



North Lorinna (Cethana) Annual Report 2009 – EL 29/2006



Setting up for drilling from quarry on Lorinna Road (CETD1)

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Summary

This report is the second 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 have been investigated.

Work by Pluton and the preceding holders (joint venture partners) for the period up until March 2009 included assay compilation from the two previous diamond drill holes, petrology on selected drill core samples and access assessments.

Drilling has intersected sheeted NNE dipping magnetite veins with visible chalcopyrite, quartz-magnetite-chlorite>pyrite-chalcopyrite veins, silica>carbonate-sulfide veins and semi massive pyrite veins. These styles of mineralisation and broad propylitic alteration characteristics suggest the area could host concealed porphyry style mineralisation.

Approximately \$370,000 dollars has been spent on exploration with the majority of this on the deep drilling and further work is planned to follow up drill testing one of the previously identified chargeability anomalies. No reduction in the current licence area is requested.

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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 15km² was made by John McDougall and Southern Ocean Science Pty. Ltd. (SOSM) in 2004. The licence application was subsequently joint ventured with Gujurat NRE Minerals (Gujurat). A new application (a joint venture between GNM and SOSM) was then approved as EL 29/2006 (9 km²) and was then successfully partnered with an earn in period for Pluton Resources (Pluton). Currently Pluton is still earning 60% in to the project with Gujurat 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 the 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 Oliver's 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 a high quality un-sealed road (Lorinna Road). Internal access is via Old Lorinna Road, formed roads (eg: Wilks Road) and four wheel driveable fire breaks and tracks. Alternative access to the Cethana prospect is from the south of the tenement by way of the Lemonthyme Road (C139) and then ungazetted track (locally known as River Road).

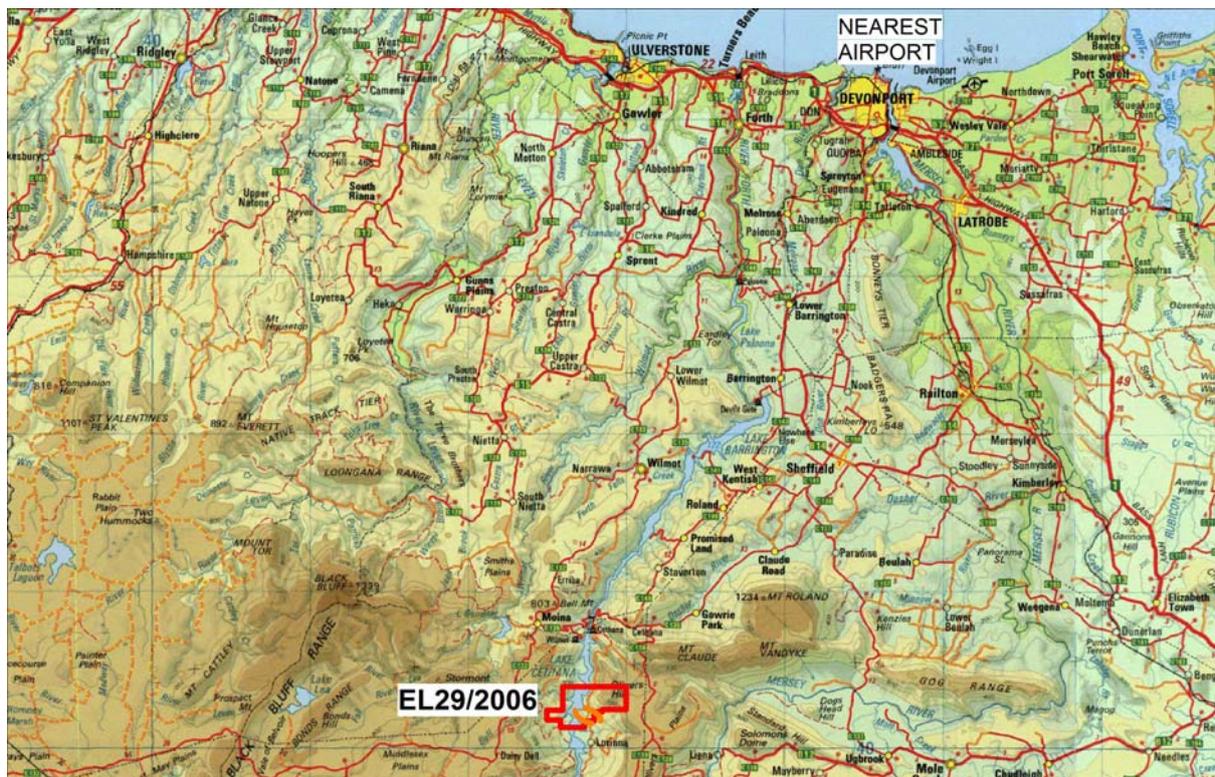


Figure 1 – Location of EL29/2006 relative to population centres (orange area is aeromagnetic anomaly outline)

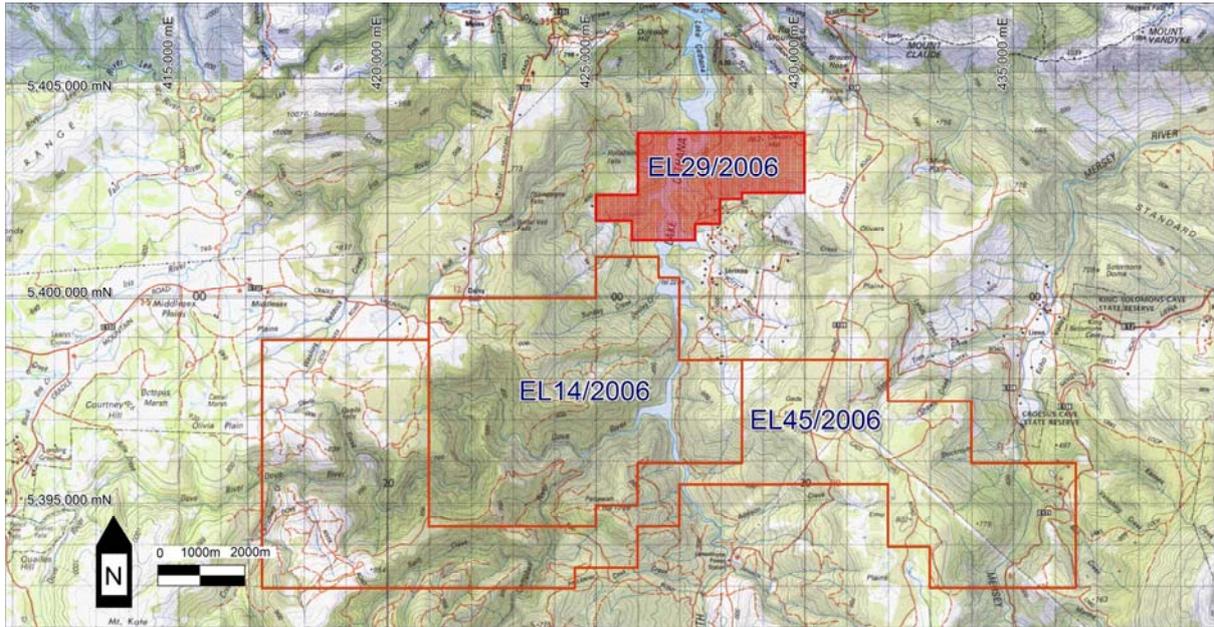


Figure 2 – Location of EL29/2006 relative to other granted Tasmanian Pluton Resources Tenements (1:100,000 Tasmap topographic base, AGD66 – Zone 55)

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 (eg. 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 Ck 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.

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.

Early Exploration History

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).

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.

Modern Exploration History

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 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).

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 12000×10^{-6} and 14000×10^{-6} c.g.s units. By comparison of the anomaly to Savage River (127000×10^{-6} c.g.s units) the susceptibility of the anomaly was attributed to 5-6% magnetite by volume and 10% by weight (Zarzavatjian, 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 35km²), 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', 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.

SHELL (1985-198)

In 1985, CRAE became managers in EL7/74 in a three-way joint venture with the Commonwealth Aluminium 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.

CRAE (1985-1988)

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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.

Work to March 2009

For a summary of work in the previous year please refer to the previous annual report

Drilling

Drilling was initially designed test the Cethana anomaly to depths of up to 700m. Diamond drilling consisted of HQ drill core with an NQ diamond 'tail' on CETD1. CETD1 drill core was sampled at one metre intervals using half core for assay determination by ICPMS for 48 elements and for Gold by 25g fire assay. Five metre composites of 5 samples were then taken for REE determinations. CETD2 drill core was less visibly mineralised and 1m half core samples were cut for assay determination by ICPMS for Cu, Pb, Zn, Ag, Fe and Co and for Gold by 25g fire assay. The 42 additional elements were assayed as 5m composites which were also used for REE determinations, all by ICPMS.

The first drill hole (CETD1) was collared over the centre of the Cethana magnetic anomaly and drilled on an azimuth of 210 degrees true, with a -80 degree dip to a depth of 600.9m. The aim of the drill hole was to prove the association between the magnetic anomaly and porphyry-style alteration and, if possible to identify associated copper-gold mineralisation. CETD1 intersected common visible chalcopyrite in veins from 213.2m to 316m down hole. The interval 319.3-411.85m contains common carbonate alteration possibly representing an 'epithermal overprint' with a wholesale reduction in mineralisation grade. Variable grades of mineralisation occur from 411.85m, including some strongly magnetic intervals from 443.2m to the end of hole. Significant intersections are listed below in Table 1.

