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## 1. SUMMARY

CRA Exploration Pty. Limited (CRAE) is exploring EL38/89 for stratabound Zn-Pb carbonate-hosted deposits in the Ordovician Gordon Limestone and surficial deposits derived by decomposition of mineralised limestone.

Results of diamond drilling received during the period indicate potential for stratabound Zn mineralisation at the lower contact of the Ordovician Gordon Limestone with the Moina Sandstone. Best results for the year include (1% Zn cut-off grade):-

47800N	ZG359	52.7m to 63.5m	10.8m @	4.0% Zn
48000N	ZG363	41.3m to 101.0m	59.7m @	4.0% Zn
48200N	ZG365	79.1m to 88.0m	8.9m @	4.5% Zn

Stratabound mineralisation plunges to grid N at 20deg to 30deg. A weak cleavage of probable pre-Devonian age visible in outcrop conforms with this plunge orientation.

Mineralogical tests confirm the three Lower Zone mineralisation types have distinct Zn species. Surficial clays are dominantly sphalerite, the siderite zone contains Zn as zincian siderite, and the stratabound clay zone contains varying proportions of sphalerite and Zn-clay. Stratabound clay mineralisation can be interpreted as deep weathering of a sulphidic black shale horizon, the Zn-clays derived by supergene alteration of pre-existing sphalerite. The siderite zone may be an alteration cap to a shale-hosted sulphide system.

Air-core drilling of the middle zone confirmed previous results that mineralisation in this position is restricted in surface extent. However, it is quite likely that the intersection in stratigraphic hole ZG1007 is the continuation of the surface outcrop 500m down-plunge. Plunge angle is equivalent to the Lower Zone plunge, suggesting a common control. Best air-core result (1% Zn cut-off grade):-

47100N	ZG374	0.0m to 4.8mEOH	4.8m @	14.2% Zn 3.7% Pb
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"Back of the envelope" economic studies indicate a hypothetical primary Zn sulphide resource would need to be of the order of 10Mt @ 10% Zn, or at lower grade, 16Mt @ 8% Zn, to satisfy CRA's investment hurdles. The siderite and Zn-clays are not economically significant as they cannot <sup>be</sup> upgraded to a marketable product.

Work planned during 1995/96 includes diamond drilling of Lower Zone down-plunge and below the depth the supergene alteration and weathering, wide-spaced diamond drilling along strike from the main prospect area, and high-resolution magnetic surveys to identify concealed siderite alteration systems.

## 2. INTRODUCTION

EL38/89 was granted to Major Mining Ltd on 30th March 1990. CRA Exploration Pty. Limited entered into a joint venture agreement with Major to explore EL38/89, commencing on 23rd April 1991. In late 1993, Major Mining Ltd divested its interest in the joint venture to Allegiance Mining NL, with the exploration tenements transferred to CRAE (90%) and Allegiance (10%) as tenants in common on 22nd January 1994.

EL38/89 covers 9 sqkm located S of Zeehan on the Tasmanian W coast (Plan Tv431). During the period under review, the fifth year of tenure, CRAE has a statutory obligation to spend \$9000.

CRAE's principal commodity of interest in the Zeehan area is Zn. Ordovician Gordon Limestone is prospective for carbonate-hosted Zn-Pb, and secondary deposits derived from the decomposition of the carbonate. During 1995, these styles of mineralisation dominated the exploration focus and will continue to do so during 1996.

One target was selected for fieldwork during 1994; Grieves prospect (Plan Tv761). During the period, reverse-circulation air-core drilling traverses were completed in an effort to delineate the extent of secondary near-surface mineralisation. Diamond drilling tentatively probed beneath the surficial mineralisation. Additional mineralogical studies were completed, and a "back of the envelope" economic study was made. At a wider scale, wacker bedrock sampling was completed along strike from the main prospect area, and orientation peat sampling was trialled along sections with known mineralisation.

This report details all exploration activities conducted within EL38/89 by CRAE during 1994/95.

### 3. CONCLUSIONS

Diamond drilling completed during the period indicates potential for stratabound Zn mineralisation at the lower contact of the Ordovician Gordon Limestone with the Moina Sandstone. Compilation of all drilling results shows the stratabound mineralisation plunges to grid N at 20deg to 30deg. A weak cleavage of probable pre-Devonian age visible in outcrop conforms with this plunge orientation. Careful mapping and interpretation of drilling results is required for effective drillhole targeting to further test the stratabound zone.

Stratabound clay mineralisation can be interpreted as deep weathering of a sulphidic black shale horizon, the Zn-clays derived by supergene alteration of pre-existing sphalerite. The siderite zone may be an alteration cap to a shale-hosted sulphide system. Deeper drilling below the depth of weathering is warranted.

Air-core drilling of the middle zone confirmed previous results that mineralisation in this position is restricted in surface extent. However, it is quite likely that the intersection in stratigraphic hole ZG1007 is the continuation of the surface outcrop 500m down-plunge. Plunge angle is equivalent to the Lower Zone plunge, suggesting a common control.

Mineralogical tests confirm the three mineralisation types have distinct Zn species. Surficial clays are dominantly sphalerite, the siderite zone contains Zn as zincian siderite, and the stratabound clay zone contains varying proportions of sphalerite and Zn-clay.

Alteration studies suggest a paragenetic sequence of replacive dolomite-siderite alteration containing high Zn, overprinted by a sulphidation event that converted zincian siderite to sphalerite and Zn-poor siderite, followed by late-stage vein and fracture-fill calcite. This result is drawn from widely differing samples, and must be treated with some caution.

"Back of the envelope" economic studies indicate that for a viable surficial clay resource approximately 6Mt to 8Mt at 4% Zn (assume 90% Zn as sphalerite) is required. The siderite and stratabound clay zones are unlikely to be economic as it does not appear possible to produce a marketable Zn concentrate. A hypothetical primary Zn sulphide resource would need to be of the order of 10Mt @ 10% Zn, or at lower grade, 16Mt @ 8% Zn, to satisfy CRA's investment hurdles.

Magnetic susceptibility measurements revealed the siderite alteration can be discriminated from unaltered limestone.

#### 4. RECOMMENDATIONS

Diamond drilling should continue to define stratabound mineralisation down-plunge at the Lower Zone. At first, a modest step-out and fan of holes is recommended to give some confidence to the plunge estimates, followed by a bolder step-out. The holes should aim to intersect the stratabound zone below the depth of deep weathering and supergene Zn-clay development. That depth is unknown.

Drilling should also investigate the down-plunge extent of Middle Zone mineralisation between the surface exposure and the stratigraphic hole.

Elsewhere in the EL, shallow diamond drilling should test alteration and mineralisation at the Lower Zone along strike to the S from the main prospect area.

Detailed high-resolution magnetics should be collected over all limestone areas to delineate any major concealed siderite alteration systems.

Collation and interpretation of all geological information amassed during the drilling programs are still required.

#### 5. REGIONAL GEOLOGY

A description of the regional geology is given in Parkinson (1994). A new Zeehan 1:50000 geological map has been published during the year which highlights the importance of thrust tectonics in the Zeehan area.

#### 6. MINERALISATION

See Parkinson (1994).

#### 7. PREVIOUS EXPLORATION BY COMPETITORS

See Parkinson (1994).

## 8. EXPLORATION BY MAJOR MINING LTD / CRAE PRIOR TO 1/3/92

- Year 1:* Activities by Major Mining prior to CRAE's involvement are detailed in the relevant statutory reports.
- Year 2:* Exploration by CRAE on EL38/89 prior to 1/3/92 focussed on a compilation and review of existing open-file data. These initial activities led to a concentration of effort on adjacent tenements EL28/88 and EL34/88, at that time considered to be more prospective.
- Year 3:* Parkinson (1993). Compilation of open-file wacker and costean geochemistry led to the recognition that significant amounts of Zn were accumulating in surficial black pug (decomposed limestone), above apparently weakly mineralised carbonates at Grieves prospect. Wacker sampling defined three separate targets; an 1100m linear zone at the upper contact of the limestone, a 700m linear trend at the base of the limestone, and a highly conspicuous single point anomaly in the middle of the limestone.

It was thought that there may be potential for sufficient metal accumulations to justify evaluation. Rock sampling of infilled costeans, mineralogical studies, and reverse-circulation air-core drilling traverses were completed in an effort to identify areas of substantial secondary near-surface mineralisation.

- Year 4:* Parkinson (1994). Additional detailed air-core traverses were completed at Grieves to identify the extent of mineralised surficial clays. Significant intersections were made over 500m of strike length at the lower Gordon Limestone - Moina Sandstone contact. Better results included:-

48250N	ZG123	5.5m to 24m EOH	18.5m @ 4.5% Zn
48200N	ZG115	2.8m to 28.5m EOH	25.7m @ 4.8% Zn
48150N	ZG352	8.0m to 28.7m EOH	20.7m @ 3.6% Zn
47850N	ZG180	2.5m to 16.0m	13.5m @ 8.5% Zn
47800N	ZG54	6.0m to 22.0m	16.0m @ 13.7% Zn
47750N	ZG181	1.5m to 20.0m	18.5m @ 3.4% Zn

Diamond drilling confirmed the surface zone is the manifestation of underlying primary stratabound Zn mineralisation. Better diamond holes returned:-

48200N	ZG365	79.1m to 88.0m	8.9m @ 4.5% Zn
48000N	ZG107	123.95m to 139.1m	15.15m @ 10.4% Zn
and		154.55m to 162.9m	8.35m @ 13.9% Zn, 8.5% Pb
47800N	ZG359	52.75m to 63.5m	10.75m @ 4.0% Zn

- Initial interpretations showed the mineralisation to have several components:-
- surficial "black-pug" style, related to geochemical dispersion and enrichment by near-surface processes.
  - stratabound mineralisation associated with siderite alteration
  - mineralisation within stratabound clays adjacent to the ankerite alteration zone.

## 9. EXPLORATION ACTIVITIES FOR THE PERIOD 1/3/93 TO 28/2/94

### 9.1 Exploration Philosophy

CRAE's principal commodity of interest in the Zeehan area is Zn. Ordovician Gordon Limestone is prospective for carbonate-hosted Zn-Pb, and secondary deposits derived from the decomposition of the carbonate. During 1994, these styles of mineralisation dominated the exploration focus and will continue to do so during 1995.

### 9.2 Grievess Prospect

#### 9.2.1 Introduction

Grievess prospect is 12km S of Zeehan, adjacent to the Zeehan-Strahan road (Plan Tv761). The prospect sits in a synform of Gordon Limestone. Quaternary gravels obscure the limestone, which has eroded to form the Badger River valley between ridges of Moina Sandstone and Crotty Quartzite.

Grievess was selected based on highly anomalous open-file wacker and costean geochemistry suggesting potential for sufficient Zn accumulations to justify CRAE's interest. Air-core drilling intersected significant grades and thicknesses of Zn mineralisation in near-surface unconsolidated pugs, justifying additional investigation.

During the period, reverse-circulation air-core drilling traverses were completed in an effort to delineate the extent of secondary near-surface mineralisation. Diamond drilling tentatively probed beneath the surficial mineralisation. Additional mineralogical studies were completed, and a "back of the envelope" economic study was made. At a wider scale, wacker bedrock sampling was completed along strike from the main prospect area, and orientation peat sampling was trialled along sections with known mineralisation.

#### 9.2.2 Geology

Grievess prospect is hosted in Ordovician Gordon Limestone. Conformably underlying the limestone is Ordovician Moina Sandstone. Crotty Quartzite, of Silurian age, conformably overlies the limestone. At Grievess the Gordon Limestone is approximately 600m thick. The sequence was folded during the Devonian Tabberaban Orogeny to produce an open NNW-plunging synform. Measured dips at Grievess are generally between 45deg and 55deg.

Stratigraphy of the Gordon Limestone in the Grievess area can be subdivided into several units based on sedimentological and alteration characteristics, determined using stratigraphic hole ZG1007, and shallow prospect diamond holes. The stratigraphy is:-

dolomite -top  
 carbonaceous siltstone  
 undifferentiated limestones  
 oolitic carbonate  
 siderite zone  
 carbonaceous, sulphidic clays  
 ferruginous clays  
 grey silty clays  
 siltstones (Moina transition) -bottom

303009

Below the base of the limestone is massive white to light grey quartzite of the Moina Sandstone. Above the Moina Sandstone is a mixed zone up to 4m thick of unconsolidated to poorly lithified sands and silts, also considered to belong to the Moina Sandstone. In the Zeehan area there are marked variations in the thickness of the Ordovician clastics (Owen Conglomerate and Moina Sandstone) that do not carry through into the Gordon Limestone. This suggests basin-bounding structures were active in the early Ordovician. Basin reconstruction has not been attempted, but from the published 1:50000 Zeehan map the main controls are WNW-striking features such as the Firewood Siding Fault, Balstrup Fault and Professor Range Fault. Irish-type exploration models regard carbonates adjacent to the down-thrown side of these structures to be highly prospective.

Overlying the Ordovician clastics is a sequence of clays up to 40m thick. The clay zone can be internally sub-divided into grey clays, locally containing sandy beds (lowermost), yellow-red-brown ferruginous and almost gossanous clays (middle), and upper dark grey to black carbonaceous and locally sulphidic clays. The sulphidic and carbonaceous sections host significant Zn mineralisation.

The origin of the stratabound clays is unclear. Planar banding parallel to bedding in the limestone and sandstone is preserved in the clay zone. This rules out the possibility of the clays being Tertiary/Quaternary karst infill. Further, cherty and sandy layers of Moina Sandstone transition are interbedded with the clay toward the base, indicating contemporaneous deposition. The clays appear undeformed, which would suggest that they have been lithified, but now rehydrated. The underlying Moina Sandstone is an aquifer, evidenced by high water flows from the contact during drilling, and would provide access to the clays for rehydration.

What was the precursor to the stratabound clays? Multi-element chemistry and mineralogy suggests a carbonaceous and sulphidic shale. A further point is the bizarre Zn-clay mineralogy. If we are looking at deep weathering, the Zn-clays may be a supergene development from a more conventional sulphide body at depth. If this is so, it is critical to intersect this unit below the zone of rehydration/leaching to determine whether the gossanous and carbonaceous bands contain appreciable sulphide mineralisation.

Above the clays is a stratabound zone of moderate to totally siderite altered carbonate up to 25m thick, intermixed with varying proportions of carbonate sand, worn carbonate fragments and clay. The siderite altered carbonate may be massive and grey to honeycombed and yellow. Relict primary sedimentary features are almost always destroyed, although rarely some oolites or skeletal material may remain. This zone probably overprints the primary stratigraphic elements (i.e. not stratiform).

The siderite alteration is more widespread than the Zn mineralisation, flagging it as a useful indicator of proximity to mineralisation. If the stratabound clay is deep weathered sulphidic shale, perhaps the siderite is a more extensive alteration cap, preserved from weathering by its low primary porosity and permeability.

Occupying a similar position to the stratabound ankerite altered carbonate is an irregular but highly distinctive oolitic carbonate up to 25m thick. This unit, where present, is always within or immediately adjacent to the altered/mineralised zones, however its distribution is highly variable, and is often absent entirely. It is unclear whether the oolitic unit is preferentially replaced by the alteration assemblage, or is acting as an impervious buffer. In the stratigraphic hole, coarse grainstone is present in place of the oolitic unit. These units indicate a similar environment of deposition (shoal sequence).

The main body of limestone above this shoal sequence, comprising about 350m, is presently undivided, although distinctive units are recognisable. The bulk of the interval is calcareous mudstone to fine grainstone, wispy to planar banded depending on amount of bioturbation and winnowing by wave action. More distinctive sub-units include rudite beds comprised of large coral and stromatoporoid fragments, and clean micritic units locally displaying birdseye texture.

Additional deep drilling in the Zeehan area may allow further sub-division of this section of stratigraphy.

In the upper part of the Gordon Limestone, a 20m to 50m thick dark grey carbonaceous and calcareous siltstone is recognised.

Uppermost is a 150m thick dolomite with common secondary porosity. Clay bands are present at the Gordon Limestone - Crotty Quartzite contact. The contact may be gradational.

Carbonate geologists from ET & I, CRAE's research group, have inspected the stratigraphic hole, and assisted with sub-unit division. In addition ET & I pursued a number of studies aimed at determining burial, fluid migration and alteration/mineralisation histories of the Gordon Limestone. Their reports are included (Appendix 1).

A locally major fault, Grieves Fault, cuts the Moina Sandstone and Gordon Limestone. Mineralisation at the Moina Sandstone - Gordon Limestone contact appears to be offset by the fault, and no mineralisation has been detected in the fault itself. The structure therefore is interpreted to disrupt a pre-existing deposit. If the fault is Devonian, this implies the mineralisation at Grieves is pre-Tabberaberan. The fault shows an apparent horizontal displacement of 200m, and a long-section of mineralisation suggests apparent vertical movement of about 150m.

Erosion has reduced the limestone to rare outcrops in Quaternary gravel-covered valleys between ridges of sandstone and quartzite. Gravels may be up to 5m thick. In-situ weathering has further degraded the limestone to a black decarbonated clay. This weathering surface is variable in depth but may locally reach 30m, averaging 3-10m. Clays are preferentially developed over altered or mineralised carbonate, and are virtually absent over fresh limestone.

### 9.2.3 Air-core Drilling

A total of 35 holes for a total metreage of 312m were completed by Wallis Drilling Pty. Ltd. of Western Australia in February 1994 targetting the S end of the basal limestone anomaly, and the middle portion of the limestone on section 47100N (ZG366 to ZG400). Analyses were not available for inclusion in the 1994 report.

Cuttings were collected at 2m intervals, with a wet 1-2kg sample "snatched" by hand for analysis. Samples were assayed at Analabs Burnie by AAS (aqua regia-perchloric acid digest) for Ag-Cu-Pb-Zn-Fe-Mn. Numerous samples were over-range for this method, and were subsequently redetermined by AAS (aqua regia-perchloric acid-hydroflouric acid digest). Samples exceeding 1% Zn were analysed for S by leco furnace.

All locateable hole collars were surveyed by theodolite, tied to Main Roads survey mark BM6372. Drill-hole locations are shown on Plan Tv712. Collar information and down-hole logs and assays are tabulated in Appendices 2 and 3.

#### ***Moina Sandstone - Gordon Limestone contact:***

Additional 10m-spaced air-core drilling at Grieves on line 47700N returned:-

ZG368	2.0m to 12.1mEOH	10.1m @	12.9% Zn	2.6% Pb
ZG370	2.5m to 14.0m	11.5m @	6.0% Zn	
and	20.0m to 32.0m	12.0m @	5.7% Zn	
ZG371	18.0m to 30.5mEOH	12.5m @	2.9% Zn	
ZG372	28.0m to 34.0m	6.0m @	3.5% Zn	

These results extend known limits to mineralisation at the lower limestone - sandstone contact a further 50m S. Known strike length is now 550m. Diamond hole ZG358 drilled on the same section in December 1993 intersected intense Fe-Mn alteration between 91.5m and 117.45m, but Zn analyses did not exceed 1200ppm.

Cross sections between 47300N and 48400N for the Moina Sandstone - Gordon Limestone contact showing geology and Zn-Fe analyses are plotted on Plans Tv906 to Tv928, and a summary section through 48000N is shown in Figure 1.

#### ***Middle portion of the limestone:***

Air-core drilling at 10m spacing around 47100N in the middle section of the limestone where hole ZG36 in early 1993 intersected 6.2m @ 5.4% Zn returned best values of:-

ZG374	0.0m to 4.8mEOH	4.8m @	14.2% Zn	3.7% Pb
ZG395	4.0m to 12.0m	8.0m @	2.0% Zn	1.0% Pb

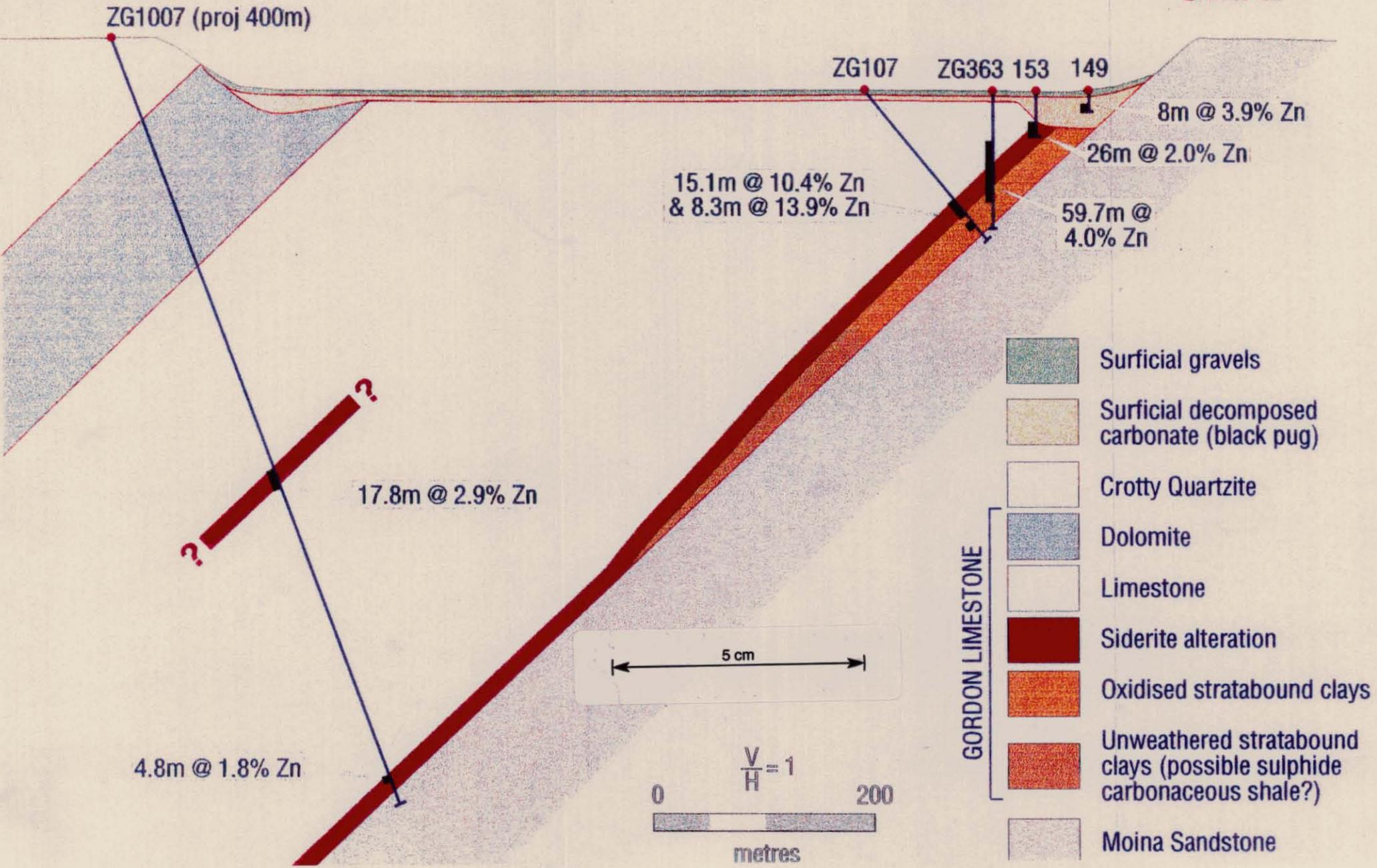
The mineralised carbonate here is not decomposed and is usually too indurated to be effectively drilled by the air-core rig. Strike length of mineralisation at this position is unlikely to exceed 100m. Depth extent is untested, but it is plausible that this zone is correlatable with the intersection in stratigraphic hole ZG1007, 600m away. This gives a plunge to the mineralisation of 20deg to 30deg, equivalent to the interpreted plunge on Lower Zone mineralisation, discussed below.

