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PLUTONIC OPERATIONS LIMITED

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EXPLORATION LICENCE 10/88

GOWRIE PARK

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Annual Report on Exploration Activity

**August 1996 to July 1997
and
Partial Relinquishment Report**

OPEN FILE

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ANNUAL/RELINQUISHMENT REPORT
ELI 10/88 - GOWRIE PARK-PLUTONIC
R CLOSE & R REID

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7th September, 1997

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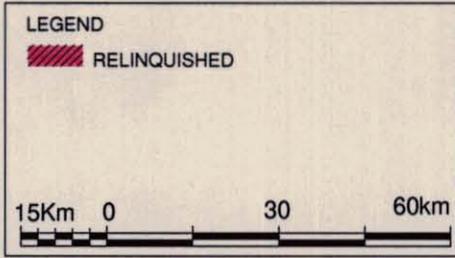
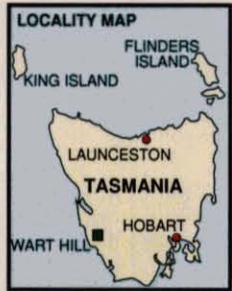
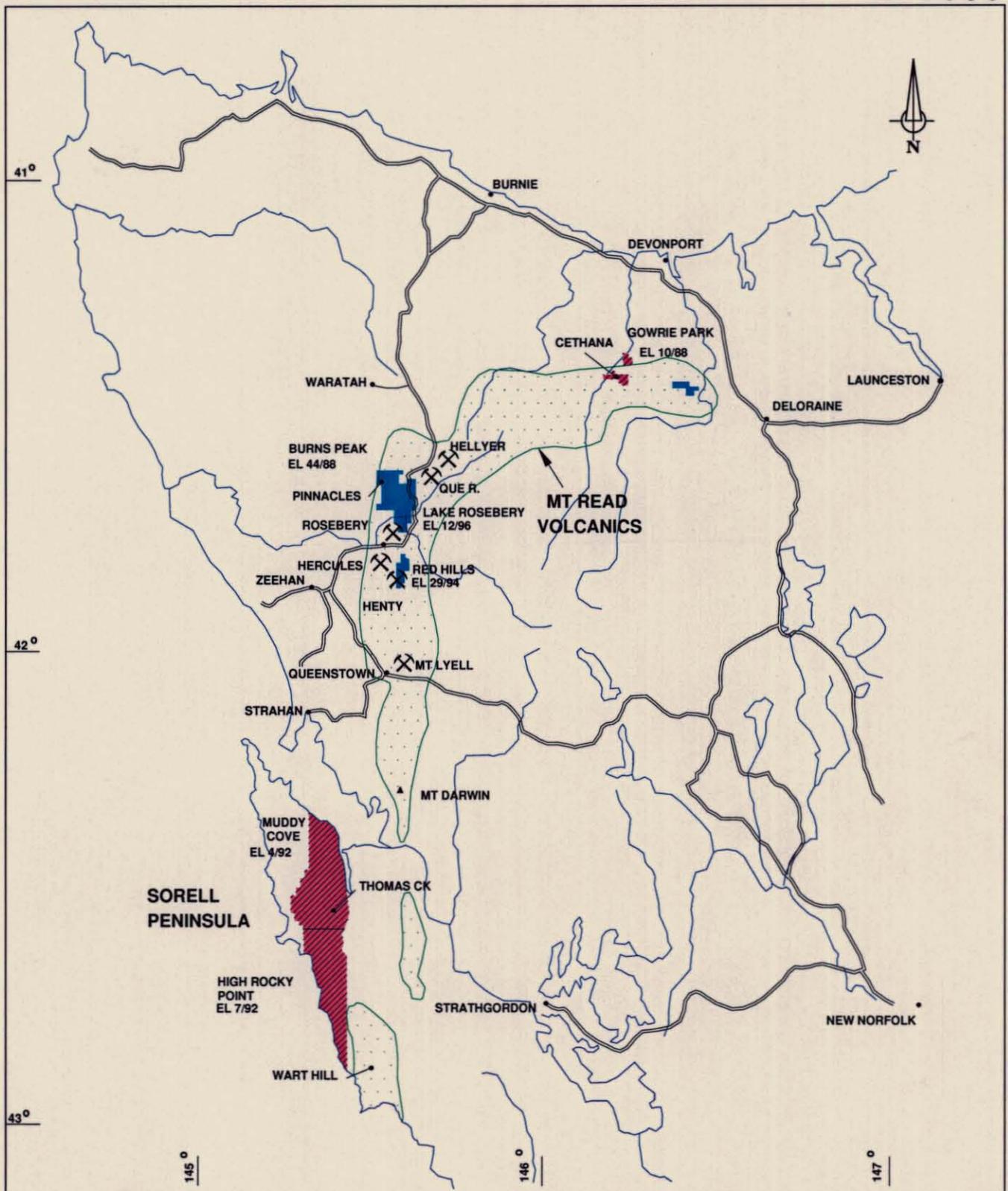
1. SUMMARY

Exploration for VHMS mineralisation in EL10/88 has been largely focused on an extensive quartz-sericite-pyrite alteration zone at Cethana. Grid mapping, soil-auger bedrock geochemistry, IP, TEM surveys and 22 drillholes have been completed at Cethana and Staverton prospects. However, no unequivocal massive sulphide mineralisation with potential economic grades has been discovered.

Plutonic exploration since 1992 has been concentrated on the Cethana East area where strong Pb-Zn geochemistry and coincident Ip anomalism were found to be related to deformed stringer pyrite veins and Pb-Zn bearing quartz-carbonate veins. This mineralisation was regarded as a footwall alteration zone to a postulated stratigraphical higher exhalative position to the north.

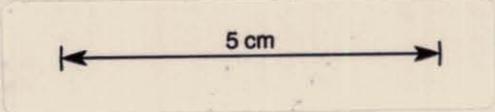
Auger drilling and shallow RC drilling of a prospective horizon during 1995-1996 failed to define evidence of exhalative mineralisation. Therefore, no further work was considered justified and the tenement areas covering Cethana and Staverton were relinquished in August 1997.

The Gog Range portion of EL10/88 has been retained in order to explore the resource potential of the Fire Tower gold prospect.



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Fig 1



2. INTRODUCTION

2.1 Tenure

EL 10/88 (Figure 1) was previously a joint venture between Plutonic Operations Ltd and Noranda Pty Ltd, however, on 2nd June, 1992 Plutonic Operations Ltd became the sole licensee and operator.

The tenement area was part of EL 7/73 granted to Asarco in March 1973. In 1974 Asarco relinquished 297km² of the original 743km², then CRA Exploration Pty Ltd. (CRAE) joint ventured into the EL in July 1976 and also pegged EL 10/76 which covered the southern part of the Lake Barrington portion of the present Gowrie Park EL. CRAE became the license holders in December 1979, reducing the total area of 7/73 to 199km² and Asarco sold its share to Carpentaria Exploration Co Ltd in June 1980. In 1983 CRAE became the sole lease holder until relinquishment of the EL in 1988.

Noranda Pty Ltd successfully tendered for the ground in August 1989, and added another 8km² as EL 35/88. The Mines Department subsequently added another 0.9km² in order to rationalise the boundaries with AMG grid lines. The EL was in two parts, however, all exploration and reporting has been conducted as if one license. Following relinquishment of half of the original area in 1993 the EL was divided into three parts (see Figure 2).

2.2 Access and Land Usage

Good access to all parts of the EL is provided by bitumen roads as well as HEC and old forestry tracks. However, access to individual prospects and/or desirable drill sites can be problematic because of steep topography. Lake Barrington itself provides excellent access by boat for the purposes of mapping.

Effectively all of the prospective rocks in the EL are within State Forest, the exception being part of the Cethana West Prospect which lies within land vested to the HEC.

3. REGIONAL GEOLOGY

The prospective rocks within the EL are part of the Cambrian Mt Read volcanics which host five gold rich polymetallic VMS deposits in Western Tasmania. These include Mt Lyell, Hercules, Rosebery, Que River and Hellyer as well as the Henty gold deposit. In addition, there are numerous occurrences of sub-economic deposits and VMS style alteration throughout the belt.

All of the above deposits occur in the Dundas Trough along the major north-south trending part of the volcanic belt which runs from Elliott Bay to north of Hellyer. The Mt Read volcanics that outcrop in EL 10/88 occupy a subsidiary region, the Fossey Mountain Trough, which trends roughly east-south-easterly from north of Hellyer to beyond Deloraine.

In the vicinity of the Gowrie Park Tenement, (refer Figure 2), Tasmanian Mines Department MRBP 1:50,000 mapping stops just within the western most boundary of the EL and is included in the "Geology of the Winterbrook-Moina" area. Other than this, the most recent Mines Department regional mapping is the very outdated "Sheffield" (1959) and Middlesex (1958) one mile to one inch mapping. Proposed revision of the "Sheffield" sheet has been shelved indefinitely.

Early Cambrian volcanism in the main Mount Read Belt was rhyolitic to dacitic in composition followed by a period of andesitic-basaltic volcanism before a return to felsic volcanism in the late Cambrian. The VMS orebodies of Rosebery and Hercules are believed to have formed later in the initial felsic volcanic phase, whereas the Que and Hellyer orebodies formed during the subsequent mafic-intermediate phase. The disseminated copper orebodies at Mt Lyell are hosted in the lower felsic phase but may be time correlates of the mafic intermediate phase having mainly been deposited sub-surface, possibly due to fluid boiling.

This relative ageing of mineralising events is subject to considerable debate due to the overprinting of alteration and deformation over initially complex inter-fingering relationships of volcanic packages related to separate volcanic centres.

The volcanics and associated sediments of the Fossey Mountain Trough have an uncertain position within this stratigraphy because regional mapping has revealed significant differences between the volcanic sequences in the Dundas Trough and the Fossey Mountain Trough. In particular the mafic-intermediate phase as represented by the Beulah Formation south of the Sheffield, may be more significant in the north of the state than in the central western part of the belt.

In the Fossey Mount Trough the siliciclastic largely Precambrian derived Roland Conglomerate and Moina Sandstone, of Late Cambrian-Ordovician age, unconformably overlie the Cambrian volcanics with small outlies of these younger rocks capping the volcanics in many places. That the unconformity is clearly angular in many places indicates that there was a major phase of deformation, (compressional) in the Late Cambrian, prior to the deposition of the siliciclastics.

The siliciclastics are overlain by the Gordon Limestone. These younger postvolcanic rocks were themselves folded, during the mid-Devonian Tabberabberan Orogeny during which time some thrust faulting is believed to have taken place. (Jennings 1979).

Williams (1979) refers to two phases of mid-Devonian folding, earlier east-west "Loongana/Wilmot trend" folds with a half wavelength of 5 km and later north-westerly to northerly "Deloraine/Railton trend" folds with a half wavelength of 2.5 km. These two folds trends interfere in the Fossey Mountains.

In general, Cambrian deformation is not considered to have produced the S1 cleavage which is considered to be consistent with the earlier of the two mid-Devonian fold trends. However Woodward et al (193) has highlighted the significance of thrusting during both late-Cambrian and mid-Devonian deformation. Recognition of thrust faulted contacts along portions of the southern margin of the Fossey Mountain Trough, indicate similar thrusts may be present in the Cambrian volcanic sequence, though none have been recognised.

Following the mid-Devonian deformation the north and west of Tasmania was intruded by granitic batholiths. Intrusive bodies in the region of EL10/88 include the Dalcoath Granite to the south of Cethana, and the Beulah Granite to the north of the Gog Range. The former granitoid was responsible for a number of relatively minor and possibly zoned base metal mineral deposits in the Moina area south-west of Cethana. Tertiary tholeiitic basalt lavas which originally infilled most topographic lows, now occupy topographic highs and cover prospective Cambrian volcanics and associated sediments in many parts of the belt.

Glaciation in the Quaternary has produced both glacial deposits and scree which is locally widespread and covers much of the northern area of the Cethana East prospect.

4. EXPLORATION PHILOSOPHY

Exploration has targeted two mineralisation styles in EL 10/88. The initial target of ASARCO/CRAE was a polymetallic volcanic hosted massive sulphide (VHMS) orebody such as those found at Rosebery, Hercules, Que River and Hellyer. The pervasive alteration at Cethana and Staverton is very similar to that seen around these orebodies.

The presence of a number of small occurrences of VHMS style mineralisation within felsic volcanoclastics at Cethana East and West emphasise the relatively high prospectivity of these prospects in relation to the rest of the Fossey Mountain Trough.

In addition, whole rock/REE geochemistry and petrology on samples from Staverton suggest that these rocks are strongly altered correlates of the mafic Que-Hellyer footwall sequence and therefore are also highly prospective.

The second target is a Cambrian volcanic-hosted gold deposit. Models initially explored for by Noranda (Jones 1989) were South Hercules and Henty which are considered to be VHMS related, although the higher grade quartz vein-silicic mineralisation at the Henty Mine is probably syndeformational and Devonian in age.

Another discretely different style of volcanic hosted gold orebody is exemplified by Voyager 12 and 24 at Elliott Bay at the extreme south of the main Mt Read Belt, and other occurrences such as Anio Creek/Ten Mile Creek which lie south-east of Que and Hellyer. These occurrences are not spatially related to VHMS orebodies but appear to be spatially/genetically related to Cambrian quartz-feldspar-biotite porphyries which occur along the eastern and southern margin of the Dundas Trough and Fossey Mountain trough respectively. The Gog Range part of the EL, including the Fire Tower prospect is prospective for this style of deposit.



5 cm

LEGEND

- Tc TERTIARY-RECENT COVER
- Tb TERTIARY BASALT
- Di DEVONIAN INTRUSIVE
- Os ORDOVICIAN SEDIMENTS
- Es CAMBRIAN SEDIMENTS
- Ef-1 CAMBRIAN FELSIC-INTERMEDIATE VOLCANICS
- * PROSPECTS

RELINQUISHED

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| SCALE: 1 : 125 000 | SOURCE: | DWG. NO.: 2 |

5. LOCAL GEOLOGY

5.1 Introduction

This district ⁷stiffers the lack of a good regional compilation map of the type produced for the Mount Read Volcanic Project. Within the tenement area Plutonic has mapped at 1:1000 to 1:2500 prospect scales augmented by previous mapping by Aberfoyle and CRAE and reconnaissance traverses compiled by Macdonald 1993.

The oldest recognised Cambrian strata at Cethana occur in the southern part of Cethana West. These sediments are moderately to steeply dipping, face north-east and comprise fine chloritic, pyritic siltstones and lesser sandstones with interbedded conglomeratic mass flows which are haematite and magnetite bearing towards the top of the sequence.

The sediments are overlain by a package of felsic lavas, volcanoclastics (reworked tuffs) grading to fine tuffaceous sediments, which are all at least moderately sericite ± chlorite ± pyrite ± haematite altered with increasing intensity up sequence to the north. This pervasively altered package is overlain by steeply dipping, unaltered greywackes and conglomerates of probable intermediate derivation, together with interbedded intermediate lavas.

Along strike at Cethana East the altered felsic sequence is similar though the felsic volcanoclastics are more dominant and associated hydrothermal alteration more widespread than at Cethana West.

An enigmatic body of quartzite low in the package, just north of Olivers Road lookout may either be a thrust slice of Precambrian or Moina Sandstone as mapped by Herrmann (1989).

North of Cethana West the intermediate sediments/lava sequence is followed by relatively unaltered felsic lavas, felsic volcanoclastics and minor sediments until another zone of strong alteration and north-north-west striking schistosity is encountered at "Campground". North of these altered felsic volcanoclastics, alteration intensity decreases and the rocks become more clearly sedimentary up to just before the Staverton prospect where outcrop includes intermediate derived mass flows and lava breccias amongst siltstones and sandstones. These sediments in turn are overlain by strongly altered andesitic to dacitic lavas at Staverton.

Further north between Staverton and the Lake Barrington prospect this stratigraphy becomes quite complex with interbedded unaltered mafic lavas, intermediate lavas and lava breccias felsic volcanoclastics, siltstones and sandstones. However, it would appear that this predominantly mafic intermediate package at Staverton occupies a major synclinal position. This is borne out by dipping/facing orientations at both the Staverton and Lake Barrington prospects.

At the Lake Barrington prospect intermediate lavas and associated sediments overlies sediments which are in turn underlain by felsic lavas and mass flows. North of the Lake Barrington prospect these felsic lavas are underlain by siltstones and felsic volcanoclastics.

The stratigraphy in the Staverton to Lake Barrington area has strong similarities to the Cethana sequence, the main difference being the major development of mafic to intermediate volcanics around Lake Barrington compared to the relatively restricted intermediate unit at Cethana West.

This could merely be a function of facies changes related to an intermediate volcanic centre to the north or east, with the upper volcanics at Cethana West being a distal expression of this volcanism. In this case the felsic volcanics north of Lake Barrington could correlate with the lower felsic volcanic sequence at Cethana.

Alternatively, it is also possible the Lake Barrington mafic intermediate volcanics extend along strike under Tertiary cover to the south-east into Gowrie Park prospect east of the current tenement. In this case, the intermediate volcanics to the north are probably younger than those at Cethana West and entirely unrelated. Also the altered felsic volcanics in the Campground area south-west of Staverton may have correlates north of Cethana East and east at Gowrie Park.

However, structural complexity could also account for disparities between volcanic sequences in these areas and the above correlations are speculative.

In the eastern portion of the tenement, the Gog Range has a somewhat different geology (Macdonald and Tomlinson, 1992 and Jones, 1989). The sequence consists of a quartz-feldspar biotite porphyry/lava overlain by intermixed felsic volcanoclastics and vitric tuffaceous siltstones. Along the western end of the range the latter siltstones are overlain by chloritic lapilli tuffs and then by siltstones and more quartz porphyry units. To the north this package is overlain by mafic-intermediate volcanics at Lower Beulah, with the contact zone the focus of strong alteration.

Jennings et al (1959) maps the sequence as "Gog Range Greywacke" overlain by "Minnow Keratophyre" overlain by "Beulah Formation". The former two units appear to have little validity and should no longer be used whilst the "Beulah Formation" should probably be retained with the cautionary note that not all mafic-intermediate volcanics in the area necessarily belong to this unit.

The Gog Range stratigraphy may be older than sequences at Cethana. The Fire Tower prospect sequence could correspond to a sequence underlying the siltstones exposed on the Lorinna Road and extend beneath the Ordovician cover, to equate with similar lithologies in the Bull Creek Formation to the west as mapped by Pemberton and Vicary (1989).

5.2 Staverton Prospect

Only relatively minor prospect scale mapping was conducted by Noranda prior to drilling a mostly geophysical-geochemical target at Staverton. The most relevant geological data was obtained from the STD1 drill core, which intersected a sequence of altered, pyritic holocrystalline andesitic to dacitic lavas with occasional felsic volcanoclastics and lava breccias. Chlorite and pyrite alteration is predominant in the mafic/intermediate rocks with sericite \pm pyrite alteration common in the interbedded felsic volcanoclastics. These latter zones are often strongly schistose with fine grained pyrite in the cleavage.

In part, early alteration is overprinted by later calcite-chlorite-pyrite-tourmaline alteration which is probably Devonian granite related.

The altered volcanics exhibited maximum values of 33 ppm Cu, 3000 ppm Pb and 3600 ppm Zn in zones with elevated sulphides. This sequence is considered to dip steeply and going to the north east based on grading in siltstones outcropping on the western shore of Lake Barrington. A major northerly structure is interpreted to mark the western boundary of the prospective volcanic sequence.

5.3 Cethana West Prospect

The steeply north-north-east dipping Cambrian volcanic/sedimentary sequence at Cethana West youngs to the north, based on rare grading and scour and fill structures in drill core and outcrop. The sequence is divided into two discrete structural blocks by a north-north-east trending fault along which there has been 400 to 600m of sinistral movement. This fault passes just to the west of DD86C'C 12 on line 70(E).

The basal rocks of the western structural block appear to be mainly plagioclase rich with lesser quartz phyric tuffs overlain by a siliceous sandstone/siltstone which was interpreted by Herrmann (1989) to be a fault bounded sliver of Moina sandstone. Contacts are weathered and it is unclear what the true relationships here are.

Adjacent to the unconformity with the Roland Conglomerate on the Lorinna Road, the Cambrian sediments at the southern ends of lines 900E to 1300E are chloritic with disseminated pyrite. DDH's 77CC2, CC3 and 86CCI3 extend into the uppermost of these rocks.

The first two of these holes intersected anomalous base metals of a similar tenor to the soil anomalies tested. However these metals are in post-cleavage carbonate veins probably associated with a Devonian granite which outcrops to the south of EL 10/88. The most significant stratabound mineralisation encountered in these sediments occurs in DD86CC13 from 206.40m to 210.00m where 3.6 metres of 0.38% Cu, 0.65% Zn and 0.46% Pb is associated with very fine grained sulphide disseminations in a chloritic mudstone. This latter mineralisation is probably Cambrian in age.

Magnetic, haematitic, chloritic and sericitic conglomerates with matrix supported rounded cherty clasts are interbedded with the upper half of these sediments. These rocks outcrop on the Lorinna Road and grid lines 900E, 1000E, 1200E, 1300E, 1400E as well as being intersected in DD77CC2, DD77CC 3 and possibly DD86CC 13.

Overlying these sediments is an important sequence of silica-sericite \pm chlorite altered felsic volcanoclastics. These rocks are characterised by rounded quartz eyes with variable amounts of pumice, feldspars and lithics, the latter being generally rounded

and of mixed provenance but are predominantly fine "rained siliceous (quenched felsic lava) clasts. Patches of diffuse haematite alteration, are seen in DD77CC2 and DD77CC3 In DD86CC13 a rock with pink feldspars which was previously described as a granodiorite (Hicks, 1990) is more probably an albite altered volcanoclastic.

Highly anomalous barium up to 9350 ppm in drill core as well as in occasional rock chips indicates that barite alteration is widespread. However, the presence of barite veins in the basal sediments as well as similar barite occurrences from the Promised Land prospect (old CRAE prospect) in the north of the EL indicates the barite may have little exploration significance for VHMS mineralisation.

Overlying the felsic volcanoclastics in the western block and in the eastern part of the eastern block are massive quartz \pm feldspar phyric lavas. In the central part of the prospect from lines 800E to 1100E are very strongly silica sericite altered schistose rocks with quartz eyes which may be altered lavas or alternatively are altered felsic volcanoclastics which were deposited into a topographic depression lying between the felsic lavas to the east and west.

This altered sequence was evaluated by DD77CC1 which intersected a late stage post cleavage vein assaying 0.4 metres @ 8.3% Zn and 0.2% Pb from 78.6 metres, then 2.0 metres @ 190 ppm Cu, 1.03% Pb, 1.09% Zn from 98 metres in a black tuffaceous siltstone. Although mineralisation is now in late stage fractures, it is unlikely to have travelled far and hence is probably Cambrian.

To the north of felsic lavas are more sericite-chlorite altered felsic volcanoclastics grading to fine grained tuffaceous siltstones. The massive pyrite reported to in PD84CC9 on line 600E would appear to be hosted in these altered sediments.

Up sequence are barren, relatively unaltered green siltstone and greywacke sandstones of probable intermediate provenance. Cherty class conglomerates and plagioclase $>$ quartz phyric lavas/intrusives in turn interfinger and overlie these unaltered sediments.

