative to other granted Tenements controlled by Pluton Resources (1:100,000 Tasmap topographic base, AGD66 – Zone 55)

## Geology

EL 29/2006 (Cethana) 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, is itself unconformably overlain by Cambro-Ordovician siliciclastics and limestones. Rocks to the north of the licence are intruded by the Devonian Dolcoath Granite and there is in part 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 (e.g. Mt Lyell, Henty).

A description of the known lithologies and observed variations within the licence and potential correlations are summarised below.

### Cambrian volcanics

The Cambrian volcanics within the 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.

### Mixed volcanic and volcanoclastic rocks

A quartz-rich volcano-sedimentary sequence was mapped within the tenement 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 drill core on the adjacent Dove River licence (a Pluton held licence).

A second sequence was mapped as Bull Creek Volcanics, Burns (1960) subdivided the Bull Creek volcanics into the Upper Porphyry, Geales Bridge Member and Lower Porphyry Member. Reid (1963) agreed with these subdivisions. The Bull Creek Volcanics are likely to be the main unit encountered in drilling and within the licence. The sequence has superficial similarities to the Tyndall Group. The 'porphyry' units mentioned are almost certainly quartz rich volcanoclastics or quartz phyric lavas.

### **Dove Granite**

Although the Dove Granite is not known to outcrop in the licence area it is of regional significance. 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 at Gads Hill with Devonian Dolcoath Granite located north of the 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 to the south of the current licence, mainly to determine if the Dove Granite is of the right composition to produce copper-gold porphyry deposits. Work is underway to examine the geochemistry of granitic rocks in the region. The presence of this granite provides a potential 'parent rock' for porphyry mineralisation within the tenement.

### **Dolcoath Granite**

Again this granite is not known to occur in the licence area, however it is of regional significance and is described by Jennings (1963) as a Quartz-Microcline>Plagioclase granite with trace biotite and zircon. The granite is thought to be an unlikely source of mineralisation associated with the magnetic anomaly.

### **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 Cethana the Ordovician rocks observed in drill core is a bioturbated coarse to pebbly sandstone. The sequence has been identified by several previous workers as Moina Sandstone. The sandstone dips gently (15-20 degrees) to the South forming a veneer over the Cambrian stratigraphy and is likely to be unconformable on the volcanics.

Several kilometres northeast of the licence, the Moina Sandstone is underlain by thick sequences of Roland Conglomerate. The absence of the conglomerate units on the licence

may indicate extensional conditions in the late Cambrian. The structures controlling this facies variation may be coincident with west-northwest-trending aeromagnetic linears including the main structural trend of the Cethana Anomaly.

Gordon Limestone conformably and gradationally overlies the Moina Sandstone just south 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 Cethana prospect has been identified through regional mapping and on the current grid. Herrmann in Fleming and Castro (1989) estimated Tertiary Basalt flows over much of the region to be only a few tens of metres thick, this appears to be true of thin basaltic soils in the south of the grid, however this would be confirmed should drilling be planned in this location.

### **Tertiary Sediments**

Tertiary sediments resembling fine lake sediments were encountered to 45m in CETD2. Similar sub-basaltic sediments were encountered in drilling south of the licence at the Powerful Prospect, this suggests a Tertiary age.

## **Review of previous work**

### **Prior to the current tenement**

(Exploration History from previous annual report)

In 1859 James Smith discovered gold in the Forth River at “Golden Point” located north of the later developed Campbell’s Reward Mine (Twelvetrees 1913). Campbell’s Reward was discovered by the Campbell Brothers and opened in 1882. The discovery was prospected for several years by the brothers and by 1887 the lease was held by John.H.Glover (lease documents) and in 1890 the Campbell’s Reward Company was formed and took over the leases from Glover.

Twelvetrees (1913) described Campbell’s Reward as being located on the “new road to Lorinna on the eastern bank of the Forth River” (now referred to as the Old Lorinna Road in this report) however the workings were abandoned at this time. The Campbell’s Reward workings are mentioned in a number of government reports, however their isolation meant that they were rarely visited and never described in any geological detail. The mine was used to float a company in about 1890, however this venture appears to have lasted only a few years. The gold was reported to be in free and barbed wire form occurring within a kaolin vein which widened out into a 30-38cm barren vein. The vein was rich in silver and this made it difficult to market the ore (description by A. Campbell to Twelvetrees 1913 – could be either Angus or Alex Campbell).

In 1963 (Jennings) the adit accessing the workings (described as being just below the old Lorinna Rd) had been cleared a little and although in poor condition was accessible to 73m beyond which there was fallen ground. Veins similar to the described main lode were present previous to the 73m mark.

### **Preamble on the Cethana Magnetic anomaly**

The Cethana magnetic anomaly is an aeromagnetic feature first identified by the Mt Lyell mining and Railway Co in 1967. It was subsequently identified by John McDougall and Alistair Reed of Southern Ocean Science Pty Ltd in Western Tasmanian Regional Minerals Program data and thought to be a previously unknown anomaly. The subsequent review of literature has identified a long history of name changes for the anomaly which are summarised below.

The anomaly was first described as "Anomaly 24" - a NW-SE trending feature identified on an east-west ¼ mile spaced survey. Anomaly 24 had an intensity of 1400 gammas, the highest amplitude anomaly in the whole survey area. Anomaly 24 soon became "Anomaly A" (Webb, 1968; Foster, 1969) and then "Lorinna East" (Askins 1980) then to complicate things the Anomaly was referred to as Lorinna North with the "Powerful" magnetic anomaly then being assigned "Lorinna East" (Smyth, 1981). In 1987 the anomaly was rediscovered and renamed by CRA as 'Anomaly 36' (Von Strokirch, 1987) which could easily lead to an incorrect conclusion that the 'Anomaly 24' of Mt Lyell was a different feature.

### **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 (Reid, 1967). 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 (22ppm) stream sediment anomaly found to be coincident with anomalous zinc (150ppm) and taken from the small creek draining the western end of magnetic anomaly 24 - the Cethana aeromagnetic anomaly.

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).

The magnetic anomaly at Cethana first identified by the Mt Lyell mining and Railway Co as "Anomaly 24" with a NW-SE trending feature identified on an east-west ¼ mile spaced survey. Anomaly 24 had an intensity of 1400 gammas, the highest amplitude anomaly in the whole survey area. Originally interpreted as 200-500 feet below surface with a dip of 86 degrees south, 500-1200 feet wide and a susceptibility of  $12000 \times 10^{-6}$  and  $14000 \times 10^{-6}$  c.g.s units. By comparison of the anomaly to Savage River ( $127000 \times 10^{-6}$  c.g.s units) the susceptibility of the anomaly was attributed to 5-6% magnetite by volume and 10% by weight (Zarzatjian, 1966). The anomaly was believed to be located within the Bull Ck Volcanics below Ordovician cover (Reid 1967) due to modelled depth.

A ground magnetics survey was recommended by Webb (1968) after discussion with K.O.Reid. Webb who noted that the Cethana Anomaly “lies at the junction of an WNW-ESE trend with a N-S trend and minor NE-SE (typing error?, -SW) trend therefore has a good structural position for mineralisation”. Webb also noted the proximity of Campbell’s Reward Mine to the anomaly.

Ground magnetics were conducted over Anomaly 24/Anomaly A (the Cethana anomaly) in 1967-8. Peak magnetism was found to be associated with north dipping sheared quartz-magnetite-chlorite schist on the southern side of the main Cethana aeromagnetic anomaly. The results of rock chip samples collected from the schist were not reported, but did not reveal ‘any... significant economic concentrations of elements’. In contrast, a small number of soil samples collected on the southern flank of the anomaly revealed cobalt anomalism of 380ppm, as well as lesser Zn and Cu anomalism (c100ppm).

Mt Lyell Co. geologists were uncertain as to whether Co anomalism was due to Tertiary basalt. However, the geochemistry of 16 Tertiary basalts from the region (provided courtesy of John Everard, Mineral Resources Tasmania) show an average Co content of 50ppm, with an SD of only 7ppm. If the residual soil value of ~400ppm is derived from the basalt then it is highly unusual. (See recent rock chip data for explanation)

Reid (1967) also recognised that there were two ages of granite (the Dove Granite is now considered to be Cambrian) and therefore a possibility of two phases of mineralisation, the possibility of Cambrian mineralisation being remobilised in the Devonian was not precluded.

Part of EL8/1965 was relinquished in 1971 (approx 35km<sup>2</sup>), however the part containing the current EL was kept due to the sheared and pyritic nature of the Bull Creek Volcanics in the zone adjacent to the BCF which had ‘similar lithological characteristics to the Mt Lyell sulphide deposits and similar age host rocks’. The Bull Creek volcanics in this zone were considered to represent a worthwhile target (McKibben, 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.

As a result of their investigations, the Mt Lyell geologists recommended more detailed soil sampling (including Au) and two drill holes. However, subsequent years saw exploration focused on other areas. This, coupled with a disastrous loss of base camp due to flooding of the Iris River saw work on the Cethana anomaly never completed and the ground was finally relinquished.

### **COMALCO (1974--1980)**

In 1974, the Cethana anomaly was included within exploration licence 7/74, held by Comalco. Like EL8/65, EL7/74 included large tracts of land and included deposits located north of the outcropping Dolcoath granite. Comalco’s exploration was primarily focused on locating extensions to fluorite mineralisation previously found at Moina (TCR’s 78-1305 A-D, 78-1306, 78-1389). The fluorite was to be used in Comalco’s aluminum smelters. Most reports up until 1980 deal almost exclusively with exploration in the Moina area.

Like the Mt Lyell company, Comalco embarked on a regional stream sediment program in the mid 70's (TCR80-1416). However, unlike Mt Lyell, Comalco used -20# (mesh) in the mistaken belief that -80# would not yield enough fine material in the steep terrane.

Ironically, Freeport had already run tests a year or so earlier in areas south of EL46/2004 (TCR73-977) and had shown that sampling using -40# underestimated results using -80# by 60% to 85%. Comalco did ultimately realise their mistake when areas of known mineralisation failed to show up in -20# data. They switched to using more conventional -80#.

Streams north and south of the Cethana anomaly were sampled using only -20#. Like the Mt Lyell company, Comalco did not include the small seasonal streams draining the Cethana anomaly. Not surprisingly, Comalco's -20# results show only very weak zinc anomalism (c85ppm) and moderate F anomalism (500-1300ppm) in the vicinity of the Cethana anomaly.

Comalco went on to explore the Cethana anomaly further. Unlike the Mt Lyell company, however, Comalco assumed that magnetite associated with the Cethana anomaly was of Devonian age. This exploration model appealed because a Devonian deposit was more likely to yield a fluorine-rich 'wrigglite' skarn, similar to that hosted by Ordovician rocks at Moina. A program of gridding, ground magnetics, geological mapping and soil sampling (Pb, Zn, Cu, Co) was undertaken over the Cethana anomaly.

The assumption was made that mineralisation was Devonian. What must have been disappointing to Comalco geologists was the almost complete lack of metal anomalism in Ordovician rocks. Samples of quartz-veined scree, typical of the Ordovician sandstone, were also barren. The geologists did note Cu and Pb anomalism in Cambrian rocks overlying the Cethana anomaly but went on to conclude that this reflected nothing more than 'elevated background'. This, despite values in soils up to 32 times that already calculated as background for the Cambrian volcanics.

Given proximity to Campbell's Reward, it was again recommended that the area be sampled for gold. Once again sampling for gold was not done.

### **SHELL (1980-1985)**

EL7/74 was transferred to a joint venture to the Shell company of Australia in early 1980 (Smyth, 1981). Like Comalco, Shell considered its focus to be Devonian mineralisation associated with the main wrigglite/pyrrhotite/sphalerite skarns in the Shepherd & Murphy Mine (Moina), and a possible low-grade Sn-Au zone in the Tin Spur area.

Shell reviewed Comalco's exploration of the Cethana anomaly (now renamed Lorinna North). They conducted their own regional aeromagnetic survey and noted that measured magnetic susceptibilities in surface rocks at Cethana did not account for the intensity of the aeromagnetic anomaly at Cethana.

A 144m percussion hole PD1 was drilled approximately in the centre of the anomaly but away from previously detected geochemical anomalism and distal to the Campbells Reward Mine (incidentally from the quarry where Pluton have drilled their first diamond hole).

PD1 passed through 58m of apparently Tertiary cover before intersecting weak metal anomalism in Cambrian magnetite-altered volcanic. The hole was assayed every 2m through cover but only once every 10m in the mineralised volcanic. The hole suffered from water problems and sample dilution. Although only mildly anomalous in copper (the log showing up to 280ppm Cu and 290ppm Zn), the results were mistakenly under-reported as being a maximum of only 105ppm Cu and gold was not assayed.

Susceptibilities measured from drill chips were believed at the time to explain the anomaly as being a magnetite-altered andesite. No attempt was made to determine the cause of the alteration.

Shell also noted that the Comalco grid was not centred on the anomaly but was rather biased south of the anomaly and into areas of Ordovician and Tertiary cover. This was probably due to poor registration of the aeromagnetic anomaly noted in the 1960's geophysical data. Instead of collecting new samples, Shell re-assayed soil samples previously collected by Comalco, but this time for Sn, W, As, and Bi. They did not explore the possibility of extensions to Pb and Cu anomalism Comalco had previously identified in Cambrian rocks along the western edges of their grid.

Like Comalco, Shell assumed a Devonian age for mineralisation, consistent with the age of mineralisation in their main areas of focus around Moina. Unlike Moina, they found no appreciable mineralisation at Cethana.

Shell re-submitted two lines of Comalco soil samples for gold assay. PD1 had already shown that Cu-Zn anomalism extended no more than a few meters into overlying Tertiary cover. Yet, only six of 39 soil samples resubmitted for Au were from soils overlying Cambrian rocks. The balance were from areas of thick Ordovician or Tertiary cover. None of the samples were from areas previously showing copper or lead anomalism. None were from the vicinity of the Campbell's Reward Goldmine. All the samples were up hill and/or in separate catchments to sites previously showing metal anomalism. All samples produced <50ppb Au, by regional standards in porphyry systems, this level of Au is now considered anomalous.

### **CRAE (1985-1988)**

In 1985, CRAE became managers of EL7/74 in a three-way joint venture with the Commonwealth Aluminum Corporation and Shell. CRAE embarked on another very widely spaced reconnaissance stream sediment survey (TCR86-2554). However, the only sample collected from the vicinity of the Cethana anomaly was upstream of the Lorinna Road, both up-stream and east of the Cethana anomaly

In 1986/7 CRAE reprocessed and reinterpreted Shell's aeromagnetic data (TCR87-2700). They 'rediscovered' the Cethana anomaly although this time it was referred to as Anomaly 36. It was again noted to be the largest anomaly within the region and, again, the association was made between the anomaly and the Campbells Reward Goldmine. CRAE disregarded that anomaly as a basic volcanic containing high magnetite. This interpretation made no reference to the earlier work already identifying the rock as variously rhyolitic, dacitic and andesitic. It also did not consider that the magnitude of the anomaly exceeded that easily explained by most basic Cambrian volcanic rocks known from the Mt Read Volcanic belt.

Exploration licence 7/74 was subsequently dropped, with the joint venture maintaining tenure over the Moina fluorite deposit via Retention Licence (RL10/1988).

### **RGC (1988-1990)**

The Cethana anomaly was included in EL8/88, held by RGC (TCR89-3038). RGC again undertook reconnaissance stream sediment sampling, collecting both -200# and panned concentrate samples from 84 locations. In contrast to CRAE, RGC collected 2 samples from the streams north of and below the Cethana anomaly. One -200# sample proved weakly anomalous in Au (15ppb) relative to surrounding areas (<5ppb), whereas the panned concentrate returned a significantly higher 135ppb Au.

Importantly, CRAE's sample from above the Lorinna Road returned only 0.1ppb Au (TCR86-2554). The anomalous samples from RGC, therefore, could only have originated from the Cethana anomaly.

RGC also embarked on two re-interpretations of regional geophysical data previously collected by Shell and a more recent survey over the area by the Mines Department (TCR89-3038 and 90-3163). This was the first time that the Cethana anomaly was recognised as associated with one of two regional-scale north-northwest trending magnetic linears.

RGC did not conduct any further work in the vicinity of the Cethana anomaly. Rather, they concentrated subsequent exploration efforts in Ordovician rocks in the Five Mile Rise and Round Hill areas. Ironically, soil results for Cu in the Round Hill area were significantly less than that that had already been identified at Cethana by Comalco. RGC relinquished most of its interest in the Moina and Cethana areas in 1990.