Preliminary results indicate drill hole CETD1 was drilled marginal to the recently identified chargeability zones. Assay results and core textures from CETD1 are consistent with drilling having intersected alteration and mineralisation marginal to a porphyry target. The presence of visible copper mineralisation was encouraging and a second drill hole was planned.

CETD2 (282.3m) was collared late during collection of geophysical data and on identification of the second chargeability zone – the Campbells Reward Extension Zone. The planned drillhole was located on an existing road and access to the site was approved quickly due to the disturbed nature of the site. The target was the coincident nature of known metal anomalism (both in soil and rock chips) and a peak in ground magnetic data. The initial advice of a contract geophysicist was that the chargeability zone could also be targeted from the collar location.

Drill hole CETD2 intersected sporadic copper mineralisation in magnetite and quartz veins and semi-massive sulphide veins at depth, however, the acute angle at which veining was intersected was discouraging and suggested a 210 degree azimuth similar to the first drill hole was more appropriate and that the zone is better tested from a more northerly location. Preliminary investigation of the chargeability anomaly on section strongly suggests that the chargeability target remains untested. CETD2 significant intersections are also listed in the table below.

Hole_ID	From	To	Significant Interval
CETD1	213.00	218.00	5m @ 0.21% Cu, 0.13g/t Au, 4g/t Ag, 144ppm Mo and 137ppm Co
CETD1	245.00	263.00	18m @ 0.1% Cu, 0.08 g/t Au, 2.6 g/t Ag, 120ppm Mo and 73ppm Co
CETD2	125.00	127.00	2m @ 0.14% Cu, 0.12 g/t Au and 1.6 g/t Ag
CETD2	232.00	236.00	4m @ 0.16% Cu, 0.09 g/t Au and 2.1 g/t Ag

Table 1: Significant Cu-Au intersections from drill holes CETD1 and CETD2

Since assays were received, 14 samples were submitted for petrographic investigation by Paul Ashley, a contract geologist with experience in the Ordovician porphyry systems of NSW. Only six of these have been examined by the contract petrologist with the eight outstanding sample descriptions expected in the next month. Preliminary findings suggest that the volcanoclastics intersected in drilling are variably altered. The initial phase of alteration is commonly recognised by (occasionally foliated) sericite, chlorite and quartz and

there is an apparent ‘metamorphic’ overprint commonly characterised by biotite, magnetite, chlorite and quartz. More strongly altered samples were identified as being propylitically altered and one sample has a distinct metasomatic mineral assemblage including tourmaline. One interpretation was that syn-post volcanic phyllic and propylitic alteration is overprinted by a metamorphic event such as a later intrusion. If the preceding alteration is intrusion related the system may have multiple intrusive phases at depth, a common feature of porphyry systems. Full descriptions of the first batch of six samples are presented in Appendix 3.

Geophysics

Induced Polarisation Survey

Drilling in the previous reporting period coincided with a geophysical (induced polarisation) survey aimed at identifying concentrations of sulphide mineralisation at depth and within the area of the magnetic anomaly; the results of this survey were encouraging with two chargeable zones defined (see Figure 3 – below).

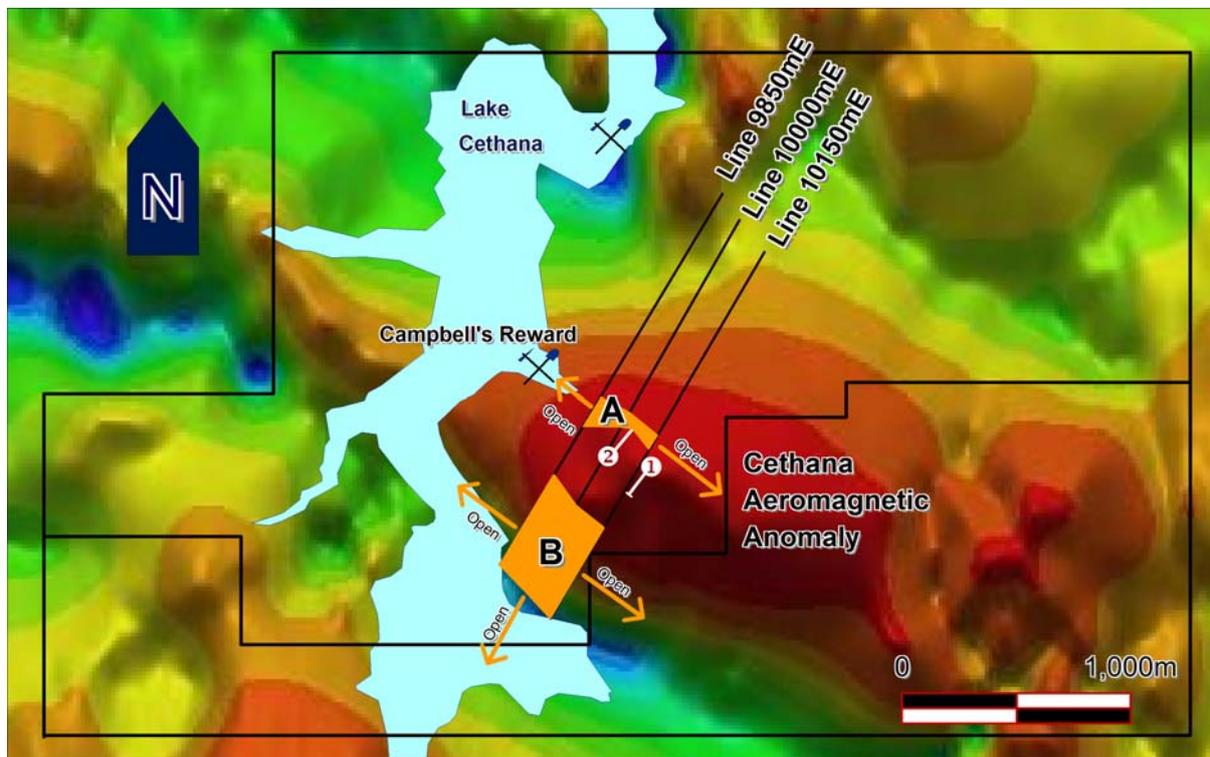


Figure 3: Schematic location of drill holes CETD1 and CETD2 (labelled 1 and 2 in white) with surface trace projected AND chargeability zones (Campbell's Reward Zone; A and Southern Zone; B) over WTRMP aeromagnetics showing the large (red) Cethana magnetic anomaly.

Mineralisation Model and discussion of results

The target style of mineralisation in the Cethana tenement is a bulk tonnage copper-gold system potentially related to the Dove Granite. The Dove Granite intrudes (possibly coeval?) Cambrian volcanics and older Precambrian schists and phyllites to the south and West of the Cethana anomaly. The area includes three known granite ‘stocks’ and porphyritic intrusives have been identified at the margins of these granite bodies.

Potentially deep crustal structures have been identified in airborne magnetic data to the north of the licence and are associated with variations in thickness within the basal Ordovician stratigraphy. These may have controlled the orientation of the Cethana Anomaly.

This has provided sufficient encouragement to investigate the potential of locating bulk tonnage copper-gold mineralisation of either an Eastern Australian porphyry style (eg: Cadia) or a disseminated style similar to the Mt Lyell deposits in Tasmania.

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

Assays from the initial drill program (particularly CETD1) indicate a strong copper-gold association although anomalism is generally weak-moderate with sub-economic grades. The two identified chargeability anomalies are not tested by the previous drilling program and provide excellent bulk tonnage targets with potential for much higher grades than previously drilled. A petrologist has confirmed alteration types typically associated with porphyry mineralisation suggesting that intrusive rocks occur at depth within the Cethana anomaly. Pluton believes the chance of an economically significant discovery at Cethana is high and future work is proposed below.

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. Drilling planned for this tenement year will target at least one chargeable zone for potential sulfide enrichment. The first hole will target the Campbells Reward Zone, the Southern Chargeability Zone will undergo more careful targeting.

Environment

Drill pads for CETD1 and CETD2 have been rehabilitated to a very high standard and are likely to require no further remediation. The cut lines from the IP survey are regenerating quickly and may need to be re-established if there are to be follow up surveys.

The disturbed site at the CETD2 drill pad is in better condition than when the site was first investigated as the excavator operator removed pre-existing rubbish from the site to the local land fill at our expense. The sumps for drilling CETD1 at the quarry on Lorinna Rd have been filled and do not appear to have subsided. No obvious disturbance is visible at either site other than the drill collars. Photos of the sites are presented in Appendix 4.

Expenditure

Total Expenditure for EL 29/2006 currently stands at \$367,271 with approximately \$60,000 expended this year and outstanding amounts likely to include ~\$10,000 on petrology and an independent industry expert opinion before the anniversary date. Expenditure will be updated in the upcoming March quarterly report.

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Keywords

Porphyry, Aeromagnetism, Induced Polarisation, Petrography, Diamond Drilling, Copper, Gold, Molybdenum, Cambrian volcanics, Mt Read Volcanics, Chargeability

Appendices

Appendix 1 – List of digital files

EL292006_200903_01_Report.pdf
EL292006_200903_02_DrillLogs.pdf
EL292006_200903_03_DrillLogCodes.pdf
EL292006_200903_04_DH_Collars.txt
EL292006_200903_05_DH_Survey.txt
EL292006_200903_06_DH_Assays.txt
EL292006_200903_07_DH_REE.txt

Appendix 2 – Drill Logs and Codes

Summary Drill Log and Header

Pluton Resources Ltd.

