97-4092

ANNUAL REPORT - EL 52/94
KC MORRISON - COPPER MINES
OF TASMANIA

Copper Mines of Tasmania Pty Ltd

EL 52 / 94 Linda Annual Report

Year 3 (13/01/97 - 13/01/98)

EL52/94

See fol 04

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Report No. T1997 - 054

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Chief Geologist
CMT Pty Ltd

Date December 10, 1997

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97-4092

ANNUAL REPORT - EL 52/94
KC MORRISON - COPPER MINES
OF TASMANIA

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SUMMARY

A regional scale study of the combined gravity and aeromagnetics signatures around major faults identified several fault zones in EL 52/94 which have similar gravity gradient character to structures closely associated with Mount Lyell deposits. Prospect generation mapping and sampling will be carried out in these areas for the next two years.

A preliminary metallurgy and mine economics study on the King Lyell copper clays deposit concluded that a mining rate of 750,000 tonnes per year for 10 years would return a positive NPV and produce a native copper / copper oxide concentrate by gravity separation methods, which could be blended with the existing sulphide concentrate. This mining rate equates to a resource base of at least 6 times the current King Lyell inferred resource of 1.2 million tonnes @ 1.4% copper. No further work on copper clays is planned for Year 4.

Ground magnetics and soil geochemistry on the Burbury Volcanics grid identified a magnetically high area of anomalous gold, zinc and lead. Mapping, sampling and geophysics, leading to drill target definition, are continuing.

TENEMENT INFORMATION

EL 52/94 Linda (Figure 1) is a 37 km^2 tenement resulting from the amalgamation of the original EL 52/94 (a 34 km^2 tenement awarded to Copper Mines of Tasmania Pty Ltd (CMT) as the successful tenderer for ETA 364) and ELA 5/95 (a 3 km^2 EL Application over the former Exempt Area between the Mineral Lease 1 M/95 and the original EL 52/94).

It extends from the eastern edge of the Mount Lyell Mineral Lease to Lake Burbury in the King River Valley and covers the Sedgwick (Comstock) and Chamounix (Linda) valleys, most of Mt, Lyell and the central and eastern portions of Mt. Owen. The Lyell Highway runs east-west through the middle of the EL, including the townsites of Gormanston and Linda.

Competitor companies and CMT hold adjoining tenements to the north, west and south, reflecting the position of the Mount Read Volcanics. Exclusions from within EL 52/94 total 6.06 km^2 comprising; 1 km^2 of Crown Reserves associated with the Gormanston and Linda townsites, 5 km^2 Hydro Electric Commission land, including part of Lake Burbury, and 6 hectares of Mining Leases consisting of 2 W/88 (Wiggins and Batchelor Pty Ltd - 4 ha) and 47 M/73 (P., K. and B. Smith - 2 ha).

EL 52/94 is held 100% by CMT and is currently in Licence Year 3, which expires on 13 January 1998. This report describes exploration completed up until 13 December 1997.

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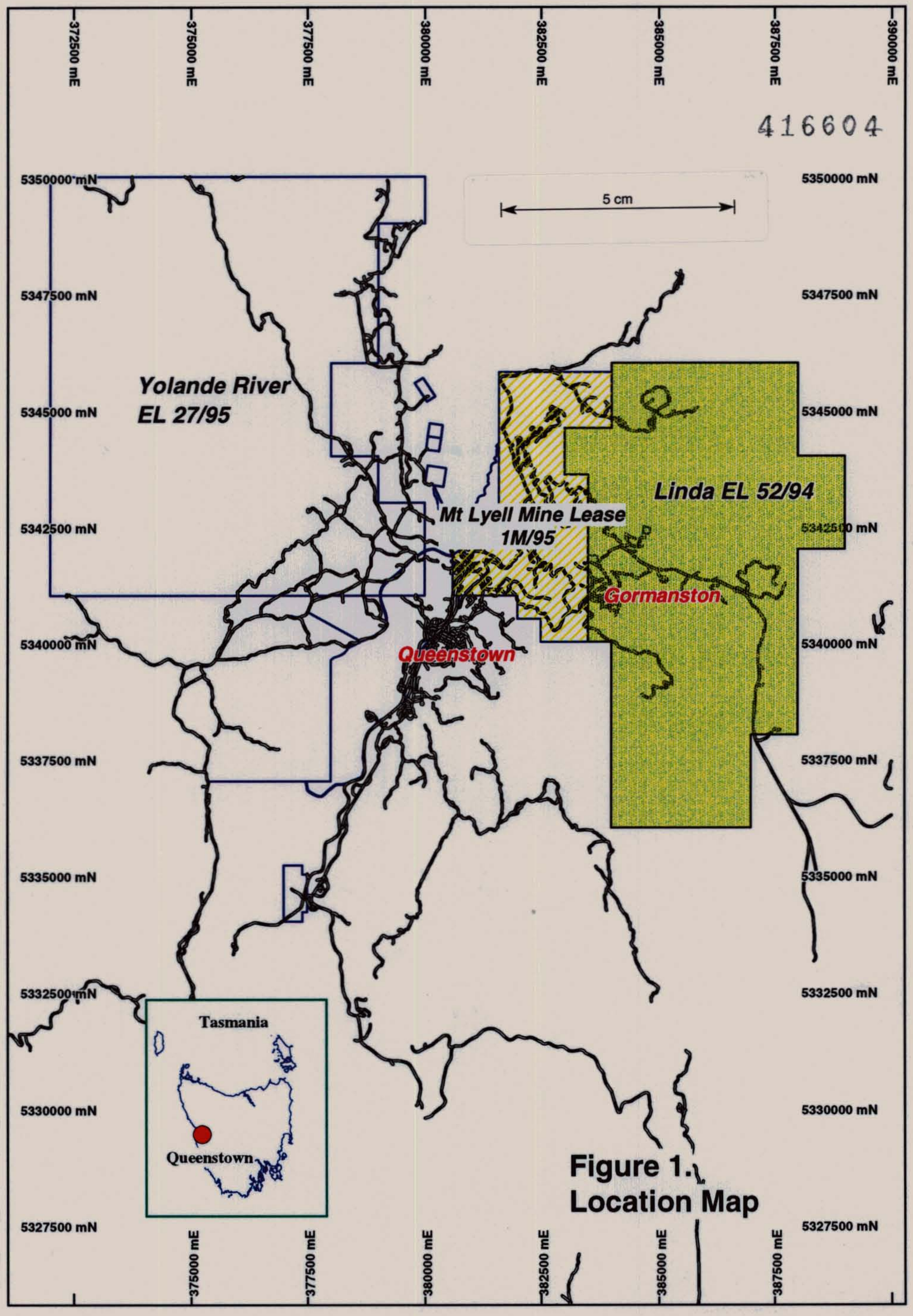

Figure 1.
Location Map

REVIEW OF PREVIOUS EXPLORATION

a) Pre EL 52/94 Exploration

Despite its location and geology, surprisingly little modern exploration has occurred since the 1883 - circa 1910 period of active prospecting and small scale alluvial gold and native copper mining in the western Linda Valley (Blainey, 1967).

The history of early prospecting and modern company exploration is compiled in detail in the Year 1 Annual Report (Morrison, Wills and Cordery, 1995) and the following summary reviews the main activities relevant to the current CMT exploration strategy.

1966 - 67	Placer Exploration Ltd	SPL-6	Gridding, S.P., Soil geochem - Linda Valley
1966 - 84	Mt Lyell Mining and Railway Co. Ltd	Els 9/66, 10/69,& leases	Gridding, I.P., S.P., EM - Comstock Valley Drilling : King Lyell (Copper Clays), Gormanston (conceptual G.L.Fault), Comstock Valley (IP anomaly Gordon Limestone)
1984 - 87	Goldfields Exploration Pty Ltd	ATP Queenstown	Stream sediment, moss geochem - Linda Valley Drilling: Gormanston, (conceptual Great Lyell Fault), McDowells (North Lyell Fault - old gold workings
1985 - 88	CRA Exploration Pty Ltd	EL 5/85	Stream sediment geochem. Comstock Valley
1987 - 91	BHP Minerals Ltd	EL 102/87	Gridding, EM - Comstock Valley Drilling - Comstock Valley (EM anomaly, Gordon Limestone, Relogging MLMRC Comstock, McDowells drill core Stream Sediment geochemistry - Comstock, Linda Valleys
1988 - 93	Aberfoyle Resources Ltd	EL 5/85	Reconnaissance Mapping - East Mt Lyell

A total of six grids are partly or entirely located on ground now covered by EL 52/94. Records of 34 drill holes within the EL have been located. Twenty nine of these were targetting either copper clays or prognosed sub Owen Conglomerate volcanics, drilled within mining leases of the time by MLMRC. Four holes were drilled on electrical geophysical targets in Gordon Limestone underlying the Comstock Valley and one hole was drilled under McDowells gold workings, against the North Lyell Fault in the Linda Valley.

b) *CMT EL 52/94 Year 1 Exploration*

A helimagnetics survey was flown over both the mine lease and the exploration licence. Survey design consisted of 100 metre spaced east-west lines and 1000 metres north-south tie lines. Sensor height was maintained at 20 - 30 metres and the sampling interval was 3 - 4 metres.

A comprehensive literature study of the known copper clays deposits (King Lyell, Lyell Consols and Lyell Blocks) by K.J. Wills (Wills, 1995) was completed. The deposits are hosted in heavily weathered and altered Gordon Group rocks preserved in east plunging tight synclines.

A program of mapping, rock chip sampling and orientation stream sediment geochemistry was conducted within the Linda Valley. This detected minor Gordon Group-hosted zinc-lead mineralisation outcropping in Cemetery Creek and a gold, arsenic, manganese stream sediment anomaly at a position where the North Lyell Fault cuts Tyndall Group porpyhyritic volcanics on the southeastren flank of Mount Lyell.

These findings, in conjunction with the literature review, lead to the definition of four informally named prospect scale exploration programs (Figure 2).

1. Chamounix Zinc
2. Burbury Volcanics
3. King Lyell Copper Clays
4. North Lyell Fault Zone

c) Year 2 Exploration

Mapping and rock chip sampling on the Chamounix Zinc and King Lyell Copper Clays prospects generated targets for 5 shallow percussion drill holes in Gordon Group clays, shale, sandstone and limestone.

The best intersections were 12 metres (downhole) @ 2.4% and 8 metres (downhole) @ 3.5% Cu, on Chamounix Zinc and King Lyell respectively.

On the Burbury Volcanics prospect, low grade gold, copper and lead mineralisation was detected in outcropping silica-hematite-pyrite altered Tyndall Group volcaniclastics and several gold and base metal anomalies were produced from a stream sediment survey (Morrison, 1996).

EXPLORATION RESULTS - LICENCE YEAR 3

a) Expenditure

Expenditure on EL 52/94 for the 12 month period, December 1996 to November 1997, totalled $56,903.

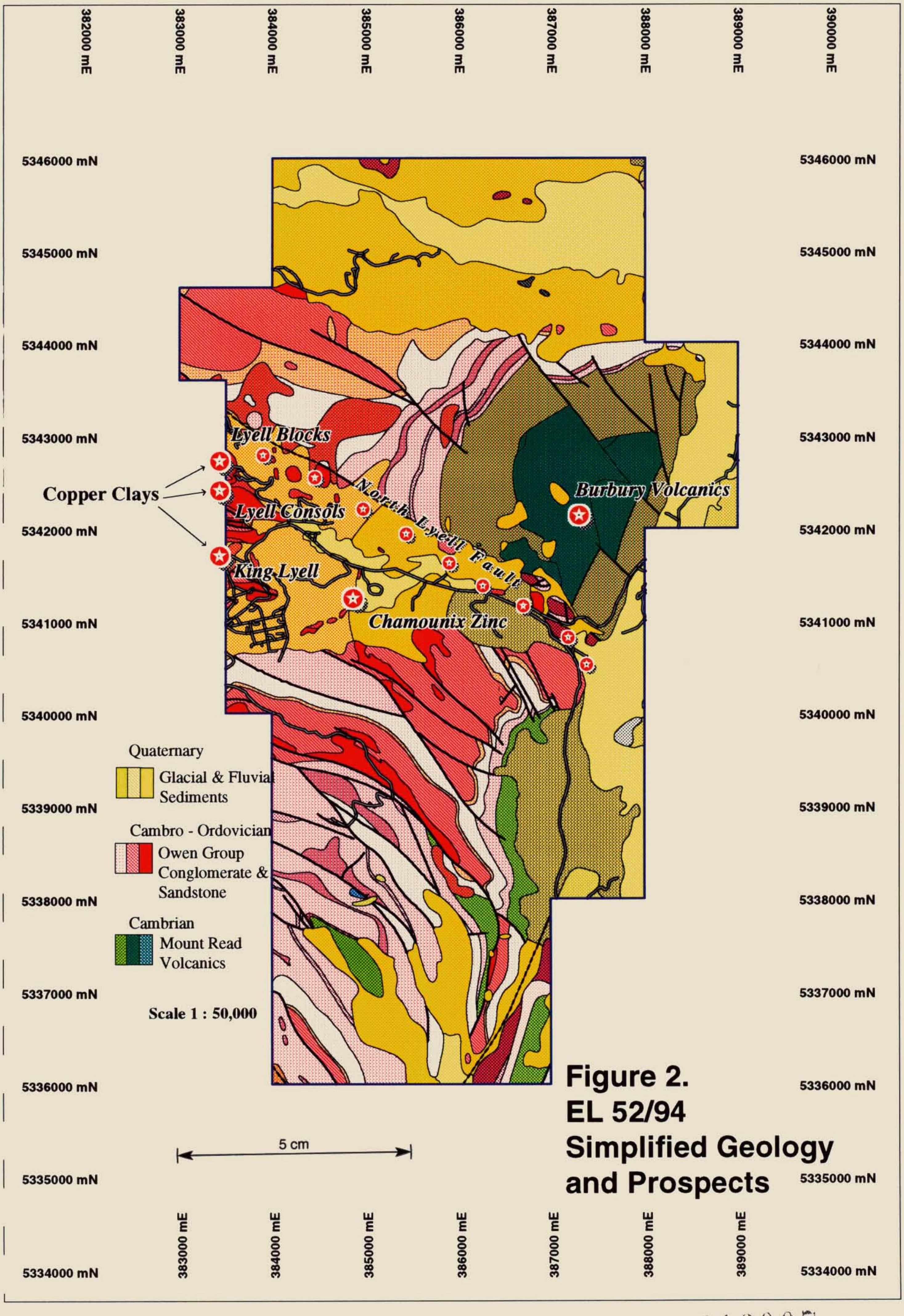

Figure 2.
EL 52/94
Simplified Geology and Prospects

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b) Regional Exploration

An aeromagnetics and gravity study of both EL 52/94 and 1M/95 by ERA Maptec was completed in July 1997.

The part of their report dealing with EL 52/94 is attached as Appendix 1.

Two major conclusions result from the study.

- Gravity data shows more direct association with mineralisation than does magnetics. Several deposits in the Mount Lyell field lie on or close to significant gravity gradients and the pyritic alteration envelope creates a gravity high. In contrast, the mineralisation has no distinctive magnetic signature but zones of fuzzy depressed magnetisation are attributed to alteration.

- Within EL 52/94, areas of intersection between gravity gradients and fault zones identified from aeromagnetic data were recognized and named; the King River Fault Zone, the North Lyell Fault Zone, the Comstock Valley Fault Zone, the Owen Spur Fault Zone and McDowells Fault Zone (see Appendix 1). By analogy with the effects by structure and alteration on the combined gravity-magnetic signatures around the Mount Lyell deposits, these fault zones are rated as potentially prospective and a phase of ground truthing and structural mapping is recommended.

c) Prospect exploration

King Lyell Copper Clays

i) Mapping - Previous mapping was upgraded with the recognition of a small wedge of Lyell Schist in an erosion gully west of the King Lyell workings (Plan 1). At this location the Lyell Schist appears to be in fault contact with Pioneer Beds on the western contact and to be stratigraphically overlain by Pioneer Beds grading upwards into Gordon Group lutites, including the ferruginous copper clays host lithology, on the eastern contact.

ii) Resource Estimate - An inferred resource was estimated by Datamine modelling of wireframed cross-sections and a longitudinal section, comprising projected unvalidated historical drilling, in addition to the 1996 CMT drill hole data (Appendix 2). A conceptual pit was modelled over the calculated volume and a total in-pit resource of 1.2 million tonnes at 1.37% copper was estimated with a stripping ratio of 2.3:1. Mineralisation is open in the down plunge direction, towards the southeast. Because of the steep plunge on the tight syncline containing the King Lyell deposit, overburden thickness increases alarmingly, and from the limited drill hole data available, there is evidence that copper grade also decreases towards the southeast, or distal from the primary copper sulphide source. The western half of the deposit contains 0.6 million tonnes @ 2.01% copper and a stripping ratio of 1.3:1.

iii) Metallurgy - Preliminary metallurgical work (Appendix 2) confirmed the mineralogy to be predominantly metastable native copper and cuprite. Copper minerals were predominantly in the +38 micron size range and therefore would probably yield a +70% recovery by desliming and gravity separation methods. Some experimental leaching work was also carried out using mine drainage sulphuric acid and ammonia carbonate leachates and although recoveries of >90% copper appear technically possible, it is doubtful that the total copper clay resource base is large enough to justify a leaching plant.

iv) Preliminary Mine Economics - A review of the resource potential and options for mining and processing was conducted by CMT Senior Mining Engineer Tony Weston in August 1997. A summary of the in-house report is enclosed in Appendix 2. The study assumed that the ore would be free digging and that open pit mining to a depth of 100 metres would feed ore to a grinding and jigs + spiral gravity separation circuit. The resultant concentrate would be blended with the current chalcopyrite concentrate, with a net increase in concentrate grade. On the basis of a $US 2204/tonne copper price, a mining rate of 750,000 tonnes of ore per year, for 10 years, is necessary to achieve a $10 million Net Present Value. If the King Lyell stripping ratio is representative for all Mount Lyell copper clays, then an additional 2.6 million tonnes/year of waste rock would be mined and stockpiled. When translated to exploration strategy, the results of the preliminary metallurgy and mining studies to date demonstrate that a resource base of at least 6 times the current King Lyell inferred resource is necessary.

In view of the current copper price and the strategic emphasis on finding additional hard rock copper sulphide/gold resources, no further work is recommended for the copper clays project in Licence Year 4.

Burbury Volcanics Prospect

An 11 line km grid was cut and pegged at 20 metre, slope corrected, intervals over the prospect area. At the time of writing, ground magnetics and soil geochemistry surveys have been completed and mapping and petrology are underway. Minor extensions to the northern end of the grid are also being cut.

The magnetics (Plan 2) clearly show the fault block of Zig Zag Hill Formation conglomerates, with detrital magnetite visible in hand specimens, along the eastern edge of the gridded area. NW-SE trending zones of magnetically high data, west of the grid base line, may be showing a fold structure but more field mapping is required to confirm the stratigraphy, structure and degree of scree cover. A prominent dipole point anomaly occurs on the base line, at approximately 20,440 North. This position coincides with outcropping silica/pyrite alteration from which chip samples grading up to 0.5% combined base metal + 0.6 g/t gold have been obtained. This feature appears to sit on the southeastern end of the NW trending linear magnetic high.

Substantial character exists in the gold, lead and zinc soil data (Plans 3, 4 and 5) but not for copper and arsenic (Appendix 3).

Gold soil geochemistry (Plan 3) shows a strong anomalous zone trending north-south, to the east of and downslope from the base line. The fault block of Zig Zag Hill Formation conglomerate also shows as a gold high along the eastern edge of the grid and the sinuous belt of intermediate gold values connecting the two areas of high gold appears to follow the stratigraphic contact at the base of the Tyndall Group. A lobe of low gold values enclosed by highs, east of the base line, corresponds to quartz porphyries and quartz sericite schists mapped regionally by the Geological Survey as Eastern Quartz Phyric Sequence.

Plan 4 shows a single strong lead anomaly restricted to a small area centred near 20,760 N on the base line. Zinc produced two strong anomalous highs within a cuspate broad high in the central part of the grid (Plan 5). Both the lead and zinc data require further field checking to explain.

In general there appears to be an area of anomalous gold, lead and zinc in the centre of the prospect, stratigraphically near the base of the Tyndall Group and in an area where outcropping alteration has been discovered. The magnetics and zinc soil data suggest that the grid should be extended to the north.

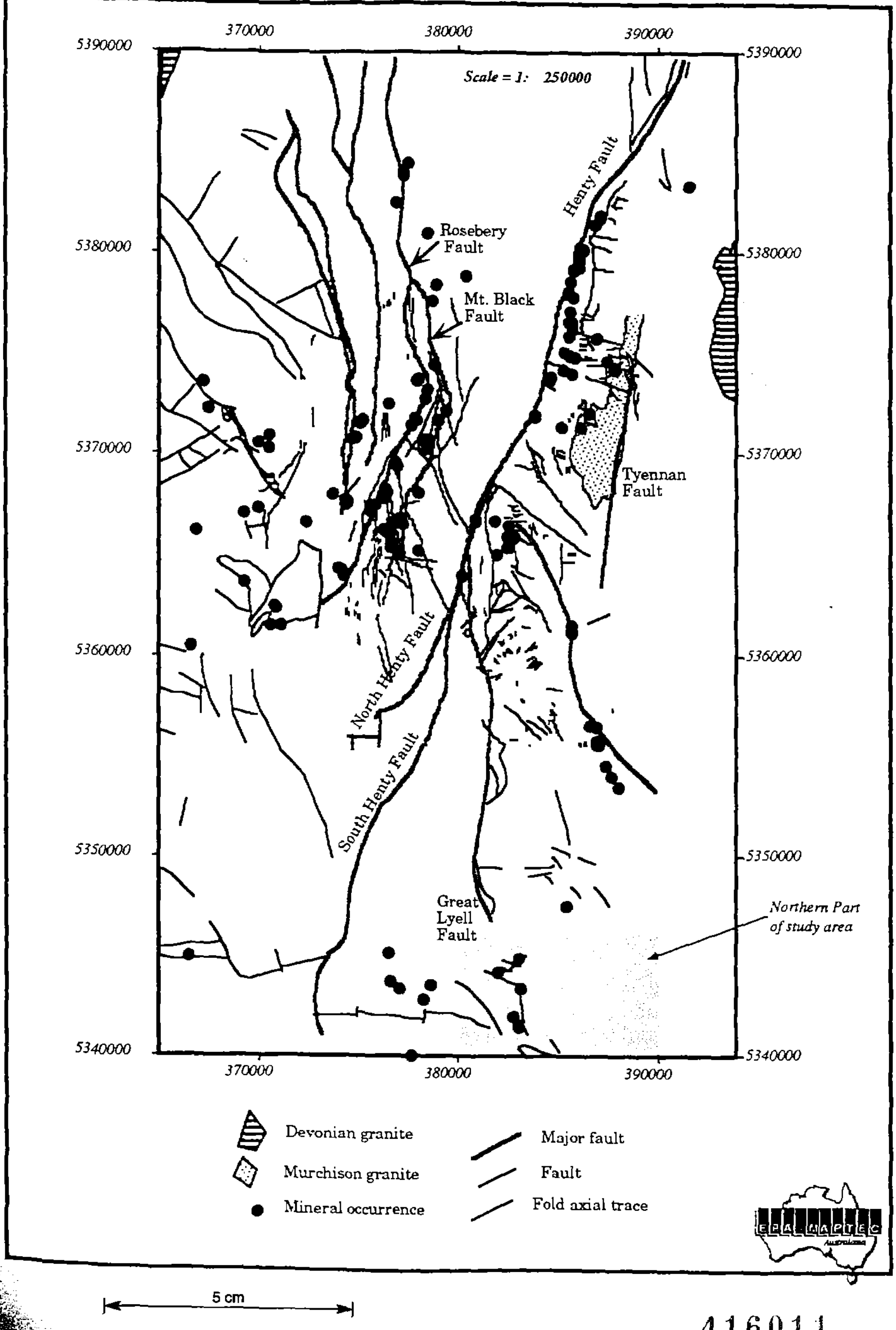
YEAR 4 WORK PROGRAM

Regional scale exploration will follow up the structural zones indicated by the ERA-Maptec gravity-magnetics study. Reconnaissance mapping and sampling of these areas will have the dual aims of generating new prospects and delineating less prospective ground for the compulsory 50% relinquishment of EL 52/94 at the end of Year 5 (13/1/2000).

Prospect scale exploration will focus on the Burbury Volcanics target, with a program of mapping, infill stream sediment and soil geochemistry, grid-based CSAMT and drilling of the best multi-source anomalies.

Volcanic-hosted copper sulphide + gold with metallurgical compatibility with Prince Lyell ore, will be the target of all prospect generation work in Year 4

Figure No. 3 Major Faults and mineral occurrences in the Mount Read Volcanics



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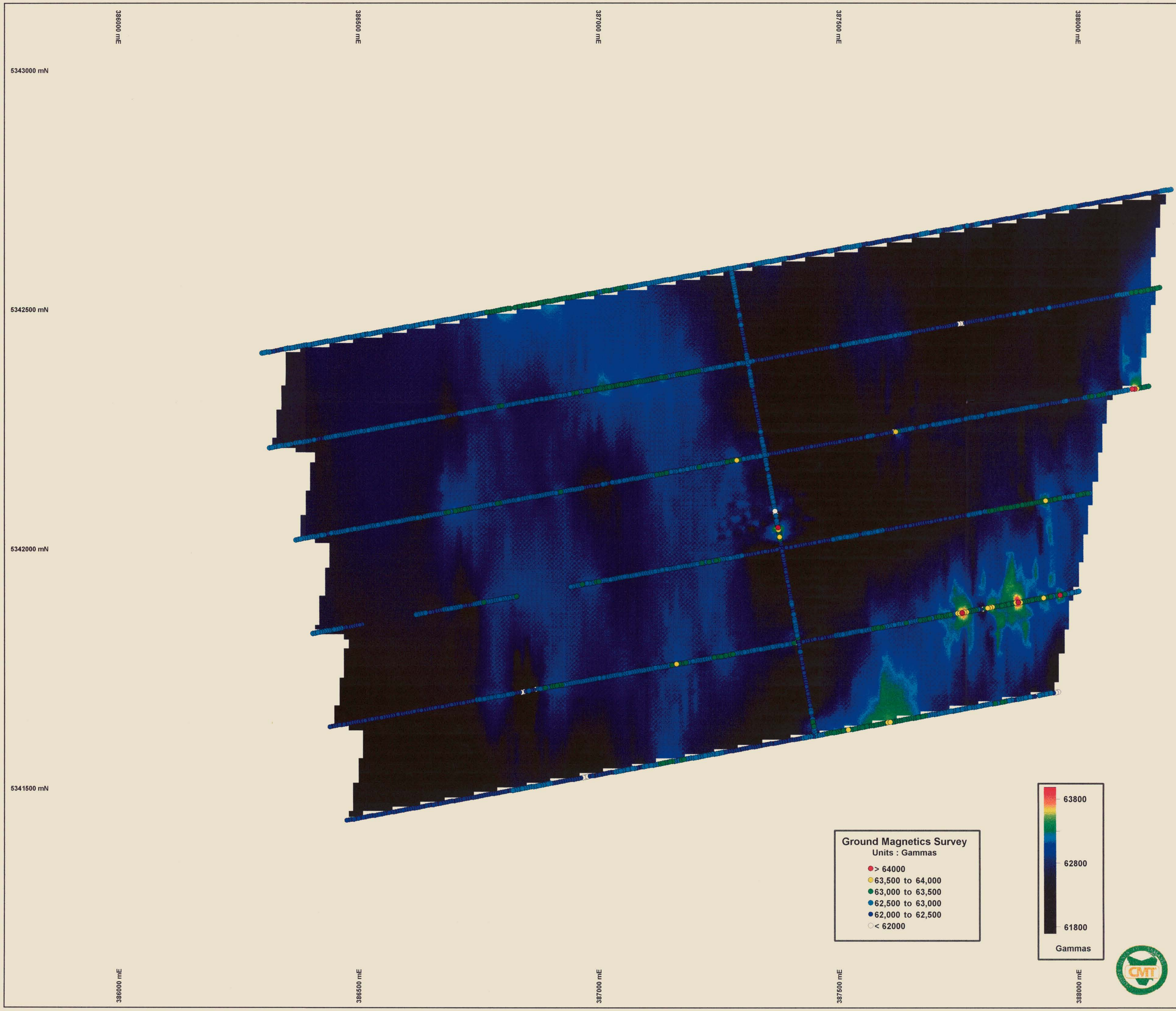

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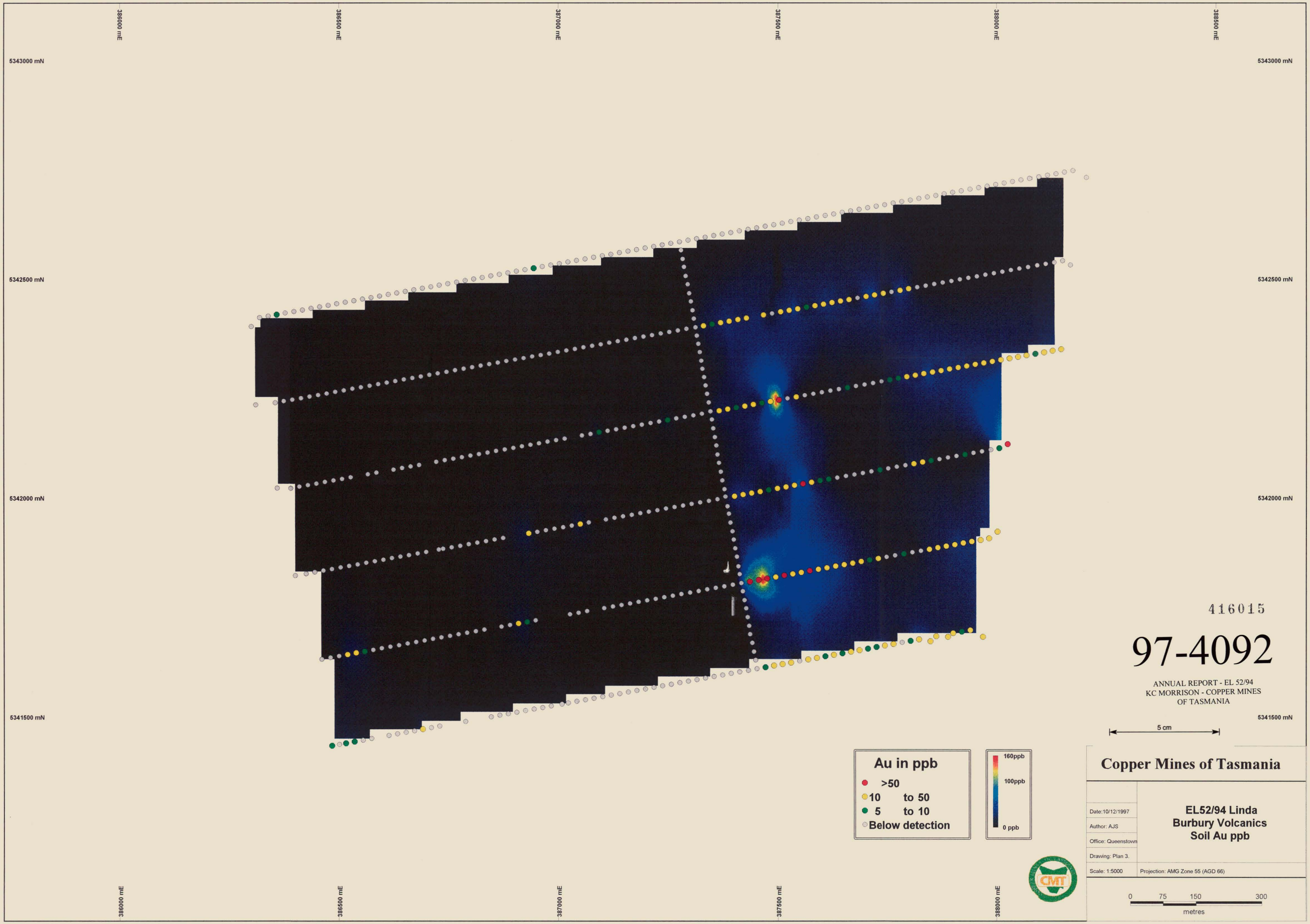
Copper Mines of Tasmania

EL 52/94 Linda
Burbury Volcanics
Ground Magnetics

Date:11/12/1997
Author: KM/AJS
Office: Queenstown
Drawing: Plan 2.
Scale: 1:5000
Projection: AMG Zone 55 (AGD 66)

0 75 150 300
metres

5 cm



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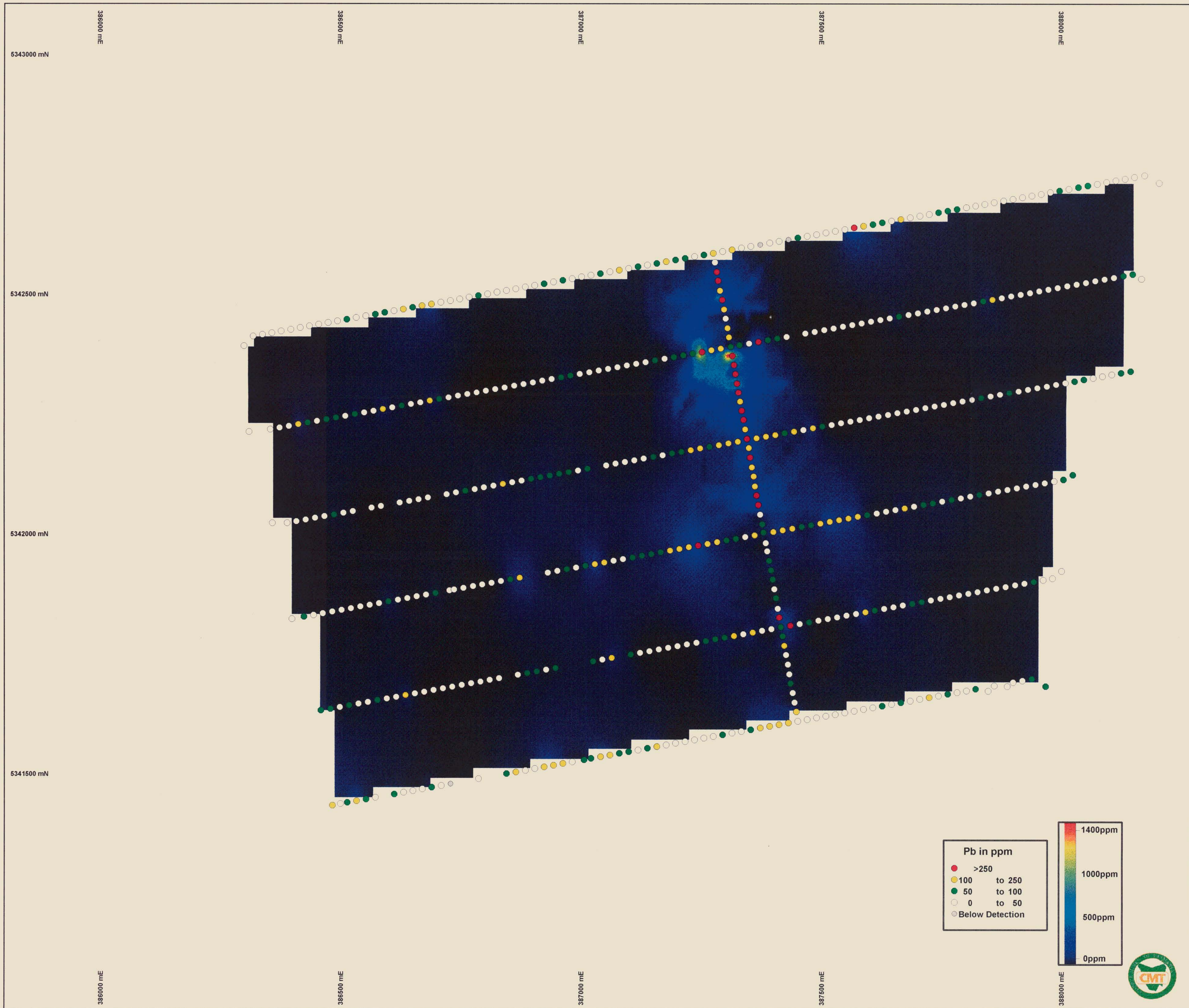
Copper Mines of Tasmania

EL52/94 Linda
Burbury Volcanics
Soil Au ppb

Date: 10/12/1997
Author: AJS
Office: Queenstown
Drawing: Plan 3.
Scale: 1:5000
Projection: AMG Zone 55 (AGD 66)