### **MRT work post 1990**

In 1999, the area was remapped by Mineral Resources Tasmania and a number of samples collected for petrological examination. The geologists mapping the area were unaware of the Cethana anomaly but collected samples containing up to 20% galena from areas previously shown to be anomalous for lead in soils, these samples were not assayed.

Western Tasmanian Regional Minerals program aeromagnetic, radiometric and electromagnetic data for the area was subsequently released in 2000/2001. In 2003, these data were used to help assess the potential of the area to yield granite-related mineralisation (UR2003-16). The Cethana anomaly was recommended for field checking. This was not done due to a lack of funds.

In 2003, a review of the stratigraphy of the Cambrian Mt Read Volcanics in the area again mentions the aeromagnetic anomaly east of Lake Cethana (UR2003-17). This report again concludes that the anomaly is likely to be a Devonian skarn, despite work already concluding this not to be the case.

## **Review of previous work by Dr Greg Corbett**

An independent review of previous exploration work including the two drill holes completed in the previous reporting period was done by Dr Greg Corbett. Dr Corbett specialises in understanding porphyry and epithermal deposits. He was asked to:

- Provide a technical review of the porphyry Cu-Au potential of Pluton's Tasmanian projects.
- Identify and prioritise targets for continued exploration.

The review of drill core was done in conjunction with petrological descriptions of the core conducted by Dr Paul Ashley. Dr Corbett identified features that he interpreted to be consistent with an unseen nearby Cambrian porphyry intrusion at Cethana. He further commented on the chlorite-magnetite-Kfeldspar alteration assemblage as being typical of the porphyritic-potassic transition and that quartz-magnetite veins are of a porphyry-related style. In conclusion he wrote "Cethana warrants immediate continued exploration as a high priority". Dr Corbett's full report is appended in Appendix 1.

## **Review of Geochemistry**

A review of all geochemical data on Pluton's Dove River Pty Ltd controlled tenements included a revision of drill core geochemistry for CETD1 and CETD2.

CETD1 was drilled across the local magnetic trend and some basic statistics were able to be collected for mineralised versus unmineralised portions of the drill hole. CETD2 was found to be much less useful in this regard, being largely drilled 'down dip'.

Within CETD1 there is a strong correlation between copper and gold (see figure 3 below); silver; molybdenum; lanthanum and strontium. There is also a correlation of copper with the elevated trace levels of uranium and tin.

The field geologists guide suggests that the metal association in the central zone of porphyry deposits includes gold, silver, molybdenum, copper, boron (not assayed), tungsten and strontium. Of the elements assayed only tungsten has a tenuous correlation with copper mineralised zones in CETD1. The presence of key elements correlating well with copper has given greater confidence to interpretations that mineralised veins are porphyry related.

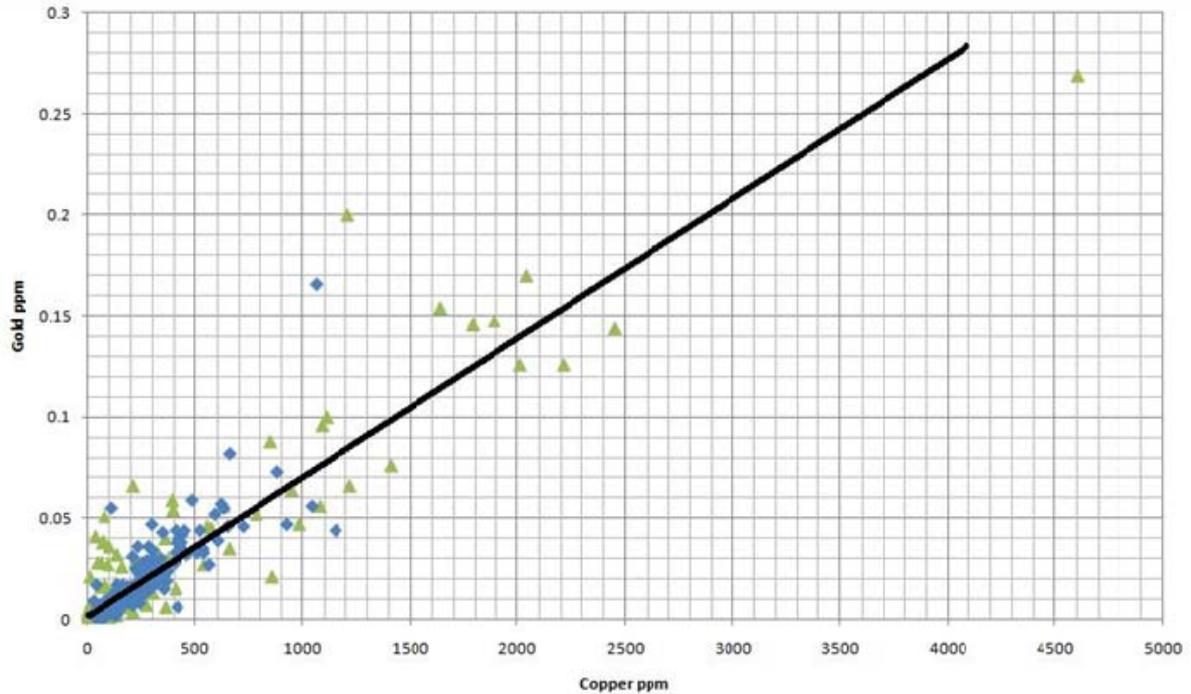


Figure 3 – A line of best fit correlation of copper and gold grades within drill hole CETD1. \*Note the two data point colours are a result of the large number of samples and the graphing limitation of the software used.

Although not presented here, rare earth element patterns for CETD1 are LREE enriched with a flat HREE pattern. It is postulated that the level of alteration is so significant that the LREE are being enriched in the volcanic pile through metasomatism including the development of allanite, a REE rich epidote group mineral identified in petrographic examination.

### **Work to March 2010**

Twenty nine rock samples have been collected, a selection will be used for petrological examination and assay. These samples are from locations proximal to the magnetic anomaly (see figure 4 below). The samples will be examined and assayed to see if alteration and geochemical trends around the magnetic anomaly, suggest a vector to a 'mineralised core'.

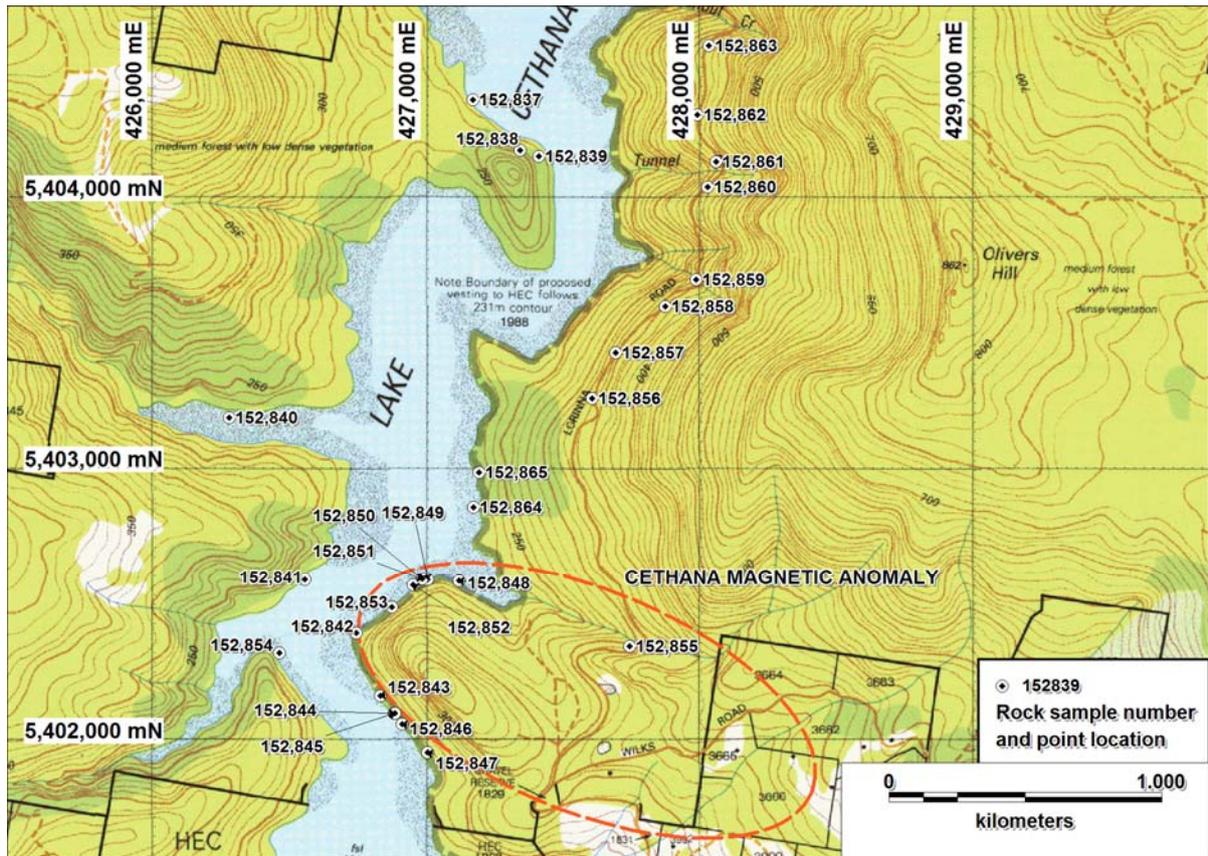


Figure 4 – Location of prospect scale rock sampling relative to the Cethana Magnetic Anomaly

## Discussion of results

Given the proximity of the northern chargeability anomaly (Campbells Reward Zone) to partially mineralised drill hole CETD1, the chargeability anomaly provides an excellent target with potential for higher grades than those previously drilled.

An independent review of the prospect has confirmed alteration types typically associated with porphyry mineralisation suggesting that intrusive rocks occur at depth within the Cethana anomaly.

Pluton also believes the chance of a significant discovery at Cethana is high because of the favourable metal correlations and size of the magnetic anomaly.

## Conclusions and Future Work

Drilling and geophysics have corroborated that areas within and around the large Cethana magnetic anomaly are a viable size Copper-Gold-Molybdenum target. An independent expert has suggested further targeting of the geophysical anomalies is warranted.

Drilling planned for the previous tenement year has been delayed due to drill rig availability. Two drill sites are planned to target a chargeable zone for potential sulphide enrichment.

The first hole is planned target the Campbells Reward Zone on the western most grid line. A second hole is planned from the Lorinna Road targeting under CETD1.

Currently the Kentish Council have not given the required access to the second site and the first site requires further approval for cutting mature trees that are potentially unsafe if left standing adjacent to the drill site, consequently drilling may be further delayed.

## **Environment**

Drill pads for the proposed drilling have been the subject of a flora and fauna survey by North Barker ecosystem services. The full report is appended in Appendix 2.

A temporary silt and hydrocarbon trap located in the roadside drain near the quarry (CETD1) has been removed at the request of Mineral Resources' environmental field officer (Photo 1 Appendix 3). Regrowth on the IP grid has been significant (see appendix 3), grid pegs will be removed where practical if further exploration results are discouraging or the licence is relinquished.

## **Expenditure**

Total Expenditure for EL 29/2006 currently stands at \$400,062 with approximately \$27,400 expended this year including expenditure on petrology and an independent industry expert opinion partially carried over from last year. Drill planning, community consultation and rock chip sampling for local petrology are the other main activities undertaken. Expenditure relating to any outstanding receipts for proposed drill site visits will be updated in the upcoming March quarterly report.

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## **Keywords**

Porphyry, Aeromagnetics, Induced Polarisation, Petrography, Copper, Gold, Molybdenum, Cambrian volcanics, Mt Read Volcanics, Chargeability

## Appendices

## **Appendix 1 – Independent Geologists Report**



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**COMMENTS ON THE  
CETHANA PROSPECT AND ENVIRONS,  
NW TASMANIA**

**For Pluton Resources Ltd**

Greg Corbett  
March 2009

## SUMMARY

The Cethana magnetic feature is targeted for buried Cambrian porphyry Cu-Au mineralisation.

The Cethana magnetic feature porphyry Cu-Au target and nearby Au (Campbell's Reward Mine, Powerful Mine and Five Mile Rise goldfield) and Ag (Devon Mine) occurrences lie within equivalents of the Mt Read Volcanic rocks in an area of complex geology in NW Tasmania. It is envisaged the Mt Read Volcanic rocks developed within a Cambrian island arc overlying an east dipping subduction zone to the west. Such an arc might have been cored by granitic intrusions which pass upwards from (as yet unrecognised) porphyry Cu-Au mineralisation, to overlying epigenetic Mt Lyell Cu-Au, and then volcanic hosted massive sulphide mineralisation formed at surficial settings. Batholith-like intrusions in the Cethana region suggest there has been erosion to levels which might expose porphyry Cu-Au targets. Cambrian intrusions and volcanic rocks are overlain by Ordovician Moina sandstone and Gordon limestone, and the region contains local Devonian granitic intrusions which account for Sn mineralisation elsewhere in Tasmania and local Ni remobilisation.

Major NW structures localise and constrain the Cethana magnetic feature, much like many known Pacific rim porphyry Cu-Au deposits. Drill hole Cet D1 which bored 600 metres (at  $-80^\circ$ ) into the Cethana magnetic feature transacted altered and weakly mineralised volcanic rocks containing only one thin possible intrusive dyke. Alteration is typical of near porphyry settings and categorised as outer propylitic (chlorite-magnetite) grading down hole to increased potassic alteration (magnetite-Kfeldspar and possible secondary biotite). Alteration is interpreted to have been initiated during deformation which produced the foliation which is locally cut by porphyry-like quartz-magnetite veins, although much of the magnetite-pyrite-chalcopyrite vein/breccia mineralisation parallels foliation. While the content of magnetite within hydrothermal alteration and later veins and breccias increases down hole to exceed 5%, Pluton Resources cite modelling to suggest a greater magnetic source is required at depth to account for the Cethana magnetic feature. Local hornfels and garnet towards the base of the drill hole also support the presence of an unseen intrusion at depth. Barite-bearing sulphide vein/breccias are typical of near porphyry low sulphidation deep epithermal quartz-sulphide Au  $\pm$  Cu veins recognised adjacent to porphyry deposits, equivalent to D veins in porphyry Cu literature, and so need not be derived as volcanic hosted massive sulphide deposits.

Continued exploration, at a high priority, should seek to test for prograde porphyry style Cu-Au mineralisation targeted within an apophysis to a magmatic source for the Cethana magnetic feature at depth.

The Powerful mine and Campbell's Reward are interpreted to have extracted near surficial supergene enriched Au from quartz-sulphide style Au near-porphyry veins, the latter related to the speculated Cethana intrusion. The Devon Ag-galena mine is also interpreted to have exploited veins derived from the Cambrian Dove granitic batholith, here of a low sulphidation epithermal carbonate-base metal Au character. None of these occurrences are considered viable targets for continued exploration. The Five Mile Rise goldfield warrants continued exploration at a moderate priority for buried porphyry Cu-Au mineralisation, possibly after continued work at Cethana has helped to resolve the distinction between Cambrian and Devonian vein mineralisation.

## INTRODUCTION

At the request of John McDougall 4 days were spent in a field examination of the Cethana Project and environs in the field and also drill core. The assistance during this work of John McDougall, Rod Campbell and Alistair Reed is gratefully acknowledged.

The brief for this work has been to:

- Provide a technical review of the porphyry Cu-Au potential of Pluton's Tasmanian projects.
- Identify and prioritise targets for continued exploration.