Cross sections between 47000N and 47200N for the Middle Zone showing geology and Zn-Fe analyses are plotted on Plans Tv901 to Tv905.

# GRIEVES PROSPECT - CROSS SECTION 48,000N

Grid W

Grid E



303012

#### 9.2.4 Diamond Drilling

During the period, two diamond holes totalling 201.5m testing the lower contact were completed on section 48200N (ZG364 and ZG365), and analyses for ZG359 to ZG365 were received.

Core was halved and sampled to lithological/alteration boundaries at nominal 5m intervals in suspected barren zones, closing down to 1-2m intervals in altered sections. Poor recovery zones were sampled between drillers core blocks. Samples were assayed at Analabs Perth by ICP-OES (aqua regia-perchloric acid-hydrofluoric acid digest) for Ag-Al-As-Ba-Ca-Cu-Fe-K-Mg-Mn-Pb-Zn. Samples over-range for this method were subsequently redetermined by AAS (aqua regia-perchloric acid-hydrofluoric acid digest). Samples exceeding 0.5% Zn were also analysed for S by leco furnace.

All diamond holes passed through a generally similar sequence of fresh limestone, followed by an altered zone of sideritic material, then plastic clays, before terminating in massive quartz sandstone. Some holes have intersected a distinctive oolitic carbonate unit. This unit, where present, is always within or immediately adjacent to the altered/mineralised zones, however its distribution is highly variable, and is often absent entirely. It is unclear whether the oolitic unit is preferentially replaced by the alteration assemblage, or is acting as an impervious buffer.

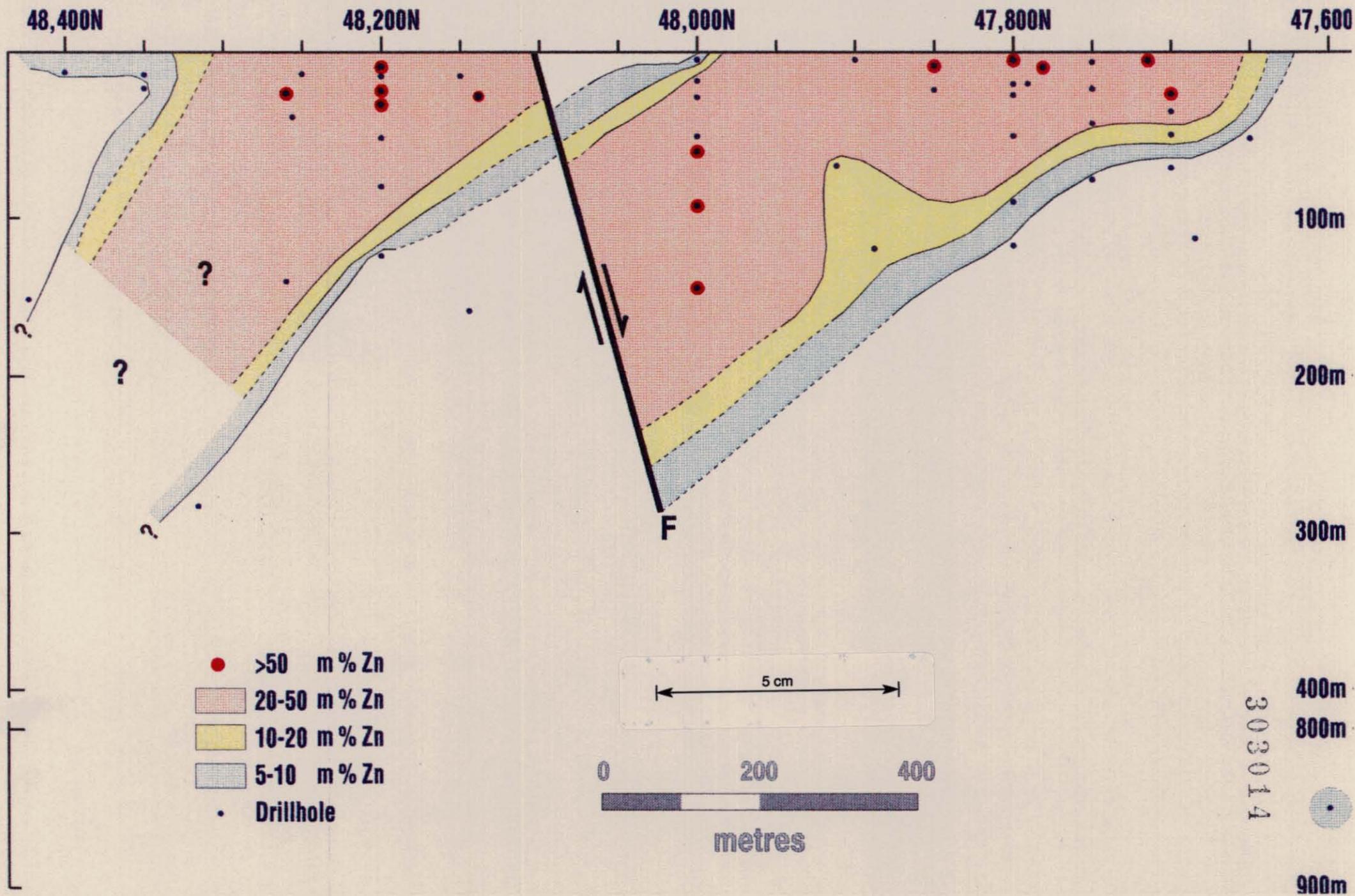
Intervals exceeding 1% Zn for results recieved during the period are:-

47800N	ZG359	52.7m to 63.5m	10.8m	@	4.0% Zn	
47800N	ZG360	71.1m to 74.8m	3.7m	@	2.3% Zn	
47900N	ZG361	46.4m to 54.5m	8.1m	@	2.4% Zn	
		and	78.6m to 85.4m	6.8m	@	2.0% Zn
48000N	ZG362	18.1m to 54.0m	35.9m	@	2.8% Zn	
		and	78.4m to 86.0m	7.6m	@	3.6% Zn
48000N	ZG363	41.3m to 101.0m	59.7m	@	4.0% Zn	
48200N	ZG364	54.0m to 65.2m	11.2m	@	3.5% Zn	
48200N	ZG365	79.1m to 88.0m	8.9m	@	4.5% Zn	

Sulphur analyses indicate sphalerite to be present but probably subordinate to Zn clay and Zn-Fe-Mn carbonate.

There was some initial concern that diamond drilling beneath highly mineralised air-core holes such as on sections 47800N and 48200N failed to intersect similar values, raising the spectre of surface enrichment. A long section showing Zn grade x thickness clearly demonstrates the mineralisation plunges across the plane of siderite alteration at 20deg to 30deg to grid N (Figure 2). Drilling to depth beneath surficial anomalies may therefore bias against making intersections of substantial grade and thickness. Conversely, section 48000N was poorly mineralised at surface, but shows strong Zn mineralisation at depth. It can also be seen on the long section that Grieves Fault displaces, and therefore post-dates, the mineralisation.

# GRIEVES PROSPECT - LONG SECTION OF LOWER ZONE



There is circumstantial evidence to suggest a low-angle syn-sedimentary fault may be controlling this plunge direction. A weak cleavage is visible in oolitic carbonate outcrops within the old workings and in underlying Moina Sandstone that has a similar orientation to the suggested plunge of the stratabound mineralisation. Carbonate breccias have also been identified in spoil at the old workings, perhaps adjacent to the surface position of the postulated fault. Oolitic carbonate is often absent or thin away from the better mineralised areas, suggesting a mineralising syn-sedimentary fault was also controlling the local depositional environment.

Drillhole collar information is listed in Appendix 2. Drill logs for holes ZG364 and ZG365, and assays for ZG359 to ZG365 are reported in Appendix 4. Drill-hole locations are shown on Plan Tv712. Cross sections between 47300N and 48400N for the Moina Sandstone - Gordon Limestone contact showing geology and Zn-Fe analyses are plotted on Plans Tv906 to Tv928, and a summary section through 48000N is shown in Figure 1. Long sections N and S of Grieves fault showing hole pierce-points are plotted as Plans Tv718 and Tv719.

#### 9.2.5 Resampling of EZ Diamond Drill Holes

All altered and mineralised sections from Grieves drillholes were relogged by Tim Moody, seconded from CRAE Mount Isa. Any altered, mineralised or clay zones not previously sampled by EZ were resampled (Appendix 5).

Best results in previously unsampled zones include (>1% Zn):-

48250N	ZG1013	105.5m to 119.0m	13.5m	@ 3.3% Zn
48400N	ZG1015	110.8m to 112.7m	1.9m	@ 1.5% Zn
		and 121.7m to 125.6m	3.9m	@ 1.1% Zn

#### 9.2.6 Air-core Bottom-of-Hole Sampling

Where possible, a sample of the formation at the bottom of each air-core hole was collected for description and multi-element analysis. Two samples of approximately 50g each were collected for description and analysis. Samples were assayed at Analabs Perth by ICP-OES (aqua regia-perchloric-hydrofluoric acid digest) for Ag-Al-As-Ba-Ca-Cu-Fe-K-Mg-Mn-Pb-Zn. For samples with over 0.5% Zn, S was determined by Leco furnace.

Samples were logged by Tim Moody, seconded from CRAE Mount Isa. Moody's report, sample descriptions and assays are presented in Appendix 6. His work shows a complex pattern of variably altered limestones and dolomites (Plan Tv869).

To complement the logging program, lithological discrimination was attempted using multi-element geochemistry. The following classifications were made:-

- siderite	>10% Fe	
- limestone	>20% Ca	<4% Mg
- dolomite	>12% Ca	>4% Mg
- impure carbonate	12-20% Ca	<4% Mg
- pelite (siltstone)	<12% Ca	>4% Al
- sandstone	<12% Ca	<4% Al

Scatterplots of Ca% vs Mg%, Ca% vs Al% and Al% vs K% with the lithological subdivisions are shown in Appendix 6 together with a statistical summary of the geochemistry of each lithological group for all CRAE air-core holes in the Zeehan area.

Results show this simple discriminant function effectively identifies the major lithologies and alteration trends within the limestone throughout the Zeehan area.

#### 9.2.7 Mineralogical Studies

**XRD:** Twenty samples of air-core and diamond core pulps with high levels of Zn were submitted to Amdel for quantitative XRD to determine proportions of sphalerite, Zn clay and Zn-Fe-Mn carbonate. It was hoped this orientation work would allow mineralogy to be predicted from geochemical signatures.

Quantitative XRD for air-core and diamond core pulps with high levels of Zn show three mineralisation groups. Type 1 is the surficial clays and decomposed carbonate, characterised by Zn mineralogy of 90% to 100% sphalerite. Type 2, the stratabound siderite zone, contains variable proportions of zincian siderite and sphalerite. Average sphalerite proportion of the Zn phases is estimated to be 30%. Type 3 is the stratabound clay. Sphalerite and Zn-clay are the dominant Zn minerals, present in the proportion 35% : 60%.

The above results are very approximate as calculated proportions depend on the relative partitioning of S between Zn and Fe. The above results are calculated assuming S partitions to the metals in proportion to their abundance. Using this relationship it is possible to calculate sphalerite abundance for all geochemical analyses without resorting to the expensive XRD.

Zinc mineralogy for two other ore types, Type 4 (middle zone) and Type 5 (upper zone) were also calculated from geochemical analyses. Type 4 mineralisation is a siderite - sphalerite mix in the proportion 60% sid : 40% sph. Type 5 is exclusively sphalerite, with excess S going to pyrite.

Table 1 shows the ore types, Zn-Fe-S analyses, and calculated Zn mineralogies. Results of the XRD studies together with calculated Zn-as-sphalerite percentages for the different ore types are presented in Appendix 7.

**Petrology:** Paul Ashley of University of New England studied a number of core samples to determine alteration characteristics and paragenesis (Appendix 8). He concluded four alteration/mineralisation phases were present. Earliest was pervasive dolomitisation, followed by siderite alteration that introduced Fe-Mn-Zn. Sulphur was added at stage three, which partly replaced metal carbonates with metal sulphides. Finally, late-stage sparry carbonate filled fractures and voids.

This cute picture must be tempered with cruelty of reality. Samples came from different prospects with possibly widely different mineralisation mechanisms (i.e. Ordovician v's Devonian). The four events may not actually occur at each carbonate-hosted Zn prospect in the Zeehan area. None-the-less, individual sample observations are extremely valuable. At Grieves there does appear to be a paragenetic sequence of early zincian siderite overprinted by sulphidation and possibly later ferroan dolomite. Additional work is required.

Table 1: Ore types and Zn distribution.

Table 1: Summary of ore types, average Zn-Fe-S analyses, and calculated Zn mineralogy										
ORE TYPE	LITHOLOGY	Number	Zn%	Fe%	S%	Calculated from analyses		Calculated from XRD		
						Zn as sphal	Zn as other mlns	Zn as sphal	Zn as siderite	Zn as clay
TYPE 1	Surficial clays and decomposed limestone	126	3.26	4.6	5.3	100%	0%	92%	2%	5%
TYPE 2	siderite zone	157	4.29	21.7	3.5	24%	76%	29%	58%	12%
TYPE 3	stratabound clays	74	4.89	12.3	4.4	46%	54%	35%	0%	62%
TYPE 4	middle zone	40	5.58	5.7	2.3	38%	62%	-	-	-
TYPE 5	upper dolomite zone	4	1.77	3.1	4.8	100%	0%	-	-	-

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#### 9.2.8 Resource Estimation

Simple length x width x depth calculations on the known extent of mineralisation show that the resource at Grieves defined by current drilling is insufficient for a CRA deposit. Consequently, no resource estimate has been calculated.

Simple statistical analysis of all Grieves air-core and diamond assays show that for a cut-off grade of 1% Zn the mean grade is 4.0% Zn. Raising the cut-off grade to 2% increases the mean grade to 6.1% Zn for a decrease in total contained Zn of 15%.

#### 9.2.9 Economic Studies

During the year, CRA Resource and Processing Developments completed a "back of the envelope" study on the size-grade-metallurgy requirements of a carbonate-hosted Zn deposit at Zeehan to satisfy CRA's investment hurdles.

The study concluded that for a viable surficial clay resource approximately 6Mt to 8Mt at 4% Zn (assume 90% Zn as sphalerite) is required.

The siderite and stratabound clay zones are unlikely to be economic as it does not appear possible to produce a marketable Zn concentrate.

A hypothetical primary Zn sulphide resource would need to be of the order of 10Mt @ 10% Zn. For a head grade of 8% Zn, the resource would need to be 16Mt. Transport options on the west coast were also studied. Surprisingly, the existing road and rail networks are not particularly cost-effective. For a large operation desired by CRAE, the preferred transport option could be establishing a port outside Macquarie Heads.

Reports on economic studies are presented in Appendix 9.

#### 9.2.10 Magnetic susceptibility measurements

Magnetic susceptibility was measured at 1m intervals on all CRAE diamond drill holes at Grieves, and composited to assay sample boundaries (Appendix 10).

Siderite alteration shows a definite magnetic response some five times greater than the magnetically quiet limestone. The siderite zones averaged  $50 \times 10^{-5}$  against a background of  $10 \times 10^{-5}$  in unaltered limestone.

This result offers some opportunity for large siderite alteration zones to be detected by non-intrusive exploration methods.

### 9.2.11 Wacker Bedrock Sampling

Fifty-seven wacker samples were collected at 200m x 25m spacing over the Moina Sandstone - Gordon Limestone contact in an effort to identify any siderite alteration and associated Zn mineralisation extending away from the known Grieves deposit (Appendix 11). Samples were assayed at Analabs Burnie by AAS (aqua regia-perchloric acid digest) for Ag-As-Cu-Pb-Zn-Fe-Mn. Sampling was effective but very slow and high cost, calculated to be about \$20/m. Geochemical plans of combined air-core and wacker bedrock sampling for Zn-Pb-Fe-Mn-As covering the Rose Valley to Professor Range area are included (Plans Tv878 to Tv882).

Elevated Fe-Zn-As was detected on lines 46900E and 46700E. Peak values of 2807 ppm Zn, 10.9% Fe, 490 ppm Mn and 190 ppm As were recorded.

### 9.2.12 Orientation Peat Sampling

Thirty-six samples of decomposed organic material were collected along sections 48200N, 47800N and 47700N to determine whether metals hydromorphically dispersed from the underlying mineralisation were being absorbed by organic compounds in the peat layer.

Orientation lines were chosen to coincide with areas of known sub-cropping mineralisation that was well defined by wacker and air-core sampling.

Figure 3 shows the sampling profile for 48200N. A weak single-point Zn anomaly of 110 ppm was recorded over highly mineralised bedrock (Appendix 12). Other samples were not anomalous on this line. Elevated values on lines 47700N and 47800N are interpreted to reflect the lack of gravels at those sites, so that the peat is directly in contact with sub-cropping mineralisation.

Results show peat sampling does not reliably detect known mineralisation at Grieves. The technique should therefore not be adopted as a routine first-pass sampling tool.

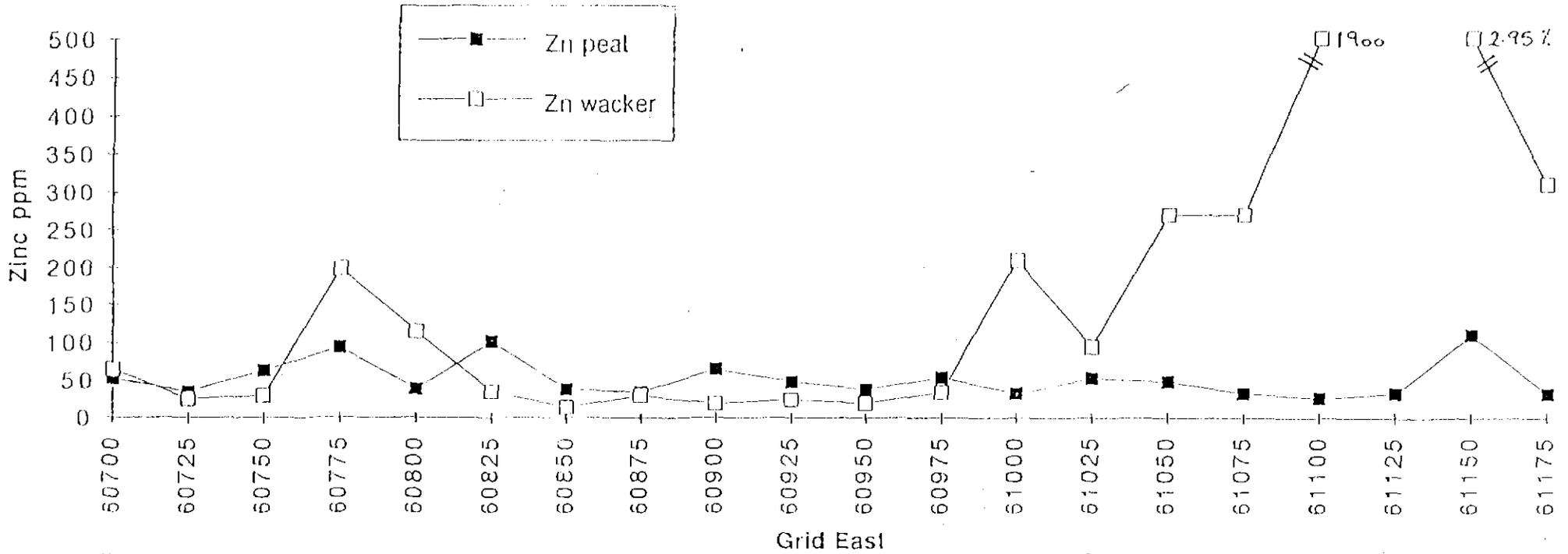
### 9.2.13 Reprocessing of Amoco gravity surveys

Gravity data collected throughout the Badger River area by Amoco, and regional BMR stations were compiled ready for re-interpretation. The aim of the study was to determine whether detailed gravity could directly detect sulphide mineralisation or an associated high-density siderite alteration halo. Compiled raw data was sent to Dr David Leaman.

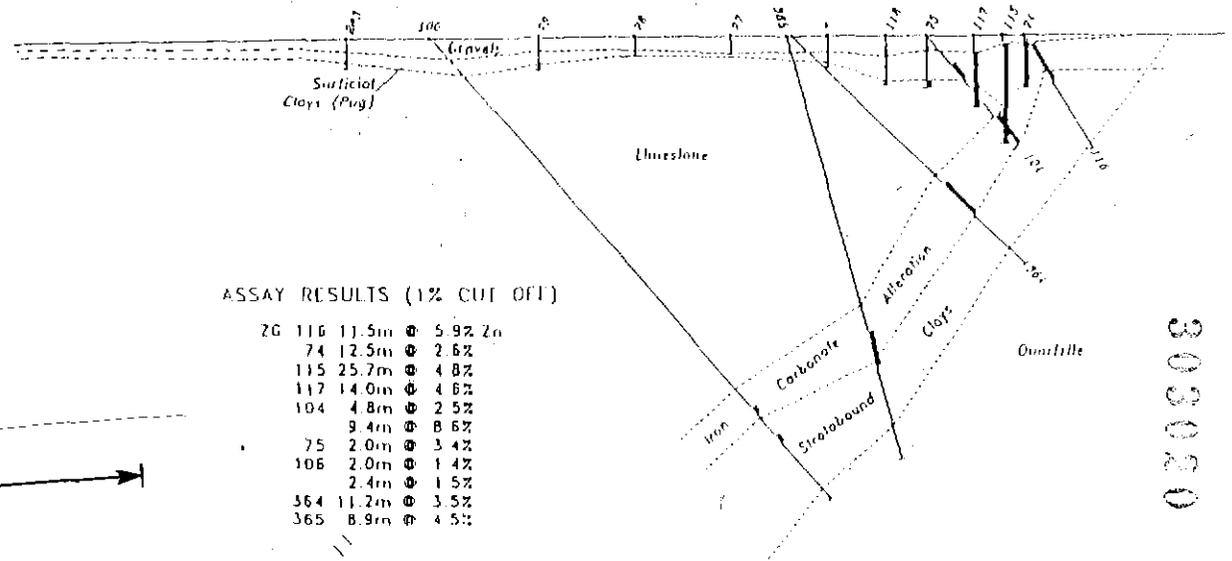
At the time of writing, work was incomplete. Modelling of observed and theoretical results suggest a large deposit (20Mt of dense material) may be weakly discernable under favourable conditions. Dr Leaman's initial response to the data, and modelling results, are appended (Appendix 13).