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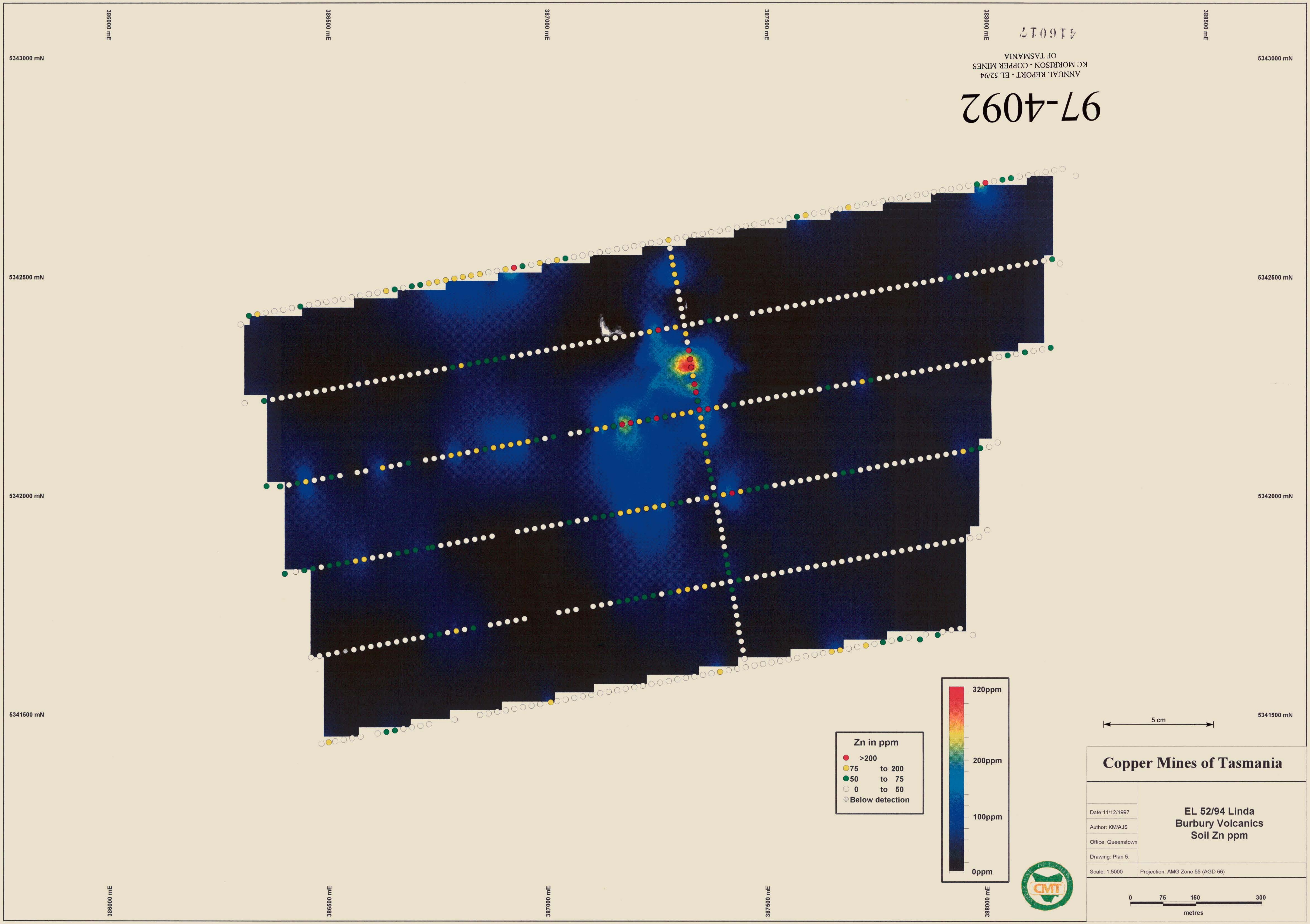
5 cm

Copper Mines of Tasmania

Date:11/12/1997	EL52/94 Linda Burbury Volcanics Soil Pb ppm
Author: KM/AJS	
Office: Queenstown	
Drawing: Plan 4.	
Scale: 1:5000	Projection: AMG Zone 55 (AGD 66)

0 75 150 300
metres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386000 mE
386500 mE
387000 mE
387500 mE
388000 mE
388500 mE
5343000 mN
5342500 mN
5342000 mN
5341500 mN
Zn in ppm
>200
75 to 200
50 to 75
0 to 50
Below detection
320ppm
200ppm
100ppm
0ppm
5 cm
Copper Mines of Tasmania
Date:11/12/1997
Author: KM/AJS
Office: Queenstown
Drawing: Plan 5.
Scale: 1:5000
EL 52/94 Linda
Burbury Volcanics
Soil Zn ppm
Projection: AMG Zone 55 (AGD 66)
0
75
150
300
metres
CMT

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APPENDIX 1

AEROMAGNETICS AND GRAVITY REPORT

97-4092A

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416019

Interpretation of Aeromagnetic and Gravity Data sets in EL 52/94 and ML 1M/95 Queenstown Tasmania

Final report

Prepared for:
Copper Mines of Tasmania

by

ERA-MAPTEC
Australasia

July 1997

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correlation between signatures and mapped geology. Many of these features are discordant to the geology and the signatures have not been constrained or limited by the known geology. The affiliation of many of them is unclear and will require investigation in the field to ascertain if they are geologically controlled. The following comments are made with regard to the interpretation:

- The intensity variations in the first vertical derivative could be related to:
  - Secondary weathering process
  - Fault controlled alteration zones. These may be in brittle fault zones that do not appear to be geologically significant in that they do not off-set geology but could be significant fracture zones and fluid pathways.
  - Quaternary cover and alluvium. This does not appear to be the case as the areas of Quaternary within the Linda survey area do not affect magnetic signatures.
  - Primary alteration of the sequence.
- Some areas of mineralisation do have an effect on the signatures but not one which is itself characteristic. This can be seen, for example, for the Prince Lyell which depresses the magnetic signature. This is most obvious where the background signature is high. This feature can be used as an exploration criteria, however, other mineralised areas do not appear to show this phenomena. It would be difficult to identify potential areas on this criteria alone.
- There is a change in broad magnetic intensity to the south of the Prince Lyell deposit suggesting a different basement type with a higher magnetic signature. The boundary between these zones appears to be ESE trending and can be traced into the Linda area. This may be a fundamental basement feature with exploration potential.
- It appears that there may also be a NW trending shear zone forming the northern margin of the Lyell Schist outcrop. Foliation, bedding trends and the Pyritic Schists rotate into this zone.
- Linear highs in the 1st VD with AGC which can be traced across a few flight lines (longer than 300m) have been included for field checking. Again these zones have no association with any mapped geological feature.
- The Agglomerate Hill Fault Zone appears to affect basement and as such has exploration potential as it is likely to have been present during deposition and the mineralising event. There is some suggestion that this zone contains a number of en echelon strands.

Linda El 52/94 Magnetic Interpretation

A similar suite of images have been produced for the Linda El as for the mine licence. Two interpretation maps have been produced from the image as there is too much information to combine in one map:

- Interpretation of the 1st vertical derivative image along with features from the maximum gradient image are shown in **Map 36** (and **Map 36b** combined with the interpretation from Ml 1M/95) and **Figure 24**.
- Interpretation of the 1st vertical derivative with automatic gain image are depicted in (**Map 37** and **Figure 25**).

Both of these maps contain the features interpreted from the RTP TMI image.

The raster images have been registered as tables in Mapinfo. The images have the following co-ordinates:

- SW corner 382875E, 5336025N
- SE corner 389175E, 5336025N
- NE corner 389175E, 5345975N
- NW corner 382875E, 5345975N

The images are 1592 pixels N-S by 1008 pixels E-W at 6.25m resolution.

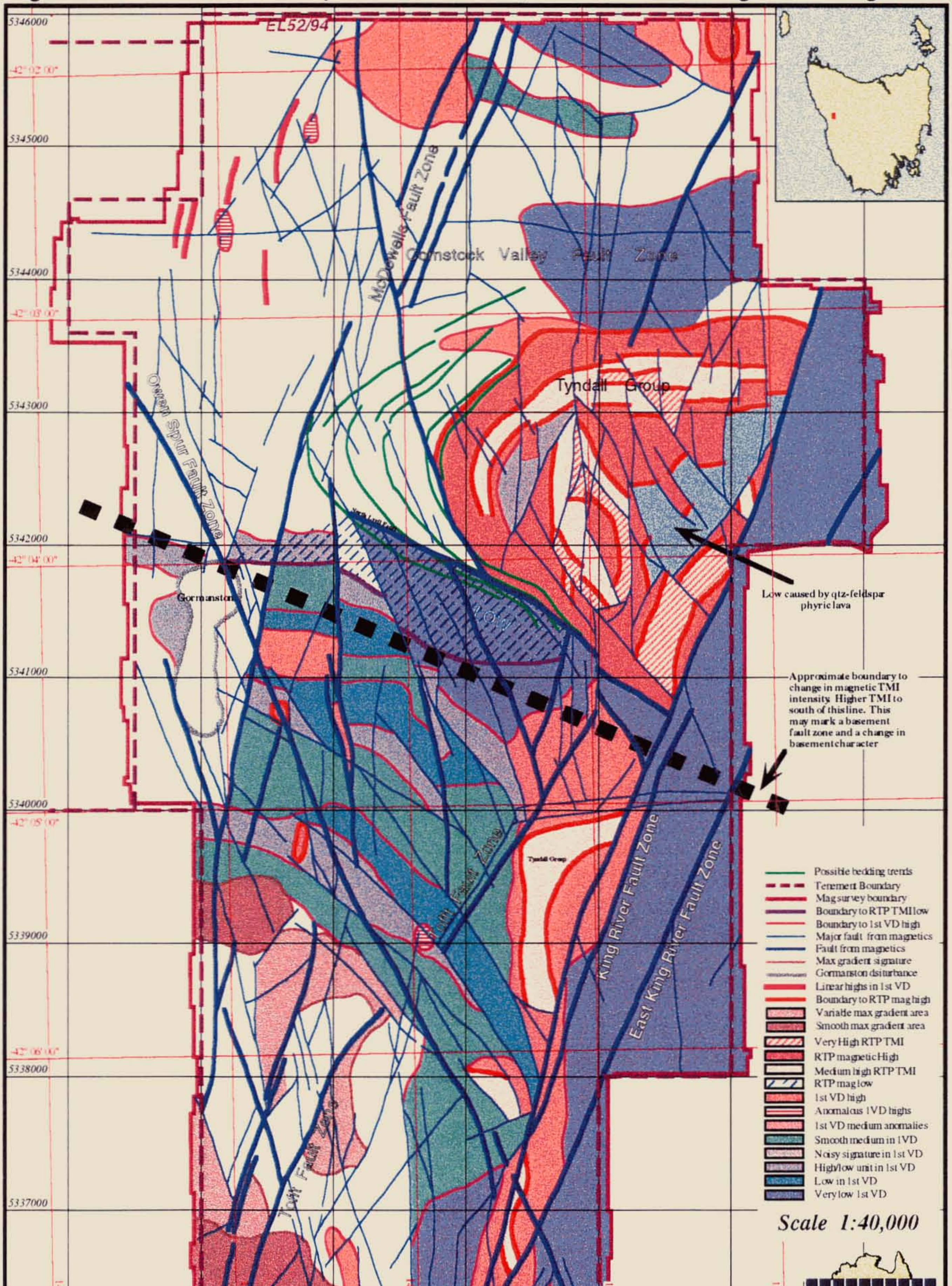
There is no topographic data coverage for this area but a geological overlay has been prepared at 1:10,000 scale to overlay the images (**Map 34**).

Reduced to pole Total Magnetic intensity (Map 21 & Figure 26)

This image has been enhanced with vertical shading which again enhances the original pixel boundaries in places. As with the survey over ML 1M/95 the distribution of the Tyndall Group has a strong influence on RTP-TMI highs.

- The extensive high area centred at 387000E, 5342500N is controlled by outcropping Tyndall Group rocks. There is a good correspondence between the upper outcrop boundary (Etc - volcaniclastic Cg + sandstone + minor mudstone and tuff) and a TMI value of 6270 nano-tesla (the bright yellow "contour" in the image). This correlation does not hold for the highs to the south of this large triangular shaped area.
- The low area within this triangular Tyndall Group high is created by a quartz- feldspar phyric lava and tuff (Etv). The interpreted area of this low is considerably different to the mapped extent of this lithology. It also seems to be affected by a number of faults.
- The highest signatures are generally coincident with part of unit Etc but there is not a 1:1 relationship with the mapped geology. The aeromagnetics suggest a different distribution of units.
- The central area of the high is coincident with unit Ett (crystal tuff with agglomerate + sandstone + siltstone + rare limestone). This has a variable signature and also contains some of the highest intensity anomalies.
- The Quartz-feldspar porphyry intrusions within the Tyndall Group outcrop area do not have a characteristic signature. They are coincident with medium high areas.
- The undifferentiated Tyndall Group outcrops in the southern half of the EL area are variably magnetic, as was the case for ML 1M/95. The anomalies do not match the mapped outcrops.

Figure No. 24 EL 52/94 - Interpretation of 1st VD, TMI and maximum gradient magnetics



5 cm

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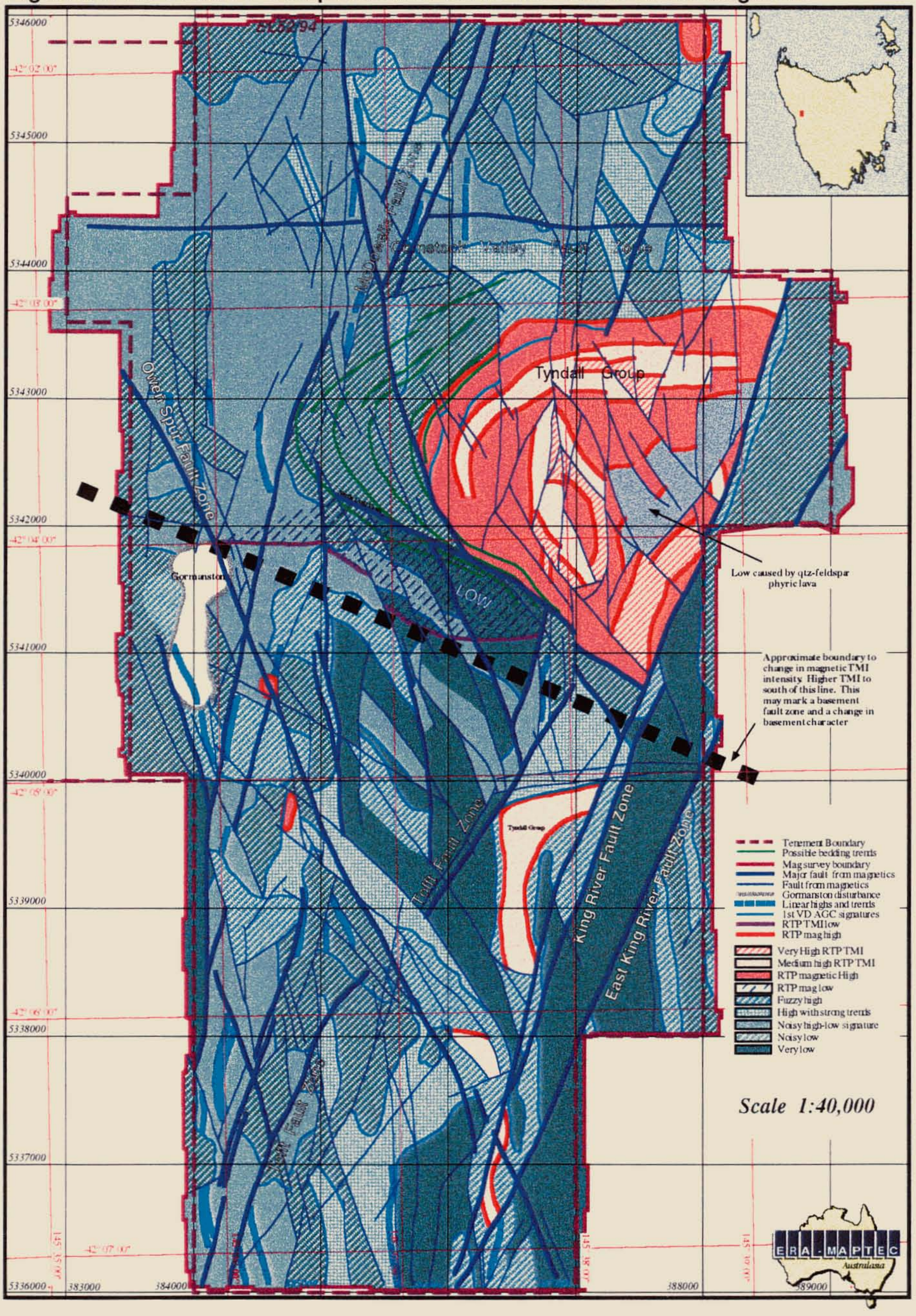
Figure No. 25 EL 52/94 - Interpretation of 1st VD with AGC and TMI magnetics



5 cm

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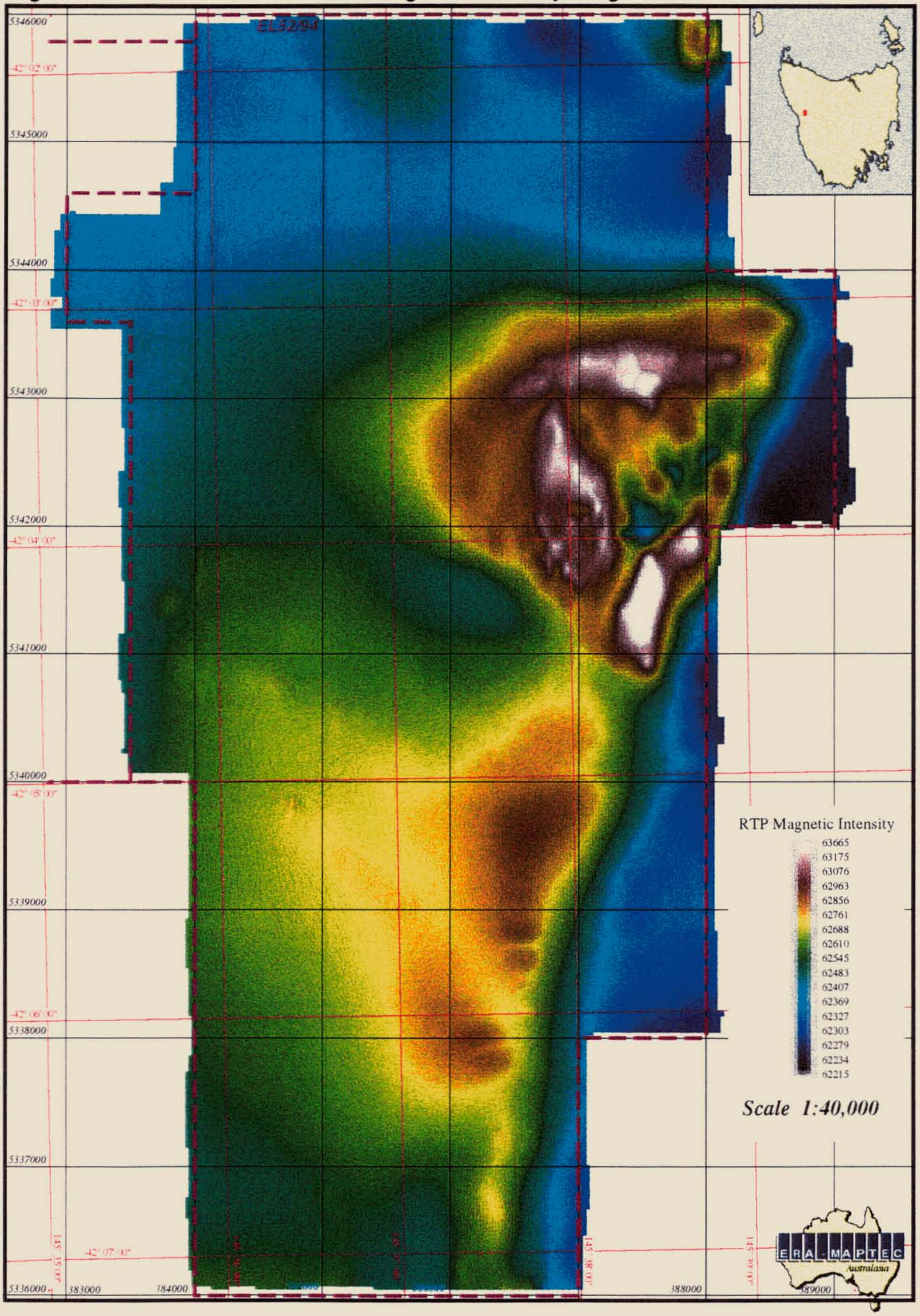
Figure No. 26 EL 52/94 - RTP total magnetic intensity image



5 cm

- The anomalies associated with Tyndall Group rocks in the south have much lower gradients which suggest gentler dips but the mapping does not show this to be the case.
- A WNW trending low is present immediately south of the North Lyell Fault which bounds the Tyndall Group outcrops in the north.
- There must be a major structure trending NNE through the King River valley sub parallel to the Tyennan Fault (see **Figure 3**). This structure terminates signatures associated with the Tyndall Group which are striking obliquely to it. Very low signatures are present to the east of the structure which are associated with the Siluro-Devonian Eldon Group. These rocks also create the E-W trending low in the north of the tenement area. This indicates that the Owen Conglomerate is missing in this area, possibly removed by an E-W trending structure.
- The isolated high in the extreme NE of the survey is also controlled by the Tyndall Group.
- The central area of the survey contains NW to WNW trending contours which is consistent with the fault and bedding strike orientation in that area. Lithologies Oop and Oous of the Owen Group seem to have some control on elevated intensities, especially Oop which is described in the Queenstown Geology Sheet as containing chromite-rich bands. The correlation is not complete though and there must be variation in the lithologies.

Shadowed RTP Image (Map 22 and Figure 27)

Only the colour composite shadowed image has been produced for the Linda survey. This combines E, NE and N shadow directions as red, green and blue respectively in the image. The following points were noted:

- Pronounced fringes are present around the western margin of the main Tyndall Group outcrop. Similar fringes were present around the Tyndall Group in the north of ML 1M/95. Again these could be coincident with lithological units as the contours are sub parallel to bedding strikes in the area.
- A dramatic change in signature is present across an E-W trending discontinuity at 5344300N. This is parallel to the flight line direction which suggests it is an artefact, but the discontinuity separates areas with very different magnetic grains. The discontinuity also makes geological sense as an E-W fault would account for the considerable thickness of Owen Conglomerate which must be missing in this vicinity.
- A number of smaller scale highs are enhanced in this data set but do not have any obvious geological or cultural association. The town of Gormanston creates some disturbance of the magnetic field.

First Vertical Derivative Image (Map 23 & 30 or 30b and Figure 28 & 29)

The interpretation of the first vertical derivative image is shown in **Map 36** and **Figure 24**. The following observations were made:

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Figure No. 27 EL 52/94 - Colour composite of TMI shadowed images

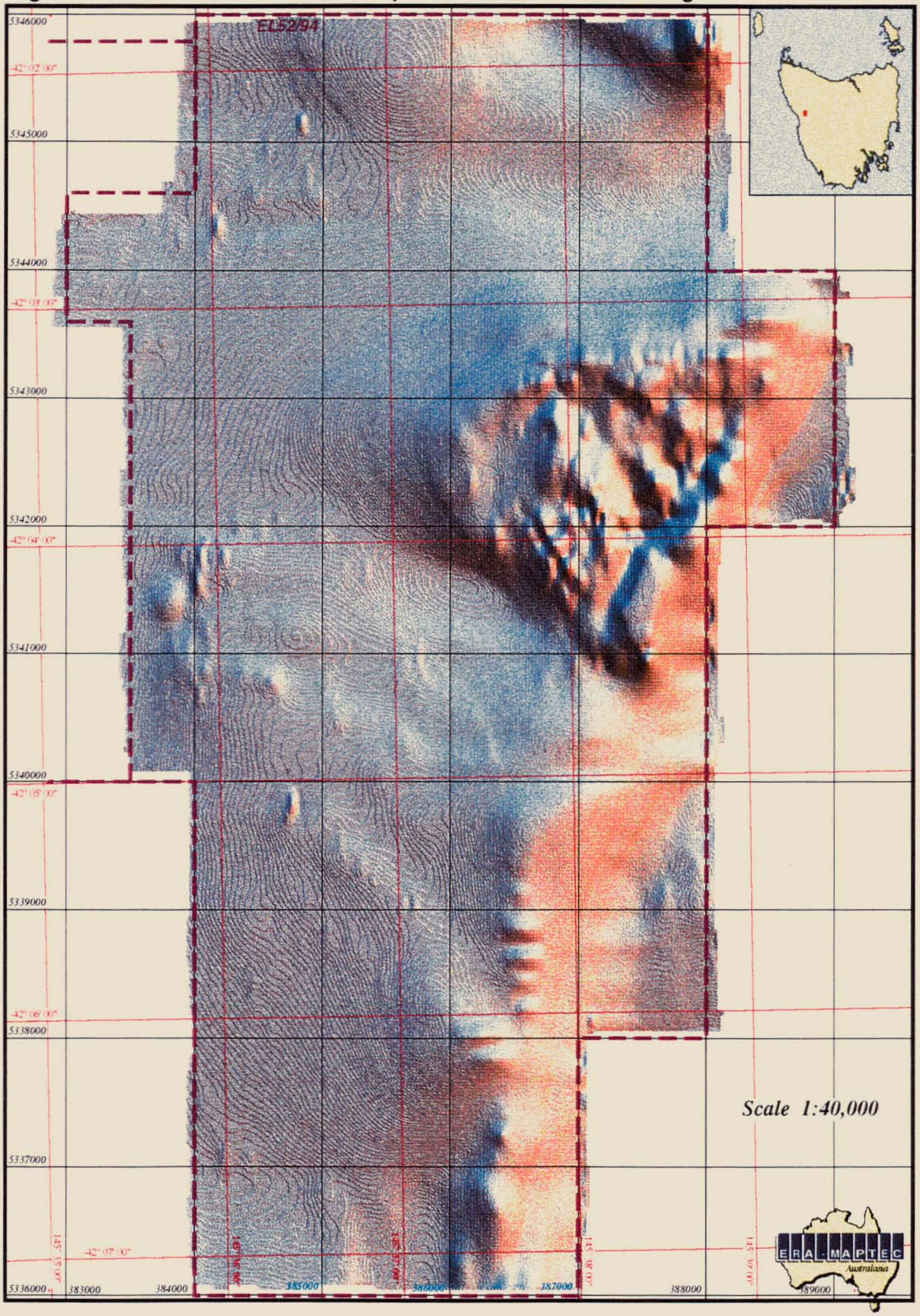

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Figure No. 28 EL 52/94 - Grey scale first vertical derivative image

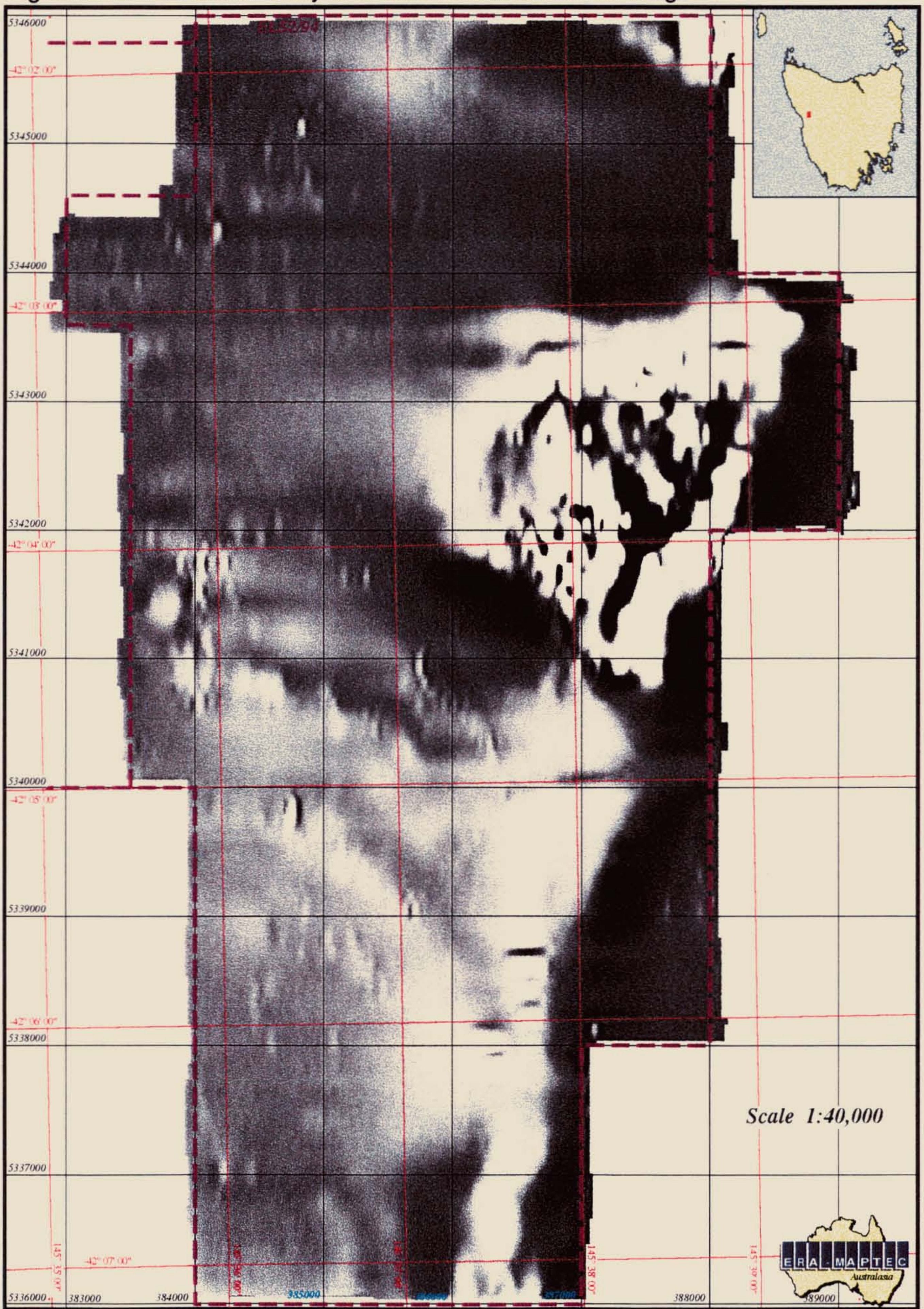

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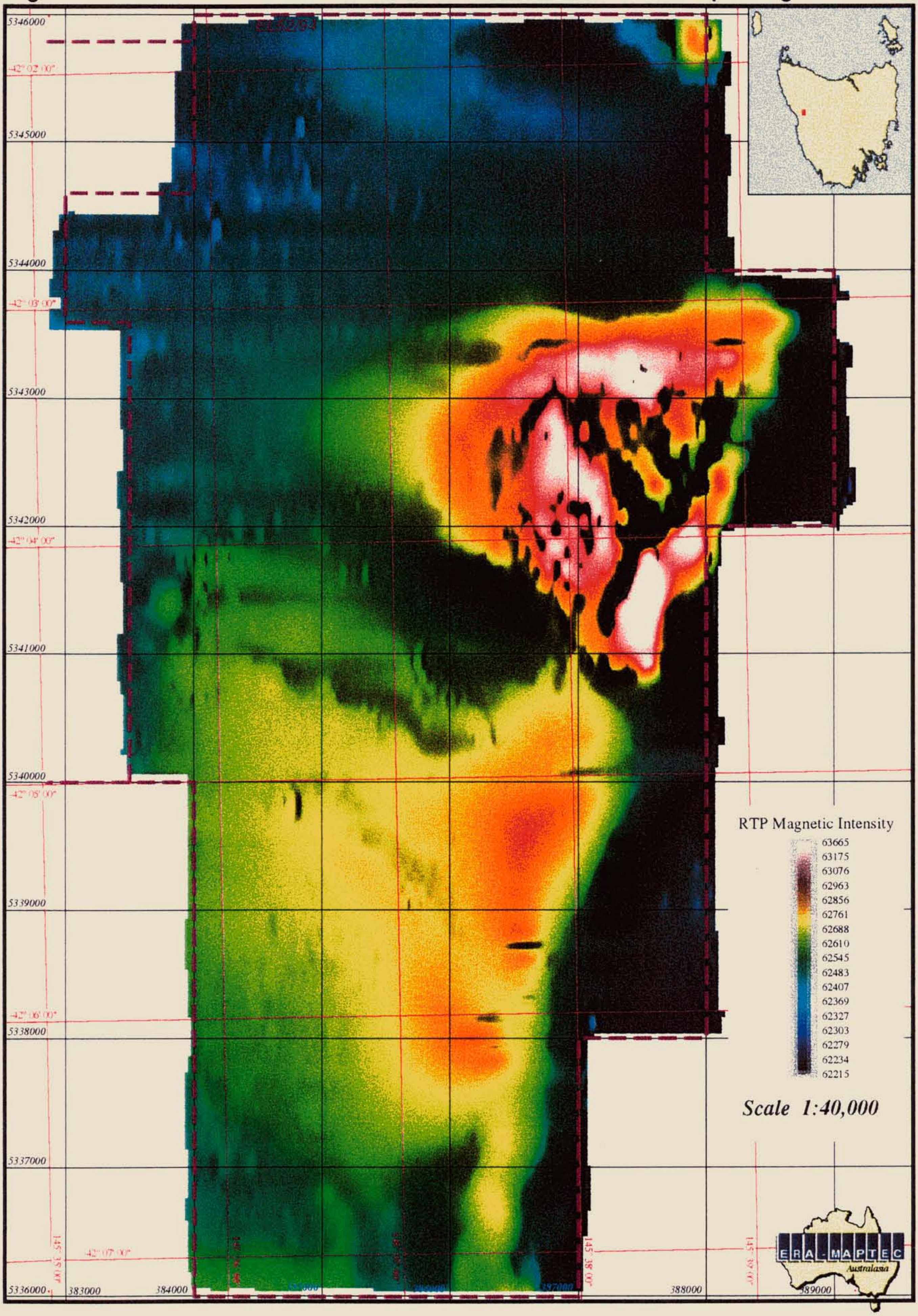
Figure No. 29 EL 52/94 - First vertical derivative with TMI colour drape image



5 cm

- The King River Structure is well defined with a very low signature to the east of it associated with the Eldon Group.
- The northern half of the survey has only been partly interpreted due to the lack of variation in the signatures. There is a change across a WNW trending line to a background of higher signatures. This can be traced into the Prince Lyell - Royal Tharsis area of ML 1M/95.
- Parts of lithologies Ous and Oop have higher noisier signatures and together with the Tyndall Group form the higher intensity areas in the southern half of the survey.
- The main mass of Tyndall Group rocks have not been interpreted further from this image as they are best interpreted from the total field image.
- The disturbance associated with the town of Gormanston is best seen in this image.
- Some isolated high anomalies have been identified but have no obvious geological or cultural association and need to be investigated in the field.

The TMI draped, first vertical derivative images for EL 52/94 and ML 1M/95 have been combined in **Map 30b**

First Vertical Derivative with Automatic Gain (AGC) (Map 25 and Figure 30)

This image shows good variation in signatures in coherent blocks which must have some geological significance although their boundaries do not precisely match the mapped geology.