The contact between the altered and unaltered sediments in the northern portion of the prospect appears to have the best prospects for a classic exhalative style VMS deposit. This zone is characterised by weak UTM anomalies along it from 100E to 700E and moderate IP anomaly in the footwall to the contact. Unfortunately the contact on line 300E is halfway down a steep slope and rocks are very leached, nevertheless it still has weakly anomalous soil geochemistry (up to 120 ppm Cu, 260 ppm Pb, 64 ppm Zn) and strongly anomalous rock chips (up to 160 ppm Cu, 1340 ppm Pb, 3700 ppm Zn).

To the east the altered volcanoclastics appear to overlap a massive felsic unit which could be a dome separating possibly equivalent volcanoclastic strata at Cethana East.

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5.4 Cethana East Prospect

Geological interpretation at Cethana East (refer Figure 4) is based largely upon G J Purvis' (1979) mapping with some check mapping re-logging of DD77CC4 - CC8 and mapping of road cuttings. The two new DDHs' CED1 and CED2, support the previous lithological interpretation but suggest the hydrothermal system is weakening to the east.

The Cethana East prospect lies along strike from Cethana West with the intervening ground covered by Quaternary glacials and periglacial Roland conglomerate scree which extends eastwards over the northern part of Cethana East. This cover obscures potentially prospective rocks which remain untested for VHMS mineralisation.

As recognised at Cethana West, the southern contact between the Cambrian volcanics/sediments and the younger Late Cambrian - Ordovician siliclastics is an angular unconformity. Towards the southern end of lines 21600E, 21700E and 21750E are unaltered siliceous sandstone outcrops. This may be fault bounded sliver of the Moina Sandstone (Herrmann 1979) but as Purvis (1979) indicates, it looks quite like a Precambrian quartzite. The contact between this sandstone/quartzite and the Cambrian volcanics to the north does not outcrop but appears as a very weak anomaly on the CRONE EM survey (MacDonald 1993) and it is probably a fault.

No facing indications were found at Cethana but it is very likely that the sub-vertical sequence youngs to the north based on the younging orientation of similar rocks to the west, along strike at Cethana West.

The Cambrian rocks at Cethana East essentially consist of a package of felsic volcanoclastics and cherty tuffaceous siltstones, the former characterised by fine grained to coarse grained quartz eyes with variable punice feldspars and lithics including rounded cherty (quenched felsic lava?) clasts and tuffaceous siltstones. Felsic lavas/porphyries are less common at Cethana East than along strike both east and west.

Overall the package appears to fine up sequence to the north in the area of Olivers Road where drilling has taken place, though the rocks further north are obscured by Quaternary cover.

A felsic lava with a hyaloclastic margin outcrops in the western part of the prospect on lines 21400E and 21450E and extends at depth in DD77CC6, (refer Figure 4). Similar lava was intersected in CED1 and CED2 to the east but lava has not been mapped in this area.

Alteration is restricted and less intense in the lavas compared to the surrounding felsic volcanoclastics, which exhibit ubiquitous but variable quartz \pm sericite \pm and chlorite development together with common post cleavage carbonate veining.

Low-grade sulphidic mineralised zones detailed in Table I and shown in Figures 6 and 7, were intersected in all CRAE drillholes. Of most significance are the semi-massive pyrite-sphalerite-galena-chalcopyrite lens form 37.8m - 38.8m in DD77CC5 and the thin massive pyrite lenses at 62.7m - 62.0m in DD77CC7 and from 61.5m - 61.75 in

DD77CC4. Most sulphidic zones consist of pyrite stringer veins and blebs partially aligned in the S₂ cleavage, which suggests an early, possibly syngenetic origin.

The most important galena-sphalerite bearing stringer zone was intersected over twelve metres from 31.0m to 43.0m in DD77CC6. This is correlated with the semi-massive zone in DD77CC5 along strike to the east. Petrology suggests this zone could be syngenetic in origin and may represent a weak early phase of exhalative mineralisation above a dominantly pyritic footwall alteration zone to the south. The lack of a significant sulphide intersection in DD77CC8 directly below the promising

intercept in DD77CC5, is considered indicative of a poorly developed lenticular mineralised zone which is unlikely to have significant lateral or vertical extent. This may be a result of rapid ongoing, sedimentation swamping and diluting the sulphide mineralisation, or erratic sub-seafloor syndiagenetic mineralisation which was controlled by relative permeability in the volcanoclastic package.

Potential remains for this mineralisation to be better developed in a more quiescent sedimentary environment, which may have existed along strike to the west of DD77CC6 but more likely was up sequence where finer lithologies are reported north of the hairpin bend on Olivers Road.

TABLE 1

PREVIOUS SIGNIFICANT DRILL RESULTS AT CETHANA EAST

| Hole No. | Interval (m) | Significant Intercept |
|----------|------------------|---|
| DD77CC5 | 37.8 - 38.8 | 1.0m @ 1.18% Cu, 0.80% Pb, 3.88% Zn, 1.85 g/t Ag and 0.7 g/t Au |
| | 57.0 - 59.3 | 2.3m @ 45 ppm Cu, 9500 ppm Pb, 3950 ppm Zn |
| | 80.0 - 85.0 | 5m @ 770 ppm Cu, 1100 ppm Pb, 3500 ppm Zn |
| DD77CC6 | 31.0 - 43.0 | 12m @ 142 ppm Cu, 3442 ppm Pb, 6308 ppm Zn |
| | incl 36.5 - 41.0 | 4.5m @ 227 ppm Cu, 3833 ppm Pb, 1.19% Zn |
| | 50.2 - 62.4 | 12.2m @ 137 ppm Cu, 5439 ppm Pb, 2412 ppm Zn |
| | incl 52.2 - 54.2 | 2m @ 110 ppm Cu, 9200 ppm Pb, 2800 ppm Zn |
| | incl 60.0 - 62.4 | 2.4m @ 310 ppm Cu, 9800 ppm Pb, 6500 ppm Zn |
| | 189.0 - 200.5 | 11.5m @ 273 ppm Cu, 743 ppm Pb, 2467 ppm Zn |
| DD77CC7 | 62.2 - 62.8 | 0.6m @ 90 ppm Cu, 1400 ppm Pb, 4550 ppm Zn |
| | 68.5 - 86.0 | 17.5m @ 72 ppm Cu, 693 ppm Pb, 2453 ppm Zn |
| | 109.3 - 112.5 | 3.2m @ 149 ppm Cu, 1694 ppm Pb, 2009 ppm Zn |
| DD77CC8 | 32.0 - 32.75 | 0.75m @ 130 ppm Cu, 1500 ppm Pb, 5000 ppm Zn |
| | 54.0 - 57.0 | 3m @ 140 ppm Cu, 1150 ppm Pb, 3150 ppm Zn |
| | 95.0 - 103.0 | 8m @ 180 ppm Cu, 1220 ppm Pb, 4120 ppm Zn |

6. EXPLORATION HISTORY

Asarco's initial program was regional stream sediment sampling at 2/km² and reconnaissance mapping. Essentially all current prospects were discovered as a result of this drainage geochemistry.

CRAE entered into a joint venture with Asarco in 1976 and initiated ground surveys to assess the targets generated through Asarco's stream sampling program. These surveys included gridding, geological mapping, soil and rock chip sampling and geophysical surveying (gradient array IP, dipole-dipole IP, magnetics, self potential and VLF-EM) on the Lake Barrington, Promised Land, Staverton, Cethana (East and West), Gog Range and Cethana Picnic Ground prospects.

Encouraging results led to detailed work to be conducted on the Lake Barrington, Cethana (East and West), Staverton and Gog Range grids. These surveys included detailed dipole-dipole IP, Genie EM, PEM, UTEM and helicopter borne EM (Dighem) results of which led to the drilling of 14 diamond and three percussion drillholes. Twelve of the holes were drilled on the Cethana Prospect with six holes each at Cethana West and Cethana East. The majority of holes intersected low-grade lead-zinc mineralisation (1%-2%) within pyritic altered volcanics and tuffaceous sediments. Best results are as shown in Table 1 and discussed in Sections 5.3 and 5.4.

All four diamond holes drilled on the Lake Barrington prospect encountered encouraging stringer-vein type pyritic copper mineralisation with some gold and silver credits within felsic volcanics and volcanoclastics. Best results are as follows:-

| Hole No. | Interval (m) | Significant Intercept |
|----------|---|---|
| DD80LB1 | 179.4 - 179.5 | 0.10m @ 14% Cu, 0.75% Pb, 0.59% Zn, 1.35 g/t Au |
| DD82LB3 | 140.8 - 140.98 156.5 - 172.45 207.85 - 209.00 | 0.18m @ 9.1% Cu, 52 g/t Ag 15.85m @ 1.2% Cu, 12 g/t Ag 1.15m @ 1.6% Cu, 18 g/t Ag |
| DD83LB4 | 48.0 - 49.0 225.8 - 226.3 | 1.00m @ 1.9% Cu, 5 g/t Ag 0.50m @ 4.8% Cu, 36 g/t Ag, 3.2 g/5 Au |

A mise-a-la-masse anomaly with almost coincident IP and strong Cu soil anomalies were not adequately tested by any of these holes at the Lake Barrington prospect.

At Staverton, percussion hole PD83SP1, designed to test coincident geochemical/geophysical responses, intersected highly altered pyritic quartz sericite schists with significant base metal mineralisation. Results included 24 metres @ 0.9% Pb, 0.5% Zn, 10 g/t Ag from 20 metres depth including 6 metres from 28 metres at 1.3% Pb, 1.0% Zn and 14 g/t Ag.

Throughout the tenement it should be noted that few gold assays were undertaken by CRAE until extremely late in the period of tenure when an attempt was made to broadly assess the licence for fine grained volcanogenic gold deposits. Bulk Cyanide Leach sampling techniques in conjunction with standard stream sediment sampling surveys were implemented *sparsely across the tenement*. Significant results were returned, however, no detailed investigations were instigated to confirm and quantify the occurrences. In particular, no detailed follow-up was undertaken of the high grade Gog Range gold/tungsten panned concentrate sample which eventually led to the discovery of the Fire Tower Prospect.

Minor re-assaying of drillcore for gold returned values to 1 g/t Au over 1 metre, however, in general, only samples which contained visible lead-zinc mineralisation were assayed and not zones with abundant pyrite and/or silica. However, all four Lake Barrington drillholes were assayed for gold by Noranda.

7. PLUTONIC EXPLORATION

7.1 1992 - 1993

In March 1992 when Plutonic became operator of the joint venture, a thorough review of all previous geological, geophysical and geochemical data was undertaken, which resulted in the recognition of potential drill targets for Cethana East and West, Staverton, Lake Barrington and Fire Tower prospects.

Reconnaissance mapping was conducted at Cethana (East and West), however, the major field work involved mapping of the Fire Tower prospect at 1:500 scale and re-logging of the 17 short DDH's drilled by Noranda at Fire Tower.

In August 1992 to July 1993 exploration was carried out on the Staverton, Cethana West and Cethana East prospects as well as on the now relinquished Lake Barrington prospect.

7.1.1 Staverton Prospect

Following limited prospect scale mapping a single DDH of 267.20 metres was targeted on coincident dipole-dipole IP and anomalous Cu, Pb and Zn in rocks and soils. The hole intersected intermediate to mafic lavas with similar trace/whole rock geochemistry to the rocks in the footwall to the Que River and Hellyer deposits. Minor associated lithologies included felsic volcanoclastics and lavas, and a major fault was interpreted near the end of the hole. Base metals and gold assays of drill core gave patchy, moderate anomalism, however, DHEM and extensive ground EM (CRONE) surveys over the whole of the prospect provided no responses considered to relate to conductive sulphides.

Mapping led to the discovery that the intermediate/mafic rocks of the Beulah Formation are much more extensive than previously understood and occupy a major synclinal position in the Staverton area. To the south-west the "Campground" alteration zone in felsic volcanics may correlate with sequences at Gowrie Park east of the Cethana prospects.

7.1.2 Cethana West Prospect

Detailed mapping, including the re-logging of previously drilled (CRAE) DDHs, was carried out along with some reconnaissance soil and rock geochemical sampling. This work led to the recognition of the existence of a contact between underlying, weakly anomalies (maximum 833 ppm Zn) altered felsic volcanics/volcanoclastics to the south, and relatively unaltered greywackes and intermediate volcanics to the north.

DHEM surveys were conducted on drillholes 77CC1 and 86CC13, and percussion holes PD84CC9, however, no responses due to conductive sulphides were recorded. Ground EM on two grid lines was also unsuccessful due to interference from overhead power lines.

No further work is recommended on this prospect.

7 1.3 Cethana East Prospect

Core re-logging and mapping at Cethana East was conducted prior to carrying out an extensive ground EM (CRONE) survey over the majority of the prospect, including a portion of the previously untested northern sequence above the area previously drilled by CRAE. No positive responses due to conductive sulphides were recorded, however, the presence of high tension power lines may have affected the results. Reconnaissance and check rock/soil geochemical sampling was conducted with the single most significant result being the 3149 ppm zinc soil sample corresponding to a dark shaley siltstone taken from north of Claude Road.

7.2 1994

Drillholes CED1 and CED2 tested the eastern extension of the pyritic alteration zone. These holes as well as three of five existing CRAE DDH's were surveyed using CRONE DHEM equipment.

| Hole No. | Co-ordinates S E | Az | Dip | Total Depth (m) | Significant Mineralisation |
|----------|---------------------|--------|-------|-----------------|--|
| CED 1 | 700 22400 | 192.5° | - 64° | 200.0 | No significant results |
| CED 2 | 3480 21825 | 192.5° | - 45° | 295.0 | 79.2 - 85.2, 6m @ 0.01% Cu, 0.20% Pb, 0.64% Zn, |
| | | | | incl | 81.2 - 83.2, 2m @ 1.02% Zn, |
| | | | | | 112.0 - 115.0, 3m @ 0.34% Pb, 0.14% Zn, 231.0 - 232.0, 1m @ 0.05% Pb, 0.46% Zn |

7.2.1 CED 1

Drillhole CED 1 (Figure 3) was sited on line 22400E to test a strong chargeability high (>3 times background) recorded in a 1990-1991 dipole-dipole IP (50m spread) survey conducted by Noranda.

The hole passed through a sequence of fine to medium grained felsic (quartz ± feldspar) volcanoclastics, moderately cleaved and moderately chlorite altered throughout with disseminated and diffuse haematite alteration and minor disseminated pyrite down to 135.15 metres. At this depth a 1.05m wide zone of pyrite stringers (15% Py) aligned into the cleavage was intersected within sericitic fine to medium

grained felsic volcanoclastics. From 136.20 metres to 148.60 metres the hole intersected further chloritic, haematitic felsic volcanoclastics and a porphyritic felsic lava (?) before intersecting a major 3.23 metre thick pyritic stringer zone, from 164.15 metres to 167.40 metres. Stringer silica-pyrite-carbonate veins and pyrite blebs range from 2% to 20% in narrow intervals in this zone. Below this zone pyrite stringers continue at a lesser frequency to the end of the hole, within mottled chloritic, haematitic, pumiceous felsic volcanoclastics. No significant base metals accompany the pyrite.

All values are less than 500 ppm Cu, Pb and Zn and maximum gold values are 0.02 g/t Au. These results match the poor surface geochemical expression of the target sequence. The pyrite stringer zones explain the IP response but the lack of associated base metals indicates this horizon is unlikely to be directly associated with an exhalative horizon of significance.

7.2.2 CED 2

Drillhole CED2 was positioned on section 21825E (Figure3) to test two targets:

1. Strong chargeability high recorded in the same 1990-1991 survey as the anomaly targeted by CED 1.
2. Geochemically anomalous fine chloritic sediments which host the base metal intersection in DD77CC5 on section 21750E, 75 metres to the west.

The hole was sited on the edge of Olivers Road and drilled at 45° towards magnetic/grid south for 295.00 metres. The hole initially passed through a package of fine tullaceous siltstones and fine to medium grained sericitic felsic volcanoclastics with minor disseminated and veinlet haematite and pyrite. From 79.0 to 88.5 metres the hole intersected base metal anomalous pyrite-silica-carbonate veinlet mineralisation within moderately chloritic siltstones and sandstones which are probably equivalent to the host sequence to the CC5 sulphide intersection. The six metre zone from 79.2 to 85.2 metres assayed 0.01% Cu, 0.20% Pb, 0.64% Zn including two metres of 1.02% Zn from 81.2 metres.

Below 109.20 metres to around 180.00 metres minor (1-5% Py) deformed pyrite stringer veinlets in the cleavage were intersected within a package of more medium grained felsic volcanoclastics exhibiting moderate sericitic and diffuse/disseminated haematite alteration. The maximum pyrite development (5-10% Py) with associated silica and carbonates occurs in a zone from 166.70 metres to 168.10 metres.

Overall base metal sulphide levels are low, though much higher than in CED1, reflecting the increasing surface geochemistry to the west towards DD77CC5. Gold assays are uniformly low with a maximum value of 0.059 g/t Au.

The equivalent horizon to the CC5 intersection exhibits elevated lead and zinc values associated with moderate development of post-cleavage carbonate-sulphide veins. Other elevated base metal anomalous zones further down hole also appear to be related to similar silica or carbonate rich veins within sericite altered volcanoclastics. However, at least some base metals are associated with pyritic blebs or stringer veins as at 231-232 metres where a 20 cm pyrite stringer assayed 0.05% Pb and 0.46% Zn.

7.2.3 Drilling Assessment

Seven diamond drill holes have been drilled at Cethana East over the past two decades. Four of those holes (CC4, CC7, CED1, CED2) were targeted on IP anomalies and two (CC5 and CC6) targeted on soil geochemical anomalies. DDHCC8 failed to intersect a significant down-dip extension of the promising semi-massive sulphide intersection in DDHCC5, however in general, surface geochemical targets have been shown to have a base metal expression at depth.

The drilling has provided sufficient geological information for it to be stated that the chargeability anomalies targeted and intersected by CC4, CC7, CED1 and CED2 are due to the one broad zone of irregular cleavage oriented pyrite \pm silica-carbonate stringers which strikes from 21600E to 222600E. This pyrite zone is considered to be typical of a deformed "footwall stringer" zone beneath a potential exhalative target horizon.

CED2 has shown that the base metal horizon intersected in CC5 on 21750E is only weakly developed on 21825E however it remains open along strike to the west of DDHCC6 where surface geochemistry remains strong.

Although many of the base metal intersections in this zone are related to narrow quartz-sulphide veins, these veins are considered to be related to a Cambrian VMS hydrothermal system which has been deformed during the Devonian.

DHEM surveys (refer Table 4) have indicated that there are no significant conductive sulphide lenses nearby any of the drillholes at Cethana East. The narrow pyrite intersection DDHCC7 has no strike extent and must be a minor lens low within the footwall sulphide zone.

TABLE 4

CETHANA EAST DHEM SURVEY RESULTS

| Hole No. | Drilled Depth (m) | Cleaned-Out Depth(m) | Survey Depth(m) | Probes | Results |
|----------------------|-------------------|----------------------|-----------------|----------|--|
| CED 1 | 200.0 | - | 195.0 | Z only | "No anomalous responses detected" |
| CED 2 | 295.0 | - | 234.0 | Z only | "No anomalous responses detected" |
| OLD CRAE DDHs | | | | | |
| 77CC4 | 149.7 | 106.0 | 100.0 | X, Y & Z | Strong anomalous response at 36-66m appears to be from steel casing left in drillhole. * No anomalies were detected outside of this interval. |
| 77CC6 | 200.5 | 200.0 | 165.0 | X, Y & Z | "No anomalous responses detected" |
| 77CC7 | 137.0 | 137.0 | 130.0 | X, Y & Z | A weak in-hole response at 60 metres coincided with the intersection of a narrow conductor. This is a single point anomaly which indicates the intersected horizon is not extensive. |
| 77CC8 | 157.6 | 157.6 | 157.0 | X, Y & Z | "No anomalous responses detected" |

* It is quite possible that casing was left in DD77CC4 in this interval as the hole changes from NQ to BQ at 64.6 metres, however, no such casing is noted in CRAE's original logs.

7.3 1995

7.3.1 Data Review

A review by Wally Herrmann (Appendix 1) was conducted of the Cethana and Staverton prospects in order to promote more effective exploration of the project. In essence, the review concluded that the Staverton area held little VHMS prospectivity but potential remains at Cethana East. However, the geological setting on both regional and prospect scales remains poorly understood, and the known mineralisation is low grade, possibly remobilised in deformation zones.

In order to properly assess the VHMS prospectivity of the Cethana East area it was recommended that a program of outcrop mapping, drill core reinterpretation of volcanic facies, alteration and structure supplemented by whole rock geochemistry be undertaken. This work was not conducted.

7.3.2 Auger Geochemistry

Prior to the review, a programme of bedrock auger sampling was conducted in covered areas at Cethana East. The aim of this survey was to provide geochemical and geological evidence to support the existence of an exhalative position north of the area previously drill tested. The auger, however, could not penetrate to bedrock over much of the western and northern portions of the grid, however a total of 75 samples were taken wherever feasible on the gridlines.

Peak values were generally achieved downslope or directly along strike from existing highly anomalous results. In the vicinity of known mineralisation intersected in drillholes DDHCC3 and 6, the geochemistry suggests there is little possibility of significant near surface strike extensions west of 21500E and south of 3400S.

To the north, however, the data is insufficiently detailed west of 21750E to preclude the possibility of an overlying mineralised position around 34000S-3450S.

A second horizon of particular interest was identified two hundred and fifty metres to the north and down slope, where an extensive but only partly defined Pb-Zn anomalous zone trends across the grid from 21200 near the Claude Road to the tenement boundary around 22400E. This zone is best developed along the 21800E line centred at 3150S where earlier sampling achieved 2860 ppm Pb, 630 ppm Zn and 3970 ppm Mn. Along the powerline track crossing the 21900E line, the anomalous target zone subcrops as a variably Fe-Mn rich gossanous felsic volcanoclastic. This lithology appears to extend east to Olivers Road around 22150E 3200S. To the west of 21800E the zone is mostly obscured under thick cover but it reappears south of the Clause Road along the 21200E and 21400E lines.

In summary, the auger bedrock sampling programme over the northern scree covered slopes at Cethana East has partially outlined an extensive geochemically anomalous target zone related to gossanous felsic volcanoclastics. This zone may have represented an upper exhalative mineralised horizon and was the target for a reverse circulation drilling programme conducted in early 1996.

7.4 Work Conducted in the Twelve Months to July 1997

7.4.1 Summary

A six hole reverse circulation drilling programme totalling 373 metres was completed over 300 metres of strike along the northern geochemical target in February 1996. This work indicates the horizon represents a poorly focussed VHMS style footwall alteration zone with minor base metal bearing stringer veins and no obvious exhalative position. There is a suggestion that the alteration and mineralisation is improving along strike to the west, however, in the absence of any stratiform mineralisation this target zone did not warrant further drilling.

Reconnaissance north of the Claude Road has located a contact between the felsic sequence and overlying intermediate volcanics. This could represent a favourable exhalative position for future exploration.