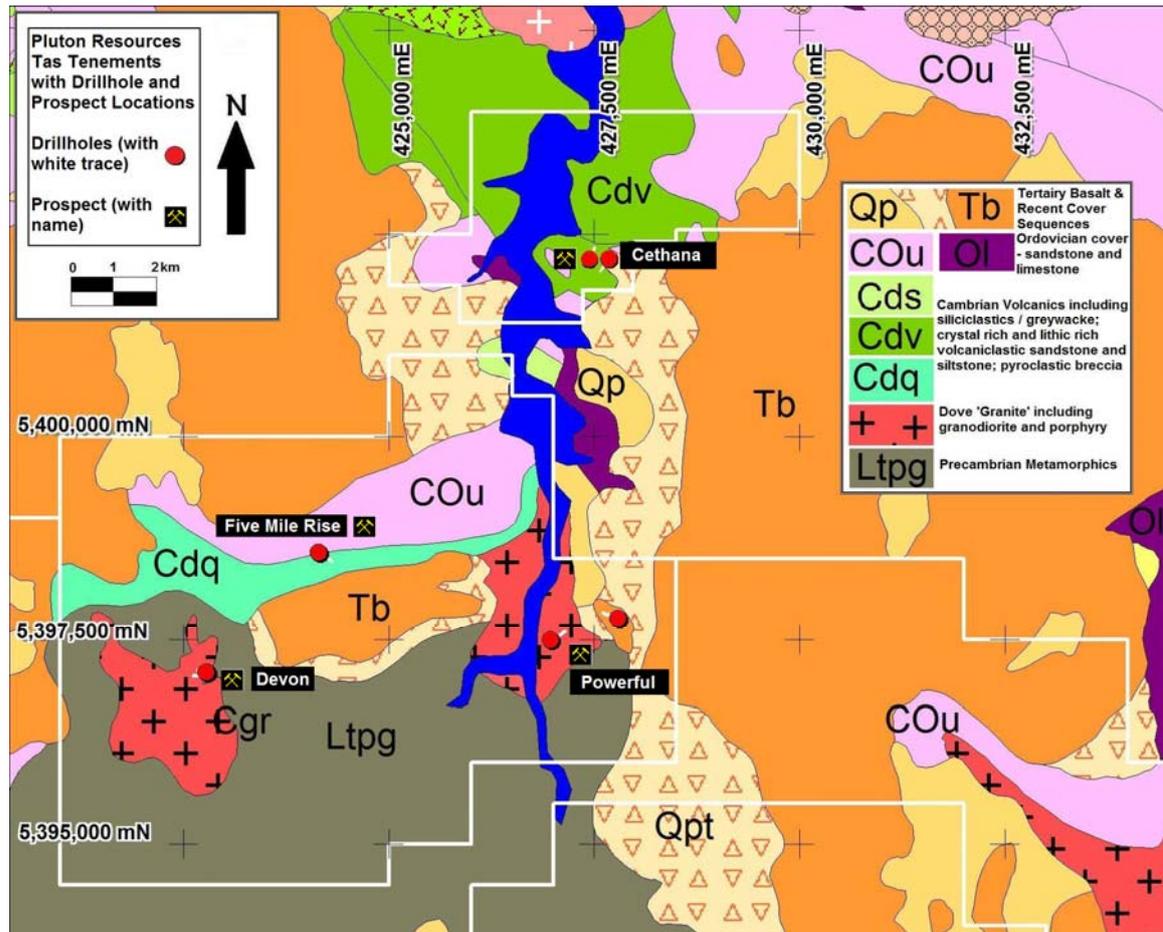


Figure 1. General geology of the Pluton exploration tenements showing position of drill holes and prospects.

## PREAMBLE

The Cethana Project and associated prospects (Devon Mine, Powerful Mine area, Five Mile Rise) are interpreted to be related to Cambrian granitic intrusions located at the northern portion of the belt which hosts the Mt Read Volcanics, with local upgrades of mineralised structures by later Devonian magmatic activity (figure 1).

It has previously been proposed (Seymour et al, 2006) the Cambrian granitic intrusions might represent part of a core to a now eroded island arc defined by the Mt Read Volcanic Belt, which in the vicinity of Cethana diverges from the general NS trend to the south, towards a NE/EW trend near Cethana, and so displays a convex relationship to a speculated palaeo subduction to the west. In such a scenario a palaeo island arc might display a vertical zonation from a granitic core at depth, to overlying porphyry Cu-Au

mineralisation, to Mt Lyell style epigenetic Cu-Au, and volcanic hosted massive sulphide deposits formed in surficial settings. Thus, exploration at Cethana seeks to identify porphyry Cu-Au mineralisation, possibly formed in apophyses to the buried magmatic source rocks apparent as granite batholiths (figure 2).

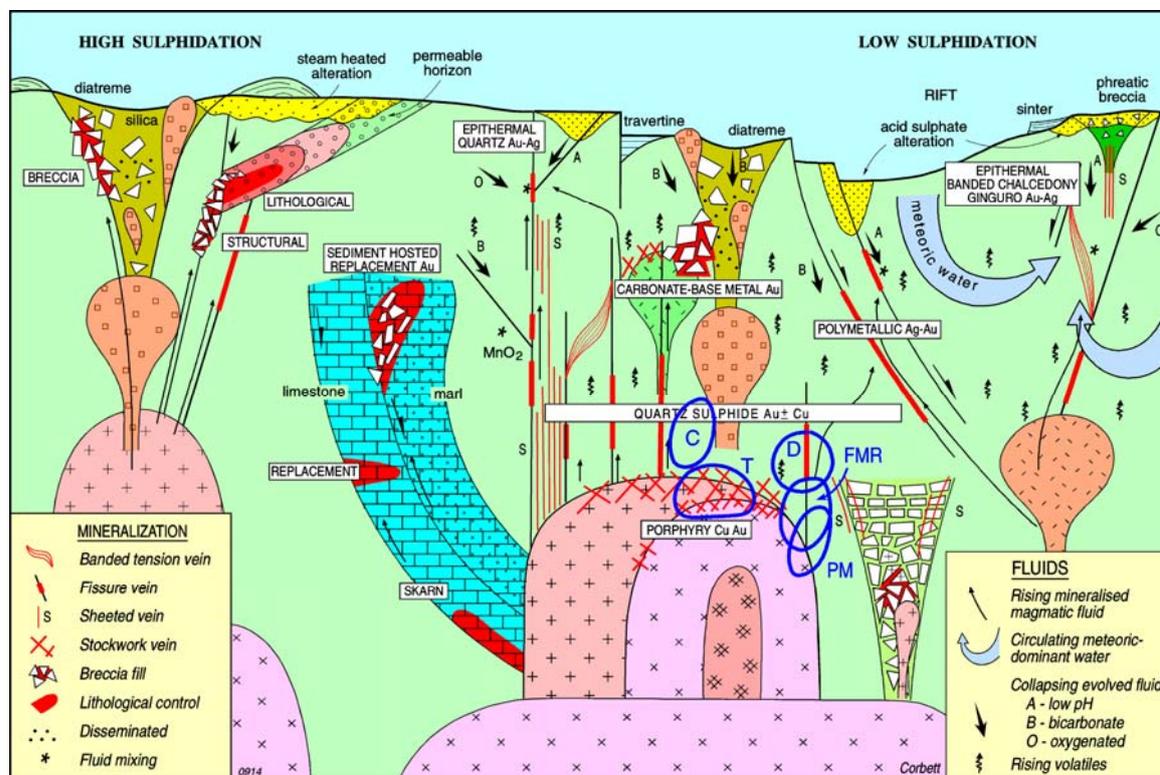


Figure 2. Conceptual model for styles of Pacific rim magmatic/island arc styles of Cu-Au mineralisation showing the interpreted settings of the portions of prospects inspected in this review and targets at Cethana. C – Cethana, D - Devon Mine, FMR – Five Mile Rise, PM – Powerful Mine, T – Cethana target.

## GEOLOGICAL SETTING

Cethana and associated prospects occur in region of complex geology in NW Tasmania characterised by repeated deformation and polyphasal magmatic activity.

### Lithology

Earliest rocks occur as Precambrian metamorphic rocks, mainly slates with polyphasal deformation, which act as local basement and were not encountered in this review.

Cambrian rocks include intrusions which vary from granite to granodiorite, and equigranular to porphyritic textures, although monzonite is locally described, while extrusive rocks are dominated by quartz-rich lithic tuffs, with local pumice-like clasts, and their reworked volcanoclastic equivalents. The granitic rocks, which crop out in three main exposures, might therefore be interpreted to intrude their own volcanic pile (figure 1).

Ordovician sediments which locally obscure the Cambrian granitic and volcanic rocks include the ridge-forming metamorphosed and locally silicified basal pebble conglomerate to the Moina Sandstone and overlying Gordon Limestone. Skarn deposits

are recognised in the limestone and some vein mineralisation transects the brittle sandstone (below).

Although several episodes of tectonism are recognised, most regional deformation apparent in this review is attributed to the (Middle Cambrian to Ordovician) Delamerian Orogeny which accounts for NW trending folding and SW directed thrust deformation of the rock package. Steep dipping NW foliation within the Cambrian volcanic rocks is interpreted to have developed synchronous with alteration and is not well developed in the intrusions (below).

Devonian Granites recognised throughout Tasmania, were not inspected in this review, although the Dolcoath Granite crops out nearby. These granites occur as gravity lows and display consistently bland (low) magnetic signatures and are most commonly anomalous in Sn-W and less commonly Au-Bi and base metals. The Devonian granites are commonly tourmaline-bearing, locally form skarns in the Ordovician limestone, and are considered the source of much of the Sn mineralisation in Tasmania, as well as metal reworking to form local epigenetic Ni. This geological model prefers the Cambrian rather than Devonian granites as likely sources for the Cethana magnetic feature.

Tertiary valley-fill basalts locally provide cap rocks in the area of interest.

## **PROSPECTS**

### **CETHANA PROSPECT**

The Cethana Prospect is primarily categorised as an intense magnetic anomaly some 1.5 x 1.0 km, within an overall larger trend, which is elongate to the NW along a regionally significant structural corridor. Such a structural corridor might localise intrusive activity as a deep crustal fracture formed normal to the interpreted magmatic arc, much like the Lachlan Transverse Zone which localises the Cadia group of mineralised intrusions in the Lachlan Orogen. Some Ordovician Moina Sandstone locally caps part of the Cambrian volcanic rock which displays prominent alteration and local vein formation. Early soil geochemistry has recognised Cu anomalism coincident with the magnetic high and IP geophysics by Pluton has identified non-coincident chargeability and resistivity anomalies (figure 3).

Surface exposures display silica-sericite (phyllic) overprint on chlorite-magnetite (outer propylitic) alteration, along with local (inner propylitic) epidote alteration. Silica-pyrite vein/breccias (photo 1) reported (J. McDougall, pers. commun.) from prospecting pits are likened to D veins (as described in the geological literature [Gustafson and Hunt, 1975; Corbett and Leach, 1998; Corbett, 2008]) which develop marginal to many mineralised porphyry Cu-Au intrusions. Buck quartz with pseudomorphs after sulphides and magnetite inspected along the shore of Lake Cethana are also typical of D veins (photo 2). FeO and MnO stain are indicative of the presence of former sulphides, probably alteration-related pyrite, and Mn carbonates, are also typical of porphyry environments. The Campbell's Reward Mine, described as one of the earliest in the region, may be flooded by Lake Cethana although the exact position remains in doubt. The described mineralogy of kaolin and wire Au is typical of sugergene Au enrichment for which D veins are noted (Corbett and Leach, 1998; Corbett, 2002, 2004, 2008). Further sampling of the buck quartz veins close to the lake shore could be useful.

Two drill holes by Plutonic test the Cethana magnetic anomaly, Cet D1 bored towards SSW at  $-80^\circ$  for 600m and Cet D2 NNE at  $-55^\circ$  and sub parallels the trend of foliation and mineralised structures. Cet D1 traverses from a cap of Ordovician sandstone into entirely volcanic rocks, apart from one 15 cm possible epidote altered dyke (photo 3), as the only intrusive activity recognised to date at Cethana. Alteration varies from outer propylitic characterised by chlorite-magnetite to local potassic, typically as magnetite-silica-Kfeldspar veins and rare Kfeldspar-epidote. Sericite overprint apparent as bleaching is also common. The most remarkable aspect of this drill hole is the intense magnetic character which increases down hole to greater than 5% at the base. However, this magnetite content is reported by Pluton (A. Reed, pers. commun) to be insufficient to account for the magnetic anomaly.

Magnetite dominates within:

- the early pervasive magnetite-chlorite (propylitic) alteration (photos 4 & 5),
- porphyry style quartz-magnetite  $\pm$  sulphide veins (photos 4-7),
- Magnetite-sulphide  $\pm$  barite veins and breccias (photos 8-13),

A paragenetic sequence is recognised as:

- Initial chlorite-magnetite alteration and localised magnetite flooding which displays a foliation currently interpreted as indicative of syn-alteration deformation (photo 14) within the Cambrian host island arc. Localised potassic alteration is apparent as Kfeldspar veins (photos 6 & 15) and Kfeldspar flooding (photo 16) in addition to less common epidote. Magnetite-biotite alteration, described by Ashely as of a metamorphic origin, is herein interpreted as potassic alteration (photo 17) with secondary biotite.
- Quartz-magnetite-chlorite  $\pm$  sulphide veins display initial syntaxial growths and so formed at the same time as the foliation (photo 4) or developed as well as later veins which cross-cut the foliation (photo 5), while other sheeted quartz-magnetite veins which transect the foliation (photo 6), suggest intrusion-related quartz veins developed late in the prograde alteration-deformation event. These veins are of a porphyry appearance and locally take on a laminated M (quartz-magnetite) vein character (photos 4-6), although some might be likened to D veins (photo 2) formed marginal to the source porphyry intrusion.
- Magnetite-specularite-haematite  $\pm$  sulphide  $\pm$  barite veins and breccias sub parallel the foliation (photos 8-13) and so are interpreted to have been emplaced during the prograde deformation-alteration-mineralisation event. Some display magnetite-pyrite-chalcopyrite mineralogies more typical of near porphyry settings (photos 10-12), while the mineralogies and metal contents of others are more typical of deep epithermal low sulphidation quartz-sulphide Au  $\pm$  Cu mineralisation (in the classification of (Corbett and Leach, 1998; Corbett, 2002, 2004, 2008) formed marginal to porphyry intrusions (photos 1 & 13), including anomalous Bi.
- Many magnetite-chalcopyrite breccias cut foliation and quartz veins and so demonstrate continuing mineralisation which may feature multiple events of magnetite deposition (photos 18 & 19).
- Late stage carbonate cuts earlier mineralisation as typical of many porphyry systems.

Local foliation parallel silica-pyrite-chalcopyrite breccia dykes (photo 20) are similar to more enigmatic silica-pyrite-chalcopyrite breccias recognised at Five Mile Rise and so may provide a link between these two mineralisation styles.

Although one thin possible dyke was intersected in the 600 m DDH Cet D1 several features suggest this drill hole is bored close to a source intrusion as:

- The increase in prograde magnetite and Kfeldspar over chlorite alteration down hole represents a progression from dominantly outer propylitic to local potassic alteration.
- The presence of porphyry style quartz-magnetite veins and increased quantity of sulphide-bearing breccias down hole. Some veins characterised by quartz-pyrite and locally Bi bearing, are of a deep low sulphidation type formed marginal to porphyry intrusions.
- Hornfels spotting (photo 22) and local garnet (photo 23) are indicative of contact metamorphism close to an intrusion source.

Speculated Cu-Au mineralisation is expected to be of a prograde porphyry style characterised by quartz-magnetite-pyrite-chalcopyrite  $\pm$  bornite formed as veins and breccias early in the emplacement of the inferred porphyry intrusion source at depth. Mineralisation therefore extends from the initiation of alteration through M style quartz-magnetite vein formation, to locally post-date vein formation.

It is interpreted alteration and vein development recognised in the Cethana drill core are related to an unseen nearby Cambrian porphyry intrusion. The chlorite-magnetite-Kfeldspar alteration assemblage is typical of the porphyritic-potassic transition and quartz-magnetite veins are of a porphyry-related style, including those present within nearby wall rocks. Although barite is a common constituent of VHMS deposits, intrusion-related low sulphidation (deep) epithermal quartz-sulphide Au  $\pm$  Cu deposits commonly contain barite, with quartz, pyrite, chalcopyrite and local pyrrhotite or specularite, so an intrusion-related origin for this material is maintained. Despite the magnetite flooding recognised to date, modelling by Pluton suggests more magnetic rocks are required at depth to account for the aeromagnetic anomaly. A magnetic porphyry at depth might represent a target for Cu-Au mineralisation and such a body may occur as an apophysis to a larger magmatic (batholith) source at depth.

### **POWERFUL MINE AREA**

The Powerful mine lies within intrusive rocks characterised by an equigranular granite and xenolith-bearing hornblende granodiorite, each with textures typical of batholithic intrusions. These intrusions are interpreted to occur as part of the Dove River batholith. One intrusive contact is apparent in drill core (DR3, 104m) between these two intrusions (photo 23). A chilled contact on the granodiorite provides the same interpretation as field exposures that the hornblende granodiorite is younger. Bleached dykes crop out in road cuttings at the mine level and also occur in drill core (photo 25), while thin pink (Kfeldspar-rich) dykes are recognised in drill core (photo 24) and at the Gads Hill ridge top. Both pervasive and epigenetic Kfeldspar alteration are recognised, the latter with minor porphyry style quartz veins (photo 26), while green retrograde sericite overprints pervasive Kfeldspar and occurs marginal to Kfeldspar veins, as typical of many porphyry systems (photo 26). Breccias examined, 2 km east of the road exposure and at a much higher elevation at Gads Hill (photo 27) are typical of magmatic hydrothermal breccias and may be derived from the same source as pink dykes recognised there in outcrop and

drill core. These breccias display a silica-Kfeldspar altered matrix and contain milled quartz vein clasts while also being cut by later open crystalline quartz veins. No sulphides indicative of Cu-Au mineralisation occur in the breccias or quartz veins.