- Again high areas are controlled by the Tyndall Group and lithologies Oop and Ous. The Tyndall Group rocks in the south are generally associated with the smooth high signature whereas the highs with strong linear highs are partly controlled by Oop.
- The King River Structure is well defined and a second, sub parallel, extensive zone has been revealed around 500m to the east.
- Trends within the image do not reflect foliation or bedding directions but are dominated by N-S orientation suggesting a strong influence by the flight line direction.
- The mapped WNW trending faults generally have no expression in the image. This could indicate that these are lower angle structures than depicted in the cross-section on the Queenstown sheet. However, they are at a far from ideal angle to the flight lines to be readily detected.
- The signature described as "low and noisy" is similar to that associated with part of the Pyritic Lyell Schist (Lsp) of the mine licence. With an extensive area immediately to the west of the Tyndall Group and another at the southern margin of the survey.
- At first sight there appear to be problems with the levelling of the data in the northern portion of the image with E-W trending banding in some images and strong E-W discontinuities in this image. However, the strike of the Tyndall Group in this area is E-W and a major

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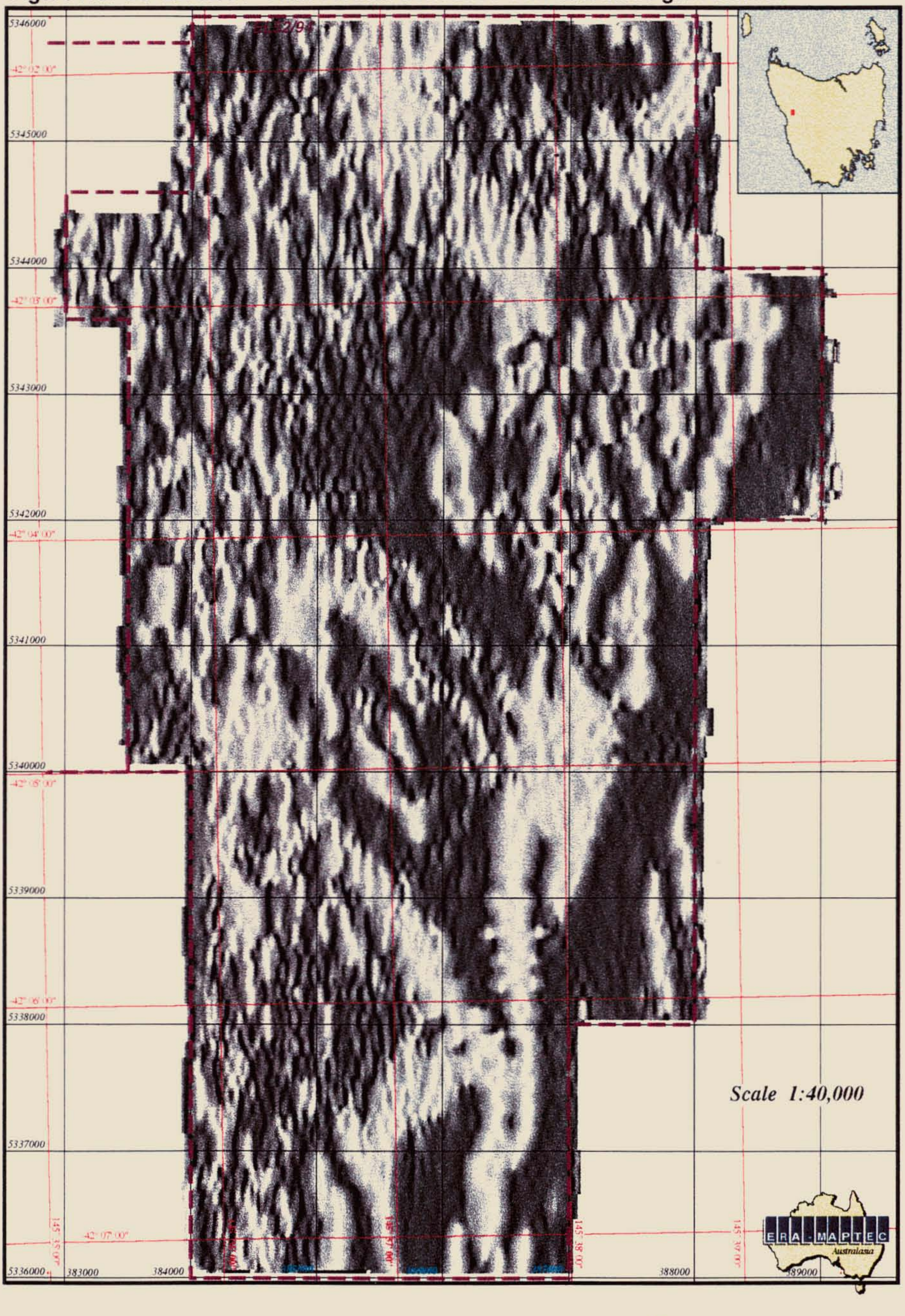
Figure No. 30 EL 52/94 - First vertical derivative with automatic gain control



structure (the Comstock Valley Fault Zone) is indicated in the geology. The flight lines are in a poor orientation to resolve these details. In addition the topography in this area has a strong E-W grain.

- The high areas in the north of the image trend at a high angle to surface geology strike and have no obvious geological association.
- The North Lyell Fault does not have a direct linear signature along its trace. However, there is a broad, low corridor around 200m wide coincident with the fault trace in the east of the area. There is a rapid change to high, noisy signatures to the south of this. The North Lyell Fault Zone appears to be much wider than specified on the geological map with a large proportion of it under Quaternary cover.
- The major NNE and NNW trending structures interpreted from the images are best seen in this data set (see **Map 37** and **Figure 25**).
    - **The Owen Spur Fault Zone** - trends NNW parallel to the Glen Lyell Fault and traverses the survey area. There is one mapped fault segment coincident with this zone and lithologies rotate clockwise into it. The outcrop pattern of Oop could also be easily modified to accommodate this zone.
    - **The Tofft Fault Zone** - trends NNE but is poorly represented in the geology although bedding strikes are sub parallel in places.
    - **The McDowell's Fault Zone** - passes through the McDowells deposit on the North Lyell Fault. It seems to be continuous across the fault even though the North Lyell Fault is clearly a significant feature. The zone contains extensive linear highs in the AGC image.
    - **The Comstock Valley Fault Zone** - trends E-W to the north of the Tyndall Group mass but is not easily seen in the AGC data. This fault zone is sub-parallel to the North Lyell Fault and passes into the NE corner of ML 1M/95 where it forms the northern margin of the Tyndall Group coincident with anomaly A12. The distribution of lithologies in the Queenstown geology sheet suggests there is significant movement on this structure. It probably links into the Great Lyell Fault and may transfer much of the shearing from it.

Shadowed First Vertical Derivative With AGC (Maps 26, 27, 28, 29 & 31, and Figures 31, 32, 33, 34 & 35)

These images have been shadowed from the SE, E, NE and N and are very difficult to interpret in isolation due to the overwhelming number of possible discontinuities and structures. They have not been considered in detail here for this reason as it would be pointless to record these features as faults as the resulting interpretation would be unusable. These images will prove useful if a prospective zone is identified from other sources and can then be traced using these shadowed images.

The colour composite image of shadow directions (**Map 31** and **Figure 35**) is easier to interpret but still contains too many unexplained discontinuities. The pattern of these features is not compatible with naturally occurring fault

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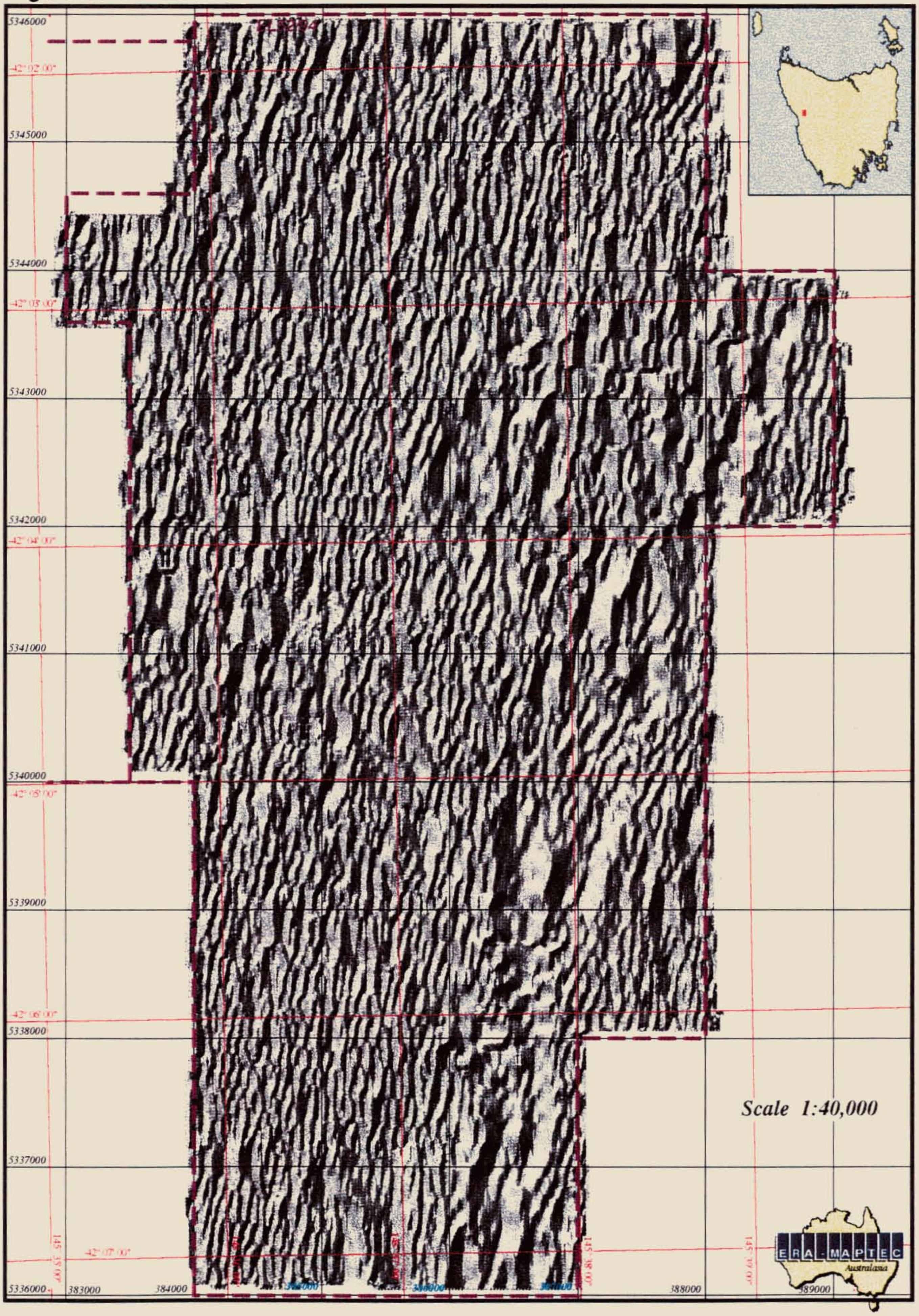
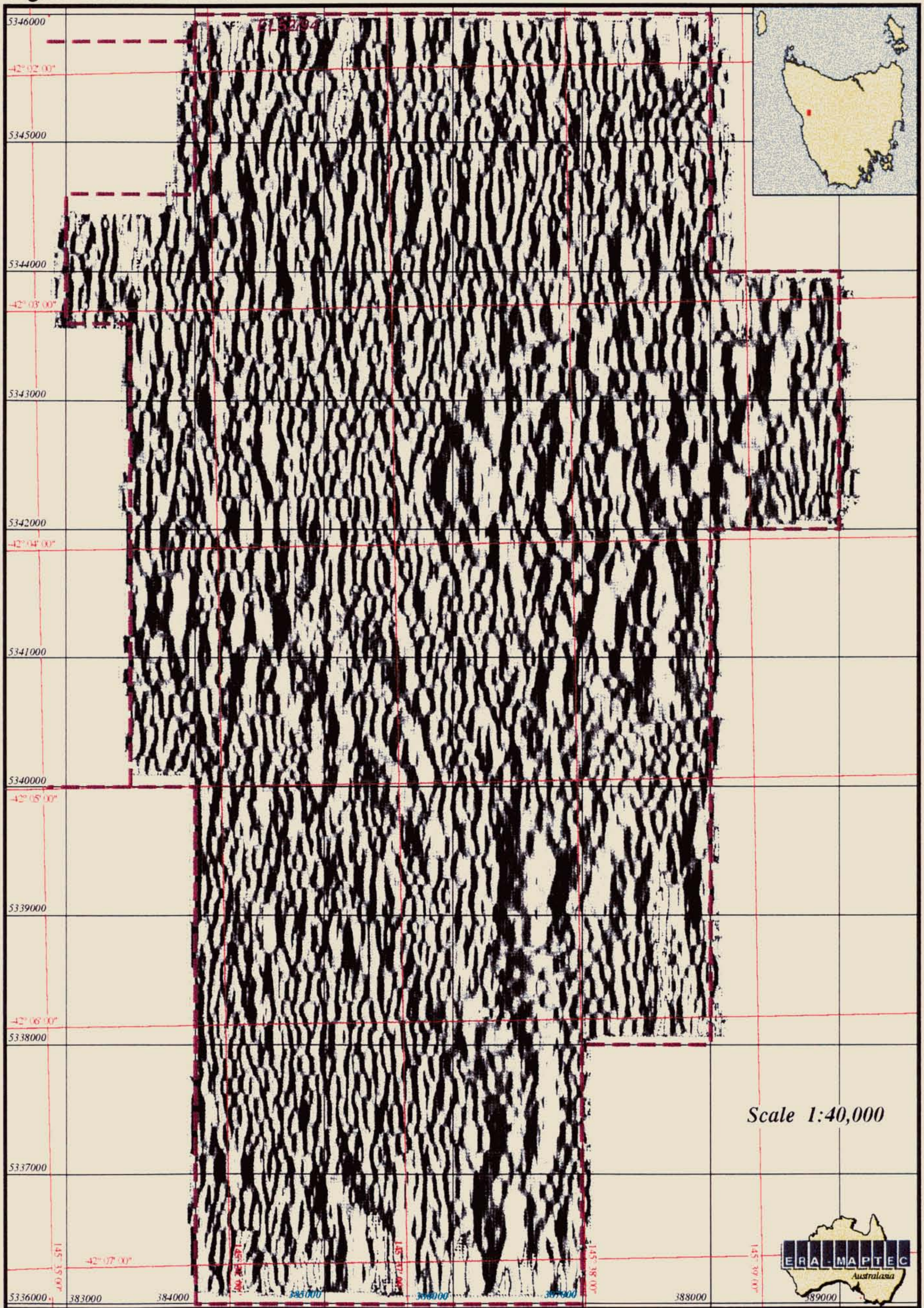
Figure No. 31 EL 52/94 - First VD with AGC shadowed from SE



5 cm

416033

Figure No. 32 EL 52/94 - First VD with AGC shadowed from east



5 cm

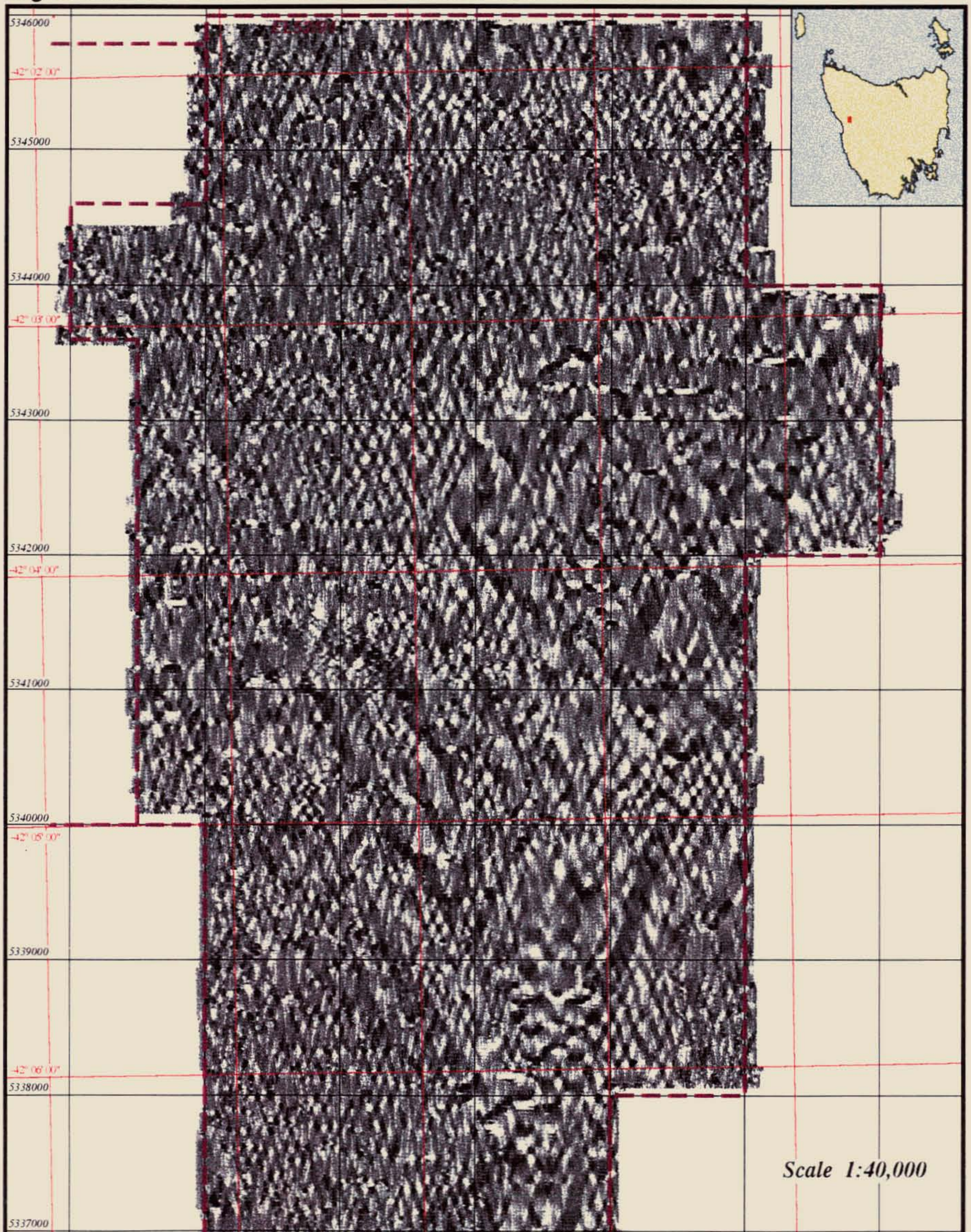
416034

Figure No. 33 EL 52/94 - First VD with AGC shadowed from NE

5 cm

416035

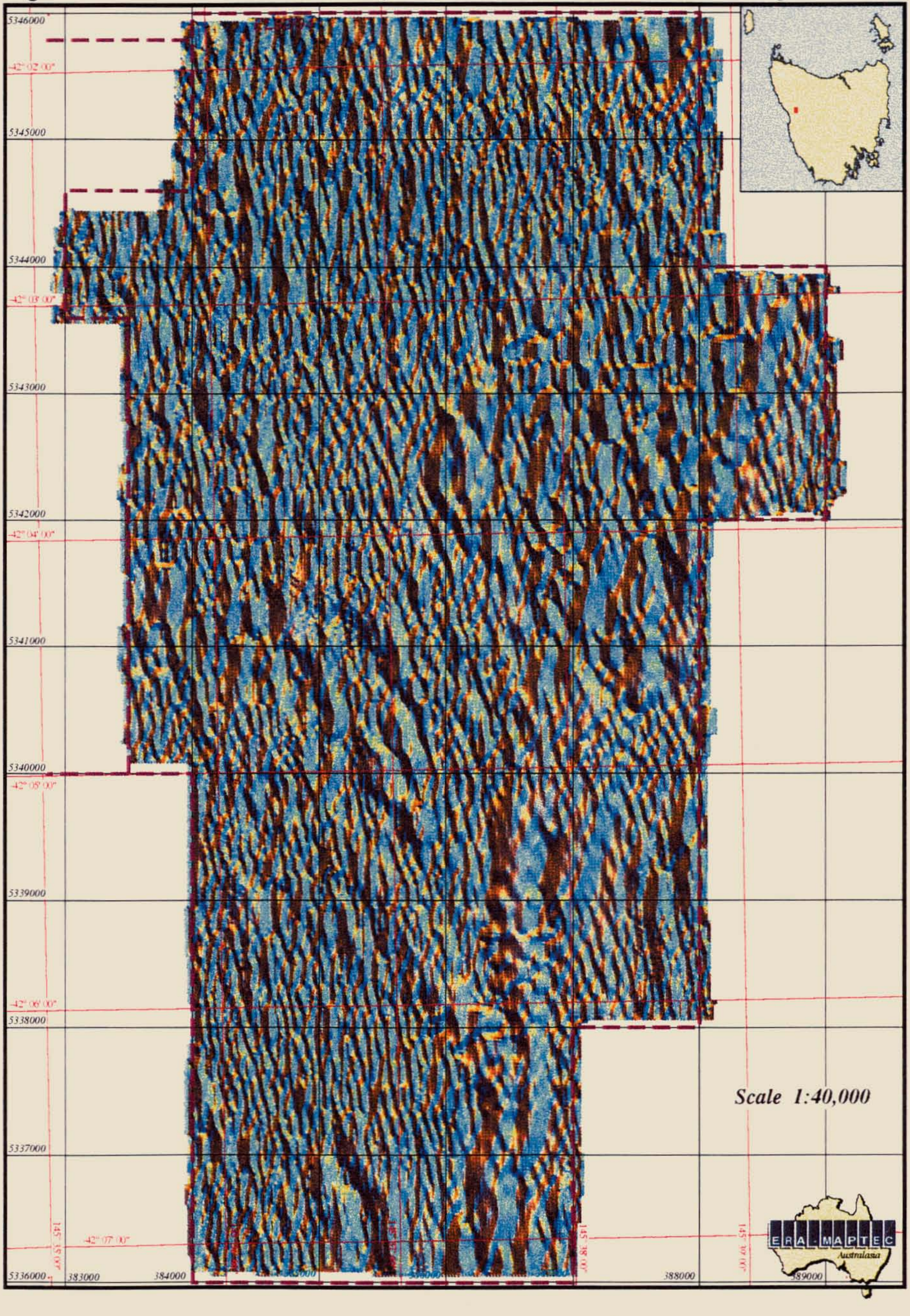
Figure No. 34 EL 52/94 - First VD with AGC shadowed from north



5 cm

416036

Figure No. 35 EL 52/94 - Colour composite of 1st VD with AGC shadow images



5 cm

systems and many must be spurious features. At this stage it is more productive to interpret major structural features from the other images.

Maximum Gradient Image (Map 24 and Figure 36)

Highest gradients are associated with the Tyndall Group rocks. Some areas with very flat, featureless signatures have been identified and are sho

wn in **Map 36** and **Figure 24**. They have no obvious geological association. The North Lyell Fault Zone contains a number of WNW trending highs which indicate a broad deformation zone. More variable signatures are present in the south of the area with bland areas in the north. There is an E-W streaking in the image which gradually increases north of about 5340000N. This is most prominent in an E-W trending, 1km wide, low zone in the image centred on 5344000N and coincident with the previously interpreted Comstock Valley Fault Zone. At first sight this feature would appear to result from levelling problems in the data as it is parallel to flight lines. However, as mentioned earlier, stratigraphy and topography are sub parallel to the zone. This may only be resolved by a further survey with N-S directed flight lines.

6 Gravity

Gravity data was supplied to the project as a Mapinfo file of residual values with co-ordinates and station numbers. These data cover a wider area (372500E - 390000E (17.5km), 5332500N - 5352000N (19.5km)) than the magnetic surveys (see **Figure 1**). The northing co-ordinates had been truncated with the leading "5" of the co-ordinate omitted. This has been remedied so that the data can be imported into Mapinfo. There are two resolutions of data:

- The regional data has a station spacing of around 1km.
- Data in the Mount Lyell area has a station spacing of around 250m.

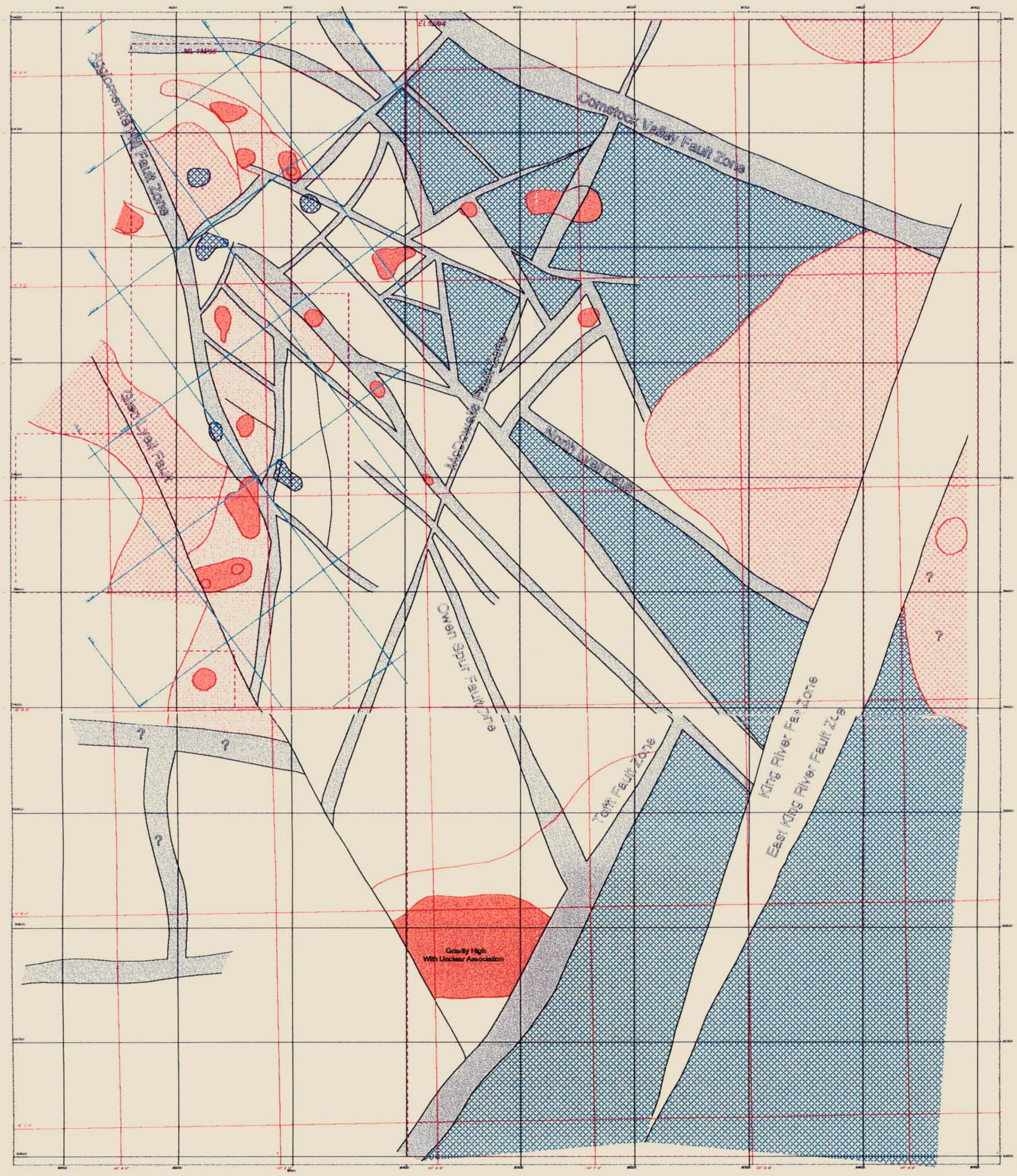
The data has been gridded at two cell sizes. A regional image for the whole data set has been gridded at 250m cell size (**Figure 37**). The more detailed data has been extracted (380600E - 386000E (5400m), 5341000N - 5347000N (6000m)) and image processed separately with a 50m cell size (**Maps 17 & 32b** and **Figure 38**). These data have been contoured at 0.5 mGal intervals and superimposed on the aeromagnetics (TMI colour drape on first vertical derivative) **Maps 18, 33**. The residual data were derived from the file "Tas Res" held by CMT. The residual data have had the following corrections performed:

- Terrain Correction
- Free air Correction
- Bouger Reduction
- Coastal Water Correction
- Mantle Correction

The data were interpolated using a simple spherical weighted fill with a radius of 4. This method was chosen after other interpolation methods and search radii were tested.

The gravity image compiled for the Linda EL 52/94 (**Map 32**) is a composite of

Figure No. 39 Interpretation of Gravity Data



AGD84 Zone 55 Coordinates

Scale 1:40,000

0 400 1200 2000 m

5 cm

- Tenement Boundary
- Gravity Gradient Zone
- Very Low Gravity - Eldon Group?
- Local Gravity Lows
- Local Gravity Highs
- Gravity High Zone Associated with Pyritic Lyell Schist
- Gravity High Associated with Tyndal Group

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Figure No. 36 EL 52/94 - Grey scale maximum gradient image

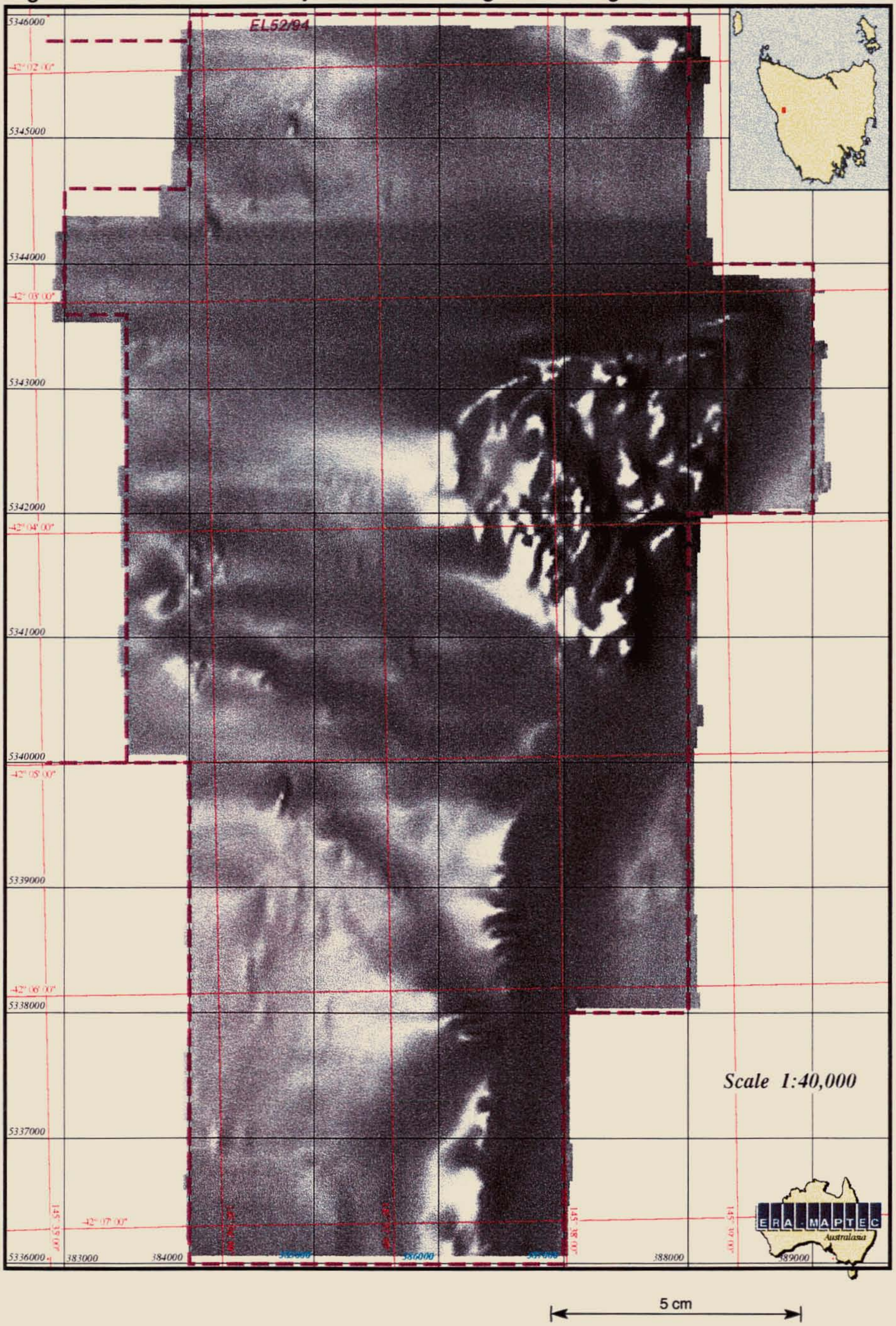


Figure No. 37 Regional gravity image with geology from Queenstown sheet

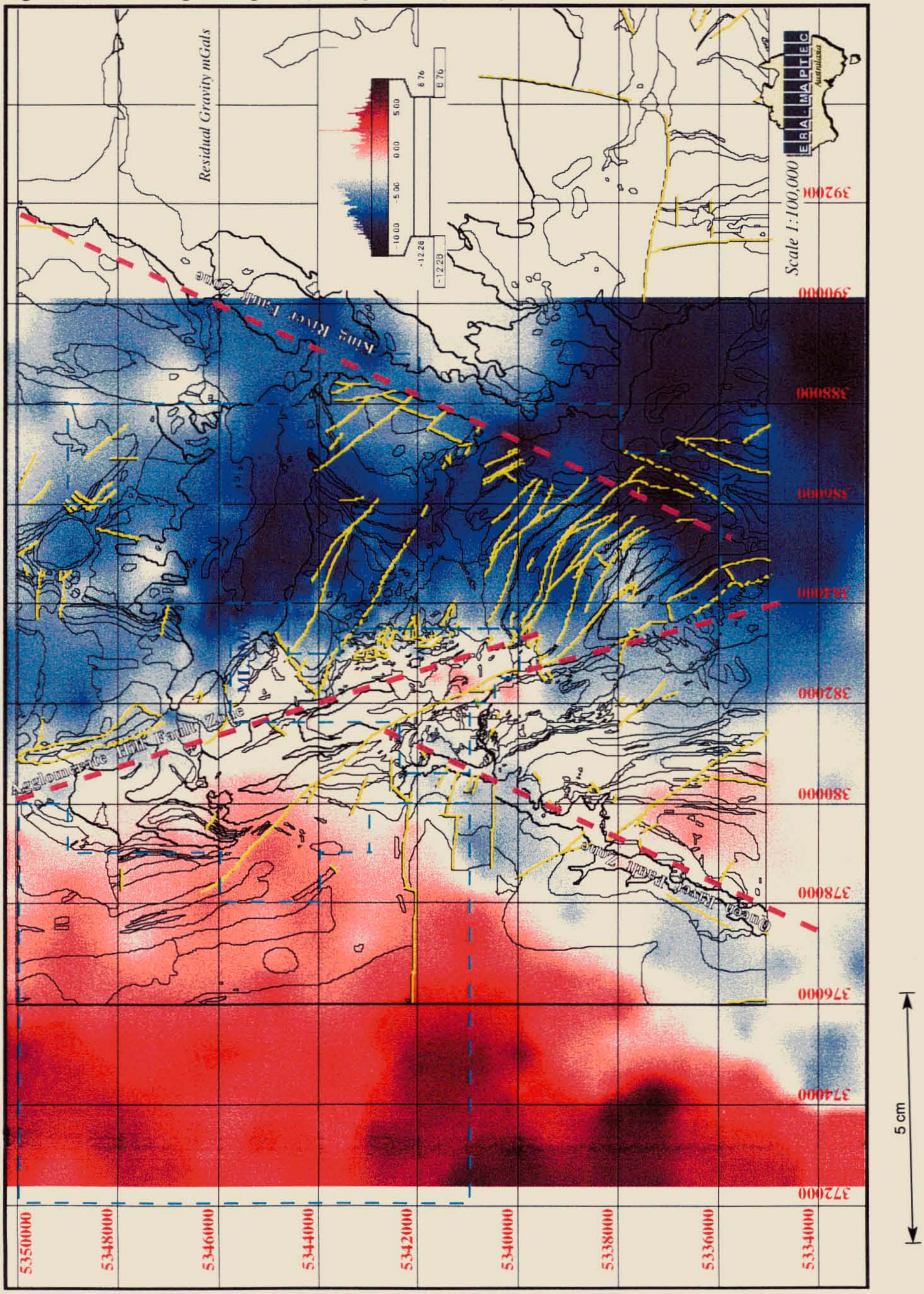
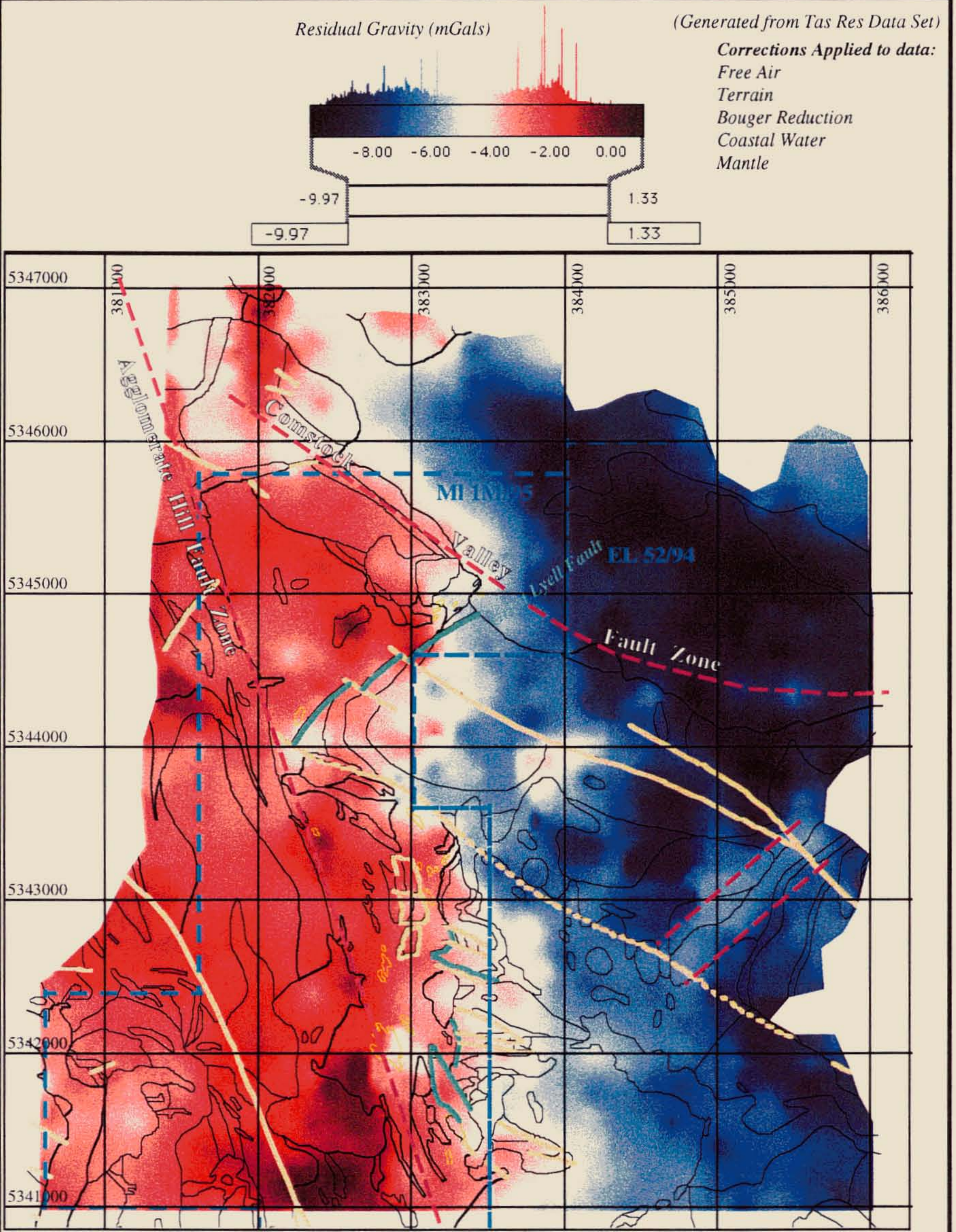


Figure No. 38 Detailed Gravity image and geology



Scale 1:35,000

Detailed gravity image over ML 1M/95 and EL 52/94. Faults from Queenstown sheet in orange, lithological boundaries in black, Great Lyell Fault in light green, mineralisation in yellow.