7.4.2 Introduction

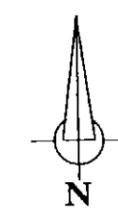
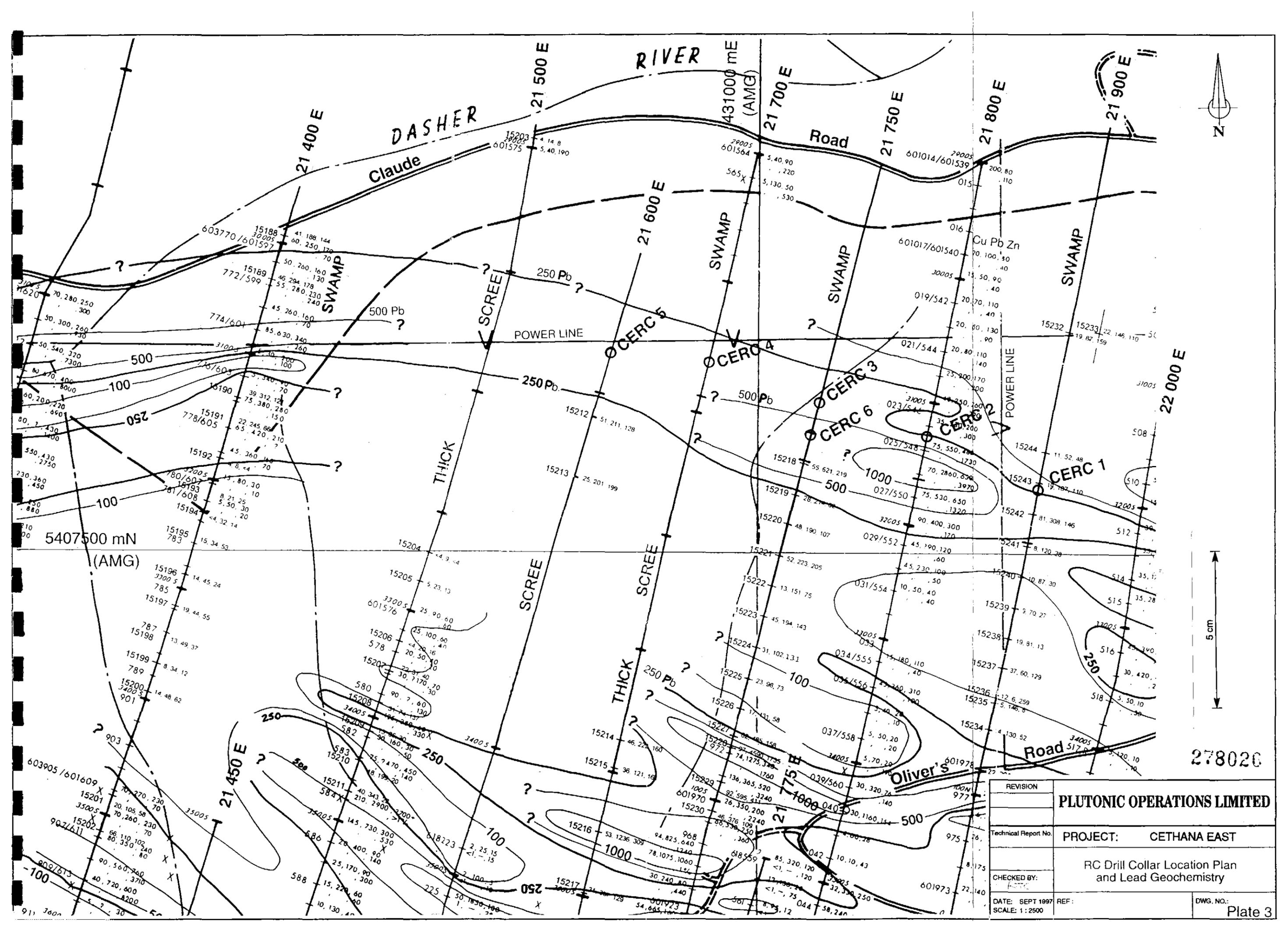
A six hole reverse circulation drill program totalling 373 metres at Cethana East was completed 2/2/97. The aim of this program was to define an exhalative VHMS horizon in the northern part to the Cethana East prospect. The proposed program originally entailed 5 drill holes for a total of 600m, targeted at peak Pb-Zn soil geochemistry of 1860 ppm Pb and 650 ppm Zn centred at 3160mN, 21800mE. Planned hole depths varied from 100 to 150m, covering approximately 300m of strike, with the western most holes targeted beneath the likely extension of mineralisation beneath scree cover.

Site locations and drilling difficulties, however, resulted in curtailing the total drilled to 373 metres, in drill holes CERC1 to 6. The final drill collar plan is presented in figure 14 and drill hole statistics are given in Table 5. Co-ordinates are presented as AMG and local grid references. Where the grid does not exist, approximate grid references are indicated (~) with the AMG reference derived via surveying from appropriate known survey points. Drill logs and assays are presented in Appendix II.

Table 5: Cethana East RC Drill Hole Statistics

| Hole | AMG Grid | | Local Grid | | Azimuth | Dip | Depth (m) | Drilled Date |
|-------|----------|---------|------------|-------|---------|-------|--------------|-----------------|
| | mE | mN | mE | mN | | | | |
| CERC1 | 431228 | 5407550 | ~21900 | ~325 | 193 | -60 | 86 | 24/01/97 |
| CERC2 | 431140 | 5407592 | 21800 | 3127 | 193 | -60 | 71 | 28/01/97 |
| CERC3 | 431049 | 5407622 | 21750 | ~421 | 193 | -60 | 49 | 29/01/97 |
| CERC4 | 430960 | 5407652 | 21700 | 3064 | 193 | -60 | 58 | 30/01/97 |
| CERC5 | 430880 | 5407654 | ~21600 | ~3060 | 193 | -60 | 66 | 31/01/97 |
| CERC6 | 431044 | 5407596 | 21750 | ~394 | 193 | -60 | 43 | 1/02/97 |
| | | | | | | Total | 373 | |

Access and drill sites were prepared using an excavator operated by Brian Rouse, a local earth moving contractor. Site clearing for holes CERC4, 5 and 6 was completed using a chain saw.



5 cm

278020

| | | |
|----------------------|--|--------------|
| REVISION | PLUTONIC OPERATIONS LIMITED | |
| Technical Report No. | PROJECT: | CETHANA EAST |
| CHECKED BY: | RC Drill Collar Location Plan and Lead Geochemistry | |
| DATE: SEPT 1997 | REF: | DWG. NO.: |
| SCALE: 1:2500 | | Plate 3 |

Hole depths attained were significantly less than expected due to adverse ground water pressures and high drill torque induced by the clayey conditions encountered. All samples were typically wet from about 30m depth and rock chip size was mostly small (<1.5cm). Drilling rates at depths greater than 60m were very slow, with as little as 3m per hour achieved at times.

A further hindrance to drilling was the notably clay-rich basal portion (~5m) of the transported overburden. Swelling clays caused hole closure around the drill rods requiring reaming this section in some holes (CERC3 and 6) as the hammer would not actuate under these conditions.

The program was subject to environmental obligations stipulated by Mineral Resources Tasmania. These included the condition that "no holes are to be left making water". This condition was satisfied by using the drill rig to ram a 50cm long pine plug into holes making water to curtail water discharge from the drill hole collar. The plugs were slightly greater in diameter than the drill hole and are expected to swell as they become water logged, further reducing the water flow with time. The plug was particularly effective in CERC2 where a 300 litre per minute discharge was reduced to a mere trickle!

Rehabilitation involved pouring drill chips into the collar to assist hole plugging, with the remainder scattered and further mixed into the substrate using an excavator as tracks were rehabilitated. Track surfaces were re-contoured and vegetation dragged across them. A final report on rehabilitation will be presented following remedial work later in 1997.

7.4.3 Geology and Mineralisation

Lithology

Quaternary cover drilled in all but CERC1 comprised largely Owen Conglomerate detritus mixed with felsic volcanics. This cover extended to a maximum of ~16m true thickness in CERC5 and was found to vary considerably in nature. Units logged and individual lenses identified vary from 1 to ~6m in thickness. Principal identifying criteria were the presence of Owen Conglomerate clasts and sub-angular to sub-rounded clast form.

The thickness and distribution of transported cover confirms the unreliability of soil sampling results north of 3125MS on line 21800mE. The distribution of cover south (upslope) of CERC2 is unknown, however, strong anomalism up-slope from here can possibly be regarded as realistic.

A clay rich substrate which could easily be mis-identified as weathered in-situ felsic volcanic occurs in the vicinity of CERC3. This hosts numerous "gossanous" ironstone fragments to boulder size. Examination of this ironstone revealed botryoidal goethite growth, semi-dendritic (plant root) cavities, Owen Conglomerate and weathered felsic volcanic clasts. The presence of included Owen Conglomerate clasts and transported cover drilled beneath this area indicates the ironstone is not in situ gossan. A rock chip sample, (15380) collected to determine the possible role of such fragments as a source of anomalism in nearby soil samples, gave results of 65ppm Cu, 1070ppm Pb and 1090ppm Zn.

In the appended drill logs and plans the graphic logging is applicable only in the broadest sense as obviously clast size in a given lithology can only be interpreted. The attributes listed on the right hand side of the logs are largely self explanatory, however some abbreviations are elaborated on here. "hm", haematite applies to a pink stain often associated with silicification and could alternatively be interpreted as k-feldspar alteration, with the exception of the jasper occurrence in CERC4. "Fe" applies to ferruginous oxidised (goethite) fragments which are commonly evident in the upper weathered portion of the drill holes.

Cambrian (MRV) lithologies intersected in drilling were of rhyolitic composition and displayed little textural variation. Volumetrically the most abundant rock type was a cream coloured fine to medium grained quartz-phyric felsic volcanoclastic sandstone. A subordinate very fine grained cream to pale green felsic volcanoclastic siltstone probably occur as thinly bedded intercalations within the dominantly quartz - phytic volcanoclastic pile.

All volcanics intersected were invariably weakly foliated. Quartz veining was evident to varying degrees in all holes and is interpreted to represent Devonian aged deformation and hydrothermal activity. Slickensides locally associated with this veining gave a dextral sense of displacement.

Alteration

Alteration and mineralisation was difficult to discern above the top of fresh rock (TOFR) encountered between 30 and 55m, but quartz veining and ferruginous fragments were readily apparent. Distribution of ferruginous fragments is obviously related to exposure to surficial weathering. A high concentration of these fragments in CERC3 immediately beneath the transported cover may reflect the presence of a Quaternary palaeosol.

Alteration is evident in two principal forms:- moderate sericitisation and silicification with chlorite. Sericitisation is commonly associated with disseminated galena, and traces of grey metallic? flecks often mentioned in the logs most likely represent galena mineralisation. Silicification with chlorite was more readily evident within weathered rock but is apparently a minor alteration style in the holes drilled.

Carbonate was less noteworthy, being infrequently observed as a constituent of "Devonian" quartz veins and accompanying a weak haematitic alteration zone from 13-17 metres in CERC2.

Mineralisation

Fragments of pyritic massive sulphide are evident in CERC3 and 4. These fragments comprised fine grained aggregates of pyrite, mostly in "massive" near pure form with another textural variant containing approximately 50% quartz eyes being sparsely evident. Disseminated pyrite is associated with weak silicification in CERC1 and sparsely distributed trace quantities accompany sericitisation in other holes.

The best candidate for an exhalitive VHMS host horizon was observed in CERC4, from 44 to 46m. This zone contains strong haematite alteration and jasper development accompanied by trace disseminated galena and pyrite aggregates within a fine grained felsic volcanic host. This interval is underlain by a zone of moderate sericitisation displaying disseminated and stringer(?) style galena grading 1% Pb over 1m from 48m. Fine grained pyrite aggregates, silica-chlorite and silica-disseminated galena vein fragments along with grey ("cherty") silicification are features of this zone. However, despite these features later examination of this interval by Wally Herrmann (report appended) indicated an exhalite was not present. Herrmann's observations are supported by low Ba and Mn analysis for this zone.

In general, alteration characteristics and zinc numbers of mineralisation within the drill holes indicates the target zone represents poorly focused footwall VHMS alteration.

A volcanoclastic origin for the enclosing rocks is supported by Ti/Zr variability, and the coarse nature of these sediments with few observed volcanoclastic siltstones suggests a high energy environment not conducive to VHMS development at this horizon.

7.4.4 Geochemistry

Initial assessment of drill cuttings was conducted by collecting four metre composite samples using a PVC pipe spear to obtain a representative portion of each bagged metre interval, resulting in a final sample weight of 2 to 3kg. In each hole, sampling commenced at the base of transported cover. An exception was CERC6 where the overburden was not readily differentiated and thus the entire hole was sampled.

A total of 92 samples were collected, comprising 71 RC-4m composites, 20 RC-1m composites and 1 gossanous rock chip sample. The one metre intervals were sampled through the best mineralised intersection, namely from 47 to 58m in CERC4 and from 57 to 66m in CERC5. Samples were analysed at Analabs, Burnie by method GA140 for Cu, Pb, Zn, Ag, Fe and Mn and for Au by method GG313.

Results

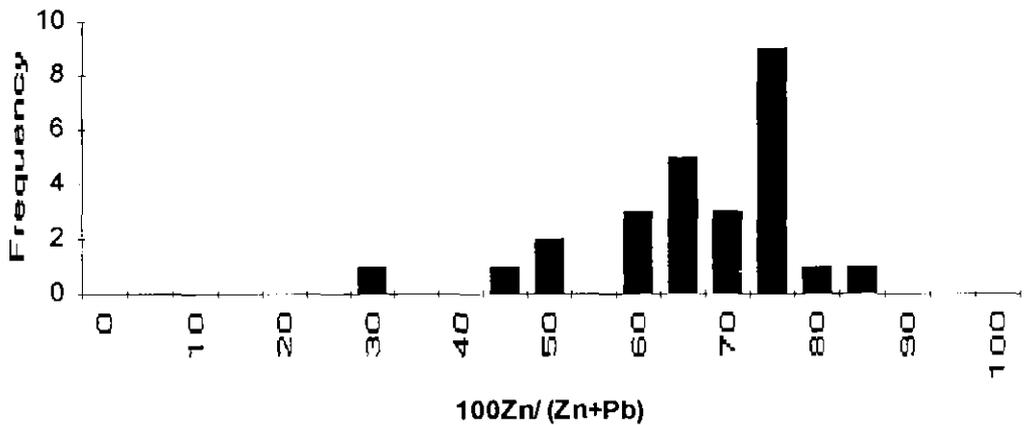
Overall, peak assays were low with maximum individual values of 86ppm Cu, 2740ppm Pb, 2620ppm Zn and 0.018ppm Au. The best mineralised intervals and peak 1m assays are tabulated below and all results are appended.

Table 6: Cethana East - Best RC Mineralised Intervals

| Hole | interval (m) | From (m) | to (m) | Pb (ppm) | Zn (ppm) |
|-------|--------------|----------|--------|----------|----------|
| CERC4 | 10 | 48 | 58 | 514 | 639 |
| inc. | 1 | 48 | 49 | 2740 | 1390 |
| CERC5 | 4 | 60 | 64 | 576 | 1438 |
| inc. | 1 | 62 | 63 | 850 | 276 |

FIGURE 4

Zn Number for Zn > 250pp



The figure above illustrates the Zinc Number calculated from all samples with anomalous Zn (> 250 ppm). Favourable comparison of the mean and standard deviation of this data (68.9,12.3) with Huston and Large's data (1987, Econ Geol v82,pp1521-1539, mean range 60-77, SD<15) suggests mineralisation is probably VHMS related.

ICPOES Sampling:

Seventeen intervals from the RC Drilling were re-sampled using the ICPOES technique to assess the distribution of major elements. Elements analysed were Ba, Ca, Na, Mg, Fe, K, As, S, Ti, Zr, P, Bi and U. The samples incorporated both mineralised and barren zones as well as hm-ks?-sil altered zones. A sampling rationale table and assays are appended.

Na depletion and alteration index were calculated from these analysis to attempt targeting VHMS style mineralisation. Data plotted on Plan2 clearly illustrate zonation in both indices with relative depletion in Na and increasing alteration index respectively from east to west. These patterns are consistent with the increasing tenor of mineralisation to the west.

Ti/Zr ratios for selected samples are very variable (12 to 38, average) and much higher values than expected. These values suggest an andesitic rather than a felsic parentage for the volcanoclastics.

Results for Bi and U were mostly below detection, suggesting no input from granitic fluids for the mineralisation.

Sample Data used in Plate 5, Cethana East : Geology and Geochemistry.

| Sample No | Ba | Ti/Zr | Na2O | Alteration Index |
|-----------|------|-------|------|------------------|
| 15340 | 404 | 16 | 0.49 | 81 |
| 15344 | 323 | 18 | 0.75 | 47 |
| 15351 | 326 | 23 | 0.55 | 44 |
| 15358 | 602 | 20 | 0.56 | 82 |
| 15363 | 585 | 21 | 0.55 | 82 |
| 15370 | 832 | 21 | 0.23 | 89 |
| 15372 | 1020 | 20 | 0.31 | 91 |
| 15379 | 824 | 22 | 0.24 | 92 |
| 15387 | 862 | 1 | 0.36 | 90 |
| 15392 | 640 | 25 | 0.14 | 92 |
| 15401 | 727 | 24 | 0.12 | 93 |
| 15407 | 1210 | 25 | 0.07 | 97 |
| 15409 | 1500 | 25 | 0.12 | 94 |
| 15413 | 1330 | 23 | 0.09 | 94 |
| 15423 | 931 | 18 | 0.42 | 87 |
| 15427 | 1020 | 24 | 0.01 | 97 |
| 15428 | 381 | 18 | 0.15 | 90 |
| 15429 | 70 | 8 | 0.07 | 86 |

Sampling rationale table

| Drill Hole | Most Mineralised | Least Mineralised | Sil-Hm/Ks? Alteration |
|------------|------------------|-------------------|-----------------------|
| CERC1 | 15340 | 15351 15344 | |
| CERC2 | 15363 | 15370 | 15358 |
| CERC3 | 15379 | | 15372 |
| CERC4 | 15392 15401 | 15387 | 15428 |
| CERC5 | 15413 15409 | 15407 | |
| CERC6 | 15423 | 15427 | |

7.4.5 Conclusions and Recommendations

The zinc number and alteration index results suggest significant alteration of a VHMS style is present within the area drilled. However, poor assay results, the stringer-type mineralisation intersected and lack of a recognisable exhalative horizon do not warrant further exploration along strike from this geochemically anomalous zone. Updip to the north the scree cover effectively prevents surface mapping and geochemistry. However, across the Claude Road reconnaissance has located a contact between felsic and dacitic to andesitic volcanics. This contact lies north of current EM and soil sample coverage and represents a potential site for VHMS mineralisation despite the lack of obvious mineralisation or increased alteration in the vicinity of this contact.

A programme of mapping, soil geochemistry and ground magnetics was proposed to provide an initial evaluation of this contact's prospectivity. However, in a final assessment of this project, this work was rejected and a decision made to relinquish this project.

8. CONCLUSIONS

Plutonic has identified several zones of weak stringer-style VHMS base metal mineralisation within a thick variable silica-sericite-pyrite altered felsic volcanoclastic sequence at Cethana East. Early exploration was focussed on drill testing the Cethana pyrite zone which has a strong IP expression but no associated EM anomalism. Recent work aimed at identifying an overlying exhalative position to the extensive alteration zone but the results were negative.

Therefore, in the absence of any suitable remaining targets no further work was considered warranted and the Cethana tenement area has subsequently been relinquished.

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APPENDIX I

**Review of Cethana and Staverton
Exploration & Potential**

by

Wally Herrmann, May 1996

97-4068A - Appx 1 of
97-4068

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PLUTONIC OPERATIONS LIMITED

MEMORANDUM

TO: Bob Close, District Geologist - Base Metals
FROM: Wally Herrmann, exploration geologist, Tasmania
DATE: May 24, 1996
SUBJECT: *Review of Cethana and Staverton Exploration & Potential*

1. SUMMARY and CONCLUSIONS

This report presents an overview and discussion of extensive and detailed exploration programmes, including soil geochemical, IP and TEM surveys and drilling of 16 holes, which have been carried out in the Cethana and Staverton areas of EL 10/88 over the past two decades.

The exploration to date at Cethana and Staverton has been narrowly focussed on areas of variably altered felsic and intermediate volcanics, originally identified by surface or drainage geochemical anomalies. However, all the discovered mineralisation is low grade, possibly re-mobilised in deformation zones. There is some evidence that extensive sericite alteration zones are also structurally controlled, and the relationship between volcanic facies, alteration, mineralisation and potential favourable horizons remains obscure.

The drilling of soil geochemical and geophysical anomalies has established that weak mineralisation gives rise to quite strong Pb-Zn geochem and IP anomalies and I think there is little value in systematically continuing this style of testing of remaining second rate anomalies on the gridded areas. Exploration opportunities for the easy to find, near surface, deposits have been largely exhausted on the gridded areas and the remaining potential appears to lie laterally or deeper.

Dreadful as it is to admit, after the extensive grid based exploration and drilling, the geological setting on both regional and prospect scales remains too poorly known to make a good estimate of conceptual exploration potential, or to dismiss the area as unprospective.

The prominence of quartz phytic felsic volcanics suggests a correlation with the Tyndall Group of the Mount Read Volcanics, as inferred by Pemberton and Vicary (1989) for the Mt Jacob - Bell Mt area nearby to the west. The andesites in the sequence at Staverton and Lake Barrington Road and the apparent north dipping, reverse faulted, contact between volcanics and Denison Group siliciclastics are faintly analogous to the Anthony Road setting (between Henty and Mt Lyell), which is currently regarded as highly prospective. The apparent geochemical similarity of Staverton andesites with Que-Hellyer footwall andesites obliquely infers potential for Hellyer type VHMS deposits.

I am inclined to recommend a two to three month (<\$35,000) programme of good surface mapping and drill core re-interpretation of volcanic facies, alteration and structure, supplemented by additional wholerock geochemistry, to address the uncertainties of litho-stratigraphic correlations with the western part of the Mt Read Volcanics, favourable horizon(s), alteration vectors and deformation, and allow greater confidence in the siting of (probably inevitably) "stratigraphic-exploratory" drill holes. However, I am under no illusions about the limitations of outcrop and will readily concede that such work may not be conclusive.

2. CETHANA AREA

278038

2.1 Summary of Cethana Exploration History

1974 T. Porter (CRAE) recognised altered volcanics in road cuttings, probably while investigating the source of Asarco stream geochem anomalies.

1976 Gridded 4.5km of strike;
Mapping: outlined a regionally extensive WNW trending zone qtz-ser-chl-CO₃ alteration associated with strong schistosity in north facing? felsic volcanoclastics.

EAST CETHANA

B-C soil & rock chip geochem: patchy weak Pb-Zn anomalies at eastern end, possibly transported.

Gradient IP: chargeable zone 1300 x 250m corresponding to soil geochem.

Magnetics:

2 DDHs: to test coincident IP & Pb-Zn soil anomalies:

CC4 significant Pyrite (~3%) throughout, low base metals,

CC5 widespread minor minz: 1m @ 0.8%Pb, 3.9%Zn, 1.2%Cu, 185Ag, 0.7Au; 5m @ 0.1%Pb, 0.4%Zn etc.

WEST CETHANA

B-C soil & rock chip geochem indicated several small, strike parallel Pb-Zn anomalies peaking at 1550ppm Pb and 3000ppm Zn in the south eastern area.