The position of mineralisation identified in one drill hole (DDH DR3, 132-134m) corresponds to the expected position of the vein exploited in the Powerful Mine. A fault zone contains a bleached dyke (photo 25), quartz-magnetite-haematite vein/breccia (photo 28), specularite-haematite fluidised breccias (photo 29) and chlorite-pyrite fluidised breccia (photo 30), all typical of D vein or low sulphidation deep epithermal quartz-sulphide Au  $\pm$  Cu veins which might be expected to develop marginal to buried porphyry intrusions. The low Cu-Au anomalism in drill core (0.05% Cu, 0.2 g/t Au; photo 30) is consistent with expected primary sulphide Au grades for this material. These veins are notorious for the development of anomalous Au by near surficial supergene Au enrichment, which may have been exploited by former miners.

It is interpreted the Powerful Mine exploited supergene enriched structurally controlled vein Au mineralisation of the style commonly present marginal to intrusions. An equigranular granite is cut by hornblende granodiorite which is in turn cut by two styles of dykes, bleached sericite-chlorite and pink Kfeldspar altered, the latter with magmatic hydrothermal breccia and quartz veins but no sulphide mineralisation. Although part of the overall porphyry intrusion-related geological model, this vein mineralisation is not considered a target for continued exploration.

### **DEVON MINE**

Pluton has carried out detailed geological mapping and sampling of the accessible Devon mine workings which have also been tested with two drill holes (DevD1 & 2). While most mining probably took place in the 1920's, some activity may have occurred as recently as the 1980's. The mine workings exploited NS fault hosted Ag-rich galena ore, although inspection of dump material, supported by Cu carbonate stain within the mine, indicates veins locally contain: early comb quartz overprinted by pyrite, chalcopyrite, galena and dark Fe-rich (high temperature) sphalerite and possible Ag sulphosalts (tennantite-tetrahedrite [apparent from limited petrology]), with later stage carbonate. This mineral assemblage is typical of polymetallic veins formed marginal to intrusions, such as D veins in the Gustafson and Hunt (1975) classification or intrusion-related low sulphidation deep epithermal carbonate-base metal Au veins in Corbett and Leach (1998). Veins intersected in DDH DevD2 (photo 31) display the paragenetic sequence of early comb quartz with chlorite progressively overprinted by pyrite-chalcopyrite, galena-sphalerite and then carbonate. Silica-tourmaline is also apparent in the vicinity of the Devon Fault overprinted by magnetite-haematite (including specularite)-pyrite and later carbonate (photo 32). No paragenetic relationships could be identified between the tourmaline and base metal veins.

The adits follow the fault-hosted veins within hornfels close to the contact between volcanic and granitic rocks, a position where there is expected to be greatest host rock competency. While the fault corridor, which varies up to several metres wide, hosts many possibly discontinuous veins and possible splays, the Ag-rich galena mined appears to have been derived from veins only a few cm wide. One 10 cm vein is apparent ready for extraction. Ore would have been hand picked prior to shipment. Projection of the veins up or down plunge away from the most competent host rocks should be treated with caution. The NS fault trend no doubt continues for some distance, as Pluton reports W. Herrmann

identified Au-mineralised float in a drainage several km north of the Devon mine, interpreted to have been derived from a continuation of that structure.

The intrusion exposed is interpreted as part of the Dove River granite suite and varies from a relatively equigranular biotite-hornblende granodiorite away from the contact, to display a more porphyritic texture with prominent quartz eyes and pervasive Kfeldspar alteration close to the contact with hornfelsed volcanic rocks. This intrusion is currently interpreted as the source for the base metal vein mineralisation, as well as the tourmaline and magnetite-haematite breccias, although the latter two interpretations remain tentative.

It is interpreted the Devon Mine veins are typical of those which might be expected to form marginal to intrusions and have been mined from a setting where competent hornfels would contribute towards quality vein formation. Tourmaline-magnetite-specularite breccias are similar to other occurrences in the region. Although it cannot be established whether vein Ag-galena mineralisation was derived from Cambrian or Devonian granitic sources, the former Cambrian Dove River batholith source is preferred. The Devon veins are not expected to represent a quality target for an economic mining operation and no evidence of porphyry mineralisation was recognised in the likely setting close to the intrusion margin. While an important element in the geological model for intrusion-related mineralisation, the Devon Mine area is not regarded as an ongoing exploration target.

#### **FIVE MILE RISE GOLDFIELD**

Five Mile Rise was one of the earliest goldfields in Tasmania. Here, a 20-30 m cap of Ordovician Moina Sandstone overlies Cambrian volcanic rocks which display strong propylitic alteration, typical of that which might be expected in the vicinity of a porphyry intrusion, intersected at depth. Porphyry style sheeted quartz-magnetite chlorite veins (photo 33) intersected in drill core (DDH DR1) cutting granitic rocks are typical of veins recognised elsewhere in the region. Volcanic rocks are described as vitric lithic tuffs in which local flattened pumice clasts locally display differential darker chlorite alteration from the general pale chlorite. FeO stain supports the possibility that disseminated pyrite has been present in what appears as propylitic alteration.

Soil geochemical anomalies obtained by RGC support the current thinking that early mineralisation and alteration in the Cambrian volcanic rocks derived from emplacement of Dove River style intrusions has been overprinted by later vein mineralisation associated with the emplacement of unseen Dolcoath-style Devonian granites (figure 3). Pluton (J. McDougall, pers. commun.) suggest lower metal grade Cambrian Au mineralisation has been remobilised by the Devonian event. Well developed pervasive Cu in soil anomalies within Cambrian volcanic rocks terminate at the contact with the Ordovician sandstones which might then be considered as post-mineral cover. Specular haematite veins within the volcanic rocks are similarly not recognised in the sandstones, interpreted as later. However, the Five Mile Rise mine workings exploited veins, no doubt with near surficial supergene enrichment, developed within the Ordovician sandstone, and are reported as continuing at depth into the underlying Cambrian volcanic rocks.

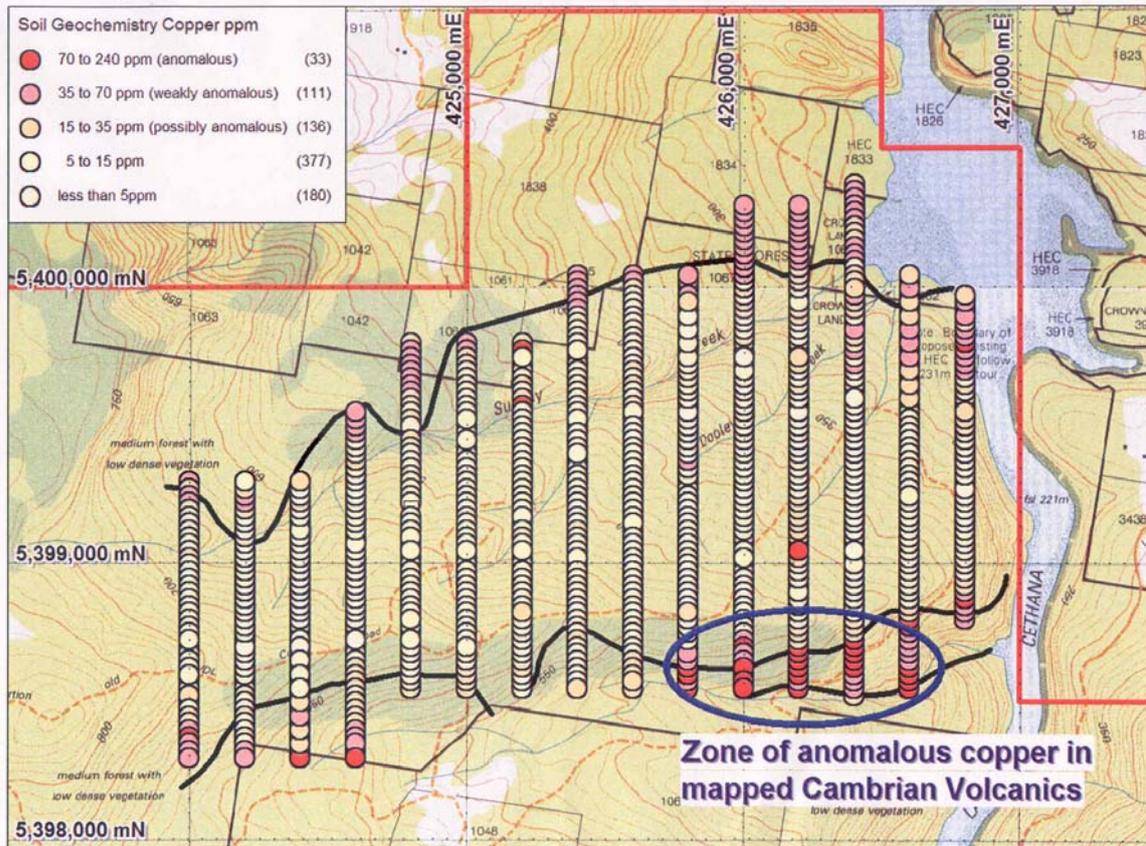


Figure 3. Original RGC geochemistry showing increase in Cu in soils outside the Ordovician (circled in black) cover and also the spot vein related anomalies within the Ordovician.

Drill hole DR1, which bores from the Ordovician sandstone into altered Cambrian volcanic and intrusive rocks, was examined in this review. While incomplete overprinting relationships prevent construction of a reliable paragenetic sequence, the current SPECULATED time relationships are:

- Silica-pyrite breccia with cross cutting chalcopyrite fracture/veins (photo 34) which is similar to breccias locally identified at Cethana (photo 20).
- Silica-tourmaline breccias cut the silica-pyrite (photo 35).
- Specularite-haematite overprints the silica-tourmaline alteration (photo 36).
- Sheeted quartz-magnetite veins occur within early Kfeldspar flooding which passes to a sericite overprint (photo 33) and locally cut the tourmaline and haematite alteration (photo 37).
- Pyrite magnetite veins (photo 38) and quartz-pyrite-chalcopyrite-galena Au-Ag mineralised lodes (photo 39) are interpreted as equivalents of D veins formed marginal to porphyry intrusions and host low grade Au mineralisation. These veins typically display near surficial supergene Au enrichment which is expected to have been exploited by former miners above the oxide zone. These may include the speculated Devonian veins exploited within the Ordovician sandstone by early miners.

It is currently interpreted unseen Devonian intrusion activity accounts for veins mined from within Ordovician sandstone which caps more diffuse Cu-Au mineralisation within Cambrian volcanic and intrusive rocks. Many features are typical of intrusion

environments such as the granite hosted sheeted quartz veins, Au-Ag base metal sulphide veins are likened to D veins formed marginal to intrusions and silica-tourmaline evolving to haematite veins, although no definitive paragenetic relationships are apparent between these features. D veins commonly display near surficial supergene Au enrichment, and if these were mined by the early miners, then these veins would be expected to be of a Devonian origin, as they cut the Ordovician sandstone. In such a model the early silica-pyrite-chalcopyrite breccias overprinted by tourmaline-specularite and sheeted quartz-chlorite veins are all likely to have been related to Cambrian magmatism and account for more dispersed Cu in soil anomalism, although the silica-pyrite-chalcopyrite breccias remain enigmatic.

Continued exploration at Five Mile Rise should proceed at a moderate priority with an aim of identification of a possible mineralised intrusion source for the near-porphyry style veins recognised to date. Additional data may aid in the resolution of the categorisation of the Cambrian/Devonian alteration and mineralisation events.

## CONCLUSIONS

Exposures of the Dove River Granite and environs near the Devon and Powerful Mines as well as Five Mile Rise display geological relationships typical of those which might be expected close to batholithic intrusions.

Most mineralisation mined to date can be classed as D vein or low sulphidation deep epithermal quartz-sulphide Au  $\pm$  Cu varying to carbonate-base metal Au vein style and typical of veins formed marginal to porphyry intrusions. The early quartz-sulphide Au  $\pm$  Cu element of these veins is notorious for near surficial supergene Au enrichment and so represents the source of material exploited by early miners. Lower precious metal grades are expected from sulphide material intersected in drill holes. Although an important element of the geological model, these veins are not expected to represent an economic target.

This review supports speculation by Pluton that the Cethana magnetic anomaly is derived from a Cambrian intrusion at depth, although the geological model cannot be verified on the data to hand. Cethana displays many features typical of a geological environment overlying a porphyry intrusion. Hydrothermal alteration increases with depth from outer propylitic (chlorite-magnetite) to potassic alteration (magnetite, Kfeldspar, biotite) as the quantity of magnetite also increases. Mineralisation occurs mainly as magnetite-pyrite-chalcopyrite fluidised breccias and veins, likened to early prograde porphyry mineralisation. Features such as barite, generally cited as evidence of VHMS mineralisation, are also recognised in low sulphidation deep epithermal quartz-sulphide Au  $\pm$  Cu veins formed marginal to porphyry intrusions. Pluton suggest that the abundant magnetite recognised in drill core remains insufficient to account for the quality of the aeromagnetic anomaly present at Cethana. Consequently, Cethana warrants additional exploration at a high priority for a porphyry Cu-Au mineralisation. A likely target represents an apophysis to a buried larger magmatic source at depth.

Cethana represents a target for continued exploration, although the Devon and Powerful mine areas display little exploration potential. Increased understanding of the hydrothermal system expected to evolve from additional work at Cethana may aid in the

evaluation of the more enigmatic Five Mile Rise area as a moderate priority at some later stage.

### **RECOMMENDATIONS**

Only Cethana warrants immediate continued exploration as a high priority, although advances in the geological model may aid in the continued evaluation of Five Mile Rise as a moderate priority at a later stage.

Additional drilling should attempt to identify any apophyses to the Cambrian granitic source for the aeromagnetic anomaly which might represent a setting for the concentration of hydrothermal fluids responsible for porphyry style Cu-Au mineralisation. Such an apophysis might be targeted by:

- Geological mapping which might identify zoned epidote or Kfeldspar as an indication of buried potassic alteration.
- Processing of the aeromagnetic data to identify any high points within the overall magnetic anomaly.
- IP chargeability anomaly as an indication of buried pyrite-chalcopyrite, although in many porphyry systems IP chargeability anomalies are derived from silica-sericite-pyrite alteration which may not be associated with Cu-Au mineralisation.

While this study is in agreement with the interpretation that most alteration and Cu-Au mineralisation are related to Cambrian intrusive activity the possible influence of later Devonian granites cannot be ruled out. Clear categorisation of these events would aid the geological model in use in the Cethana region.

The magnetite-biotite identified in drill hole Cet D1, 589.9m, should be re-examined to determine whether an alternative interpretation of secondary biotite, typical of potassic alteration, might be possible.

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Photo 1. Sample from Cethana prospecting pits contains quartz with in fill of pyrite with 0.3% Co and trace Au, typical of (deep) epithermal quartz-sulphide Au  $\pm$  Cu or D vein mineralisation.



Photo 2. Coarse crystalline to bucky quartz vein with magnetite and sulphide pseudomorphs from the shore of Lake Cethana, interpreted typical of a D style vein formed marginal to a porphyry intrusion.



Photo 3. Cethana possible epidote altered dyke - DDH D1, 442m.

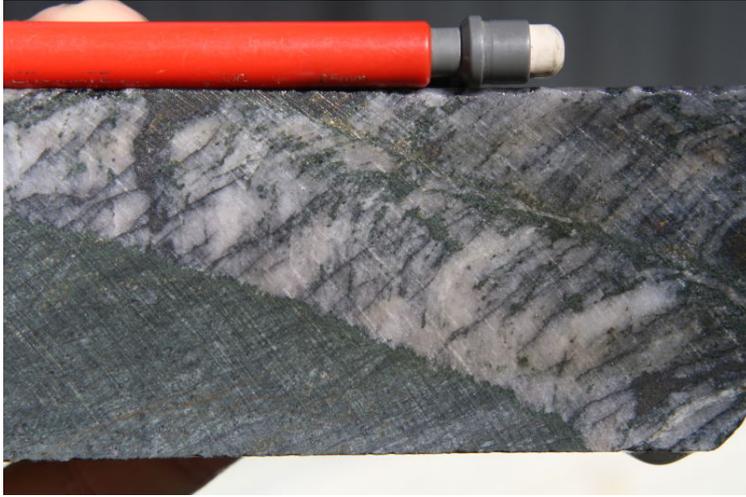


Photo 4. Syntaxial quartz-magnetite-chlorite vein within foliated chlorite-magnetite altered volcanic rock – DDH D1, 273.3m.