PROJECT:	Tas Porphyry	HOLE NO:	CETD1	DRILL TYPE:	Diamond
PROSPECT:	Cethana	DATE COMMENCED:	09-01-2008	DRILLER:	Spaulding Drillers
EL:	29/2006	DATE COMPLETED:	07-02-2008	LOGGED BY:	John McD
EASTING	427656 +/-	TOTAL DEPTH (m):	600.9	DATE:	30-03-2008
NORTHING	5402174 5m	AZIMUTH:	210	OXIDATION BOPO:	25.9
COLLAR RL:	305	DIP:	-80	BOCO:	9.0

Drilling details		
Core Size	From	To
HWT casing	0.00	27.00
HQ	0.00	263.00
NQ	263.00	600.90
BQ		

Comments
Hole designed to:- Test the centre of the Cethana Aeromagnetic anomaly from the easiest point of access (the quarry), HWT stayed in the hole (partially collapsed), Triple tube (HQ3) required to 129m to recover broken core. Hole lifted further than planned, trainee driller pushing rig too hard.

Summary Log			
From	To	Graphic	Summary Description (Lith, Altn, Mineralisation)
0.00	51.00	COu	Pebbly broken and bioturbated Sandstone - Moina Sandstone
50.90	60.80	Cv	Hematite and magnetite altered volcanics including breccias near up hole contact with pyrite to 10% over 50cm near contact
60.80	213.00	Cv	Grey - green med volcanoclastic sst with <10% qtz veins, occasional cb alteration, weak dissem py, mag>>py>cpy in qtz veins and trace mag-sx veins
213.00	228.10	Cv	Moderately foliated volcanoclastic with trace cpy up to 0.5% over a metre, including cpy in barite veins and pale green silica bands
228.10	242.50	Cv	Foliated medium grained volcanoclastics with up to 20% mag as veins plus up to 0.5% cpy in one metre intervals, 3-5% disseminated pyrite
242.50	245.30	Cv	Fine volcanoclastics with occasional cpy bearing veins and pale green foliated silica bands
245.30	262.80	Cv	Foliated and mineralised coarse volcanoclastic sandstone with light grey silicification, common 'sheeted' magnetite veins and disseminated pyrite
262.80	346.60	Cv	Grey-green medium grained (sometimes lapilli lithic) volcanoclastic sandstone with propylitic alteration and occasional sulphidic veins
346.60	443.40	Cv	Medium-coarse dark grey commonly lapilli lithic volcanoclastic sandstone with weak mag veining/ alteration and trace sulphidic veins
443.40	600.90	Cv	Chlorite-magnetite altered volcanoclastics with lapilli lithic and occasionally quartz eye rich and hornfels spotted zones and mag veins
		EOH	

Significant Intervals:			
Hole_ID	From	To	Interval
CETD1	213.00	218.00	5m @ 0.21% Cu, 0.13g/t Au, 4g/t Ag, 144ppm Mo and 137ppm Co
CETD1	227.00	231.00	4m @ 0.055% Cu, 0.07g/t Au, 1.8g/t Ag, 51ppm Mo and 61ppm Co
CETD1	245.00	263.00	18m @ 0.1% Cu, 0.08 g/t, 2.6 g/t Ag, 120ppm Mo and 73ppm Co
CETD1	285.00	296.00	11m @ 0.044% Cu, 0.03g/t Au, 2.8 g/t Ag, 57ppm Mo and 98ppm Co
CETD1	435.00	437.00	2m @ 0.1% Cu, 0.045 g/t Au, 1.5 g/t Ag, 15ppm Mo and 28ppm Co
CETD1	453.00	462.00	9m @ 0.035% Cu, 0.03 g/t Au, 0.7g/t Ag, 80ppm Mo and 44ppm Co
CETD1	495.00	508.00	13m @ 0.033% Cu, 0.03 g/t Au, 0.4 g/t Ag, 60ppm Mo and 54ppm Co
CETD1	535.00	562.00	27m @ 0.03% Cu, 0.03 g/t Au, 0.4 g/t Ag, 71ppm Mo and 43ppm Co

Pluton Resources Detailed Drill Log																																				
Hole Number	CETD1	Sheet No	Mineralisation / Alteration and additional descriptors																									Full description: including colour, main alteration type and								
INTERVAL		ROCK CODES		Alteration summary				Pyrite		Chalco		Moly		Magnet		Potassic		Phyllic		Propylitic		Argillic		Silicific'n		QVN		Other minerals / texture / colour								
FROM (m)	TO (m)	Strat Code	Rock type	Primary Altn	2nd Altn	3rd Altn	Weathering	Syhe	Amount %	Syhe	Amount %	Syhe	Amount %	Syhe	Amount %	Syhe	Amount (WMS)	Syhe	Amount (WMS)	Syhe	Amount (WMS)	Syhe	Amount (WMS)	Syhe	Amount (WMS)	Mineral 1	Syhe	Amount %	Mineral 2	Syhe	Amount %	Broken (WMS)	Colour			
0.00	9.10	Q	CCOL				M																								S	C-W	Cream and white moina sst rubble and rounded pebbles			
9.10	21.20	COu	SSAND				W																							S	2A-1P	Fine-medium grained light grey (silicified?) and light pink (hematitic?) cream sandstone (Moina Sandstone) with a few limonite bands				
21.20	23.00	COu	CGOSS	Hem			S						D	5												He	P	30			W	3R-2O	Red and orange gossanous hematitic and limonitic medium grained sandstone with relict magnetite precursor disseminated in the matrix, pyrite on down hole contact			
23.00	31.00	COu	SSILT				T	Rp	0.2																						M	2A-2Br-4Br	Light tan and light grey siltstone with dark brown 'sandy' interbeds with strong banded (almost skarn like) appearance, silty beds increasing down hole, lenses of py to 2cm			
31.00	50.90	COu	SPEBSAND	Sil			T	D	0.5				D	0.2																		M	3A-1A	Light grey-green fine sandstone with light tan silty interbeds (occasionally pale yellow sericitised?) trending sandstone dominant down hole and with an increasing pebble content and common bioturbation, foliated (w-m), moderately-strongly silicified with associated weakly disseminated magnetite and py and trace chalcopyrite approaching downhole contact (transitional) with hematitic 'sedimentary breccia'		
50.90	54.00	Cu	SBREC	Mag	Hem		T	D	1				Rp	4													Cb	vn	0.1	He	Rp	4	W	1Y-C-2R-2A	Grey, light yellow and red interbedded 'sedimentary breccia' with pebbly quartz to 3mm on uphole 'contact' and disseminated pyrite to 10% as clots over the first 50cm, probable silicification light grey areas with magnetite altered angular clasts to 3cm, interbeds of 'silty' matrix supported material are light yellow sericitised? and interbedded with a hematitic volcaniclastic? breccia (with weak selective chloritisation of clasts to 4cm) approaching the down hole contact.	
54.00	55.60	Cu	SBREC	Hem	Mag		T	Sp	1				Rp	5													He	Rp	30			W/M	3R-4A	Dark reddish maroon pervasively and selectively hematite altered breccia with medium coarse matrix and angular magnetite altered clasts to 3cm, disseminated pyrite to 0.5%, clots and veins of carbonate both to 3mm		
55.60	60.80	Cv	VSST	Hem			T	D	0.2				Bnd	2												Sp	vw		He	Bnd	8		W	3R-2A	Grey and red hematitic coarse quartz rich (30%) volcaniclastic sandstone, hematite and lesser magnetite replacing the matrix in the foliation and causing a moderately laminated/banded appearance commonly subparallel to probable bedding, trace hydrous Fe oxides as spots and possible weathering in hematitic bands. Less altered parts are light-med grey with a greenish epidote? discoloration	
60.80	69.05	Cv	VSST	Sil	Cb			Vn	0.2				Vn	1													P	w		Cb	sP	8		W/M	3A	Medium grey weakly foliated moderately magnetite altered and weakly carbonate altered (fine veinlets in foliation) coarse qtz rich (25% and to 4mm) volcaniclastic sandstone, massive magnetite with associated pyrite-hematite alteration of this unit at the contact with the finer unit. Trace limonite on fractures, jasper veinlets and possible rare chloritic alteration of 'clasts' or selective clotty replacement
69.05	99.80	Cv	VSST	Ch	Cb			Vn	0.1				D	3													sP	m		Cb	sP	3		W	3Gr-3A	Grey-bluish green fine grained foliated, pervasively chlorite (w) and carbonate (veinlet swarm) altered sparsely quartz phyrlic volcaniclastic sandstone with fine disseminated magnetite (3%) and occasional pale cream spotting to 1mm (5%), occasional selceively replaced 'clots' of cb altered material to 4cm or chl-mag selective replacement (78-79.2 and 84.8-90) possibly highlighting coarser primary volcaniclastic texture, trace silica-pyrite, jasper, hematite-pyrite and quartz veins to 2mm
99.80	108.80	Cv	VSST	QVN	Prop			Vn	0.3	Vn	0.01		Vn	4							P	m					m	He	Vn	0.2	Ch	Vn	1	M/S	4Gr-4A	Dark grey and green fine grained volcaniclastic sandstone with common quartz vein, typically quartz-magnetite-chlorite-py-cpy with one hematite bearing quartz vein, significant disseminated magnetite and pervasive chloritisation of matrix, 3-5% quartz, typically 1mm but up to 2.5mm
108.80	132.20	Cv	VSST	Prop				Vn	1	Vn	0.01		Rp	6							P	w/m											W/M	4A	Dark grey and lesser light grey and dark green sparsely quartz phyrlic fine-medium volcaniclastic sandstone with sparse quartz veining and common weak selective magnetite clot replacement, occasional magnetite veins to 3cm and typically 2 quartz veins/metre, 1% pyrite and trace chalcopyrite in veins, zones of coarser material	
132.20	166.80	Cv	VSST	QVN	Prop			Vn	0.1	Vn	0.01		Rp	4							P	m											W	4Gr-4A	Dark grey and green fine grained weakly foliated volcaniclastic sandstone with moderate quartz (+chlorite) veining up to 30% by volume over 1m but typically 8-10%, veins contain chlorite clots and selvages/alteration halos, magnetite contributes up to 5% of vein material with trace pyrite and lesser chalcopyrite and epidote in selvages, foliation and quartz-chlorite veining within the foliation has an approximate -70 degree	
166.80	170.50	Cv	VSST	Cb				Vn	0.05				Vn	0.1							Vn	w/m											M/S	2A-2Br	Light tan, grey, medium brown and cream coarse volcaniclastic sandstone with creamy coloured carbonate, probably siderite as veins and selective clotty replacement, weak strong brecciation, probable magnetite destructive overprint, no mag response, occasional qt-hem-py-cpy veins	
170.50	213.20	Cv	VSST	Prop	Sil			Vn	0.02				Rp	5							P	m					P	w	w	He	Vn	0.1		W	5A/Gr>3A	Dark Grey-green and lesser medium grey 'massive' volcaniclastic, occasional foliated zones with cpy in veins, trace cpy overall, 2-5% quartz veining 85% of veins are barren magnetite-chlorite-quartz, sparse magnetite veins include trace amounts of fine sulphide, occasional jasper veins, some quartz veins have cb selvages