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boundary between the data sets on the map in order to preserve the detail in the higher resolution data. Contours have also been generated at 0.5 mGal intervals for the regional data. These have been spliced with detailed contours and superimposed on the magnetic data (TMI colour drape on first vertical derivative) (**Map 33**). There is a degree of mismatch with the detailed contours due to the differing interpolation cell size.

A composite gravity image covering both EL 52/94 and ML 1M/95 has been produced (**Map 32b**) which also contains the contour data and data station locations to aid resolution of anomalies and gradients and to depict the varying degree of interpolation over the map.

The interpretation of the gravity data is shown in **Figure 39** and **Map 39**. The following observations have been made from the gravity images and contour maps.

- There is a general gravity gradient from low in the east to high in the west in association with the exposure of the Tyndall Group.
- The exposed area of Tyndall Group in EL 52/94 also controls a gravity high. The high is poorly constrained by only a few stations in the regional data.
- There are some extensive gradients in the data, some of which are coincident with known structures. The gradients separate blocks with a gravity change of up to 4 mGals.
- There is a very strong N-S gradient coincident with the eastern margin of the projected positions of the Prince Lyell and Royal Tharsis mineralisation and which also forms the western margin of Tharsis Ridge.
- A prominent low is present close to the projected position of the Prince Lyell mineralisation and which coincides with a gap in the mineralisation. The cause of this low is not clear (alteration, development voids?) and is defined by one station. There is a relatively high degree of interpolation in this area due lack of stations.
- There are a series of local gravity highs immediately west of the N-S gradient which correlate well with the distribution of the pyritic Lyell Schist (Lsp).
- Although the Tyndall Group rocks clearly control gravity highs there is a poor correlation between mapped boundaries and lithologies and the gravity signature. This suggests remapping is required.
- The Agglomerate Hill Fault Zone which was prominent in the magnetic data in ML 1M/95 is not so obvious within the gravity data but is consistent with the data and seems to create a low zone.
- The North Lyell Fault does not have a simple gradient associated with it and it appears there is a more complex fault pattern present than is mapped. A strong zone of NW trending structures with linking ESE zones is indicated. The North Lyell Fault, and the NE trending Great Lyell Fault, bound a gravity low are which is consistent with the presence of the Owen Conglomerate.
- The strong gravity gradient on the eastern margin of Prince Lyell

extends to the south and appears to end at around 5335000N in an area of poor data station density. The gradient zone contains patches of Pyritic Lyell Schist. The strength of the gradient and the local highs to the west suggest that either:

- The Pyritic Lyell Schist is strongly developed at depth or
- Tyndall Group rocks are present at depth. The magnetics suggest this is not the case as the gravity highs are coincident with lower magnetic signatures.

- The surface expression of the Great Lyell Fault east of Prince Lyell controls a very weak gradient.
- Gravity contours east of the Great Lyell Fault are influenced by the ESE structures associated with the Linda Disturbance. The folding mapped in the Pioneer Beds is also reflected in the gravity data.
- There is no obvious gravity low connecting Tharsis Ridge and Razorback which could be used to infer Owen Conglomerate at depth.
- The King River Fault System creates a broad low zone. A gravity high to the east of it suggest Tyndall Group rocks are present in places.
- There is a NE trending gravity ridge at around 385000E, 5343000N. This has no correlation with magnetics but is defined by a number of stations.
- The Comstock Valley Fault Zone as interpreted from magnetics is consistent with the gravity data, forming the margin to local highs but is not a prominent gravity feature. A much more significant feature in the detailed data is present to the north but is poorly constrained in the regional data.
- The Eldon Group creates low signatures and is possibly present south of the North Lyell Fault in EL 52/94.
- The Owen Spur Fault Zone as interpreted from magnetics is coincident with a saddle in high NE gravity trend in the south of EL 52/94.
- The McDowells Fault Zone is reflected in the gravity data.
- The Tofft Fault Zone could form the eastern margin to the southern gravity high in EL 52/94.
- Copper Estates lies within the broad spaced data and has no characteristic signature.
- Iron Blow is coincident with a -4 mGal gravity low.
- Western Tharsis is coincident with a gravity high anomaly (-0.22 mGals). The contours have a similar trend to the deposit strike.
- North Lyell lies in a lower gravity area but with no characteristic signature.
- Lyell Tharsis also on the margin of a low (probably associated with the Owen Conglomerate).
- Cape Horn lies in the NE trending gradient created by the Great Lyell

Fault. This gradient is much stronger than that coincident with the Great Lyell Fault to the south. A prominent gravity low is present just to the south (-4.26 mGals similar in size to that at Prince Lyell) at the junction of the Great Lyell and North Lyell Faults.

- Lyell Comstock is also within the Great Lyell Fault gradient but also lies on a strong N-S gradient created by the eastern margin of the Pyritic Lyell Schist (Lsp). The gravity high in this area indicates that Lsp extends away from the Great Lyell Fault and indicates a significant area of Lsp which contains some prominent local highs. The shape of the anomaly is consistent with foliation trends.
- A high is present at around 381600E, 5344200N which could be bounded by the Agglomerate Hill Fault Zone and the extension of the North Lyell Fault. The cause of this high is not clear although it lies within mapped Tyndall Group. It is possible it could be create by a fault bounded area of Lsp as it is not directly coincident with a magnetic high.

There is a direct association between gravity features and mineralisation and the results of the contouring and image processing of the data can be used as a strong criteria during target generation. The contoured data shown in **Maps 18** and **33** are more useful than the images for accurately positioning faults interpreted from strong gravity gradients, however the images give a better appreciation of the overall geometry of the gravity data. These interpreted features have been compiled in **Figure 39** and **Map 39**.

7 Identification of Target Areas

The major structural features in ML 1M/95 and EL 52/94 have been compiled in **Map 38** and **Figure 40**. This map contains:

- Faults from ML 1M/95 geology map
- Faults from Queenstown 1:25,000 sheet
- Mineralisation polygons from 1M/95.
- Major and minor structures interpreted from aeromagnetic images.
- Features interpreted from regional and detailed gravity data.

Although the aeromagnetic data did not match closely with the mapped geology, many of the features interpreted can be corroborated by reinterpreting the mapped geological boundaries and it is felt that the major fault zones identified in the interpretation will prove to be present when ground truthing is undertaken. The important points to arise from this study are:

- The mineralisation itself has no distinctive magnetic signature but **can be coincident with depressed magnetisation and fuzzy masking signatures probably related to alteration.**
- The Lyell Schists seem to have undergone considerably more

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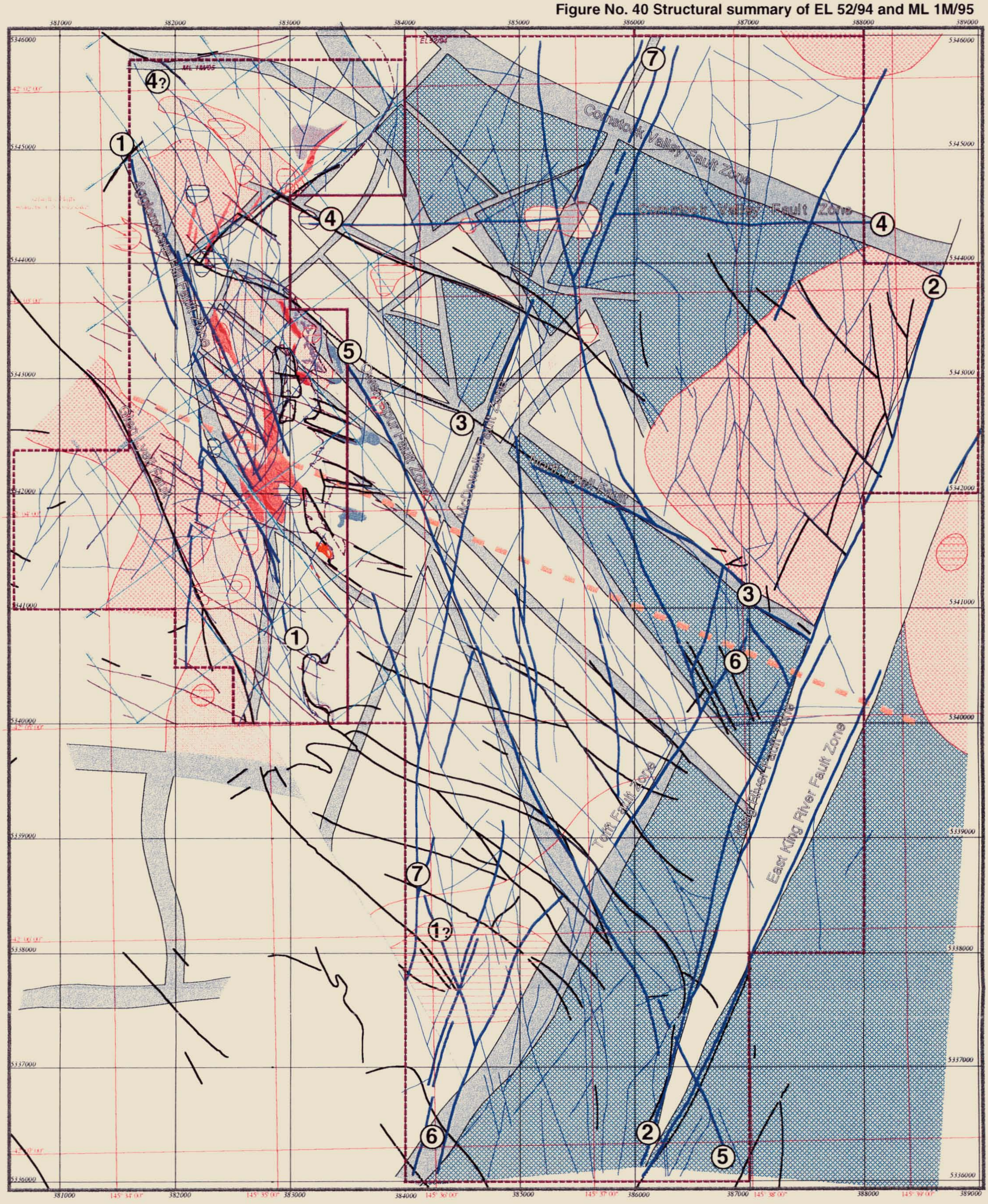
Figure No. 40 Structural summary of EL 52/94 and ML 1M/95



Scale 1:30,000

Structural summary of fault data for EL 52/94 and ML 1M/95. The major fault zones have been numbered. Note that the fault zones interpreted from aeromagnetic data are parallel to known major fault systems which trend both NNE and NNW. The intersection zones of these structural zones with gravity gradients should be further investigated as exploration targets.

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5 cm

deformation than the Ordovician rocks. This may be because they are deformed by broad zones of shearing including the Agglomerate Hill Fault Zone which, along with the King River Fault Zone, controls the strongest deformation in the study area.

- The **gravity data has a much more direct association with mineralisation**. The Mount Lyell deposits are coincident with both local high and low gravity signatures within an envelope of higher signatures created by the Pyritic Lyell Schist. A number of the deposits lie on or close to significant gravity gradients which could be the expression of basement fault zones. The Irish base metal deposits have a strong association with SW trending basement high margins which controlled the development of the later basins which contain the mineralisation and also provide the source for mineralising fluids. A similar model is applicable to the Mount Lyell deposits with VMS mineralisation sourced from deep seated basement structures which also had an important control on later deformation.
- The gravity data indicate an extensive development of pyritic Lyell Schist south of the Prince Lyell deposit, much more significant than indicated by mapping. The gravity highs are more intense than those in Lsp to the north.

Criteria for identifying target areas for further exploration include:

- Major fault zones which affect the gravity data. These have been numbered in Figure 40 and include:
  - **1** - The Agglomerate Hill Fault Zone
  - **2** - The King River Fault Zone
  - **3** - The North Lyell Fault
  - **4** - The Comstock Valley Fault Zone

  A number of other gravity gradient structures have also been identified (**Map 39 and Figure 39**) and also provide exploration potential. The largest gradients should be investigated first.
- Local gravity highs and lows are coincident with known deposits. Similar types of anomalies are present within ML 1M/95 and EL 52/94.
- Intersections of gravity gradients with other fault zones identified from the aeromagnetic data which include:
  - **5** - The Owen Spur Fault Zone
  - **6** - The Tofft Fault Zone
  - **7** - The McDowells Fault Zone
- The Agglomerate Hill and King River Fault Zones approach each other in the south of the Linda tenement. Faults also increase in frequency in this area. Enhanced fluid flow may have been generated in this zone. Some exposures of Mount Read Volcanics are mapped in this area on the Queenstown 1:25,000 sheet with potential for more extensive development under Quaternary cover. A gravity high is partly coincident with the volcanics but the high is poorly constrained due to a lack of data.

8 Recommendations

Following the interpretation of the data sets in this project the following recommendations are made:

- If flying further aeromagnetics it would be more useful to fly a symmetrical grid with tie lines at the same spacing as flight lines. There are significant features trending both E-W and N-S. A tighter line spacing would be required of 25 or 50m. Such a survey would also reduce the number of spurious features generated in the interpolation process.
- There are clearly large scale features present which have not been recognised in the mapping to date. A phase of ground truthing and structural mapping of the major zones identified in this project is required. This work would also delineate strain gradients within the area which seem to be closely linked to mineralisation.
- Further infill of the regional gravity survey would better delineate the anomalies in the southern portion of ML 1M/95, especially over the areas interpreted as possible Pyritic Lyell Schist. The southern portion of EL 52/94 and the area of the exposed Tyndall Group would also benefit from close spaced gravity data.

References

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Wills, K. 1995 Solid Geology Interpretation Map (Scale 1:5,000) Compiled from previous mapping. *CMT proprietary map.*

APPENDIX 2

KING LYELL COPPER CLAYS REPORTS

KING LYELL COPPER CLAYS

RESOURCE ASSESSMENT

MAY 1997

PREPARED BY K.MORRISON & J. KNIGHT

FOR

COPPER MINES OF TASMANIA

SUMMARY

The King Lyell copper clays lie to the east of the King Lyell area, at the head of the Linda Valley. Ten drill holes which intersect the mineralised zone were used in this assessment, together with maps showing the surface outcrop at the western extent, and cross sections from a report by K Wills. K. Morrison defined an overall limit to mineralisation, based on the drill hole data and the field mapping, and this limit has been respected in this assessment.

The mineralised zone is a tongue shaped body, pinching out to surface at the western end, and dipping gently to the east south-east. The body has been interpreted as extending east as far as drill hole M12, just west of the Lyell Highway. The inferred resource is estimated to be 1.2 million tonnes of copper clay with an average grade of 1.37% copper. However, the grades in the western half of the body are consistently higher than in the deeper, eastern half. The average grade in the western 0.6 million tonnes is 2.01% copper.

A conceptual ultimate pit was modelled around the body, assuming an ultimate slope of 60 degrees, to get a feel for stripping ratios. This yielded an overall ratio (tonnes of waste to tonnes of "ore") of 2.3, and 1.3 for the western half only.

The author stresses that this is a very preliminary assessment, based on the field mapping and just ten drill holes. The volumes were calculated by wire-framing from cross sections, with no attempt to model grade distribution at this stage. The grades quoted above are simple arithmetic averages from the drill hole intersections, and the boundaries of mineralisation are based loosely on a minimum grade of 0.2% copper. Therefore the assessment is prepared as a preliminary estimate only, as instructed, and is not claimed to be rigorous.

DATA PREPARATION

Database

All data has been loaded on to a Datamine database. The maps and sections supplied by CMT, from which some data was extracted, are listed in Appendix I.

Topographic data

Topographic data and the locations of creeks and roads were supplied in digital form by CMT as ASCII files

Drill holes

All drill holes have been assumed to be vertical. Collar coordinates were obtained to the nearest half metre from maps supplied by CMT, and elevations were determined to the nearest half metre from the topographic data. Depths were given on the sections prepared by K Wills, and graphical logs in the case of KL1, KL2, and KL13.

Mineralisation Limit

K. Morrison provided an estimate of where the surface geology constrains the extent of mineralisation. This limit has also been included in the database (as a polygon) to control the extent of the model in the cross sections.

The topographic data, drill hole locations, cross section locations, and the mineralisation limit are shown on the base map in Figure 1.

Assays

Average assay values over mineralised intersections were taken from the sections preparaed by K Wills. In the case of KL1, KL2, and KL13, half metre and metre sample values were available, but grades were averaged over the mineralised intersections for consistency with the earlier holes. The intersections are summarised below.

Drill hole	From	To	%Cu
KL2	74.0	77.8	0.86
KL13	42.2	69.4	1.08
KL1	0.0	7.6	1.69
KLC1	45.0	58.0	0.85
KLC2	29.0	38.0	3.11
KL16	36.0	37.5	0.13
ML9	2.0	42.0	2.16
ML10	30.0	37.6	0.44
ML11	47.5	84.0	0.67
ML12	64.0	112.8	0.52

Section location and grids

The topographic data and more recent location maps are based on AMG coordinates. The map showing the location of the cross sections prepared by K. Wills is based on a mine grid. Using the location of drill holes KL1, KL2, and KL13 which are shown in both grids, the location of the cross sections in AMG was determined. AMG coordinates have been used in this evaluation. The section locations are shown on Figure 1.

Topographic profiles

Topographic profiles were obtained for the sections by vertically slicing a wireframe surface (DTM) constructed from the topographic contours, along the sections. There are some minor differences between these profiles and the ones on K. Wills' sections.

Copper Clay Mineralisation

The extent of copper clay mineralisation is shown on Cross Sections 1, 2, and 3 as prepared by K. Wills. These boundaries were digitised into the database as a starting point for modelling the extent of the mineralisation in 3D.

MODELLING

The three cross sections prepared by K.Wills form the basis for the 3D modelling. However, they are too far apart to allow immediate construction of a wireframe to link them. Additional intermediate cross sections were digitised within GUIDE (the graphical side of Datamine) based on limiting the view to include two adjacent original sections, and all drill hole intersections between them. In addition, the location of the overall limit to mineralisation provided by K. Morrison was also displayed, and respected in the construction of the additional cross sections. Topography was also respected where the body outcrops, by using topographic profiles constructed as already described, for all intermediate sections.

The body was extended to the east as far as drill hole M12 which required additional sections beyond those of Wills. The western end of the body was constrained by a small section representing the body just before it pinches out to surface. The Long Section of Wills was used as a guide in modelling the shape of the western and eastern extents of the body.

Once sufficient sections were constructed, they were linked to form a closed wireframe body whose volume can be immediately evaluated.

Grade data is insufficient to allow interpolation of grade distribution. The best (but hardly rigorous !) estimate of overall grade at this stage is simply to average the average grades of the intersections.

The sections corresponding to the locations of K.Wills' sections, as well as the section through ML12 are shown in Figures 2 to 6.

Figure 7 is an isometric view of the polygons defining the mineralised body, together with the drill holes and mineralised intersections.

Figure 8 is a West-East section projection of the wireframe (back side hidden) enclosing the body, together with the drill holes.

CONCEPTUAL PITS

In order to get a preliminary feel for stripping ratio, the body was enclosed in a wireframe representing an open pit based on an ultimate slope of 60 degrees. This pit is only conceptual, and was constructed by digitising (within GUIDE) pit sections around the body on each section, and respecting the topographic sections described above.

Figure 9 shows the pit outlines enclosing the body outlines.

RESULTS

The average grades in the western half of the body are consistently higher than those in the eastern, deeper half of the body. Therefore the results are presented for the case where only the western half of the body is considered, as well as for the whole body as far as drill hole M12.

	Mineralised Zone		Overburden			
	Cubic metres	Tonnes	Cubic metres	Tonnes	S/R	Grade
West only	240,123	612,314	363,469	799,632	1.3	2.01%
Whole body	475,085	1,211,467	1,243,028	2,734,662	2.3	1.37%

Note that the grades have been calculated excluding the intersections from KL16 and ML10 which lie at the very edge of the body as it is now defined (see figures 2 and 3), and whose grades are below the minimum of 0.2% on which the intersections have been (loosely) based. Tonnages were calculated using densities supplied by CMT of 2.55 for mineralised rock, and 2.2 for waste.

APPENDIX I

List of maps and diagrams supplied by CMT

King Lyell Data Compilation Fig. 15 (Dwg No KL1001)

King Lyell Cross Section 1 (6345E) Fig 16 (Dwg No 1002)

King Lyell Cross Section 2 (6410E) Fig 17 (Dwg No 1003)

King Lyell Cross Section 3 (6493E) Fig 18 (Dwg No 1004)

King Lyell Long Section 4 (4658N) Fig 19 (Dwg No 1005)

King Lyell Dholes - Rockchips Cu_ppm 06-Nov-96 (AMG)

King Lyell 18-Aug-96 (AMG)

King Lyell Geology EL52/94 21-Mar-97 (AMG)

King Lyell Geology & Drill Holes EL52/94 21-Mar-97 (AMG)

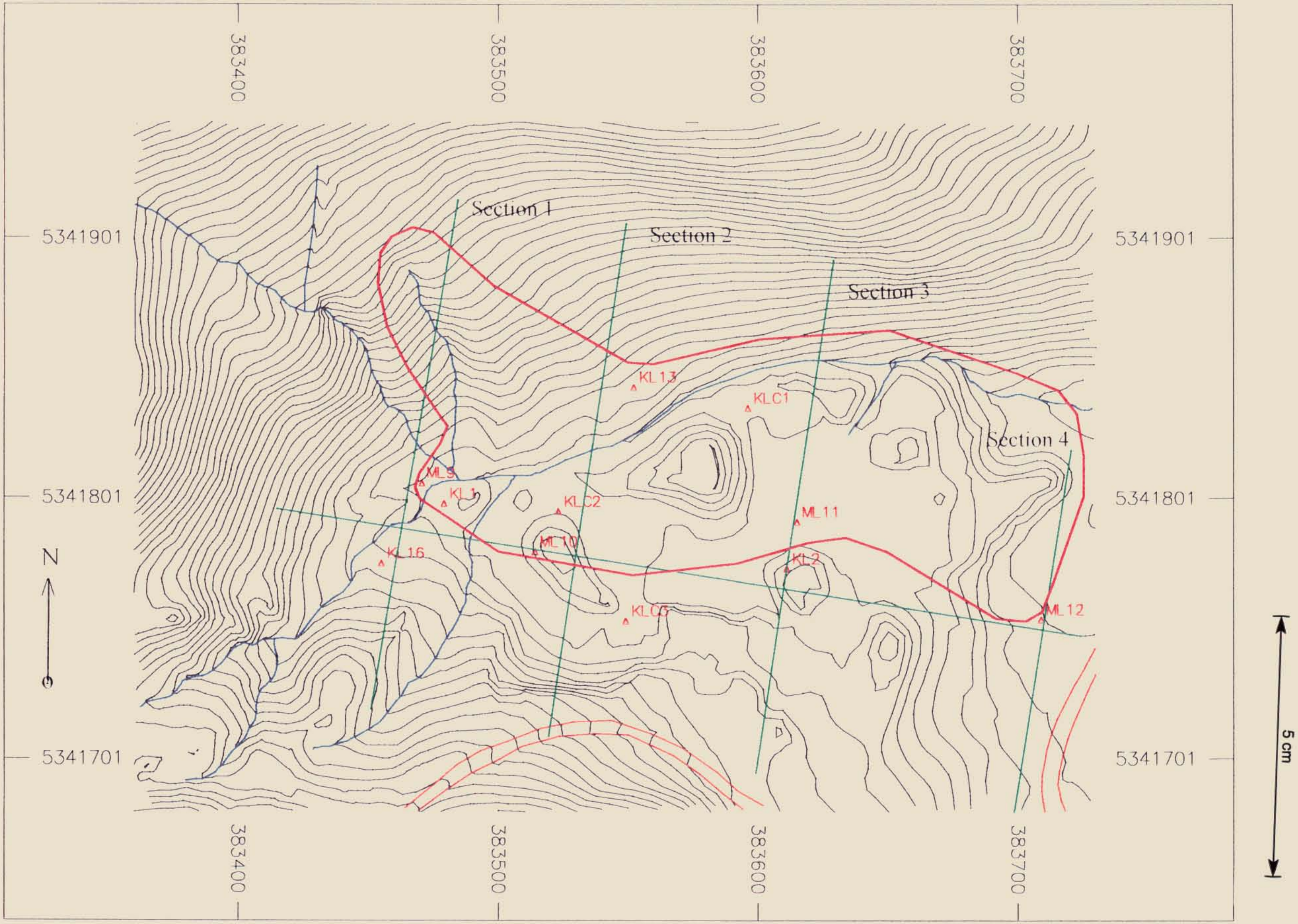

Figure 1. Base map, scale 1:2000, showing topography, creeks, Lyell Highway (red), limit to mineralisation (magenta) drill hole locations (AMG coordinates), and section locations (green)

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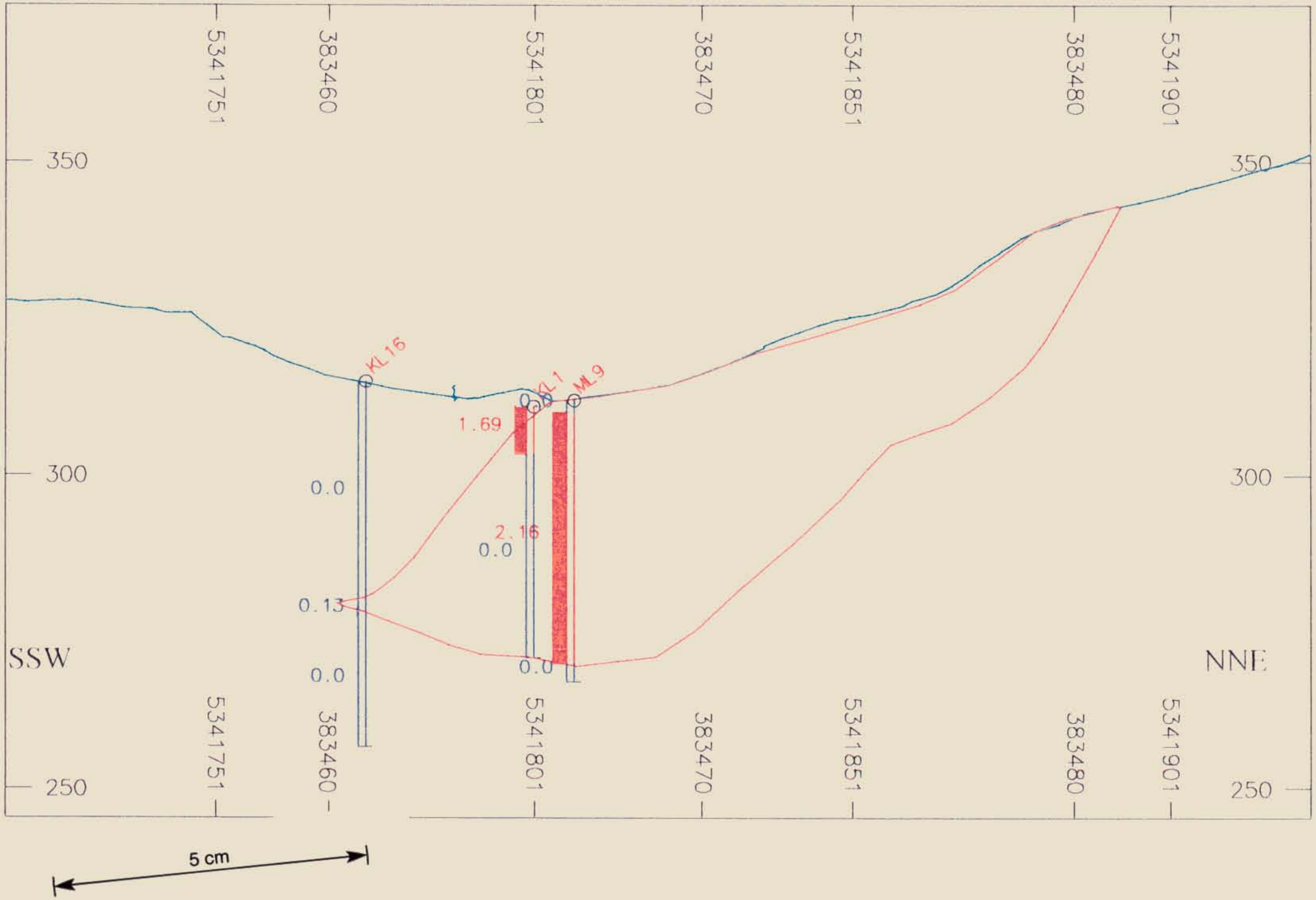

Figure 2. Cross Section 1, showing intersection grades in % Cu.

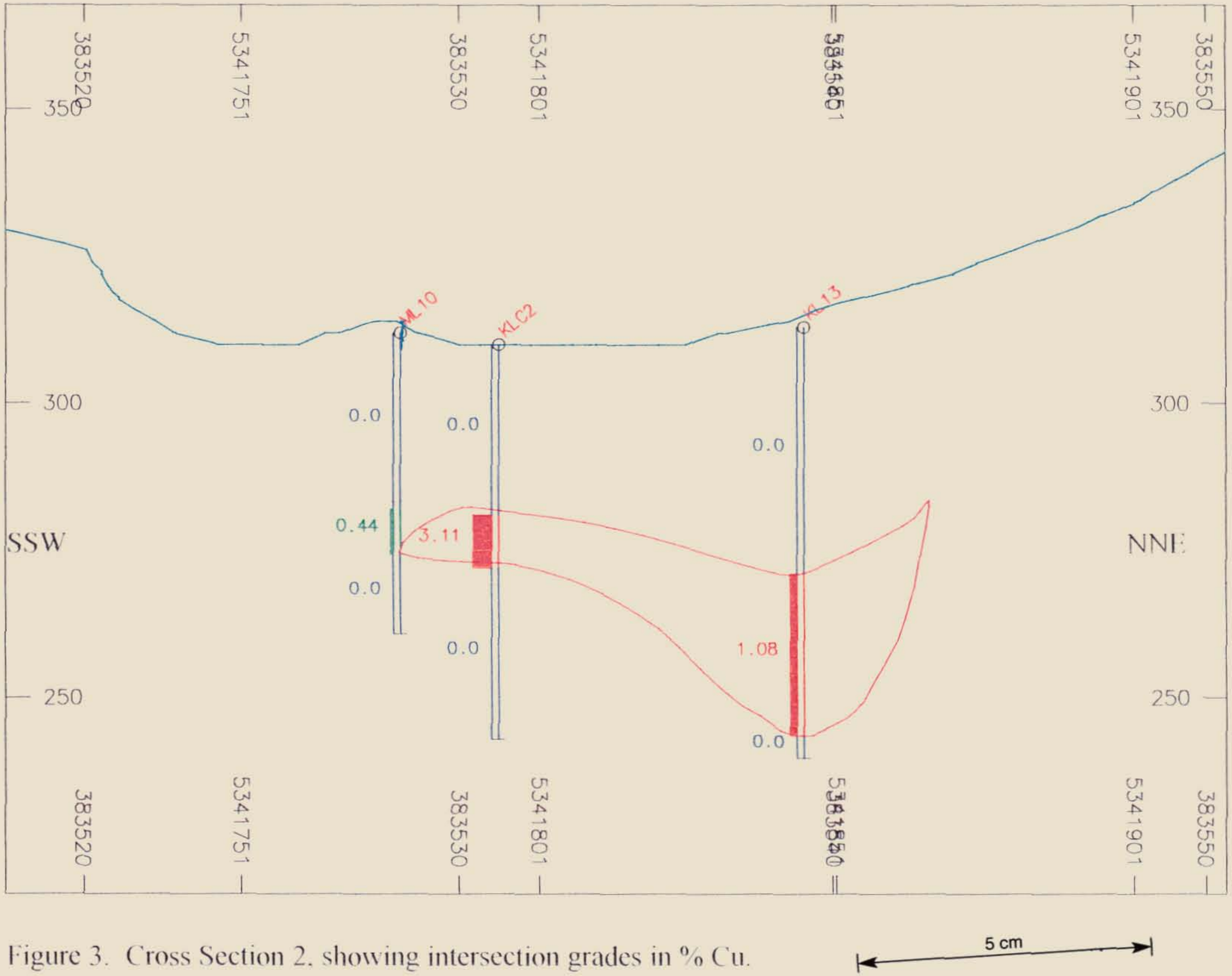

Figure 3. Cross Section 2, showing intersection grades in % Cu.

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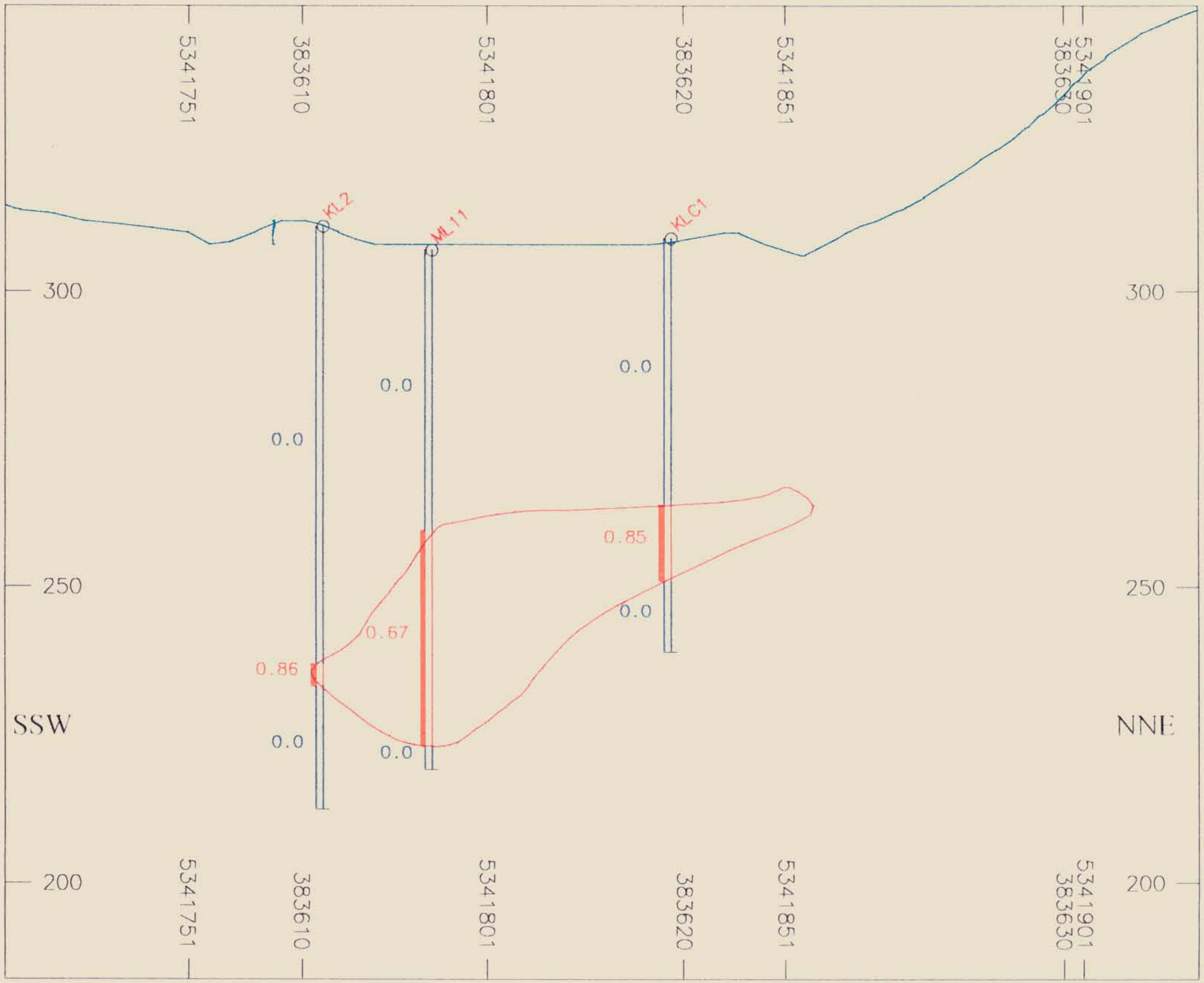
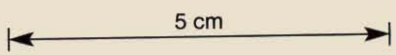


Figure 4. Cross Section 3, showing intersection grades in % Cu.