Photo 5. Magnetite-chlorite wall rock alteration cut by quartz-magnetite veins – DDH D1, 116.9m.

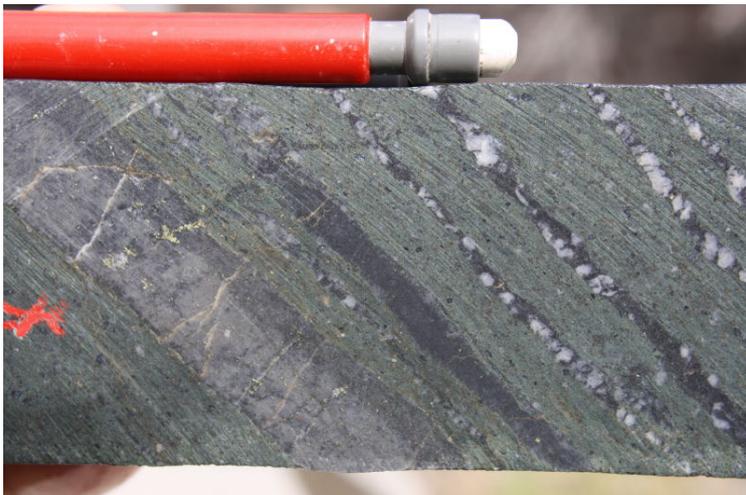


Photo 6. Cethana sheeted quartz-magnetite and Kfeldspar veins – DDH D1, 403m.

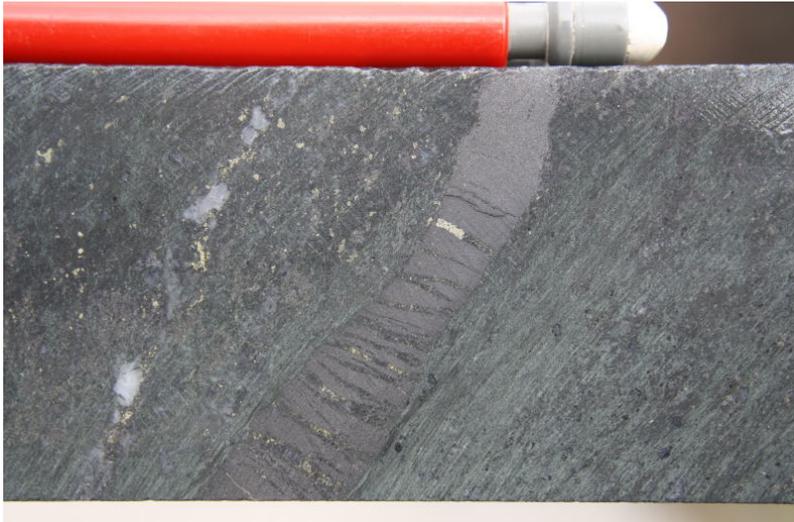


Photo 7. Cethana magnetite-sulphide vein – DDH D1, 229.5m.

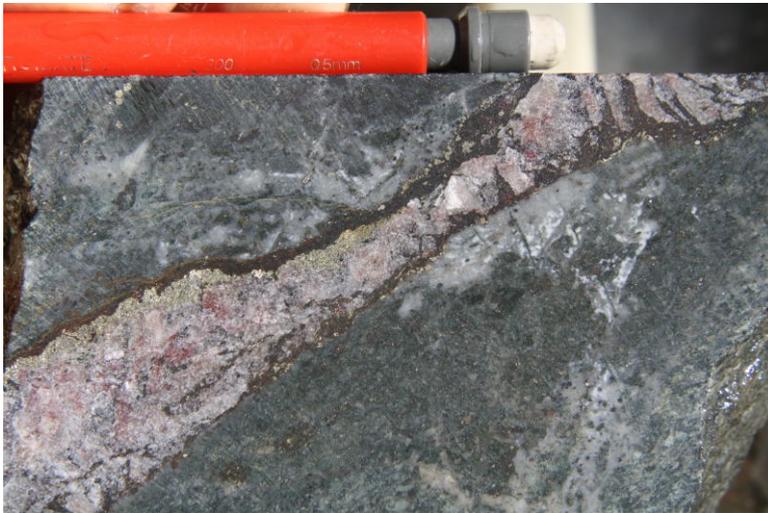


Photo 8. Cethana magnetite-chlorite cut by magnetite-pyrite-barite vein – DDH D1, 221.2m.



Photo 9. Cethana magnetite-sulphide (pyrite-chalcopyrite)-barite fluidised breccia – DDH D1, 229.2m.

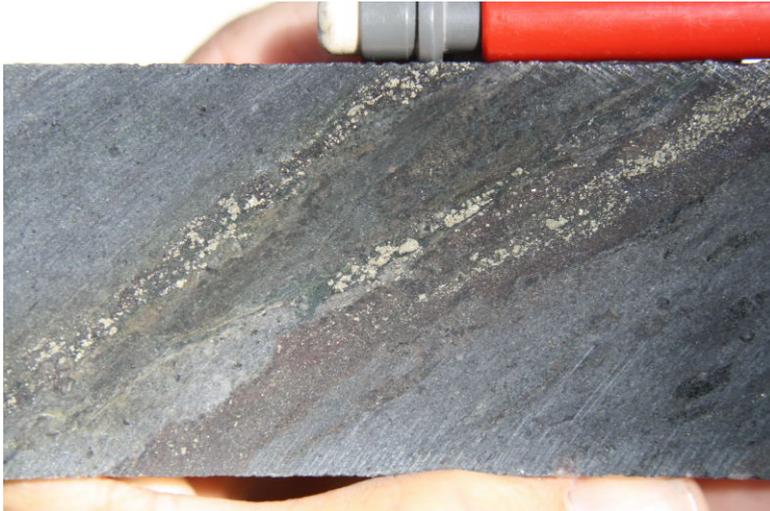


Photo 10. Cethana magnetite sulphide vein breccias cut chlorite-magnetite – DDH1, 206.5m.

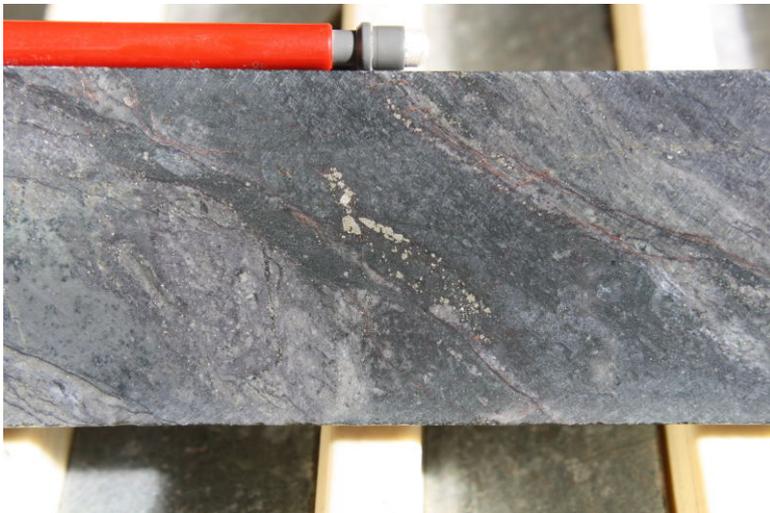


Photo 11. Cethana magnetite-sulphide fluidised breccia – DDH D1, 218.4m.



Photo 12. Cethana magnetite-sulphide fluidised breccia dyke - DDH D1, 562m.



Photo 13. Cethana silica-sulphide-magnetite-haematite fluidised breccia with adjacent sericite alteration, which is anomalous in Bi and contains trace Au and so likened to low sulphidation epithermal quartz-sulphide Au  $\pm$  Cu mineralisation – DDH D1, 215.5m.

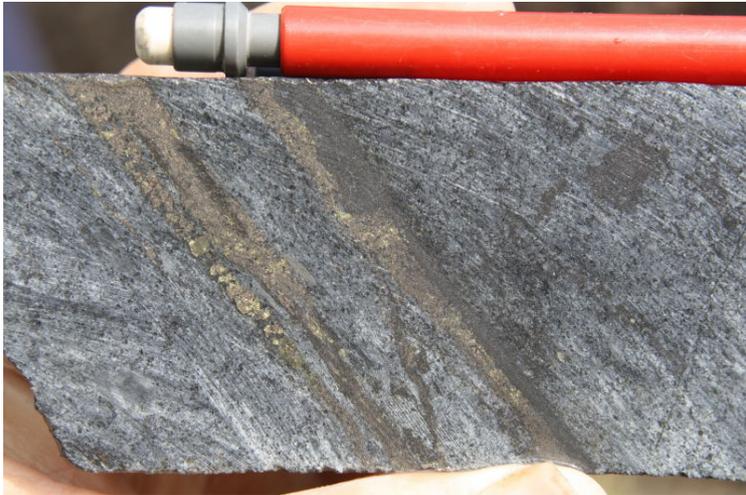


Photo 14. Cethana magnetite-sulphide veins cut magnetite-chlorite alteration - DDH D1, 456.8m.

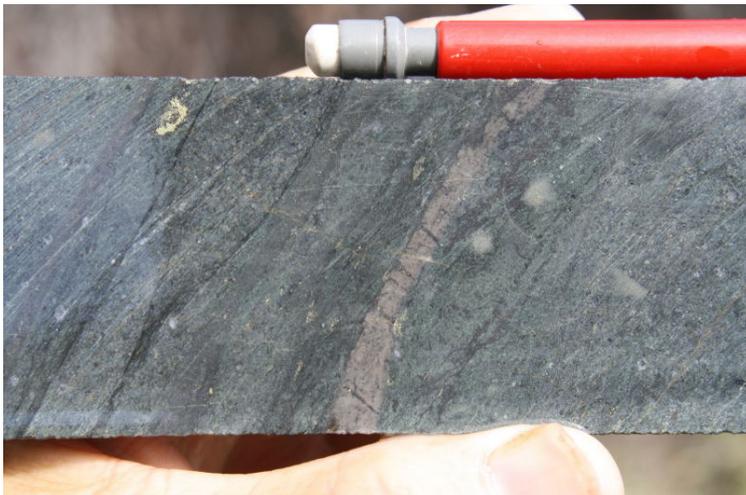


Photo 15. Cethana Kfeldspar-chalcopyrite vein in magnetite shear cutting chlorite-magnetite alteration - DDH D1, 203m.



Photo 16. Cethana pervasive Kfeldspar-magnetite alteration - DDH D1, 535m.

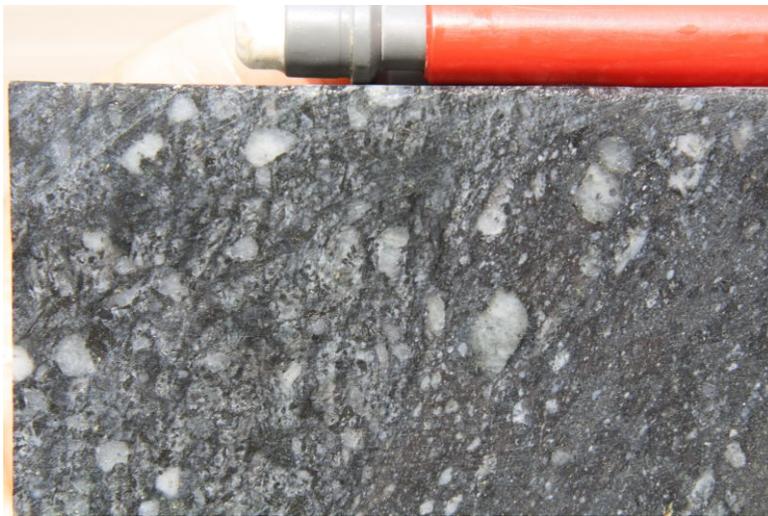


Photo 17. Cethana magnetite-biotite interpreted as secondary biotite typical of potassic alteration - DDH D1, 589.9m.

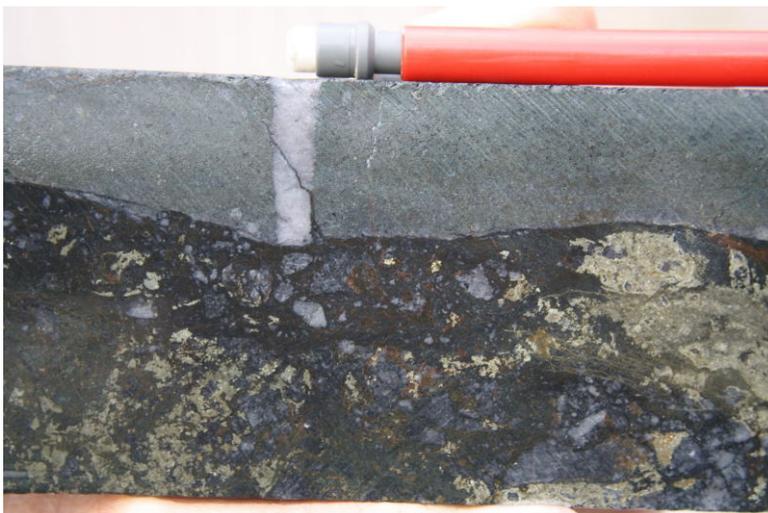


Photo 18. Magnetite-chalcopyrite fluidised breccia cuts quartz veins – DDH D2, 258.5m.

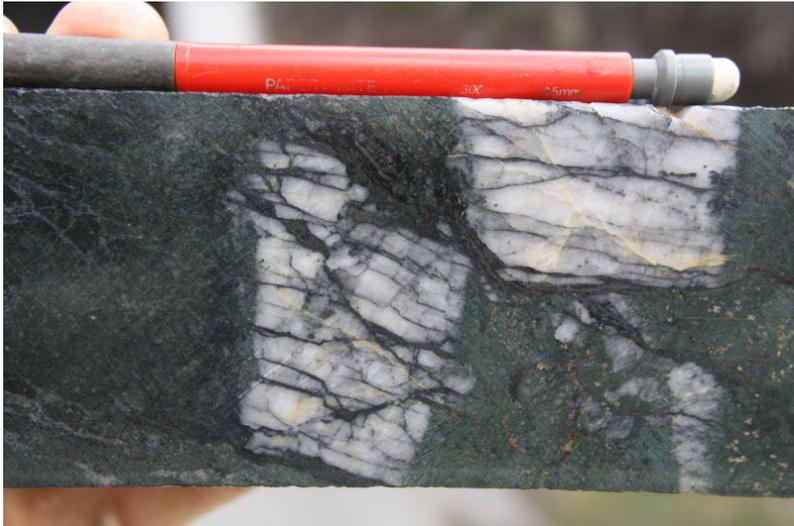


Photo 19. Cethana pyrite vein cut by magnetite-chalcopyrite breccia - DDH D2 258.2m.



Photo 20. Cethana silica-pyrite-chalcopyrite breccia dyke cross cuts foliated chlorite-magnetite altered volcanic rock - DDH D1, 577m.

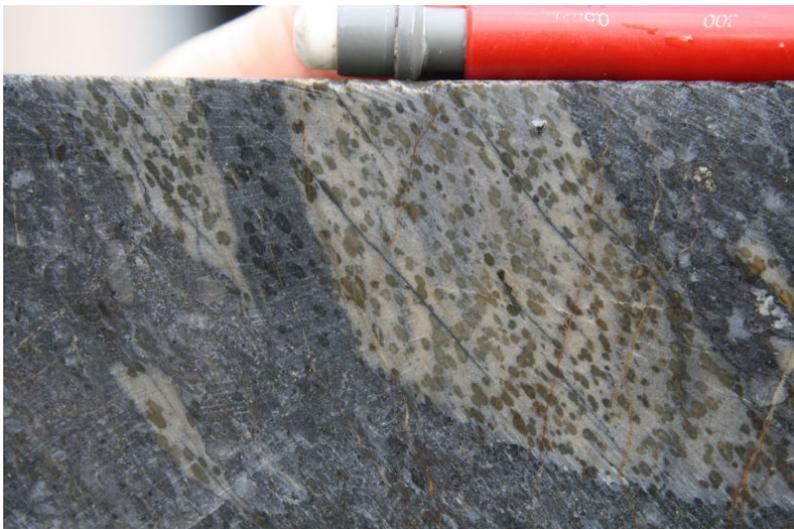


Photo 21. Cethana possible hornfels spotting - DDH D1, 562m.