Pluton Resources Detailed Drill Log

Hole Number		CETD1	Sheet No	Mineralisation / Alteration and additional descriptors																				Full description: including colour, main alteration type and strength, component minerals (pref in order of abundance), rock type, texture, alteration and mineralisation details eg: pale green phyllic (moderate) quartz-feldspar pyritic dacite porphyry, phenocrysts to 4mm, sericite (m) altered phenocrysts, silica (w) altered groundmass, pyrite(3-5%) as disseminations and minor veinlets						
INTERVAL		ROCK CODES		Alteration summary				Pyrite		Chalco		Moly		Magnet		Potassic	Phyllic	Propylitic	Argillic	Silicific'n	QVN	Other minerals / texture / colour								
FROM (m)	TO (m)	Strat Code	Rock type	Primary Altn	2nd Altn	3rd Altn	Weathering	Syle	Amount %	Syle	Amount %	Syle	Amount %	Syle	Amount %	Syle	Amount (WMS)	Syle	Amount (WMS)	Syle	Amount (WMS)	Mineral 1	Syle	Amount %	Mineral 2	Syle	Amount %	Broken (WMS)	Colour	
213.20	217.50	Cv	OHBx	Sil				Vn	3	Vn	0.5			Vn	6					sP	s							M	5Br-1A	Strongly foliated and altered, pale green silicified and dark brown magnetite (s) alteration/veining of brecciated probable coarse volcaniclastic sandstone, with silica-p-cpy veins and magnetite veins (m), approximately 0.5% chalcocopyrite, occasional grey-green silica bands, occasional qtz->hematite veins with approximately 5% sulphide in the selvedge
217.50	228.10	Cv	VSST	Prop	Sil	QVN		D	0.5	Vn	0.01			D	6					P	m							W	3A-3Gr	Light grey-medium green chloritic, silicified (semi pervasive) and magnetite altered weakly foliated medium grained volcaniclastic sandstone, weak to moderate quartz-chlorite veins, trace siderite veinlets, 0.5% disseminated pyrite, possible KSP altn at
228.10	231.00	Cv	VSST	Sil	Prop			Vn	2	Vn	0.2			Vn	15					sP	w		Ba	Vn	0.5			W	3A-1Gr	Light grey-pale green strongly foliated and occasionally brecciated silicified and magnetite altered volcaniclastic with up to 20% mag as veinlet swarms, pyrite and cpy present as vein selvages including one white and red (barite?) crystalline vein
231.00	237.25	Cv	VSST	Prop				D	1					D	5					P	m							W	3Gr-4A	Dark grey-green propylitically altered medium grained volcaniclastic sandstone with pervasive chlorite in the matrix, <5% quartz clasts to 3mm, disseminated pyrite 1%
237.25	244.25	Cv	VSST	Sil	Prop			Vn	2	Vn	0.1			Vn	2					sP	w							W	3A-4Gr-1Gr	Medium grey-dark green, pale green and cream banded silicified and magnetite altered foliated volcaniclastic sandstone with pyrite as disseminations in veins to 2%, trace chalcocopyrite, bands occur in probable coarser beds with strong brecciation with moderate-strong foliation
244.25	245.30	Cv	VSST	Prop				D	1					Sp	4					P	m/s							W	4A-4Gr	Dark grey and green propylitically altered volcaniclastic sandstone, moderately magnetic, weakly disseminated pyrite
245.30	262.80	Cv	VSST	Mag	Sil	Prop		D	2.5	Sp	0.01			Vn	15					sP	w/m							W	3A-4Br	Light grey and medium brown commonly magnetite veined or altered, foliated and mineralised coarse volcaniclastic sandstone, light grey silicification with common micro veinlet stringer swarms of magnetite, abundant disseminated pyrite in wider magnetite bands, trace cpy as clots in veins
262.80	267.90	Cv	VSST	Mag	Prop			Vn	2	D	0.01			Vn	8					sP	w							W	3A	Medium grey moderately foliated fine volcaniclastic sandstone with quartz to 3mm, weakly pyritic as bands and disseminations in reddish magnetite bearing bands, fine magnetite veinlet swarms
267.90	271.10	Cv	VSST	Prop	Sil			D	1.5					D	4					P	w							W	4A-3Gr	Grey-medium green homogeneous fine-medium grained volcaniclastic sandstone with 4% disseminated/replacement style? magnetite and minor disseminated pyrite
271.10	316.00	Cv	VSST	Prop	Sil			Vn	1	Vn	0.01			Vn	4					P	vw							W	3A	Medium grey moderately foliated fine-medium grained volcaniclastic sandstone with sparse quartz to 3mm, weakly silicified and weakly mineralised (pyrite as veins), occasional med-coarse sandstone interbeds with clotty chlorite
316.00	317.80	Cv	VSST	SISX	Prop			Vn	5					Vn	3.5					sP	w/m				Po	Vn	1	W	1A-4A	Dark and light grey 'autobrecciated' hydrothermally altered (silicified and brecciated) fine-med volcaniclastic sandstone with significant magnetite and pyrite veining, trace cpy associated with 1% pyrrhotite in a po-py vein
317.80	319.30	Cv	VSST	Prop				D	1.5					D	5					P	m							W	3Gr	Med-dark green fine-medium grained propylitically altered volcaniclastic sandstone with up to 3% disseminated/clotty pyrite
319.30	346.60	Cv	VLSST	Prop	QVN			D	0.01					D	3						m							W	3Gr-2A	Green-light grey weakly quartz veined, weakly foliated coarse lapilli lithic volcaniclastic sandstone, clasts flattened in the foliation and chlorite->magnetite replaced, occasional cherty silica veins with clotty cpy, includes some sub-rounded silicified clasts to 2%, possible mass flow unit
346.60	361.50	Cv	VSLST	Sil				Sp	1					D	1					P	vw							W	2A-4A	Light tan and grey fine volcaniclastic siltstone-sandstone sequence with small clots of pyrite (1%)