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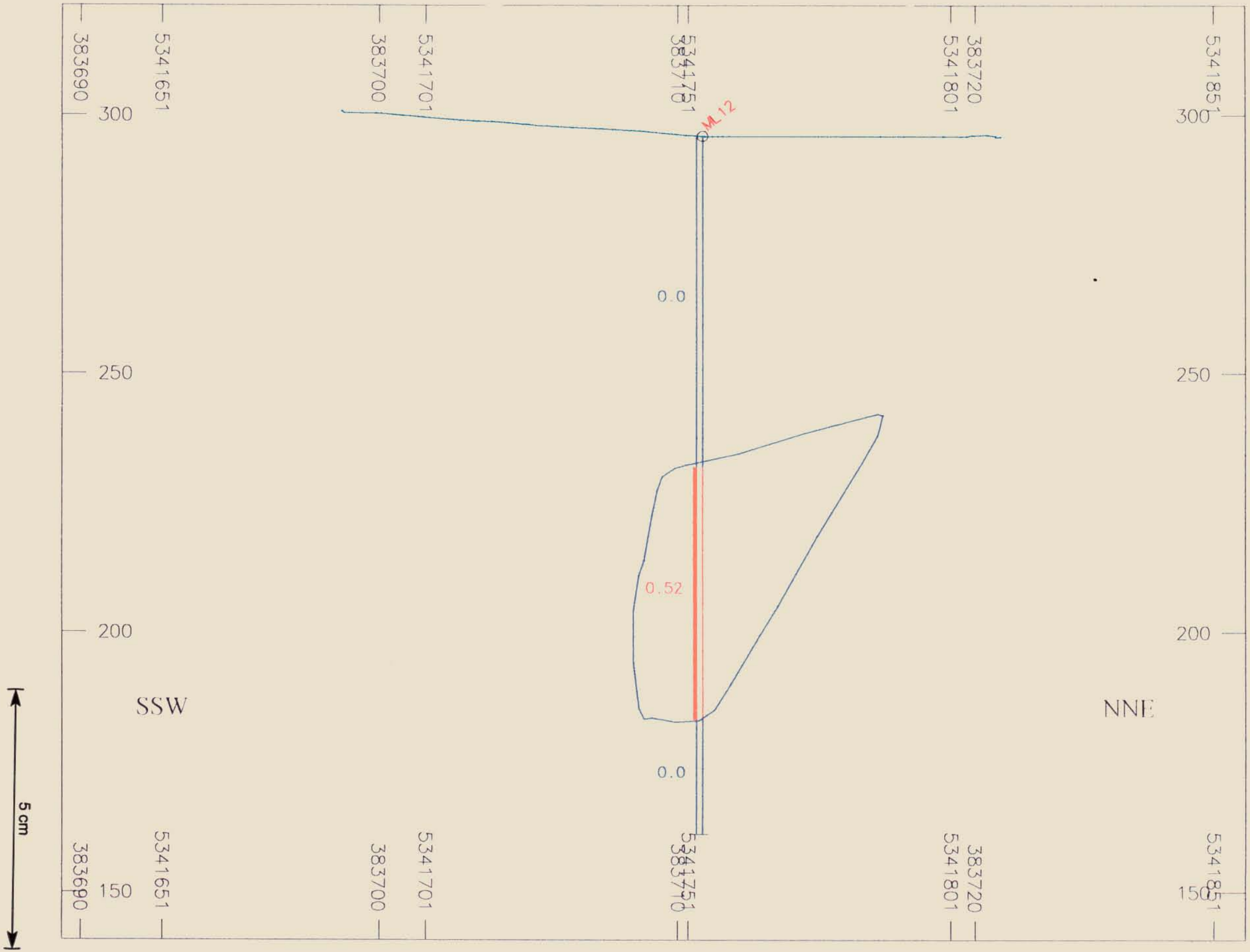

Figure 5. Cross Section 4 through drill hole ML12, showing intersection grades in % Cu.

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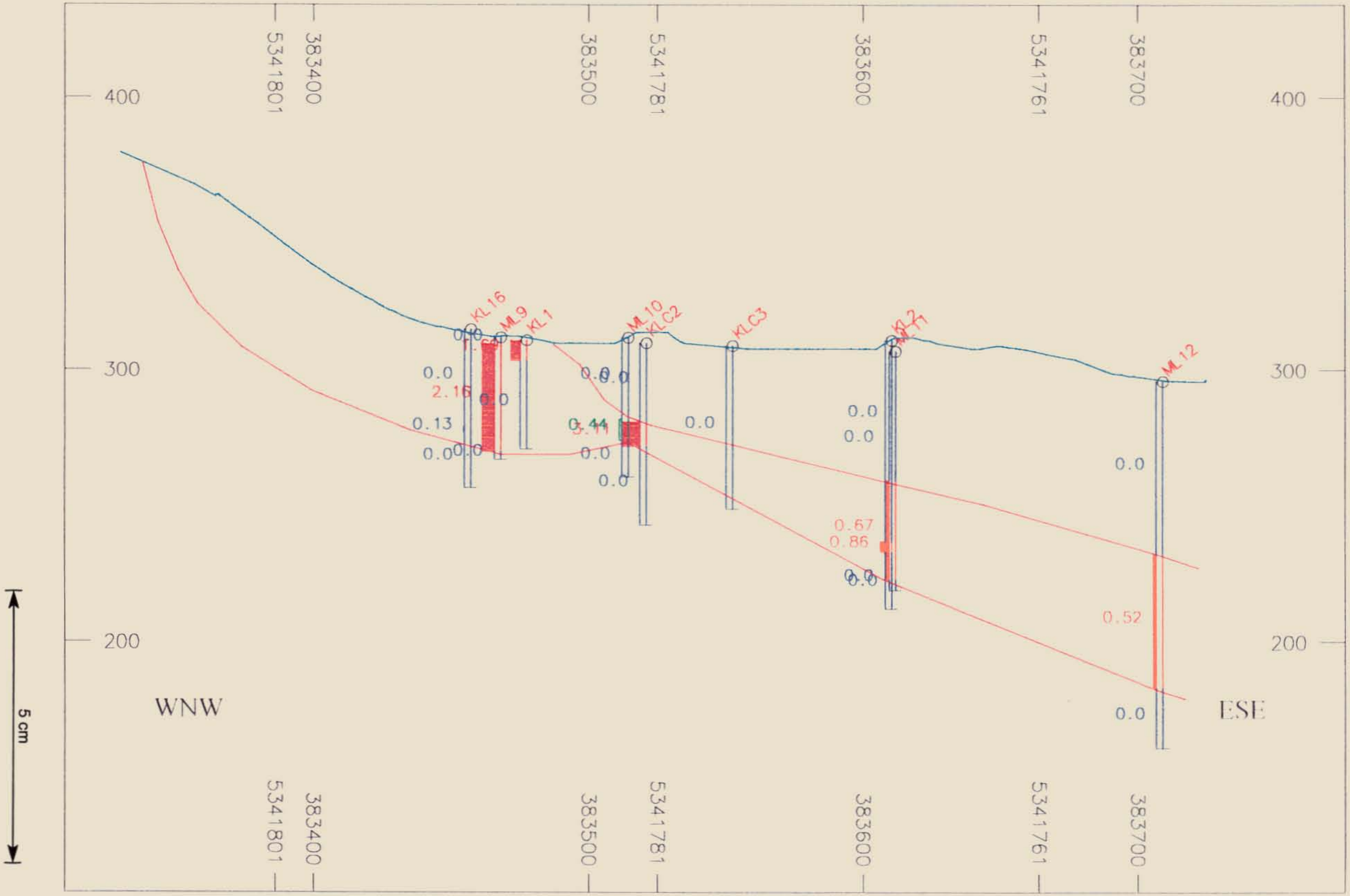

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Figure 6. Longitudinal Projection through drill hole ML12, showing intersection grades in % Cu.

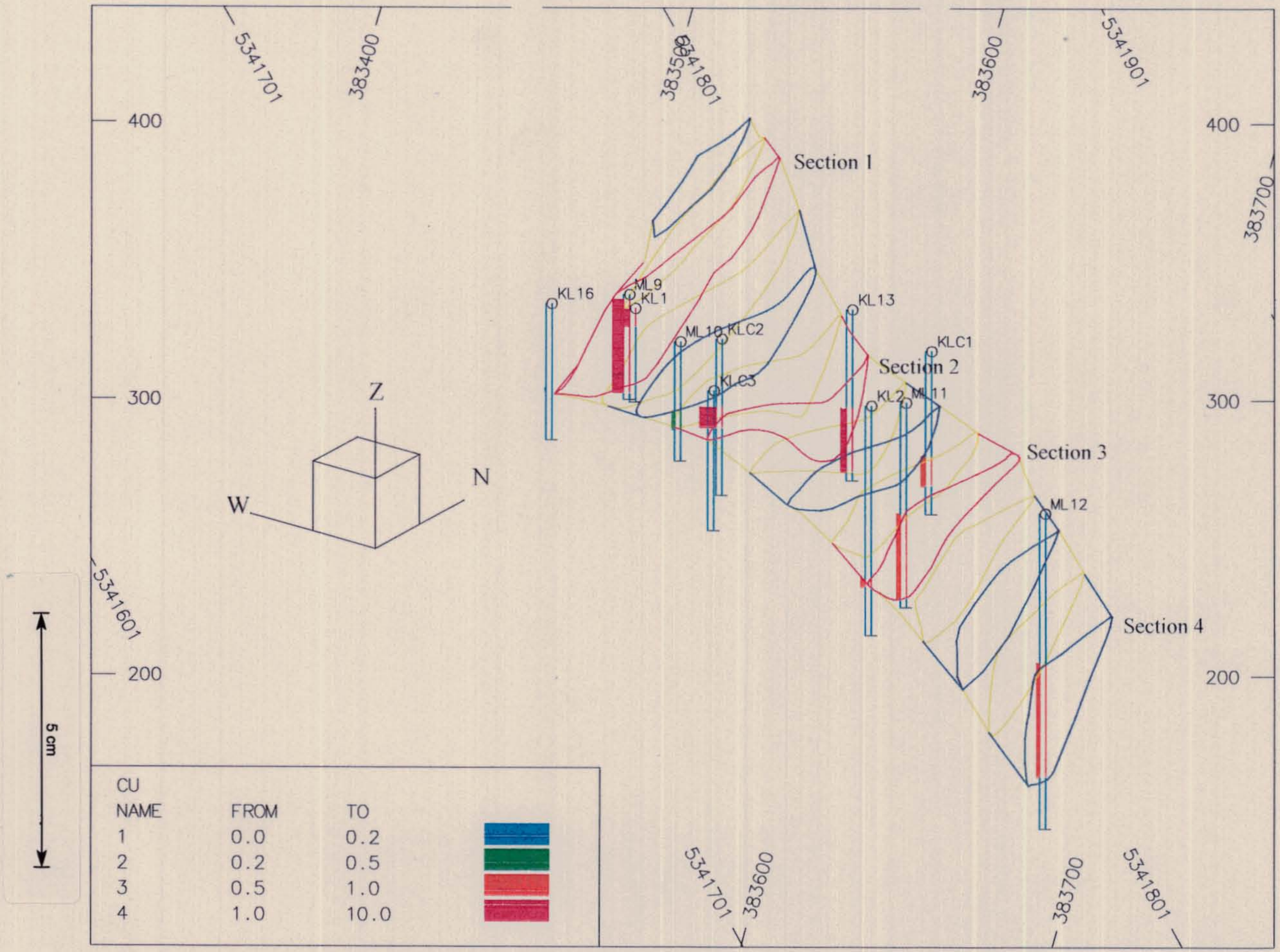

Figure 7. Isometric Projection showing model sections, drill holes and mineralised intersections

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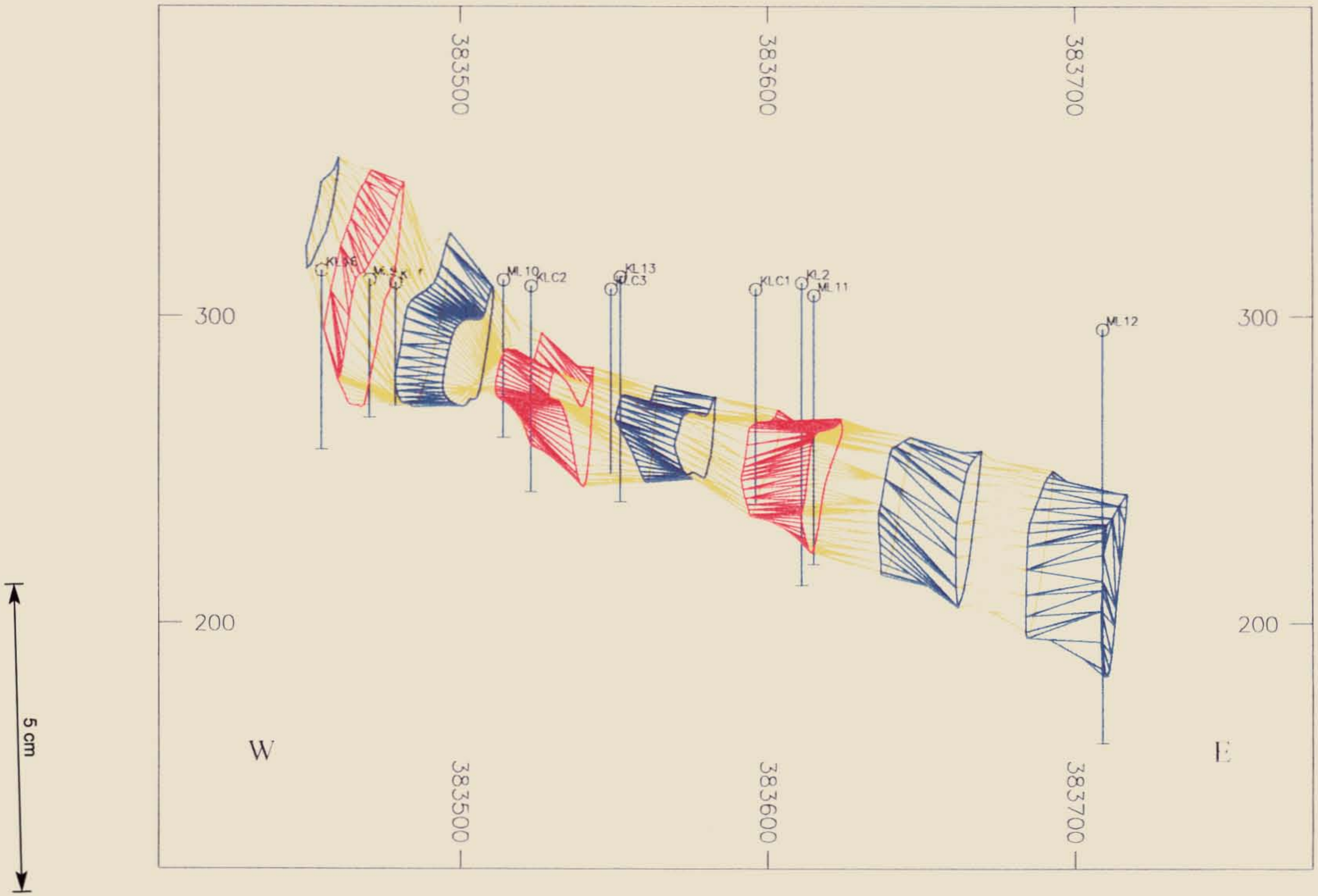

Figure 8. West to East Longitudinal Projection, showing wireframe around mineralised body (back side hidden), sections, and drill holes

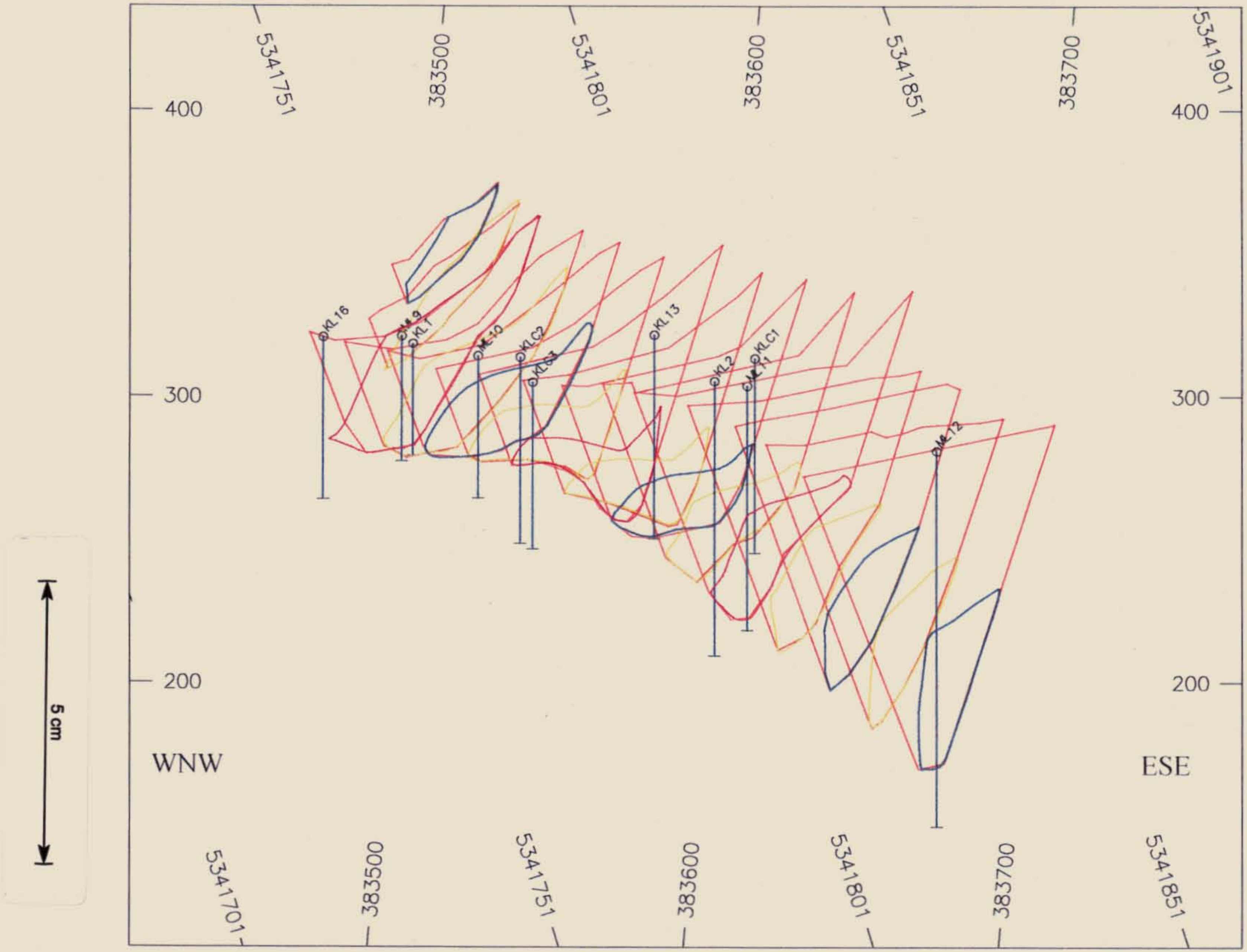

Figure 9. Isometric Projection,showing conceptual pit outlines surrounding mineralised body outlines

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CMS

4 July 1997

Dr N. Clarke
Copper Mines of Tasmania Pty Ltd
PO Box 84
QUEENSTOWN TAS 7467

REPORT CMS 97/6/10

YOUR REFERENCE: O.N. C0865

DATE RECEIVED: 25 June 1997

SAMPLE NO'S: As per report

SUBMITTED BY: S. Pollé

WORK REQUESTED: Mineralogy

H.W. Fander, M.Sc.

REPORT CMS 97/6/10

MT LYALL COPPER CLAYS

Four samples were received for mineralogical examination. 50g portions were Superpanned, and the concentrates were examined for oxidic Cu minerals, then briquetted and polished for mineragraphic examination.

All four Superpanner concentrates contained abundant +38µ grains; the two samples marked "decanted" contained very little -38µ material - this had presumably been lost in decantation.

All the concentrates contained copper minerals, but their mineralogical compositions varied considerably (probably because of selective losses in the "decanted" samples).

1. Bag -38 Superpanner Con.
This consisted of sulphides (up to 250µ), gangue (quartz-chlorite schist, goethite) particles up to 800µ, zircon and other heavy non-sulphides. The large goethite grains contained occasional native Cu inclusions up to 20µ and are probably from gossanous outcrops; it is very likely that the goethite will contain some Cu in solid solution but this would need to be verified by EPMA; if so, it would constitute a source of Cu losses.

The main sulphide is **digenite**, as very uniform free grains and minute crystal groups, in the 10µ to 30µ range; there is minor chalcopyrite as free grains up to 200µ, and as 1µ - 50µ inclusions in silicate gangue (schist) grains; as well, there are coarser-grained composites of chalcopyrite with pyrite and with magnetite. There is a trace of covellite as <30µ free grains.

Minor native Cu occurs as 10-30µ free grains, usually covered with a very thin (<1µ) oxide film.

Other components include pyrite (small framboids, and larger splinters up to 250µ), a trace of magnetite, and fragments of ?nickel wire (50-120µ diameter).

2. Bag - 38µ Decanted Superpanner Con.
This concentrate contained very little -38µ material, consisting dominantly of silicate grains up to 400µ and fresh pyrite up to 250µ. There was minor chalcopyrite, as free grains up to 250µ and as 2µ-20µ inclusions in silicates and magnetite. There were traces of <30µ digenite and rare native Cu grains (as in 1); a few pyrite/chalcopyrite composites were present.

<u>3. Foil -38µ</u> **Superpanner Con.**

This was composed of gangue (schist) grains and pyrite, up to 400µ, and copper minerals.

The main Cu mineral was **<u>pseudomalachite</u>** [$Cu_5(OH)_4(PO_4)_2$] as free grains 25µ - 100µ, with minor chalcopyrite 20µ - 150µ, traces of fine digenite and malachite, and rare grains of ?atacamite. Chalcopyrite also occurred as composites with pyrite and as small inclusions in schist particles. In terms of Cu content, chalcopyrite probably contributed almost as much as the pseudomalachite.

NB Pseudomalachite contains about 55% Cu.

<u>4. Foil -38µ Decanted</u> **Superpanner Con.**

This was composed mainly of gangue (schist) grains, many of them with sulphides, up to 600µ and fresh pyrite as free grains up to 500µ.

Free chalcopyrite occurred as 20µ - 500µ grains; as well, there were inclusions up to 200µ in gangue, 1-30µ in magnetite, and composites up to 400µ with pyrite. No oxidic Cu minerals were seen.

Pyrite was abundant as 50-500µ free grains, and in gangue.

Most grains in this concentrate were >200µ.

24/3/97 416068

Memorandum

DATE: March 24, 1997

TO: Peter Benjamin

FROM: Nick Clarke

RE: Copper Clay Metallurgy - Preliminary Thoughts

CC: Peter Williams, Shane Polle, Ken Morrison

1. INTRODUCTION

Some work has been completed on a sample of copper clays from an outcrop at King Lyell. The work comprises wet and dry sieve sizing and cyclosizing, assay of size fractions and inspection of some size fractions under the stereo microscope. The report by Kevin Wills has also been read, and the MLMRC flotation results reported there have been summarised. This memorandum records the results of work to date, and some resulting preliminary thoughts.

2. SUMMARY

Copper concentrations in the copper clay sample analysed are highest in the coarsest fraction, and decline with decreasing size. A considerable amount of the coarse fractions consisted of agglomerated clay balls. Presumably if these were broken up, the grade of the coarser fractions would increase.

The copper appeared to be present as minerals tentatively identified as cuprite, malachite, chrysocolla, chlacocite and possibly chalcopyrite. From comments by Ken Morrison, it is assumed the cuprite was formed by oxidation of native copper. No native copper was observed. The cuprite appeared quite crystalline.

The copper minerals broke down quite readily, to particles in the range 10 - 30 microns, and possibly finer. It seems likely from this and K. Wills theories of formation that all the copper is present as discrete copper mineral, but it is possible some is adsorbed onto the clays.

Historical and current information suggests that recoveries on ore of treatable grade and type would be in the range 60 - 70% could be achieved by either gravity or flotation separation. In practice, it is likely both head grades and recoveries would be highly variable. A process of desliming and conventional gravity separation might achieve recoveries in the 60% range, based on the sample analysed. Use of centrifugal separators could improve recovery and might avoid the need for desliming. Leaching might achieve higher recoveries, and could generate saleable copper metal on site. However, difficulties with liquid-solid separation and capital cost may militate against leaching.

The viability of an operation to recover copper from the copper clays is somewhat doubtful. The grade is very low for the available tonnage. Capital costs would be substantial, since even a simple gravity recovery plant would require proper means of tailings disposal. Possibly, a plant could be established by mining the King Lyell first, and following with the Blocks.

A small amount of metallurgical testwork is proposed. It is suggested this be followed by a desk-top scoping study, to determine if an operation could potentially be feasible, and what direction further work should take.

3. RESULTS

3.1 Assays

Table 1 records the results of the size analysis and assays on size fractions. Table 2 gives copper distributions by size.

It is apparent there is rather poor agreement between calculated and measured assays. The measured head assay was 2.70% Cu, whereas the assay calculated from the size fractions was 2.44% Cu. The measured assay of the -38 micron fraction was 1.24% Cu, whereas the calculated assay from cyclosizer fractions was 0.80% Cu. Some very coarse lumps resulting from the size analysis are not included in the assays shown. The lumps were assayed later, and ran (from memory) about 10% Cu. This would bring the calculated assay up to better agreement with measured. The poor agreement between measured and calculated assays on the -38 micron fraction could be due to loss of - Cone 5 material, although much of it was recovered. If this is the cause of the difference, then the lost material would have been very low grade.

Inspection of Table 2 shows that grades are highest in the coarsest fraction, and decline steadily with size.

3.2 Mineralogy

The +106 micron fraction was selected to examine under the stereomicroscope. All grains appeared a uniform pale brown. Weak acid was applied and it was found that most of the lumps consisted of agglomerated fines. This size fraction was rewashed on a 106 micron sieve, with gentle brushing to break down the "clay" lumps, and 84% of the weight passed through the sieve. The remaining oversize material contained particles tentatively identified as chrysocolla, malachite and a dark red brown substance likely to be cuprite. Around 10% of the mass was transparent silicates (quartz?) and 20% clay lumps remained.

The material washed through the sieve contained a lot of clay material plus ?cuprite and ?malachite in all sizes down to 20 microns and finer.

The +38 micron fraction was inspected, and contained relatively little clay lump. The major species present was ?quartz, with a substantial amount of ?cuprite and rather less ?malachite. There was visibly less copper mineral present than in the +106 micron fraction.

The -38 micron dry sieve fraction was observed, and appeared to consist dominantly of ?quartz, with 20- 30% clay lump, and trace ?cuprite and rare ?malachite.

The -38 micron wet fraction was inspected. By dispersing in water, it was possible to observe minor cuprite, but the sample appeared to consist dominantly of clay lump.

No recognisable native copper was seen in any fractions. Presumably, from Ken Morrison's observations, all native copper had converted to cuprite. Since native copper can certainly be stable in air, there is presumably some reason why the native copper in the copper clays is so reactive.

Very rare grey black and very friable mineral was seen, possibly chalcocite. Rare fresh and sharp edged sulphide was also seen, and it was thought could have arisen from contamination in screening, but could also have come from the copper clays.

It seems quite likely from the assays and observation that most, possibly all, of the copper is present as discrete copper mineral and tends to be fairly coarse. However, because of the generally soft nature of the minerals, they are readily broken down to finer sizes. It is possible some copper is absorbed onto clay mineral.

3.3 *Flotation*

Table 3 summarises the results of flotation tests conducted by MLMRC on a number of copper clay samples. Unfortunately only one test records the reagents used, which were xanthate, a di-thiophosphate and Aero 404, which is recommended for tarnished and secondary copper minerals.

One test tried sulphidisation on a mids product without success - it is assumed from the mention of this that no other tests used sulphidisation.

Results of flotation appear to have been quite good. Three out of the four samples had about 80% of the copper in the "sand" fraction, in two cases in about 25% of the weight. Flotation recovery of the copper in this fraction was about 90%. Flotation recovery overall varied from 31% to 77%. The lowest recovery was from a sample with head grade 0.13% Cu, but one high grade sample (head grade 1.8%) also gave poor overall recovery because 54% of the copper reported to the slimes. However, nothing is known of how the sand/slime separation was done, or what the approximate split size was.

It appears from these results that a considerable variation in metallurgical response to physical separation procedures could be expected and would be driven mainly by the size distribution of the copper.

It is interesting that the recovery from Lyell Blocks ore by gravity methods was quoted at 72%.

4. PROCESS OPTIONS

A number of approaches could be envisaged for recovering copper:

a) Deslime (10 microns?) and float the oversize, potentially in the existing plant, probably more successfully with a tailored reagent regime. Maximum recovery about 70%.

b) Deslime (38 microns) and recover copper from oversize on say spirals. Maximum recovery about 60%.

c) Recover copper using a centrifugal concentrator, with or without prior desliming. Possible machines are a continuous Falcon or Knelson concentrator, Kelsey jig or Mosley Multi-gravity concentrator. The latter two are quite expensive, but cannot be ruled out at this stage. Maximum recovery unknown, but probably about 70% on the ore sample examined.

d) For the above three approaches, very coarse material might go directly to concentrate, and the concentrate could probably be mixed with existing sulphide flotation concentrate for sale and treatment.

e) Recover the copper by leaching. Acid leaching is the simplest approach, but given the presence of native copper and/or cuprite, will probably be unsuccessful. Ammonia/ammonium carbonate leaching would probably be technically successful - in fact almost ideally suited to this ore. Leaching followed by solvent extraction and electrowinning would have the benefit of producing copper on site. The biggest difficulty I think would be liquid-solid separation - desliming to eliminate clay fines would probably be necessary. Other problems would be capital cost and ammonia recovery costs. Recovery could be >90% if the clay fraction is leached, but more likely about 70% with desliming and direct discard of the clay.

I have little doubt from data available now that most or all of the above methods would be technically feasible. The highest recovery would likely be from leaching, and the lowest from desliming and spirals. Cost would probably be in the same order as recovery. The big question is whether any of these techniques could be economically viable. King Lyell would obviously be the best prospect on the basis of grade, but with very little tonnage available to justify an operation.

5. VIABILITY

The combination of low grade and low tonnage for the copper clay resource means that it is likely to be difficult to mine and treat economically. Capital and operating costs for a small plant would be high, and the best chance would probably be if enough tonnes could be proved up for say an operation treating 1 million tpa over 5 years.

On the downside, capital cost would be significant, even for a simple deslime and spiral or float type operation. The simplest flowsheet would involve perhaps a log washer or agitator to disperse the clays in water, a screen to remove coarse material and trash, spiral concentrators for recovery, possibly a thickener and either a tailings dam or a pipeline to the existing tailings dam. Addition of flocculant and possibly a clarification agent would likely be necessary to produce a clear overflow for discharge to the environment or re-use in the plant.

Taking account of the cost of tailings disposal, the cost of $1.50/t for copper recovery seems too low, for a small scale operation. For a resource of say 600,000 t, and a throughput of say 200,000 tpa, 1 shift operator represents a cost of $1/t ore.

The cost of copper transport and recovery will depend very much on concentrate grade if the copper is sold as a concentrate. However, it is important to note that the cost of realisation depends on the amount of copper in the ore, so low grade ore has low realisation costs.

On the upside, perhaps mining costs could be reduced below those quoted by Kevin Wills. Would it be possible to recover clay using a floating dredge/pump and so perhaps reduce the stripping ratio?

There is some possibility that grades in drill holes could be underestimates, given the relatively coarse size of the copper. The sludge assays quoted by Kevin suggest that lost material might be higher in grade. If coarse and dense copper occurs in a clay matrix, is the copper more or less likely to be recovered in drilling than the clay?

However, it seems unlikely that actual grades would be much higher than those estimated from drill holes, since the Lyell Blocks operation was presumably trying to follow high grade material, and head grades declined from 4.3% at the start of operations to 1.5% by the end. Still, 1.5% is substantially higher than 0.5% Cu.

For the Blocks, there also seems to be a reasonable chance of some gold and silver which would be recovered in a gravity or flotation process - the amount seems highly variable. If we assume 0.2 g/t Au and 3 g/t silver, that would add about $4/t to the ore value.

6. RECOMMENDATIONS

6.1 Metallurgical Testwork

I suggest the following approach:

1) Re-screen both surface exposure and drill samples by wet sieving with gentle brushing to break up clay lump. Brushing should be continued until the water runs clear. To avoid damaging the sieve, this could be done on say a 75 micron sieve, then the undersize poured through a 38 micron sieve. The +38 micron fraction should be dry screened on 600, 300, 150, 75 and 38 micron screens. Assay a portion of the -38 micron combined dry and wet fraction.

The combined -38 dry + wet fraction of undersize should be carefully dispersed in water in a 1 litre beaker, with say 100 mm of water depth. Disperse avoiding swirling, then allow to settle for 120 minutes (+- 10 minutes OK). Decant off the suspended solids, but be careful to avoid disturbing the settled solids. Leave about 1 cm of water in the beaker. Make up to 10 mm water depth, and repeat. Repeat again. This should eliminate most material finer than around 4 microns. Cyclosize, and collect the first dustbin full of cyclosizer - cone 5 product, then discard the remainder of the - cone 5. Cones 1-3 and 4 & 5 may be combined. Assay all sieve fractions, cone 1-3, cone 4-5, -cone 5 cyclosizer and beaker decantation fines separately, for copper only. Also make up samples of the combined sieve size fractions, cones 1-5 and -5 combined, and beaker decant solids and assay for gold and silver.

2) Prepare a sample of surface exposure and drill "core" material for gravity separation , by the same procedure as used for preparing the cyclosizer feed sample. Send settled and decanted solids to Central Mineralogical Services for Superpanning and microscopic examination.

3) Leach a sample of unsized surface ore in sulphuric acid. Record the acid consumption and measure the copper extraction.

4) Leach a sample of unsized surface ore in acid drainage liquor (say from sample point H3 & H4). If necessary, supplement the AD with sulphuric acid.

5) Leach a sample of unsized surface ore in ammonia/ammonium carbonate under atmospheric conditions.

6) Deslime about 2 kg of surface exposure ore by decanting from a bucket (allow 10 minutes settling time per cm of water depth, and repeat the decantation operation 3 times). Assay and discard the suspended solids. Carry out a flotation test on the settled solids. It may be necessary to obtain a suitable reagent from Cytec, depending on what we have available.

The above testwork will indicate what methods of concentration could be viable, and what recovery might be expected.

6.2 Scoping Study

Before proceeding further, I suggest a desktop scoping study should be carried out, to see whether a project could potentially be feasible.

At this stage I would suggest that for the project to have a chance, and to have a worthwhile impact on cash flow, it would be necessary for the copper clays in the Blocks at least to be economic to treat, so that a reasonable plant capacity could be established based on mining King Lyell first, then the Blocks.

6.3 Drill Core Loss

Would it be possible to establish the effect of core loss on drill grade by drilling a short hole in accessible copper clays, then confirming grade from a bulk sample?