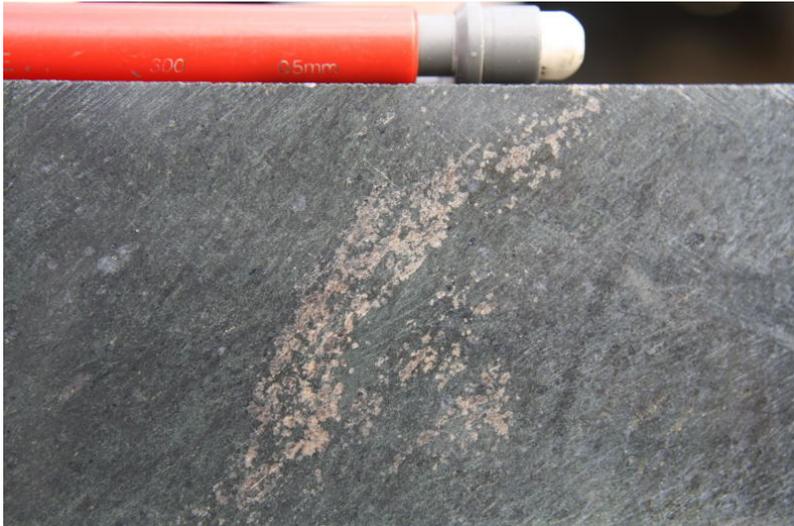


Photo 22. Cethana garnet hornfels – DDH D1, 528m.



Photo 23. Powerful mine area contact between two intrusions cut by later magnetite-chlorite shear. The chilled margin suggests the hornblende granodiorite on the left is later - DDH DR3, 104.2m.



Photo 24. Powerful Mine area orange ?Kfeldspar dyke – DDH DR3, 113.2m.

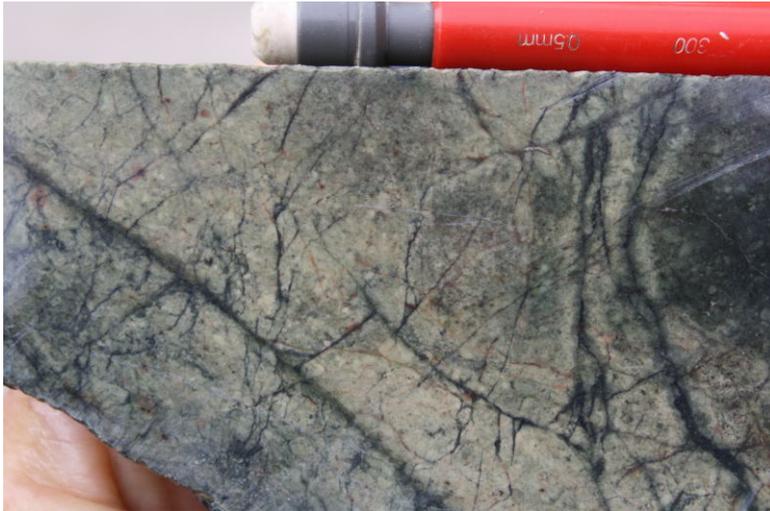


Photo 25. Powerful Mine area bleached dyke with possible sericite-chlorite alteration - DDH DR3, 132.2m.



Photo 26. Powerful Mine area Kfeldspar cut by later quartz vein with marginal sericite – DDH DR3.



Photo 27. Gads Hill magmatic hydrothermal breccia with quartz clasts in a pink matrix and cut by later quartz veins.

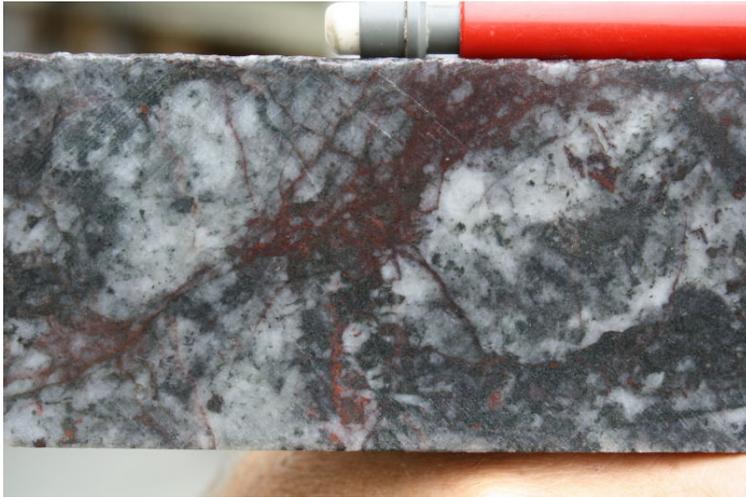


Photo28. Powerful Mine area quartz-magnetite-haematite vein/breccia typical of intrusion-related D veins - DDH DR3, 133.1m.

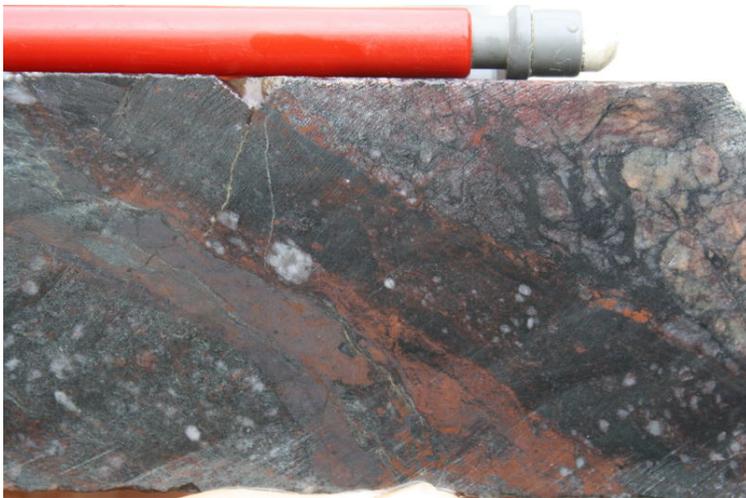


Photo 29. Powerful Mine area magnetite-haematite fluidised breccia - DDH DR3, 133m.



Photo 30. Powerful Mine area chlorite-sulphide shear typical of deep epithermal low sulphidation quartz-sulphide  $\text{Au} \pm \text{Cu}$  vein mineralisation. This material assayed 0.05% Cu & 0.2 g/t Au - DDH DR3, 132.1m.

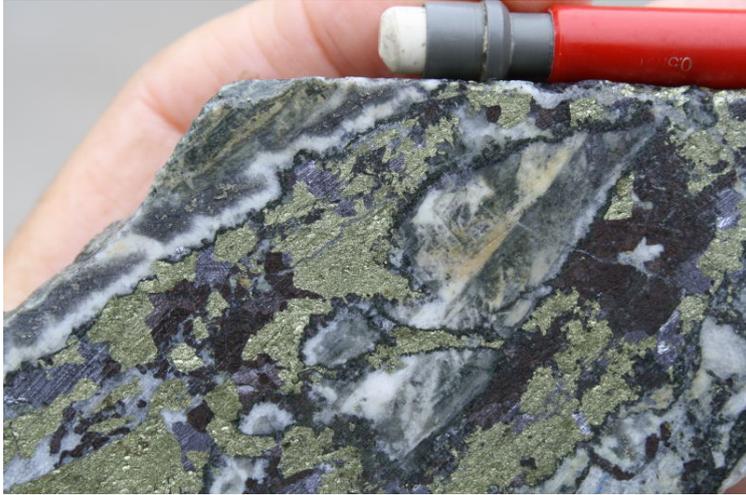


Photo 31. Devon mine quartz sulphide vein with pyrite, chalcopyrite, Ag-galena and dark sphalerite – DDH Dev2, 103.3m.

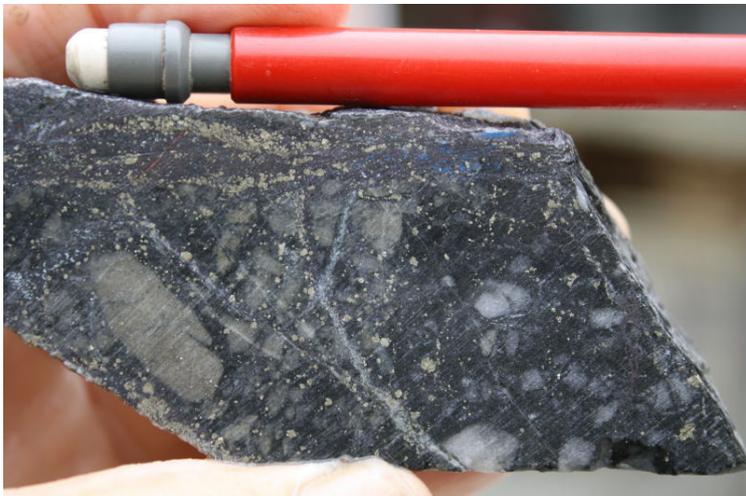


Photo 32. Tourmaline fluidised breccia cut by magnetite-haematite-sulphide fluidised breccia – DDH Dev2, 109.7m.

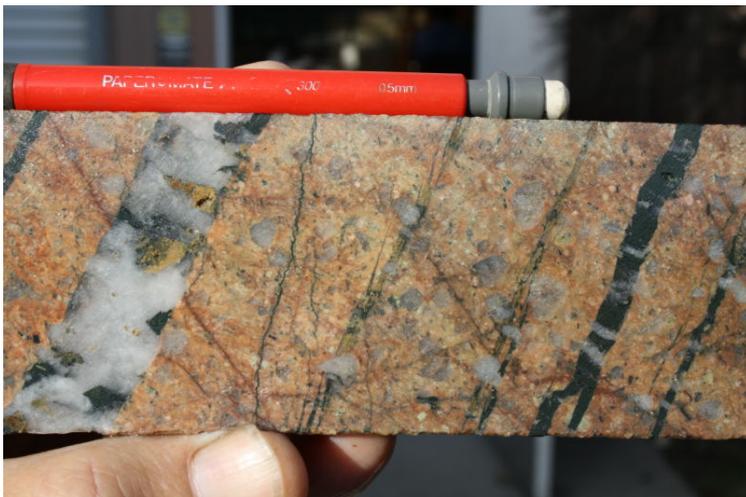


Photo 33. Five Mile Rise intrusion style sheeted quartz-magnetite-chlorite veins - DDH DR1, 282m.

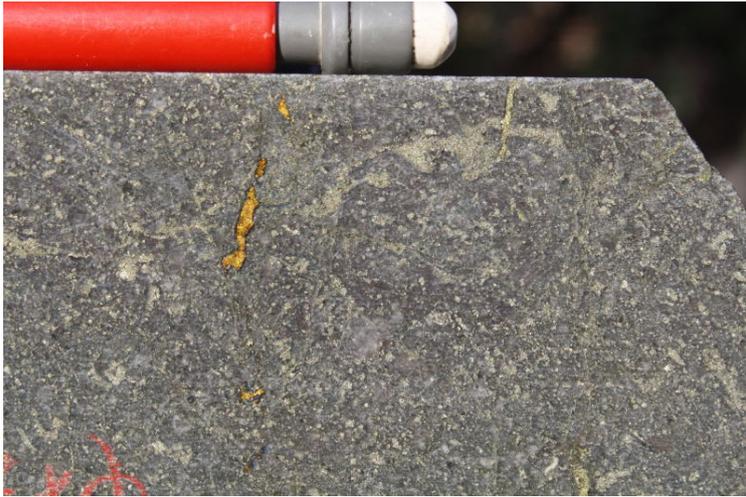


Photo 34. Five Mile Rise silica-pyrite-chalcopryite breccia – DDH DR1, 232m.



Photo 35. Five Mile Rise silica-pyrite-chalcopryite breccia cut by silica-tourmaline with later stage magnetite-specularite – DDH DR1, 236m.



Photo 36. Five Mile Rise silica-tourmaline cut by sheeted quartz-haematite veins – DDH DR1, 145.4m.



Photo 37. Intrusion-related quartz vein cuts tourmaline vein/breccia within volcaniclastic rocks - DDH DR1, 138m.



Photo 38. Shear hosted magnetite-pyrite vein cuts and alters earlier magnetite - DDH DR1, 336m, 1.37 g/t Au.

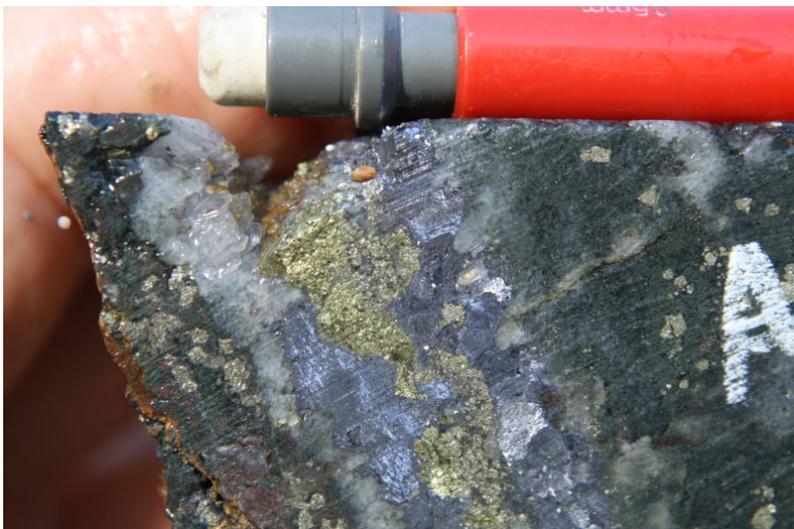


Photo 39. Five Mile Rise quartz-pyrite-galena vein with 1.13 g/t Au, 63 g/t Ag & 3% Pb – DDH DR1, 215m.

## Appendix 2 – Flora and Fauna Survey



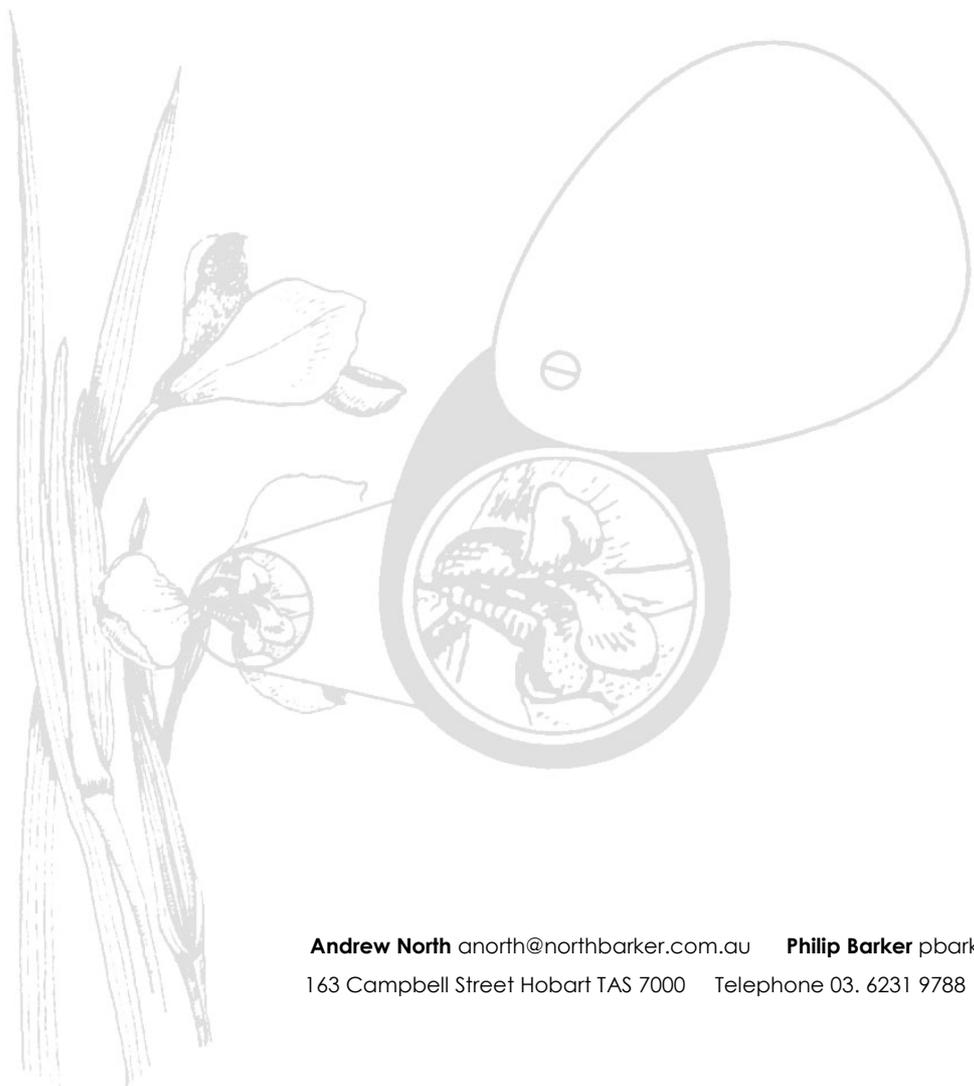
Lake Cethana Drill Sites, Lorinna

## VEGETATION SURVEY AND FAUNA HABITAT ASSESSMENT

5 March 2010

For Pluton Resources

PLU001



## SUMMARY

A vegetation survey and fauna habitat assessment was undertaken of 3 proposed drill sites, including a new access track, located on the eastern bank of Lake Cethana in Lorinna.