Pluton Resources Detailed Drill Log

Hole Number	CETD2	Sheet No	Mineralisation / Alteration and additional descriptors																				Full description: including colour, main alteration type and strength, component minerals (pref in order of abundance), rock type, texture, alteration and mineralisation details eg: pale green phyllic (moderate) quartz-feldspar phric dacite porphyry, phenocrysts to 4mm, sericite (m) altered phenocrysts, silica (w) altered groundmass, pyrite(3-5%) as disseminations and minor veinlets														
INTERVAL		ROCK CODES		Alteration summary				Pyrite		Chalco		Moly		Magnet		Potassic		Phyllic		Propylitic		Argillic		Silicific'n		QVN		Other minerals / texture / colour									
FROM (m)	TO (m)	Strat Code	Rock type	Primary Altn	2nd Altn	3rd Altn	Weathering	Sylve	Amount %	Sylve	Amount %	Sylve	Amount %	Sylve	Amount %	Sylve	Amount (WMS)	Sylve	Amount (WMS)	Sylve	Amount (WMS)	Sylve	Amount (WMS)	Sylve	Amount (WMS)	Mineral 1	Sylve	Amount %	Mineral 2	Sylve	Amount %	Broken (WMS)	Colour				
0.00	6.00		CSOILB				s																									s	2O	Light orange clay with 5-10% rounded pebbles			
6.00	31.80	Q	CALUV				M																									w	4Br	Med-dark brown competent clay with mud-silt sized micaceous fraction and occasional plant fragments - very likely to be lacustrine sediment			
31.80	31.90	Q	CALUV				w																									M	2A-5Br	Fine grey mud/ash with coalified organics/charcoal			
31.90	32.00	T	SCONG				w																									w	3O	Medium orange conglomerate with rounded and angular pebbles of silicified sandstone and felsic volcanics within a moderate - coarse limonitic matrix			
32.00	33.00	T	SBREC				M																									M	C-2O	Light orange sub-gossanous rubble breccia with a hematitic and limonitic matrix, possible moina sst clasts			
33.00	34.00	Cv	VSST	Sil	Prop		M	D	0.1											Sp	w				P	w/m	He	SP	10			M	2A-2O	Moderately weathered light pale green, grey and orange medium grained volcaniclastic sandstone with 15% quartz and flattened lithics at approx 10 deg LCA, sil (w-m), foliated (m) 15 deg to LCA			
34.00	36.40	Cv	VSST	Sil	Phyl	Prop	w	D	1				Sp	3						SP	w	P	w			SP	m	Li	D	10			M	3A-2O	Moderately weathered light grey-green and orange medium grained volcaniclastic sandstone with 15-20% quartz with moderately silicified matrix, moderate pervasive chlorite, limonitic boxwork after pyrite? and limonitic fractures commonly at 30 and 45 deg to LCA, occasional mag veins at 5 deg to LCA and clots, some iron oxide staining from weathering, up to 1% disseminated pyrite		
36.40	56.50	Cv	VSST	Prop	Phyl		D	2	Vn	0.05			SP	8						SP	w	P	m/s	Vn	w	SP	m	Cb	Vn	0.1	He	Vn	0.1	M	4A	Dark grey-green medium grained volcaniclastic sandstone with possible flattened lithic at 10-15 deg LCA, selective magnetite replacement of lithic components and quartz to 4mm - variable content to 20% but typically 5-10% with larger quartzes occasionally smoky, fine limonitic boxwork after strongly disseminated magnetite, very fine (<0.5mm) disseminated pyrite to 1% and possible argillic overprint, magnetite is pervasive in darker zones. Veining consists of sparse jasper veins with hematitic and pyritic selvages, magnetite-carbonate veins at 30 deg to LCA, silica magnetite veins at 10 deg to LCA. Silica 55%>Chl 25-30%>Magnetite 8%>quartz 6%>veins>pyrite 1%	
56.50	61.20	Cv	VSST	Prop	Sil		D	3	Vn	0.2			D	6							P	m				SP	m	w	Aspy	Vn	0.1			W	3A	Medium grey medium grained volcaniclastic sandstone with possible flattened lithics at 10-15 deg LCA, selective magnetite replacement and quartz to 4mm - variable content to 20% but typically 5-10%, common silica veins with disseminated pyrite halos (3% pyrite) and occasional cpy phase in veins, particularly 1 @ 50m bearing Aspy and Cpy at 28 deg to LCA	
61.20	66.00	Cv	VSST	QVN	Prop		D	1					Vn	8							P	m												W	3A	Medium grey medium grained volcaniclastic sandstone with possible flattened lithics at 10-15 deg LCA, selective magnetite replacement and quartz to 4mm - variable content to 20% but typically 5-10%, common quartz-chlorite-magnetite-carbonate (siderite?) veins, magnetite is strong in 'fractured' quartz-chlorite vein selvages	
66.00	77.70	Cv	VSST	Prop			D	0.5					P	8							p	m												W	4Gr-4A	Medium grey-green fine grained volcaniclastic sandstone with <5% quartz, 0.5% disseminated pyrite and strong magnetite-chlorite alteration (pervasive propylitic)	
77.70	81.00	Cv	VSST	Prop	QVN		D	0.2					Sp	8							P	m					w/m	Ep	Vn	0.2				W	4Gr-4A	Dark grey-green moderate propylitic alteration of fine volcaniclastic sandstone with several quartz-magnetite-chlorite-epidote veins typically with a strong chloritic alteration selvage + siderite (unreactive carbonate)	
81.00	91.40	Cv	VSST	Prop	QVN		D	4	Vn	0.02			D	8							P	m					w/m	Ep	Vn	0.5				W	4A	Very dark grey fine volcaniclastic sandstone with occasional fine epidote veins, occasional quartz-epidote-chlorite veins at high LCA and pyrite bearing quartz veins at 30-40 deg to LCA including veins with very strong chloritic selvages	
91.40	94.00	Cv	VSST	QVN	Prop		Vn	2					Vn	10							P	s													W	4Gr-4A	Dark grey-green strong propylitic alteration of fine volcaniclastic sandstone with disseminated mag and moderate-strong quartz veining, typically qtz-mag-chl selvage (s) veins at high to moderate angle to LCA trace cpy in veins and one py rich vein
94.00	101.00	Cv	VSST	Prop			D	0.02					P	8							P	m													W	4A	Very dark grey fine possibly weakly lithic volcaniclastic sandstone with moderate propylitic alteration dominated by strongly disseminated magnetite and weak pervasive chlorite, up to 2% fine quartz, trace magnetite as veins and trace disseminated pyrite
101.00	107.00	Cv	VSST	Prop	QVN				Vn	0.1			D	8							P	m						m/s	Ep	Vn	1.5				W	4Gr-4A	Dark grey-green strong propylitic alteration of fine volcaniclastic sandstone with disseminated mag and moderate-strong quartz veining, typically qtz-mag-epidote clots and chloritic selvage (s) veins at high to moderate angle to LCA, quartz veins are commonly sinuous ladder like veins with magnetite and cpy in the partings
107.00	122.50	Cv	VSST	Prop									D	9							P	m													W	3Gr-4A	Dark grey-green moderately propylitically altered medium grained volcaniclastic sandstone with <5% quartz and sparse quartz-magnetite-cpy veins at high angle to LCA and trace magnetite-pyrite veins at 15-30 deg to LCA
122.50	127.00	Cv	VSST	Prop	QVN		Vn	3	Vn	0.02			Vn	15							P	s					Vn	m	m/s					M	3Gr	Moderate-dark green medium grained volcaniclastic dominated by quartz-mag-chl veins and a low angle to LCA sil-mag-py and tr cpy vein	

Lithology				Lithology (cont)			
CATEGORY	CODE	LITHOLOGY	New Lith_ID	CATEGORY	CODE	LITHOLOGY	New Lith_ID
COVER SEQUENCES	CFIL	Undifferentiated fill eg: drill pad/road rubble		INTRUSIVES	IFUND	Felsic undifferentiated intrusive	
	CLOS	Core loss - no lithology			IFGRAD	Granite	
	CAVE	Cavity or old workings			IFGRAD	Granodiorite	
	CASH	Recent ash fall			IFADAM	Adamellite	
	CSOILA	A horizon soil			IFPEG	Pegmatite	
	CSOILB	B horizon soil			IFGA	Intrusive fine grained granite - aplite or microgranite	
	CALUV	Alluvium			IUUND	Intrusive intermediate undifferentiated	
	CCOL	Colluvium			IISY	Syenite	
	CELLUV	Elluvium			IID	Diorite (plag dominant, includes porphyry)	
	CAEOL	Aeolian			IIM	Monzonite (typically k-felds 35-65%, includes porphyry)	
	CHRD	Hardpan			IIT	Tonalite (qtz bearing >20% diorite, includes porphyry)	
	CFCT	Ferricrete			IIMDI	monzodiorite (plag rich up to 90%, includes porphyry)	
	CCCT	Calcrete			IIA	Anorthosite	
	CSCT	Silcrete			IMUND	Mafic intrusive - undifferentiated	
	CGOSS	Gossan !			IMGB	Gabbro	
SEDIMENTARY	SUCLAST	sedimentary undifferentiated clastic			IMDL	Dolerite	
	SUCHEM	sedimentary undifferentiated chemical			IMN	Norite	
	SSHALE	shale (includes carbonaceous/graphitic fine layered sediments)			IUUND	Ultramafic intrusive undifferentiated	
	SMDST	mudstone			IUPYRX	Pyroxenite	
	SSILT	siltstone			IUPERID	Peridotite	
	SSAND	sandstone - grain size not measured			IUDUNT	Dunite	
	SCONG	conglomerate - grainsize not measured		TECTONIC	TFBX	Fault breccia	
	SGWAC	greywacke			TCATA	Cataclasite	
	SFSAND	Fine sandstone (0.06-0.25mm)			TMYO	Mylonite	
	SMSAND	Medium sandstone (0.25-0.5mm)			TFG	Fault gouge	
	SCSAND	Coarse sandstone (0.5-2mm)		METAMORPHIC	MUSED	Undifferentiated metasediments	
	SGRANSAND	Granule sandstone - max detrital qtz grains 2-4mm			MSLAT	Slate	
	SGRANCONG	Granule conglomerate >50% 2-4mm grains/clasts			MPHYL	Phyllite	
	SPBSAND	Pebble sandstone - max detrital qtz grains 4-64mm			MSHST	Schist	
	SPBECONG	Pebble conglomerate >50% 4-64mm clasts			MQTZ	Quartzite	
	SCOBCONG	Cobble conglomerate clasts > 64mm commonly present			MHORN	Hornfels	
	SVCONG	Conglomerate with dominant volcanic clasts			MMBL	Marble	
	STILL	Tillite			MGN	Gneiss	
	SARK	arkose			MFGN	Felsic Gneiss	
	SESST	Epiclastic sandstone			MIGN	Intermediate gneiss	
	SBREC	Sedimentary breccia			MMSHST	Mafic schist	
	SCHERT	Chert			MMGN	Mafic Gneiss	
	SDOLM	Dolomite			MMA	Amphibolite	
	SLMST	Limestone			MUMSHST	Ultramafic schist	
	SLMST	Limestone			MUMSERP	Serpentinite	
	SBIFOX	Banded Iron Formation - Oxide Facies		STRONGLY MINERALISED / ALTERED	MSSX	Massive Sulphide ! - only to be used where the rock type is not clear, MSSX should be used primarily as an alteration/mineralisation code	
	SBIFCB	Banded Iron Formation - Carbonate Facies			MSSXC	Massive Sulphide (cumulate)	
	SBIFSX	Banded Iron Formation - Sulphide Facies		OTHER	OSKARN	Skarn - Only to be used where no primary textures are seen and alteration is pervasive and strong, undifferentiated sedimentary or igneous code code should be used as a preference	
	SCOAL	Coal			OVEIN	Vein - only to be used where the whole interval consist of a vein or >60% veining where alteration is so strong that primary textures are not evident, undifferentiated sedimentary or igneous code code should be used as a preference and vein orientations should be stored in structure	
VOLCANICLASTICS	VMDST	volcaniclastic mudstone			OIL	Lamprophyre	
	VSLST	volcaniclastic siltstone			OIK	Kimberlite	
	VSST	volcaniclastic sandstone			OIC	Carbonatite	
	VQXSST	quartz-crystal-rich volcaniclastic sandstone			OIP	Pepperite (describe phases fully)	
	VPSST	Pumecious volcaniclastic sandstone			OHBX	Hydrothermal breccia	
	VLLSST	Lapilli lithic volcaniclastic sandstone (lapilli size lithics)					
	VBLSST	Block lithic volcaniclastic sandstone (block sized lithics)					
	VB	volcanic breccia (undifferentiated origin)					
	VBB	volcanic block breccia (undifferentiated origin)					
	VUND	Undifferentiated volcaniclastic					
LAVAS	LFR	Rhyolite lava					
	LFD	Dacite lava					
	LIT	Trachyte - typically packed feldspars					
	LIA	Andesite lava					
	LMB	Basalt lava					
	LFUND	Undifferentiated felsic lava					
	LIUND	Undifferentiated intermediate lava					
	LMUND	Undifferentiated mafic lava					
	LUUND	Ultramafic lava - undifferentiated					
	LUKOMT	Komatite					