Gradient IP: no significant anomalies

3 DDHs targeted on geochemical anomalies over 600m of strike:

CC1 intersected qtz-sericite altered felsic volcanics with widespread minor sulphides (~1% Sp+Gn+Py) in quartz veinlets and disseminated trains with 5m unit of black shale near end of hole grading 1%Pb, 0.9%Zn.

CC2 intersected an alternating sequence of green chloritised and hematitic felsic volcanoclastics with some short intervals of <0.5% Pb+Zn in the upper part of the hole.

CC3 intersected a sequence of variably chloritic-sericitic, weakly pyritic (1-2% Py) and locally hematitic altered felsic volcanoclastics with several short intervals of ≤0.5% Pb+Zn mainly associated with carbonate veining and alteration.

1977 3 more DDHs at CETHANA EAST:

CC6 & CC7 to test IP anomaly peaks; minor mineralisation in graphitic? vitric tuffs, few metres ~1-1.5% Pb+Zn.

CC8 60m down dip of CC5: several short intervals of <0.6% Pb+Zn, not comparable to CC5, possibly faulted off?

Zn Ratio: (CCs 4,5,6,7,8, n=112 where Pb & Zn >500ppm) Mean=59, $\sigma=19$; with 34% of samples < 55. This is just outside typical VHMS range (means: 60-77, $\sigma < 15$); equivocal, possibly indicating Devonian vein style overprint or remobilised? Cambrian mineralisation.

1978-79 20m dipole-dipole IP on lines 21500E to 21800E at CETHANA EAST showed that the (already drilled) gradient IP anomalies were spurious but did, however, detect a new anomaly northeast of the previous drill holes, at >60m depth on lines 21750E and 21800E and beneath a road cutting chip sample of 7m @ 1.2%Pb, 0.2%Zn, in a favourable environment near the top of zone of "altered, dirty, cherty tuffs". Drilling was recommended but not carried out. It was concluded that the remaining gradient IP and spot geochem anomalies were either spurious or related to minor vein style mineralisation and did not warrant testing.

1981 DIGHEM II survey detected anomaly near western end of Cethana East grid; follow up with VLF showed linear conductor associated with moderate gradient IP chargeability anomaly in a talus covered area along strike from a black shale unit; Cronc PEM showed no response but data was affected by power line noise.

1984 UTEM survey continuous across Cethana East and West with some gaps due to power line noise, (data was not well reported by CRAE but 1991 Noranda plan showed a gap between 21600E and 22200E). No anomalies worth drilling at CETHANA EAST.

Two UTEM anomalies at CETHANA WEST and CENTRAL were drilled by percussion holes CC9 & CC10, respectively. CC9, drilled NE on line 600E, intersected variably (quartz-sericite-chlorite-epidote) altered felsic volcanoclastics and schists with generally 2-3% disseminated pyrite and upto 7-15% pyrite in the interval 72-96m which coincides with the geophysical target at 65-75m down hole. Pb & Zn values are generally <500ppm but are slightly higher in the pyritic zone with max: 320ppm Pb and 820ppm Zn. DHEM failed to indicate in or off hole responses and suggested that the UTEM target anomaly was due to surficial conductive effects!

The UTEM target on 20400E was drilled to the SW by CC10 which intersected mixed chloritic volcanoclastics and minor quartzites and grey shales with widespread 1-3% disseminated pyrite and passed into siliciclastic Roland Conglomerate at 83m. Base metal values are generally <100ppm with isolated peaks of 1800ppm Pb and 760ppm Zn. DHEM failed to indicate conductive responses and the UTEM target anomaly was again attributed to surface effects.

Previous holes CC1-CC8 were selectively re-assayed for gold (where Pb+Zn > 0.15%, Ag >5g/t or Pyrite >5%) but no significant Au was detected.

1986 CRAE cored two diamond drill holes at CETHANA WEST, CC12 & CC13 both inclined to the southwest, on lines 900E and 700E respectively, to test a concept that Cu-Pb-Zn zonation in soil geochemistry eastwards along strike from CC9 indicated a southerly facing. (CC12 was a redrill of CC11 which was abandoned due to drilling difficulties). Both holes intersected chloritic and sericitic lithic felsic volcanoclastics with elastic material increasing downhole in CC13 to end in cherty mudstone. Pb and Zn values are mostly <500ppm but erratically range upto 0.6% apparently in association with quartz-carbonate veins and shear zones. DHEM was unsuccessful due to power line noise problems.

1989 NORANDA
A review of CRAE geophysics by Zarzavation (in: Jones, 1989) showed that not all of the alteration zone had been covered by IP and UTEM; numerous IP anomalies at ends of lines and some others with coincident geochem had not been followed up; IP-Res anomalies between 20200E and 21800E were recommended for detailing.

Reconnaissance mapping and sampling was carried out; 30 whole rock and petrographic samples, isotope studies foreshadowed.

Petrographic report by A.J.Crawford noted stronger than normal MRV regional sericite alteration and suggested "that this significant hydrothermal alteration appears to have accompanied deformation"; (sample No: C106).

Pb-isotope studies indicated that mineralisation in previous Cethana DDHs has a Cambrian signature similar to Rosebery.

P.A.Jones (NORANDA) considered that Cethana had been adequately explored at shallow depths but potential remained for deeper mineralisation within the alteration zone.

1990

D.E.LEAMAN supervised acquisition of additional gravity data and a helicopter borne high resolution aeromagnetic survey. He interpreted the gravity data to indicate major NE trending basement structures? intersecting a WNW trending gravity gradient (Erriba Zone) in the Lake Barrington-Cethana area suggesting that these were deep crustal structures related to mineralisation; it pointed to the area SW and W of Staverton grid (later called "Campground" by MacDonald) as being the most prospective area. Complex thickness variations in the Cambrian volcanic rocks (=growth faulting?) and possible thrust sheet stacking was inferred. The northern margin of the Dolcoath granite was interpreted to dip steeply north and most of the Cethana pyrite-sericite alteration zone is outside of its metamorphic aureole. The gravity-magnetic data also outlined three minor lobe like intrusions of probable Cambrian (or possible Devonian) granite in the Cethana area. Assessment of magnetic characteristics of alteration was not attempted (pending acquisition of located data tapes from the survey contractor).

D.Hicks' Hons. project concluded that:

- * Cethana ser-chl-CO₃-qtz-py alteration is associated with Na,Ca,Sr depletion and Mg,K,Rb enrichment, therefore was VHMS type?
- * O-isotopes showed sea water dominated system with high water/rock ratios, O₁₈ depletion ~11.6 around altered zone; temperatures estimated ~200°C, possibly re-equilibrated during Devonian deformation.
- * S-isotopes, by contrast, indicated magmatic source; leached from volcanics? mean ~-6.5 comparable to other Tasmanian VHMS; eastern end has lowest δS_{34} suggesting it may be more proximal to hydrothermal centre?
- * Zn Ratios for Cethana East drilled mineralisation (>200ppm Pb+Zn!) showed Mean=68, SD=19.4 which is a higher variance than for Tasmanian VHMS deposits and indicates some re-mobilisation and overprinting.

50m dipole IP on 6 wide spaced lines (200-100m apart) produced strong well defined responses indicative of significant sulphide (or black shales?) on lines 21700E and 21800E (100m either side of CC4). Also some chargeability anomalies further east on lines 22200E, 22400E & 22600E; these are not particularly associated with low resistivity or UTEM anomalies. Diamond drilling and DHEM was proposed but not carried out.

1992

PLUTONIC

P.Zarvation reviewed all geophysics again and found many weak anomalies at the western end of Cethana East but was especially keen on CHAR-CE1, at the eastern

end, which he considered to be a single continuous chargeability anomaly running E-W between 21600E and 22600E, probably extending beyond in both directions and speculatively connecting with (CHAR-CW2) chargeability anomaly at Cethana West giving an interpreted strike length of ~3km.

The existing DDHs had not adequately tested this anomaly, partly due to inadequate consideration of topography, but CC4 must have gone close; perhaps through the fringe of the anomaly. It intersected a broad zone of 1-5% pyrite, locally upto 10-15%. Zarzavation suggested that the anomaly was probably related to pyrite, hoped for some base metal sulphides in (unspecified) adjoining zones and proposed 10 diamond drill holes totalling 1950m on 5 sections to test this anomaly between 21600E and 22600E!

1993 Crone PEM survey covered 2 lines on CETHANA WEST and 13 lines (=1500m strike) on CETHANA EAST but recorded no significant anomalies apart from possible power line effects (which could obscure bedrock responses?).

DHEM (Crone PEM) surveys of CETHANA WEST holes CC1, CC9 & CC13 recorded no anomalies, some power line and surface conductive responses.

Reconn geochem sampling produced upto 0.3% Zn in soil north of Claude Rd.

Mapping and geological interpretation by G.MacDonald suggested that the northern contact of the extensive Cethana quartz-sericite-(pyrite) alteration zone, against relatively unaltered overlying? volcano-sedimentary rocks, represented a favourable horizon for VHMS deposits. It was argued that the extensive IP anomalies reflected a pyritic footwall alteration zone stratigraphically below this contact, which is marked by a string of weak UTEM anomalies at CETHANA WEST, but had not anywhere been adequately covered by IP nor tested by drilling.

An EL area reduction resulted in fragmentation leaving 10sqkm at Cethana, 5sqkm at Staverton and 9sqkm at Gog Range.

1994-95 2 DDHs at CETHANA EAST

CED1 (200m) to test 1991 IP anomaly on 22400E about 150m below surface; it intersected cleaved moderately chloritic-diffusely hematitic felsic volcanoclastics with two narrow zones of 2-20% pyrite in blebs and stringers at about the target depth with low base metals and gold. This was not considered likely to be a favourable horizon.

CED2 (295m) on 21825E, was designed to test at depth and along strike of mineralised chloritic sediments intersected in CC5 (on 21750E) and the same IP trend as CED1. It intersected a sequence of sericitic felsic volcanoclastics and tuffaceous siltstones with minor disseminated and veiny hematite and pyrite (of separate orientation/generation?) with local mineralisation in post-cleavage Py-quartz-carbonate-sulphide veinlets in a chloritic siltstone-sandstone (6m @ 0.2%Pb, 0.6%Zn) probably equivalent to the CC5 intersection. Below this was a 70m interval of 1-5% (locally 10%) Py in deformed stringer veinlets in medium grained sericitic-hematitic felsic volcanoclastics and sparse Pb-Zn anomalous qtz-carbonate veins.

DHEM (Crone) in CEDs 1 & 2 and CCs 4, 6, 7 & 8 showed no off hole responses; a weak in-hole response in CC7 at 60m corresponds to 25cm massive pyrite lens but it is a single point response (readings at 10m intervals) indicating it has no significant extent.

It was concluded that the zone of high chargeability between 21600E & 22600E tested by CC4, CC7, CED1, CED2 is a broad zone of pyrite-qtz-carbonate (?) stringers considered to be a typical VHMS footwall stringer zone (although carbonate is not typical of good stringer zones, *WH*). Vein style Pb-Zn in CC5 & CED2 was considered to be remobilised? Cambrian VHMS related mineralisation apparently petering out eastwards but remaining open west of CC6 (suggested by soil geochem). A recommendation was made to test this zone by drilling a fence of percussion holes along the track at ~21400E.

The exploration concept was re-modelled to suggest that a favourable horizon exists up sequence to the north between a pyritic "footwall" zone and Claude Road. It was recommended that soil geochem sampling, augmented by shallow percussion drilling over covered areas, should be undertaken to locate targets related to the new concept.

Soil geochemical sampling was attempted over talus covered areas at CETHANA EAST in late 1995 but the portable motorised "post hole" auger employed did not enable consistent penetration to bedrock and large gaps in the geochemical data remain, especially in the hypothetical favourable zone north of the IP responses. This phase of sampling turned up a few anomalous values upto a few hundred ppm Pb and Zn, mainly in the vicinity of previously known and drilled geochemical anomalies, but it has not significantly upgraded the geochemical picture or provided support for the favourable horizon concept.

2.2 Interpretation of Hicks' (1989) Wholerock Geochem Data

Hicks (1989) analysed 35 rock outcrop samples, from three roughly north-south traverses across the CPZ, for major and immobile trace elements. The sample locations are shown on "Enclosure 2" of Jones, 1989.

Hicks' geological map and sample descriptions are, unfortunately, barely adequate to allow correlations between samples on different traverses (to check "geochemical stratigraphy") nor comparison between altered and unaltered samples of individual volcanic units (to estimate chemical changes due to alteration).

Figure 2 shows an immobile, compatible-incompatible (TiO₂-Zr) scatter plot of the samples from the Cethana area divided (as near as I can guess) into Hick's "lower altered volcanics" (LAV) and "upper unaltered volcanics" (UUV) respectively south and north of the main "Cethana pyrite zone" (CPZ).

There is obviously considerable overlap between LAV and UUV. Even if the two UUVs with Ti/Zr ≥ 30 are excluded (C174 & C184 in Table 1), about half the samples from both groups fall in the overlap field between 7.4 and 13.4 Ti/Zr; this could be partly due to volcaniclastic mixing of materials from different eruptive sources. The generally lower average Ti/Zr ratios of the UUV samples in comparison to LAV, and the suggestion that Ti/Zr ratios decrease northward away from the CPZ at Staverton Rd and Day's Rd (not evident at Oliver's Rd), are consistent with the expected magmatic differentiation trend and faintly support Hick's assertion that it is a north facing sequence. It is, however, not very clear evidence of volcanic stratigraphy; nowhere near as distinct as, for example, the Thalanga favourable horizon where altered footwall rhyolites with Ti/Zr < 7 are overlain by unaltered hangingwall dacites with Ti/Zr > 11.

The most striking thing about Hicks' data is the extent of apparent sodium depletion! In the entire batch of Cethana samples only two (C78 & C200) have Na₂O contents remotely approaching normal felsic volcanic levels (>1.5%) and both are within the LAV; the majority

(including those from the so called UUV) contain <0.5% or zero Na₂O. The CaO contents are similarly low and consequently these analyses generate very high Alteration Indices (AI = $100[\text{MgO} + \text{K}_2\text{O}] / [\text{MgO} + \text{K}_2\text{O} + \text{CaO} + \text{Na}_2\text{O}]$). These samples are from an area apparently representing ~1500m of stratigraphic thickness and ~4km of strike which, if judged by AI or sodium depletion, would represent a monster hydrothermal alteration zone.

However, the lack of internal AI and Na₂O zonation within this area, and the observation that the samples logged as relatively unaltered (C164, C169 etc.) are equally "depleted", strongly suggests an analytical problem, probably related to sampling of weathered surface outcrops. This implies serious limitations in the use of this data for estimating hydrothermal alteration effects - it is greatly preferable to use fresh drill core samples to eliminate surface weathering effects.

Nevertheless, I have separated the analyses into a number of groups, corresponding to the cross strike traverses, and attempted to identify good linear correlations on immobile compatible-incompatible component plots which could indicate variable alteration within a single volcanic precursor unit. Most of the groups (Fig. 1) show a fair scatter and range and, given the lack of geological detail, it's doubtful if anything can be done with them.

There is one exception: the five samples spaced over ~500m of section north of Cethana Bridge (Group 1 in Table 1; labelled C88..C106 in Fig. 1) have a high correlation ($r = 0.978$) with a linear regression line which passes close to the origin on the TiO₂-Zr scatter plot (Fig. 1) consistent with the type of distribution attributable to alteration mass changes (eg: MacLean & Barrett, 1993; Herrmann, 1994). These five samples could (but are not proven to) represent differing degrees of hydrothermal alteration of an originally chemically uniform volcanic unit or series of co-magmatic units and, on this assumption, may be used to estimate the mass changes due to alteration.

The sample locations from this group, C88 to C106, are consecutively spaced along Cethana Road 200m, 270m, 430m, 600m and 700m NNE of the bridge over the Forth River. Hicks' descriptions (Table 1) are ambiguous referring to altered quartz phyric lavas and/or tuffs; C103 supposedly preserves an ignimbritic texture and C106 is quartz+feldspar phyric and glassy; the first four are within Hicks' LAV and the last, C106, is just within his CPZ.

I have mapped this section myself, in 1988, and found that outcrops near the bridge are of fairly fresh quartz+(feldspar+biotite) phyric rhyolite with minor patches of strong silicification. The degree of sericite alteration and foliation gradually increases (but some relict feldspars are preserved) northwards over about 400m (the zone including C88 & C93) before passing abruptly into quartz+sericite schists in which former volcanic textures, apart from relict quartz phenocrysts, are completely destroyed (the zone including C98, C103 & C106). This zone of strong foliation and sericitisation? is what I would term the CPZ although it contains very little pyrite: at most <1% finely disseminated pyrite with no observed stringer development. Hicks (1989) places the southern margin of the CPZ about 300m further north.

Comparison of the analyses from, what I consider to be, the less altered zone (C88 & C93) with those from the strongly altered CPZ (C98, C103 & C106) shows that the latter have higher concentrations of the immobile components TiO₂, Al₂O₃ and Zr, suggesting that the alteration has been associated with net mass loss. It is slightly problematic to quantify the mass changes because one of the less altered samples, C93, has anomalously high Fe₂O₃ and because of the above mentioned doubts about Na and Ca analyses.

However, two versions of calculated mass changes are shown on Page 2 of Table 1, using the method of MacLean & Barrett (1993) with Zr as the immobile monitor and, alternately, C88 and the mean of C88 & C93 as the least altered precursor composition. In both precursor cases the dominant apparent mass changes are losses of SiO₂ in the range 12 to 28 g/100g. It is notable that the greatest mass loss appears to be in C98, from the southern edge of what I interpret to be the strongly altered CPZ.

Silica loss is not characteristic of Australian VHMS footwall alteration zones. For examples: the Hellyer footwall has SiO₂ gains ranging from 10g/100g in the stringer envelope (outer) zone to 95g/100g in the siliceous core (Gemmel and Large, 1992) and the Thalanga footwall appears to have gained from ~10g/100g SiO₂ in the moderately altered peripheral zones to ~35g/100g in the proximal pyritic stringer zones (Herrmann, 1994). (There is a slight anomaly in the Hellyer mass change pattern in that the chloritic zone, between the siliceous core and outer sericitic zones, appears to have lost about 12g/100g SiO₂ but still had a net mass gain due to addition of Fe₂O₃, MgO and S.)

In the VHMS sea floor hydrothermal model, silica loss is likely to occur in the peripheral "recharge" zones of convective systems where cool descending seawater leaches silica from hot glassy rocks. In a brittle deformation environment, fracture permeability could increase water/rock ratios and hydrothermal flow leading to silica depletion in glassy rocks intersected by fault zones.

These limited and dubious Cethana analytical data, with inadequate geological control, cannot provide an unequivocal interpretation, but tend to indicate that the western end of the CPZ is not proximal VHMS type footwall alteration.

It is regrettable that wholerock analyses are not available from drill core of holes CC1 which appears to be entirely within the CPZ, and CC2 and CC3 which appear to have intersected the margin of the CPZ and passed southward into less altered rocks, (Herrmann, 1989 - Appendix 1 in: Jones, 1989) to allow better estimates of mass changes and from the Cethana drill holes in general, to assess alteration intensity zonation.

2.3 Notes on CEDI Alteration Style (Based on a cursory core log by W.Herrmann)

Disseminated granular hematite is virtually ubiquitous in all lithologies intersected by the hole except where overprinted by quartz-sericite-pyrite alteration. Hematite could be a primary accessory or at least a very early alteration phase following devitrification.

Moderate to strong semi pervasive to fracture controlled dark chlorite alteration is also common and seems to be co-stable with hematite (eg: specimen from 61m which contains granules of disseminated hematite and hematite stained fringes of chlorite-carbonate veins. Chlorite is most abundant in apparent volcanoclastic lithofacies and is restricted to veinlets and fractures in the more coherent units (as in specimen from 61m) suggesting permeability control on this type of alteration.

Patchy quartz-sericite-pyrite alteration undoubtedly post dates hematite formation and pyrite and hematite never closely co-exist; (eg: in coherent QFphyric rhyolite at 163m there are diffuse relict kernels of purplish grey with disseminated hematite separated by bands and vein selvages of quartz-sericite-pyrite alteration around narrow trains of pyrite.

In general, pyrite is fairly restricted in the hole to narrow zones and fracture related alteration especially near brittle-puggy fault zones (eg: 38m, 72m). Near the end of the hole (eg: in coherent rhyolite at 199m) pyrite is concentrated in spaced anastomosing fractures and finely milled zones separating kernels of relatively unaltered pinkish rhyolite.

Although locally significant, pyrite does not generally exceed ~5% over more than a metre or two; 1-2% is more typical over several metre intercepts. Silicate alteration in association with pyrite does not seem particularly strong and I would not be surprised to find some relict feldspar in these zones; ie: this does not look like very proximal - high fluid/rock ratio - VHMS footwall type alteration.

The association of quartz-sericite-pyrite alteration with brittle fault zones is consistent with earlier interpretations (Herrmann, Appendix 1; Crawford, Appendix 2; in: Jones, 1989) that alteration accompanied deformation - possibly Devonian thrusting. Clearly, the dominant chlorite-hematite alteration was produced by (oxidised) fluids, unlike those expected in VHMS footwall systems. A possible source of oxidised fluids could be Cambrian granitoids (like the hematite bearing Dove Granite) which are inferred to exist as small intrusive stocks in the Cethana area (Leaman, in: Jones 1990).

The latest phase of alteration and veining is straw-white carbonate-quartz-minor chlorite in tensional veinlets which cross cut or exist within pyritic zones. There is locally an increased frequency of carbonate-quartz veinlets adjacent to or in quartz-pyrite alteration zones suggesting late stage brittle failure around earlier silicified fault zones. This late carbonate-quartz-minor chlorite assemblage does not include hematite.

2.4 Discussion (Cethana)

After two decades of intermittent exploration there is still no good geological map or convincing interpretation of stratigraphy, volcanic facies and hydrothermal alteration. Although the poor outcrop and low readability of rocks (apart from in the road cuttings) has been a major factor, I suspect that this could be a case where there have been too many geoscientists having sporadic hit or miss exploration potshots without expending the time to really put the whole story together.

After Gerald Purvis' earliest work for CRAE, Phil Jones, for Noranda, came closest to seeing the "big picture" recognising that VHMS potential could lie down dip or along strike of the large "Cethana Pyrite Zone" (CPZ) and that exploration should seek alteration vectors and mega-structural and facies controls. Regrettably, he farmed out a lot of the important observation and interpretation work to other geologists, students and geophysicists. No less than three consultant geophysicists were involved in reviews and additional surveys during 1989 & 1990, and one wonders how much of a grasp they had of the previous data and particularly of geological concepts. The work (as reported) seems to have lacked integration and unifying interpretation.

The greatest deficiencies are in volcanic facies and alteration mapping; various workers have been impressed by the extent of the CPZ but none have produced an alteration intensity or mineral zonation map. The nearest documented attempts at outlining the sericitic (foliated) zone are Jones' (1989) 1:10,000 presentation (which is based on my own cursory mapping of road cuttings only, over a contract period of a few days) and Hicks' nearly illegible and unsophisticated 1:10,000 map (in: Jones, 1990) which is not convincing in terms of volcanic facies and CPZ boundaries which do not coincide with my interpretation.

Surface mapping and drill core logging has not been integrated to produce a 3D alteration model of the whole area.