# ZEEHAN 4 EL 38/89 GRIEVES PROSPECT

## PEAT vs WACKER GEOCHEMISTRY - Line 48200N



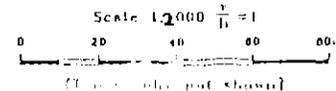
### GEOLOGICAL SECTION



#### ASSAY RESULTS (1% CUT OFF)

ZG	Depth (m)	Grade (%)	Zn (%)
116	11.5m	5.9%	Zn
74	12.5m	2.6%	
115	25.7m	4.8%	
117	14.0m	4.6%	
104	4.8m	2.5%	
	9.4m	8.6%	
75	2.0m	3.4%	
106	2.0m	1.4%	
	2.4m	1.5%	
364	11.2m	3.5%	
365	8.9m	4.5%	

5 cm



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### 9.3 Zinc Mineralisation in the Gordon Limestone

CRAE's exploration and research activities directed at locating carbonate-hosted Zn-Pb mineralisation within Gordon Limestone at Zeehan have led to a number of mineralisation styles being recognised. The following discussion is a synthesis of CRAE's current level of knowledge, gained from work throughout the Zeehan area.

CRAE's exploration activities in the Zeehan area have indicated that Zn-Pb mineralisation within the Gordon Limestone may be pre-Devonian in age, and therefore unrelated to the Tabberabberan Orogeny. On this basis, it is possible that carbonate-hosted Zn-Pb mineralisation may be more widespread than that presently under evaluation at Zeehan.

The Gordon Limestone originally occupied a large area, deposited at the close of a major period of tectonic activity that produced the metal-rich Mount Read Volcanics. During and immediately before carbonate deposition the tectonic regime was still unstable, evidenced by rapid changes in stratigraphic thickness of Ordovician strata. Hydrothermal systems may have continued to emit metals into this system, focussed by basement irregularities and syn-sedimentary faults. Basin-bounding syn-sedimentary faults in the Zeehan area are WNW-trending, and include the Firewood Siding Fault on the SW side, and Professor Range and Balstrup Faults on the NE side.

*The present Gordon Limestone exposure is a vestige of Devonian deformation. Ordovician mineralisation may have a distribution totally independent of the well-documented Devonian systems.*

Five targets are recognised for the carbonate-hosted Zn mineralisation in Gordon Limestone at Zeehan, subdivided by the stratigraphic interval in which they are hosted (Figure 4):-

- stratabound at the lower limestone-sandstone contact
- stratabound at the upper limestone-quartzite contact
- stratabound within a sub-unit in the middle of the limestone sequence
- structurally controlled discordant mineralisation
- surficial "clay-hosted" accumulations developed above primary mineralisation

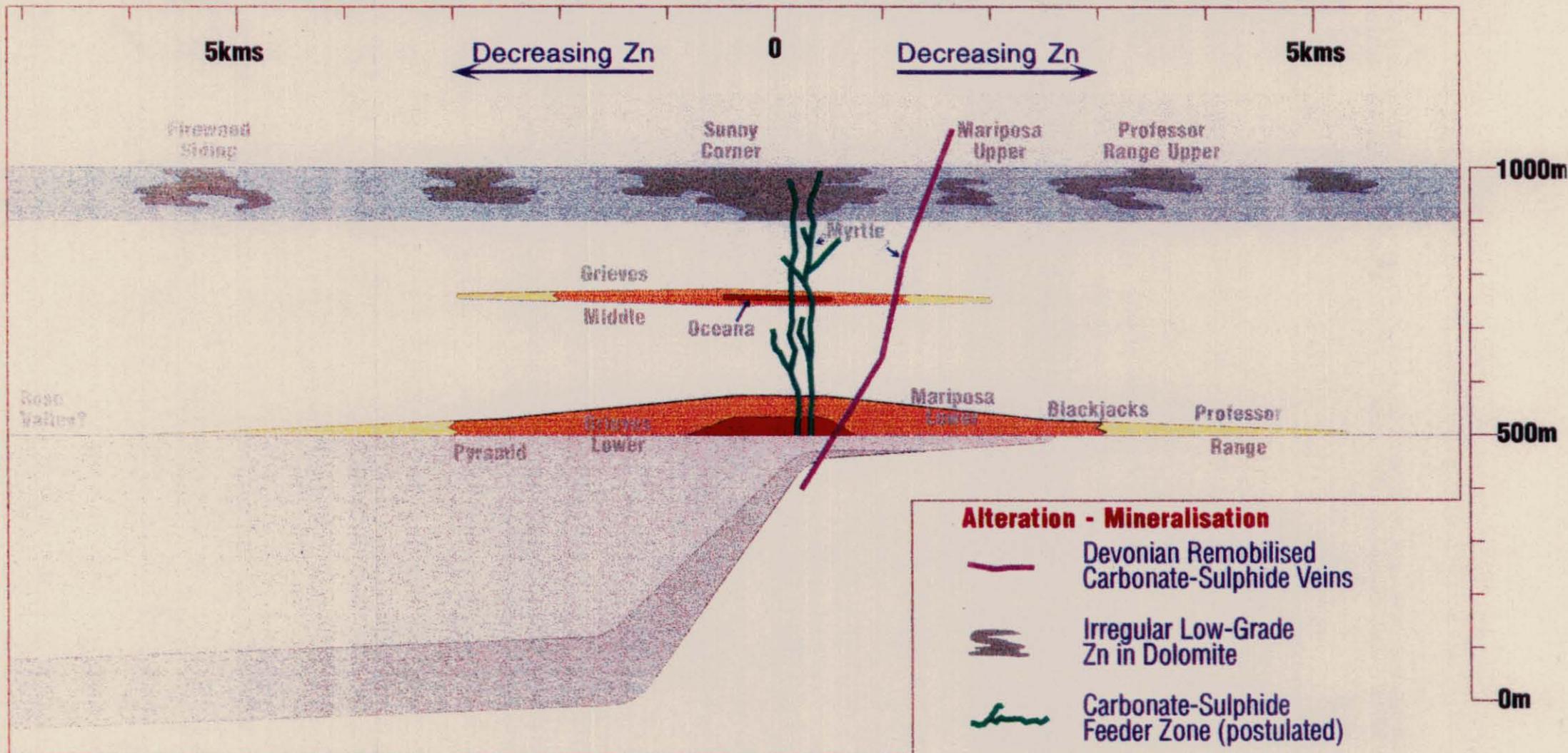
#### ***Stratabound at the lower limestone-sandstone contact***

Mineralisation at Grieves and Mariposa falls into this category. Alteration located at Blackjacks, Pyramid and Professor Range may also belong to this deposit type.

This position is characterised by carbonaceous and/or ferruginous clays resting on the Moina Sandstone, in turn overlain by a massive siderite zone. The siderite zone passes stratigraphically upward either gradationally or abruptly into unaltered and unmineralised limestone. The clay layer may be up to 50m thick and the siderite zone up to 25m thick. Both may contain Zn mineralisation up to several percent. The clay and siderite zone are laterally quite uniform and it may be that the mineralisation is actually stratiform.

Mineralisation of this style has an alteration halo that is both visually and geochemically distinct. This halo, characterised by vuggy, broken or massive recrystallised Fe-carbonate and Fe-rich clays, may extend laterally hundreds of metres beyond the main Zn mineralisation, and thus presents a considerably larger target than the mineralised core. Lateral alteration geochemistry is reflected by Fe-Mn-As-Zn. Stratigraphically above the mineralised core is a weaker halo of elevated Zn ( $\pm$  As).

# SCHEMATIC REPRESENTATION OF MINERALISATION IN THE GORDON LIMESTONE AT ZEEHAN



## Geology

	Silurian - Quartzite		Ordovician - Sandstone
	Ordovician - Dolomite		- Conglomerate
	- Limestone		Cambrian - Sediments and volcaniclastics

## Alteration - Mineralisation

- Devonian Remobilised Carbonate-Sulphide Veins
- Irregular Low-Grade Zn in Dolomite
- Carbonate-Sulphide Feeder Zone (postulated)
- Zn - poor Stratabound Siderite Alteration
- Zn - rich Stratabound Siderite Alteration
- Sulphide Mineralisation - Stratabound (postulated)

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Ore mineralogy, based on work at Grieves, is complex with a mixture of zincian siderite and minor sphalerite in the siderite zone, and a Zn-clay with minor to moderate amounts of sphalerite in the clay zone. It is not known whether this is a regional characteristic of this position. It could be possible that the complex clay mineralogy is a supergene weathering process acting on an original sphalerite-pyrite mineralised black shale. The siderite may be capping the sulphide system, preserved in its primary form due to its low porosity and permeability.

The stratiform character, replacive style of alteration/mineralisation, intense Fe-Mn alteration, and reasonably predictable geometry suggest similarities to Navan or Reocin.

***Stratabound at the upper limestone-quartzite contact***

Low-grade but widely anomalous zones from Firewood Siding, Grieves, Professor Range, Sunny Corner, and Mariposa are examples of this type.

Upper zone mineralisation occurs near the contact between the limestone and overlying Crotty Quartzite. Mineralisation is not closely bound to the upper quartzite contact, but may "wander" up to 100m stratigraphically below the contact.

Mineralisation appears characterised by widespread but low-level Zn in the 0.1% to 2% Zn range. None of the prospects tested has revealed a higher-grade core, although given the limited drilling it is entirely possible high-grade cores may exist. Limited mineralogy suggests all Zn to be as sphalerite.

Air-core drilling shows the mineralised zones to be comprised of clays and decomposed carbonate. Rare fresher material is usually a granular recrystallised dolomite, and can be ferroan. Intense siderite alteration is absent. A detailed geochemical study of the alteration has not been completed.

The upper zone style may be occurring within karstic structures formed by Ordovician weathering before deposition of the Crotty Quartzite. This setting is analogous to Bleiberg or Cracow-Silesia.

***Stratabound in a middle sub-unit of the limestone sequence***

Currently two occurrences fall into this grouping, Grieves middle zone, and Oceana. Apart from their stratigraphic concurrence, these two deposits may not share many other similarities.

The mineralised middle sub-unit is equidistant from the upper and lower contacts, although facies variations may affect the location at other prospects. Mineralisation is breccia hosted, and in the case of Grieves has a linear aspect. For Grieves there is very little indication of proximity to mineralisation as there is virtually no alteration outside the breccia zone itself.

Mineralogy at Grieves is a mixture of zincian siderite and sphalerite. Oceana is dominated by galena with subordinate (?) sphalerite. There is also intense siderite alteration at Oceana, presumably containing Zn?

Zinc grades at both prospects are high, locally forming massive sulphide. There has been insufficient work completed at Grieves middle zone to suggest any controlling mechanisms.

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***Structurally controlled discordant mineralisation***

Most mineralisation in the Zeehan area is structurally controlled. Mineralisation at the historic Mariposa mine, and at Myrtle belong to this type. Possibly some of the mineralisation at Oceana is also structurally controlled.

Structurally controlled mineralisation may occur at any stratigraphic level. It appears to be late-stage filling of brittle fractures. Alteration of wall-rocks is absent, and the gangue to mineralisation may be pure calcite. Mineralisation within the structures is patchily distributed. Ore minerals are coarse-grained sulphides.

Devonian deformation is the likely cause of the fracturing and mineralisation. Potential deposit size is small, although the presence of discordant mineralisation may indicate a nearby stratabound source. Late-stage structurally controlled deposits *per se* are not currently considered a valid CRAE target.

***Surficial "clay-hosted" accumulations developed above primary mineralisation***

Surficial Zn accumulations within decomposed carbonate was CRAE's original target for carbonate exploration at Zeehan. All currently tested prospects were selected due to the presence of known surficial mineralisation.

It has now been conclusively demonstrated that the surficial mineralisation occupies the surface trace of underlying stratabound mineralisation. Geometry of the surficial deposits are therefore dependent on the shape and extent of this underlying mineralisation. Depth extent of the Zn-rich clays and decomposed carbonates averages 10m to 20m, but have been reported to be over 100m at Oceana.

A thin layer of decomposed carbonate exists over large areas of limestone, but this layer only thickens and becomes substantially Zn-rich as "basement" mineralisation is approached. Areas of +0.1% Zn in the clay layer are regionally extensive, indicating substantial dispersions from the primary zone. Clay thickness and Zn grade may be useful vectors toward primary zones. Geochemically inert peat and gravels up to 5m thick obscure the clays and limestone over virtually the entire trace of the Gordon Limestone.

Zinc ore mineralogy is dominantly to exclusively sphalerite.

Because of their restriction to the surface zone, the potential size of the surficial deposits is somewhat limited. They are probably unlikely to be a CRA target in themselves. Their main attraction is their usefulness as an indicator of the underlying primary mineralisation. If a large primary deposit suitable to CRAE's requirements can be identified, then the surficial deposits would possibly be an easy way to generate short-term cash-flow whilst the major deposit was being developed.

Zinc-rich clay deposits overlying primary carbonate mineralisation have been described at Tynagh and Silvermines.

## 10. ENVIRONMENT AND REHABILITATION

The past two years have seen a substantial amount of exploration work completed in a relatively small area. A total of 400 air-core and diamond holes have been drilled in an area not much greater than 1sqkm.

During the period under review, the only activities impacting on the environment were the drilling of two diamond holes from the same site using a skid-mounted Longyear 38, towed by an excavator. The excavator was fitted with extra-wide swamp tracks to reduce ground pressure. It is unavoidable that such heavy machinery will cause significant ground disturbance. Tracks were kept to a minimum, and were positioned where possible to take advantage of naturally firm, gravelly areas. No formal tracks were constructed. All access tracks were progressively rehabilitated by filling in ruts, breaking in windrows and re-establishing drainage. Currently no seeding or fertilising has been done. It is expected that parts of these tracks will take several seasons to regenerate.

Minimal preparation was completed on diamond drill sites. No vegetation was cleared as often this was the only firm working surface. Sumps were dug to contain drill cuttings, although due to the flat topography and high water table (often at-surface) they were often marginally effective. Sumps were refilled on completion of the hole and the site ripped to loosen compacted ground.

Holes making water were plugged at depth, then cemented. Due to high water flows in some holes, and the poor ground conditions to hold plugs and cement, these may not be permanently effective.

All drill cuttings from the air-core program were bagged to enable the samples to be easily returned to the holes or removed from site. This was completed during the year. Bags used are photo-degradable, and will rapidly break down in disposal sites.

Wacker sampling did not leave any significant visual impact on the ground.

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- PARKINSON R.G. 1994 Zeehan No. 4 EL38/89, Tasmania. Report on exploration for the fourth year of tenure 1/3/93 to 28/2/94. *CRAE Report No.* 19635.

KEYWORDS

TASMANIA, ORDOVICIAN, CARBONATE-HOSTED, GORDON LIMESTONE, MINERALOGY, PETROLOGY, AIR-CORE DRILLING, DIAMOND DRILLING, BEDROCK SAMPLING, ECONOMIC STUDIES, ZINC.

LOCATION

QUEENSTOWN	SK55-5	1:250000
PIEMAN	7914	1:100000
ZEEHAN	7914-S	1:50000

LIST OF DPOs

77131  
77138  
77147  
77148  
77149  
77150  
77213  
77655  
77658  
77663  
77668  
77672  
77673  
77675

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Tv 761	Zeehan Area Gordon Limestone Prospect and Drillhole Location Plan	1:50,000
Tv 712	Zeehan 4 EL 38/89 Grievess Prospect Drillhole Location Plan	1:2,500
Tv 901	Zeehan 4 EL 38/89 Grievess Prospect Section 47000N Fe & Zn Geochem	1:500
Tv 902	Zeehan 4 EL 38/89 Grievess Prospect Section 47050N Fe & Zn Geochem	1:500
Tv 903	Zeehan 4 EL 38/89 Grievess Prospect Section 47100N Fe & Zn Geochem	1:500
Tv 904	Zeehan 4 EL 38/89 Grievess Prospect Section 47150N Fe & Zn Geochem	1:500
Tv 905	Zeehan 4 EL 38/89 Grievess Prospect Section 47200N Fe & Zn Geochem	1:500
Tv 906	Zeehan 4 EL 38/89 Grievess Prospect Section 47300N Fe & Zn Geochem	1:500
Tv 907	Zeehan 4 EL 38/89 Grievess Prospect Section 47350N Fe & Zn Geochem	1:500

Tv 908	Zeehan 4 EL 38/89 Grieves Prospect Section 47400N Fe & Zn Geochem	1:500
Tv 909	Zeehan 4 EL 38/89 Grieves Prospect Section 47450N Fe & Zn Geochem	1:500
Tv 910	Zeehan 4 EL 38/89 Grieves Prospect Section 47500N Fe & Zn Geochem	1:500
Tv 911	Zeehan 4 EL 38/89 Grieves Prospect Section 47550N Fe & Zn Geochem	1:500
Tv 912	Zeehan 4 EL 38/89 Grieves Prospect Section 47600N Fe & Zn Geochem	1:500
Tv 913	Zeehan 4 EL 38/89 Grieves Prospect Section 47650N Fe & Zn Geochem	1:500
Tv 914	Zeehan 4 EL 38/89 Grieves Prospect Section 47700N Fe & Zn Geochem	1:500
Tv 915	Zeehan 4 EL 38/89 Grieves Prospect Section 47750N Fe & Zn Geochem	1:500
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Tv 917	Zeehan 4 EL 38/89 Grieves Prospect Section 47850N Fe & Zn Geochem	1:500
Tv 918	Zeehan 4 EL 38/89 Grieves Prospect Section 47900N Fe & Zn Geochem	1:500
Tv 919	Zeehan 4 EL 38/89 Grieves Prospect Section 47950N Fe & Zn Geochem	1:500
Tv 920	Zeehan 4 EL 38/89 Grieves Prospect Section 48000N Fe & Zn Geochem	1:500
Tv 921	Zeehan 4 EL 38/89 Grieves Prospect Section 48050N Fe & Zn Geochem	1:500
Tv 922	Zeehan 4 EL 38/89 Grieves Prospect Section 48100N Fe & Zn Geochem	1:500
Tv 923	Zeehan 4 EL 38/89 Grieves Prospect Section 48150N Fe & Zn Geochem	1:500
Tv 924	Zeehan 4 EL 38/89 Grieves Prospect Section 48200N Fe & Zn Geochem	1:500
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Tv 926	Zeehan 4 EL 38/89 Grieves Prospect Section 48300N Fe & Zn Geochem	1:500
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APPENDIX 1

Reports by D. Morris and D Taylor - Zinc mineralisation in the Gordon  
Limestone; Pyrobitumen reflectance.

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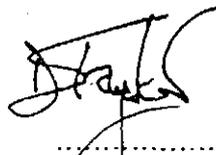
ZINC MINERALISATION  
IN THE GORDON LIMESTONE, TASMANIA.

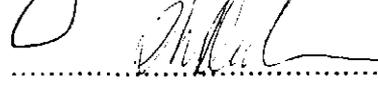
Authors: Dennis Taylor and Doug Morris

Date: 3 August, 1994

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Jacob Rebek, CRAE Gordon

Submitted by:  Douglas J. Morris

Accepted by: 

Report No: 20080

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## 1. SUMMARY

The mineralisation of interest is a zinc rich, hydrocarbon replacement type, stratabound within the Ordovician Gordon Limestone. In drill core it appears to be crosscutting but not obviously related to structure. It is regional in extent occurring beyond the Zeehan District.

The mineralisation at the base of the Gordon Limestone is not syngenetic and is irregular in its distribution. Where seen in CRAE drill core it is heavily weathered and the true nature of the primary mineralisation is not yet apparent. Primary sulphide mineralisation was seen in core from the upper part of the limestone and in rock specimens and drill core from the Oceana Mine. It clearly replaces the rock matrix and is associated with bitumen.

The zinc rich siderite in the basal mineralised zone is very atypical of carbonate hosted lead-zinc deposits. This style of mineralisation may therefore be unique and existing exploration models should be applied with caution. Siderite is a common gangue of the vein type lead/silver mineralisation of the Zeehan district and veins of this type extend up into the Upper Devonian.

The associated black, zinc rich, muds may be largely secondary in origin. We think that they are a residue of decalcification of the limestone due to acid leaching within the present weathering profile. They are not present in the only available deep drill intersection. If derived from a strongly mineralised area they could constitute an ore.

Previous mining in the Zeehan District was almost exclusively for lead and silver. Most came from vein systems in the Proterozoic and Early Cambrian with only a minor production recorded from the Gordon Limestone. The zinc-rich mineralisation in the Gordon Limestone would not have been of interest to the early miners. Given the poor outcrop of the Gordon Limestone throughout western Tasmania it is probable that a significant zinc-rich mineralisation would have been overlooked.

Exploration results to date indicate that minor mineralisation within the Gordon Limestone is widespread. Major accumulations of metal require some further control. This may be provided by early structures which controlled sediment deposition, facies distribution and fluid flow. Large variations in thickness of the basal clastic units can be inferred from the geological map and may have provided a focus for major ore deposition. Ore deposition overlying pinch-outs would be expected to extend upwards through a significant thickness of the Gordon Limestone, and could provide a major deposit of sulphides.

The style of mineralisation is similar to lead-zinc deposits in undeformed basins. The burial history shows that the Gordon Limestone was driven through peak oil generation and fluid drive in the Devonian, prior to the Tabberabberan Orogeny and granite emplacement. The mineralisation is therefore likely to be related to early structures and independent of structures produced by the orogeny. The mineralisation will have been deformed with its host unit during the Tabberabberan Orogeny and its present attitude will bear little relation to its original orientation.

Because of this later structuring and poor outcrop, it will be difficult to explore the Zeehan area for major deposits. Once the present program of drilling known occurrences is completed we will need to develop some means of targeting more favourable areas for testing. Possible target concepts are:-

- 1) Basal clastic pinchouts related to early structure.
- 2) Areas of karsting below the Crotty Quartzite.
- 3) Zones of concentrated vein mineralisation in the overlying Siluro-Devonian
- 4) Zones of zinc-rich black mud in modern karst on the upper or lower contacts of the Gordon Limestone.
- 5) Early, pre-Tabberabberan, domal structures or listric roll-overs.

Of these 1 and 4 appear to be the easiest to find.

Topographic features suggest and drilling confirms that major amounts of ground water are circulating through the sandstone aquifers above and below the Gordon Limestone. In other parts of Tasmania major cave systems are developed in the limestone. Similar cave systems may be anticipated in the Zeehan district and there are records of miners being drowned through mine water break out. Ground water is likely to be a major impediment to mining in the district.