Appendix 3 – Petrology descriptions (Paul Ashley - Adjunct Associate Professor UNE)

CETD1 589.6 m TS

Summary: Metamorphosed and recrystallised coarsely fragmental felsic volcanic, e.g. crystal-lithic-vitric tuff, perhaps of originally dacitic composition. The rock has recrystallised lithic fragments, relict phenocrystal quartz and pseudomorphs after former phenocrystal grains of ferromagnesian and feldspar. In the recrystallised matrix, there are rare relict shapes after former glass shards. The rock was possibly altered and deformed, with development of a weak foliation in the matrix and accompanying development of sericite. Subsequently, a metamorphic overprint caused fine grained recrystallisation of the matrix and former feldspar and ferromagnesian components with replacement by an assemblage of biotite, feldspars, quartz and chlorite, with minor muscovite/sericite, magnetite and traces of carbonate, tourmaline, titanite, allanite, pyrite and chalcopyrite.

Handspecimen: The drill core sample is composed of a massive, porphyritic, dark grey quartzofeldspathic rock, probably containing considerable metamorphic biotite. It displays scattered quartz phenocrysts up to 5 mm across and possible altered feldspar grains, in a finer grained matrix. A few small grains of pyrite are evident and the rock must contain disseminated magnetite, as it is strongly magnetic, with susceptibility up to 6810×10^{-5} SI units.

Petrographic Section:

a) Primary mineralogy and textures: In the section, it is apparent that the rock has been rather strongly recrystallised and altered, most likely as a result of metamorphism, but relict texture is moderately well preserved. It is probable that the rock represents a type of coarse felsic volcanoclastic. There are diffuse outlines after former volcanic lithic fragments up to several millimetres across, relict phenocrystal grains of quartz up to 5 mm across and “ghosted” pseudomorphs after former phenocrystal grains of feldspars (e.g. plagioclase) and ferromagnesian. Relict shapes of the latter suggest that biotite might have been one of the original ferromagnesian phases. The remainder of the rock constitutes recrystallised finer grained quartzofeldspathic matrix material in which there are rare pseudomorphs after former glass shards, along with a few small relict grains of apatite and zircon. From the relict textural features and the bulk composition of the sample, it is interpreted that the rock was a crystal-lithic-vitric tuff, perhaps of dacitic type.

b) Alteration and structure: The original volcanoclastic rock was metamorphosed and strongly recrystallised. However, it is likely that prior to metamorphic recrystallisation, the rock underwent initial low grade alteration and deformation, resulting in the development of a weak foliation in the matrix and partial replacement of the matrix by fine grained sericite (defining the foliation). Subsequently, a thermal metamorphic event was imposed, causing partial recrystallisation and replacement (matrix, former feldspar and ferromagnesian phenocrysts). The matrix was replaced by fine grained granular quartz, feldspars, biotite, sericite and subordinate chlorite, with scattered grains and aggregates of magnetite and traces of carbonate, titanite, allanite, pyrite and tourmaline. Former ferromagnesian grains were replaced by aggregates containing one or more of biotite, chlorite, muscovite/sericite, magnetite and trace tourmaline, pyrite and chalcopyrite. Feldspars were recrystallised and partly replaced by biotite and chlorite. In the matrix, there is local growth of coarser, porphyroblastic feldspar, some of which is K-feldspar, but albite probably predominates. Metamorphic biotite has random orientation, overprinting the earlier sericite foliation. Metamorphism has attained at least biotite grade.

c) Mineragraphy and paragenesis: There has been rather strong development of magnetite in the rock, with disseminated grain and aggregates up to 3 mm across, in places with biotite, chlorite and trace pyrite. There are also discrete grains of pyrite up to 0.3 mm across, and trace chalcopyrite, commonly at altered ferromagnesian sites.

Mineral Mode: Approximate modal proportions are: feldspars (plagioclase > K-feldspar) 35%, quartz 30%, biotite 15%, sericite/muscovite 10%, chlorite 5%, magnetite 4% and traces of carbonate, apatite, zircon, allanite, tourmaline, titanite, pyrite and chalcopyrite.

Interpretation and Comments: It is interpreted that the sample is a metamorphosed and recrystallised coarsely fragmental felsic volcanic, e.g. dacitic crystal-lithic-vitric tuff. The rock has recrystallised lithic fragments, relict phenocrystal quartz and pseudomorphs after former phenocrystal grains of ferromagnesian and feldspar. In the recrystallised matrix, there are rare relict shapes after former glass shards. The rock was possibly altered and deformed, with development of sericite and a weak foliation in the matrix. Subsequently, a metamorphic overprint to biotite grade caused fine grained recrystallisation of the matrix and former feldspar and ferromagnesian components with replacement by an assemblage of biotite, feldspars, quartz and chlorite, with minor muscovite/sericite, magnetite and traces of carbonate, tourmaline, titanite, allanite, pyrite and chalcopyrite.

CETD2 144.45 m TS

Summary: Metamorphosed altered medium to coarse grained volcanoclastic rock, e.g. lithic-crystal-vitric tuff of felsic composition. The original rock contained scattered volcanic lithic fragments and phenocrystal grains of quartz, feldspar and ferromagnesian phases, with traces of apatite, in a matrix that probably had significant vitric material. It is likely that the rock underwent early alteration, with development of foliated sericite and layer-parallel quartz aggregates. There was a subsequent metamorphic overprint, with recrystallisation to a non-foliated assemblage of biotite, quartz, chlorite and magnetite. Minor pyrite occurs with magnetite and also occurs as discrete subhedra.

Handspecimen: The drill core sample is composed of a dark grey, metamorphosed porphyritic volcanic rock, with a few relict quartz phenocrysts and groundmass material recrystallised to fine grained quartz, feldspar, metamorphic biotite, chlorite and magnetite. Irregular to veinlike magnetite aggregates are present, some of which are associated with minor pyrite. A weak foliation occurs approximately parallel to the core axis. Due to the presence of visible magnetite, the rock is very strongly magnetic, with susceptibility up to 1240×10^{-4} SI units.

Petrographic Section:

a) Primary mineralogy and textures: In the section, relict texture is moderately preserved and it is likely that the rock represents a layered, medium to coarse grained lithic-crystal felsic tuff. There are a few relict phenocrystal grains of quartz up to 2 mm across and uncommon apatite microphenocrysts up to 0.7 mm across. Scattered former feldspar and ferromagnesian grains were up to 1.5 mm across and have been completely altered. The rock contains "ghosted" lithic fragments up to a few millimetres across, some of which are porphyritic. Other fragments might represent former wispy vitric material. The matrix enclosing the fragments and phenocrystal grains is finer grained, weakly foliated and could represent former vitriclastic material.

b) Alteration and structure: It is interpreted that the original volcanoclastic rock was underwent alteration and deformation, followed by an overprinting metamorphic event, leading to considerable recrystallisation. Initial alteration appears to have been of quartz-sericite type, with partial replacement of original feldspar (although minor albitic feldspar remains) and development of fine grained foliated sericite aggregates and, in one part of the section, strong replacement, parallel to foliation by veinlike masses rich in fine to medium grained quartz. Subsequently, the portion of the rock not strongly replaced by quartz, was overprinted by development of fine grained metamorphic biotite (green to brown), chlorite, quartz and magnetite, with minor pyrite and trace hematite. Former feldspar grains have been replaced by sericite, biotite and chlorite, with ferromagnesian grains replaced by biotite, chlorite, quartz and magnetite. The matrix material and much of the lithic fragments, have been replaced by sericite, chlorite, biotite, magnetite and trace titanite. Metamorphic biotite has random orientation and overprints earlier sericite. Magnetite is relatively abundant, forming disseminations and fine to medium grained aggregates up to several millimetres across. Magnetite is locally intergrown with pyrite and shows slight replacement by hematite. Pyrite also forms discrete subhedra up to 2 mm across, locally replaced by magnetite and hematite.

c) Mineralogy and paragenesis: The rock contains relatively abundant fine disseminations and aggregates of magnetite up to several millimetres across. Fine to medium grained inequigranular

magnetite is locally intergrown with pyrite and locally replaced by hematite. Pyrite also forms discrete subhedra up to 2 mm across, locally replaced about rims by magnetite and hematite.