Referring again to my cursory mapping in 1989: it is apparent that the CPZ is a series of elongate zones of strong sericitisation and cleavage development (but quite low pyrite content $\leq 1\%$), possibly strata bound in pumiceous quartz phyric felsic volcanoclastic units, and aligned sub parallel to the WNW trending, probably thrust faulted, contact between volcanics and Denison Group siliciclastics. It is possible that sericitisation was due to broad unfocussed hydrothermal circulation in an extensive, aquifer like, permeable volcanoclastic or pumice breccia unit sandwiched amongst less permeable units, not necessarily in proximity to a favourable (sea floor-exhalative) horizon.

Alternatively, the almost regional extent ($>4\text{km}$ strike) of the sericitic-foliated zones at Cethana and the apparent sub parallel repetitions 2.5km and 4km to the north (at Campground and

Staverton prospects), could indicate that the foliation is related to brittle-ductile shearing in weak pumiceous units in a contractional-reverse fault structural setting, analogous to that adjacent to the Great Lyell Fault etc.

This is supported by numerous petrographic observations (AJ Crawford in: Jones, 1989) inferring a relationship between alteration and deformation such as: shearing accompanying sericitisation; sericitisation along lacework fractures in non pervasively altered more competent rhyolite, and tourmaline in quartz veinlets in altered rhyolite suggesting an association with Devonian? granite emplacement and deformation.

In CED1, near the eastern end of the sericite zone, quartz-sericite-pyrite alteration is spatially associated with brittle faults and fractures and overprints an earlier chlorite-hematite alteration assemblage.

Near Cethana Dam, the Moina Sandstone (=Denison Group) locally contains 2-5% disseminated pyrite although elsewhere it is generally hematitic. This clearly post volcanic, probably post depositional, hydrothermal alteration might be similar to that in the CPZ and would have been a useful comparison for Hicks' (1989) isotope study. Obviously, if all the alteration can be attributed to post volcanic events, then the VHMS prospectivity is not enhanced by the existence of the CPZ.

On the other hand, the CPZ contains a few sniffs of base metal mineralisation which (although it is mostly in syn or post cleavage veinlets) has Pb isotopic and Zn/Pb ratios which are equivocal but consistent with a Cambrian VHMS origin modified by Devonian granitoid related overprint. This supports the possibility that the CPZ represents a synvolcanic (Cambrian) sericitic alteration zone which, due to relative incompetence, has localised strain during Devonian deformation.

If so, the important exploration questions are:

- Which is the favourable horizon?
- Was the favourable horizon detached from its sericitic footwall by deformation?
- Are there any alteration vectors pointing to ore?

At this point, none of the important questions can be convincingly answered. All are worthy of attention but I think the last is likely to be most fruitful.

Hicks' 1989 wholerock analytical and alteration study proved inconclusive due to a dubious sampling method and would need to be expanded in drill core sampling and better geological and alteration mapping. The objective is to recognise zonations, such as pyrite concentration, absolute mass changes and δO_{18} depletion, to infer hydrothermal fluid flow paths and explore the areas down stream and up stratigraphy for VHMS deposits. The potential alteration picture which could be developed might be fairly skeletal due to the clustering of drill holes at Cethana West and East giving an uneven spread of fresh samples.

I have looked at Hicks' (1989) O & S isotopic data and remain quite unconvinced of his conclusions in regard to lighter δS_{34} at East Cethana indicating a more proximal hydrothermal setting, the validity of comparing weathered surface samples with unoxidised drill core for δO_{18} zonation and the rough and ready calculation of fluid temperatures suggesting that Cethana was not hot enough to transport and deposit base metals. I am not an isotope expert but it seems that Hicks has used a fairly "black box" approach for comparison with known deposits, largely in the absence of a good geological and alteration framework.

The IP chargeability compilation (enclosure 8 in: Jones, 1991) indicates a broad area of high chargeability over at least 1km of strike (open ended to east) at Cethana East which is broadly coincident with soil geochem anomalies and much stronger than the chargeability responses over Cethana West (where the soil geochem is equally anomalous). In terms of the sericite-pyrite footwall alteration concept, this suggests that the eastern end experienced higher

hydrothermal fluid/rock ratios and possibly temperatures, and was therefore perhaps more proximal to a VHMS deposit.

JR Bishop (in: Jones, 1991) noted that these eastern chargeability anomalies correspond with resistivity highs; he speculated on increased resistivity due to silicification and possible connections with epithermal gold mineralisation and suggested that the higher resistivities may be enhancing the IP effect due to a relatively low concentration of sulphides.

Certainly, the rather low concentration and irregular distribution of pyrite intersected by CED1 barely accounts for the ~4 times background chargeability response on line 22400E. It is not clear how this hole was targeted (Close and MacDonald, 1995) but it seems to have been collared 170m too far north and too steeply to test the "main" anomaly (A) zone identified by Zarzavation (in: MacDonald & Tomlinson, 1992) and without taking account of Zarzavation's comments about topographic effects.

Whatever the case, I remain doubtful, in view of the association between faults and alteration, and the presence of carbonate, about the conclusion of Close and MacDonald (1995) that the broad zone of "pyrite+/-silica-carbonate stringers" reflected in the eastern chargeability anomaly (21600E to 22600E) is "typical of a deformed footwall stringer zone beneath a potential exhalative target horizon". I regard it as a good concept, and not a new one, but not yet well established.

Accordingly, an attempt to test the favourable horizon by drilling (either fences of short RC holes or longer diamond core holes) would be of an essentially stratigraphic nature, and unlikely to be conclusive, if not carried out in conjunction with studies enabling a better interpretation of alteration vectors, volcanic facies and structural controls.

The previous coverage by "black box" geophysical surveys is more or less adequate although many of the surveys have been rather restricted in cross strike extent due to the assumption that the initial grid and soil geochem anomalies had already defined the favourable horizon. Various IP and EM surveys have fairly well covered the ~4km of gridded strike length and the best anomalies have been tested by 14 drill holes. None of them are very deep holes but DHEM surveys in 7 holes at Cethana East, 3 holes at Cethana West and CC10 in the Central area have not indicated any off hole conductors to encourage further work in those areas.

The 4km long grid more or less covers the width of the EL; the ground to the east (where the pyritic zone appears to be open ended) is held by RGC but the CPZ possibly extends westward for ~1km before running under Tertiary basalt cover west of the Forth River. There is, therefore, not a great deal of scope for further work along strike.

Induced Polarisation, with 50m dipoles, is a most useful method to map out shallow pyritic VHMS footwall alteration and IP could be extended across strike in both north and south directions on selected lines, particularly at Cethana East, with this objective. Some kind of mathematical filtering to integrate the existing diverse IP surveys and dipole spacings to produce contourable chargeability and resistivity plans, would be a useful adjunct to alteration mapping.

I am inclined to agree, with G. MacDonald, that the results of UTEM and PEM surveys do not necessarily downgrade the prospectivity of the Cethana area; not particularly because the target deposits may not be very conductive but rather because these surveys have not been convincingly demonstrated to have covered the favourable horizon(s). However, I do not advocate extension of the EM blanket coverage. It would be preferable to use IP to map pyrite distribution and infer alteration patterns to point to favourable horizons or zones, with more selective TEM to assist targeting, and DHEM to increase the "search radius", of future exploratory holes.

Soil geochemistry has proven almost too effective in producing red herrings - moderately

strong anomalies over very weak primary mineralisation - but it has been useful in drawing attention to the CPZ and suggesting that the hydrothermal system had some primary or secondary? connection with Cambrian mineralisation. However, I don't think it can be relied on for targeting buried massive deposits, especially under areas of transported soil, and at this stage of exploration should only be selectively used where the favourable horizon(s) are otherwise identified.

3. STAVERTON AREA

3.1 Summary of Staverton Prospect Exploration History

- Early 1970's The prospect was identified by ASARCO's regional drainage geochem survey; a brief soil and rock sampling follow up produced a spot soil anomaly of 590ppm Pb but low Cu & Zn and was dismissed as unprospective.
- 1977 CRAE established a 400m spaced grid over 1200 x 800m, carried out mapping, rock & soil geochem and gradient IP surveys and found that some felsic? volcanics were strongly altered to quartz-sericite schists locally containing several percent disseminated pyrite. Soil geochem gave encouragement with peaks of 1800ppm Pb and 1100ppm Zn but IP detected only weak responses.
- 1982 The grid was "infilled" to 100m line spacings and further mapping, rock chip sampling, dipole-dipole IP (mostly 25m dipoles, additional 50m dipole survey on 500E, 1000E & 1100E) and limited Pulse EM surveys, were undertaken. Rock chip samples of sericitic altered volcanics from the soil anomaly zone were found to contain upto 0.9% Pb and 0.26% Zn but PEM results were flat. IP responses correlated with soil geochem but were interpreted as superficial and depth limited. The coincident IP-geochem anomaly trends south over ~600m, apparently parallel to the strike of the country rocks but also near parallel to a "major fault .. possible discontinuity" shown, 100-200m west of the anomalous trend, on CRAE's geological plan.
- 1983 UTEM survey was undertaken on three short (275m) traverses on lines 400E, 500E & 600E across the main soil geochem anomaly but it detected only very weak responses.
- A short percussion hole (SP1, 102m) was drilled southwestwards to test the geochem-IP anomaly on 600E; it intersected quartz-sericite-(chlorite) schists with minor pyrite, galena and chalcopyrite mineralisation. The interval 20-44m averaged 0.85% Pb, 0.54% Zn and 9g/t Ag with the best assay at 32-34m of 1.9% Pb, 1.2% Zn and 22g/t Ag; background values elsewhere in the hole ranged ~100-500ppm Pb & Zn and <1g/t Ag. Copper peaked at 610ppm in the anomalous zone but elsewhere was generally <100ppm whilst Ba had background levels of ~200-600ppm and appeared to be slightly depleted to <250ppm in the Pb-Zn-Ag anomalous zone. (Gold was not reported, probably not analysed.) Zn Ratios for the zone with >0.1% Pb & Zn (interval 20-50m) showed mean = 38 and $\sigma = 15$ for $n = 16$ samples; unlike Tasmanian VHMS deposits.
- Further UTEM was recommended along strike to cover geochem anomalies on lines 700E-1000E.
- 1986 A re-appraisal of geophysics in light of results of SP1 implied that the body is likely

to be shallow but of too low conductivity to be a large sulphide body and no further work was recommended.

- 1989 Zarzavation reviewed the geophysical data for NORANDA and expressed concern about the effects of topography on IP interpretation and whether SPI had been an adequate test. He recommended further exploratory drilling along strike of the IP zone.
- 1992 Zarzavation again reviewed the geophysical data for PLUTONIC and recommended two to four additional holes, 100-120m deep, to test the coincident IP-geochem anomaly on lines 900E and 1000E. He suggested that IP coverage should be extended along strike to the south east if the results of drilling proved encouraging.
- 1993 PLUTONIC re-established the CRAE grid, did a bit of mapping over the anomalous zone, covered the grid by Crone PEM and ground magnetic surveys, and core drilled a hole (STD1, 267.2m, drilled -45° to SW) to test the IP-geochem anomaly on 900E.

The PEM grid survey and a 2 loop DHEM survey of STD1 did not detect any conductive responses.

STD1 intersected a thick sequence of plagioclase phyric dacitic to andesitic lavas, related holocrystalline intrusives and minor volcanoclastics interrupted by several sericitic shear zones before passing through a major? brittle fault zone at 255m into bedded, coarse to fine grained, quartz phyric-pumiceous felsic volcanoclastics. Patchy disseminated to veiny galena-sphalerite-pyrite mineralisation, upto 0.6% Pb+Zn but with low Cu, Ag and Au, exists in the dacitic-andesitic units above the lower fault, more or less associated with sericite-carbonate altered shear zones and quartz-tourmaline-chlorite alteration.

Zinc Ratios were reported as equivocal but tending towards a Cambrian VHMS pattern. Petrographic study and limited wholerock geochemistry suggested the "highly altered" andesites are geochemical correlates of Suite I of the MRV (= Que-Hellyer footwall andesites).

It was concluded that the hole had "explained" the IP and geochemical anomalies, that the altered rocks were favourable and that much VHMS potential remained. Tentative evidence (grading in volcanoclastics on opposite shore of Lake Barrington) that the sequence faces northeast was interpreted to indicate that highest prospectivity was northeast of the grid, ie: up stratigraphy from the "footwall" Que-Hellyer andesite equivalents.

3.1 Discussion (Staverton)

MacDonald's (1993a) calculation of Zn Ratios for 113 samples from STD1 indicated a mean of 64 and $\sigma = 21.7$ which he interpreted as equivocal (on account of the high σ) but tending to indicate Cambrian VHMS (because of the appropriate mean). The cut off grade was not stated but his population evidently included fairly low values to come up with 113 samples.

I have calculated Zn Ratios for STD1 samples in two groups as below:

| | |
|--|----------------------------------|
| Samples with both Pb & Zn >500ppm: | n = 24, mean = 48, $\sigma = 12$ |
| Samples with either of Pb or Zn >500ppm: | n = 49, mean = 43, $\sigma = 22$ |

This provides a pretty clear indication that the "mineralisation" (ie: above background levels) has a Zinc Ratio population unlike Tasmanian VHMS deposits and is in accord with the results from CRAE's SPI.

I have also made a cursory inspection of the STD1 core (stored at MRT in Hobart) and was not much impressed by the degree of alteration. It seems that patchy pale sericite-carbonate "bleaching" of the dacitic-andesitic rocks is closely associated with semi-ductile shear zones. Some of these zones appear to be intruded? by pink quartzo-feldspathic assemblages resembling granite, locally associated with veiny quartz-chlorite-tourmaline alteration. There is no strong pervasive alteration away from these fracture zones.

Samples which AJ Crawford (in: MacDonald, 1993 a) described as moderately to intensely altered (eg: petrographic and analytical samples 23, 27, 28 & 33) generally have well preserved textures and the feldspars are albitised but intact. This is borne out by the four wholerock analyses ranging from 2.5 to 4.2% Na₂O and alteration indices (AI) from 40 to 48.

These analyses are almost comparable with the average unaltered andesite from the Hellyer footwall (quoted by Gemmell and Large, 1992) and certainly indicate lesser alteration than that of the Hellyer outer footwall "stringer envelope zone". In isolation, these relatively unaltered samples do not provide us with an alteration vector to ore.

However, as is well known, the Hellyer footwall alteration system is tightly focussed, on a synvolcanic fault in relatively coherent and impermeable andesites, and the stringer envelope zone generally extends only a few tens of metres to a maximum of ~100m laterally from the central siliceous core directly under the ore deposit.

To pursue the analogy: it is not valid to suggest that this lack of pervasive alteration in a pile of mainly coherent andesites and related intrusives in STD1, precludes the nearby presence of a VHMS deposit and hydrothermal alteration system.

On the other hand, the grid PEM and DHEM results and the style of possibly deformation-granite emplacement related? mineralisation intersected to date, do not suggest a deposit in close proximity.

Unlike Cethana, however, the Staverton prospect work has been restricted to a fairly small grid (1200m x 800m) and relatively unexplored country, not covered by Tertiary basalt, extends for about 3km to the NE and 3km to the SW along the Forth River valley, partly within the current EL boundary and on adjacent "open ground".

There is insufficient knowledge of litho-stratigraphic and structural relationships to form any convictions on where further potential may lie.

The Campground sericite alteration zone 1.5km SW of the Staverton Prospect was identified by Leaman (in: Jones, 1990) as being most prospective from a regional structural interpretation but appears to have had very little follow up investigation. Even Leaman's interpretation, particularly of magnetics, seems to have been fairly preliminary and could probably be rendered more user friendly by preparation of enhanced gravity and magnetic images.

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5. ATTACHMENTS

- Table 1 Cethana Volcanics - Hicks' (1989) Wholerock analyses and mass change calculations, (2 pp.)
- Fig. 1 TiO₂-Zr scatter plot of Cethana Volcanics.
- Fig. 2 TiO₂-Zr scatter plot differentiating? Hicks' (1989) LAV and UUV.

Table 1

CETHANA VOLCANICS - Analyses of surface samples from Hicks, 1989

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| Sample | Description | Gp | SiO2 % | TiO2 % | Al2O3 % | Fe2O3 % | MnO % | MgO % | CaO % | Na2O % | K2O % | P2O5 % | CO2 % | S % | LOI % | Total % | Nb ppm | Y ppm | Zr ppm | Ti/Zr | A.I. |
|--------|-----------------|----|-----------|-----------|------------|------------|----------|----------|----------|-----------|----------|-----------|----------|--------|----------|------------|-----------|----------|-----------|-------|------|
| C88 | alt QpR | 1 | 77.59 | 0.50 | 14.19 | 2.29 | 0.01 | 0.58 | 0.02 | 0.00 | 4.60 | 0.05 | | | 2.86 | 102.69 | 11 | 19 | 234 | 12.8 | 100 |
| C93 | alt QpR or tuff | 1 | 70.81 | 0.48 | 13.50 | 7.88 | 0.64 | 2.36 | 0.03 | 0.00 | 4.08 | 0.08 | | | 4.02 | 103.88 | 12 | 80 | 235 | 12.2 | 100 |
| C98 | alt QpR or tuff | 1 | 69.12 | 0.73 | 18.46 | 4.21 | 0.37 | 0.95 | 0.02 | 0.00 | 5.88 | 0.13 | | | 3.62 | 103.49 | 15 | 27 | 329 | 13.3 | 100 |
| C103 | xtR/agn | 1 | 73.58 | 0.64 | 17.55 | 3.39 | 0.13 | 0.43 | 0.01 | 0.26 | 3.86 | 0.15 | | | 4.53 | 104.53 | 15 | 26 | 279 | 13.8 | 94 |
| C106 | alt QFp felsic | 1 | 72.13 | 0.57 | 14.90 | 7.46 | 0.03 | 0.34 | 0.01 | 0.00 | 4.35 | 0.04 | | | 3.88 | 103.73 | 13 | 41 | 273 | 12.5 | 100 |
| C5 | Qwacke | 2 | 88.43 | 0.47 | 7.14 | 1.28 | 0.00 | 0.42 | 0.01 | 0.00 | 2.23 | 0.03 | | | 1.47 | 101.48 | 12 | 35 | 321 | 8.8 | 100 |
| C2 | alt QpR or xt | 2 | 86.62 | 0.21 | 11.01 | 1.87 | 0.01 | 0.46 | 0.03 | 0.00 | 3.72 | 0.03 | | | 2.55 | 106.51 | 12 | 30 | 143 | 8.8 | 99 |
| C78 | alt QpR | 2 | 77.56 | 0.25 | 13.43 | 1.53 | 0.06 | 0.60 | 0.05 | 1.68 | 4.81 | 0.03 | | | 2.01 | 102.01 | 13 | 38 | 169 | 8.9 | 76 |
| C9 | ~alt QpR | 2 | 75.39 | 0.41 | 14.71 | 3.09 | 0.01 | 1.02 | 0.01 | 0.00 | 5.30 | 0.03 | | | 2.95 | 102.92 | 14 | 35 | 244 | 10.1 | 100 |
| C4 | QFp felsic? | 2 | 71.31 | 0.51 | 17.01 | 5.00 | 0.09 | 1.22 | 0.03 | 0.00 | 4.73 | 0.07 | | | 4.70 | 104.67 | 13 | 28 | 242 | 12.6 | 99 |
| C14 | Qwacke | 2 | 80.15 | 0.70 | 9.91 | 3.32 | 0.01 | 0.90 | 0.74 | 0.00 | 3.59 | 0.51 | | | 3.57 | 103.40 | 12 | 41 | 285 | 14.7 | 86 |
| C7 | alt Dac/luff | 2 | 69.7 | 0.77 | 14.76 | 7.86 | 0.04 | 3.17 | 0.43 | 0.00 | 3.97 | 0.16 | | | 5.63 | 106.49 | 17 | 27 | 267 | 16.1 | 94 |
| C164 | fresh Qpr | 3 | 82.49 | 0.23 | 12.93 | 1.35 | 0.00 | 0.24 | 0.01 | 0.00 | 2.68 | 0.00 | | | 3.32 | 103.25 | 15 | 41 | 244 | 5.7 | 100 |
| C161 | alt QpR | 3 | 80.16 | 0.33 | 13.66 | 1.10 | 0.01 | 0.26 | 0.02 | 0.28 | 4.19 | 0.00 | | | 2.25 | 102.26 | 13 | 28 | 282 | 7.0 | 94 |
| C200 | cherty Vc | 3 | 78.82 | 0.16 | 13.66 | 1.41 | 0.03 | 0.44 | 0.03 | 1.71 | 3.71 | 0.03 | | | 2.09 | 102.09 | 19 | 41 | 129 | 7.4 | 70 |
| C190 | alt QFp xit | 3 | 70.2 | 0.93 | 20.60 | 1.41 | 0.01 | 0.46 | 0.07 | 0.00 | 6.09 | 0.09 | | | 3.64 | 103.50 | 22 | 51 | 485 | 11.5 | 99 |
| C210 | mudst/Sst | 3 | 76.01 | 0.61 | 14.79 | 2.82 | 0.00 | 0.59 | 0.10 | 0.20 | 4.72 | 0.15 | | | 2.99 | 102.98 | 14 | 35 | 288 | 12.7 | 95 |
| C215 | Sist | 3 | 74.98 | 0.58 | 17.08 | 1.45 | 0.00 | 0.51 | 0.01 | 0.00 | 5.17 | 0.04 | | | 3.05 | 102.87 | 16 | 29 | 233 | 14.9 | 100 |
| C204 | bd slst/shale | 3 | 75.03 | 0.40 | 15.82 | 2.17 | 0.01 | 1.14 | 0.01 | 0.00 | 5.37 | 0.02 | | | 3.25 | 103.22 | 14 | 24 | 147 | 18.3 | 100 |
| C194 | chl alt cg Vc | 3 | 56.71 | 0.65 | 18.05 | 18.45 | 0.18 | 4.01 | 0.02 | 0.00 | 1.70 | 0.07 | | | 7.22 | 107.06 | 7 | 15 | 124 | 31.4 | 100 |
| C179 | fg Vc | 4 | 80.27 | 0.19 | 13.48 | 1.71 | 0.01 | 0.14 | 0.00 | 0.53 | 3.65 | 0.00 | | | 2.22 | 102.20 | 18 | 38 | 251 | 4.5 | 88 |
| C175 | fg Vc | 4 | 76.7 | 0.25 | 16.53 | 2.84 | 0.02 | 0.59 | 0.02 | 0.23 | 2.78 | 0.03 | | | 5.33 | 105.32 | 14 | 44 | 330 | 4.5 | 83 |
| C169 | fresh QFpR | 4 | 75.6 | 0.65 | 14.78 | 3.77 | 0.02 | 0.50 | 0.00 | 0.00 | 4.60 | 0.04 | | | 3.13 | 103.09 | 15 | 34 | 374 | 10.4 | 100 |
| C174 | fg Vc | 4 | 70.33 | 1.18 | 19.90 | 1.80 | 0.00 | 0.53 | 0.30 | 0.30 | 5.27 | 0.39 | | | 4.08 | 104.08 | 17 | 26 | 236 | 30.0 | 91 |
| C225 | alt QFpRxt | 5 | 78.89 | 0.57 | 14.86 | 1.02 | 0.01 | 0.16 | 0.02 | 0.24 | 4.21 | 0.02 | | | 2.36 | 102.36 | 11 | 24 | 387 | 8.8 | 94 |
| C218 | alt QpR | 5 | 77.67 | 0.56 | 15.32 | 1.58 | 0.01 | 0.26 | 0.01 | 0.30 | 4.20 | 0.09 | | | 2.73 | 102.73 | 14 | 48 | 252 | 13.3 | 94 |
| C232 | alt pum? Vc | 5 | 70.9 | 0.81 | 17.67 | 4.27 | 0.00 | 0.44 | 0.06 | 0.00 | 5.52 | 0.21 | | | 3.69 | 103.57 | 15 | 28 | 275 | 17.7 | 99 |
| C184 | alt Rhy? | 5 | 68.56 | 1.00 | 22.82 | 1.19 | 0.00 | 0.19 | 0.01 | 0.86 | 5.47 | 0.10 | | | 4.02 | 104.02 | 13 | 51 | 136 | 44.4 | 89 |
| 225108 | | 6 | 81.22 | 0.21 | 13.81 | 1.04 | 0.00 | 0.21 | 0.01 | 0.30 | 3.18 | 0.02 | | | 2.75 | 102.75 | 15 | 29 | 209 | 6.0 | 92 |
| 226101 | | 6 | 79.85 | 0.37 | 13.84 | 2.27 | 0.01 | 1.21 | 0.16 | 0.64 | 1.59 | 0.05 | | | 2.39 | 102.38 | 16 | 30 | 328 | 6.8 | 78 |
| 225222 | | 6 | 72.11 | 0.41 | 14.79 | 3.21 | 0.06 | 1.39 | 1.97 | 2.42 | 3.56 | 0.07 | | | 4.71 | 104.70 | 15 | 31 | 260 | 9.5 | 53 |
| 225221 | | 8 | 59.03 | 0.73 | 16.08 | 7.49 | 0.15 | 4.35 | 6.58 | 2.38 | 3.02 | 0.17 | | | 8.09 | 108.07 | 9 | 27 | 142 | 30.8 | 45 |
| 225223 | | 6 | 59.96 | 1.06 | 17.85 | 7.02 | 0.12 | 2.73 | 6.46 | 3.62 | 1.17 | 0.20 | | | 3.89 | 103.88 | 9 | 28 | 150 | 42.4 | 28 |
| C52 | alt+wd GDiorite | | 64.73 | 0.91 | 16.75 | 7.52 | 0.19 | 3.45 | 0.44 | 0.00 | 3.52 | 0.22 | | | 3.67 | 101.40 | 13 | 23 | 204 | 26.7 | 94 |
| C28 | Molina Sst | | 94.77 | 0.27 | 2.92 | 0.89 | 0.01 | 0.21 | 0.06 | 0.00 | 0.72 | 0.12 | | | 0.90 | 100.89 | 4 | 17 | 97 | 16.7 | 92 |