## 2. CONCLUSIONS

- 1) A previously unknown style of mineralisation has been found at the base of the Gordon Limestone near Zeehan.
- 2) The primary nature and ultimate potential of this mineralisation is unknown.
- 3) Mineralisation is regional in extent and untested.
- 4) A major deposit of zinc may be present.
- 5) Deeper drill testing is required at existing prospects.
- 6) A more regional approach is now required to locate the most prospective ground.

## 3. RECOMMENDATIONS

- 1) Test known occurrences with deeper drill holes to investigate the basal zone below surficial alteration.
- 2) Concentrate current exploration techniques on the areas of pinch-out of the basal clastics.
- 3) Test the Gordon Limestone, by deep drilling, in the zone of vein deposits in the Siluro-Devonian north of the Balstrup Fault near Zeehan.
- 4) Carry out a detailed analysis of the Zeehan Sub-basin to determine pre-Tabberabberan structure and facies control.
- 5) Test outcrop areas of the Gordon Limestone elsewhere in Tasmania for zinc rich ores.
- 6) Monitor tenement status in the Mole Creek, Florentine Valley and the Mackintosh-Huskisson Rivers areas.
- 7) Perform water flow tests in all exploration holes to quantify water problems.

#### 4. OBSERVATIONS AND DISCUSSION

The mineralisation in the Gordon Limestone in the Zeehan area is a zinc rich, carbonate hosted strata-bound type occurring within the Ordovician Gordon Limestone. In drill core it appears to be crosscutting although it is not obviously related to fault structures or veins. Occurrences at Oceana, in the Zeehan area (plan Tc 225) and Bubs Hill, between Queenstown and the Florentine Valley, have been compared to Irish type and MVT deposits respectively.

Deposits of this type normally develop during diagenesis and catagenesis of carbonate basins and have no relationship to later deformation and granite intrusion. The distribution of these deposits is frequently related to basin forming structures, pinch out of basal aquifers or karsting developed during or shortly after deposition. Mineralisation frequently is associated in time with hydrocarbon generation and migration and, like hydrocarbons, occurs in early porosity traps of various kinds.

The Gordon Limestone has generated and reservoired hydrocarbons and these hydrocarbons have been destroyed by over maturation and/or penetration of ground waters to leave abundant bitumen residues. In drill core, where fresh and unweathered, some sphalerite was observed to be intimately associated with bitumen.

Mineralisation is not restricted to the organic rich rocks at the base of the limestone but also occurs near the top and also at various intervals throughout it. At the largest known deposit, Oceana, the mineralisation occurs in a fossiliferous calcirudite in about the middle of the formation. Brecciation and dolomitisation of the limestone is associated with the mineralisation at the base of the limestone and this mineralisation is concentrated on the interface between calcite and dolomite.

The mineralisation in the basal part of the limestone is unusual in that a large percentage of the zinc is in non-sulphide minerals, either zinc rich siderite or chloritic clays.

In drill core the Gordon Limestone is dominantly carbonaceous, nodular lime mudstone with minor oolitic and fossiliferous fine to coarse grained calcarenite. Significant zones of early diagenetic dolomite are present at the top of the limestone in the Grieves siding area. These are not associated with mineralisation. High amplitude stylolites are abundant and indicate removal of a large percentage of the carbonate due to pressure solution. Cross cutting calcite and dolomite veins of several generations, and open fractures filled with bitumen, are abundant.

The Gordon Limestone is sandwiched between two major sandstone units which are at present shallow aquifers, the underlying Ordovician Moina Sandstone and the overlying Silurian Crotty Quartzite. The Moina Sandstone in outcrop contains abundant tubular trace fossils and in drill core is light grey indicative of reducing conditions. It has a porosity and permeability varying from intergranular and high to low where porosity is occluded by secondary silicification. In the footwall of the Grieves mineralisation porosity and permeability is very high, the unit acting as an artesian aquifer when penetrated by drilling. At greater depth in the mines department hole the Moina Sandstone is siliceous and tight but the basal dolomitised zone of the limestone is porous and permeable.

The Gordon Limestone in the Zeehan area is generally steeply dipping, ranging from 50 degrees to vertical in the areas visited. Three post depositional phases of deformation can be identified.

- 1) Late Devonian to Early Carboniferous associated with the Tabberabberan Orogeny and granite intrusion. This event led to basin inversion on northwest trending structures which truncated the eastern margin of the preserved sub-basin. Fold axes in the Siluro-Devonian sequence also follow this trend. This event possibly caused inversion of pre-existing basin defining structures. Regional mapping of facies trends and thickness variations in the Ordovician basal clastics would identify these early structures. It is these that are most likely to have controlled mineralisation.
- 2) Post Permian and possibly post Jurassic thrusting from north to south. These thrusts divide the area into east west slices emplacing older over younger rocks. Faults of this series appear to have faulted out the Gordon Limestone near Zeehan town, immediately south of Oceana Mine and at the north end of the Professor Range, north of the Grieves Siding mineralisation.
- 3) Very recent rifting on northwest to southeast trending faults which have controlled deposition of Tertiary and recent sediments in Maquarie Harbour and uplift of beach terraces on the west flank of Mount Sorrel. Other faults in the Zeehan district such as the northwest trending fault which appears to truncate the glacial moraine in the Henty River valley were also probably reactivated very recently.

The structuring appears to be post mineralisation and greatly complicates the search for ore in the Gordon Limestone.

The Gordon Limestone as a whole has been extensively dissolved by acid ground water and underlies a series of valleys floored by peat. The peat

overlies bleached siliceous scree material derived from the flanking sandstones. The scree overlies black mud derived from the underlying limestone by decalcification. As a result the formation outcrops exceedingly poorly and any zinc mineralisation is not likely to outcrop. Decalcification of the lower part of the limestone has occurred due to present day acid ground water flowing through the underlying sandstone aquifer. This has converted the lower part of the limestone to a residue of black mud which extends to the greatest depth of CRAE drilling. Similar conditions are present at the top contact in the Mines Department hole, but the clays are not present at depth at the basal contact in this hole.

The present ground waters are acid and reducing due to the presence of an organic-rich peaty soil profile developed during post glacial times. These waters are observed to be removing carbonate and iron in the ferrous state leaving white bleached siliceous sandstone, but are not oxidising sulphide. At Grieves there is frequently observed an oxidised zone of variably abundant limonite associated with grey, yellow brown and orange clay. This is clearly due to weathering but would not appear to be forming under the present ground water conditions. This oxidised zone is seen in the deepest hole drilled by CRAE and lies between two zones of high zinc values. Some of the present distribution of zinc therefore appears to be due to overprinting by recent and possibly older weathering. The original unweathered lithological nature of the clay zone hosting the mineralisation at Grieves is not known and deeper drilling in the area of known mineralisation is needed to resolve its nature.

The basal Ordovician clastics and aquifer system, which comprises the Owen Conglomerate and the overlying Moina Sandstone, are very variable in thickness in the Zeehan area and appear to be locally absent at Mariposa. The Silurian Crotty Quartzite everywhere overlies the Ordovician Gordon Limestone in the Zeehan area but regional relationships indicate a significant time break between the two units. Disconformity would allow the potential for palaeokarst development at the top of the Gordon Limestone.

Potential controls on the zinc mineralisation are considered to be pinch out of the underlying clastics on early structures or basement highs which will mainly influence mineralisation at the base of the Gordon Limestone, and palaeokarst which would provide a trap site for mineralisation higher in the limestone. Particularly favourable locations for mineralisation can be visualised where fluid systems originating in the basal aquifer have broken through along early structures and allowed mineralisation to extend through the full thickness of the Gordon Limestone.

Mineralisation in the Devonian Bell Shale north of the Balstrup Fault indicates fluid escape to high levels of the stratigraphy. Porosity variation within the Gordon Limestone, probably related to primary facies

distribution, may also provide zones for preferential fluid flow and control mineralisation. The very poor outcrop in the Zeehan district does not allow facies variations to be ascertained except by drilling.

## 5. BURIAL HISTORY

Plan Tc 226 presents the decompacted stratigraphic burial plot for the Ordovician to Devonian sequences in the Zeehan Sub-basin (table 1). In the Zeehan area the preserved thickness of sediment to the top of the Bell Shale is nowhere near sufficient to explain the level of thermal alteration of organics and degree of pressure solution observed in the Gordon Limestone. It is therefore indicated that there has been significant removal of Devonian stratigraphic section as a result of the Tabberabberan Orogeny. The preserved thickness of the Bell Shale at Teepookana on the Strahan 1:50000 sheet and in the Eldon River area near Queenstown is far greater than at Zeehan, while in the Spero Bay area a younger Devonian section of carbonate and red bed clastics is preserved in a fault outlier (Banks 1962). In the burial history plot the additional thicknesses of the Spero Bay Group and the Bell Shale in the Eldon River area have been added to the Zeehan data to approximate the pre-deformation sedimentary history. Following discussion with the author the thickness of 4000 metres for the Bell Shale in the Eldon River area was calculated from outcrop data on the Lyell 1:50000 Sheet (Calver et. al. 1987)

The basin can be divided into three genetic phases:

### 1) Rift-Sag.

The Owen Conglomerate and Moina Sandstone are the infill of an initial extensional rift phase and the Gordon Limestone is a platform sequence deposited as a response to thermal subsidence. The top of the Gordon Limestone is a paraconformity to unconformity and a major sequence break.

### 2) Passive Margin.

The Eldon Group appears to represent a continental margin shelf and slope wedge with progressive deepening with time. The burial history plot shows that deposition of the Bell Shale was coincident with a period of rapid subsidence of the basin which drove the Gordon Limestone through peak oil generation and fluid drive. Structures influencing sedimentation at this time are likely to have provided trap sites for mineralisation. The basal units of the Spero Group, the Clear Water Bay Sandstone and the Point Hibbs Limestone, appear to represent the final filling prograde stage of the passive margin basin coincident with cessation of extension.

The top of the Point Hibbs Limestone is at least a paraconformity and a major sequence break.

### 3) Foreland Basin.

The upper three formations of the Spero Group are coarse grained red bed clastic units deposited as a response to the initial phases of the Tabberabberan Orogeny. Deposition of similar deposits are coincident in time throughout the continental platform basin sequences in Australia and record a period of generally north to south compressive stress. Uplift on the Little Henty and the Balstrup reverse faults may have commenced during this time.

TABLE 1

#### ZEEHAN SUB-BASIN

DATA FOR BURIAL HISTORY MODEL from Blissett 1962, Banks 1962 and calculated from outcrop data on published Lyell 1:50000 sheet 1987 (Calver et al)

FORMATION	AGE	THICKNESS	CUM.
White Horse Beach Sandstone	365-	64	64
Red Reef Cliff Sandstone		67	131
Sanctuary Bay Sandstone	-370	244	375
Point Hibbs Limestone	370 - 372	183	558
Clearwater Bay Sandstone	372 - 380	82	640
Bell Shale	380 - 390	4000	4640
Florence Quartzite	390 - 405	488	5128
Austral Creek Siltstone	405 - 415	213	5341
Keel Quartzite	415 - 420	61	5402
Amber Slate	420 - 430	244	5646
Crotty Quartzite	430 - 435	488	6134
Gordon Limestone	435 - 475	457	6591
Moina Sandstone	475 - 490	365	6956
Owen Conglomerate	490 - 500	152	7108

The Ordovician and uppermost Cambrian (Dundas Trough) sequences appear to be paraconformable along the eastern margin of the Zeehan Sub-basin resulting in difficulty in resolving the boundary between the sequences in mapping in the Mariposa and the Bottle Creek-Henty River areas. The underlying Dundas Group may have been unstructured and under mature at the onset of deposition of the Ordovician and therefore may have been a source for metal carrying fluid during later basin evolution.

The amount of alteration observed in the Gordon Limestone may be more than that indicated by the burial history plot. This needs to be confirmed

by organic petrographic studies. The intrusion of the Heemskirk Granite provides a limit on deposition of 330 to 360 My, and the Pieman Granite, with a smaller range from 340 to 355 my, indicates a period of 20 my between the intrusion of the granites and the youngest age of preserved sediment. The period of granite intrusion most likely represents an episode of elevated heat flow. When combined with the observed burial history this may account for the observed level of alteration.

Variations in thickness of the Crotty Quartzite, the basal Silurian unit, are most likely associated with a period of mild structuring at the close of deposition of the Gordon Limestone. Banks(1962) notes that the Crotty Quartzite appears to reach a maximum thickness south of Zeehan and decreases both to the south and east. Associated with the decrease in thickness there is an increase in the proportion of conglomerate. The Amber Slate also appears to thicken from Zeehan to Queenstown. These thickness differences would have had an affect on hydrocarbon generation in the Gordon Limestone and therefore on fluid drive.

Determination of facies variations and thickness of both the Ordovician and Siluro-Devonian sequences will be important in delineating structures that control basin architecture. These pre-Tabberabberan structures may provide potential trap sites for mineralisation.

## 6. OTHER AREAS OF INTEREST

The Gordon Limestone was deposited on a continental platform that probably covered nearly all of west and central Tasmania except for possibly the Rocky Cape cratonic nucleus northwest of the Arthur Lineament. Elements of the Ordovician to Devonian units are preserved, as outliers, in a series of synforms, and in the central and south parts of the island, are exposed in erosional windows through the post Devonian cover sequence. The most important of the outliers are in the Mole Creek-Moina (plan Tc 227) and Mackintosh-Huskisson Rivers (plan Tc 228) areas and the Florentine Valley (plan Tc 229). At Moina skarn mineralisation related to Devonian Granite overprints what initially was a zinc rich siderite mineralisation at the base of the Gordon Limestone. A minor occurrence of lead and zinc mineralisation in the Gordon Limestone is reported from the east bank of the Huskisson River. No mineral occurrences have been reported from the Florentine Valley area, however an MVT occurrence has been reported from Bubs Hill between Queenstown and the Florentine Valley. The lower dip of the limestone in some of these districts may make them more attractive exploration targets than the Zeehan area itself.

If a significant exploration push is to be undertaken in the Zeehan district then these other areas of outcrop of the Gordon Limestone should be

covered by tenement, to allow reconnaissance testing and forestall competitors.

## 7. REFERENCES

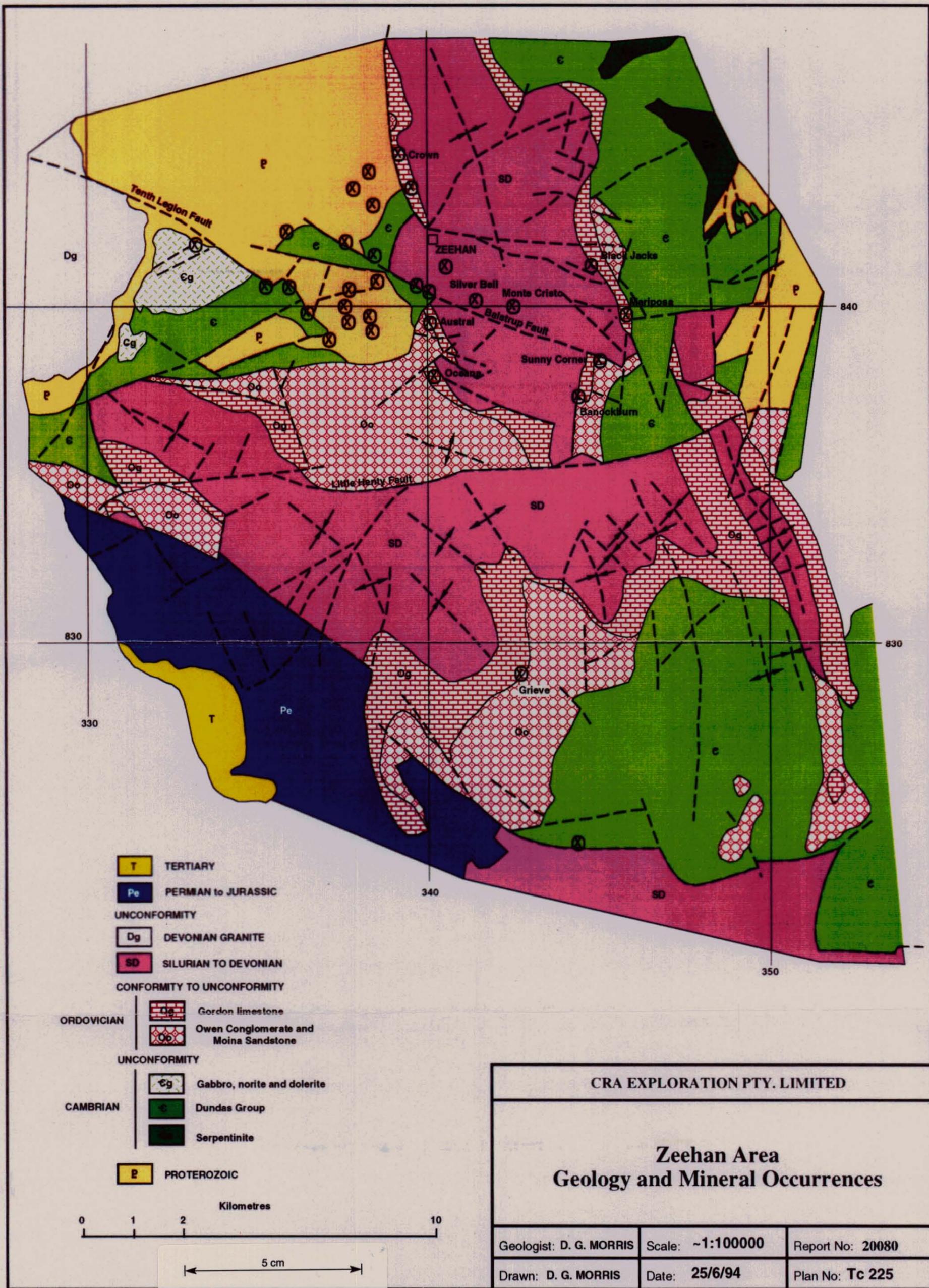
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Tc 225	Zeehan Area. Geology and mineral occurrences.
Tc 226	Zeehan Sub-basin. Burial History Model Ordovician to Devonian
Tc 227	Moina-Mole Creek Area General Geology
Tc 228	Mackintosh-Huskisson Rivers area General Geology
Tc 229	Florentine Valley General Geology

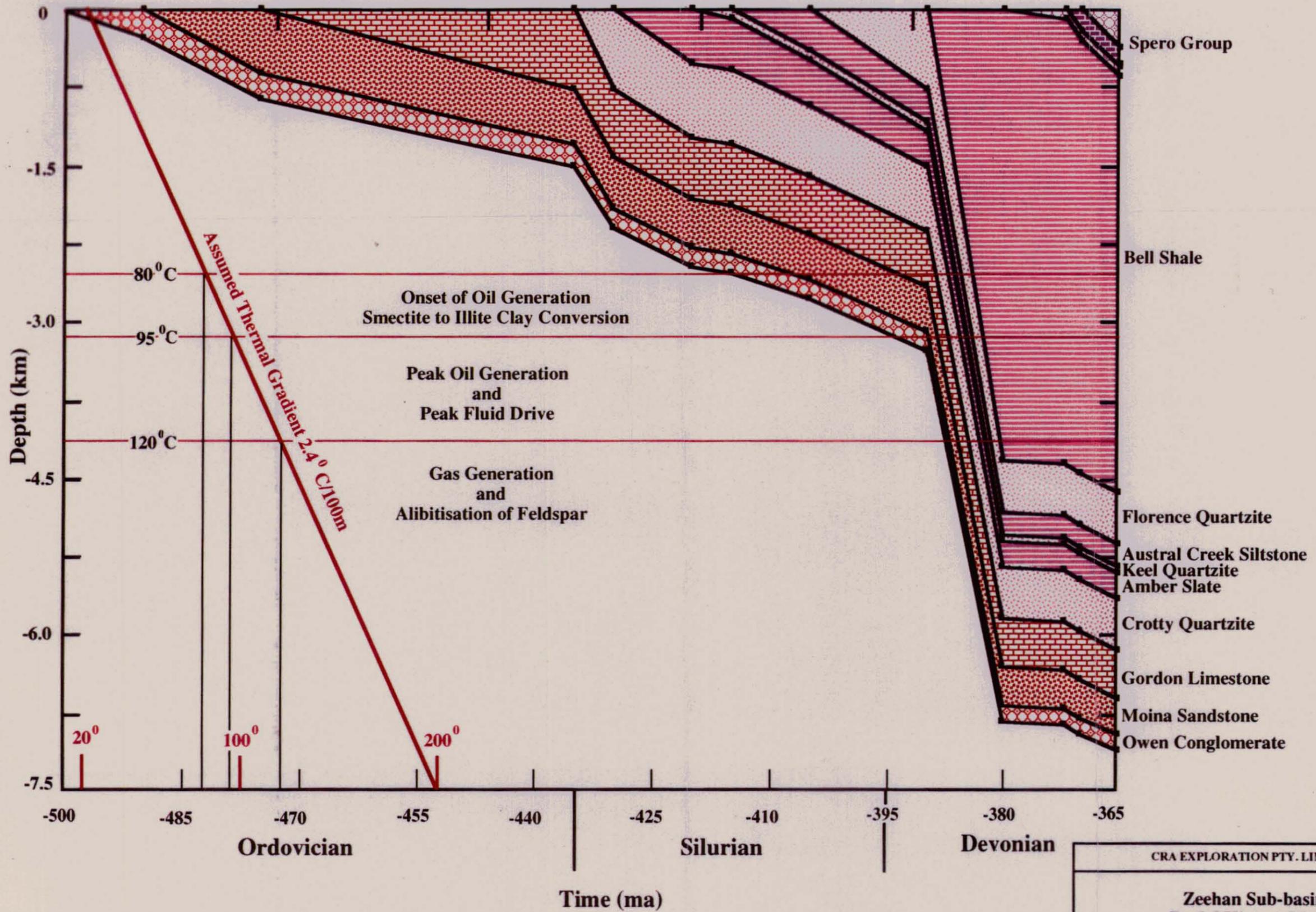


<b>CRA EXPLORATION PTY. LIMITED</b>		
<b>Zeehan Area Geology and Mineral Occurrences</b>		
Geologist: D. G. MORRIS	Scale: ~1:100000	Report No: 20080
Drawn: D. G. MORRIS	Date: 25/6/94	Plan No: Tc 225