The three sites are situated within native bushland, which accords to the TASVEG native forest community classification:

- **WOU** – *Eucalyptus obliqua* wet forest (undifferentiated), which is not listed as threatened under the Nature Conservation Act, 2002.

The forest in the vicinity of the sites contains occasional very large old-growth gums over a sub-canopy of common dogwood, silver wattle and musk daisybush, with an open ground layer dominated by ferns and native currant.

No threatened plant species listed under state or federal legislation were recorded within the study areas surrounding the drill sites and there is a high degree of confidence that none have been overlooked.

The wider forested area would provide suitable habitat for a number of threatened fauna species, although the drill sites are located in areas that appear to have been previously disturbed and do not contain many features suitable for a range of threatened fauna. A commitment has been made by Pluton Resources to avoid disturbance to any of the large canopy trees in the vicinity of the sites, and to removing as little vegetation as possible from the drill sites such that it is considered unlikely that the drilling would represent a material impact on any listed fauna species.

No 'declared' weeds or significant environmental weeds were identified within the study areas surrounding the proposed drill sites. Quarantine measures, such as washing down of vehicles and drilling machinery prior to entering the sites, must be undertaken to prevent the spread of weeds into, and between, the drill sites.

Temporary discharge of drilling water has the potential to cause temporary waterlogging downslope of the drill holes. The impact of the discharge water could be minimised by dispersing the discharge over a wide area.

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## INTRODUCTION

**Date of Survey:** 11th February 2010.

**Surveyor:** Kirsty Kay, NBES.

**Report:** Andrew North and Kirsty Kay, NBES.

**Mapping:** Kerry Lee, NBES.

**Method:** Fieldwork based on the Timed Meander Search Procedure<sup>1</sup>. Review of Natural Values Report 38358<sup>2</sup>.

**Background:** Pluton Resources propose to install one drill hole at each of three sites to the north of Lorinna on the eastern bank of Lake Cethana. North Barker Ecosystem Services have been contracted to undertake a vegetation survey and fauna habitat assessment of the drill sites.

This report presents the results of the survey. A review of the potential of the site to support threatened species known to occur within the vicinity of the property is also included.

In addition to native plant species, non-native species were recorded when encountered with emphasis on 'declared' weeds listed in the *Weed Management Act 1999* plus any environmental weeds.

**Limitations:** The survey was undertaken in late summer. There may be some herb, grass, orchid and graminoid species present which flower at other times of the year, notably spring / early summer that could have been overlooked during the survey. However, all threatened plant species known from the area are considered in the light of habitat suitability.

## SITE DESCRIPTIONS

The drill sites are located on the eastern bank of Lake Cethana to the north of Lorinna in north-western Tasmania (Figure 1). The altitude ranges from approximately 200m to 300m. The underlying geology at Drill Site 1 and Drill Site 2 is Late to Middle Cambrian folded deformed and altered volcanic rocks of various compositions, and related intrusive igneous rocks, sandstone, siltstone and conglomerate. The underlying geology at Drill Site 3 is Tertiary basalt and related sediments and Mid Ordovician to Late Cambrian folded and locally deformed conglomerate, sandstone, quartzite, siltstone and shale.

In total, the areas investigated occupy approximately 3 hectares. The layout of the three drill sites is indicated in Figure 2.

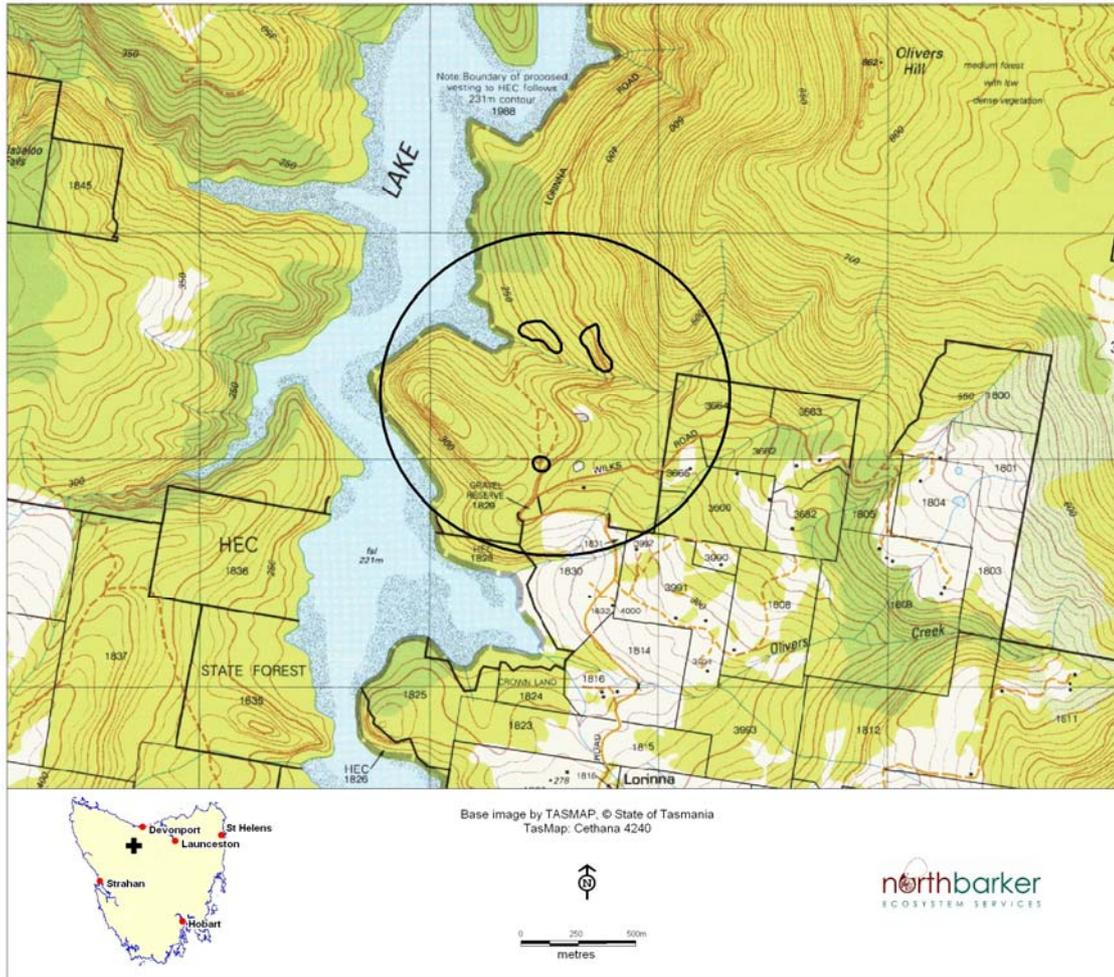
The proposed works require that a hole is drilled at each of the three drill sites to a depth of 400m below ground level. At each of the drill sites it is proposed to discharge approximately 10,000 litres of water a day for a period of five to six weeks.

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<sup>1</sup> Goff *et al.* 1982

<sup>2</sup> Natural Values Report (09/02/10), DPIW

**Figure 1: Location of the property**



### Drill Site 1

Drill Site 1 would be accessed most of the way by an existing road that leads to Lake Cethana from just north of the intersection of Lorinna Road and Wilks Road. Drill Site 1 is located partway up the hill from the existing road and therefore would require an additional access track to be constructed in order to bring the drill rig to the drilling site. This new access track and the location of drill site 1 are indicated on Figure 2. It appears that the location of the new access track follows the line of an old track, which follows the contour of the slope. This area has been flattened out at some time and is regrown with predominantly common dogwood, musk daisybush and silver wattle. There are no mature or old-growth trees in the line of the new access track that would need to be removed.

The study area surrounding drill site 1 included the area around the proposed drill site and the proposed access track, indicated on Figure 2.

In the vicinity of drill site 1 the slope is moderate (approximately 20°). The vegetation in the vicinity of Drill Site 1 consists of wet forest and is mostly in moderate to good condition floristically. The tall eucalypt canopy cover is approximately 20% and is dominated by stringybarks (*Eucalyptus obliqua*) with white gum (*Eucalyptus viminalis*) a sub-dominant.

The sub-canopy layer is relatively thick (approximately 60% cover) and comprised of common dogwood, silver wattle and musk daisybush. The ground layer is dominated by ferns (approximately 50% cover) with scattered native current. Leaf litter comprises approximately 40%, with fallen rotting timber in the order of 10%.



**Drill Site 1**

### **Drill Site 2**

Drill Site 2 would be accessed from Lorinna Road. The drill hole will be located in the layby to the south-west of Lorinna Road, as illustrated in the photo below. The drilling rig would be located on Lorinna Road and therefore very little vegetation would be required to be cleared at this drill site. The study area included the area downslope of the road at this point and along the edge of the road to the south of the drill hole at the request of Pluton Resources. The study area is shown in Figure 2.

The vegetation downslope of the road at Drill Site 2 is very similar to that at Drill Site 1, described above. The slope to the south-west of Lorinna Road is moderate. There is a very tall canopy of occasional old-growth eucalypts (*Eucalyptus obliqua* dominant, *Eucalyptus viminalis* sub-dominant), over a denser sub-canopy of common dogwood, musk daisybush and silver wattle to approximately 8m. Shrubs included guitar plant, prickly mimosa, and Tasmanian blanketleaf over an open ground layer dominated by ferns and native current (approximately 50% cover). Leaf litter and fallen and rotting timber cover is also approximately 50%.



**Drill Site 2**

### **Drill Site 3**

Drill Site 3 is located immediately to the west of the junction of Lorinna Road and the unnamed road that leads to Drill Site 1 and Lake Cethana. The drill site is immediately adjacent to the road in an area that has previously been used as a refuse disposal site and therefore contains few shrubs or canopy trees.

It is proposed to park the drill rig on the road shown in the photo below and drill off the road to the west in an area that is currently dominated by ferns. The only canopy tree in the vicinity of Drill Site 3 is a large *Eucalyptus obliqua* located to the west of the Site, which would not be impacted by the drilling.

The slope of Drill Site 3 is gentler than that at the other sites. The vegetation is dominated by ferns and rushes, with scattered shrubs including common dogwood, blackwood, silver wattle, Tasmanian blanketleaf, and prickly moses.



**Drill Site 3**

## **BIOLOGICAL VALUES**

### **Vegetation**

The three drill sites occur within wet forest vegetation dominated by *Eucalyptus obliqua* which accords to the TASVEG (version 2.0) community:

#### **WOU – *Eucalyptus obliqua* wet forest (undifferentiated).**

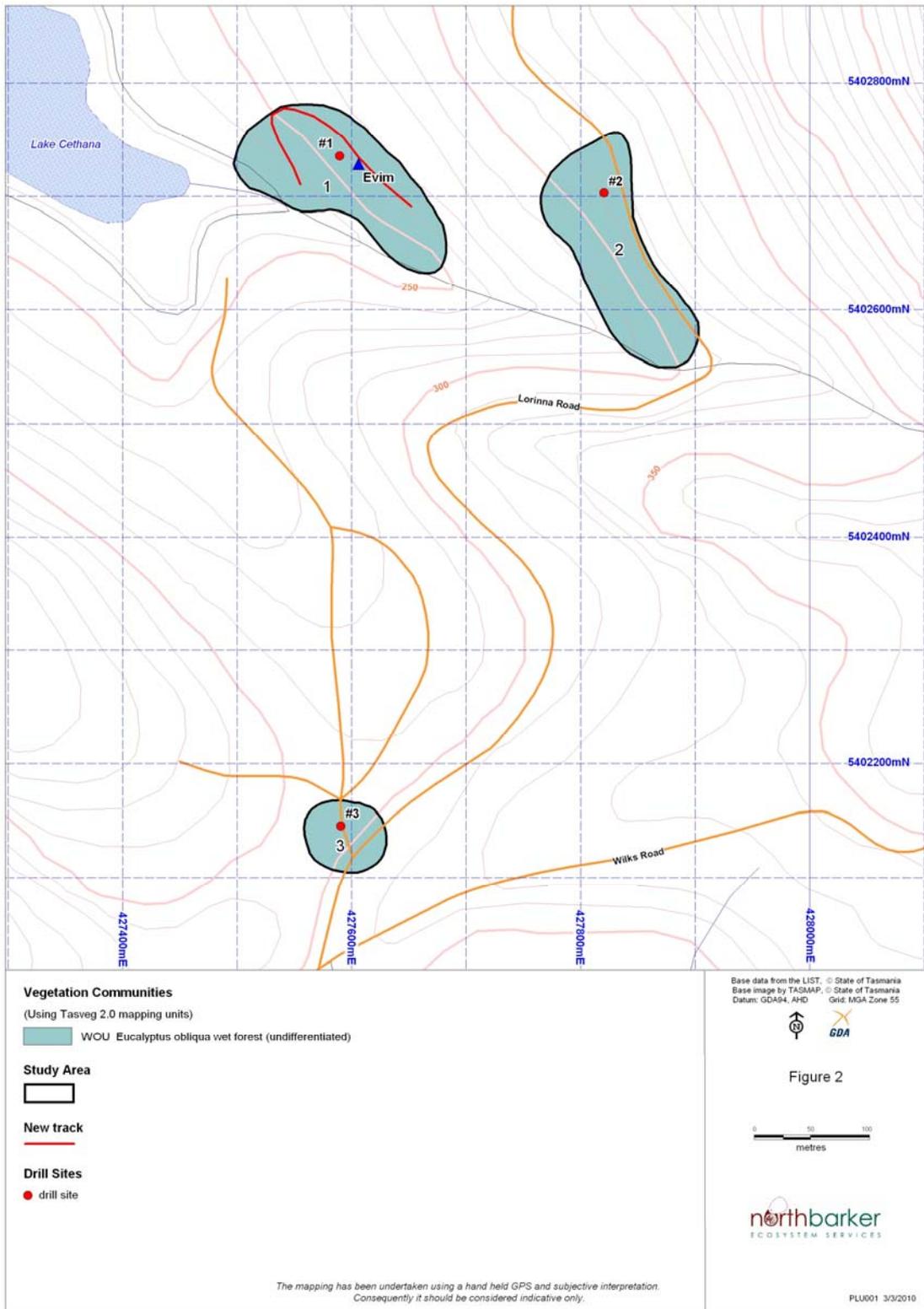
This community is not listed as a threatened native forest community under the Tasmanian Nature Conservation Amendment Act<sup>3</sup> as it is considered to be widespread and well reserved.

Figure 2 presents a map identifying the vegetation within the study areas.

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<sup>3</sup> *Nature Conservation Amendment Act 2006*

**Figure 2: Vegetation of the property**



## **Plant Species**

The areas surveyed around each drill location are illustrated in Figure 2. A total of 37 species of vascular plants were recorded from the three sites, including 1 introduced species that is not listed as a 'declared' weed or an important environmental weed. The full species list for each drill site is given at the end of the report (Appendix 1).

No threatened species listed under the Tasmanian *Threatened Species Protection Act 1995* (TSPA) or the Commonwealth *Environment Protection & Biodiversity Conservation Act 1999* (EPBCA) were recorded.

Previous surveys within 5 km of the property have identified 5 species of threatened flora listed under the TSPA and no species listed under the EPBCA. These are discussed below including a description of their preferred habitat and an assessment of their likely occurrence within the study sites.

### **Chocolate lily (*Arthropodium strictum*)**

The chocolate lily is listed as rare under the TSPA and is not listed under the EPBCA. It is a purple flowered, sweet-smelling lily up to 90cm tall. The species is suffering incremental loss due to agricultural and residential development. However, the species is due for reassessment for possible delisting due to its widespread distribution and large number of populations and individuals. There is one record of chocolate lily from within 5km of the study sites and it is considered likely that this is an error as the species occurs predominantly in the eastern half of the state (through the Midlands, north-east and on the East Coast). It is found in open forest, dry hillsides and grasslands and as a result none of the study areas provide suitable habitat for the species. The species was not recorded during the survey and it is considered highly unlikely that it occurs within any of the study areas or in the vicinity.

### **Slender twigsedge (*Baumea gunnii*)**

Slender twigsedge is listed as rare under the TSPA and is not listed under the EPBCA. It is a perennial sedge and occurs in wet moors, creeks and riverbanks. There is only one record for the species within 5km of the study areas and none of the study areas contain suitable habitat for this species. The species was not recorded during the survey and it is considered highly unlikely that it occurs within any of the study areas or in the vicinity.