Nick Clarke

TABLE 1: Size Analysis

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Size Analysis on:	Cu Clay Sample 1 - King Lyell Outcrop
Sampled:	

Cyclo Cone	Sieve Size Microns	Wgt g	Cu %	Zn %	Pb %	Wgt Held %	Cum Wgt Pass %
	850					0	100.00
	600	5.09	5.80	0.50	0.017	2.56	97.44
	425	9.27	5.80	0.50	0.017	4.67	92.77
	300	10.17	5.80	0.50	0.017	5.12	87.65
	212	5.79	5.80	0.50	0.017	2.91	84.74
	150	0.00	0.00	0.00	0.000	0.00	84.74
	106	8.58	6.35	0.48	0.015	4.32	80.42
	75	0.00	0.00	0.00	0.000	0.00	80.42
	53	8.58	6.85	0.43	0.011	4.32	76.10
	38	3.63	3.65	0.39	0.011	1.83	74.27
	-38	147.52	1.24	0.36	0.016	74.27	-
Cone 1	45.2	-	1.23	0.26	0.010	0.44	73.83
Cone 2	33.1	-	1.23	0.26	0.010	1.01	72.82
Cone 3	23.7	-	1.23	0.26	0.010	4.31	68.51
Cone 4	17.2	-	0.67	0.22	0.007	6.24	62.27
Cone 5	12.3	-	0.67	0.22	0.007	6.20	56.08
- Cone 5	-12.3	-	0.79	0.42	0.019	56.08	-
Calc -38			0.80	0.37			
Total Calculated		198.63	2.44	0.39	0.016	100.00	-
Total Measured		200	2.70	0.40	0.015		

Wet Sieve Weights	
Head g	200
+38W g	55.27
-38W g	143.56
-38D g	3.96
Checks:	
-38 Dry	3.96
Total	
Dry Calc	55.07
Dry Meas	55.27
+38 Wet	55.27
-38 Wet	143.56
Total	
Wet Calc	198.83
Wet Meas	200.00

Cyclosizer Data	Wgt g	Wgt %
Cone 1	0.31	0.590
Cone 2	0.72	1.358
Cone 3	3.08	5.807
Cone 4	4.45	8.400
Cone 5	4.42	8.342
-Cone 5	-	75.504
Head	52.98	100.000

Particle S.G.	2.7
Elutriation Temperature	11
Elutriation Flowrate	180
Elutriation Time, mins	30

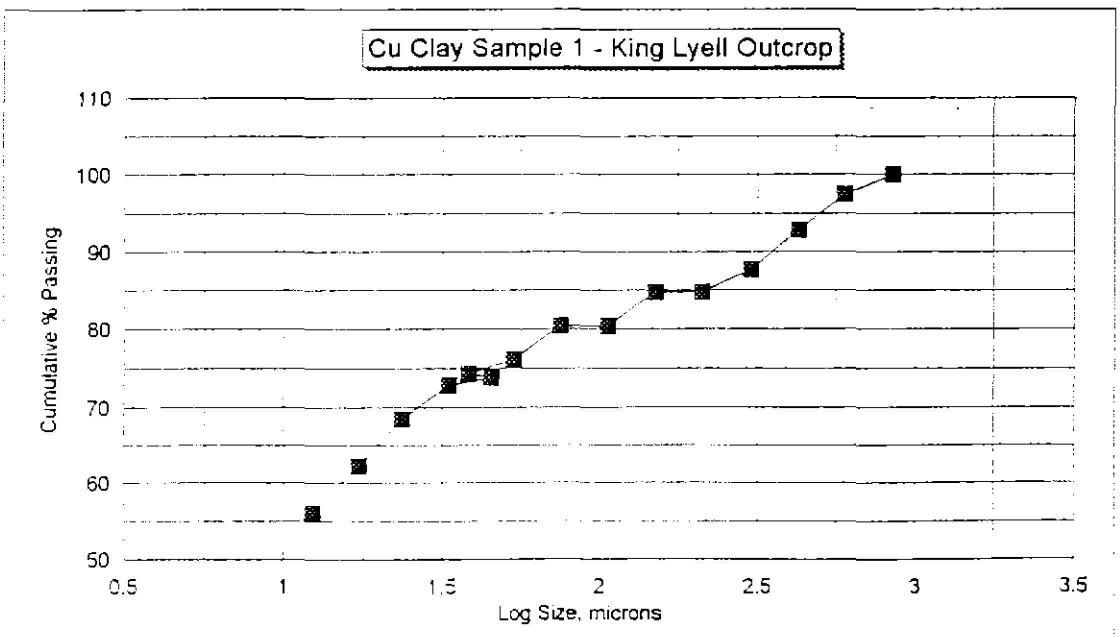


TABLE 2: Copper Clay King Lyell Outcrop Sample

Sieve Size Microns	Weight % Held	Cu %	Cu Units	Cu Dist %	Corr Cu Dist %	Cum Cu Dist %
212	15.26	5.80	88.51	36.23	36.23	36.23
106	4.32	6.35	27.43	11.23	11.23	47.46
53	4.32	6.85	29.59	12.11	12.11	59.57
38	1.83	3.65	6.68	2.73	2.73	62.30
-38 Measd	74.27	1.24	92.09	37.70	37.70	100.00
-38 Calcd	74.28	0.80	59.72			
23.7	5.76	1.23	7.08	2.90	4.47	66.78
12.3	12.44	0.67	8.33	3.41	5.26	72.04
-12.3	56.08	0.79	44.30	18.13	27.96	100.00
Total Calc	100	2.44	244.31	100.00		
Head Assay	100	2.70				

TABLE 3: Summary of MLMRC Flotation Results on Copper Clays

Sample	Head	Sands						Slime				
	% Cu	% Cu	% Wgt	Cu Dist %	Cu Rec Sand %	Cu Rec Total %	Conc Cu %	% Cu	% Wgt	Cu Dist %	Cu Rec %	Conc Cu %
Native Copper Clays	2.3	6.67	26.53	77.60	91.49	71.00	26.81	0.70	73.47	22.40		
Cu Blocks Float II	0.1	0.13	50.30	57.30	55.15	31.60	0.86	0.09	49.75	43.01		
Consols 3	0.9	1.78	22.70	86.72	89.46	41.60	17.30	0.61	77.30	53.50		
Cu Blocks V	0.3	0.34	64.80	84.80	91.27	77.40	10.48	0.11	35.20	15.20		
King Lyell Outcrop (1996)	1.4	5.91	25.70	62.30				1.24	74.30	37.70		

Conditions of Leach Tests

Weight	1.000g	: This is the standard weight used for copper analysis
Volume	850-950ml	: A 1L beaker was used and this was the largest the would enable the beaker to sit on a magnetic stirrer and still allow the collection tube to reach over the top into the solutuon. This dilution ie 1 in 850 or 950, also enables a very good absorbance on the AAS
Floc	50ml	This was used to settle out the solids as soon as possible so as to prevent a blockage in the AAS The Floc used was 10% Superfloc used in the lab for analytical purposes

Method of Leach Tests

Time	0min	Turn Stirrer on and add Acid or Acid Drainage straight away.
	5min	Read pH and turn off stirrer.
	7min	Read std on AAS, then solution.
	9min	Read solution.
	11min	Read solution.
		On the Ammonia and pure Acid Drainage leaches, the settling times needed to be extended, due to the high % solids.

Note:

The pH reading was casually oberseved during the 5min of stirring and had usually stablised by 2-3min .
The Sulphuric Acid was actually added as 50% Sulphuric Acid, this was to enable safer handling. The numbers reported on the results sheet is the equivalent amount of pure sulphuric acid.

It was also noted on the -38um leach tests that after about 10hrs the pH had droped by about 5% and the copper level had risen by about 10%.

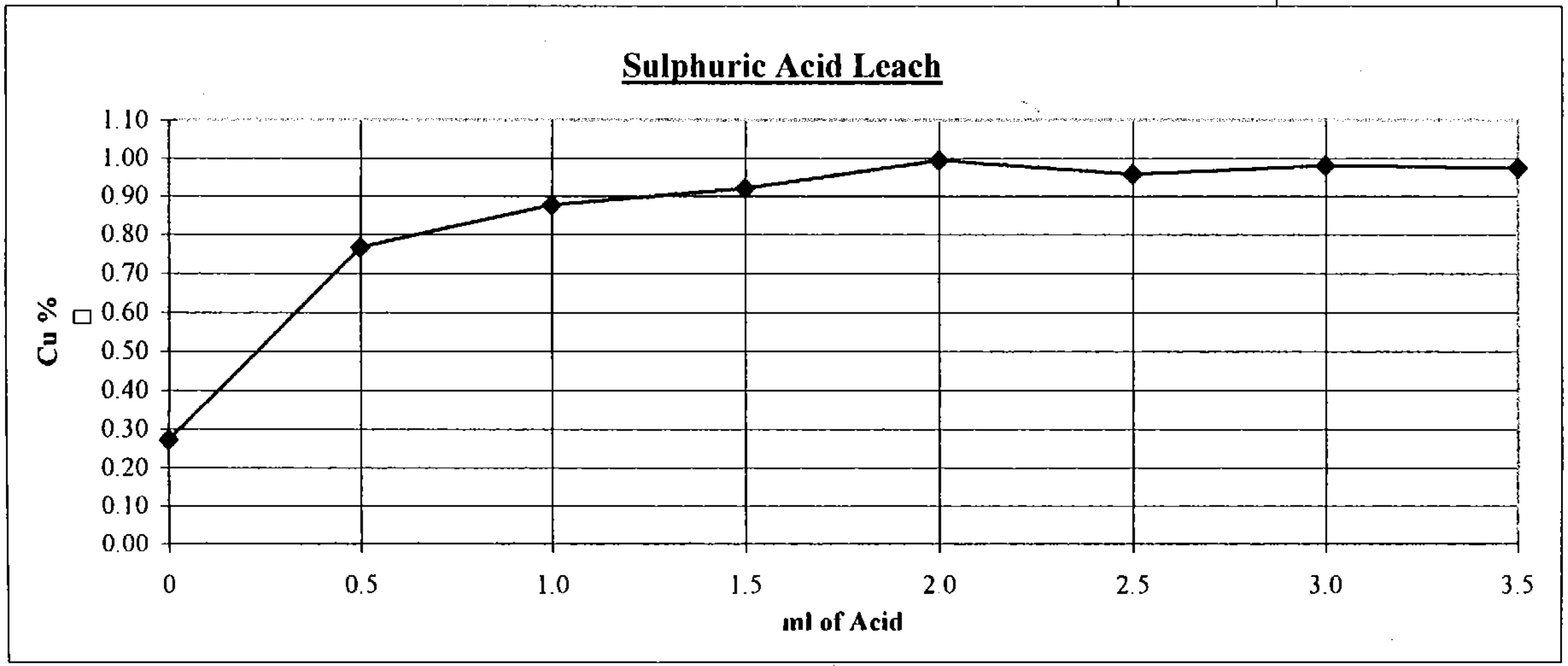
Sulphuric Acid added to Copper clay (-38 fraction) in water

416077

Sample Weight 1.00g
Solution Volume 800ml
includes 50ml Floc

Head grade of sample =	1.24	% Cu
1.000g of sample contains =	12.4	mg of Cu

50% Acid Volume	Equivalent Acid Volume	Cu% Reading 1	Cu% Reading 2	Average	%Cu after dilution	Recovery %	Cu in sol ppm	Std
0	0	0.101	0.102	0.102	0.27	0.22	3.38	0.100
1	0.5	0.290	0.284	0.287	0.77	0.62	9.57	0.100
2	1.0	0.328	0.329	0.329	0.88	0.71	10.95	0.100
3	1.5	0.345	0.345	0.345	0.92	0.74	11.50	0.100
4	2.0	0.368	0.377	0.373	0.99	0.80	12.42	0.098
5	2.5	0.358	0.360	0.359	0.96	0.77	11.97	0.099
6	3.0	0.370	0.365	0.368	0.98	0.79	12.25	0.100
7	3.5	0.366	0.365	0.366	0.97	0.79	12.18	0.098

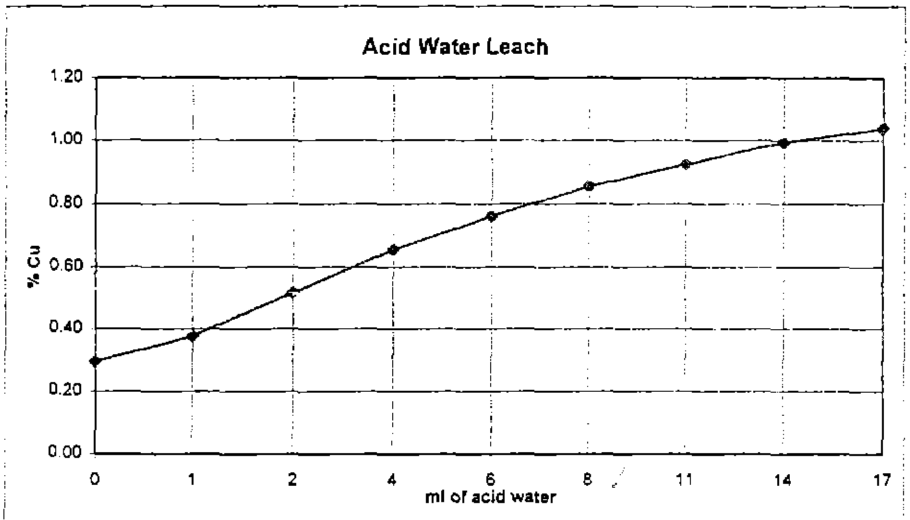


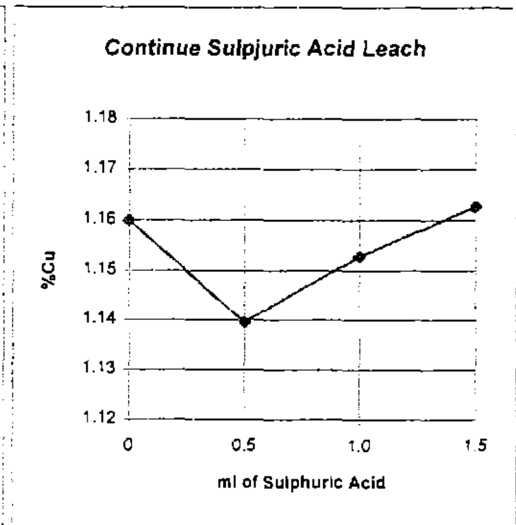
416078

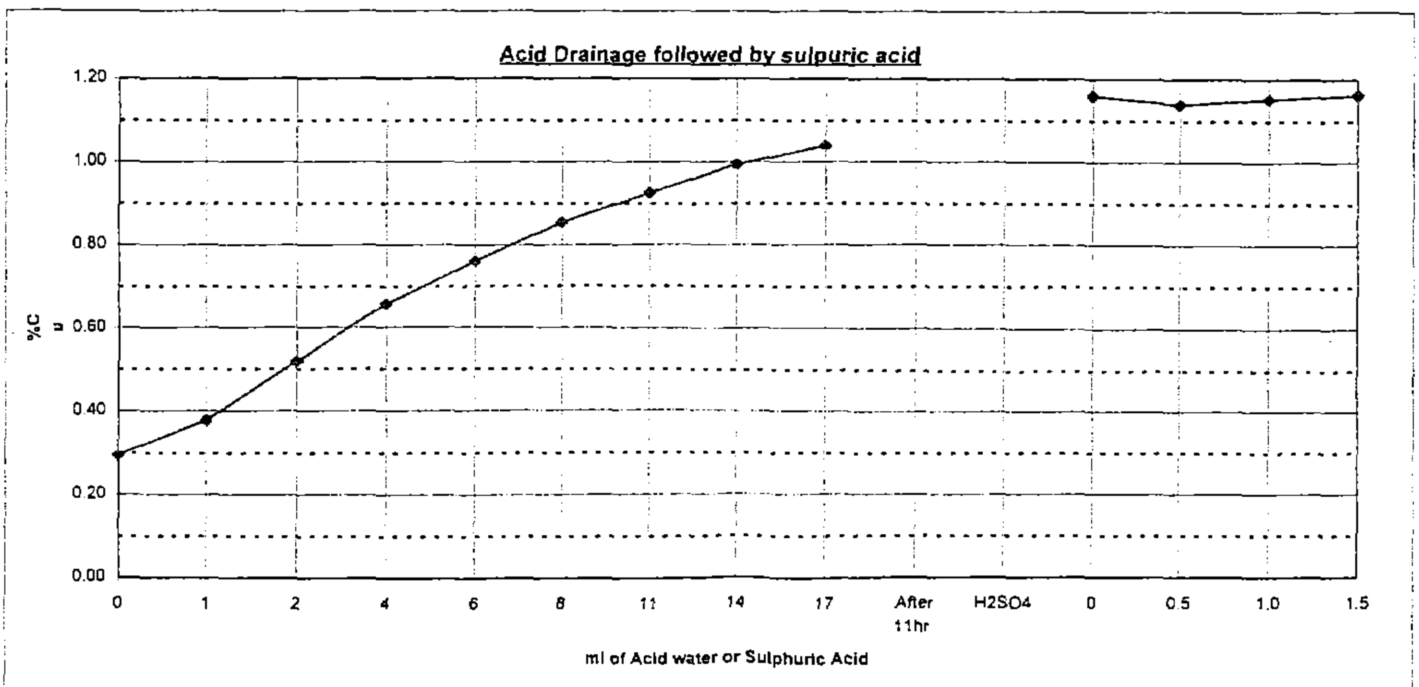
Leaching (-38 Fraction) using Acid Drainage followed by Sulphuric Acid

Weight	1.00g	Acid Drainage water: **pH 2.4**	**130ppm Cu**
Volume	800ml		
floc	50ml	1ml of Acid Drainage water in 800ml = 0.16ppm Cu	
		17ml of Acid Drainage water in 800ml = 2.8ppm Cu	

Acid water	Reading			Average	Dilution	pH	std	Cu ppm in
ml	2min	3min	4min	%Cu	correction		% Cu	Solution
0	0.112	0.112	0.108	0.111	**0.30**	5.3	0.105	9.84
1	0.149	0.141	0.135	0.142	**0.38**	4.7	0.105	12.59
2	0.189	0.195	0.198	0.194	**0.52**	4.1	0.104	17.24
4	0.243	0.248	0.248	0.246	**0.66**	3.7	0.104	21.90
6	0.286	0.283	0.288	0.286	**0.76**	3.5	0.106	25.39
8	0.323	0.319	0.320	0.321	**0.86**	3.3	0.103	28.50
11	0.343	0.349	0.349	0.347	**0.93**	3.2	0.103	30.84
14	0.377	0.372	0.369	0.373	**0.99**	3.1	0.103	33.13
17	0.390	0.392	0.387	0.390	**1.04**	3.0	0.106	34.64
After 11hr								
H_2SO_4								
0	0.440	0.432	0.433	0.435	**1.16**	3.1	0.105	38.67
0.5	0.425	0.428	0.429	0.427	**1.14**	2.1	0.104	37.99
1.0	0.430	0.434	0.433	0.432	**1.15**	1.7	0.102	38.43
1.5	0.437	0.436	0.435	0.436	**1.16**	1.6	0.101	38.76







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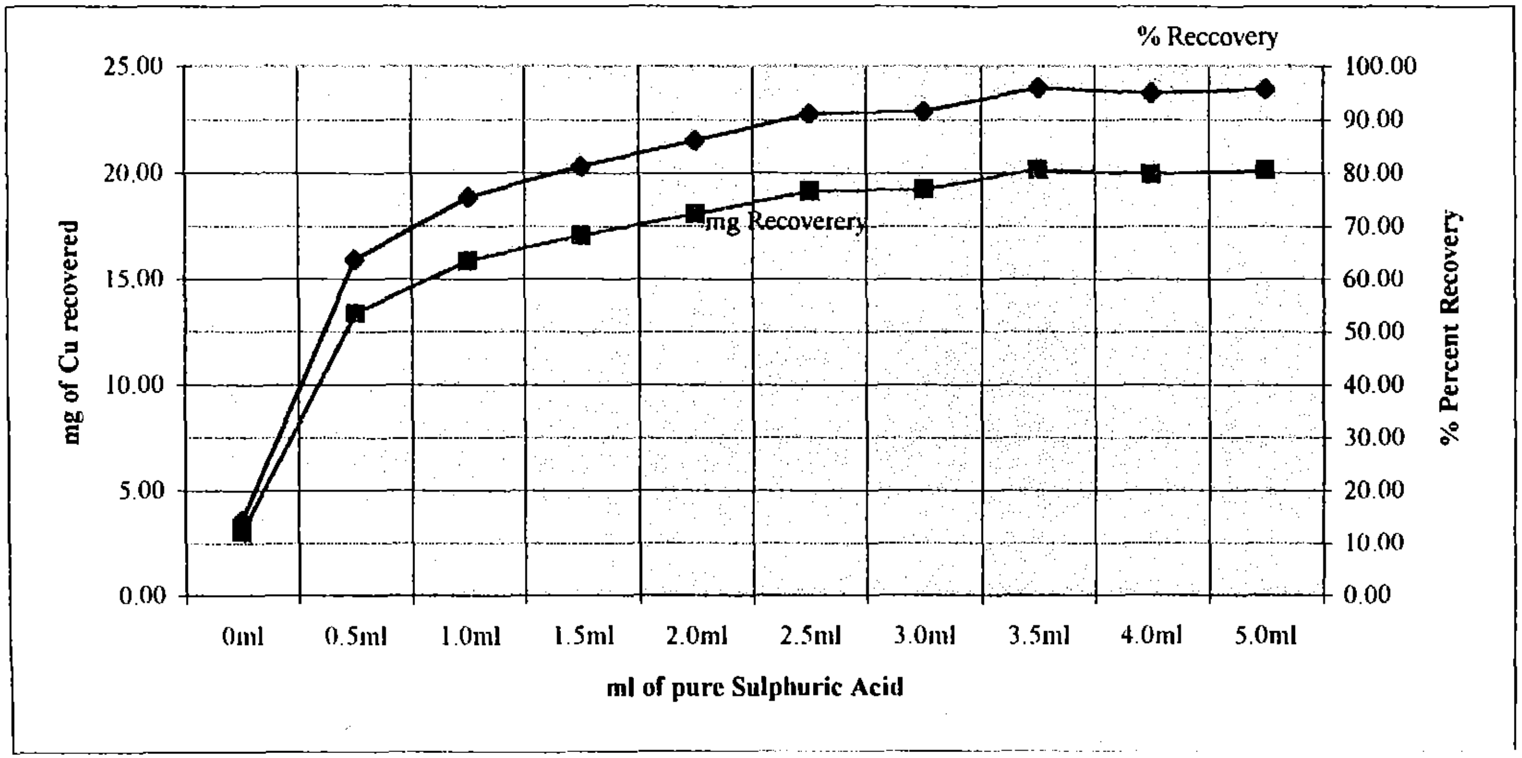
416079

Sample Weight	1.000g
Solution Volume	950ml
includes	50ml Floc

Head grade of sample =	2.10	% Cu
1.000g of sample contains =	21.0	mg of Cu

Acid Drainage added Volume	pH	Cu% Reading 1	Cu% Reading 2	Cu% Reading 3	Cu % Average	mg of Cu released from sample	Recovery %	Std
0ml	4.93	0.314	0.295	0.301	0.303	3.03	14.43	0.500
0.5ml	1.90	1.311	1.324	1.374	1.336	13.36	63.63	0.502
1.0ml	1.67	1.568	1.577	1.609	1.584	15.84	75.45	0.506
1.5ml	1.48	1.704	1.688	1.729	1.707	17.07	81.28	0.504
2.0ml	1.37	1.777	1.818	1.827	1.807	18.07	86.05	0.509
2.5ml	1.28	1.894	1.929	1.919	1.914	19.14	91.13	0.510
3.0ml	1.20	1.899	1.935	1.934	1.923	19.23	91.55	0.498
3.5ml	1.14	1.957	2.125	1.967	2.016	20.16	96.01	0.509
4.0ml	1.10	1.982	1.973	2.027	1.994	19.94	94.95	0.518
5.0ml	1.00	2.024	1.995	2.014	2.011	20.11	95.75	0.517

*Note : The Sulphuric Acid was actu*Note : The Sulphuric Aci*Note : The Sulphuric AciNote : The Sulphuric Acic : The Sulphuric A



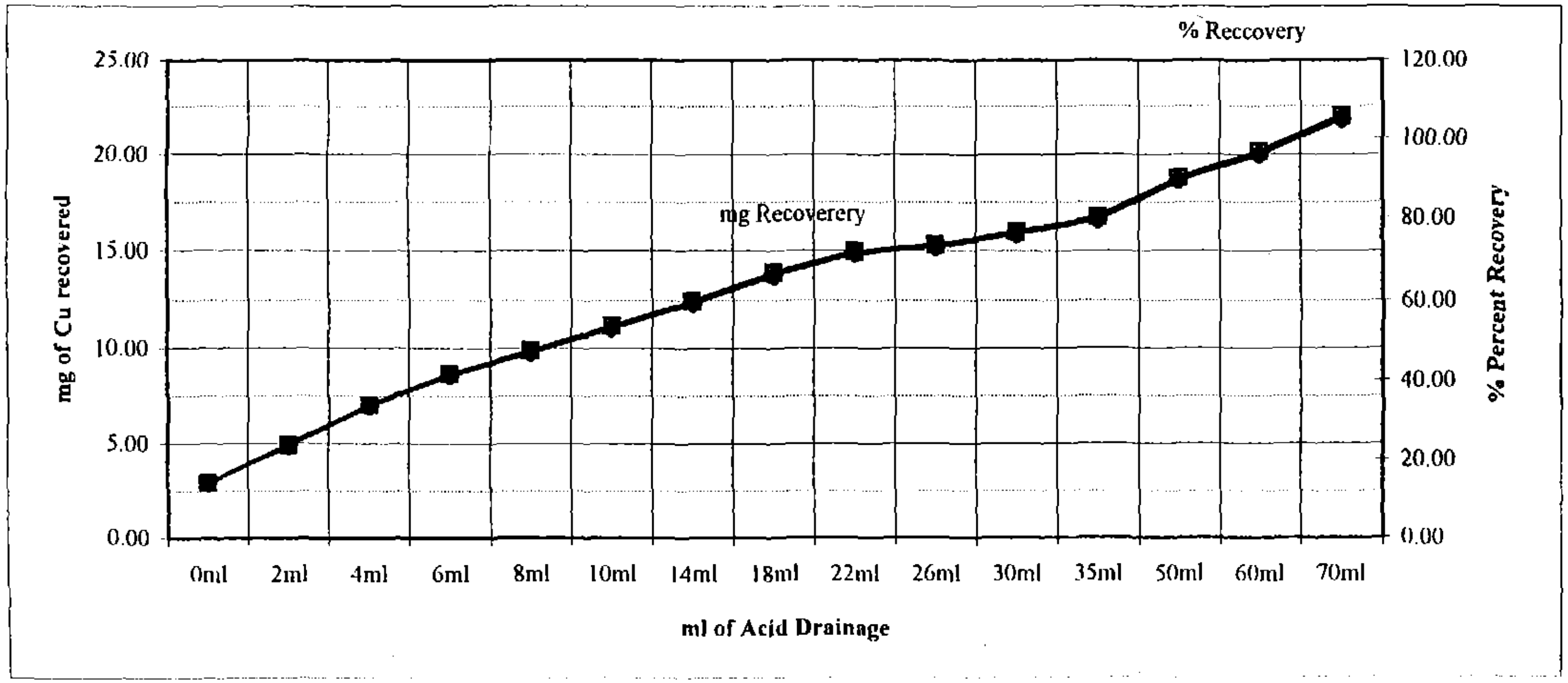
H3 & H4 Acid Drainage added Copper clay in water

416080

Sample Weight	1.000g
Solution Volume	900ml
includes	50ml Floc

Cu in Acid Drainage =	130	mg/L
pH =	2.4	
Head grade of sample =	2.10	% Cu
1.000g of sample contains =	21.0	mg of Cu

Acid Drainage added Volume	pH	Cu% Reading 1	Cu% Reading 2	Cu% Reading 3	Cu % Average	mg of Cu released from sample	Recovery %	mg of Cu added in AD	Std
0ml	4.9	0.299	0.299	0.288	0.295	2.95	14.05	0.000	
2ml	Not Analysised	0.504	0.495	0.480	0.493	4.93	23.48	0.015	0.495
4ml	3.8	0.705	0.705	0.705	0.705	7.05	33.57	0.031	0.494
6ml	3.7	0.870	0.879	0.849	0.866	8.66	41.24	0.046	0.496
8ml	3.5	0.975	1.005	0.981	0.987	9.87	47.00	0.062	0.509
10ml	3.4	1.104	1.134	1.107	1.115	11.15	53.10	0.077	0.510
14ml	3.2	1.242	1.266	1.230	1.246	12.46	59.33	0.108	0.503
18ml	3.1	1.371	1.386	1.401	1.386	13.86	66.00	0.138	0.506
22ml	3.1	1.488	1.497	1.503	1.496	14.96	71.24	0.169	0.510
26ml	3.0	1.521	1.521	1.548	1.530	15.30	72.86	0.200	0.506
30ml	2.9	1.572	1.608	1.608	1.596	15.96	76.00	0.231	0.500
35ml	2.9	1.659	1.659	1.692	1.670	16.70	79.52	0.269	0.513
50ml	2.8	1.917	1.885	1.835	1.879	18.79	89.48	0.346	0.520
60ml	2.8	2.016	2.016	2.013	2.015	20.15	95.95	0.423	0.510
70ml	Not Analysised	2.187	2.202	2.211	2.200	22.00	104.76	0.500	0.513



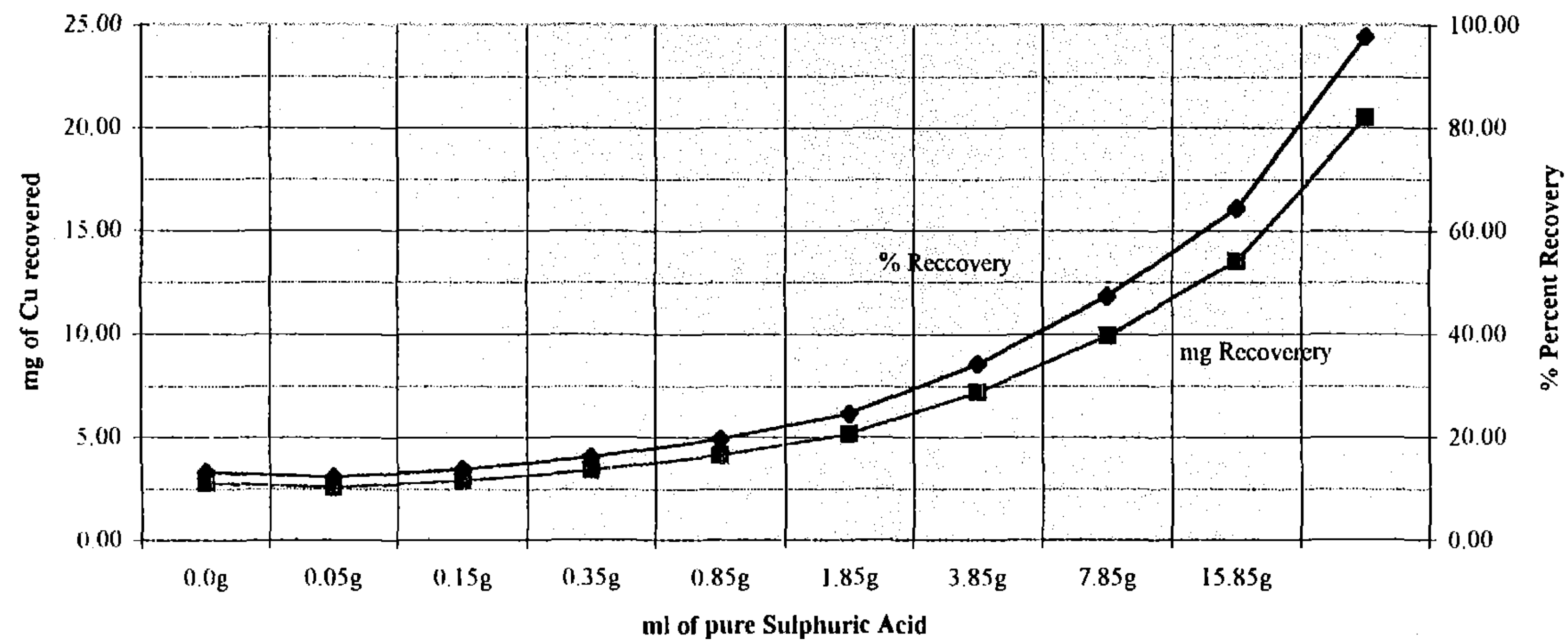
Ammonia Carbonate added to Copper clay in water

416081

Sample Weight	1.000g
Solution Volume	850ml
includes	50ml Floc

Head grade of sample =	2.10	% Cu
1.000g of sample contains =	21.0	mg of Cu

$(NH_4)_2CO_3$ added to solution	Total solids (g)	pH	Cu% Reading 1	Cu% Reading 2	Cu% Reading 3	Cu % Average	mg of Cu released	Recovery %	Std
0.0g	0.0g	4.10	0.267	0.278	0.285	0.277	2.77	13.17	0.101
0.05g	0.05g	4.50	0.264	0.252	0.255	0.257	2.57	12.23	0.102
0.10g	0.15g	6.70	0.286	0.289	0.292	0.289	2.89	13.76	0.101
0.20g	0.35g	7.80	0.343	0.332	0.346	0.340	3.40	16.19	0.103
0.50g	0.85g	8.40	0.408	0.408	0.422	0.413	4.13	19.65	0.108
1.00g	1.85g	8.80	0.513	0.519	0.516	0.516	5.16	24.56	0.109
2.00g	3.85g	8.90	0.714	0.720	0.728	0.721	7.21	34.31	0.109
4.00g	7.85g	9.00	0.978	1.003	0.997	0.993	9.93	47.27	0.103
8.00g	15.85g	9.00	1.335	1.352	1.366	1.351	13.51	64.31	0.104
After 14 hrs			2.05	2.01	2.09	2.050	20.50	97.62	0.102

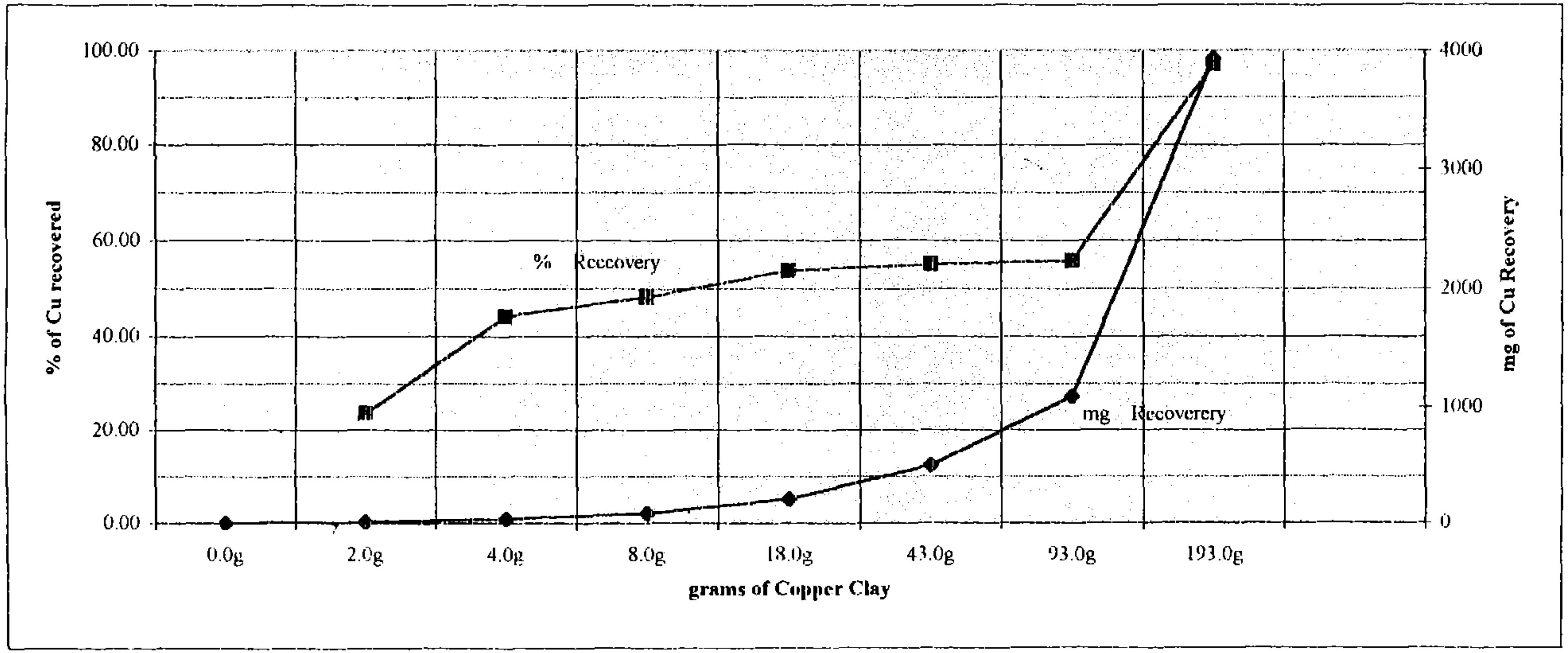


Copper Clay added to H3 & H4 Acid Drainage leach conditions

Solution Volume	850ml
includes	50ml Floc

Cu in Acid Drainage =	279	mg/L
pH =	2.3	
Head grade of sample =	2.10	% Cu
1.000g of sample contains =	21.0	mg of Cu

Copper clay added to solution	Total solids (g)	pH	Cu ppm Reading 1	Cu ppm Reading 2	Cu ppm Reading 3	Cu ppm Average	Cuppm - AD	Cu mg/L	mg of Cu in sample	Recovery %	Std
0.0g	**0.0g**	2.18	273	275	277	275	0	0	0		
2.0g	**2.0g**	2.19	290	280	290	287	11.7	9.9	42	23.61	507
2.0g	**4.0g**	2.21	313	318	325	319	44	37.1	84	44.19	539
4.0g	**8.0g**	2.25	361	372	378	370	95	81.0	168	48.23	503
10.0g	**18.0g**	2.39	510	510	522	514	239	203	378	53.74	514
25.0g	**43.0g**	2.62	861	861	861	861	586	498	903	55.16	507
50.0g	**93.0g**	2.82	1523	1575	1571	1556	1281	1089	1953	55.77	517
100.0g	**193.0g**	3.13	3062	5062	4822	4900	4625	3931	4053	97.00	511



Note: Test was stopped due to the very high solids and that the levels of copper in solution was beyond the scope of the AAS.
In-line filters would be required filter the solids and allow a dilution, with minimum volume loss.