279052

Table 1 CETHANA VOLCANICS - Analyses of surface samples from Hicks, 1989

May 21, 1996

Page 2

| Sample | Description | Gp | SiO2 | TiO2 | Al2O3 | Fe2O3 | MnO | MgO | CaO | Na2O | K2O | P2O5 | CO2 | S | LOI | Total | Nb | Y | Zr | Ti/Zr | A.I. |
|---|-------------|----|-------|------|-------|-------|------|------|------|------|------|------|-----|---|------|--------|----|----|-----|-------|-------|
| Least altered precursor? (Average of C88 & C93) | | | | | | | | | | | | | | | | | | | | | |
| | | | 74.20 | 0.49 | 13.84 | 5.09 | 0.32 | 1.47 | 0.02 | 0.00 | 4.34 | 0.06 | | | 3.44 | 103.29 | 12 | 50 | 234 | 12.5 | 99.58 |

MASS CHANGES in CPZ Group 1 relative to least altered precursor? = C88; Zr as immobile monitor

| | (g/100g) | | SiO2 | TiO2 | Al2O3 | Fe2O3 | MnO | MgO | CaO | Na2O | K2O | P2O5 | CO2 | S | Net change/g/100g |
|------|-----------------|---|------|------|-------|-------|-----|-----|-----|------|-----|------|-----|---|-------------------|
| C88 | alt QpR | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | 0 |
| C93 | alt QpR or tuff | 1 | -7 | -0 | -1 | 6 | 1 | 2 | 0 | 0 | -1 | 0 | | | -0 |
| C98 | alt QpR or tuff | 1 | -28 | 0 | -1 | 1 | 0 | 0 | -0 | 0 | -0 | 0 | | | -29 |
| C103 | xtRMgn | 1 | -16 | 0 | 1 | 1 | 0 | -0 | -0 | 0 | -1 | 0 | | | -16 |
| C106 | alt QFp felsic | 1 | -16 | -0 | -1 | 4 | 0 | -0 | -0 | 0 | -1 | -0 | | | -14 |

MASS CHANGES in CPZ Group 1 relative to least altered precursor? = Average of C88 & C93; Zr as immobile monitor

| | (g/100g) | | SiO2 | TiO2 | Al2O3 | Fe2O3 | MnO | MgO | CaO | Na2O | K2O | P2O5 | CO2 | S | Net change/g/100g |
|------|-----------------|---|------|------|-------|-------|-----|-----|-----|------|-----|------|-----|---|-------------------|
| C88 | alt QpR | 1 | 4 | 0 | 0 | -3 | -0 | -1 | -0 | 0 | 0 | -0 | | | 0 |
| C93 | alt QpR or tuff | 1 | -4 | -0 | -0 | 3 | 0 | 1 | 0 | 0 | -0 | 0 | | | -0 |
| C98 | alt QpR or tuff | 1 | -25 | 0 | -1 | -2 | -0 | -1 | -0 | 0 | -0 | 0 | | | -29 |
| C103 | xtRMgn | 1 | -12 | 0 | 1 | -2 | -0 | -1 | -0 | 0 | -1 | 0 | | | -16 |
| C106 | alt QFp felsic | 1 | -12 | -0 | -1 | 1 | -0 | -1 | -0 | 0 | -1 | -0 | | | -14 |

Group Locations:

- Gp 1 North of Cethana Bridge
- Gp 2 South of Cethana Bridge
- Gp 3 Day's Rd to Machinery Creek
- Gp 4 Staverton Rd north of Cethana Rd
- Gp 5 Oliver's Road
- Gp 6 Staverton Prospect & Lake Barrington Road

278053

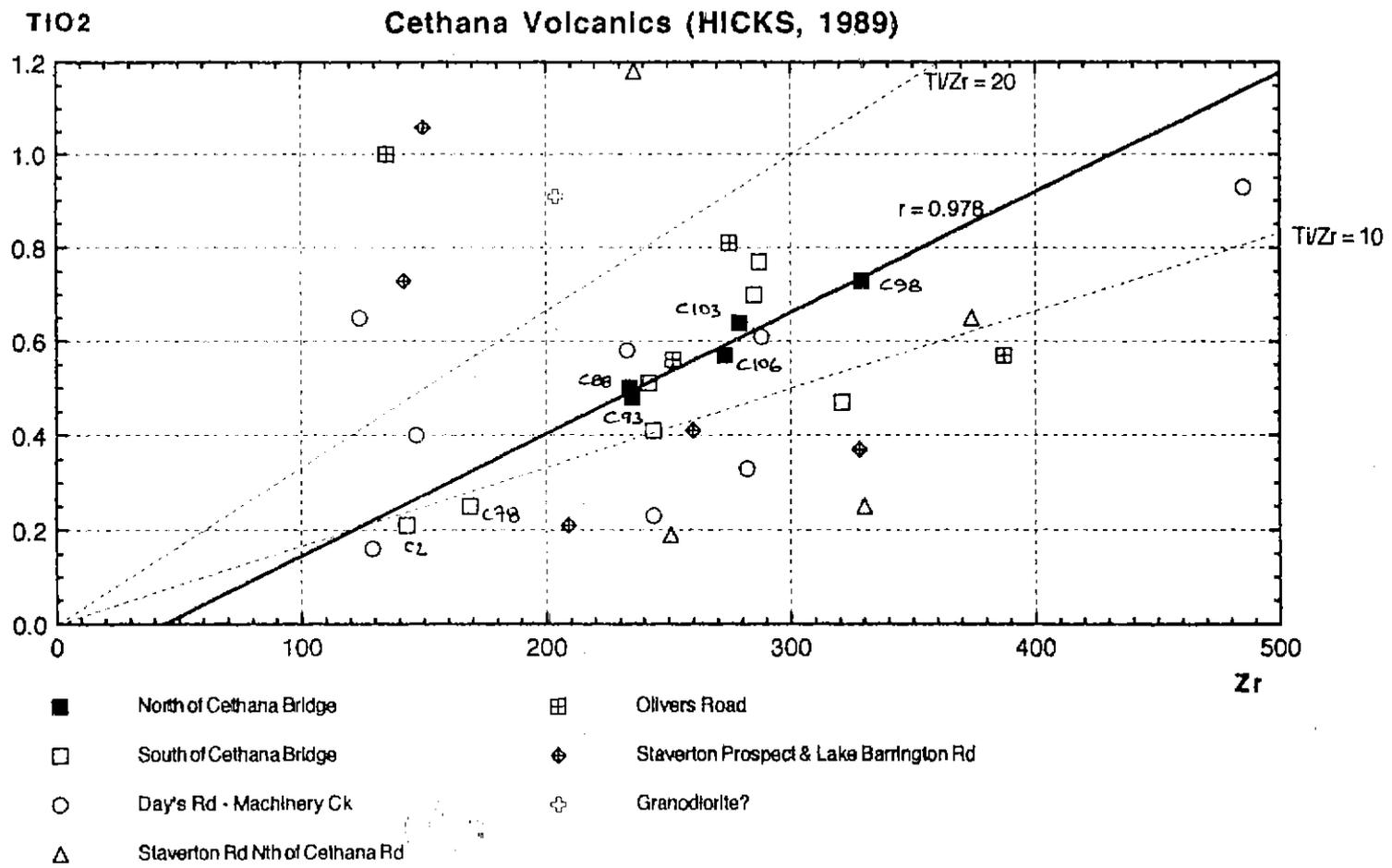
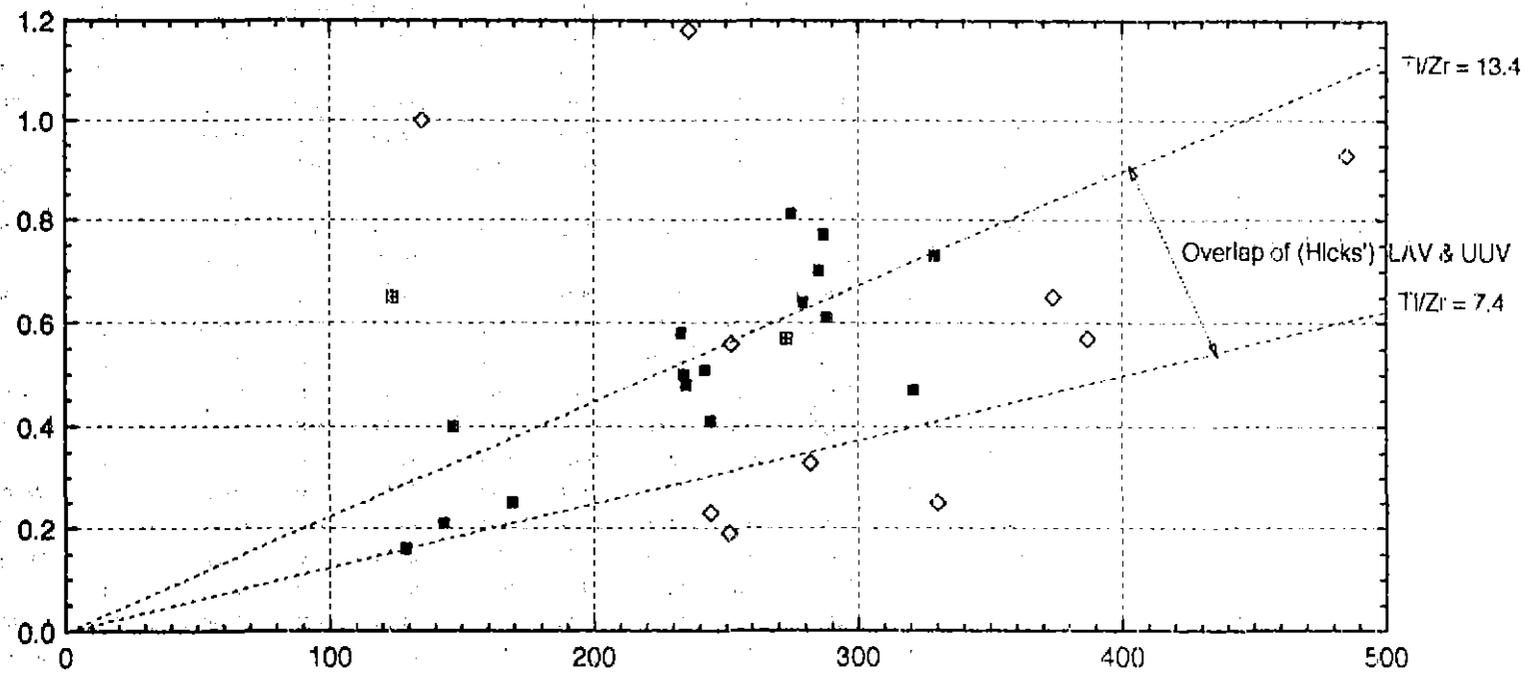


Fig 1. TiO₂-Zr scatterplot of Cethana Volcanics

278054

TiO₂

Gethana Volcanics (Hicks', 1989)



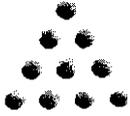
- LAV (Lower altered volcanics)
- ▣ CPZ (Gethana pyrite zone)
- ◇ UUV (Upper unaltered volcanics)

Fig 2 TiO₂/Zr scatterplot differentiating? Hicks' (1989) LAV and UUV

278055

APPENDIX II

1. Drill Logs for CERC 1-6
2. Assay Results for CERC 1-6



MEMORANDUM

To Rob Reid
Plutonic Operations Ltd., Tasmania

From Wally Herrmann

Date 5 March, 1997 **Pages** 2

Subject Cethana East RC drilling results

Dear Rob,

Thanks for your details on Cethana East RC programme.

As requested, I visited the site today to obtain the sample and make a brief inspection of the cuttings from hole CERC4. The samples (labelled 15428 for the bulk sample from 44-45m and 15429 for a smaller pick of pink siliceous chips from the same interval) will be dispatched to Analabs-Burnie tomorrow to await your instructions.

These are my geological impressions:

Lithotypes in CERC4 (at least below ~25m) are essentially uniform sericitic quartz phyrlic "rhyolitic" felsic volcanics. The least foliated, least sericitic examples (eg: 27-28m, >56m) retain quite well preserved tabular feldspar (2mm, 10%) and euhedral clear quartz (1-2mm, 10%) phenocrysts in a fine pale cream-grey devitrified matrix. They look like coherent facies; they could of course represent porphyritic lithic clasts from some kind of coarse volcanoclastic but, in that case, their abundance and uniformity would suggest a virtually monomict breccia.

Samples from the interval 44-46m consist of some essentially similar sericitic quartz phyrlic felsic volcanic and a major proportion (>60%) of reddish hematite stained siliceous rock. Individual chips of the latter vary from fairly fine granular cherty? quartz (containing upto 10% evenly dispersed, whitish, fuzzy specks to 0.1mm which look a little like relict spherulites??), medium granular quartzite and distinctly coarse granular, silicic-lithic sandstone. Clastic grains include clear and milky blue quartz, red jaspery chert and steely hematite granules in a framework supported aggregate with hematite staining on grain surfaces. Some chips have remnants of small clear quartz veinlets and rare smears of pyrite but not in significant quantity to raise interest.

The general granular/clastic appearance, quartz-hematite composition and lack of relict volcanic (quartz phenocryst) textures of these samples most resembles the Roland Conglomerate-sandstone lithology. I can not provide a convincing explanation of why a <2m thick interval of Denison Group siliciclastics exists within possibly coherent older felsic volcanics but the following are some wild possibilities:

- an in faulted narrow sliver of Oc?
- an Oc floater at the base of weathered felsic volcanic talus?
- a Oc floater from higher in the hole which fell or was pushed down when re-running the hammer?

None are easily credible; knowledge of the drilling conditions may eliminate or support the last two.

Apart from the quartz-hematite composition, there is nothing about this pink rock which really invites an interpretation as an exhalite. There does not seem to be any change in lithology or alteration style above or below it to suggest a break in volcanic deposition.

The unfortunate nature of the samples (medium sand with few chips in the 5-10mm size range) does not permit confident interpretation of the volcanic facies to constrain the set up but a thin exhalite horizon might not be expected in a pile of felsic domes and sills and if it were present, would probably not be laterally persistent.

I think we're really scratching to interpret this from the chips but it looks most like Roland Conglomerate to my eye. A reasonable alternative suggested in your logs is jaspery silica-hematite alteration of the volcanics.

A cursory inspection (which I undertook last autumn) of diamond drill core from CED1 indicated that "Disseminated granular hematite is virtually ubiquitous in all lithologies intersected by the hole [CED1] except where overprinted by quartz-sericite-pyrite alteration. Hematite could be a primary accessory or at least a very early alteration phase following devitrification.

Moderate to strong semi pervasive to fracture controlled dark chlorite alteration is also common and seems to be co-stable with hematite (eg: specimen from 61m which contains granules of disseminated hematite and hematite stained fringes of chlorite-carbonate veins. Chlorite is most abundant in apparent volcanoclastic lithofacies and is restricted to veinlets and fractures in the more coherent units (as in specimen from 61m) suggesting permeability control on this type of alteration. Patchy quartz-sericite-pyrite alteration in CED1 undoubtedly post dates hematite formation and pyrite and hematite never closely co-exist; (eg: in coherent QFphyric rhyolite at 163m there are diffuse relict kernels of purplish grey with disseminated hematite separated by bands and vein selvages of quartz-sericite-pyrite alteration around narrow trains of pyrite." (Herrmann, 1996).

I seem to recall that the hematite was mainly disseminated in small blebs and dusty patches, rather than being associated with quartz or cherty silica, and it doesn't seem like a direct analogue for the stuff in CERC4.

The sulphides prominent in sample from 48-49m include pyrite-galena-sphalerite (latter is a dark iron grey variety) in blurry disseminations and streaks associated with minor veinlets of quartz in typical sericitic quartz phyric felsic volcanic, as before. The alteration style is perhaps slightly more siliceous but not significantly different. This kind of thing is like a "background" style of mineralisation at Cethana; there are numerous short to medium intervals of sub percent vein style Pb-Zn mineralisation in some of the previous diamond cored holes and I don't think it is very significant in terms of an alteration facies or VHMS exploration model.

However, all of these comments are rather subjective, due to the difficult nature of the CERC4 chip samples which defy convincing megascopic interpretation. I would expect that, if the 44-46m interval did represent an exhalite and a proximal mineralised palaeo-sea floor setting, there would be some marked difference in alteration style and intensity, and possibly volcanic bulk composition, on either side of it. This could be tested by systematic major element geochemistry or (at least) Na₂O, Ti and Zr analyses.

Best regards,

Reference

Herrmann, W. 1996 Review of Cethana and Staverton Exploration & Potential exploration, Memo to Bob Close, Plutonic; May 24, 1996

278061

| Hole No. CERC 1 | | Depth 86 m | | | | | | | | | | | | | | | | | | |
|--|----------------------------------|--|---|------------|----|---|---|-----|-----|-----|-----|------|---------------------|--|--|--|--|--|--|---------------------|
| Scale 1: By Rob Reid Date 24/1/97 Page 3 of 3 | | Project Gauric Park, Cathara East Section 21900E (N325N) Collar co-ords AME 431228 mE 5407550 mN Az. 193° G M -60° Incl. RL | | | | | | | | | | | | | | | | | | |
| Depth From To | Mean Grainsize Med 0.5 2 8 32 | Max Clast & Structure | Description | Attributes | | | | | | | | | | | | | | | | |
| | | | | Ser | ch | h | M | sil | chl | col | com | carb | Ca, Pb, Zn, Fe, etc | | | | | | | |
| 66 67 | | | w ² AA. com / blk grey siliceous / ash, Fl (Rhy) weak seric. matrix, sparse grey Hacks | W | W | | | | | | | | | | | | | | | |
| 67 68 | | | w ¹ AA | W | | | | | | | | | | | | | | | | |
| 68 69 | | | AA | W | | | | | | | | | | | | | | | | |
| 69 70 | | | AA | W | | | | | | | | | | | | | | | | |
| 70 71 | | | AA | W | | | | | | | | | | | | | | | | 10, 32, 61, 175 |
| 71 72 | | | AA | W | | | | | | | | | | | | | | | | |
| 72 73 | | | AA | W | | | | | | | | | | | | | | | | |
| 73 74 | | | AA | W | | | | | | | | | | | | | | | | |
| 74 75 | | | AA | W | W | | | | | | | | | | | | | | | 12, 10, 75, 1095 |
| 75 76 | | | AA | W | W | | | | | | | | | | | | | | | |
| 76 77 | | | AA but com / grey colour | W | W | | | | | | | | | | | | | | | |
| 77 78 | | | w/m ² AA com & grey weak ch alt zone | W | W | | | | | | | | | | | | | | | |
| 78 79 | | | w/m ¹ AA " " " white carb-vnd (sl%), ch in selvages. | W | W | | | | | | | | | | | | | | | 16, 23, 61, 203 |
| 79 80 | | | w/m ² AA com & grey. | W | W | | | | | | | | | | | | | | | |
| 80 81 | | | AA " " " , lg py dss | W | W | | | | | | | | | | | | | | | |
| 81 82 | | | w/m ¹ AA | W | | | | | | | | | | | | | | | | |
| 82 83 | | | w/m ² AA | W | | | | | | | | | | | | | | | | 17, 23, 51, 213, 70 |
| 83 84 | | | AA | W | | | | | | | | | | | | | | | | |
| 84 85 | | | AA | W | | | | | | | | | | | | | | | | 15, 23, 48, 216, 70 |
| 85 86 | | | AA | W | | | | | | | | | | | | | | | | |

EOH @ 86m; - Very strong water flow
 - very slow drilling
 - anomaly on section adequately covered.