303045

# Decompacted Stratigraphy vs. Time

303046

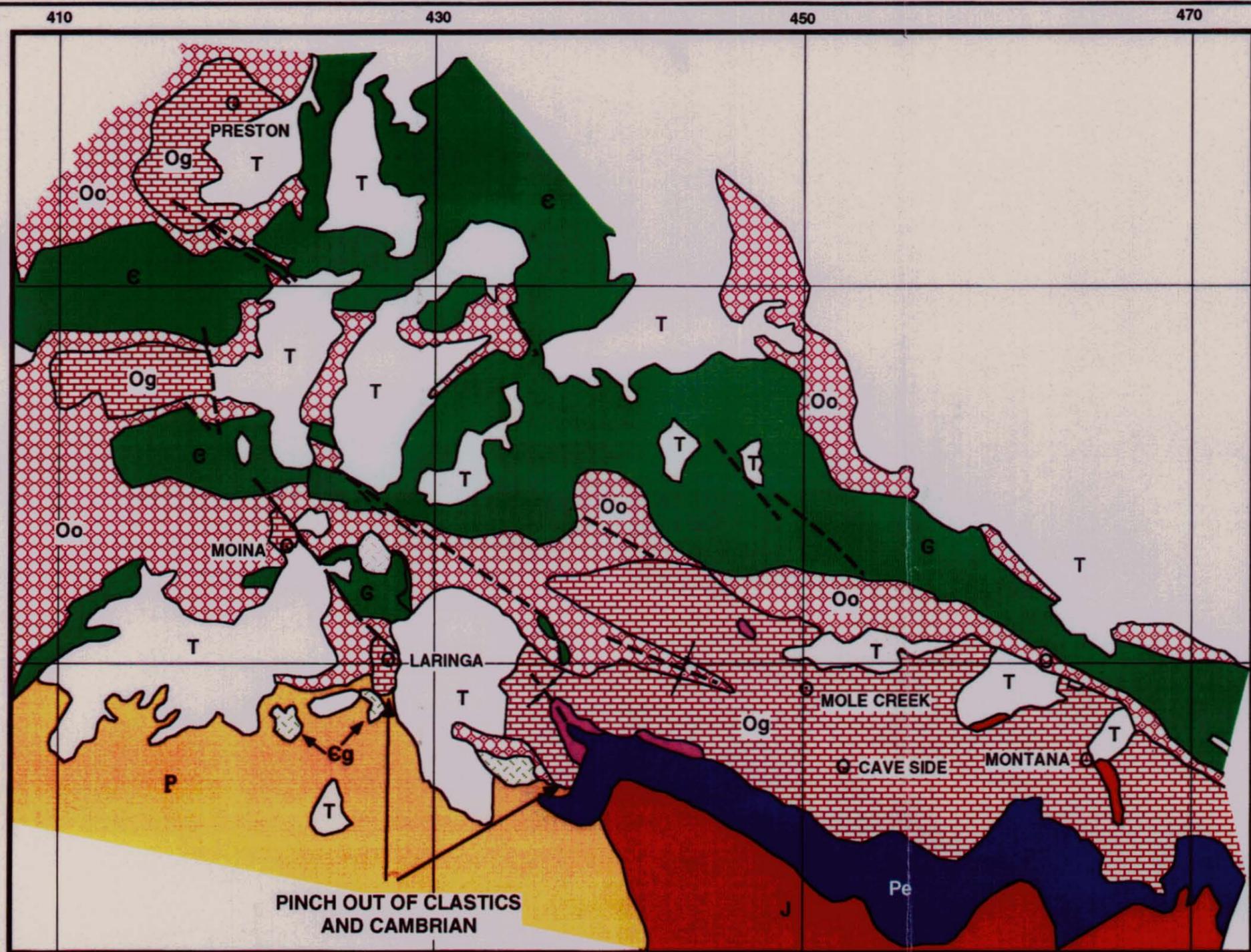


NB. Temperature Zones are those for a standard thermal gradient of 24 °C/1km

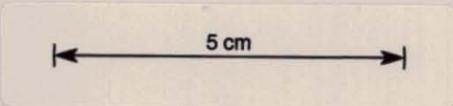
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**Zeehan Sub-basin  
 Burial History Model  
 Ordovician to Devonian**

Geologist: D. G. MORRIS	Scale: NA	Report No: 20080
Drawn: D. G. MORRIS	Date: 11/7/94	Plan No: Tc 226



- T Tertiary
- J Jurassic
- Pe Permian
- Unconformity**
- Dg Devonian Granite
- SD Silurian to Devonian
- Conformity to Unconformity**
- Ordovician**
- Og Gordon Limestone
- Oo Conglomerate and Sandstone
- Unconformity**
- Eg Granite
- Cambrian**
- C Sediments and Volcanics
- Cs Serpentine
- P Proterozoic

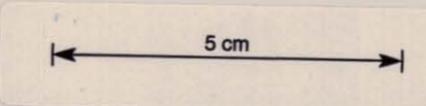
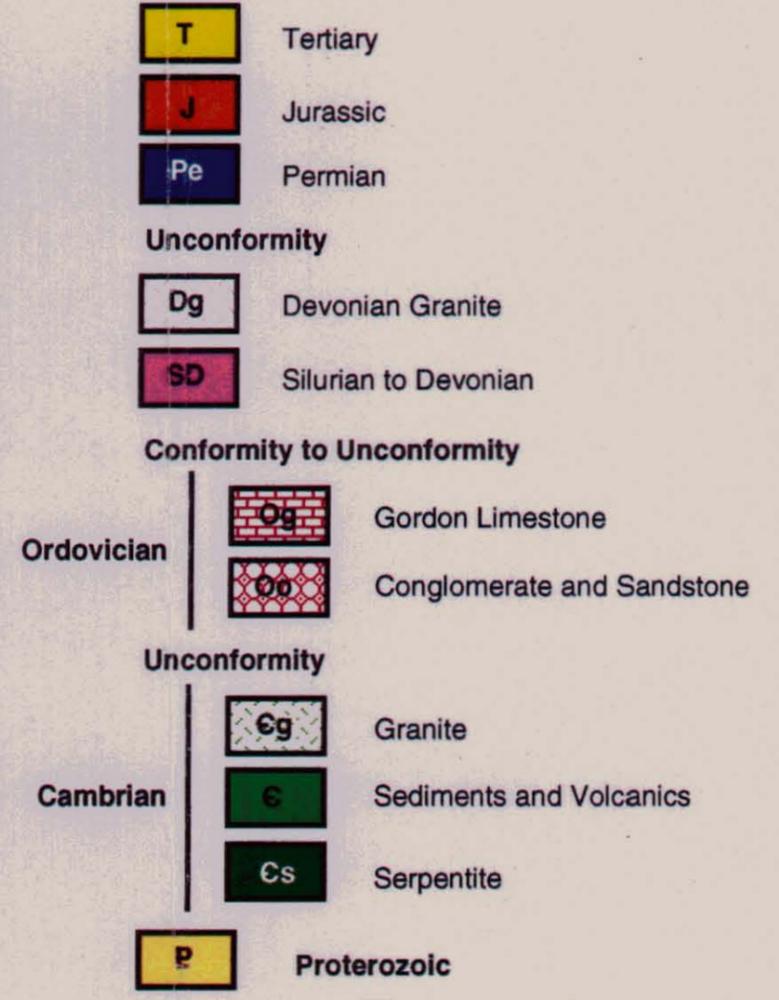
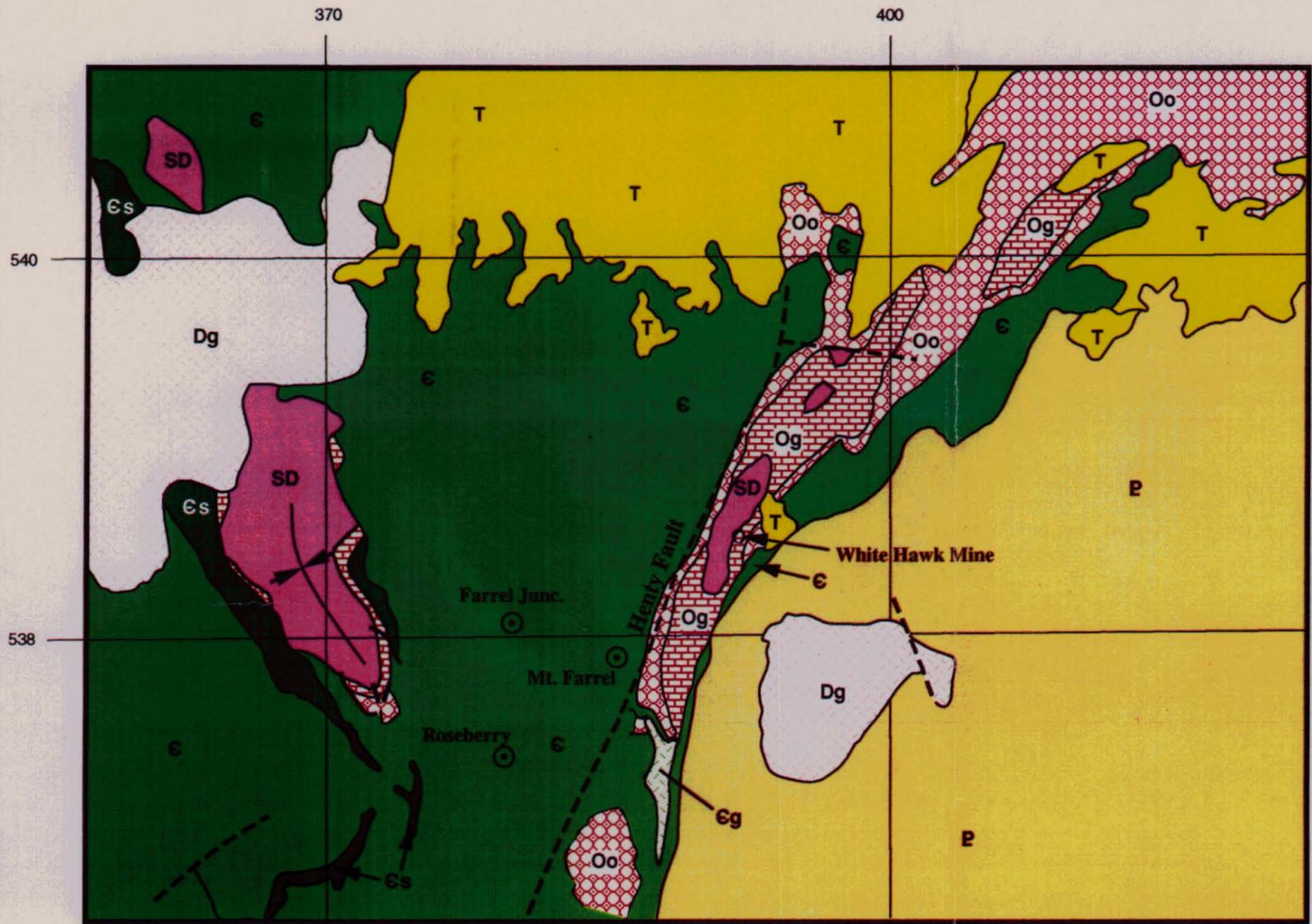


Moina - Mole Creek Area

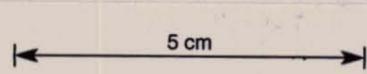
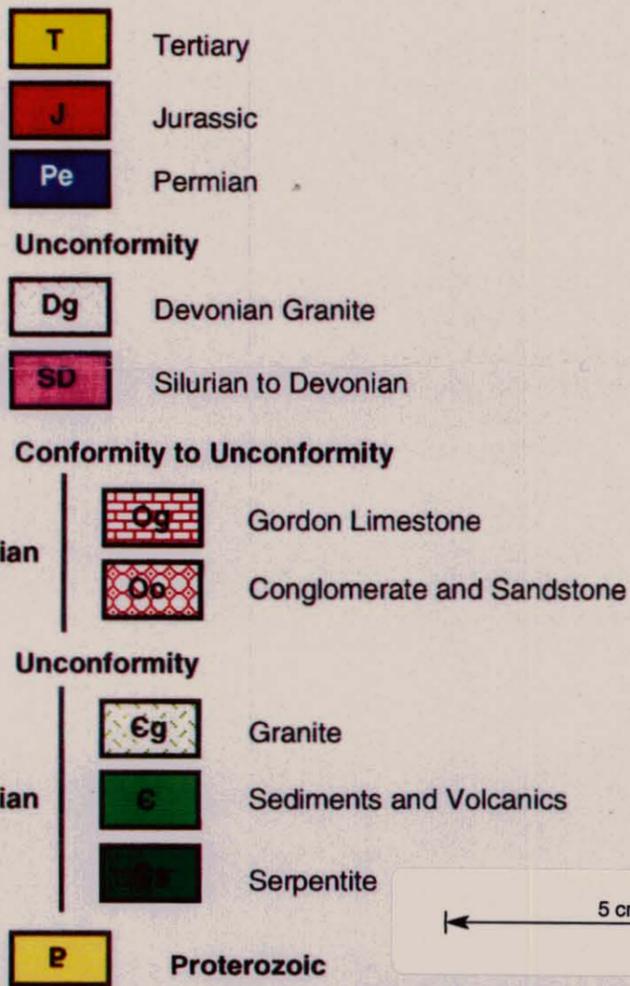
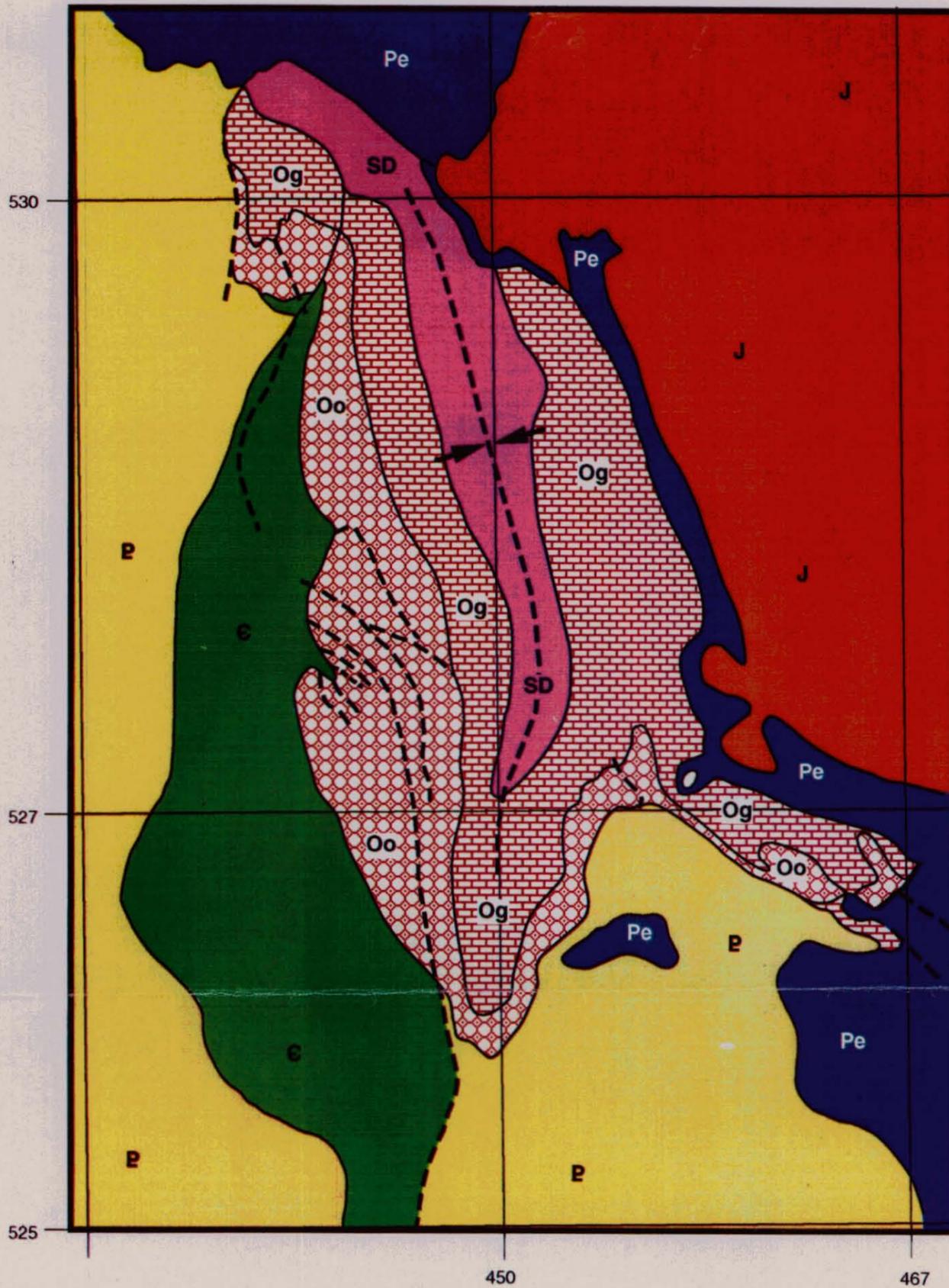
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## Moina - Mole Creek Area General Geology

Geol: D. G. Morris	Scale: ~1:250000	Report No: 20080
Drawn: D.G. Morris S. Jacka	Date: June 1994	Plan No: Tc 227



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<b>Mackintosh - Huskisson Rivers Area General Geology</b>		
Geol: D. G. Morris	Scale: ~1:250000	Report No: 20080
Drawn: S. Jacka	Date: June 1994	Plan No: Tc 228



CRA EXPLORATION PTY. LIMITED		
<b>Florentine Valley Area General Geology</b>		
Geol: D.G. Morris	Scale: ~1:250000	Report No: 20080
Drawn: S. Jacka	Date: June 1994	Plan No: Tc 229

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K. D. TUCKWELL  
CIS

## Zeehan Sub-basin. Correlation of pyrobitumen reflectance and lithogeochemistry and implications for mineralisation.

### 1. CONCLUSIONS AND RECOMMENDATIONS

All organic material identified in the Gordon Limestone is pyrobitumen. Reflectance (R<sub>o</sub>%) of the bitumen ranges from 2 to 11%, mineralisation is associated with the lowest values and the highest values are associated with zones of secondary porosity. Overall the reflectance profile decreases from the top of the limestone to the base, a result that precludes thermal alteration by burial metamorphism alone. Calculated vitrinite reflectance from burial history analysis is 2.2% nearly equivalent to the lowest measured reflectance of 2.0%. Burial history analysis also indicates that the oil that was later converted to pyrobitumen was derived locally, from within the limestone and not from the overlying Siluro-Devonian sequence.

The organic studies and lithogeochemistry combined with evidence from mineral petrographic work carried out by P. Ashley (CRAE report 20159) indicate that three fluid phases were possibly involved in the mineralisation process at Zeehan;

- 1) A sulphide poor zinc rich fluid responsible for alteration of limestone to dolomite, and ferroan and zincian carbonates. Distribution of zinc carbonate suggests that this fluid was entrained in the Ordovician clastic aquifer basal to the limestone. Basement pinchouts and growth faults would be expected to have influenced this plumbing system.
- 2) Oil generation and local migration within the Gordon Limestone. A modest amount of hydrocarbons trapped within the limestone could have provided *reductant* for later thermochemical sulphate reduction. The presence of pyrobitumen indicates the presence of precursor oil, however significant hydrocarbon source rocks have not as yet been identified within the Gordon Limestone. The grey, reduced facies, carbonates could have generated the modest amounts of bitumen observed.
- 3) Hot, (>180 degrees centigrade) fluid, probably a gaseous oil field brine carrying  $H_2S$  and/or  $SO_2$ , entrained in the aquifer system above the limestone. The observed pyrobitumen reflectance profile indicates that this fluid appears to have invaded the limestone from the top, secondary porosity and faulting providing conduits. Temperature was high enough to overcome the 180 degree centigrade limit for thermochemical sulphate reduction to produce sulphide.

It is likely that this fluid mixed, within the limestone, with fluid derived from the basal aquifer. Sphalerite only partially replaces zincian carbonate in the sulphide poor mineralisation hosted in the basal part of of the limestone. Sulphide becomes more prevalent in the mid part and galena predominates over sphalerite in mineralisation at the top of the limestone where zinc carbonates have not been reported and sulphide is dominant. Two possible mechanisms are therefore possible, either fluid mixing across the Gordon limestone or early carbonate mineralisation, produced by a fluid derived from the basal aquifer, which was subsequently overprinted by a sulphidation event from above.

Thermal advection related to the intrusion of Devonian granite may have provided the heat source and drive for the later fluid flow system. Reactivation of growth faults during the onset of orogenesis is likely to have provided fracture porosity and conduits for mixing of the two fluid regimes across the limestone.

Identification of growth faults which influenced distribution of the basal clastic sequence, Owen Conglomerate and Moina Sandstone, subsequently controlled facies distribution within the Gordon Limestone, and were later involved in the early stages of deformation due to the Tabberabberan Orogeny would therefore be a priority. The basal Ordovician clastic sequence appears to occupy a sub-basin pinching out against Cambrian basement on its northern margin in an ESE trending zone between the Central Balstrup Prospect southwest of Zeehan and the Mariposa Prospect. The eastern margin of the sub-basin, and associated pinch out, appears to lie in an ENE trending zone extending from the eastern end of the Professor Range to Waterway Creek, east of the Mariposa Prospect. The southern and western margins are not defined. A significant proportion of the known mineral occurrences in the post Cambrian sequence lie along or in proximity to the northern zone.

Coarsely crystalline aggregates of sphalerite occur in near surface exposures of the black clays at Grieves Prospect and indicate that biogenic sulphate reduction may be occurring in the acid ground waters of the present weathering cycle. Primary zinc carbonate mineralisation may have been sulphidised and significantly upgraded by this process. Areas of drainage floored by Gordon Limestone which are at present, or in the recent past have been, ponded due to faulting or blockage by glacial moraine would be sites for preservation of surficial mineralisation of this genesis. Two sites in the Zeehan area are the valley of Amber Creek which has been dammed by glacial moraine and the Parting Creek Lake valley which appears to have been ponded by faulting.

## 2. DATA

### 2.1 Stratigraphic Section

Drill hole BHZ 1007 was drilled by the Tasmanian Mines Department and provides the only unbroken section through the Gordon Limestone. The hole is located to the west of Grieves Prospect and commenced in the base of the Crotty Quartzite and was terminated in the Moina Sandstone. The nature and position of the contact between the Gordon Limestone and the overlying Crotty Quartzite is not clear due to weathering induration. In the section (plan Tc230) it has been placed at the contact

between yellow brown clay (Crotty Quartzite) and soft black clay which is probably the decalcified residue of limestone and dolomite. The contact between the Gordon Limestone and the underlying Moina Sandstone appears to be disconformable with a thin regolith of sandstone fragments in a sand and clay matrix separating the two units.

The drill section through the Gordon Limestone can be divided into four facies subdivisions, from the base to the top:

650 to 731.28 metres. Dominantly a carbonate shoal sequence consisting of medium to very coarse grained intraclastic grainstone with minor interbeds of finer grained, bioturbated, peloid grainstone and stromatolitic dolostone which were probably deposited in barred lagoon or intra shoal bar areas. In outcrop the shoal sequence at Grieves Prospect is oolitic. The top 9 metres of this sequence is limestone and the remainder has been variably dolomitised. Parts of the shoal sequence have high secondary porosity. Mineralisation is associated with ferroan carbonate alteration of bioclastic medium to coarse grained dolarenite at the base of the sequence.