416083

MEMORANDUM

TO: Peter Benjamin

FROM: Tony Weston

DATE: 1 August, 1997

SUBJECT: King Lyell Copper Clays

CC: Hamish Bohannan, Colin Farr, Nick Clarke, Peter Williams

Scope

To recommend a strategy for further exploration work on the King Lyell copper clay deposit, and other copper clays in general.

The study was intended to briefly examine the potential economics of the King Lyell, without detailed geology, mining or milling plans. High grading was not considered.

Conclusions

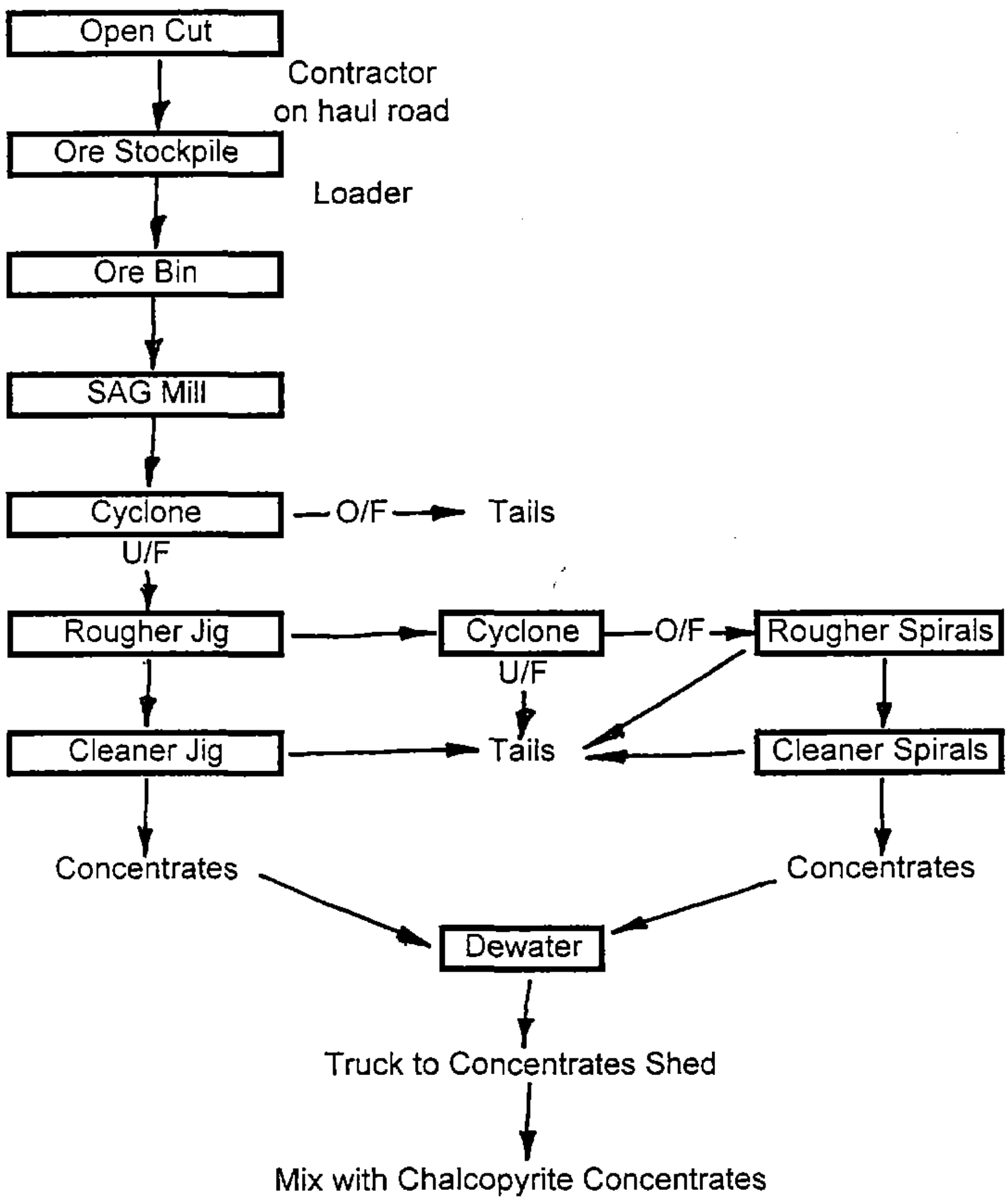
- the current lower grade (full) King Lyell resource has a negative NPV at 250,000 tpa due to the small size of the deposit and the capital cost of setting up a mill
- a conceptual larger resource at a similar grade, mined at 750,000 tpa for ten years would have a positive NPV, but sensitive to changes in operating costs, head grade, stripping ratio and copper price
- environmental and operating strategies for this area of the Linda Valley would need to be well thought through

Recommendations

- check the overall potential resource for the King Lyell and other copper clays
- if this is likely to be in the range from 5 to 10 million tonnes continue with further exploration work
- if less than 5 million tonnes it is unlikely for the copper clays to be attractive

Tony Weston
Senior Mining Engineer

PROPOSED KING LYELL COPPER CLAYS FLOW CHART



O/F - overflow
U/F - underflow

AJW/30.7.97

ap 18. Regional gravity contours (Bouger residual) superimposed on magnetics (1st VD with TMI colour drape). EL 52/94 tenement boundaries, Mount Lyell area, Queenstown, Tasmania, on a 10,000 grid.

5 cm

416085

Map 32: Gravity image, Bouger residual for area of 250m and regional 1km station spacing data - , Linda EL 52/94 tenement boundaries, Queenstown, Tasmania, on a 10,000 grid.

5 cm

416086

416087

Map 33: Regional and detailed gravity contours (Bouger residual) superimposed on magnetics (1st VD with TMI colour drape) - , Linda EL 52/94 tenement boundaries, Queenstown, Tasmania, on a 10,000 grid.

5 cm

97-4092

ANNUAL REPORT - EL 52/94
KC MORRISON - COPPER MINES
OF TASMANIA

APPENDIX 3

**BURBURY VOLCANICS DATA SHEETS
AND MAGNETICS DISK**

Copper Mines of Tasmania

DataSet BV Prospect Burbury Volcanics

Sample No.	AMG North	AMG East	Cu ppm	Cu ppb	Au ppm	Au ppb	Ag ppm	Pb ppm	Pb ppb	Zn ppm	Zn ppb	As ppm	description
	5341744.6	387427.61											MMI
H0751	5341607.1	387452.14		7480		0.92			2540		400		MMI
H0752	5341626.7	387449.26		7880		0.77			7860		480		MMI
H0753	5341646.2	387445.48		3480		-0.25			5380		200		MMI
H0754	5341665.9	387441.62		6180		0.31			282		260		MMI
H0755	5341685.9	387436.73		1560		1.26			9660		800		MMI
H0756	5341705.1	387434.39		7320		0.78			11100		1120		MMI
H0757	5341724.6	387431.16		12600		0.42			7980		1080		MMI
H0758	5341764.0	387423.87		7980		0.32			19700		1260		MMI
H0759	5341784.1	387420.29		5960		0.99			6680		840		MMI
H0760	5341803.2	387416.58		4360		0.56			2320		400		MMI
H0761	5341823.0	387413.09		7560		0.56			4380		880		MMI
H0762	5341841.0	387410.05		7280		0.76			9040		440		MMI
H0763	5341862.5	387406.46		7520		0.44			8960		180		MMI
H0764	5341882.1	387402.89		2820		-0.25			2200		340		MMI
H0765	5341901.8	387399.45		5220		0.42			5940		200		MMI
H0766	5341921.3	387396.25		9200		1.61			8980		560		MMI
H0767	5341940.8	387391.92		5400		0.91			7400		340		MMI
H0768	5341960.5	387388.25		18900		1.60			31500		620		MMI
H0770	5341999.6	387380.46		8980		1.02			11200		340		MMI

Sample No.	AMG North	AMG East	Cu ppm	Cu ppb	Au ppm	Au ppb	Ag ppm	Pb ppm	Pb ppb	Zn ppm	Zn ppb	As ppm	description
H0772	5342037.4	387373.31		2880		-0.25			4120		560		MMI
H0773	5342057.1	387369.64		2960		0.62			2300		100		MMI
H0774	5342076.8	387365.68		6920		0.87			6020		200		MMI
H0775	5342095.6	387362.24		9900		0.92			18800		200		MMI
H0776	5342116.8	387359.73		8140		0.40			9700		440		MMI
H0777	5342136.4	387356.13		2680		-0.25			2480		260		MMI
H0778	5342155.9	387352.32		9700		0.89			23700		520		MMI
H0779	5342175.5	387349.52		10400		1.48			1080		1420		MMI
H0780	5342194.8	387345.88		7740		1.00			17300		580		MMI
H0781	5342214.5	387342.20		6700		0.39			7260		240		MMI
H0782	5342234.8	387338.48		4300		0.34			4780		140		MMI
H0783	5342254.1	387335.00		3160		-0.25			3440		260		MMI
H0784	5342273.3	387331.67		6480		0.54			9500		340		MMI
H0785	5342292.1	387328.03		5520		0.32			5860		220		MMI
H0786	5342311.4	387325.32		1740		-0.25			1980		200		MMI
H0787	5342330.7	387321.89		1220		1.37			18700		280		MMI
H0788	5342350.2	387318.66		6800		0.58			9100		200		MMI
H0789	5342369.4	387315.23		9020		1.13			20600		160		MMI
H0790	5342388.3	387312.20		5500		0.44			3600		620		MMI
H0791	5342407.9	387308.23		1580		-0.25			2660		60		MMI
H0792	5342427.4	387305.16		3640		0.75			8980		280		MMI
H0793	5342447.0	387301.56		12400		0.70			11700		400		MMI
H0794	5342466.1	387297.88		18300		2.06			21980		540		MMI
H0795	5342486.1	387294.33		3480		0.40			2380		160		MMI

Sample No.	AMG North	AMG East	Cu ppm	Cu ppb	Au ppm	Au ppb	Ag ppm	Pb ppm	Pb ppb	Zn ppm	Zn ppb	As ppm	description
H0797	5342525.6	387285.86		4940		0.50			9100		760		MMI
H0798	5342544.4	387282.83		3720		0.28			2500		2260		MMI
H0799	5342563.6	387279.12		9220		0.44			8440		880		MMI
H0800	5342583.2	387275.75		2100		-0.25			1120		1000		MMI
H1101	5341607	387452.1	94		-0.005		-1	49		9			A HORIZ
H1102	5341607	387452.1	46		-0.005		-1	36		16			C HORIZ
H1103	5341627	387449.3	52		-0.005		-1	69		15			A HORIZ
H1104	5341627	387449.3	81		-0.005		-1	146		27			C HORIZ
H1105	5341646	387445.5	25		-0.005		-1	34		10			A HORIZ
H1106	5341646	387445.5	25		-0.005		-1	36		17			C HORIZ
H1107	5341666	387441.6	58		-0.005		-1	50		30			A HORIZ
H1108	5341666	387441.6	225		-0.005		-1	47		43			C HORIZ
H1109	5341686	387436.7											NTS
H1110	5341686	387436.7	83		-0.005		-1	91		17			C HORIZ
H1111	5341705	387434.4											NTS
H1112	5341705	387434.4	18		-0.005		-1	48		33			C HORIZ
H1113	5341725	387431.2											NTS
H1114	5341725	387431.2	37		-0.005		-1	38		26			C HORIZ
H1115	5341745	387427.6	65		-0.005		-1	65		42			A HORIZ
H1116	5341745	387427.6	71		-0.005		-1	47		43			C HORIZ
H1117	5341764	387423.9											NTS
H1118	5341764	387423.9	71		-0.005		-1	131		42			C HORIZ
H1119	5341784	387420.3	101		-0.005		-1	216		52			A HORIZ
H1120	5341784	387420.3	38		-0.005		-1	66		60			C HORIZ

Sample No.	AMG North	AMG East	Cu ppm	Cu ppb	Au ppm	Au ppb	Ag ppm	Pb ppm	Pb ppb	Zn ppm	Zn ppb	As ppm	description
H1121	5341803	387416.6											NTS
H1122	5341803	387416.6	62		-0.005		-1	65		36			C HORIZ
H1123	5341823	387413.1	96		-0.005		-1	403		68			A HORIZ
H1124	5341823	387413.1	71		-0.005		-1	291		67			C HORIZ
H1125	5341841	387410.1	34		-0.005		-1	70		43			A HORIZ
H1126	5341841	387410.1	16		-0.005		-1	26		66			C HORIZ
H1127	5341863	387406.5	39		-0.005		-1	86		60			A HORIZ
H1128	5341863	387406.5	30		-0.005		-1	55		63			C HORIZ
H1129	5341882	387402.9	46		-0.005		-1	84		36			A HORIZ
H1130	5341882	387402.9	11		-0.005		-1	26		35			C HORIZ
H1131	5341902	387399.5	79		-0.005		-1	80		22			A HORIZ
H1132	5341902	387399.5	36		-0.005		-1	62		22			C HORIZ
H1133	5341921	387396.3	105		-0.005		-1	203		36			A HORIZ
H1134	5341921	387396.3	44		-0.005		-1	87		27			C HORIZ
H1135	5341941	387391.9	92		-0.005		-1	183		40			A HORIZ
H1136	5341941	387391.9	30		-0.005		-1	96		49			C HORIZ
H1137	5341961	387388.3											NTS
H1138	5341961	387388.3	33		-0.005		-1	39		25			C HORIZ
H1139	5341978.0	387385.05											NTS
H1140	5341978.0	387385.05	7		-0.005		-1	17		38			C HORIZ
H1141	5342000	387380.5	14		-0.005		-1	66		50			A HORIZ
H1142	5342000	387380.5	29		-0.005		-1	87		65			C HORIZ
H1143	5342017.0	387377.98	127		0.032		-1	149		38			A HORIZ
H1144	5342017.0	387377.98	34		-0.005		-1	77		36			C HORIZ

Sample No.	AMG North	AMG East	Cu ppm	Cu ppb	Au ppm	Au ppb	Ag ppm	Pb ppm	Pb ppb	Zn ppm	Zn ppb	As ppm	description
H1169	5342273	387331.7	88		-0.005		-1	336		44			A HORIZ
H1170	5342273	387331.7	9		-0.005		-1	227		94			C HORIZ
H1171	5342292	387328											NTS
H1172	5342292	387328	38		-0.005		-1	279		388			C HORIZ
H1173	5342311	387325.3	180		-0.005		-1	666		56			A HORIZ
H1174	5342311	387325.3	26		-0.005		-1	796		260			C HORIZ
H1175	5342331	387321.9	104		-0.005		-1	267		45			A HORIZ
H1176	5342331	387321.9	39		-0.005		-1	340		201			C HORIZ
H1177	5342350	387318.7	49		-0.005		-1	270		35			A HORIZ
H1178	5342350	387318.7	34		-0.005		-1	348		42			C HORIZ
H1179	5342369	387315.2	117		-0.005		-1	498		45			A HORIZ
H1180	5342369	387315.2	58		-0.005		-1	1711		110			C HORIZ
H1181	5342388	387312.2											NTS
H1182	5342388	387312.2	20		-0.005		-1	53		14			C HORIZ
H1183	5342408	387308.2											NTS
H1184	5342408	387308.2	25		-0.005		-1	109		27			C HORIZ
H1185	5342427	387305.2											NTS
H1186	5342427	387305.2	75		-0.005		-1	237		14			C HORIZ
H1187	5342447	387301.6											NTS
H1188	5342447	387301.6	52		-0.005		-1	26		7			C HORIZ
H1189	5342466	387297.9											NTS
H1190	5342466	387297.9	22		-0.005		-1	173		27			C HORIZ
H1191	5342486	387294.3	23		-0.005		-1	209		23			A HORIZ
H1192	5342486	387294.3	29		-0.005		-1	705		126			C HORIZ

Sample No.	AMG North	AMG East	Cu ppm	Cu ppb	Au ppm	Au ppb	Ag ppm	Pb ppm	Pb ppb	Zn ppm	Zn ppb	As ppm	description
H1145	5342037	387373.3	20		-0.005		-1	41		37			A HORIZ
H1146	5342037	387373.3	12		-0.005		-1	36		51			C HORIZ
H1147	5342057	387369.6	16		-0.005		-1	189		38			A HORIZ
H1148	5342057	387369.6	24		-0.005		-1	429		52			C HORIZ
H1149	5342077	387365.7	110		-0.005		-1	377		78			A HORIZ
H1150	5342077	387365.7	65		-0.005		-1	292		81			C HORIZ
H1151	5342096	387362.2	60		-0.005		-1	228		62			A HORIZ
H1152	5342096	387362.2	48		-0.005		-1	195		65			C HORIZ
H1153	5342117	387359.7	136		-0.005		-1	454		71			A HORIZ
H1154	5342117	387359.7	52		-0.005		-1	196		100			C HORIZ
H1155	5342136	387356.1	83		-0.005		-1	271		86			A HORIZ
H1156	5342136	387356.1	29		-0.005		-1	181		129			C HORIZ
H1157	5342156	387352.3	80		-0.005		-1	329		97			A HORIZ
H1158	5342156	387352.3	33		-0.005		-1	351		152			C HORIZ
H1159	5342176	387349.5	123		-0.005		-1	338		41			A HORIZ
H1160	5342176	387349.5	38		-0.005		-1	147		141			C HORIZ
H1161	5342195	387345.9	21		-0.005		-1	122		24			A HORIZ
H1162	5342195	387345.9	33		-0.005		-1	587		202			C HORIZ
H1163	5342215	387342.2	49		-0.005		-1	184		17			A HORIZ
H1164	5342215	387342.2	4		-0.005		-1	205		50			C HORIZ
H1165	5342235	387338.5	66		-0.005		-1	242		43			A HORIZ
H1166	5342235	387338.5	18		-0.005		-1	463		238			C HORIZ
H1167	5342254	387335	82		-0.005		-1	312		49			A HORIZ
H1168	5342254	387335	32		-0.005		-1	338		243			C HORIZ

Sample No.	AMG North	AMG East	Cu ppm	Cu ppb	Au ppm	Au ppb	Ag ppm	Pb ppm	Pb ppb	Zn ppm	Zn ppb	As ppm	description
H1193	5342505.0	387289.71	22		-0.005		-1	43		22			A HORIZ
H1194	5342505.0	387289.71	79		-0.005		-1	127		162			C HORIZ
H1195	5342526	387285.9	43		-0.005		-1	273		30			A HORIZ
H1196	5342526	387285.9	16		-0.005		-1	257		82			C HORIZ
H1197	5342544	387282.8	32		-0.005		-1	83		24			A HORIZ
H1198	5342544	387282.8	17		-0.005		-1	286		120			C HORIZ
H1199	5342564	387279.1											NTS
H1200	5342564	387279.1	27		-0.005		-1	25		6			C HORIZ
H1201	5342583	387275.8	65		-0.005		-1	229		85			A HORIZ
H1202	5342583	387275.8	36		-0.005		-1	239		119			C HORIZ
H1751	5341431.9	386483.91	69		0.009		1	145		36		-50	C HORIZON
H1752	5341434.9	386500.50	38		-0.005		1	37		90		-50	C HORIZON
H1753	5341437.6	386515.15	89		0.007		1	84		26		-50	B HORIZON
H1754	5341441.1	386534.67	174		0.008		-1	178		28		56	C HORIZON
H1755	5341444.6	386554.19	80		-0.005		-1	73		19		-50	B/C HORIZO
H1756	5341448.2	386573.71	56		-0.005		-1	22		14		-50	B/C HORIZO
H1757	5341451.7	386593.23											NO SAMPLE
H1758	5341455.2	386612.75	89		-0.005		-1	85		20		-50	C HORIZON
H1759	5341458.8	386632.27	37		-0.005		1	44		55		-50	C HORIZON
H1760	5341462.3	386651.79	14		-0.005		-1	26		51		-50	C HORIZON
H1761	5341465.8	386671.31	34		-0.005		-1	23		30		-50	C HORIZON
H1762	5341469.4	386690.83	115		0.01		-1	85		24		-50	B HORIZON
H1763	5341472.9	386710.35	37		-0.005		-1	25		18		-50	B HORIZON
H1764	5341476.4	386729.87	15		-0.005		-1	-3		21		-50	C HORIZON

Sample No.	AMG North	AMG East	Cu ppm	Cu ppb	Au ppm	Au ppb	Ag ppm	Pb ppm	Pb ppb	Zn ppm	Zn ppb	As ppm	description
H1765	5341479.9	386749.39											NO SAMPLE
H1766	5341483.5	386768.91											NO SAMPLE
H1767	5341487.0	386788.43	100		-0.005		-1	16		22		-50	C HORIZON
H1768	5341490.5	386807.95											NO SAMPLE
H1769	5341494.1	386827.48											NO SAMPLE
H1770	5341497.6	386847.00	114		-0.005		-1	62		16		-50	B/C HORIZO
H1771	5341501.1	386866.52	64		-0.005		-1	105		14		-50	A/B HORIZO
H1772	5341504.7	386886.04	48		-0.005		-1	14		13		-50	B HORIZON
H1773	5341508.2	386905.56	66		-0.005		-1	35		13		-50	B HORIZON
H1774	5341511.7	386925.08	150		-0.005		-1	163		23		-50	B HORIZON
H1775	5341515.3	386944.60	193		-0.005		-1	224		18		-50	C HORIZON
H1776	5341518.8	386964.12	103		-0.005		1	100		16		-50	B HORIZON
H1777	5341522.3	386983.64	43		-0.005		-1	42		12		83	C HORIZON
H1778	5341526.7	387008.04	50		-0.005		-1	53		100		-50	C HORIZON
H1779	5341529.4	387022.68	87		-0.005		-1	72		13		-50	C HORIZON
H1780	5341532.9	387042.20	129		-0.005		-1	160		26		-50	C HORIZON
H1781	5341536.4	387061.72	97		-0.005		-1	110		16		-50	C HORIZON
H1782	5341540.0	387081.24	81		-0.005		-1	53		13		-50	C HORIZON
H1783	5341543.5	387100.76	57		-0.005		-1	54		17		-50	C HORIZON
H1784	5341547.0	387120.28	35		-0.005		-1	21		10		-50	C HORIZON
H1785	5341550.6	387139.81	67		-0.005		-1	71		15		-50	C HORIZON
H1786	5341554.1	387159.33	29		-0.005		-1	138		25		-50	C HORIZON
H1787	5341557.6	387178.85	53		-0.005		-1	25		21		-50	C HORIZON
H1788	5341561.2	387198.37	22		-0.005		-1	11		18		-50	B HORIZON

Sample No.	AMG North	AMG East	Cu ppm	Cu ppb	Au ppm	Au ppb	Ag ppm	Pb ppm	Pb ppb	Zn ppm	Zn ppb	As ppm	description
H1789	5341564.7	387217.89	62		-0.005		-1	19		15		-50	B HORIZON
H1790	5341568.2	387237.41	43		-0.005		-1	21		18		-50	B HORIZON
H1791	5341571.8	387256.93	36		-0.005		-1	18		14		-50	B HORIZON
H1792	5341575.3	387276.45	14		-0.005		-1	31		20		-50	A/B HORIZO
H1793	5341578.8	387295.97	51		-0.005		-1	50		30		-50	B HORIZON
H1794	5341582.3	387315.49	50		-0.005		-1	38		14		-50	B/C HORIZO
H1795	5341585.9	387335.01	12		-0.005		-1	35		48		-50	C HORIZON
H1796	5341589.4	387354.53	84		-0.005		-1	77		18		-50	B HORIZON
H1797	5341592.9	387374.05	135		-0.005		-1	172		26		-50	A/B HORIZO
H1798	5341596.5	387393.57	101		-0.005		-1	155		146		-50	A/B HORIZO
H1799	5341600.0	387413.09	95		-0.005		-1	165		20		146	A/B HORIZO
H1800	5341603.5	387432.62	49		-0.005		-1	139		20		-50	A/B HORIZO
H1801	5341631.8	386432.05	17		-0.005		-1	-3		25		-50	BLANK
H1802	5341629.3	386460.31	49		-0.005		-1	98		33		-50	C HORIZON
H1803	5341632.8	386479.84	95		-0.005		-1	65		27		93	B/C HORIZO
H1804	5341636.3	386499.36	36		-0.005		-1	11		17		-50	B HORIZON
H1805	5341639.8	386518.88	70		0.015		-1	59		20		-50	B HORIZON
H1806	5341643.4	386538.40	43		0.011		-1	34		-2		-50	B HORIZON
H1807	5341646.9	386557.92	63		0.007		-1	47		16		-50	B HORIZON
H1808	5341650.4	386577.44	72		-0.005		-1	59		14		-50	B HORIZON
H1809	5341654.0	386596.96	64		-0.005		-1	48		11		-50	B HORIZON
H1810	5341657.5	386616.48	44		-0.005		-1	20		9		-50	B HORIZON
H1811	5341661.0	386636.00	108		-0.005		-1	121		19		-50	B/C HORIZO
H1812	5341664.6	386655.52	49		-0.005		-1	31		18		51	B/C HORIZO

Sample No.	AMG North	AMG East	Cu ppm	Cu ppb	Au ppm	Au ppb	Ag ppm	Pb ppm	Pb ppb	Zn ppm	Zn ppb	As ppm	description
H1813	5341668.1	386675.04	17		-0.005		-1	11		21		-50	C HORIZON
H1814	5341671.6	386694.56	36		-0.005		-1	11		23		-50	C HORIZON
H1815	5341675.2	386714.08	30		-0.005		-1	22		24		-50	C HORIZON
H1816	5341678.7	386733.60	42		-0.005		-1	22		61		-50	C HORIZON
H1817	5341682.2	386753.12	51		-0.005		1	19		64		-50	C HORIZON
H1818	5341685.7	386772.64	36		-0.005		-1	13		39		-50	C HORIZON
H1819	5341689.3	386792.17	-2		-0.005		-1	27		94		63	C HORIZON
H1820	5341692.8	386811.69	38		-0.005		-1	14		28		-50	C HORIZON
H1821	5341696.3	386831.21	39		-0.005		1	28		72		-50	C HORIZON
H1822	5341699.9	386850.73											NO SAMPLE
H1823	5341703.4	386870.25	43		-0.005		-1	21		34		-50	C HORIZON
H1824	5341706.9	386889.77	63		-0.005		1	58		32		-50	C HORIZON
H1825	5341710.5	386909.29	101		0.01		-1	73		33		-50	C HORIZON
H1826	5341714.0	386928.81	53		0.007		-1	17		11		-50	B HORIZON
H1827	5341717.5	386948.33	84		-0.005		-1	52		11		-50	C HORIZON
H1828	5341721.1	386967.85											NO SAMPLE
H1829	5341724.6	386987.37											NO SAMPLE
H1830	5341728.1	387006.89											NO SAMPLE
H1831	5341731.7	387026.41	66		-0.005		-1	65		18		-50	B HORIZON
H1832	5341735.2	387045.93	37		-0.005		-1	26		14		-50	B HORIZON
H1833	5341738.7	387065.45	110		-0.005		-1	128		14		-50	B HORIZON
H1834	5341742.2	387084.97											NO SAMPLE
H1835	5341745.8	387104.50	107		-0.005		-1	54		9		-50	B HORIZON
H1836	5341749.3	387124.02	37		-0.005		-1	24		25		54	C HORIZON

Sample No.	AMG North	AMG East	Cu ppm	Cu ppb	Au ppm	Au ppb	Ag ppm	Pb ppm	Pb ppb	Zn ppm	Zn ppb	As ppm	description
H1861	5341856.2	386600.69	84		-0.005		2	97		46		57	C HORIZON
H1862	5341859.8	386620.21	32		-0.005		1	45		38		-50	C HORIZON
H1863	5341863.3	386639.73	26		-0.005		3	25		48		-50	C HORIZON
H1864	5341866.8	386659.25	34		-0.005		2	21		55		-50	C HORIZON
H1865	5341870.4	386678.77	38		-0.005		2	35		54		-50	C HORIZON
H1866	5341873.9	386698.29	70		-0.005		1	64		72		-50	C HORIZON
H1867	5341879.2	386727.57	44		-0.005		2	18		64		-50	C HORIZON
H1868	5341881.0	386737.33	40		-0.005		2	43		63		-50	C HORIZON
H1869	5341884.5	386756.85	38		-0.005		1	23		37		-50	C HORIZON
H1870	5341888.0	386776.38	42		-0.005		1	16		26		-50	C HORIZON
H1871	5341891.5	386795.90	38		-0.005		2	17		20		-50	C HORIZON
H1872	5341895.1	386815.42	14		-0.005		2	5		37		-50	C HORIZON
H1873	5341898.6	386834.94	33		-0.005		2	38		30		-50	C HORIZON
H1874	5341902.1	386854.46	82		-0.005		-1	99		16		-50	A/B HORIZO
H1875	5341905.7	386873.98	104		-0.005		-1	185		14		-50	A/B HORIZO
H1876	5341909.2	386893.50	39		-0.005		2	48		63		64	NO SAMPLE
H1877	5341912.7	386913.02	58		-0.005		1	41		11		-50	NO SAMPLE
H1878	5341916.3	386932.54	36		0.012		1	43		21		-50	C HORIZON
H1879	5341919.8	386952.06	25		-0.005		1	29		27		-50	C HORIZON
H1880	5341923.3	386971.58	45		-0.005		1	68		14		-50	B/C HORIZO
H1881	5341926.9	386991.10	41		-0.005		1	26		20		-50	A/C HORIZO
H1882	5341930.4	387010.62	63		-0.005		1	86		21		-50	C HORIZON
H1883	5341933.9	387030.14	152		-0.005		1	242		22		-50	C HORIZON
H1884	5341937.5	387049.66	87		0.014		1	115		54		82	A/B HORIZO

Sample No.	AMG North	AMG East	Cu ppm	Cu ppb	Au ppm	Au ppb	Ag ppm	Pb ppm	Pb ppb	Zn ppm	Zn ppb	As ppm	description
H1837	5341752.8	387143.54	60		-0.005		1	20		29		-50	C HORIZON
H1838	5341756.4	387163.06	14		-0.005		1	17		65		-50	C HORIZON
H1839	5341759.9	387182.58	10		-0.005		1	14		61		-50	C HORIZON
H1840	5341763.4	387202.10	11		-0.005		1	19		70		-50	C HORIZON
H1841	5341767.0	387221.62	34		-0.005		1	26		65		-50	C HORIZON
H1842	5341770.5	387241.14	55		-0.005		-1	29		56		59	C HORIZON
H1843	5341774.0	387260.66	49		-0.005		-1	94		39		56	C HORIZON
H1844	5341777.6	387280.18	60		-0.005		1	93		74		74	C HORIZON
H1845	5341781.1	387299.70	39		-0.005		-1	81		76		86	C HORIZON
H1846	5341784.6	387319.22	87		-0.005		1	101		75		75	C HORIZON
H1847	5341788.1	387338.74	57		-0.005		1	34		47		-50	C HORIZON
H1848	5341791.7	387358.26	36		-0.005		1	154		79		53	C HORIZON
H1849	5341795.2	387377.78	40		-0.005		-1	30		36		-50	C HORIZON
H1850	5341798.7	387397.30	35		-0.005		-1	32		25		-50	C HORIZON
H1851	5341820	386400	34		-0.005		1	25		52		-50	C HORIZON
H1852	5341824.5	386425.00	52		-0.005		2	60		44		-50	C HORIZON
H1853	5341828.0	386444.52	39		-0.005		2	15		59		-50	C HORIZON
H1854	5341831.5	386464.05	50		-0.005		3	24		68		-50	C HORIZON
H1855	5341835.1	386483.57	63		-0.005		1	45		18		-50	C HORIZON
H1856	5341838.6	386503.09	41		-0.005		2	39		54		-50	C HORIZON
H1857	5341842.1	386522.61	24		-0.005		1	21		51		-50	C HORIZON
H1858	5341845.6	386542.13	34		-0.005		2	17		69		-50	C HORIZON
H1859	5341849.2	386561.65	25		-0.005		2	19		78		-50	C HORIZON
H1860	5341852.7	386581.17	47		-0.005		2	24		93		-50	C HORIZON

Sample No.	AMG North	AMG East	Cu ppm	Cu ppb	Au ppm	Au ppb	Ag ppm	Pb ppm	Pb ppb	Zn ppm	Zn ppb	As ppm	description
H1885	5341941.0	387069.19	9		-0.005		1	10		42		-50	B/C HORIZO
H1886	5341944.5	387088.71											B/C HORIZO
H1887	5341948.0	387108.23	46		-0.005		1	89		55		-50	C HORIZON
H1888	5341951.6	387127.75	50		-0.005		1	91		51		-50	C HORIZON
H1889	5341955.1	387147.27	26		-0.005		1	96		71		-50	C HORIZON
H1890	5341958.6	387166.79	13		-0.005		2	85		97		-50	B/C HORIZO
H1891	5341962.2	387186.31	27		-0.005		2	119		157		-50	B/C HORIZO
H1892	5341965.7	387205.83	52		-0.005		2	218		126		-50	C HORIZON
H1893	5341969.2	387225.35	19		-0.005		1	175		80		-50	C HORIZON
H1894	5341972.8	387244.87	53		-0.005		2	382		117		-50	C HORIZON
H1895	5341976.3	387264.39	43		-0.005		3	142		183		-50	C HORIZON
H1896	5341979.8	387283.91	58		-0.005		1	153		65		-50	C HORIZON
H1897	5341983.4	387303.43	36		-0.005		1	94		70		-50	C HORIZON
H1898	5341986.9	387322.95	32		-0.005		1	89		49		-50	C HORIZON
H1899	5341990.4	387342.47	15		-0.005		-1	37		32		-50	C HORIZON
H1900	5341993.9	387361.99	24		-0.005		-1	115		118		-50	C HORIZON
H1901	5342020	386359	20		-0.005		7	16		57		-50	C HORIZON
H1902	5342019.7	386389.69	20		-0.005		1	16		56		-50	C HORIZON
H1903	5342023.2	386409.21	25		-0.005		-1	21		36		-50	C HORIZON
H1904	5342026.7	386428.74	41		-0.005		1	23		66		-50	C HORIZON
H1905	5342030.3	386448.26	41		-0.005		1	19		183		-50	C HORIZON
H1906	5342033.8	386467.78	30		-0.005		6	37		45		-50	C HORIZON
H1907	5342037.3	386487.30	72		-0.005		3	53		49		-50	C HORIZON
H1908	5342040.8	386506.82	57		-0.005		2	42		51		-50	C HORIZON