278063

| Hole No. CERC 2 | | Depth 71 m | | | | | | | | |
|--|----------------|---|---|------------|-----|----|----|-----|----|----|
| Scale 1: By Rob Reid Date 28-1-97 Page 2 of 3 | | Project Gowrie Park - Cethana East. Section 21800 E Collar co-ords 21800 mE 3127 mN RL Az. 193 G M -60 Incl. | | | | | | | | |
| Depth From To | Mean Grainsize | Max Clast & Structure | Description | Attributes | | | | | | |
| | Med 0.5 2 6 32 | | | Grain | Sil | Ch | Py | Sp | Gr | Gr |
| 33 | 34 | ? | AA, con/tan, lg FV, abundant qb grains are plaus? | | | tr | | | | |
| 34 | 35 | q-phc | tan/pgn lg q-phc FV (Rhy) | | | | | | | 1 |
| 35 | 36 | FV | tan " " | | | | | | | |
| 36 | 37 | --- | AA " " | | | | | | | |
| 37 | 38 | --- | bull/pgn " " | | | | | | | tr |
| 38 | 39 | qtz-mnd | milky (semi translucent vein) qtz (Devonian?), 4% FV, qtz appears barren. | | | | | | | 25 |
| 39 | 40 | --- | AA, ferruginous frags (5%), FV 5% | | | | | | | 5 |
| 40 | 41 | q-phc | bull/pgn silicified q-phc FV | w? | | | | | | 1 |
| 41 | 42 | FV | AA " " | | w | | | | | 1 |
| 42 | 43 | --- | " " " | | w | | | | | 2 |
| 43 | 44 | --- | sem & bn silicified q-phc FV (Rhy) (AA), trace stau, gray flcks, ferruginous frags (6%) | | | | | tr? | | 6 |
| 44 | 45 | q-phc | AA (8) | | | | | tr? | | 8 |
| 45 | 46 | q-phc | AA \approx 25% milky vein - quartz | | | | | | | 10 |
| 46 | 47 | FV | AA \approx abundant vlg dark specks within silicified FV | | | tr | | ? | | 5 |
| 47 | 48 | q-phc | pgn silicified q-phc FV | w | w | w | | | | tr |
| 48 | 49 | q-phc | tan q-phc FV (Rhy), milky vein - qtz | | | | | | | 15 |
| 49 | 50 | --- | " " " \approx trace included chlorite | | | tr | | | | 10 |
| 50 | 51 | q-phc | " " " " | | | tr | | | | 6 |
| 51 | 52 | FV | con/tan, q-phc FV | | | tr | | | | 25 |
| 52 | 53 | --- | * TOFR, con q-phc FV \approx tr dark flcks (metallic?) | | | | | ? | | 1 |
| 53 | 54 | --- | con & pgn, AA, ch (w) | | | w | | | | |
| 54 | 55 | --- | pgn " ch & trace dark flcks | | | w | | tr | | |
| 55 | 56 | --- | pgn " ch flcks | | | w | | | | |
| 56 | 57 | --- | pgn AA " trace usually silicified frags, no apparent ch inclusion | | | w | | tr | | |
| 57 | 58 | --- | flcks, AA, ch flcks abundant, weak Fe stain | | | w | | | | |
| 58 | 59 | --- | pgn " trace silicified frags | | | w | | tr | | tr |
| 59 | 60 | --- | pgn q-phc FV, | | | w | | | | tr |
| 60 | 61 | --- | AA " " | | | w | | | | |
| 61 | 62 | --- | AA semi translucent qb-ch-py und (<0.5%) | | | w | | tr | | 25 |
| 62 | 63 | --- | AA dark flcks py dms | | | w | | tr | | |
| 63 | 64 | --- | AA ch flcks <1%, in weathered frags/continuation of | | | w | | | | 5 |
| 64 | 65 | --- | AA " " | | | w | | | | |
| 65 | 66 | --- | AA " " | | | w | | | | |

278066

| Hole No. <i>CERC 3</i> | | Depth <i>49</i> m | | | | | | | | | | | | | | | | | | | |
|--|--|--|---|------------|----|----|----|----|----|----|----|----|----|-----|----|----|----|----|----|-----|--|
| Scale <i>1:</i> By <i>Rob Reid</i> Date <i>29-1-97</i> Page <i>2 of 2</i> | | Project <i>Gormie Park - Cellana East</i> Section <i>21750 E (-421 N)</i> Collar co-ords <i>ANG 431049 mE 5407622 mN</i> RL Az. <i>193° G</i> M <i>-60°</i> Incl. | | | | | | | | | | | | | | | | | | | |
| Depth From To | Mean Grainsize <small>Max 0.5 2 8 32</small> | Max-Glast & Structure | Description | Attributes | | | | | | | | | | | | | | | | | |
| | | | | Ser | Ch | Fl | Gr | Al | Pl | Sp | Tr | Op | Ms | Qtz | Pl | Sp | Tr | Op | Ms | Qtz | |
| <i>33</i> | <i>34</i> | <i>wf</i> | <i>crs & pgn fglng q-phe FVest; silvery dark flcks (gal?) tr. ch-sil? ^{semi-} permin</i> | | | | | | | | | | | | | | | | | | |
| <i>34</i> | <i>35</i> | <i>wf</i> | <i>AA</i> | | | | | | | | | | | | | | | | | | |
| <i>35</i> | <i>36</i> | <i>wf</i> | <i>AA</i> | | | | | | | | | | | | | | | | | | |
| <i>36</i> | <i>37</i> | <i>wf</i> | <i>AA</i> | | | | | | | | | | | | | | | | | | |
| <i>37</i> | <i>38</i> | <i>wf</i> | <i>AA</i> | | | | | | | | | | | | | | | | | | |
| <i>38</i> | <i>39</i> | <i>wf</i> | <i>pgn fglng q-phe FV, tr above & locally ch(s) patches, q-ch-und</i> | | | | | | | | | | | | | | | | | | |
| <i>39</i> | <i>40</i> | <i>wf</i> | <i>AA</i> | | | | | | | | | | | | | | | | | | |
| <i>40</i> | <i>41</i> | <i>wf</i> | <i>AA ch veinlets & flcks patches</i> | | | | | | | | | | | | | | | | | | |
| <i>41</i> | <i>42</i> | <i>wf</i> | <i>AA</i> | | | | | | | | | | | | | | | | | | |
| <i>42</i> | <i>43</i> | <i>wf</i> | <i>AA c small (6um) aggregates of fg PY (ms) with silicified inclusions.</i> | | | | | | | | | | | | | | | | | | |
| <i>43</i> | <i>44</i> | <i>wf</i> | <i>AA c fg PY aggregates (ms), c silicified FV - dss py, note clear radial qtz ch-sil? ^{support} w/gy rod.</i> | | | | | | | | | | | | | | | | | | |
| <i>44</i> | <i>45</i> | <i>wf</i> | <i>pgn q-phe FV, q-ch-und, py, AA</i> | | | | | | | | | | | | | | | | | | |
| <i>45</i> | <i>46</i> | <i>wf</i> | <i>pgn, AA, sil (tr) locally, dark grey flcks tr (gal?)</i> | | | | | | | | | | | | | | | | | | |
| <i>46</i> | <i>47</i> | <i>wf</i> | <i>AA</i> | | | | | | | | | | | | | | | | | | |
| <i>47</i> | <i>48</i> | <i>wf</i> | <i>AA fglng dk rlg MS+ , fg py aggregate (0.5)</i> | | | | | | | | | | | | | | | | | | |
| <i>48</i> | <i>49</i> | <i>wf</i> | | | | | | | | | | | | | | | | | | | |
| <i>49</i> | <i>50</i> | | | | | | | | | | | | | | | | | | | | |
| <i>50</i> | <i>51</i> | | | | | | | | | | | | | | | | | | | | |
| <i>51</i> | <i>52</i> | | | | | | | | | | | | | | | | | | | | |
| <i>52</i> | <i>53</i> | | | | | | | | | | | | | | | | | | | | |
| <i>53</i> | <i>54</i> | | | | | | | | | | | | | | | | | | | | |
| <i>54</i> | <i>55</i> | | | | | | | | | | | | | | | | | | | | |
| <i>55</i> | <i>56</i> | | | | | | | | | | | | | | | | | | | | |
| <i>56</i> | <i>57</i> | | | | | | | | | | | | | | | | | | | | |
| <i>57</i> | <i>58</i> | | | | | | | | | | | | | | | | | | | | |
| <i>58</i> | <i>59</i> | | | | | | | | | | | | | | | | | | | | |
| <i>59</i> | <i>60</i> | | | | | | | | | | | | | | | | | | | | |
| <i>60</i> | <i>61</i> | | | | | | | | | | | | | | | | | | | | |
| <i>61</i> | <i>62</i> | | | | | | | | | | | | | | | | | | | | |
| <i>62</i> | <i>63</i> | | | | | | | | | | | | | | | | | | | | |
| <i>63</i> | <i>64</i> | | | | | | | | | | | | | | | | | | | | |
| <i>64</i> | <i>65</i> | | | | | | | | | | | | | | | | | | | | |
| <i>65</i> | <i>66</i> | | | | | | | | | | | | | | | | | | | | |
| <i>ECH @ 49m</i> | | | | | | | | | | | | | | | | | | | | | |
| <i>Driller advised strong likely hood</i> | | | | | | | | | | | | | | | | | | | | | |
| <i>of bogging rods.</i> | | | | | | | | | | | | | | | | | | | | | |

| Hole No. CERC 5 | | Depth 66 m | | | | | | | | |
|---|----------------------------------|---|--|------------|-----|------|----|-----|----|----|
| Scale 1: By Rob Reid Date 1-2-97 Page 2 of 2 | | Project Gornic Park - Cerkovci East Section 21600E (~3060N) Collar co-ords ANG 430880 mE 5407654 mN RL Az. 193°G M -60 Incl. | | | | | | | | |
| Depth From To | Mean Grainsize Mod 0.5 2 8 32 | Max-Glast & Structure | Description | Attributes | | | | | | |
| | | | | Scratch | Sil | carb | py | gal | py | |
| 33 34 | | | tan of sil-ss frags, milky un-ol (2%), pk km-sil frags (1) | | | | | | tr | 2 |
| 34 35 | | | tan AA, locally g-ph, trace qb-ss (contamination) | | | | | | | |
| 35 36 | | | AA sil-ss frags (1) | | | | | | | 10 |
| 36 37 | | | contamination, along qb-ph & V/V, milky ch ground frags (20%) | | | | | | | 10 |
| 37 38 | | | cont of g-ph & V/V, milky un-ol, trace other contamination | | | | | | | 1 |
| 38 39 | | | AA oven contamination 5% | | | | | | | |
| 39 40 | | | tan g-ph & V/V, trace pk km-sil frags | | | | | | tr | tr |
| 40 41 | | | AA sil-ss frags 1% | | | | | | | 1 |
| 41 42 | | | AA, translucent un-ol (tr), pk km stain (tr) | | | | | | | tr |
| 42 43 | | | AA | | | | | | | tr |
| 43 44 | | | AA | | | | | | | tr |
| 44 45 | | | AA | | | | | | | tr |
| 45 46 | | | AA | | | | | | | tr |
| 46 47 | | | AA | | | | | | | tr |
| 47 48 | | | thin g-ph & V/V, chloride as black & green, weak Fe stain | | | | | | tr | tr |
| 48 49 | | | crustlike AA | | | | | | | tr |
| 49 50 | | | thin g-ph, ch as black & green, milky qb-ss un-ol | | | | | | W | tr |
| 50 51 | | | " AA " pk hematite frags | | | | | | W | tr |
| 51 52 | | | tan & tan, sil-ss & V/V, 3% FeO frags, | | | | | | ? | tr |
| 52 53 | | | tan & tan AA, qb-ss un-ol (1%) | | | | | | | tr |
| 53 54 | | | tan AA, translucent qb-ss un-ol (1%) | | | | | | W | tr |
| 54 55 | | | thin AA, ~TOFR | | | | | | W | tr |
| 55 56 | | | thin AA | | | | | | W | tr |
| 56 57 | | | thin AA | | | | | | W | tr |
| 57 58 | | | AA | | | | | | W | tr |
| 58 59 | | | thin AA, sil-ph-py altered (di. phase replacement) contam (tr) | | | | | | W | tr |
| 59 60 | | | AA, gal dss & paint on foliation surfaces (dss assoc with sil) (contam 3%) | | | | | | W | tr |
| 60 61 | | | " " qb-sil-ch-gal un-ol & diffuse zones (no contam) | | | | | | W | tr |
| 61 62 | | | AA | | | | | | W | tr |
| 62 63 | | | AA, AA reddish-brown sp-hal (tr) contamination (1-2%) | | | | | | W | tr |
| 63 64 | | | AA, sil-ch-gal-py un-ol (tr) " (tr) | | | | | | W | tr |
| 64 65 | | | AA " (tr) py dss (tr) " (30%) | | | | | | W | tr |
| 65 66 | | | AA, dss py & gal (tan 3% in some frags) " (20%) | | | | | | W | tr |

0.08%

gal on fol pairs
is bright & pure
suggests
remobilised?

18: grains
py & gal in
11 lines washed
of sample bag.

gal *

at

penetration ...

273073

SAMPLE RECORD SHEET

PROJECT NAME: Gowrie Park CODE: 706 TENEMENT: _____
 PROSPECT NAME: Cethana East (or SHEET No.) _____
 SAMPLER: J. FOSTER SAMPLE TYPE: RC 4m Comp DATE: 24/1/97
 HOLE ID: CERC 1 / CERC 2 P.O. No.: _____

| SAMPLE No. | TYPE | INTERVAL/ LOCATION/CO-ORDS | DESCRIPTION |
|------------|-----------|------------------------------|--|
| S 15331 | RC 4m | 0-4m CERC1 | 0-1m and 1-2m → 10% recovery |
| 2 | Composite | 5-8m | 7-8m WET → 20% recovery |
| 3 | " | 9-12m | |
| 4 | " | 13-16m | |
| 5 | | 17-20m | |
| 6 | | 21-24m | |
| 7 | | 25-28m | |
| 8 | | 29-32m | |
| 9 | | 33-36m | |
| S 15340 | | 37-40m | |
| 1 | " | 41-44m | |
| 2 | | 45-48m | |
| 3 | | 49-52m | |
| 4 | | 53-56m | 53-5m hit water seam → all further samples very wet. |
| 5 | | 57-60m | |
| 6 | | 61-64m | 60-61 bag split 10% recovery |
| 7 | | 65-68m | 53-4/40% 54-5/30% 55-6/40% 58-9/50% |
| 8 | | 69-72m | |
| 9 | | 73-76m | |
| S 15350 | " | 77-80m | |
| 1 | | 80-84m | Sample 84-86m only - hole ends 86m |
| 2 | " | 84-86m CERC1 | 2m Comp |
| 3 | | 88-92m 0-4m CERC2 | |
| 4 | | 92-96m 4-8m | |
| 5 | | 96-100m 8-12m | |
| 6 | RC 4m | 12-16m | CERC-2 |
| 7 | Composite | 16-20m | |
| 8 | | 20-24m | |
| 9 | | 24-28m | 25-26m damp/50% recovery |
| S 15360 | | 28-32m | 31-32m wet/30% recovery |

REMARKS:

WHITE: Assay File
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SAMPLE RECORD SHEET

278074

PROJECT NAME: Gowrie Park CODE: 706 TENEMENT:
PROSPECT NAME: Cethana East (or SHEET No.)
AMPLER: J. FOSTER SAMPLE TYPE: RC 4m Comp DATE: 28-1-97
HOLE I.D.: CERC 2 / CERC 3 / CERC 4 P.O. No.:

| SAMPLE No. | TYPE | INTERVAL/ LOCATION/CO-ORDS | DESCRIPTION |
|------------|-----------|-------------------------------|---|
| S 15361 | RC 4m | 32-36m | 34-35 and 35-36 / 20% recovery |
| 2 | Composite | 36-40m | |
| 3 | " | 40-44m | 41-42m. very wet - all further samples |
| 4 | " | 44-48m | very wet |
| 5 | " | 48-52m | |
| 6 | " | 52-56m | |
| 7 | " | 56-60m | |
| 8 | " | 60-64m | 63-64m contamination 5% |
| 9 | " | 64-68m | 65-67m & 67-68m Contamination 5-10% Recovery |
| S 15370 | " | 68- 72 71m | Hole Ends 71m ∴ sample only 3m |
| 1 | RC 4m | 72-76m 13-17m | CERC 3 |
| 2 | Composite | 76-80m 17-21m | |
| 3 | " | 21-25m | |
| 4 | " | 25-29m | |
| 5 | " | 29-33m | 31-32m wet / 25% recovery |
| 6 | " | 33-37m | 36m problem in hole - started to pump |
| 7 | " | 37-41m | WET ↓ water through. |
| 8 | " | 41-45m | |
| 9 | " | 45-49m | Hole Ends 49m |
| S 15380 | Rock Chip | 49-53m | Gossanous sample from road push 30m |
| 1 | | 53-57m | North of CERC 3 (FLOAT) |
| 2 | | 57-61m | |
| 3 | RC 4m | 15-19m | CERC 4 |
| 4 | Composite | 19-23m | |
| 5 | " | 23-27m | |
| 6 | RC 4m | 27-31m | 30-31m / 30% recovery |
| 7 | Composite | 31-35m | |
| 8 | " | 35-39m | 35-36m WET ↓ contaminated, 38-39 / 50% recovery |
| 9 | " | 39-43m | 36-38 and 39-42 / 75% recovery |
| S 15390 | | 43-47m | |

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SAMPLE RECORD SHEET

278075

PROJECT NAME: Gowrie Park CODE: 706 TENEMENT: _____
(or SHEET No.)

PROSPECT NAME: Cethana East

SAMPLER: J. Foster SAMPLE TYPE: RC 1m and 4m Comp. DATE: 31-1-97

HOLE ID: CERC 4 / CERC 5 / CERC 6 P.O. No.: _____

| SAMPLE No. | TYPE | INTERVAL/ LOCATION/CO-ORDS | DESCRIPTION |
|------------|-----------|----------------------------|-------------------------------------|
| S 15391 | RC 1m | 47-48m | |
| 2 | " | 48-49m | |
| 3 | | 49-50m | |
| 4 | | 50-51m | |
| 5 | | 51-52m | |
| 6 | | 52-53m | |
| 7 | | 53-54m | |
| 8 | | 54-55m | |
| 9 | | 55-56m | |
| S 15400 | | 57-57m | |
| 1 | " | 57-58m | EQH. 58m. |
| 2 | RC 4m | 33-37m | CERC 5 WET FROM 28-29 |
| 3 | Composite | 37-41m | Contamination 37-38, etc; 38-39 5%. |
| 4 | | 41-45m | |
| 5 | | 45-49m | |
| 6 | | 49-53m | |
| 7 | | 53-57m | 53-54 1% contamination 54-55 2% |
| 8 | | 57- 58 58m | * |
| 9 | | 58-59m | trace contamination |
| S 15410 | | 59-60m | 3% contamination |
| 1 | | 60-61m | |
| 2 | | 61-62m | 130% recovery |
| 3 | | 62-63m | 120% recovery 11-2% contamination |
| 4 | | 63-64m | trace contamination |
| 5 | | 64-65m | 130% recovery / 30% contamination |
| 6 | | 65-66m | 200% contamination |
| 7 | RC 4m | 0-4m | CERC 6 |
| 8 | Composite | 4-8m | 5-10m / 50% recovery |
| 9 | | 8-12m | |
| S 15420 | | 12-16m | |

REMARKS:

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SAMPLE RECORD SHEET

278076

PROJECT NAME: Gowrie Park CODE: 706 TENEMENT: _____
PROSPECT NAME: Cethana East (or SHEET No.)
SAMPLER: J. Foster SAMPLE TYPE: RC 4m Comp. DATE: 1-2-97
HOLE I.D.: CERC 6 P.O. No.: _____

| SAMPLE No. | TYPE | INTERVAL/ LOCATION/CO-ORDS | DESCRIPTION |
|------------|-----------|----------------------------|--------------------------------|
| S 15421 | RC 4m | 16-20m | CERC 6 17-18m/50% recovery |
| 2 | Composite | 20-24m | |
| 3 | | 24-28m | 25-26m/75% 27-28m/50% recovery |
| 4 | | 28-32m | 31-36m/50% recovery |
| 5 | | 32-36m | WET FROM 32-33m |
| 6 | | 36-40m | 36-40m/80% recovery |
| 7 | 3m Comp. | 40- 42 43m | EOH, 43m |
| 8 | 1m | CERCA 44-45m | Major Element Analysis |
| 9 | 1 | AA | Jasper Fragments |
| S 15430 | | | |
| 1 | | | |
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| 4 | | | |
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| 7 | | | |
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| S 15440 | | | |
| 1 | | | |
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| 9 | | | |
| S 15450 | | | |

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Phone (004) 318897

14 Birrell St. COOEE TAS 7320

Fax (004) 318890

ANALYTICAL REPORT No.

PLU202.60.12775

THIS REPORT MUST BE READ IN CONJUNCTION WITH THE ACCOMPANYING ANALYTICAL DATA

INVOICE TO:

Plutonic Operations Limited
Level 37
North Sydney NSW 2060

ORDER No.