292.02 to 650 metres. Dominantly fossiliferous and bioturbated dark grey to black fine to medium grained pelletal and pelloid grainstone, mainly a wackestone, with interbeds of lime mudstone. Calcareous mudstone to fine grained grainstone is variably carbonaceous and wispy and wavy laminated, in part contains articulated bivalves and brachiopods, and is variably nodular bedded, suggesting deposition in environments below storm wave base under alternating aerobic to dysaerobic conditions. Some intervals contain large broken coral and stromatoporoid fragments which were probably transported into the sediment by debris flow. Packstone (fine to medium grained calcarenite) with birdseye textures occurs between 570 and 581 metres indicating the development of some secondary porosity although the sequence is generally of low porosity overall. Mineralisation between 416 and 431 metres is associated with fractures in interbedded bioclastic calcarenite and bituminous nodular lime mudstone.

263 to 292.02 metres. Wispy and wavy laminated, nodular bedded calcareous siltstone. Moderate content of carbonaceous material, bioturbation, sedimentary boudinage and lack of shell fragments indicate deposition under quiet, dysaerobic to nearly anaerobic conditions.

76.6 to 263 metres. Dominantly medium to coarse grained intraclastic and bioclastic grainstone with minor interbeds of lime mudstone and calcareous siltstone. This sequence appears to have been deposited under dominantly aerobic condition within storm wave base, packstone dominating over wackestone. Dolomitisation and development of secondary and vug porosity extends from the top to 220.5 metres.

## 2.2 Organic Petrography

Results of organic petrographic study of 18 samples from the drill section through the Gordon Limestone, Mines Department hole BHZ B1007, located to the north of Grieves Prospect have been received from M. Glikson of the University of Queensland (table 1). All organic material was identified as pyrobitumen, the residue from the thermal cracking and/or gas deasphalting of migrated liquid hydrocarbons or oil. Kerogen, or in situ organic material was not identified.

Pyrobitumen reflectance ranges are plotted against base metal geochemical values and summary stratigraphic column in plan Tc230.

Table 1. Pyrobitumen Reflectance Drill Hole BHZ B1007

Sample No.	Depth	Ro Min	Ro Max	Ro Mode
2738191	76	•	•	•
2738192	108	6.5	9.6	8.1
2738193	144	8	11	9.6
2738194	260	4.4	6.5	5.2
2738195	286	7	9	7.8
2738196	318	7.2	8.5	7.8
2738197	370	6.5	7.6	7.5
2738198	387	5.2	6.4	5.8
2738200	415	4.3	6.6	5.1
2738199	425	1.8	4	2
2738020	447	4.8	5.7	5.2
2738021	482	•	•	•
2738022	506	3.2	4.5	3.9
2738023	536	7.4	8.2	7.8
2738024	569	8	9.6	9.2
2738025	623	5.5	7.2	5.8
2738026	690	•	•	•
2738027	719	3.2	4	3.5

### 2.3 Mineralogical Petrography

P. M. Ashley of the Department of Geology and Geophysics of the University of New England carried out a detailed petrographic study and some microprobe analysis of eighteen drill core samples of mineralised and unmineralised carbonates from the Gordon Limestone (CRAE Report 20159). Initial alteration of the mineralised limestone was associated with pervasive dolomitisation followed by intense but more restricted replacement by ferroan carbonates with significant Zn and Mn contents and minor quartz. This was then followed by a sulphide stage with sphalerite being generally subordinate to galena. The most sulphide rich rocks also contain traces of marcasite, chalcopyrite and tetrahedrite. The final stage was sparry carbonate deposition (ferroan) which appears to overlap the sulphide phase.

The samples studied by Paul Ashley were from Grieves Prospect, lower and middle mineralised zones and essentially barren limestone/dolomite from the middle and upper parts of the sequence, the upper mineralised zone at Mariposa, and from the mineralised zone in the central part of the sequence at Oceana. At Grieves in the lower and middle mineralised zones sphalerite replaces ferroan and zincian carbonates and the majority of the zinc is in the carbonates. Zincian carbonate was not described from the upper mineralised zone at Mariposa or the central zone at Oceana, all the zinc occurring in sphalerite. The general pattern appears to be:-

- 1) Zincian carbonate predominates at the base of the limestone with minor later replacement by sulphide.
- 2) More pervasive replacement of zincian and ferroan carbonates in mineralisation hosted in the mid part of the limestone. R. Parkinson (pers comm.) has noted that at Grieves Prospect the mineralisation style is very patchy with some drill intersections dominantly sulphide and others dominantly zincian carbonate with variations occurring over very short distances. Zinc mineralisation is predominantly sphalerite in the central zone at Oceana.
- 3) No zincian carbonate has been reported from the mineralisation near the top of the limestone where it is all sulphide, galena appearing to predominate over sphalerite.

## **2.4 Litho geochemistry**

Four zones of base metal anomalism occur in the Gordon Limestone in the BHZ 1007 drill hole section. The two dominant occurrences are at the base of the limestone between 722.9 and 729.8 metres (1.2% Zn) and midway through the section between 417.9 and 433.05 metres (3.1% Zn). Subsidiary anomalism occurs at the top of the limestone (79.2 to 83.4m, 2622ppm Zn) and within the upper dolomitised section (147.35 to 161.4m, 4862ppm Zn).

The anomalism at the base and the top of the limestone is clearly associated with stratigraphic contrast of lithology while the occurrences within the limestone do not appear to be associated with facies but with

structure. Sulphides or alteration were not observed in the zone of anomalism at 155 metres in the dolomitised upper section of the limestone during study of the core, the zone only being recognised on later geochemical analysis. The central zone between 417.9 and 433 metres does not appear to be facies dependant, the mineralisation occurring within fractures in fine grained relatively tight carbonate. The relatively low reflectance pyrobitumen studied in this interval occurred within the host carbonate and not within the fractures.

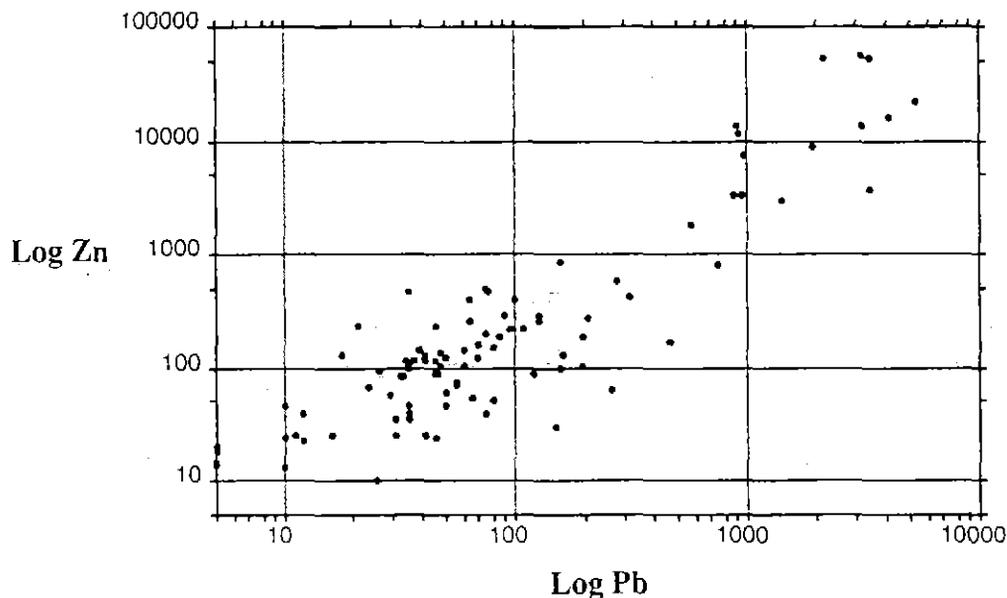


Figure 1. Scatter plot for Pb and Zn drill hole BHZ 1007

The scatter plot of Zn to Pb ( figure 1) indicates that the the elements are relatively positively correlated but Zn predominates over Pb by a factor of approximately 4 to 5. The plot of log Pb/Zn ratio with depth (figure 2) indicates that in the mineralised zones at the base and central parts of the sequence zinc overwhelmingly predominates over Pb. This plot also indicates that there is a relative increase in Pb from the base to the top of the section. There is also a strong positive correlation with manganese and iron (figure 2) with a few outlying samples associated with mineralisation in the middle and top of the limestone showing a relative increase in iron over manganese. In the mineralised interval in the centre of the limestone iron is relatively depleted within the mineralised interval but very stongly enriched at the footwall of the mineralisation. The scatter plot of iron against sulphur (figure 4) also indicates that there is a negative correlation between the two elements suggesting that basemetal

sulphide mineralisation is associated with the removal of iron from the ferroan carbonates.

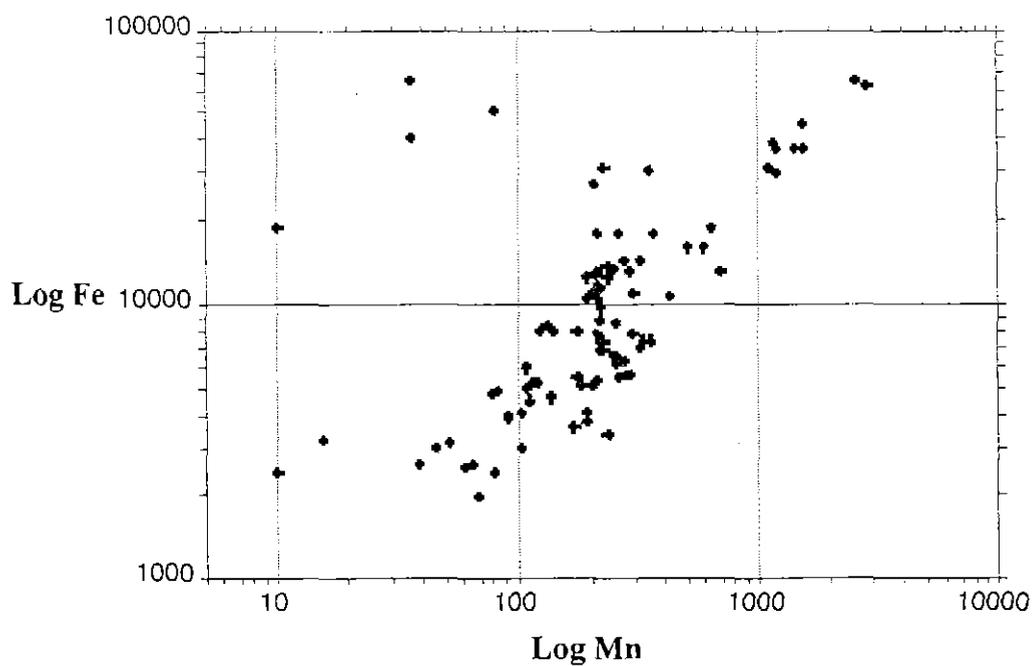
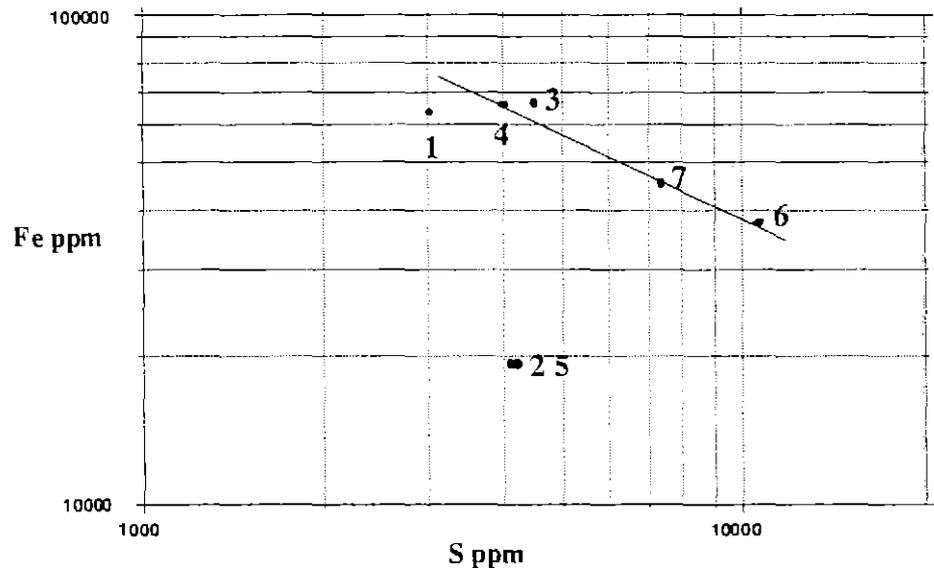
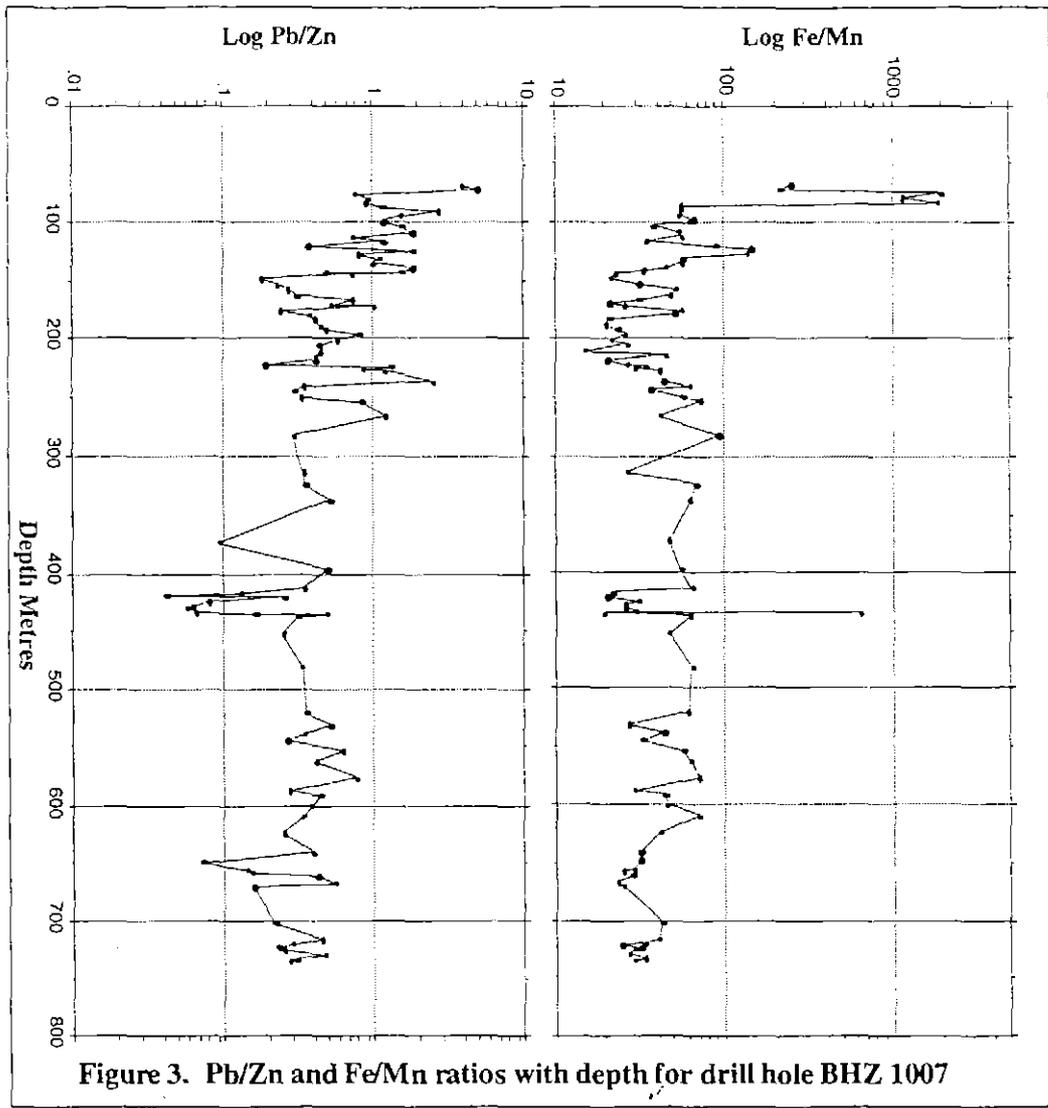


Figure 2. Scatter plot for Fe and Mn Drill hole BHZ 1007



In figure 4 and also figures 5&6. Point numbers 1 to 5 are samples from the central interval of mineralisation and points 6 & 7 are from the mineralised interval near the base of the limestone.

Only seven samples, 2 from the basal mineralised zone and five from the central zone, were analysed for sulphur. Log log plots of Pb and Zn to S of these few samples indicate that there are possibly two distinct populations one with a strong basemetal association with positive correlation and another which shows little correlation.. The two samples from the basal mineralisation fall in the strongly positively correlated group. In this later group Pb ppm is almost half that of sulphur and zinc is up to twice that of sulphur. The relationships also indicate that all of the Pb is associated with sulphide but up to over 50% of the zinc is in a non sulphide form as observed by Ashely. However, the analytical results from the drill hole indicate that, in its case, the central zone is markedly more sulphur deficient than the basal zone.

Correlation between sulphur and magnesium is positive but with calcium it is negative. This suggests that the introduction of sulphide was associated with dolomitisation, and either followed porosity in previously dolomitised zones or accompanied dolomitisation.

Preliminary microprobe analysis of metallic inclusions in the pyrobitumen associated with mineralisation at 425m indicate that they are sphalerite and native lead. Inclusions in pyrobitumen not associated with mineralisation at 536 metres are pyrite. This is a similar result to studies of pyrobitumens in the Carboniferous carbonates of the British Isles and Ireland where it has been suggested that base metal sulphide inclusions in pyrobitumen are more common in proximity to mineralisation and may provide a pointer to ore.

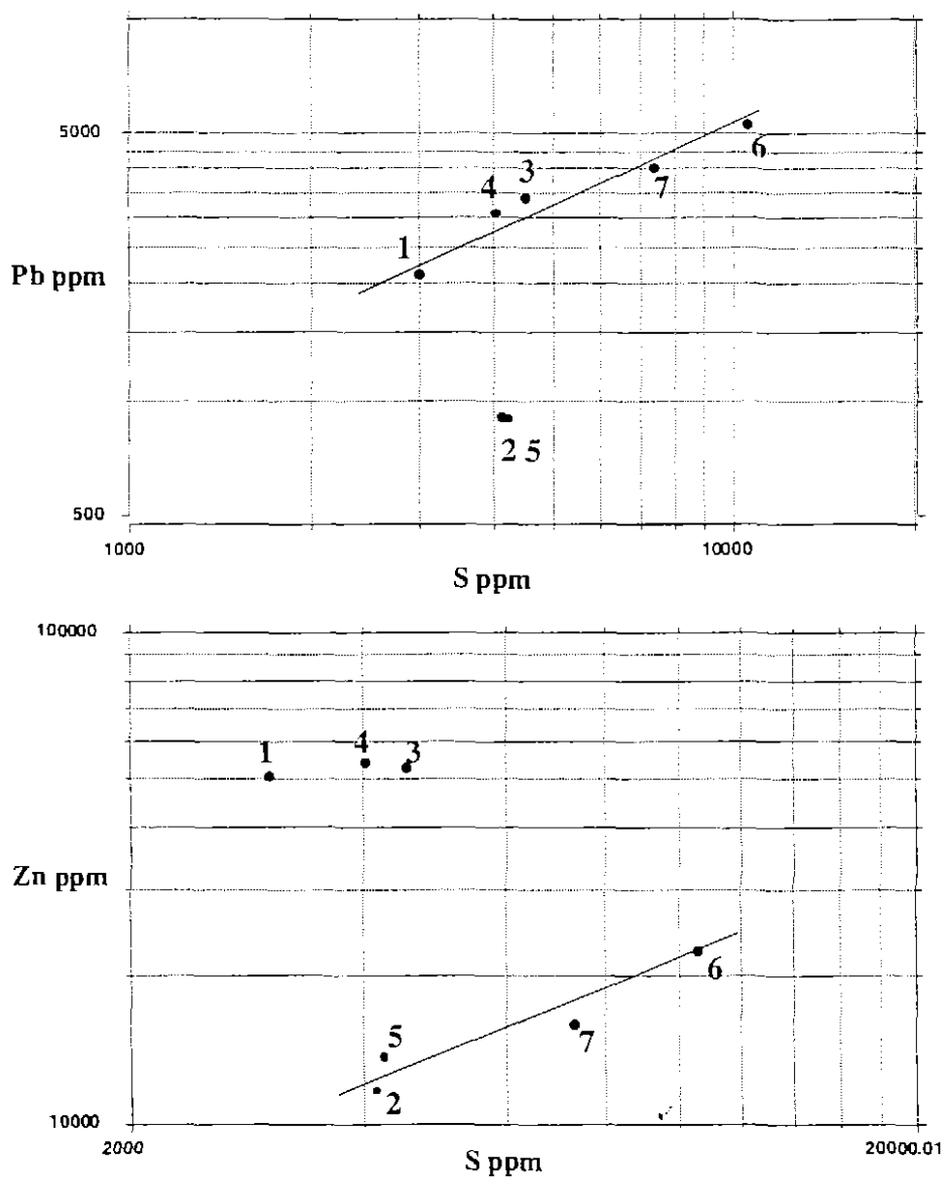


Figure 5. Log log scatter plots of Pb and Zn to sulphur for drill hole BHZ 1007. Samples 1 to 5 are from the mineralisation in central part of limestone and 6 and 7 are from the base.

### 3 DISCUSSION

#### 3.1 Pyrobitumen Alteration Profile

Overall the thermal alteration of pyrobitumen decreases from the top of the stratigraphic section through the Gordon Limestone to the base, the reverse of what would be expected if alteration was due to simple burial metamorphism. The reflectance profile is divided into two distinct parts, an upper with a maximum value of  $R_o$  11% (graphitic) near the top of the limestone to a low of about  $R_o$  2% at 425m., and a lower zone with a maximum of 9.6% at 569m decreasing to 4% at 719m, near the base of the limestone. The large variation in reflectance over a very short stratigraphic interval, up to  $R_o$  6.5% over 50 metres, also indicates that alteration was due primarily to another mechanism apart from burial metamorphism.

At this stage, due to the absence of data, it is not possible to ascertain whether or not the thermal profile for the Greives drill hole in the Gordon Limestone is anomalous in comparison with the Zeehan Sub-basin as a whole. It is possible however to calculate the expected level of organic alteration for the sequence in the Zeehan Sub-basin from the inferred burial history plot (plan Tbd 1) utilizing the correlation between the Time Temperature Index of Thermal Alteration (TTI), of Waples 1980 (AAPG Bull. V. 64) and vitrinite reflectance equivalence. Calculated TTI for maximum depth of burial, prior to the Tabberaberan Orogeny, is 2008, or equivalent of a vitrinite reflectance (VRo) of approximately 2.1% for a standard thermal gradient of 24 degrees per 1000 metres. This value is close to the lower mode  $R_o$ % of the sample associated with mineralisation at 425m.