Sample No.	AMG North	AMG East	Cu ppm	Cu ppb	Au ppm	Au ppb	Ag ppm	Pb ppm	Pb ppb	Zn ppm	Zn ppb	As ppm	description
H1909	5342044.4	386526.34	50		-0.005		1	28		47		-50	C HORIZON
H1910	5342047.9	386545.86											NO SAMPLE
H1911	5342051.4	386565.38	18		-0.005		-1	8		16		-50	A/B HORIZO
H1912	5342055.0	386584.90	12		-0.005		-1	5		47		-50	C HORIZON
H1913	5342058.5	386604.42											NO SAMPLE
H1914	5342062.0	386623.94	20		-0.005		-1	47		112		-50	C HORIZON
H1915	5342065.6	386643.46	23		-0.005		-1	29		25		-50	B/C HORIZO
H1916	5342069.1	386662.98	31		-0.005		-1	27		44		-50	B HORIZON
H1917	5342072.6	386682.50	21		-0.005		-1	17		53		-50	C HORIZON
H1918	5342076.2	386702.02											NO SAMPLE
H1919	5342079.7	386721.54	29		-0.005		-1	41		22		-50	B HORIZON
H1920	5342083.2	386741.07	37		-0.005		-1	40		20		-50	B HORIZON
H1921	5342086.8	386760.59	57		-0.005		1	61		49		-50	C HORIZON
H1922	5342090.3	386780.11	34		-0.005		1	33		105		-50	C HORIZON
H1923	5342093.8	386799.63	27		-0.005		1	48		109		-50	C HORIZON
H1924	5342097.3	386819.15	37		-0.005		-1	40		47		-50	C HORIZON
H1925	5342100.9	386838.67	48		-0.005		-1	102		88		-50	C HORIZON
H1926	5342104.4	386858.19	27		-0.005		-1	40		72		-50	C HORIZON
H1927	5342107.9	386877.71	15		-0.005		-1	37		100		-50	C HORIZON
H1928	5342111.5	386897.23	36		-0.005		-1	66		102		-50	C HORIZON
H1929	5342115.0	386916.75	34		-0.005		1	74		89		-50	C HORIZON
H1930	5342118.5	386936.27	58		-0.005		-1	87		143		93	C HORIZON
H1931	5342122.1	386955.79	28		-0.005		-1	56		80		-50	C HORIZON
H1932	5342125.6	386975.31	30		-0.005		-1	50		60		-50	C HORIZON

Sample No.	AMG North	AMG East	Cu ppm	Cu ppb	Au ppm	Au ppb	Ag ppm	Pb ppm	Pb ppb	Zn ppm	Zn ppb	As ppm	description
H1933	5342129.1	386994.83	19		-0.005		-1	42		45		-50	B HORIZON
H1934	5342132.7	387014.35	65		-0.005		-1	83		65		-50	A/C HORIZO
H1935	5342136.2	387033.87											NO SAMPLE
H1936	5342139.7	387053.40	38		-0.005		-1	37		43		52	B/C HORIZO
H1937	5342143.2	387072.92	24		-0.005		-1	27		33		-50	B/C HORIZO
H1938	5342146.8	387092.44	24		0.005		-1	44		52		-50	C HORIZON
H1939	5342150.3	387111.96	39		-0.005		-1	44		86		-50	C HORIZON
H1940	5342153.8	387131.48	46		-0.005		-1	37		195		-50	C HORIZON
H1941	5342157.4	387151.00	50		-0.005		-1	50		53		-50	C HORIZON
H1942	5342160.9	387170.52	45		-0.005		-1	36		259		-50	C HORIZON
H1943	5342164.4	387190.04	64		-0.005		1	93		232		-50	C HORIZON
H1944	5342168.0	387209.56	69		-0.005		-1	66		140		-50	C HORIZON
H1945	5342171.5	387229.08	50		-0.005		-1	104		68		72	C HORIZON
H1946	5342175.0	387248.60	32		0.007		1	173		209		-50	C HORIZON
H1947	5342178.6	387268.12	48		-0.005		-1	98		53		-50	C HORIZON
H1948	5342182.1	387287.64	76		-0.005		1	175		97		71	C HORIZON
H1949	5342185.6	387307.16	57		-0.005		-1	138		80		-50	C HORIZON
H1950	5342189.2	387326.68	8		-0.005		-1	161		91		-50	C HORIZON
H1951	5342210	386310	9		-0.005		-1	18		46		-50	C HORIZON
H1952	5342214.9	386354.38	14		-0.005		-1	28		67		-50	C HORIZON
H1953	5342218.4	386373.90	10		-0.005		-1	11		33		-50	C HORIZON
H1954	5342221.9	386393.42	4		-0.005		-1	7		21		-50	C HORIZON
H1955	5342225.5	386412.95	33		-0.005		-1	137		32		-50	C HORIZON
H1956	5342229.0	386432.47	14		-0.005		-1	63		20		-50	C HORIZON

Sample No.	AMG North	AMG East	Cu ppm	Cu ppb	Au ppm	Au ppb	Ag ppm	Pb ppm	Pb ppb	Zn ppm	Zn ppb	As ppm	description
H1957	5342232.5	386451.99	13		-0.005		-1	22		8		-50	C HORIZON
H1958	5342236.1	386471.51	45		-0.005		-1	60		8		-50	B/C HORIZO
H1959	5342239.6	386491.03	48		-0.005		-1	61		12		-50	B/C HORIZO
H1960	5342243.1	386510.55	20		-0.005		-1	22		6		-50	A/B HORIZO
H1961	5342246.6	386530.07	25		-0.005		-1	96		12		-50	B HORIZON
H1962	5342250.2	386549.59	15		-0.005		-1	41		15		-50	B/C HORIZO
H1963	5342253.7	386569.11	3		-0.005		-1	25		46		-50	C HORIZON
H1964	5342257.2	386588.63	20		-0.005		-1	129		22		-50	B/C HORIZO
H1965	5342260.8	386608.15	5		-0.005		-1	32		29		-50	C HORIZON
H1966	5342264.3	386627.67	71		-0.005		-1	64		11		-50	A/B HORIZO
H1967	5342267.8	386647.19	19		-0.005		-1	35		13		-50	A/B HORIZO
H1968	5342271.4	386666.71	4		-0.005		-1	19		23		-50	C HORIZON
H1969	5342274.9	386686.23	19		-0.005		-1	108		18		-50	C HORIZON
H1970	5342278.4	386705.76	21		-0.005		-1	84		27		-50	C HORIZON
H1971	5342282.0	386725.28	13		-0.005		-1	23		31		-50	C HORIZON
H1972	5342285.5	386744.80	5		-0.005		-1	20		32		-50	C HORIZON
H1973	5342289.0	386764.32	5		-0.005		-1	11		22		-50	C HORIZON
H1974	5342292.6	386783.84	6		-0.005		-1	9		56		-50	C HORIZON
H1975	5342296.1	386803.36	3		-0.005		-1	7		79		-50	C HORIZON
H1976	5342299.6	386822.88	2		-0.005		1	7		58		-50	C HORIZON
H1977	5342303.1	386842.40	2		-0.005		1	9		62		-50	C HORIZON
H1978	5342306.7	386861.92	4		-0.005		-1	11		55		-50	C HORIZON
H1979	5342310.2	386881.44	17		-0.005		-1	33		52		-50	C HORIZON
H1980	5342313.7	386900.96	16		-0.005		-1	24		56		-50	C HORIZON

Sample No.	AMG North	AMG East	Cu ppm	Cu ppb	Au ppm	Au ppb	Ag ppm	Pb ppm	Pb ppb	Zn ppm	Zn ppb	As ppm	description
H1981	5342317.3	386920.48	11		-0.005		-1	20		47		-50	C HORIZON
H1982	5342320.8	386940.00	8		-0.005		-1	17		37		-50	C HORIZON
H1983	5342324.3	386959.52	19		-0.005		-1	55		44		72	C HORIZON
H1984	5342327.9	386979.04	23		-0.005		-1	79		46		76	C HORIZON
H1985	5342331.4	386998.56	10		-0.005		-1	27		39		-50	C HORIZON
H1986	5342334.9	387018.09	10		-0.005		-1	25		30		-50	C HORIZON
H1987	5342338.5	387037.61	9		-0.005		-1	20		19		-50	A/B HORIZO
H1988	5342342.0	387057.13	10		-0.005		-1	29		13		-50	A/B HORIZO
H1989	5342345.5	387076.65	11		-0.005		-1	33		9		-50	A/B HORIZO
H1990	5342349.0	387096.17	18		-0.005		-1	23		6		-50	A/B HORIZO
H1991	5342352.6	387115.69	11		-0.005		-1	13		13		-50	A/B HORIZO
H1992	5342356.1	387135.21	15		-0.005		-1	26		5		-50	B HORIZON
H1993	5342359.6	387154.73	18		-0.005		-1	56		6		-50	B HORIZON
H1994	5342363.2	387174.25	6		-0.005		-1	5		4		-50	A/B HORIZO
H1995	5342366.7	387193.77	72		-0.005		-1	69		6		-50	A/B HORIZO
H1996	5342370.2	387213.29	51		-0.005		-1	73		29		-50	C HORIZON
H1997	5342373.8	387232.81	32		-0.005		-1	90		109		-50	C HORIZON
H1998	5342377.3	387252.33	42		-0.005		-1	1530		235		-50	C HORIZON
H1999	5342380.8	387271.85	36		-0.005		-1	152		30		-50	C HORIZON
H2000	5342384.4	387291.37	51		-0.005		1	218		114		-50	C HORIZON
H2001	5342390	386300	26		-0.005		2	29		42		-50	C HORIZON
H2002	5342410.1	386319.07	19		-0.005		1	21		56		-50	C HORIZON
H2003	5342413.6	386338.59	23		-0.005		-1	24		76		-50	C HORIZON
H2004	5342417.1	386358.11	49		0.006		-1	44		24		-50	C HORIZON

Sample No.	AMG North	AMG East	Cu ppm	Cu ppb	Au ppm	Au ppb	Ag ppm	Pb ppm	Pb ppb	Zn ppm	Zn ppb	As ppm	description
H2005	5342420.7	386377.64	35		-0.005		-1	20		36		-50	C HORIZON
H2006	5342424.2	386397.16	19		-0.005		-1	22		45		-50	C HORIZON
H2007	5342427.7	386416.68	28		-0.005		1	27		34		-50	C HORIZON
H2008	5342431.3	386436.20	42		-0.005		1	30		50		-50	C HORIZON
H2009	5342434.8	386455.72	28		-0.005		-1	21		35		-50	C HORIZON
H2010	5342438.3	386475.24	33		-0.005		-1	26		34		-50	C HORIZON
H2011	5342441.9	386494.76	27		-0.005		-1	31		25		-50	C HORIZON
H2012	5342445.4	386514.28	73		-0.005		-1	69		37		80	C HORIZON
H2013	5342448.9	386533.80	22		-0.005		-1	26		38		-50	C HORIZON
H2014	5342452.4	386553.32	35		-0.005		-1	39		23		-50	C HORIZON
H2015	5342456.0	386572.84	55		-0.005		-1	66		21		-50	C HORIZON
H2016	5342459.5	386592.36	8		-0.005		1	67		34		-50	C HORIZON
H2017	5342463.0	386611.88	20		-0.005		-1	47		42		-50	C HORIZON
H2018	5342466.6	386631.40	19		-0.005		-1	113		85		-50	C HORIZON
H2019	5342470.1	386650.92	21		-0.005		-1	63		62		-50	C HORIZON
H2020	5342473.6	386670.44	70		-0.005		1	109		34		101	C HORIZON
H2021	5342477.2	386689.97	101		-0.005		-1	227		63		-50	B/C HORIZO
H2022	5342480.7	386709.49	27		-0.005		-1	26		58		-50	C HORIZON
H2023	5342484.2	386729.01	21		-0.005		-1	23		118		-50	C HORIZON
H2024	5342487.8	386748.53	45		-0.005		-1	42		122		-50	C HORIZON
H2025	5342491.3	386768.05	27		-0.005		-1	35		93		-50	C HORIZON
H2026	5342494.8	386787.57	45		-0.005		1	50		105		-50	C HORIZON
H2027	5342498.4	386807.09	27		-0.005		1	32		116		-50	C HORIZON
H2028	5342501.9	386826.61	36		-0.005		-1	35		114		68	C HORIZON

Sample No.	AMG North	AMG East	Cu ppm	Cu ppb	Au ppm	Au ppb	Ag ppm	Pb ppm	Pb ppb	Zn ppm	Zn ppb	As ppm	description
H2029	5342505.4	386846.13	30		-0.005		-1	27		130		-50	C HORIZON
H2030	5342508.9	386865.65	32		-0.005		-1	30		40		62	C HORIZON
H2031	5342512.5	386885.17	24		-0.005		-1	24		39		-50	C HORIZON
H2032	5342516.0	386904.69	37		-0.005		1	42		177		-50	C HORIZON
H2033	5342519.5	386924.21	17		-0.005		-1	66		263		-50	C HORIZON
H2034	5342523.1	386943.73	13		0.009		-1	32		53		-50	C HORIZON
H2035	5342526.6	386963.25	21		-0.005		1	78		18		-50	C HORIZON
H2036	5342530.1	386982.77	28		-0.005		1	49		93		-50	C HORIZON
H2037	5342533.7	387002.30	21		-0.005		-1	20		42		-50	C HORIZON
H2038	5342537.2	387021.82	19		-0.005		1	37		106		-50	C HORIZON
H2039	5342540.7	387041.34	48		-0.005		1	63		71		-50	C HORIZON
H2040	5342544.3	387060.86	23		-0.005		-1	31		30		-50	C HORIZON
H2041	5342547.8	387080.38	29		-0.005		-1	106		27		-50	C HORIZON
H2042	5342551.3	387099.90	13		-0.005		1	22		16		-50	B/C HORIZO
H2043	5342554.8	387119.42	34		-0.005		-1	59		12		-50	B HORIZON
H2044	5342558.4	387138.94	37		-0.005		-1	33		14		-50	B HORIZON
H2045	5342561.9	387158.46	24		-0.005		-1	57		15		-50	B HORIZON
H2046	5342565.4	387177.98	48		-0.005		-1	135		22		-50	A/B HORIZO
H2047	5342569.0	387197.50	93		-0.005		-1	91		19		-50	A/B HORIZO
H2048	5342572.5	387217.02	73		-0.005		-1	64		17		-50	A/B HORIZO
H2049	5342576.0	387236.54	16		-0.005		-1	23		19		-50	A/B HORIZO
H2050	5342579.6	387256.06	49		-0.005		1	66		19		-50	A/B HORIZO
H2051	5342586.6	387295.11	12		-0.005		1	25		37		-50	C HORIZON
H2052	5342590.2	387314.63	50		-0.005		1	197		37		-50	C HORIZON

Sample No.	AMG North	AMG East	Cu ppm	Cu ppb	Au ppm	Au ppb	Ag ppm	Pb ppm	Pb ppb	Zn ppm	Zn ppb	As ppm	description
H2053	5342593.7	387334.15	19		-0.005		1	34		10		-50	A/B HORIZO
H2054	5342597.2	387353.67	30		-0.005		1	38		22		-50	C HORIZON
H2055	5342600.8	387373.19	11		-0.005		-1	-3		9		-50	A/B HORIZO
H2056	5342604.3	387392.71	15		-0.005		-1	12		7		-50	A/B HORIZO
H2057	5342607.8	387412.23	21		-0.005		-1	18		10		-50	A/B HORIZO
H2058	5342611.3	387431.75	11		-0.005		-1	-3		17		-50	B/C HORIZO
H2059	5342614.9	387451.27	28		-0.005		-1	54		12		-50	A/B HORIZO
H2060	5342618.4	387470.79	30		-0.005		1	37		8		-50	A/B HORIZO
H2061	5342621.9	387490.31	53		-0.005		1	32		13		-50	A/B HORIZO
H2062	5342625.5	387509.83	28		-0.005		1	10		14		-50	A/B HORIZO
H2063	5342629.0	387529.35	18		-0.005		1	21		10		-50	A/B HORIZO
H2064	5342632.5	387548.87	15		-0.005		-1	43		23		-50	A/B HORIZO
H2065	5342636.1	387568.39	24		-0.005		2	331		65		-50	C HORIZON
H2066	5342639.6	387587.91	67		-0.005		1	180		127		122	C HORIZON
H2067	5342643.1	387607.44	40		-0.005		-1	96		15		-50	A/B HORIZO
H2068	5342646.7	387626.96	34		-0.005		1	69		18		53	C HORIZON
H2069	5342650.2	387646.48	44		-0.005		1	25		36		-50	C HORIZON
H2070	5342653.7	387666.00	147		-0.005		1	221		32		75	A/C HORIZO
H2071	5342657.2	387685.52	32		-0.005		3	30		90		-50	C HORIZON
H2072	5342660.8	387705.04	33		-0.005		1	39		21		-50	C HORIZON
H2073	5342664.3	387724.56	24		-0.005		1	20		14		-50	C HORIZON
H2074	5342667.8	387744.08	59		-0.005		-1	97		27		55	C HORIZON
H2075	5342671.4	387763.60	37		-0.005		-1	53		26		82	C HORIZON
H2076	5342674.9	387783.12	42		-0.005		2	51		23		-50	C HORIZON

Sample No.	AMG North	AMG East	Cu ppm	Cu ppb	Au ppm	Au ppb	Ag ppm	Pb ppm	Pb ppb	Zn ppm	Zn ppb	As ppm	description
H2077	5342678.4	387802.64	39		-0.005		-1	34		14		-50	C HORIZON
H2078	5342682.0	387822.16	21		-0.005		1	46		16		-50	C HORIZON
H2079	5342685.5	387841.68	12		-0.005		1	26		20		-50	C HORIZON
H2080	5342689.0	387861.20	11		-0.005		3	17		26		-50	C HORIZON
H2081	5342692.6	387880.72	16		-0.005		1	17		28		-50	C HORIZON
H2082	5342696.1	387900.24	17		-0.005		1	41		25		-50	C HORIZON
H2083	5342699.6	387919.77	25		-0.005		-1	41		48		-50	C HORIZON
H2084	5342703.2	387939.29	7		-0.005		1	15		20		-50	C HORIZON
H2085	5342706.7	387958.81	5		-0.005		1	8		15		-50	C HORIZON
H2086	5342710.2	387978.33	12		-0.005		1	17		56		-50	C HORIZON
H2087	5342713.7	387997.85	1780		-0.005		2	86		320		-50	C HORIZON
H2088	5342717.3	388017.37	25		-0.005		-1	46		46		-50	C HORIZON
H2089	5342720.8	388036.89	15		-0.005		-1	51		74		-50	C HORIZON
H2090	5342724.3	388056.41	15		-0.005		2	57		54		-50	C HORIZON
H2091	5342727.9	388075.93	11		-0.005		1	35		36		-50	C HORIZON
H2092	5342731.4	388095.45	9		-0.005		-1	20		33		-50	C HORIZON
H2093	5342734.9	388114.97	10		-0.005		1	27		28		-50	C HORIZON
H2094	5342738.5	388134.49	17		-0.005		-1	26		31		-50	C HORIZON
H2095	5342742.0	388154.01	12		-0.005		-1	25		41		-50	C HORIZON
H2096	5342745.5	388173.53	13		-0.005		1	34		40		-50	C HORIZON
H2097	5342730	388204	11		-0.005		-1	27		29		-50	C HORIZON
H2098	5342530	388168	19		-0.005		-1	34		42		-50	C HORIZON
H2099	5342539.7	388150.28	39		-0.005		-1	57		54		-50	C HORIZON
H2101			16		-0.005		-1	12		39		-50	BLANK

Sample No.	AMG North	AMG East	Cu ppm	Cu ppb	Au ppm	Au ppb	Ag ppm	Pb ppm	Pb ppb	Zn ppm	Zn ppb	As ppm	description
H2102	5342536.2	388130.76	33		-0.005		-1	63		32		-50	C HORIZON
H2103	5342532.7	388111.24	5		-0.005		-1	7		16		-50	C HORIZON
H2104	5342529.1	388091.72	5		-0.005		1	10		13		-50	C HORIZON
H2105	5342525.6	388072.20	12		-0.005		-1	18		26		-50	C HORIZON
H2106	5342522.1	388052.68	18		-0.005		1	16		28		-50	C HORIZON
H2107	5342518.5	388033.16	6		-0.005		-1	15		17		-50	C HORIZON
H2108	5342515.0	388013.64	13		-0.005		-1	16		13		-50	C HORIZON
H2109	5342511.5	387994.12	11		-0.005		-1	18		26		-50	C HORIZON
H2110	5342507.9	387974.60	18		-0.005		-1	36		15		-50	C HORIZON
H2111	5342504.4	387955.08	18		-0.005		-1	20		48		-50	C HORIZON
H2112	5342500.9	387935.55	13		-0.005		-1	17		29		-50	C HORIZON
H2113	5342497.4	387916.03	19		-0.005		-1	29		68		-50	C HORIZON
H2114	5342493.8	387896.51	23		-0.005		1	34		19		-50	C HORIZON
H2115	5342490.3	387876.99	18		-0.005		-1	24		25		-50	C HORIZON
H2116	5342486.8	387857.47	15		-0.005		1	117		37		-50	C HORIZON
H2117	5342483.2	387837.95	40		-0.005		-1	55		8		-50	C HORIZON
H2118	5342479.7	387818.43	12		-0.005		-1	41		10		-50	C HORIZON
H2119	5342476.2	387798.91	14		0.031		-1	19		14		-50	C HORIZON
H2120	5342472.6	387779.39	31		0.027		1	47		11		-50	C HORIZON
H2121	5342469.1	387759.87	12		-0.005		3	20		12		-50	C HORIZON
H2122	5342465.6	387740.35	27		0.016		1	48		23		-50	C HORIZON
H2123	5342462.0	387720.83	26		0.039		1	43		17		-50	C HORIZON
H2124	5342458.5	387701.31	14		0.021		-1	13		22		-50	C HORIZON
H2125	5342455.0	387681.79	21		-0.005		1	17		21		-50	B/C HORIZO

Sample No.	AMG North	AMG East	Cu ppm	Cu ppb	Au ppm	Au ppb	Ag ppm	Pb ppm	Pb ppb	Zn ppm	Zn ppb	As ppm	description
H2126	5342451.4	387662.27	36		0.021		-1	93		28		-50	C HORIZON
H2127	5342447.9	387642.75	16		0.015		-1	16		21		-50	C HORIZON
H2128	5342444.4	387623.22	23		0.025		-1	24		15		-50	C HORIZON
H2129	5342440.9	387603.70	9		0.021		-1	20		20		-50	C HORIZON
H2130	5342437.3	387584.18	7		0.012		-1	6		8		-50	C HORIZON
H2131	5342433.8	387564.66	24		0.007		-1	14		7		-50	C HORIZON
H2132	5342430.3	387545.14	12		0.034		-1	17		14		-50	B/C HORIZO
H2133	5342426.7	387525.62	16		0.021		-1	19		5		-50	B/C HORIZO
H2134	5342423.2	387506.10	15		0.017		2	4		9		-50	B/C HORIZO
H2135	5342419.7	387486.58	22		-0.005		1	18		12		-50	B/C HORIZO
H2136	5342416.1	387467.06	11		0.023		-1	6		24		-50	C HORIZON
H2137	5342412.6	387447.54											NO SAMPLE
H2138	5342409.1	387428.02	17		0.015		-1	23		10		-50	C HORIZON
H2139	5342405.5	387408.50	18		0.019		4	53		26		-50	C HORIZON
H2140	5342402.0	387388.98	40		0.025		5	96		24		-50	C HORIZON
H2141	5342398.5	387369.46	92		0.019		5	328		62		-50	A/B HORIZO
H2142	5342395.0	387349.94	60		0.009		3	32		12		53	B HORIZON
H2143	5342391.4	387330.42	38		0.014		3	91		15		-50	A/B HORIZO
H2144	5342196.2	387365.73	40		0.017		5	213		211		-50	C HORIZON
H2145	5342199.7	387385.25	46		0.016		4	168		123		-50	C HORIZON
H2146	5342203.3	387404.77	13		0.009		3	105		33		-50	C HORIZON
H2147	5342206.8	387424.29	28		0.017		-1	83		52		51	C HORIZON
H2148	5342210.3	387443.81	48		0.011		2	119		31		78	C HORIZON
H2149	5342213.9	387463.33	20		0.006		1	34		9		-50	A/B HORIZO

Sample No.	AMG North	AMG East	Cu ppm	Cu ppb	Au ppm	Au ppb	Ag ppm	Pb ppm	Pb ppb	Zn ppm	Zn ppb	As ppm	description
H2150	5342217.4	387482.85	48		0.028		3	166		23		-50	B/C HORIZO
H2151			16		0.006		1	3		29		-50	BLANK
H2152	5342220.9	387502.37	19		0.214		-1	65		17		-50	C HORIZON
H2153	5342224.5	387521.89	17		-0.005		-1	8		12		-50	C HORIZON
H2154	5342228.0	387541.41	11		0.017		-1	9		7		-50	C HORIZON
H2155	5342231.5	387560.93	6		-0.005		-1	5		8		-50	B/C HORIZO
H2156	5342235.1	387580.45	21		-0.005		-1	28		15		-50	C HORIZON
H2157	5342238.6	387599.97	16		-0.005		1	12		9		-50	C HORIZON
H2158	5342242.1	387619.49	41		-0.005		1	49		17		-50	B/C HORIZO
H2159	5342245.6	387639.01	26		-0.005		-1	20		63		-50	C HORIZON
H2160	5342249.2	387658.54	24		0.008		-1	20		30		-50	C HORIZON
H2161	5342252.7	387678.06	13		-0.005		1	15		29		-50	C HORIZON
H2162	5342256.2	387697.58	27		-0.005		-1	30		24		-50	C HORIZON
H2163	5342259.8	387717.10	17		-0.005		1	33		105		-50	C HORIZON
H2164	5342263.3	387736.62	19		-0.005		-1	14		59		-50	C HORIZON
H2165	5342266.8	387756.14	27		0.006		-1	21		19		-50	C HORIZON
H2166	5342270.4	387775.66	15		0.007		-1	10		13		-50	B HORIZON
H2167	5342273.9	387795.18	26		0.023		-1	18		24		-50	C HORIZON
H2168	5342277.4	387814.70	37		0.015		-1	21		39		-50	C HORIZON
H2169	5342281.0	387834.22	27		0.018		-1	57		31		-50	C HORIZON
H2170	5342284.5	387853.74	12		0.04		-1	27		39		-50	C HORIZON
H2171	5342288.0	387873.26	15		0.015		-1	30		37		-50	C HORIZON
H2172	5342291.6	387892.78	41		0.031		-1	50		27		-50	C HORIZON
H2173	5342295.1	387912.30	33		0.019		-1	40		28		-50	C HORIZON

Sample No.	AMG North	AMG East	Cu ppm	Cu ppb	Au ppm	Au ppb	Ag ppm	Pb ppm	Pb ppb	Zn ppm	Zn ppb	As ppm	description
H2174	5342298.6	387931.82	28		0.026		-1	19		41		-50	C HORIZON
H2175	5342302.1	387951.34	8		0.014		2	44		40		-50	C HORIZON
H2176	5342305.7	387970.87	9		0.019		-1	13		25		-50	C HORIZON
H2177	5342309.2	387990.39	11		0.015		-1	20		22		-50	C HORIZON
H2178	5342312.7	388009.91	20		0.021		-1	10		7		-50	B HORIZON
H2179	5342316.3	388029.43	39		0.025		-1	56		17		-50	C HORIZON
H2180	5342319.8	388048.95	51		0.019		-1	77		65		121	C HORIZON
H2181	5342323.3	388068.47	24		0.022		-1	27		38		-50	C HORIZON
H2182	5342326.9	388087.99	30		0.007		-1	23		50		-50	C HORIZON
H2183	5342330.4	388107.51	19		0.012		-1	20		20		-50	C HORIZON
H2184	5342333.9	388127.03	17		0.018		1	56		49		-50	C HORIZON
H2185	5342337.5	388146.55	42		0.021		1	72		58		-50	C HORIZON
H2186	5342001.0	387401.04	29		0.027		1	151		104		-50	C HORIZON
H2187	5342004.5	387420.56	114		0.027		2	208		200		-50	C HORIZON
H2188	5342008.1	387440.08	58		0.025		-1	155		76		-50	C HORIZON
H2189	5342011.6	387459.60	16		0.01		-1	63		58		-50	C HORIZON
H2190	5342015.1	387479.12	8		0.005		-1	77		55		-50	C HORIZON
H2191	5342018.7	387498.64	39		0.012		-1	123		52		-50	B HORIZON
H2192	5342022.2	387518.16	88		0.014		-1	235		44		-50	A/B HORIZO
H2193	5342025.7	387537.68	110		0.02		-1	177		35		-50	A/B HORIZO
H2194	5342029.3	387557.20	73		0.077		1	171		35		-50	A/B HORIZO
H2195	5342032.8	387576.72	112		0.023		-1	213		33		-50	A/B HORIZO
H2196	5342036.3	387596.24	36		0.007		-1	61		34		-50	C HORIZON
H2197	5342039.8	387615.76	14		0.009		-1	28		29		-50	C HORIZON

Sample No.	AMG North	AMG East	Cu ppm	Cu ppb	Au ppm	Au ppb	Ag ppm	Pb ppm	Pb ppb	Zn ppm	Zn ppb	As ppm	description
H2198	5342043.4	387635.28	69		-0.005		-1	40		16		-50	B HORIZON
H2199	5342046.9	387654.80	6		-0.005		-1	25		25		-50	C HORIZON
H2200	5342050.4	387674.32	76		-0.005		-1	103		62		-50	C HORIZON
H2201			12		-0.005		-1	3		57		-50	BLANK
H2202	5342054.0	387693.85	30		-0.005		-1	38		53		-50	C HORIZON
H2203	5342057.5	387713.37	6		-0.005		-1	52		46		-50	C HORIZON
H2204	5342061.0	387732.89	45		0.006		-1	62		42		-50	C HORIZON
H2205	5342064.6	387752.41	-2		-0.005		-1	47		39		-50	C HORIZON
H2206	5342068.1	387771.93	76		-0.005		-1	89		39		-50	A/C HORIZO
H2207	5342071.6	387791.45	7		-0.005		-1	39		19		-50	C HORIZON
H2208	5342075.2	387810.97	7		0.013		-1	47		26		-50	C HORIZON
H2209	5342078.7	387830.49	42		0.01		-1	59		29		-50	C HORIZON
H2210	5342082.2	387850.01	-2		0.005		-1	19		16		-50	C HORIZON
H2211	5342085.8	387869.53	5		-0.005		-1	32		27		-50	C HORIZON
H2212	5342089.3	387889.05	-2		-0.005		-1	5		18		-50	C HORIZON
H2213	5342092.8	387908.57	-2		-0.005		-1	9		17		-50	C HORIZON
H2214	5342096.3	387928.09	6		0.006		-1	23		35		-50	C HORIZON
H2215	5342099.9	387947.61	18		-0.005		-1	49		82		-50	C HORIZON
H2216	5342103.4	387967.13	36		-0.005		-1	35		62		-50	C HORIZON
H2217	5342106.9	387986.65	26		-0.005		-1	28		58		-50	C HORIZON
H2218	5342110.5	388006.18	27		0.007		-1	73		29		-50	C HORIZON
H2219	5342120	338029	41		0.102		-1	98		47		160	C HORIZON
H2220	5341805.8	387436.35	221		0.128		1	268		72		-50	A/C HORIZO
H2221	5341809.3	387455.87	13		0.085		-1	45		27		-50	C HORIZON

Sample No.	AMG North	AMG East	Cu ppm	Cu ppb	Au ppm	Au ppb	Ag ppm	Pb ppm	Pb ppb	Zn ppm	Zn ppb	As ppm	description
H2222	5341812.9	387475.39	8		0.175		-1	62		44		-50	C HORIZON
H2223	5341816.4	387494.91	8		0.037		-1	16		26		-50	C HORIZON
H2224	5341819.9	387514.43	9		0.057		-1	19		26		-50	C HORIZON
H2225	5341823.5	387533.95	4		0.047		-1	35		38		-50	C HORIZON
H2226	5341827.0	387553.47	18		0.038		-1	45		38		-50	C HORIZON
H2227	5341830.5	387572.99	8		0.052		1	29		42		-50	C HORIZON
H2228	5341834.1	387592.51	102		0.044		-1	180		48		-50	A/C HORIZO
H2229	5341837.6	387612.03	44		0.027		-1	82		42		-50	C HORIZON
H2230	5341841.1	387631.55	26		0.03		-1	43		26		-50	C HORIZON
H2231	5341844.6	387651.07	9		0.029		-1	38		42		-50	C HORIZON
H2232	5341848.2	387670.59	16		0.016		-1	39		12		-50	C HORIZON
H2233	5341851.7	387690.11	35		0.012		4	94		49		-50	C HORIZON
H2234	5341855.2	387709.63	40		0.009		-1	73		23		-50	C HORIZON
H2235	5341858.8	387729.16	24		0.011		-1	31		27		-50	C HORIZON
H2236	5341862.3	387748.68	26		-0.005		-1	23		25		52	C HORIZON
H2237	5341865.8	387768.20	22		-0.005		-1	24		37		-50	C HORIZON
H2238	5341869.4	387787.72	9		0.008		-1	15		33		-50	C HORIZON
H2239	5341872.9	387807.24	35		-0.005		-1	49		24		-50	C HORIZON
H2240	5341876.4	387826.76	28		-0.005		-1	33		16		-50	C HORIZON
H2241	5341880.0	387846.28	14		0.014		-1	25		21		-50	C HORIZON
H2242	5341883.5	387865.80	14		0.012		-1	18		43		60	C HORIZON
H2243	5341887.0	387885.32	-2		0.011		-1	16		22		-50	C HORIZON
H2244	5341890.5	387904.84	21		0.018		-1	25		27		-50	C HORIZON
H2245	5341894.1	387924.36	16		0.026		-1	23		16		-50	C HORIZON

Sample No.	AMG North	AMG East	Cu ppm	Cu ppb	Au ppm	Au ppb	Ag ppm	Pb ppm	Pb ppb	Zn ppm	Zn ppb	As ppm	description
H2246	5341897.6	387943.88	36		0.022		-1	61		18		-50	C HORIZON
H2247	5341901.1	387963.40	17		0.012		-1	24		25		-50	C HORIZON
H2248	5341904.7	387982.92	22		0.023		-1	39		40		-50	C HORIZON
H2249	5341920	388002	20		0.019		-1	45		27		-50	C HORIZON
H2250			13		0.012		-1	12		41		-50	BLANK
H2251	5341610.6	387471.66	45		0.008		-1	30		13		-50	C HORIZON
H2252	5341614.1	387491.18	26		0.011		-1	29		32		-50	C HORIZON
H2253	5341617.7	387510.70	55		0.026		-1	34		38		-50	C HORIZON
H2254	5341621.2	387530.22	50		0.014		-1	39		17		-50	C HORIZON
H2255	5341624.7	387549.74	66		-0.005		-1	30		17		-50	C HORIZON
H2256	5341628.3	387569.26	15		0.012		-1	27		12		-50	C HORIZON
H2257	5341631.8	387588.78	47		0.023		-1	27		9		-50	C HORIZON
H2258	5341635.3	387608.30	52		0.009		-1	49		16		-50	C HORIZON
H2259	5341638.8	387627.82	60		0.015		-1	76		31		-50	C HORIZON
H2260	5341642.4	387647.34	14		0.008		1	11		78		-50	C HORIZON
H2261	5341645.9	387666.86	55		0.01		1	58		112		-50	C HORIZON
H2262	5341649.4	387686.38	30		0.013		-1	45		47		-50	C HORIZON
H2263	5341653.0	387705.90	32		0.007		-1	46		38		-50	C HORIZON
H2264	5341656.5	387725.42	61		0.007		-1	106		104		-50	C HORIZON
H2265	5341660.0	387744.95	25		0.024		-1	27		33		-50	C HORIZON
H2266	5341663.6	387764.47	41		0.01		-1	64		55		-50	C HORIZON
H2267	5341667.1	387783.99	12		-0.005		-1	21		29		-50	C HORIZON
H2268	5341670.6	387803.51	29		0.006		1	19		70		-50	C HORIZON
H2269	5341674.2	387823.03	50		0.033		-1	93		37		-50	C HORIZON

Sample No.	AMG North	AMG East	Cu ppm	Cu ppb	Au ppm	Au ppb	Ag ppm	Pb ppm	Pb ppb	Zn ppm	Zn ppb	As ppm	description
H2270	5341670	387849	45		0.029		-1	36		51		71	C HORIZON
H2271	5341681.2	387862.07	11		0.013		-1	12		17		-50	C HORIZON
H2272	5341680	387889	42		0.011		-1	32		56		-50	C HORIZON
H2273	5341688.3	387901.11	27		0.012		-1	16		24		-50	C HORIZON
H2274	5341691.8	387920.63	21		0.007		-1	32		20		-50	C HORIZON
H2275	5341695.3	387940.15	28		0.014		-1	64		27		-50	C HORIZON
H2276	5341680	387969	56		0.02		1	90		32		68	C HORIZON
H2277			17		0.018		-1	12		34		-50	BLANK