### **Short bentgrass (*Deyeuxia brachyathera*)**

Short bentgrass is listed as rare under the TSPA and is not listed under the EPBCA. It is an erect, stout and hairless perennial grass that reaches up to 100cm tall. In Tasmania, the species is found in dry sclerophyll forest and wet moors and soaks within highland grasslands. There is only one record for this species within 5km of the study areas and there is no suitable habitat for this species within any of the study areas. The species was not recorded during the survey and it is considered highly unlikely that it occurs within any of the study areas or in the vicinity.

### **Forth River peppermint (*Eucalyptus radiata* *ubsp.. radiata*)**

The Forth River peppermint is listed as rare under the TSPA and is not listed under the EPBCA. It is very similar to the more common black peppermint (*Eucalyptus amygdalina*), but differs in its juvenile leaves which are over 15mm wide at the widest point. The species is largely restricted to the mid to upper sections of the Forth River catchment. It occurs on basalt, granite, quartzite, sediments and metamorphic substrates and inhabits forest types from dry sclerophyll to wet

sclerophyll. There are a large number of records for the species within 5km of the study areas and a number of trees on Lorinna Road between Drill Site 2 and Drill Site 3 were positively identified as forth river peppermints on the day of the survey. However, no trees of the species were identified within any of the study areas illustrated in Figure 2. Drilling within the study areas would not result in the removal of any forth river peppermints, and therefore no material impact on the species is anticipated.

### **Matted lignum (*Muehlenbeckia axillaris*)**

Matted lignum is listed as rare under the TSPA and is not listed under the EPBCA. It is a small prostrate, straggling or trailing shrub forming densely matted to open patches 6 – 80cm in diameter. Flowering is from December to February. There are only two previous records of the species within 5km of the study areas. It is predominantly found in moist gravelly or rocky places on the Central Plateau, extending out to the north-east, north-west and west of the State. Suitable habitat for the species is therefore not present within any of the three study areas and the species was not identified during the survey. It is considered highly unlikely that the species occurs within any of the study areas, or in the immediate vicinity.

In summary, none of the 5 threatened species recorded within 5km of the study areas were recorded within the study areas, or are considered likely to occur within the study areas. The forth river peppermint does occur in the wider vicinity surrounding the sites, but the drilling within the 3 sites would have no effect on any specimens of this species.

### **Introduced Plants**

No introduced plants listed as ‘declared’ weeds under the *Weed Management Act 1999*, or significant environmental weeds, were recorded from any of the drill sites.

Two ‘declared’ weeds, Blackberry (*Rubus fruticosus*) and canary broom (*Genista monspessulana*), were identified adjacent to Lorinna Road approximately 100m south of drill site 2.

### **Fauna Conservation Values**

Threatened fauna species previously recorded within 5 km of the study area, or which may potentially occur there, are listed in Table 3 together with a description of their preferred habitat and an assessment of their likely occurrence on the property.

**Table 2: Fauna species of conservation significance previously recorded, or which may potentially occur, within 5 km of the property<sup>4</sup>.**

Species	Status TSPA/EPBCA	Significance of habitat within study areas	Observations and Preferred Habitat <sup>5</sup>
<b>BIRDS</b>			
Grey goshawk <i>Accipiter novaehollandiae</i>	Endangered/-	MODERATE	Inhabits large tracts of wet forest and requires old trees for nesting. The drill sites are located within an area of wet forest and there are several large old growth eucalypts in the vicinity of the sites.
Wedge-tailed eagle <i>Aquila audax</i>	Endangered/ Endangered	MODERATE	Requires large sheltered trees for nesting and is highly sensitive to disturbance during the breeding season. The drill sites are located within an extensive area of forest with several old growth eucalypts which provide suitable nesting habitat for this species. The drill sites are likely to be located within its hunting territory.
Masked owl <i>Tyto novaehollandiae castanops</i>	Endangered/-	MODERATE	Requires a mosaic of forest and open areas for foraging and large old-growth hollow-bearing trees for nesting. There are large old-growth eucalypts in the vicinity of the drill sites and it is likely that the drill sites are located within the species hunting territory.
<b>MAMMALS</b>			
Eastern-barred bandicoot <i>Perameles gunnii</i>	-/Vulnerable	MODERATE	This species favours a mosaic of open grassy areas for foraging with thick vegetation cover for shelter and nesting. There is some habitat potential on the property and it is likely that the species occurs in the vicinity of the drill sites.
Spotted-tailed quoll <i>Dasyurus maculatus maculatus</i>	Rare/Vulnerable	MODERATE	This naturally rare forest-dweller most commonly inhabits wet forest but also occurs in dry forest. It forages and hunts on farmland and pasture, travelling up to 20 km at night, and shelters in logs, rocks or thick vegetation. There is some habitat present within the drill site areas and it is likely that the species could occur in the vicinity of the drill sites.
Tasmanian devil <i>Sarcophilus harrisi</i>	Endangered / Endangered	MODERATE	Devils are found in a wide variety of habitats throughout Tasmania, e.g. coastal heath, open dry sclerophyll forest, and mixed sclerophyll rainforest. There is good habitat present within the drill site areas and in the immediate vicinity. No evidence of devils, such as devil dens or latrines was encountered during the survey. The major threat to the species is currently Devil Facial Tumour Disease.

<sup>4</sup> Natural Values report 09/02/10, DPIW

<sup>5</sup> Bryant & Jackson 1999

Species	Status TSPA/EPBCA	Significance of habitat within study areas	Observations and Preferred Habitat <sup>6</sup>
<b>INSECTS</b>			
Ptunarra brown butterfly <i>Oreixenica ptunarra</i> subsp. <i>ptunarra</i>	Vulnerable/-	NONE	Generally a montane to alpine species being restricted to sites above 400m. Throughout its range the butterfly is found in areas where there is a significant cover of <i>Poa</i> tussock. The preferred habitat ranges from <i>Poa</i> tussock grassland to <i>Hakea macrocarpa</i> grassy shrubland to <i>Eucalyptus</i> grassy open woodland. There is no suitable habitat present within the study areas.
<b>CRUSTACEANS</b>			
Giant freshwater grayfish <i>Astacopsis gouldi</i>	Vulnerable/ Vulnerable	NONE	Inhabits rivers and streams. No suitable habitat present.

In summary, the forest surrounding the study areas could potentially provide habitat to six of the eight threatened species previously recorded in a 5km radius. This is due to the fact that the study areas are located within a large area of contiguous, good quality wet forest with a number of old-growth eucalypts. However, the drill sites are located in areas that appear to have been previously disturbed and do not contain many features, such as old-growth eucalypts, suitable for a range of threatened fauna. A commitment has been made by Pluton Resources to avoid removal of any eucalypts (including mature or old-growth canopy trees) in the vicinity of the sites, and to remove as little vegetation as possible from the drill sites, such that it is considered unlikely that the drilling would represent a material impact on any listed fauna species.

As part of the fauna habitat assessment, Pluton Resources requested that an assessment be made of the habitat suitability of a white gum (*Eucalyptus viminalis*) stag that appears to have sustained lightning damage, located in the vicinity of Drill Site 1. This tree is illustrated in the photos below and its location is shown in Figure 2. The drill operator has expressed concern over the safety of leaving this tree in close proximity to the drill hole. Although the tree contains rot holes, there is no obvious hollow development along the length of the stag. No bird nests were identified on the upper part of the stag. Overall, the tree is considered to be of very low significance as a fauna habitat tree. It is considered that if the tree is required to be removed this would not represent a negative impact in terms of any threatened fauna habitat.

<sup>6</sup> Bryant & Jackson 1999



**Lower half of  
*Eucalyptus viminalis*  
stag**



**Central part of *Eucalyptus*  
*viminalis* stag**



**Upper part of *Eucalyptus*  
*viminalis* stag**

## **DISCUSSION**

### **Potential impact of the proposed drilling**

The proposed drill sites occur in areas which appear to have been previously disturbed and contain few canopy trees. Drill Sites 2 and 3 are to be accessed from existing roads or tracks and therefore require very little additional vegetation to be cleared in order to gain access. Drill Site 1 can be partially accessed by an existing track, but does require the construction of a new section of track, which will follow the route of an old track. The area has regrown with shrubs; predominantly common dogwood.

No threatened flora species have been recorded within the study areas surrounding the proposed drill holes, and therefore no adverse impacts are anticipated on any threatened flora species. There will inevitably be some clearance of common ground layer species such as ferns and native currant, and shrubs and small trees such as musk daisybush and common dogwood, from the proposed drill sites, particularly to enable construction of the new track access into Drill Site 1. However, it is not considered that removal of this vegetation would represent a significant ecological impact.

Providing no mature or old-growth canopy trees are removed as part of the proposed works, it is anticipated that there would also be no adverse impacts on any threatened fauna species likely to occur in the vicinity of the study sites.

There are currently very few non-native species within each of the three study areas. The proposed drilling works have the potential to introduce weed species, adhered to drilling machinery and vehicles, into the study areas. Appropriate quarantine procedures, such as washing down of machinery before entering and leaving each drill site, should be adopted to reduce weed dispersion into the drill sites.

Pluton Resources have estimated that approximately 10,000 litres of water per drilling day is to be expelled from the each of the drill sites for a period of five to six weeks. This would inevitably lead to localised temporary water logging of the soil and vegetation down slope of the drill sites, which should not have a significant impact on the health of the native vegetation in these areas, particularly at Drill Site 1 and 2, where the slope is relatively steep. In order to reduce water logging, water should be dispersed over as wide an area as possible.

### **Legislative implications**

#### Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBCA)

The EPBCA is structured for self-assessment; the proponent must indicate whether or not the project is considered a 'controlled action' which if confirmed would require approval from the Commonwealth Minister.

The probability of any nationally listed flora species occurring on the property is considered highly unlikely.

Four nationally listed fauna species, the wedge-tailed eagle, the eastern-barred bandicoot, the spotted-tailed quoll and the Tasmanian devil, are considered likely to occur in the vicinity of the three study areas. It is considered that the proposed works are unlikely to cause a measurable decline to any of these species. Consequently, the proposed drilling is unlikely to trigger this legislation.

#### Tasmanian Threatened Species Protection Act 1995 (TSPA)

No threatened plant species listed under this act were recorded during the survey, and there is very low potential for any to be present.

Impacts on state listed fauna are considered highly unlikely.

Consequently, the proposed drilling is unlikely to trigger this legislation.

#### Tasmanian Weed Management Act 1999 (WMA)

Disturbances associated with the drilling may introduce 'declared' or important environmental weeds into the drill sites and will need to be carefully managed to prevent this.

### **Mitigating Impacts**

A Vegetation Management Plan should be prepared which includes prescriptions for weed management, such as wash down of vehicles and drilling machinery before entering and leaving the drill sites.

Discharged drilling water should be dispersed in order to reduce the effects of temporary water logging on native vegetation and soils down slope of drill sites.

### **CONCLUSION AND RECOMMENDATIONS**

The drill sites, and new track access to Drill Site 1, are located in areas which appear to have previously been disturbed. The vegetation in the vicinity of the drill sites consists of wet forest dominated by *Eucalyptus obliqua*, which is not considered to be a threatened native forest community. No threatened flora species were identified within the study areas surrounding the three proposed drill sites. Providing drilling activities are restricted to those areas surveyed, no impacts on threatened flora or fauna species are anticipated.

It is recommended that no mature or old-growth eucalypts are removed from the vicinity of the drill sites. Mature and old-growth canopy trees in the area provide valuable fauna habitat to a range of threatened fauna species.

It is recommended that discharged drilling water should be dispersed over as wide an area as possible to reduce the effects of temporary water logging down slope of drill holes.

A *Vegetation Management Plan* should be prepared that sets out appropriate weed management procedures for the works.

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## APPENDIX 1: VASCULAR PLANT SPECIES

### Status codes:

ORIGIN

i - introduced

d - declared weed WM Act

en - endemic to Tasmania

t - within Australia, occurs only in Tas.

NATIONAL SCHEDULE

EPBC Act 1999

CR - critically endangered

EN - endangered

VU - vulnerable

STATE SCHEDULE

TSP Act 1995

e - endangered

v - vulnerable

r - rare

### Sites

1	WOU - E427589, N5402736	11/02/2010
2	WOU - E427820, N5402703	11/02/2010
3	WOU - E427591, N5402146	11/02/2010

Site	Name	Common name	Status
<b>DICOTYLEDONAE</b>			
<b>ASTERACEAE</b>			
1 2	<i>Bedfordia salicina</i>	tasmanian blanketleaf	en
3	<i>Cassinia aculeata</i>	dollybush	
1 2 3	<i>Olearia argophylla</i>	musk daisybush	
1 2 3	<i>Olearia lirata</i>	forest daisybush	
<b>ATHEROSPERMATACEAE</b>			
1	<i>Atherosperma moschatum</i> subsp. <i>moschatum</i>	sassafras	
<b>CARYOPHYLLACEAE</b>			
2 3	<i>Stellaria pungens</i>	prickly starwort	
<b>FABACEAE</b>			
2	<i>Pultenaea juniperina</i>	prickly beauty	
<b>GENTIANACEAE</b>			
3	<i>Centaurium erythraea</i>	common centaury	i
<b>HALORAGACEAE</b>			
3	<i>Gonocarpus tetragynus</i>	common raspwort	
<b>MIMOSACEAE</b>			
1 2 3	<i>Acacia dealbata</i> subsp. <i>dealbata</i>	silver wattle	
3	<i>Acacia melanoxylon</i>	blackwood	
1 2 3	<i>Acacia verticillata</i>	prickly mimosa	
<b>MYRTACEAE</b>			
1 2 3	<i>Eucalyptus obliqua</i>	stringybark	
1 2 3	<i>Eucalyptus viminalis</i> subsp. <i>viminalis</i>	white gum	
<b>OXALIDACEAE</b>			
1 2 3	<i>Oxalis</i> sp.	woodsorrel	
<b>PROTEACEAE</b>			
2 3	<i>Lomatia tinctoria</i>	guitarplant	en
<b>RANUNCULACEAE</b>			
1 2	<i>Clematis aristata</i>	mountain clematis	

	<b>RHAMNACEAE</b>		
1 2 3	<i>Pomaderris apetala</i>	common dogwood	
	<b>ROSACEAE</b>		
3	<i>Acaena novae-zelandiae</i>	common buzzy	
	<b>RUBIACEAE</b>		
1 2 3	<i>Coprosma quadrifida</i>	native currant	
	<b>THYMELAEACEAE</b>		
1 2 3	<i>Pimelea drupacea</i>	cherry riceflower	
	<b>MONOCOTYLEDONAE</b>		
	<b>CYPERACEAE</b>		
3	<i>Carex appressa</i>	tall sedge	
	<b>JUNCACEAE</b>		
2 3	<i>Juncus pallidus</i>	pale rush	
3	<i>Juncus pauciflorus</i>	looseflower rush	
3	<i>Juncus sarophorus</i>	broom rush	
	<b>LILIACEAE</b>		
1 2 3	<i>Dianella tasmanica</i>	forest flaxlily	
1 2	<i>Drymophila cyanocarpa</i>	turquoise berry	
	<b>POACEAE</b>		
3	<i>Australopyrum pectinatum</i>	prickly wheatgrass	en
3	<i>Ehrharta stipoides</i>	weeping grass	
	<b>XANTHORRHOEACEAE</b>		
1 2 3	<i>Lomandra longifolia</i>	sagg	
	<b>PTERIDOPHYTA</b>		
	<b>ASPIDIACEAE</b>		
1 2 3	<i>Polystichum proliferum</i>	mother shieldfern	
	<b>ASPLENIACEAE</b>		
1	<i>Asplenium bulbiferum subsp.</i>	mother spleenwort	
	<b>BLECHNACEAE</b>		
1 2 3	<i>Blechnum nudum</i>	fishbone waterfern	
	<b>DENNSTAEDTIACEAE</b>		
3	<i>Histiopteris incisa</i>	batswing fern	
1 2 3	<i>Pteridium esculentum</i>	bracken	
	<b>DICKSONIACEAE</b>		
1 2 3	<i>Dicksonia antarctica</i>	soft treefern	
	<b>POLYPODIACEAE</b>		
2	<i>Microsorium pustulatum subsp.</i>	kangaroo fern	

### Appendix 3 – Rehabilitation Photos



Photo 1 – Silt and hydrocarbon trap in drain below CETD1, removed March 2010



Photo 2 – Regrowth at water tank site (CETD2) Jan 2010



Photo 3 - Fern growth on grid line 9850E Feb 2010



Photo 4 – Plants (*Lomatia* spp.) re-establishing on grid line 9850E Feb 2010