The two lowest reflectance values are clearly associated with the maximum basemetal values and are associated with mineralisation. A subsidiary basemetal peak at approximately 152m lies close to, but below, the sample with the highest reflectance value of  $R_o$ % 11 at 144m. The sample at 569 metres with a reflectance of 9.2 is closely associated with a zone of secondary porosity and the most altered sample at 144 metres is associated with porous dolomite.

It is not possible to alter the pyrobitumens in the Gordon Limestone to the variable degrees indicated by the alteration profile by simple thermal cracking by burial metamorphism alone and therefore another mechanism must also have taken place. As noted above the lowest reflectance pyrobitumens have an Ro% consistent with the expected level of thermal alteration due to burial metamorphism. The samples recording the highest alteration are many times greater, well above any expected error. The following two mechanisms are put forward to explain the observed extreme range of alteration of the pyrobitumen;

1) An initial liquid hydrocarbon phase migrated into and was trapped within the Gordon Limestone and then thermally altered by burial metamorphism to produce the level of Ro 2.1 (above the oil preservation window) of the least thermally altered surviving pyrobitumen. The sequence was then invaded by a higher temperature gas bearing liquid, probably above 300 degrees centigrade to account for the levels of alteration measured, leading to deasphalting and thermal cracking of hydrocarbons in porosity that allowed the invasion of the fluid. This would suggest that the sections of stratigraphy hosting the mineralisation and the bitumens exhibiting the lowest alteration were protected from alteration due to porosity occlusion not allowing invasion by the higher temperature fluid. It should be noted that the zones exhibiting the highest alteration appear to exhibit the highest existing porosity.

2) Oil phase hydrocarbons trapped within the Gordon Limestone were thermally altered by burial metamorphism to Ro% 10-11 and then the sequence was invaded by a second fluid generated from a less thermally altered source. The only perceived mechanism for this would be that the sequence under study was overthrust onto a less thermally altered sequence and liquid hydrocarbons generated by thrust loading of the footwall sequence migrated into the hanging wall sequence and then altered further by further sedimentary loading or increase in thermal gradient. Thrusting is common in the Zeehan area and in the Strahan Sheet area to the south where the Ordovician to Devonian Zeehan Sub-basin sequence is thrust over the post Taberaberran Permian sequence. The problem with this mechanism is that the pyrobitumens with the highest alteration appear to be associated with the zones of highest

existing secondary porosity while, the pyrobitumens with the lowest level of alteration are associated with zones of porosity occlusion.

At present the first mechanism is preferred, mainly due to the observation of porosity associations and the absence of both very low and very high Ro% pyrobitumens in any one sample. The overprinting by a high temperature oil field brine also appears to be consistent with mineralogical petrography.

### 3.2 POSSIBLE MINERALISING SYSTEMS

The mineralogical petrography indicates an overprint of sulphidation on an earlier carbonate mineralisation and an increase in sulphur from the base to the top of the limestone. Lithogeochemistry indicates that the system is sulphur deficient, that there is an association of sulphide with dolomitisation, and an increase in Pb/Zn ratio up the stratigraphic section. It is also indicated that replacement of carbonate mineralisation by sulphide was accompanied by the removal of Fe. Sulphide mineralisation and zincian carbonates are associated with fracturing. Zincian carbonates are also stratabound and are more common towards the base of the limestone. Stylolites crosscut vein mineralisation indicating that mineralisation probably predated peak burial of the limestone. Organic petrographic study indicates the association of the least altered pyrobitumen with mineralisation and an overall increase in alteration from the base to the top of the limestone.

Identified fluid systems are:

- 1) A sulphide poor zinc rich fluid responsible for alteration of limestone to dolomite, and ferroan and zincian carbonates. Distribution of zinc carbonate suggests that this fluid was entrained in the Ordovician clastic aquifer basal to the limestone. Basement pinchouts and growth faults would be expected to have influenced this plumbing system.
- 2) A locally generated hydrocarbon-bearing fluid within the Gordon Limestone. The modest amount of hydrocarbons trapped within the limestone could have provided reductant for later thermochemical

sulphate reduction. The presence of pyrobitumen indicates the presence of precursor oil, however significant hydrocarbon source rocks have not as yet been identified within the Gordon Limestone. The grey, reduced facies carbonates could have generated the modest amounts of bitumen observed.

3) Hot, (>180 degrees centigrade) fluid, probably a gas bearing oil field brine carrying H<sub>2</sub>S and/or SO<sub>2</sub> entrained in the aquifer system above the limestone. The observed pyrobitumen reflectance profile indicates that this fluid appears to have invaded the limestone from the top, secondary porosity and faulting providing conduits. Temperature was high enough to overcome the 180 degree centigrade limit for thermochemical sulphate reduction to produce sulphide. The distribution of lead suggests that it was possibly introduced into the system by this fluid. If that is the case then the fluid would not have also been carrying reduced sulphur and sulphur reduction would have taken place within the limestone near the site of the sulphide mineralisation. Pyrobitumen reflectance and burial history analysis indicates that this fluid was at a temperature far in excess of that expected for peak burial (~170 degrees centigrade). The intrusion of the Devonian granites is the most likely cause for the drive of this later fluid system and involved lateral advection due to blanketing and sealing by the thick Devonian shale sequence.

### **3.3 IMPLICATIONS FOR EXPLORATION.**

#### **3.3.1 Sulphides**

The main possibility for major sulphide concentration appears to be the mixing of fluids within the limestone from the upper and lower aquifer systems and/or the alteration of pre-existing zincian carbonate to sulphide. These processes would be controlled by the development of secondary fracture porosity and therefore by faulting allowing cross stratal flow of the fluids. The concentration of zincian carbonate is envisaged to have been controlled by restriction of the plumbing system in the basal aquifer system by pinchouts and therefore also by faulting. The precipitation of sulphide would also be limited by the availability of reduced sulphur and evidence to date indicates that the system was relatively reduced and sulphur deficient, zincian carbonate being only

partially replaced in many drill sections. Identification of growth faults which influenced distribution of the basal clastic sequence, Owen Conglomerate and Moina Sandstone, subsequently controlled facies distribution within the Gordon Limestone and were later involved in the early stages of deformation due to the Tabberabberan Orogeny would therefore be a priority. The basal Ordovician clastic sequence appears to occupy a sub-basin pinching out against Cambrian basement on its northern margin in a ESE trending zone between the Central Balstrup Prospect southwest of Zeehan and the Mariposa Prospect. The eastern margin of the sub-basin, and associated pinch out, appears to lie in an ENE trending zone extending from the eastern end of the Professor Range to Waterway Creek, east of Mariposa Prospect. The southern and western margins are not defined.

### **3.3.2 Non-sulphides**

Zincian and ferroan carbonate mineralisation appears to be early, is replacive of limestone and is statabound at the base of the limestone and fracture controlled higher in the sequence. The fluid responsible for the mineralisation is thought to have been entrained in the basal aquifer system. Mineralisation is therefore likely to have been controlled by growth faults which affected the distribution of the basal Ordovician clastics, facies distribution in the Gordon Limestone and later fracturing of the limestone. Identification of these early structures by analysis to determine the pre-Tabberabberan architecture of the Zeehan Sub-basin should assist in identification of exploration targets.

### **3.3.3 Affect of the weathering profile**

The Gordon Limestone has been extensively dissolved by acid, humic rich and reducing, ground water derived from the overlying peat soils. Decalcification of the limestone has resulted in a residue of black mud underlying peat and quartzite scree.

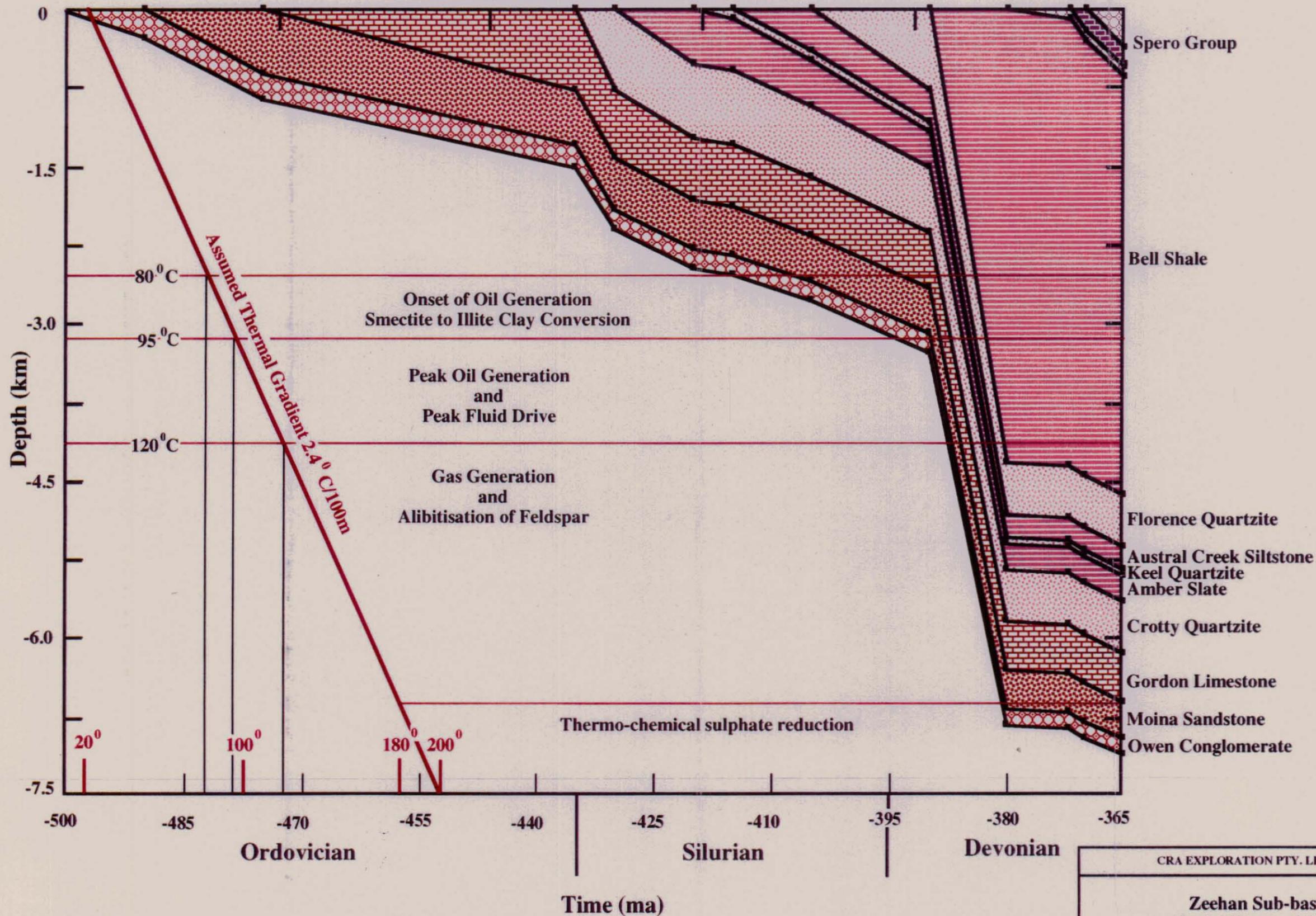
Coarsely crystalline sphalerite aggregates occur in near surface exposures of the black clays at Grieves Prospect and indicate that biogenic sulphate reduction may be occurring in the acid reducing ground waters of the present weathering cycle. The black clays are the residue of

decalcification of the carbonates by modern acid ground waters and biogenic sulphide reduction may have sulphidised and upgraded primary zinc carbonate mineralisation. Final grades would be dependant on the initial grade of the carbonate mineralisation, supply of sulphate for biogenic reduction to sulphide and protection from mechanical erosion to allow retention of a large volume of clay residue.

The most likely sites for this mechanism to occur are areas of drainage floored by Gordon Limestone which are at present, or in the recent past have been, subjected to ponding due to recent faulting or blockage by glacial moraine. Two such areas are obvious on the Zeehan Sheet one that has been blocked by glacial moraine in the valley of Amber Creek and a second, Parting Creek Lake valley which appears to have been ponded by recent faulting. A similar broad alluvium filled valley is that of Shell Creek in the west.

# Decompacted Stratigraphy vs. Time

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NB. Temperature Zones are those for a standard thermal gradient of 24°C/1km

CRA EXPLORATION PTY. LIMITED

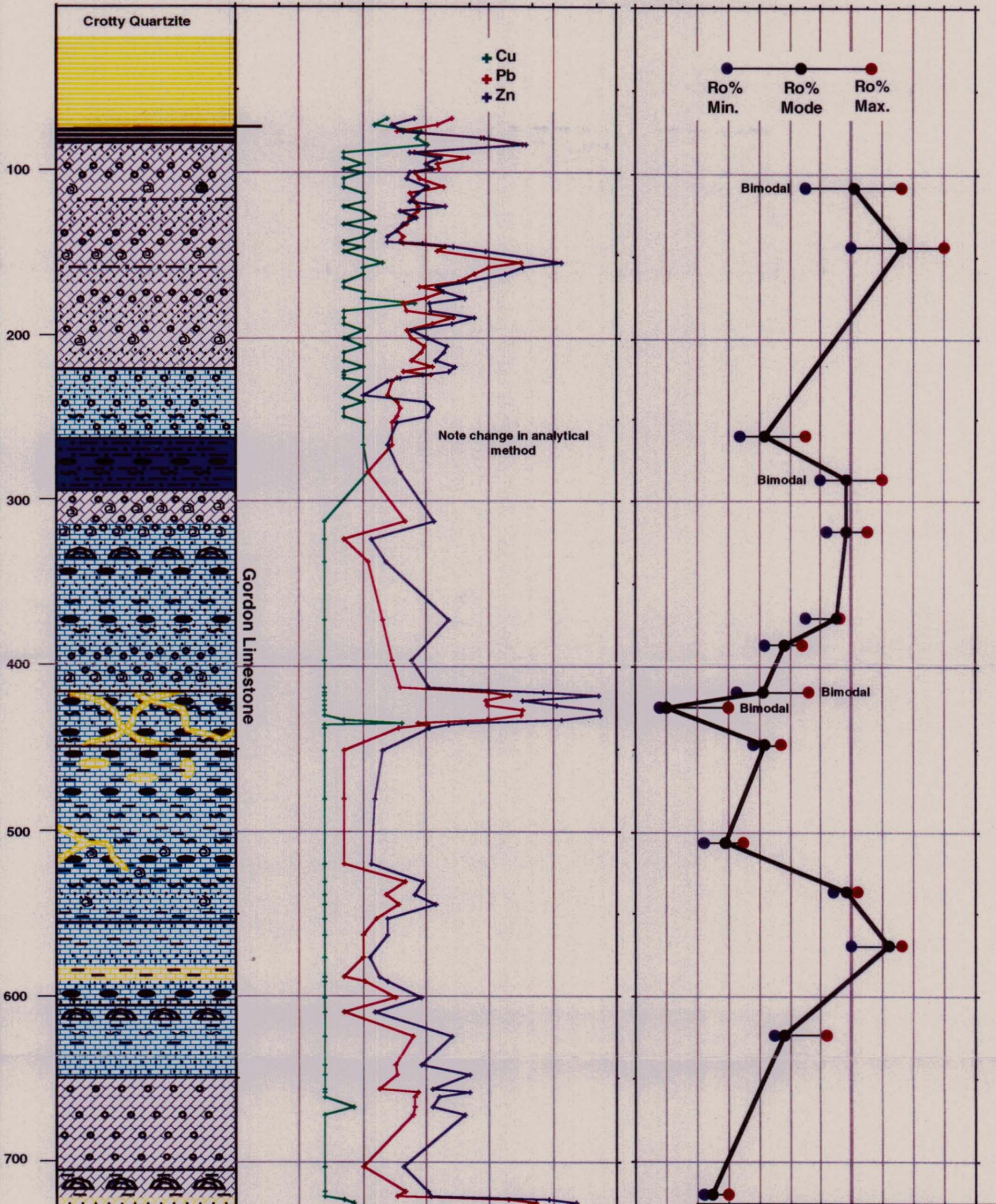
## Zeehan Sub-basin Burial History Model Ordovician to Devonian

Geologist: D. G. MORRIS	Scale: NA	Report No: 20350
Drawn: D. G. MORRIS	Date: 6/1/95	Plan No: Tbd1

Copper, Lead and Zinc ppm

Pyrobitumen Reflectance

1 10 100 1000 100000 2 4 6 8 10 12



Legend for Stratigraphic Column:

- Stromatolitic Nodular
- Coarse grainstone to rudite
- Bituminous
- Fossiliferous
- Peloid grainstone
- Sideritic alteration
- Limestone
- Dolomite
- Calcareous siltstone

CRA EXPLORATION PTY. LIMITED

Zeehan Tasmania  
 Drill Hole BHZ B1007  
 Grieve Siding

Stratigraphic column through the Gordon Limestone  
 Pyrobitumen reflectance and  
 Base metal geochemistry

Geologist: D. MORRIS	Scale: N/A	Report No: 20350
Drawn: D. MORRIS	Date: 11/10/94	Plan No: Tc 230

303069

303070

APPENDIX 2

Drill-hole collar survey data

Appendix 2: Grieves prospect. Drillhole collar information.

APPENDIX 2: Grieves prospect. Drillhole collar information.												
HOLE	PLOTNAME	COMPANY	AMG E	AMG N	LOCAL E	LOCAL N	RL	DEPTH	AZIM (AMG)	INCL	SURVEYED	DH SURVEYS
ZG1001	ZG1001	EZ	363550.9	5349070.6	61066	47066	149.5	149.40	144	-50		YES
ZG1002	ZG1002	EZ	364509.2	5349405.3	61198	47891	143.3	150.00	142	-50		YES
ZG1007	ZG1007	EZ	363835.0	5349821.4	60460	47603	170.0	737.30	147	-70		YES
ZG1009	ZG1009	EZ	364199.2	5349663.8	60805	47799	134.1	151.00	142	-60		YES
ZG1010	ZG1010	EZ	364012.4	5349523.6	60815	47565	130.5	170.00	137	-60	YES	YES
ZG1011	ZG1011	EZ	363718.1	5349334.4	60871	47310	127.5	300.00	140	-60		YES
ZG1012	ZG1012	EZ	363924.1	5349708.2	60604	47606	130.6	348.90	142	-70		YES
ZG1013	ZG1013	EZ	364684.7	5349760.5	61020	48245	150.0	138.50	127	-60		YES
ZG1014	ZG1014	EZ	364667.8	5349894.7	60900	48315	150.8	292.30	142	-60	YES	YES
ZG1015	ZG1015	EZ	364780.7	5349889.1	60975	48399	156.0	177.60	122	-60		YES
ZG1016	ZG1016	EZ	364592.4	5349727.7	60985	48145	147.2	187.50	142	-60	YES	YES
ZWG1	ZWG1	EZ	363615.5	5348993.5	61160	47102	122.8	22.75	159	-60		
ZWG2	ZWG2	EZ	363613.2	5349003.2	61150	47103	122.8	30.70	158	-70		
ZWG3	ZWG3	EZ	363590.6	5348982.8	61162	47075	122.0	17.00	169	-60		
ZWG4	ZWG4	EZ	363593.9	5348973.3	61172	47075	122.0	18.80	164	-60		
ZWG5	ZWG5	EZ	363529.5	5348930.0	61192	47000	121.0	33.55	161	-60		
ZWG6	ZWG6	EZ	363519.7	5348958.4	61162	47000	121.0	13.95	161	-60		
ZWG7	ZWG7	EZ	363523.9	5348946.1	61175	47000	121.0	31.40	161	-60		
ZWG8	ZWG8	EZ	363730.1	5348959.1	61225	47200	128.3	29.25	161	-60		
ZWG9	ZWG9	EZ	363677.4	5349422.0	60775	47300	127.7	19.55	161	-60		
ZWG10	ZWG10	EZ	363682.9	5349405.9	60792	47300	125.0	16.00	161	-60		
ZWG11	ZWG11	EZ	363913.4	5349047.8	61125	47200	127.5	26.65	142	-60		
ZWG12	ZWG12	EZ	363928.4	5349027.8	61150	47200	127.5	15.70	142	-60		
ZWG20	ZWG20	EZ	363649.5	5349042.2	61125	47150	124.2	14.90	161	-60		
ZWG21	ZWG21	EZ	363654.4	5349028.0	61140	47150	124.6	35.60	161	-80		
ZWG22	ZWG22	EZ	363663.4	5348994.3	61170	47150	125.2	16.00	161	-80	YES	
ZWG23	ZWG23	EZ	363840.2	5348949.2	61275	47300	128.7	29.40	161	-70		
ZWG24	ZWG24	EZ	363845.0	5348935.0	61290	47300	130.0	13.00	161	-70		
ZWG25	ZWG25	EZ	363849.9	5348920.8	61305	47300	131.4	24.20	0	-90		
ZWG26	ZWG26	EZ	363667.7	5348980.5	61185	47150	126.6	22.40	0	-90	YES	
AC93ZG1	ZG1	CRAE	363551.5	5348865.9	61250	47000	122.6	0.90	0	-90	YES	
AC93ZG2	ZG2	CRAE	363557.9	5348841.9	61275	47000	123.0	1.20	0	-90		

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Appendix 2: Grieves prospect. Drillhole collar information.