PROJECT

2018616

DATE RECEIVED

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07/02/97

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5

18/03/97

1

92

SAMPLE NUMBERS

SAMPLE DESCRIPTION

ELEMENT/METHOD

801157, 19356/80, 19383/427

SO Pres : GP032

Cu, Pb, Zn, Co, Fe, Ni / BA140

801158

SO Pres : GP032

As, Au / G0313

RESULTS TO

Rob Reed
Plutonic Operations Limited
P.O. Box 282
ZEEHAN TAS 7447

RESULTS TO

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RESULTS TO

[Empty box for results recipient]

REMARKS

278077

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SAMPLE PREFIX

REPORT NO

REPORT DATE

CLIENT ORDER NO

PAGE

PLU202.60.12775

18/03/97

2018616

1 OF 5

| SAMPLE No. | Au | Au (R) | Cu | Pb | Zn | Ag | Fe | Fe | Mn |
|------------|-------|--------|-------|-------|-------|-------|-------|-------|-------|
| | GG313 | GG313 | GA140 | GA140 | GA140 | GA140 | GA140 | GA104 | GA140 |
| 15331 | - | - | 51 | 80 | 107 | 1 | 2.80 | - | 91 |
| 15332 | - | - | 40 | 132 | 121 | <1 | 2.44 | - | 102 |
| 15333 | - | - | 26 | 219 | 94 | <1 | 2.35 | - | 101 |
| 15334 | - | - | 19 | 61 | 105 | <1 | 2.71 | - | 53 |
| 15335 | - | - | 11 | 13 | 82 | <1 | 1.98 | - | 46 |
| 15336 | - | - | 17 | 65 | 92 | <1 | 2.93 | - | 72 |
| 15337 | - | - | 15 | 17 | 87 | 1 | 1.90 | - | 49 |
| 15338 | - | - | 15 | 4 | 132 | <1 | 3.20 | - | 1240 |
| 15339 | - | - | 16 | 14 | 134 | <1 | 2.51 | - | 1730 |
| 15340 | - | - | 11 | 187 | 214 | <1 | 1.89 | - | 1380 |
| 15341 | - | - | 12 | 55 | 101 | <1 | 1.97 | - | 1260 |
| 15342 | - | - | 12 | 12 | 90 | <1 | 2.40 | - | 1310 |
| 15343 | - | - | 16 | 10 | 79 | <1 | 1.98 | - | 970 |
| 15344 | - | - | 15 | 11 | 84 | <1 | 2.25 | - | 880 |
| 15345 | - | - | 14 | <3 | 86 | 1 | 2.33 | - | 1610 |
| 15346 | - | - | 17 | <3 | 80 | <1 | 2.24 | - | 1460 |
| 15347 | - | - | 11 | 71 | 57 | 1 | 1.62 | - | 1080 |
| 15348 | - | - | 10 | 32 | 61 | <1 | 1.75 | - | 1040 |
| 15349 | - | - | 12 | 10 | 75 | <1 | 1.93 | - | 780 |
| 15350 | - | - | 15 | <3 | 61 | <1 | 2.33 | - | 630 |
| 15351 | - | - | 17 | <3 | 57 | <1 | 2.13 | - | 760 |
| 15352 | - | - | 15 | <3 | 48 | <1 | 2.16 | - | 750 |
| 15356 | - | - | 31 | 97 | 221 | <1 | 4.69 | - | 170 |
| 15357 | - | - | 42 | <3 | 218 | 1 | 3.67 | - | 130 |
| 15358 | - | - | 39 | 145 | 184 | <1 | 2.95 | - | 92 |

213078

all in ppm unless otherwise specified
 element not determined

ANALYTICAL DATA

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REPORT DATE

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18/03/97

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2 OF 5

| SAMPLE No. | Au | Au(R) | Cu | Pb | Zn | Ag | Fe | Fe | Mn |
|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| | GG313 | GG313 | GA140 | GA140 | GA140 | GA140 | GA140 | GA104 | GA140 |
| 15359 | - | - | 40 | 104 | 226 | <1 | 3.80 | - | 98 |
| 15360 | - | - | 24 | 35 | 154 | 1 | 3.88 | - | 53 |
| 15361 | - | - | 20 | 163 | 91 | 1 | 2.05 | - | 38 |
| 15362 | - | - | 36 | 305 | 90 | <1 | 1.54 | - | 720 |
| 15363 | - | - | 49 | 600 | 163 | <1 | 3.42 | - | 361 |
| 15364 | - | - | 26 | 107 | 110 | <1 | 2.65 | - | 53 |
| 15365 | - | - | 17 | 50 | 98 | <1 | 2.21 | - | 470 |
| 15366 | - | - | 11 | 17 | 78 | <1 | 1.75 | - | 480 |
| 15367 | - | - | 9 | 10 | 92 | 1 | 2.06 | - | 610 |
| 15368 | - | - | 11 | 67 | 116 | <1 | 1.65 | - | 312 |
| 15369 | - | - | 19 | 40 | 95 | <1 | 1.53 | - | 790 |
| 15370 | - | - | 25 | 12 | 203 | 1 | 1.79 | - | 400 |
| 15371 | - | - | 29 | 221 | 440 | <1 | >5.00 | 13.80 | 62 |
| 15372 | - | - | 23 | 273 | 145 | 1 | 1.82 | - | 21 |
| 15373 | - | - | 29 | 318 | 190 | <1 | 2.25 | - | <3 |
| 15374 | - | - | 18 | 118 | 141 | <1 | 1.39 | - | <3 |
| 15375 | - | - | 26 | 64 | 69 | <1 | 0.65 | - | <3 |
| 15376 | - | - | 22 | 73 | 90 | <1 | 0.63 | - | 11 |
| 15377 | - | - | 13 | 31 | 88 | <1 | 0.38 | - | 6 |
| 15378 | - | - | 6 | 56 | 134 | <1 | 0.52 | - | <3 |
| 15379 | - | - | 15 | 160 | 216 | 1 | 0.66 | - | 59 |
| 15380 | - | - | 65 | 1070 | 1090 | 1 | >5.00 | 8.66 | >5000 |
| 15383 | - | - | 26 | 97 | 121 | 1 | 0.67 | - | 270 |
| 15384 | - | - | 24 | 145 | 161 | <1 | 2.10 | - | 550 |
| 15385 | - | - | 15 | 189 | 92 | <1 | 0.87 | - | 99 |

278079

Unless otherwise specified, all elements are assumed to be in the form of the element.

SN1 - Sample No.

ANALYTICAL DATA

SAMPLE PREFIX

REPORT NO.

REPORT DATE

CLIENT ORDER NO.

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18/03/97

2018616

3 OF 5

| SAMPLE No. | Au | Au (R) | Cu | Pb | Zn | Ag | Fe | Fe | Mn |
|------------|--------|--------|-------|-------|-------|-------|-------|-------|-------|
| | GB313 | GB313 | GA140 | GA140 | GA140 | GA140 | GA140 | GA104 | GA140 |
| 15386 | - | - | 14 | 109 | 75 | <1 | 0.66 | - | 141 |
| 15387 | - | - | 20 | 176 | 269 | <1 | 1.34 | - | 65 |
| 15388 | 0.010 | 0.009 | 15 | 86 | 470 | <1 | 0.61 | - | 89 |
| 15389 | <0.005 | - | 12 | 102 | 241 | <1 | 0.47 | - | 31 |
| 15390 | <0.005 | - | 8 | 78 | 178 | <1 | 0.69 | - | 18 |
| 15391 | <0.005 | - | 9 | 128 | 199 | <1 | 1.56 | - | 670 |
| 15392 | <0.005 | - | 72 | 2740 | 1390 | 4 | 2.72 | - | 1650 |
| 15393 | <0.005 | - | 43 | 510 | 530 | 2 | 2.13 | - | 1120 |
| 15394 | 0.007 | - | 18 | 400 | 320 | 1 | 2.83 | - | 1760 |
| 15395 | 0.006 | - | 14 | 209 | 590 | <1 | 2.52 | - | 920 |
| 15396 | 0.005 | - | 13 | 63 | 357 | <1 | 1.39 | - | 700 |
| 15397 | <0.005 | - | 12 | 132 | 450 | <1 | 2.08 | - | 1320 |
| 15398 | 0.008 | - | 12 | 580 | 480 | <1 | 1.80 | - | 1030 |
| 15399 | 0.018 | 0.018 | 14 | 163 | 500 | <1 | 1.59 | - | 960 |
| 15400 | 0.008 | - | 9 | 128 | 480 | <1 | 2.05 | - | 1180 |
| 15401 | 0.008 | - | 6 | 212 | 790 | <1 | 1.31 | - | 800 |
| 15402 | - | - | 8 | 151 | 169 | <1 | 2.39 | - | 16 |
| 15403 | - | - | 9 | 125 | 124 | <1 | 1.50 | - | 22 |
| 15404 | - | - | 14 | 109 | 251 | <1 | 2.79 | - | 36 |
| 15405 | - | - | 14 | 177 | 404 | <1 | 3.62 | - | 38 |
| 15406 | - | - | 16 | 148 | 308 | <1 | 1.96 | - | 12 |
| 15407 | - | - | 9 | 25 | 142 | <1 | 1.26 | - | 17 |
| 15408 | - | - | 4 | 79 | 139 | <1 | 1.14 | - | <3 |
| 15409 | - | - | 81 | 193 | 520 | <1 | 1.81 | - | 14 |
| 15410 | - | - | 24 | 121 | 365 | <1 | 1.16 | - | 10 |

218030

Sample not received

Sample not received

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18/03/97

2018616

5 OF 5

| SAMPLE No | Min | | | | | | | | |
|-----------|-----------|-------|--|--|--|--|--|--|--|
| 1 | 15380 | 10.80 | | | | | | | |
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| 23 | | | | | | | | | |
| 24 | DETECTION | 0.01 | | | | | | | |
| 25 | UNITS | % | | | | | | | |

278082

IS - Insufficient sample
SNR - sample not received

IS - Insufficient sample
SNR - sample not received

AUTHORISED OFFICER

Phone (0041) 316837

11 Thirkeil St. EDDIE TAS 7320

Fax (004) 318890

ANALYTICAL REPORT No.

FLU202.60.12907

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11/04/97

1

18

SAMPLE NUMBERS

SAMPLE DESCRIPTION

ELEMENT/METHOD

340 & others

Pil Prep :

Ba, Nb, Ca, K, As, Mo, S, Fe, Ti, Zr, P.
.../61211

RESULTS
TO

Rob Reid
Electronic Operations Limited
P.O. Box 292
ZEEHAN TAS 7449

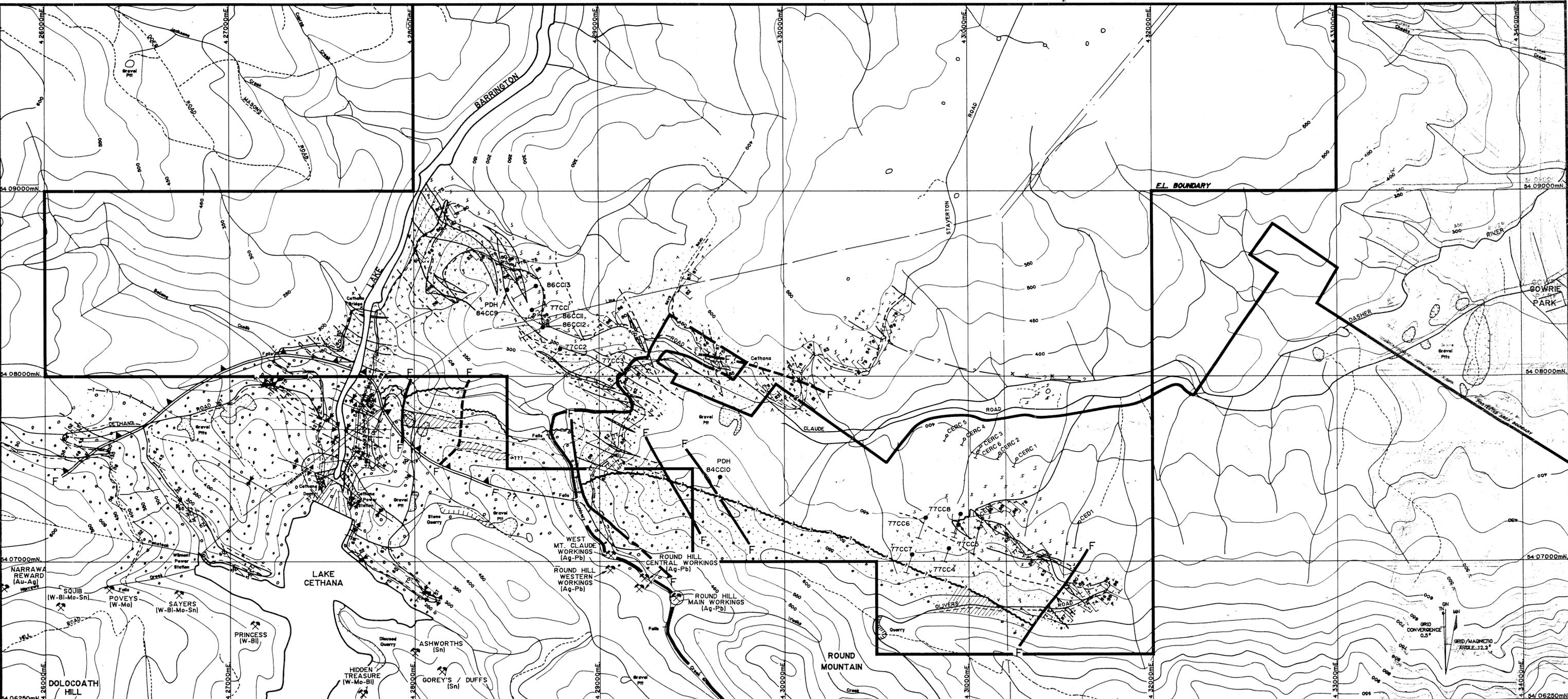
RESULTS
TO

RESULTS
TO

REMARKS

AUTHORISED OFFICER

278083



LEGEND

EARLY ORDOVICIAN - LATE CAMBRIAN :
(Danison Group)

- = Marine quartzose sandstone, shale, minor conglomerate (Molna Sandstone)
- = Quartzite and vein quartz pebbles to boulder conglomerate, polymict towards base (Roland conglomerate)
- = Interbedded quartzite/sandstone beds
- = Angular (erosional) unconformity

CAMBRIAN FELSIC VOLCANICS :
(Including Minnow Keratophyre, Bull Creek Formation)

- = Acid vitric tuff
- = Quartz - phytic, glassy rhyolitic lava
- = Fine to coarse grained epiclastic/volcaniclastics (occasionally bedded)
- = Coarse conglomerate/breccia volcaniclastics
- = Rhyolitic crystal - vitric tuff (showing weak ignimbritic textures)
- = Quartz - phytic crystal tuff
- = Fine grained (siliceous) bedded, variable volcaniclastic sediments
- = Quartz + feldspar - phytic rhyolitic tuffs and/or lavas
- = Quartz - phytic rhyolitic lavas and/or tuffs

MIXED VOLCANO - SEDIMENTARY ROCKS OF UNCERTAIN AGE :
(Lorina Greywacke correlates)

- = Silicified and recrystallized volcanoclastic/lava units
- = Dacitic - Andesitic pyroclastics & Lavas

CAMBRIAN INTRUSIVE ROCKS :
(Dove River Granodiorite correlate ?)

- = Granite dykes (coarsely crystalline, altered and severely weathered granodiorite bodies)

CAMBRIAN HYDROTHERMAL ALTERATION :

- = Quartz - sericitic schists

- = Geological boundary (observed; Inferred/extrapolated)
- = Unconformity (observed; Inferred/extrapolated)
- = Fault (observed, position approximate); Fault (Inferred/extrapolated)
- = Thrust Fault (teeth on upper plate)
- = Anticline (position approximate, plunge shown where measured)
- = Syncline (position approximate, plunge shown where measured)
- = Bedding (dip and strike as shown); Cleavage (dip and strike as shown)
- = Abandoned prospect; active prospect

PLUTONIC OPERATIONS LIMITED

E.L. 10/88

INTERPRETIVE SURFACE GEOLOGY OF THE CETHANA ALTERATION ZONE

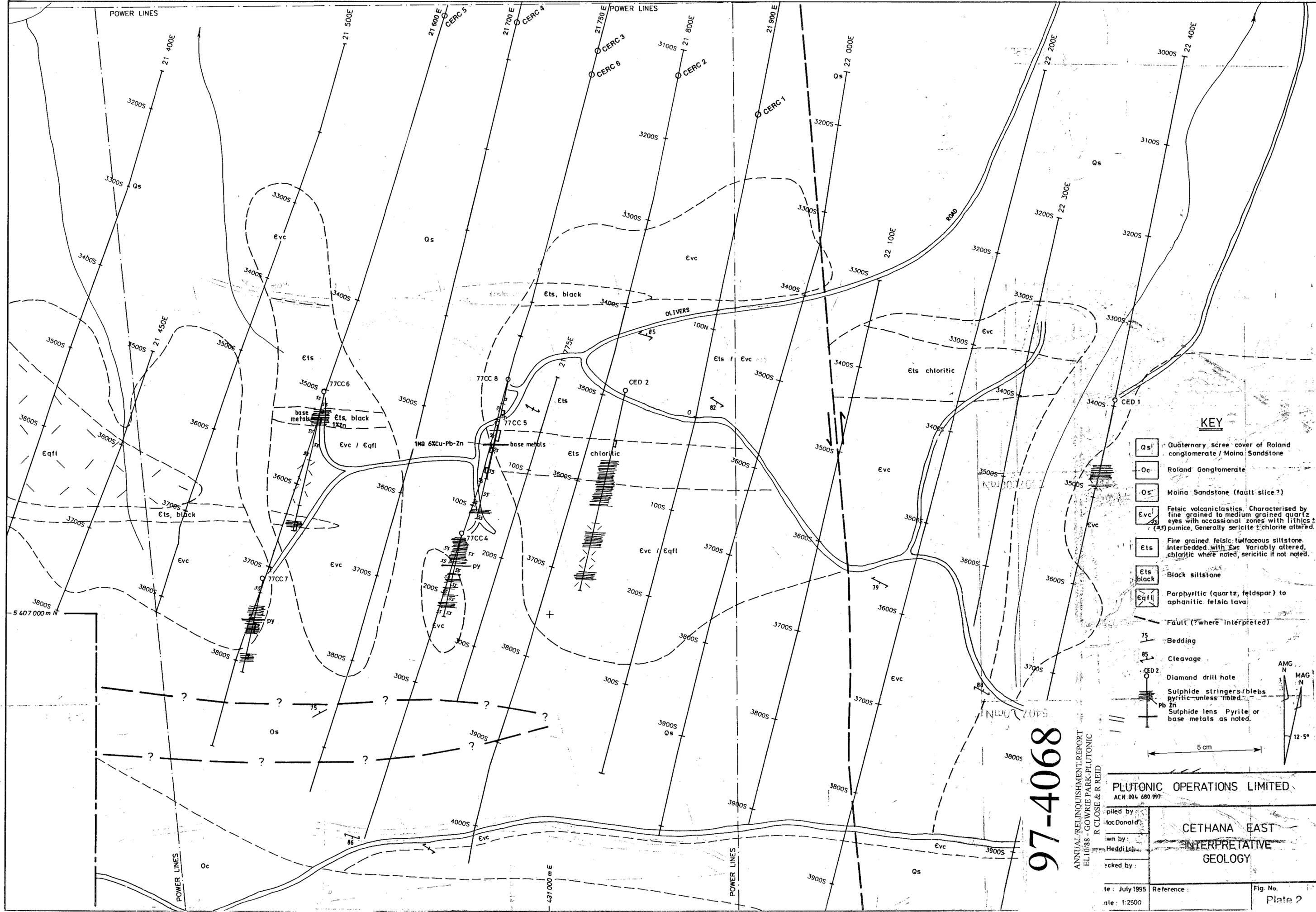
SCALE 1:10000

DRAWN BY: D.J.H.
DRAFTSMAN: T.G.D.S.
DATE: Oct 88
REVISIONS:
FILE No. NOR10022

Plate 1

CETHANA (Gowrie Park) 1:10,000
 Interpretive Surface Geology
 of the Cethana Alteration Zone
 1:10,000

97-4068
 ANNUAL RELINQUISHMENT REPORT
 E.L. 1088 - GOWRIE PARK-PLUTONIC
 R. CLOSE & R. REID
 278086



KEY

- Qs Quaternary scree cover of Roland conglomerate / Maina Sandstone
- Oc Roland Conglomerate
- Os Maina Sandstone (fault slice?)
- Evc Felsic volcanoclastics. Characterised by fine grained to medium grained quartz eyes with occasional zones with lithics (ss) pumice. Generally sericite & chlorite altered.
- Ets Fine grained felsic tuffaceous siltstone. Interbedded with Evc. Variably altered, chloritic where noted, sericitic if not noted.
- Ets black Black siltstone
- Eqfl Porphyritic (quartz, feldspar) to aphanitic felsic lava
- Fault (?where interpreted)
- Bedding
- Cleavage
- Diamond drill hole
- Sulphide stringers/blebs pyritic-unless noted
- Sulphide lens Pyrite or base metals as noted.



5 cm

97-4068

ANNUAL RELINQUISHMENT REPORT
EL10/88 - GOWRIE PARK-PLUTONIC
R CLOSE & R REID

PLUTONIC OPERATIONS LIMITED
ACN 004 680 997

Compiled by:
MacDonald
Drawn by:
Heddlow
Checked by:

CETHANA EAST
INTERPRETATIVE
GEOLOGY

Date: July 1995 Reference: Fig. No.
Scale: 1:2500 Plate 2

278037

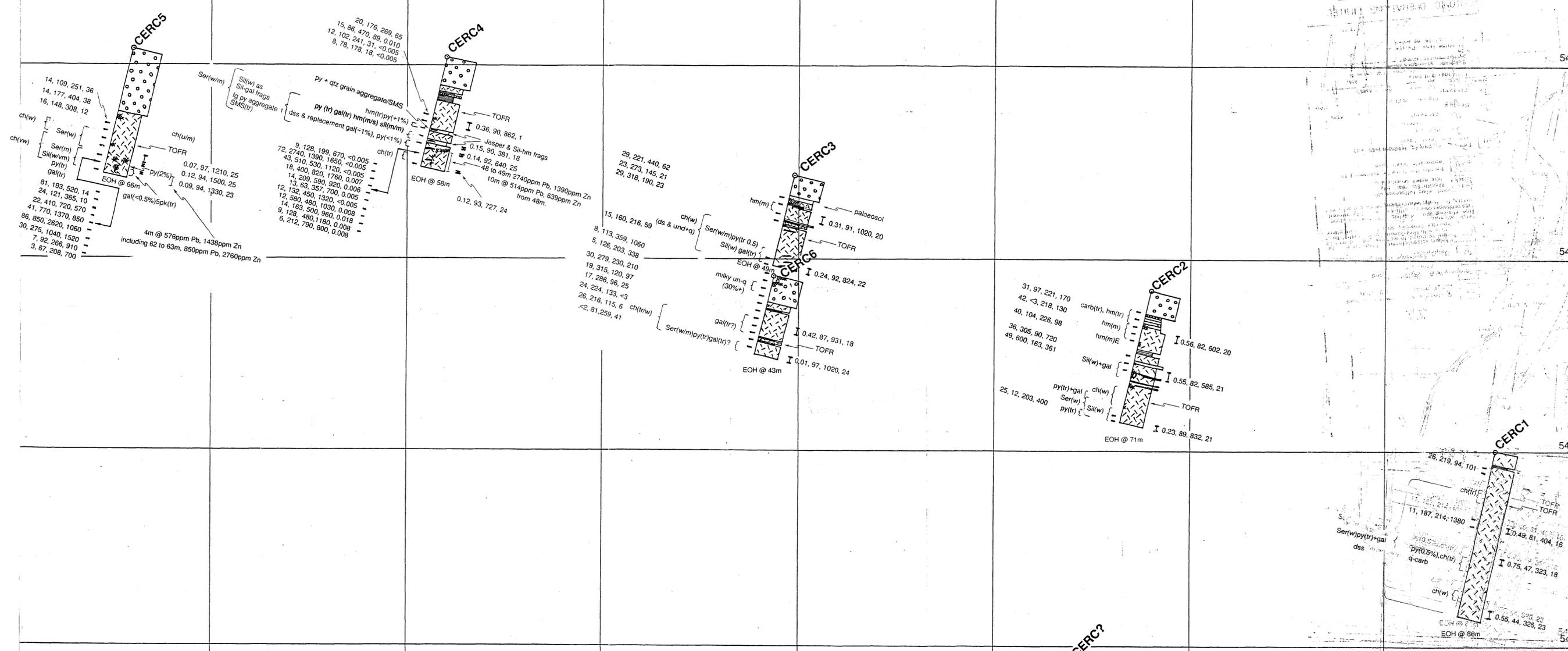
5407700mN

5407650mN

5407600mN

5407550mN

5407500mN



(Where Pb and/or Zn are > 200ppm)

Cu, Pb, Zn, Mn, Au (ppm) (4m Composite)

stringer? - sulphide - qtz(Sil) + ch veinlets

Devonian ? quartz veining (>10% only shown)

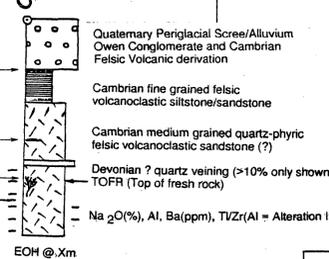
TOFR (Top of fresh rock)

Cu, Pb, Zn, Mn, Au (ppm) (1m Composite)

Na₂O(%) , Al, Ba(ppm), Tl/Zr(Al) = Alteration Index =

$\frac{MgO + CaO}{MgO + CaO + Na_2O + K_2O} \times 100$

EOH @ Xm



5 cm

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| | | |
|----------------------|--|-------------------|
| REVISION | PLUTONIC OPERATIONS LIMITED | |
| Technical Report No. | PROJECT: GECETHANA EAST | |
| CHECKED BY: | RC Drill Collar Plan Geology and Geochemistry | |
| DATE: SEPT 1997 | REF: | DWG. NO.: Plate 4 |
| SCALE: 1 : 500 | | |