Mineral Mode: Approximate modal proportions are: quartz 45%, sericite 18%, biotite, chlorite and feldspar (probably albite) each 10%, magnetite 5%, pyrite 1% and traces of apatite, hematite and titanite.

Interpretation and Comments: It is interpreted that the sample represents a metamorphosed altered medium to coarse grained volcanoclastic rock, e.g. lithic-crystal-vitric tuff of felsic composition. The original rock contained scattered volcanic lithic fragments and phenocrystal grains of quartz, feldspar and ferromagnesian phases, with traces of apatite, in a matrix that probably had significant vitric material. There was likely early alteration, with development of foliated sericite and layer-parallel quartz aggregates. Subsequently, a metamorphic overprint occurred, causing recrystallisation to a non-foliated assemblage of biotite, quartz, chlorite and magnetite. Minor pyrite occurs with magnetite and also occurs as discrete subhedra.

CETD2 178.2 m TS

Summary: Metamorphosed altered medium to coarse grained volcanoclastic rock, e.g. lithic-crystal-vitric tuff of felsic composition. The rock originally contained a few quartz phenocrysts and possible volcanic lithic fragments and feldspar and ferromagnesian grains, as well as microphenocrystal grains of apatite and FeTi oxide. There was initial alteration, probably resulting in the formation of weakly foliated sericite and patchy layered replacement by quartz. Minor sulphides (pyrite mainly) could also have been deposited. It is interpreted that the rock was subsequently metamorphosed to biotite grade, with partial recrystallisation and formation of metamorphic biotite, chlorite and magnetite. A little barite occurs in some of the quartz-rich replacement layers and can be associated with magnetite, pyrite and traces of chalcopyrite, Fe-poor sphalerite and paragenetically later hematite.

Handspecimen: The drill core sample is composed of a dark green-grey, metamorphosed altered porphyritic felsic volcanic rock. It has a few relict quartz phenocrysts up to 3 mm across in a recrystallised fine grained groundmass containing quartz, chlorite, sericite and possible biotite. Disseminated magnetite and a little pyrite are present. Due to the presence of visible magnetite, the rock is strongly magnetic, with susceptibility up to 1470×10^{-5} SI units.

Petrographic Section:

a) Primary mineralogy and textures: In the section, it is evident that the rock underwent hydrothermal alteration, weak deformation and subsequent metamorphic recrystallisation. Relict textures are consequently only moderately preserved. There are a few relict quartz phenocrysts up to 3 mm across and a few relict apatite microphenocrysts up to 0.9 mm across. The rock probably contained scattered phenocrystal grains of feldspar, ferromagnesian material and FeTi oxide, along with volcanic lithic fragments up to a few millimetres across in a finer matrix that shows a weak relict foliation and could have originally contained vitriclastic material. The relict features are interpreted as indicating that the rock represents a former lithic-crystal-vitric felsic tuff.

b) Alteration and structure: The original rock was hydrothermally altered, weakly deformed and subsequently partly recrystallised as a result of imposed metamorphism. Initially, the rock was subject to partial replacement by weakly foliated fine grained sericite and quartz, although some relict altered feldspar (e.g. albite) remains. Associated with this alteration was replacement by layers or veinlike masses of fine to medium grained quartz, parallel to the foliation. Associated with the quartz-rich masses are minor amounts of barite and pyrite. There was apparent later growth of randomly oriented fine grained brownish to green biotite, quartz, minor chlorite, magnetite, pyrite and trace titanite. In many of the quartz-rich masses, there are scattered aggregates of fine to medium grained magnetite up to several millimetres across, along with pyrite and barite up to 2 mm across, chlorite and green biotite, and traces of Fe-poor sphalerite and chalcopyrite (generally associated with magnetite, pyrite and chlorite). A little hematite is also present as a paragenetically late phase associated with magnetite and pyrite. The mineral assemblages are interpreted as indicating initial phyllic-silicic alteration perhaps with early deposition of sulphides and maybe barite, with later metamorphism to biotite grade and partial recrystallisation.

c) Mineragraphy and paragenesis: The rock contains scattered fine disseminations and aggregates of magnetite up to several millimetres across. It is associated locally with fine grained pyrite,

chalcopyrite and Fe-poor sphalerite, with the latter forming rare aggregates up to 1 mm across. Pyrite also forms subhedra up to 2 mm across and larger medium grained aggregates. Pyrite is locally intergrown with magnetite and there may be a little paragenetically later hematite associated with magnetite and pyrite.

Mineral Mode: Approximate modal proportions are: quartz 50%, sericite 20%, feldspar (e.g. albite) 10%, biotite 7%, chlorite 5%, magnetite 4%, barite 2%, pyrite 1% and traces of chalcopyrite, sphalerite, apatite, titanite and hematite.

Interpretation and Comments: It is interpreted that the sample is a metamorphosed altered medium to coarse grained lithic-crystal-vitric tuff of felsic composition. It originally contained a few quartz phenocrysts and possible volcanic lithic fragments and feldspar and ferromagnesian grains, as well as microphenocrystal grains of apatite and FeTi oxide. There was initial alteration, probably resulting in the formation of weakly foliated sericite and patchy layered replacement by quartz. Minor sulphides (pyrite mainly) could also have been deposited. It is interpreted that the rock was subsequently metamorphosed to biotite grade, with partial recrystallisation and formation of metamorphic biotite, chlorite and magnetite. A little barite occurs in some of the quartz-rich replacement layers and can be associated with magnetite, pyrite and traces of chalcopyrite, Fe-poor sphalerite and paragenetically later hematite.

CETD2 212.8 m TS

Summary: Strongly altered lithic-crystal-vitric felsic tuff, with an incipient metamorphic overprint. The original rock contained phenocrystal grains of quartz, feldspar and small grains of FeTi oxide and apatite. Lithic grains are mostly porphyritic felsic volcanic, but there is a single altered siltstone fragment. Matrix material might have been dominated by former vitriclastic grains. The rock was altered to an assemblage of chlorite, quartz and sericite, with minor albitised plagioclase remaining and original FeTi oxide replaced by leucoxene/rutile and magnetite. Apparent fine grained metamorphic magnetite and incipient biotite have formed locally.

Handspecimen: The drill core sample is composed of a massive, green-grey strongly altered, quartz-phyric felsic volcanic. The rock contains abundant small relict quartz phenocrysts up to 2 mm across in a fine grained groundmass probably rich in chlorite, quartz and with minor yellow-green sericite. The rock must contain minor disseminated magnetite, as it is strongly magnetic, with susceptibility up to 5520×10^{-5} SI units.

Petrographic Section:

a) Primary mineralogy and textures: In the section, relict texture is moderately well preserved. The rock contains scattered relict phenocrystal grains of quartz up to 2 mm across, with a few relict microphenocrysts of apatite up to 0.5 mm across. There are also pseudomorphs after former feldspar (e.g. plagioclase) grains up to 1.5 mm across and partly altered microphenocrysts of FeTi oxide up to 0.8 mm across. Lithic fragments up to several millimetres across are present; mostly these are composed of porphyritic felsic volcanic rock, but one about 1 cm across is composed of a fine grained altered volcanoclastic siltstone. Mineral grains and lithic fragments occur in a weakly foliated matrix of altered volcanic material (some of which might represent former wispy vitriclastic grains) and a trace of zircon. The relict characteristics indicate that the rock represents a lithic-crystal-vitric tuff, probably of original dacite composition.

b) Alteration and structure: The original volcanoclastic rock was strongly hydrothermally altered to a propylitic assemblage, weakly deformed and possibly subject to a weakly developed metamorphic overprint. Former matrix material, volcanic lithic fragments and feldspar grains were largely replaced by weakly foliated aggregates of chlorite and sericite, with quartz-rich aggregates at most former feldspar and lithic grains, although a little relict albitised plagioclase remains. Original FeTi oxide grains were replaced by leucoxene/rutile and in some cases, developed magnetite rims. Foliation in the matrix of the rock is defined by preferred orientation of sericite and chlorite (and elongation of former vitric fragments). Within the foliated aggregates, there has been local development of randomly oriented fine grained brown biotite and of magnetite. The metamorphic overprint could have just attained biotite grade.

c) Mineralogy and paragenesis: The rock contains scattered fine disseminations and aggregates of magnetite up to 1 mm across. Some magnetite could represent relict igneous grains, but some (finer grained material) is interpreted to be a product of metamorphism and is commonly enclosed in chlorite.

Mineral Mode: Approximate modal proportions are: chlorite 44%, quartz 30%, sericite 15%, feldspar (e.g. albite) 5%, magnetite 4%, leucoxene/rutile 1% and traces of apatite, biotite and zircon.

Interpretation and Comments: It is interpreted that the sample represents a strongly altered lithic-crystal-vitric felsic tuff, with an incipient metamorphic overprint. The original rock contained phenocrystal grains of quartz, feldspar and small grains of FeTi oxide and apatite. Lithic grains are mostly porphyritic felsic volcanic, but there is a single altered siltstone fragment. Matrix material might have been dominated by former vitriclastic grains. The rock was altered to an assemblage of chlorite, quartz and sericite, with minor albitised plagioclase remaining and original FeTi oxide replaced by leucoxene/rutile and magnetite. There might be an incipient metamorphic overprint with development of fine grained metamorphic magnetite and trace biotite.

CETD2 259.4 m PTS

Summary: Felsic crystal-lithic tuff, with strong alteration and a metasomatic replacement zone with almost complete obliteration of primary features. The original rock contained scattered phenocrystal grains of quartz and possible feldspar, with microphenocrysts of apatite and FeTi oxide, plus a few porphyritic volcanic lithic fragments. Pervasive alteration led to replacement by fine to medium grained quartz and chlorite, with a little albite, tourmaline, pyrite and rutile. The more intense alteration zone is dominated by coarser grained quartz, fine to medium grained tourmaline and pyrite, with minor chlorite and carbonate associated with tourmaline and a little disseminated magnetite. Textures suggest that much pyrite in the sample replaced earlier pyrrhotite.

Handspecimen: The drill core sample is composed of a green-grey strongly altered felsic volcanic rock containing a heterogeneous mass about 4 cm wide of fine to medium grained quartz, black tourmaline and scattered pyrite aggregates. The altered host rock probably contains quartz and chlorite. A little magnetite occurs in the sample as it is strongly magnetic, with susceptibility up to 1940×10^{-5} SI units.

Petrographic Section:

a) Primary mineralogy and textures: In the section, there are domains in which relict porphyritic and fragmental textures are moderately preserved. Elsewhere, relict texture tends to have been obliterated by alteration and recrystallisation. Where relict texture is preserved, there are scattered relict phenocrystal grains of quartz up to 3.5 mm across and a few microphenocrysts of apatite up to 0.6 mm across, along with pseudomorphs after a few grains of feldspar and FeTi oxide. Probable porphyritic volcanic lithic fragments up to a few millimetres across are also present in a finer grained tuffaceous matrix containing rare relict zircon. It is speculated that the original rock was a crystal-lithic felsic tuff.

b) Alteration and structure: The protolith was strongly hydrothermally altered, with emplacement of a more intensely altered domain of veinlike metasomatic character. The domains that display stronger retention of relict texture show replacement by an assemblage of fine to medium grained quartz, commonly with abundant chlorite, and with a little albite, acicular brown-green-blue tourmaline, and traces of pyrite and rutile (e.g. at former FeTi oxide sites). Where alteration is more intense, there has been replacement by domains that range from medium to coarse grained quartz to fine to medium grained acicular tourmaline to pyrite-rich. Most pyrite tends to be in association with tourmaline and these domains also contain minor chlorite, carbonate, a little magnetite and traces of titanite and epidote. A little magnetite and disseminated tourmaline also occur in the quartz-rich domains. In the intensely altered zones. Tourmaline prisms are up to 0.6 mm long, carbonate aggregates up to 0.4 mm across, magnetite granules up to 0.1 mm across and pyrite aggregates are up to several millimetres across. Textures in the latter suggest that at least some of the pyrite has replaced earlier pyrrhotite. A consequence of this alteration might be the development of goethite staining in adjacent carbonate aggregates. The altered rock has been pervaded by a few irregular to sub-planar veins up to 1 mm wide that contain assemblages of quartz \pm chlorite, of tourmaline, pyrite or rare carbonate.

c) Mineralogy and paragenesis: The rock contains considerable fine to medium grained aggregates and disseminations of pyrite, with larger aggregates being up to several millimetres across. Textures

in pyrite suggest that at least some has replaced earlier formed pyrrhotite. The rock also contains minor granular magnetite, commonly hosted in quartz and tourmaline adjacent to pyrite masses.

Mineral Mode: Approximate modal proportions are: quartz 50%, tourmaline 20%, pyrite 15%, chlorite 8%, carbonate (+ goethite) 3%, magnetite 2%, albite 1% and traces of rutile, apatite, titanite, epidote and zircon.

Interpretation and Comments: It is interpreted that the sample represents a former felsic crystal-lithic tuff, displaying strong alteration and a metasomatic replacement zone with almost complete obliteration of primary features. The original rock contained scattered phenocrystal grains of quartz and possible feldspar, with microphenocrysts of apatite and FeTi oxide, plus a few porphyritic felsic volcanic lithic fragments. Pervasive alteration led to replacement by fine to medium grained quartz and chlorite, with a little albite, tourmaline, pyrite and rutile. The more intense alteration zone is dominated by coarser grained quartz, fine to medium grained tourmaline and pyrite, with minor chlorite and carbonate associated with tourmaline and a little disseminated magnetite. Textures suggest that much pyrite in the sample replaced earlier pyrrhotite.

CETD2 279.35 m TS

Summary: Strongly altered felsic crystal-lithic-vitric tuff, with minor development of an overprinting metamorphic assemblage. The original rock was relatively coarse grained, with altered porphyritic felsic volcanic and possible former vitric fragments, along with phenocrystal grains of quartz, feldspar (e.g. plagioclase) and a few ferromagnesian and FeTi oxide grains. The rock underwent strong propylitic alteration with replacement by an assemblage of chlorite, quartz, albite and sericite, with development of a weak foliation, largely manifest in chlorite and elongation of feldspar and lithic fragments. Subsequently, the metamorphic overprint resulted in the formation of disseminations and aggregates of fine grained biotite and magnetite. The rock contains minor pyrite and trace chalcopyrite, in places in association with magnetite.

Handspecimen: The drill core sample is composed of a weakly foliated, grey-green altered porphyritic felsic volcanic rock. It is probably dominated by quartz and chlorite and contains scattered whitish aggregates that might represent former feldspar grains. The rock has a few relict quartz phenocrysts and a little disseminated magnetite. Due to the presence of magnetite, the rock is strongly magnetic, with susceptibility up to 3910×10^{-5} SI units.

Petrographic Section:

a) Primary mineralogy and textures: In the section, relict texture is moderately preserved. The original rock contained scattered phenocrystal grains of quartz up to 2.5 mm across and there are pseudomorphs after scattered former feldspar grains up to 2 mm across, plus after a few ferromagnesian grains (some could have been biotite) and FeTi oxide. There are also scattered altered lithic fragments of porphyritic felsic volcanic rock up to several millimetres across. All occurring in a strongly altered, weakly foliated finer grained tuffaceous matrix, possibly vitriclastic originally, with traces of relict apatite and zircon. From the relict characteristics, it is interpreted that the original rock was a crystal-lithic-vitric felsic tuff.

b) Alteration and structure: The rock underwent strong alteration of propylitic type, weak deformation and later imposition of thermal metamorphism that probably attained biotite grade. Feldspar grains and much of the lithic porphyritic volcanic fragments were replaced initially by albite, with subsequent partial to complete replacement by sericite, chlorite and quartz. Some fragments recrystallised to quartz-rich aggregates. Matrix material was replaced by dominant foliated fine to medium grained chlorite, with minor quartz, albite, sericite and scattered aggregates of green-brown biotite up to 1 mm across, plus disseminations and aggregates of magnetite, with a little pyrite and trace chalcopyrite. FeTi oxide grains were partly replaced by leucoxene/rutile and chlorite. The sulphide minerals locally forms composite aggregates with magnetite. Foliation in the sample is defined by preferred orientation of chlorite and of altered lithic fragments and feldspar grains. Notably, fine grained biotite aggregates associated with chlorite have random orientation.

c) Mineragraphy and paragenesis: The rock contains minor disseminations and elongate aggregates up to 2 mm across of fine to medium grained magnetite, in places with a little intergrown pyrite and chalcopyrite. Pyrite also forms discrete elongate aggregates up to 1 mm across.

Mineral Mode: Approximate modal proportions are: chlorite 40%, quartz 35%, albite 10%, sericite 8%, magnetite 3%, biotite 1%, pyrite 1% and traces of apatite, zircon, leucoxene/ rutile and chalcopyrite.

Interpretation and Comments: It is interpreted that the sample is a strongly altered crystal-lithic-vitric felsic tuff, with a minor overprinting metamorphic assemblage. The original rock was relatively coarse grained, with altered porphyritic felsic volcanic and possible former vitric fragments, along with phenocrystal grains of quartz, feldspar (e.g. plagioclase) and a few ferromagnesian and FeTi oxide grains. The rock underwent strong propylitic alteration with replacement by an assemblage of chlorite, quartz, albite and sericite, with development of a weak foliation, largely manifest in chlorite and elongation of feldspar and lithic fragments. Subsequently, the metamorphic overprint resulted in the formation of disseminations and aggregates of fine grained biotite and magnetite. The rock contains minor pyrite and trace chalcopyrite, in places in association with magnetite.

Appendix 4 – Rehabilitation Photos



Photo 1 – Sump adjacent to collar at CETD1 – quarry on Lorinna Rd



Photo 2 – CETD1 drill site with Water Truck and hydrocarbon boom (foreground)



Photo 3 – Capped drill collar at CETD1



Photo 4 – Drill site (quarry on Lorinna Rd) after rehab September 2008, note collar is brightly coloured for traffic safety reasons



Photo 5 – Silt and hydrocarbon trap in drain below CETD1, September 2008



Photo 6 – Hard water ferns replaced at CETD2 water tank site, Lorinna Rd and Old Lorinna Rd Junction, April 08



Photo 7 – CETD2 drill site looking South – note scarified ground and replacement of leaf and forest litter to aid regeneration, local seed was also scattered on this site



Photo 8 - CETD2 drill site looking SW from old Lorinna Rd, September 2008