HOLE	PLOTNAME	COMPANY	AMG E	AMG N	LOCAL E	LOCAL N	RL	DEPTH	AZIM (AMG)	INCL	SURVEYED	DH SURVEYS
AC93ZG3	ZG3	CRAE	363564.3	5348817.8	61300	47000	128.1	6.10	0	-90	YES	
AC93ZG4	ZG4	CRAE	363572.8	5348794.3	61325	47000	127.2	5.80	0	-90		
AC93ZG5	ZG5	CRAE	363580.9	5348770.6	61350	47000	126.4	11.00	0	-90		
AC93ZG6	ZG6	CRAE	363589.1	5348747.0	61375	47000	126.7	16.00	0	-90		
AC93ZG7	ZG7	CRAE	363597.2	5348723.3	61400	47000	127.0	13.00	0	-90		
AC93ZG8	ZG8	CRAE	363605.3	5348699.7	61425	47000	129.1	15.00	0	-90		
AC93ZG9	ZG9	CRAE	363683.6	5348789.5	61375	47100	130.3	17.00	0	-90		
AC93ZG10	ZG10	CRAE	363691.8	5348765.9	61400	47100	131.4	7.40	0	-90	GRAVITY RL	
AC93ZG11	ZG11	CRAE	363699.9	5348742.3	61425	47100	133.6	4.00	0	-90		
AC93ZG12	ZG12	CRAE	363675.5	5348813.2	61350	47100	129.2	14.00	0	-90	GRAVITY RL	
AC93ZG13	ZG13	CRAE	363667.3	5348836.8	61325	47100	126.1	7.00	0	-90		
AC93ZG14	ZG14	CRAE	363659.2	5348860.4	61300	47100	122.9	15.50	0	-90	GRAVITY RL	
AC93ZG15	ZG15	CRAE	363724.3	5348671.3	61500	47100	139.5	18.00	0	-90	GRAVITY RL	
AC93ZG16	ZG16	CRAE	363810.7	5348722.5	61475	47200	137.0	15.00	0	-90		
AC93ZG17	ZG17	CRAE	363802.6	5348746.2	61450	47200	135.0	8.00	0	-90		
AC93ZG18	ZG18	CRAE	363794.4	5348769.8	61425	47200	133.2	10.00	0	-90		
AC93ZG19	ZG19	CRAE	363786.3	5348793.5	61400	47200	131.4	10.00	0	-90		
AC93ZG20	ZG20	CRAE	363778.2	5348817.1	61375	47200	130.2	7.00	0	-90		
AC93ZG21	ZG21	CRAE	363770.0	5348840.7	61350	47200	129.0	2.50	0	-90		
AC93ZG22	ZG22	CRAE	363761.9	5348864.4	61325	47200	126.9	6.00	0	-90		
AC93ZG23	ZG23	CRAE	363753.7	5348888.0	61300	47200	124.7	6.00	0	-90		
AC93ZG24	ZG24	CRAE	363745.6	5348911.6	61275	47200	127.1	4.50	0	-90		
AC93ZG25	ZG25	CRAE	363737.9	5348934.7	61250	47200	129.5	3.50	0	-90	YES	
AC93ZG26	ZG26	CRAE	363730.1	5348959.1	61225	47200	128.3	4.50	0	-90		
AC93ZG27	ZG27	CRAE	363722.2	5348983.6	61200	47200	127.1	3.00	0	-90	YES	
AC93ZG28	ZG28	CRAE	363713.1	5349006.2	61175	47200	125.4	3.00	0	-90		
AC93ZG29	ZG29	CRAE	363704.9	5349029.8	61150	47200	123.6	2.50	0	-90		
AC93ZG30	ZG30	CRAE	363696.8	5349053.5	61125	47200	123.5	2.10	0	-90		
AC93ZG31	ZG31	CRAE	363688.6	5349077.1	61100	47200	123.3	1.80	0	-90		
AC93ZG32	ZG32	CRAE	363609.9	5349079.3	61075	47120	122.9	2.30	0	-90	YES	
AC93ZG33	ZG33	CRAE	363617.4	5349054.8	61100	47120	123.1	1.80	0	-90	YES	
AC93ZG34	ZG34	CRAE	363624.2	5349032.1	61125	47120	123.6	2.20	0	-90	YES	
AC93ZG35	ZG35	CRAE	363631.6	5349007.9	61150	47120	124.0	3.00	0	-90		
AC93ZG36	ZG36	CRAE	363639.1	5348983.6	61175	47120	124.3	12.20	0	-90	YES	
AC93ZG37	ZG37	CRAE	363638.6	5348961.3	61200	47110	123.5	3.00	0	-90	YES	

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Appendix 2: Grieves prospect. Drillhole collar information.

HOLE	PLOTNAME	COMPANY	AMG E	AMG N	LOCAL E	LOCAL N	RL	DEPTH	AZIM (AMG)	INCL	SURVEYED	DH SURVEYS
AC93ZG38	ZG38	CRAE	363634.8	5348931.4	61225	47100	124.0	9.00		0	-90	
AC93ZG39	ZG39	CRAE	363643.6	5348905.6	61250	47100	129.3	7.50		0	-90	YES
AC93ZG40	ZG40	CRAE	363651.1	5348884.1	61275	47100	126.1	9.80		0	-90	
AC93ZG41	ZG41	CRAE	364297.6	5349368.6	61100	47700	137.7	21.30		0	-90	GRAVITY RL
AC93ZG42	ZG42	CRAE	364282.6	5349388.6	61075	47700	137.0	19.50		0	-90	
AC93ZG43	ZG43	CRAE	364267.5	5349408.6	61050	47700	136.2	13.50		0	-90	GRAVITY RL
AC93ZG44	ZG44	CRAE	364312.7	5349348.7	61125	47700	138.5	9.00		0	-90	
AC93ZG45	ZG45	CRAE	364327.7	5349328.7	61150	47700	139.2	18.50		0	-90	GRAVITY RL
AC93ZG46	ZG46	CRAE	364342.8	5349308.7	61175	47700	140.8	15.00		0	-90	
AC93ZG47	ZG47	CRAE	364357.8	5349288.8	61200	47700	142.3	16.50		0	-90	GRAVITY RL
AC93ZG48	ZG48	CRAE	364372.9	5349268.8	61225	47700	143.9	2.00		0	-90	
AC93ZG49	ZG49	CRAE	364387.9	5349248.8	61250	47700	145.4	15.80		0	-90	GRAVITY RL
AC93ZG50	ZG50	CRAE	364403.0	5349228.9	61275	47700	147.2	20.00		0	-90	
AC93ZG51	ZG51	CRAE	364418.0	5349208.9	61300	47700	148.9	54.00		0	-90	GRAVITY RL
AC93ZG52	ZG52	CRAE	364409.1	5349170.9	61325	47670	151.0	4.00		0	-90	
AC93ZG53	ZG53	CRAE	364424.1	5349150.9	61350	47670	152.9	3.00		0	-90	
AC93ZG54	ZG54	CRAE	364516.1	5349224.6	61350	47785	154.7	35.50		0	-90	YES
AC93ZG55	ZG55	CRAE	364512.9	5349249.1	61325	47800	148.8	18.00		0	-90	
AC93ZG56	ZG56	CRAE	364497.9	5349269.1	61300	47800	147.6	9.50		0	-90	GRAVITY RL
AC93ZG57	ZG57	CRAE	364482.8	5349289.1	61275	47800	146.0	14.50		0	-90	
AC93ZG58	ZG58	CRAE	364467.8	5349309.0	61250	47800	144.3	10.30		0	-90	GRAVITY RL
AC93ZG59	ZG59	CRAE	364452.7	5349329.0	61225	47800	143.9	21.50		0	-90	
AC93ZG60	ZG60	CRAE	364437.7	5349349.0	61200	47800	143.5	19.00		0	-90	GRAVITY RL
AC93ZG61	ZG61	CRAE	364422.6	5349368.9	61175	47800	142.2	16.00		0	-90	
AC93ZG62	ZG62	CRAE	364407.6	5349388.9	61150	47800	140.9	13.50		0	-90	GRAVITY RL
AC93ZG63	ZG63	CRAE	364389.5	5349412.8	61120	47800	141.3	11.50		0	-90	
AC93ZG64	ZG64	CRAE	364377.5	5349428.8	61100	47800	141.6	5.50		0	-90	GRAVITY RL
AC93ZG65	ZG65	CRAE	364252.5	5349428.5	61025	47700	136.0	3.00		0	-90	
AC93ZG66	ZG66	CRAE	364237.5	5349448.5	61000	47700	135.8	3.70		0	-90	GRAVITY RL
AC93ZG67	ZG67	CRAE	364457.4	5349489.0	61100	47900	138.7	6.80		0	-90	GRAVITY RL
AC93ZG68	ZG68	CRAE	364472.4	5349469.0	61125	47900	140.2	8.50		0	-90	
AC93ZG69	ZG69	CRAE	364487.5	5349449.1	61150	47900	141.6	4.10		0	-90	GRAVITY RL
AC93ZG70	ZG70	CRAE	364502.5	5349429.1	61175	47900	142.3	7.00		0	-90	
AC93ZG71	ZG71	CRAE	364517.5	5349409.1	61200	47900	143.0	7.00		0	-90	GRAVITY RL
AC93ZG72	ZG72	CRAE	364532.6	5349389.2	61225	47900	144.5	4.80		0	-90	

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Appendix 2: Grieves prospect. Drillhole collar information.

HOLE	PLOTNAME	COMPANY	AMG E	AMG N	LOCAL E	LOCAL N	RL	DEPTH	AZIM (AMG)	INCL	SURVEYED	DH SURVEYS
AC93ZG73	ZG73	CRAE	364547.6	5349369.2	61250	47900	145.9	12.80	0	-90	GRAVITY RL	
AC93ZG74	ZG74	CRAE	364733.4	5349629.3	61150	48200	152.7	14.50	0	-90		
AC93ZG75	ZG75	CRAE	364716.0	5349650.6	61125	48200	151.6	14.00	0	-90		
AC93ZG76	ZG76	CRAE	364701.0	5349670.5	61100	48200	150.5	8.40	0	-90	GRAVITY RL	
AC93ZG77	ZG77	CRAE	364685.9	5349690.5	61075	48200	149.6	5.30	0	-90		
AC93ZG78	ZG78	CRAE	364670.9	5349710.5	61050	48200	148.6	4.90	0	-90	GRAVITY RL	
AC93ZG79	ZG79	CRAE	364655.8	5349730.4	61025	48200	148.8	9.60	0	-90		
AC93ZG80	ZG80	CRAE	363886.8	5349747.7	60550	47600	132.6	19.70	0	-90	GRAVITY RL	
AC93ZG81	ZG81	CRAE	363901.8	5349727.7	60575	47600	131.6	9.50	0	-90		
AC93ZG82	ZG82	CRAE	363916.9	5349707.8	60600	47600	130.6	9.50	0	-90	GRAVITY RL	
AC93ZG83	ZG83	CRAE	363931.9	5349687.8	60625	47600	129.4	2.50	0	-90		
AC93ZG84	ZG84	CRAE	363947.0	5349667.8	60650	47600	128.2	10.50	0	-90	GRAVITY RL	
AC93ZG85	ZG85	CRAE	363962.0	5349647.9	60675	47600	127.9	6.40	0	-90		
AC93ZG86	ZG86	CRAE	363977.0	5349627.9	60700	47600	127.5	12.00	0	-90	GRAVITY RL	
AC93ZG87	ZG87	CRAE	363992.1	5349607.9	60725	47600	129.4	9.30	0	-90		
AC93ZG88	ZG88	CRAE	364007.1	5349588.0	60750	47600	131.2	16.00	0	-90	GRAVITY RL	
AC93ZG89	ZG89	CRAE	364022.2	5349568.0	60775	47600	131.0	34.00	0	-90		
AC93ZG90	ZG90	CRAE	364037.2	5349548.0	60800	47600	130.8	10.30	0	-90	GRAVITY RL	
AC93ZG91	ZG91	CRAE	364026.5	5349878.0	60530	47790	131.4	18.00	0	-90		
AC93ZG92	ZG92	CRAE	364061.5	5349848.1	60575	47800	130.3	9.00	0	-90		
AC93ZG93	ZG93	CRAE	364076.6	5349828.1	60600	47800	131.0	4.50	0	-90	GRAVITY RL	
AC93ZG94	ZG94	CRAE	364091.6	5349808.2	60625	47800	131.3	1.80	0	-90		
AC93ZG95	ZG95	CRAE	364106.7	5349788.2	60650	47800	131.5	3.00	0	-90	GRAVITY RL	
AC93ZG96	ZG96	CRAE	364121.7	5349768.2	60675	47800	133.2	8.00	0	-90		
AC93ZG97	ZG97	CRAE	364136.8	5349748.3	60700	47800	134.9	13.00	0	-90	GRAVITY RL	
AC93ZG98	ZG98	CRAE	364151.4	5349731.0	60725	47800	135.5	25.80	0	-90	YES	
AC93ZG99	ZG99	CRAE	364165.2	5349708.4	60750	47800	134.9	23.80	0	-90	YES	
AC93ZG100	ZG100	CRAE	364181.9	5349688.4	60775	47800	134.5	2.40	0	-90		
AC93ZG101	ZG101	CRAE	364197.0	5349668.4	60800	47800	134.1	3.50	0	-90	GRAVITY RL	
AC93ZG102	ZG102	CRAE	364860.0	5349828.7	61071	48426	161.0	20.00	0	-90		
AC93ZG103	ZG103	CRAE	364833.4	5349832.5	61052	48407	160.5	4.70	0	-90		
DD93ZG104	ZG104	CRAE	364713.7	5349646.4	61125	48200	151.1	36.70	142	-50	YES	
DD93ZG105	ZG105	CRAE	364512.9	5349249.4	61325	47800	148.8	40.90	142	-52	YES	
DD93ZG106	ZG106	CRAE	364637.5	5349751.8	60997	48200	149.0	161.00	142	-50	YES	YES
DD93ZG107	ZG107	CRAE	364565.9	5349512.0	61142.5	48000	142.8	175.00	145	-50	YES	YES

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Appendix 2: Grieves prospect. Drillhole collar information.

HOLE	PLOTNAME	COMPANY	AMG E	AMG N	LOCAL E	LOCAL N	RL	DEPTH	AZIM (AMG)	INCL	SURVEYED	DH SURVEYS
AC93ZG108	ZG108	CRAE	364695.5	5349602.2	61150	48150	148.5	31.00	0	-90	YES	
AC93ZG109	ZG109	CRAE	364688.3	5349610.4	61140	48150	148.6	6.00	0	-90		
AC93ZG109a	ZG109a	CRAE	364693.1	5349615.0	61140	48160	148.9	5.00	0	-90	YES	
AC93ZG110	ZG110	CRAE	364681.1	5349618.6	61130	48150	148.6	13.00	0	-90	YES	
AC93ZG111	ZG111	CRAE	364674.6	5349625.1	61120	48150	148.5	8.50	0	-90	YES	
AC93ZG112	ZG112	CRAE	364667.7	5349632.5	61110	48150	148.5	4.00	0	-90	YES	
AC93ZG113	ZG113	CRAE	364661.4	5349639.6	61100	48150	148.3	12.50	0	-90	YES	
AC93ZG114	ZG114	CRAE	364655.0	5349647.2	61090	48150	148.4	9.00	0	-90	YES	
AC93ZG115	ZG115	CRAE	364729.3	5349634.4	61145	48200	152.1	28.50	0	-90	YES	
AC93ZG116	ZG116	CRAE	364733.4	5349629.3	61150	48200	152.8	35.00	135	-58	YES	
AC93ZG117	ZG117	CRAE	364724.5	5349639.3	61137	48200	151.8	19.00	0	-90	YES	
AC93ZG118	ZG118	CRAE	364710.9	5349658.3	61115	48200	151.2	7.50	0	-90	YES	
AC93ZG118a	ZG118a	CRAE	364710.9	5349658.3	61115	48200	151.2	13.00	0	-90		
AC93ZG119	ZG119	CRAE	364788.9	5349633.4	61180	48250	157.7	7.50	142	-60	YES	
AC93ZG120	ZG120	CRAE	364780.5	5349644.0	61167	48250	156.5	24.00	0	-90	YES	
AC93ZG121	ZG121	CRAE	364776.0	5349649.7	61160	48250	156.0	4.00	0	-90		
AC93ZG122	ZG122	CRAE	364767.6	5349660.9	61146	48250	155.0	4.00	0	-90		
AC93ZG123	ZG123	CRAE	364759.3	5349684.5	61125	48260	154.2	24.00	0	-90	YES	
AC93ZG124	ZG124	CRAE	364736.6	5349695.0	61100	48250	152.6	6.00	0	-90	YES	
AC93ZG125	ZG125	CRAE	364677.6	5349541.3	61190	48100	147.7	16.00	0	-90	YES	
AC93ZG126	ZG126	CRAE	364670.2	5349551.4	61180	48100	147.3	8.00	0	-90	YES	
AC93ZG127	ZG127	CRAE	364663.7	5349559.1	61170	48100	147.3	23.00	0	-90	YES	
AC93ZG128	ZG128	CRAE	364658.6	5349565.3	61160	48100	146.7	10.00	0	-90	YES	
AC93ZG129	ZG129	CRAE	364651.8	5349573.6	61150	48100	145.7	12.00	0	-90	YES	
AC93ZG130	ZG130	CRAE	364634.5	5349596.2	61125	48100	146.4	14.00	0	-90	YES	
AC93ZG131	ZG131	CRAE	364621.3	5349613.5	61100	48100	146.7	6.50	0	-90	YES	
AC93ZG132	ZG132	CRAE	364606.0	5349633.3	61075	48100	146.0	6.00	0	-90		
AC93ZG133	ZG133	CRAE	364708.5	5349427.5	61300	48050	148.2	28.00	0	-90	YES	
AC93ZG134	ZG134	CRAE	364701.8	5349435.6	61290	48050	147.1	15.00	0	-90	YES	
AC93ZG135	ZG135	CRAE	364696.4	5349441.3	61280	48050	146.8	10.00	0	-90	YES	
AC93ZG136	ZG136	CRAE	364686.7	5349450.4	61270	48050	145.5	7.00	0	-90	YES	
AC93ZG137	ZG137	CRAE	364680.6	5349457.4	61260	48050	145.0	7.00	0	-90	YES	
AC93ZG138	ZG138	CRAE	364674.1	5349464.0	61250	48050	144.7	1.70	0	-90	YES	
AC93ZG139	ZG139	CRAE	364656.9	5349484.0	61225	48050	144.6	8.00	0	-90	YES	
AC93ZG140	ZG140	CRAE	364642.7	5349502.4	61200	48050	144.3	8.00	0	-90	YES	

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Appendix 2: Grievies prospect. Drillhole collar information.

HOLE	PLOTNAME	COMPANY	AMG E	AMG N	LOCAL E	LOCAL N	RL	DEPTH	AZIM (AMG)	INCL	SURVEYED	DH SURVEYS
AC93ZG141	ZG141	CRAE	364627.6	5349523.1	61175	48050	144.1	13.00		0	-90	YES
AC93ZG142	ZG142	CRAE	364611.6	5349543.2	61150	48050	144.8	11.00		0	-90	YES
AC93ZG143	ZG143	CRAE	364597.0	5349562.8	61125	48050	144.8	3.50		0	-90	YES
AC93ZG144	ZG144	CRAE	364581.4	5349581.4	61100	48050	144.7	6.00		0	-90	YES
AC93ZG145	ZG145	CRAE	364566.6	5349601.1	61075	48050	144.8	4.00		0	-90	YES
AC93ZG146	ZG146	CRAE	364551.1	5349621.2	61050	48050	144.7	4.00		0	-90	
AC93ZG147	ZG147	CRAE	364536.0	5349641.2	61025	48050	144.7	3.50		0	-90	
AC93ZG148	ZG148	CRAE	364521.0	5349661.1	61000	48050	144.7	4.00		0	-90	
AC93ZG149	ZG149	CRAE	364680.7	5349351.4	61340	48000	152.8	16.00		0	-90	YES
AC93ZG150	ZG150	CRAE	364676.0	5349360.3	61330	48000	151.4	14.00		0	-90	
AC93ZG151	ZG151	CRAE	364671.3	5349369.3	61320	48000	149.9	11.50		0	-90	
AC93ZG152	ZG152	CRAE	364666.5	5349378.3	61310	48000	148.4	20.00		0	-90	YES
AC93ZG153	ZG153	CRAE	364654.6	5349393.4	61290	48000	146.3	44.00		0	-90	
AC93ZG154	ZG154	CRAE	364648.6	5349401.4	61280	48000	145.3	34.00		0	-90	
AC93ZG155	ZG155	CRAE	364642.5	5349409.4	61270	48000	144.3	39.00		0	-90	
AC93ZG156	ZG156	CRAE	364636.5	5349417.4	61260	48000	143.3	27.00		0	-90	
AC93ZG157	ZG157	CRAE	364617.5	5349439.4	61230	48000	142.5	3.00		0	-90	YES
AC93ZG158	ZG158	CRAE	364601.5	5349459.4	61204	48000	142.0	8.00		0	-90	YES
AC93ZG159	ZG159	CRAE	364584.5	5349485.0	61175	48000	142.1	8.00		0	-90	YES
AC93ZG160	ZG160	CRAE	364554.3	5349524.6	61125	48000	142.2	9.00		0	-90	YES
AC93ZG161	ZG161	CRAE	364543.1	5349548.2	61100	48000	142.4	13.00		0	-90	YES
AC93ZG162	ZG162	CRAE	364527.1	5349567.6	61075	48000	143.3	3.20		0	-90	YES
AC93ZG163	ZG163	CRAE	364509.7	5349585.4	61050	48000	142.6	7.00		0	-90	YES
AC93ZG164	ZG164	CRAE	364492.1	5349609.1	61025	48000	141.8	10.00		0	-90	
AC93ZG165	ZG165	CRAE	364477.0	5349629.0	61000	48000	140.9	8.00		0	-90	GRAVITY RL
AC93ZG166	ZG166	CRAE	364599.6	5349383.3	61270	47950	146.5	6.00		0	-90	
AC93ZG167	ZG167	CRAE	364585.9	5349397.2	61250	47950	145.6	5.00		0	-90	YES
AC93ZG168	ZG168	CRAE	364576.7	5349410.7	61235	47950	144.5	12.00		0	-90	YES
AC93ZG169	ZG169	CRAE	364536.0	5349228.0	61355	47800	155.4	36.00		0	-90	YES
AC93ZG170	ZG170	CRAE	364524.6	5349234.2	61343	47795	152.3	7.00		0	-90	YES
AC93ZG171	ZG171	CRAE	364518.5	5349240.4	61335	47795	151.2	22.00		0	-90	YES
AC93ZG172	ZG172	CRAE	364517.9	5349245.8	61330	47800	150.0	22.00		0	-90	YES
AC93ZG173	ZG173	CRAE	364512.9	5349249.1	61325	47800	148.8	24.00		0	-90	
AC93ZG174	ZG174	CRAE	364509.9	5349253.1	61320	47800	148.5	34.00		0	-90	
AC93ZG175	ZG175	CRAE	364506.9	5349257.1	61315	47800	148.2	44.00		0	-90	

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Appendix 2: Grieves prospect. Drillhole collar information.

HOLE	PLOTNAME	COMPANY	AMG E	AMG N	LOCAL E	LOCAL N	RL	DEPTH	AZIM (AMG)	INCL	SURVEYED	DH SURVEYS
AC93ZG176	ZG176	CRAE	364503.9	5349261.1	61310	47800	147.9	4.00	0	-90		
AC93ZG177	ZG177	CRAE	364500.9	5349265.1	61305	47800	147.6	57.00	0	-90		
AC93ZG178	ZG178	CRAE	364562.2	5349280.9	61330	47850	157.7	17.50	0	-90	YES	
AC93ZG179	ZG179	CRAE	364569.1	5349272.4	61340	47850	156.9	5.00	0	-90	YES	
AC93ZG180	ZG180	CRAE	364574.7	5349263.6	61350	47850	158.7	29.50	0	-90	YES	
AC93ZG181	ZG181	CRAE	364495.0	5349206.0	61350	47750	151.6	31.50	0	-90	YES	
AC93ZG182	ZG182	CRAE	364489.0	5349213.2	61340	47750	152.6	13.00	0	-90	YES	
AC93ZG183	ZG183	CRAE	364484.2	5349221.1	61330	47750	152.2	21.00	0	-90	YES	
AC93ZG184	ZG184	CRAE	364479.9	5349229.1	61320	47750	151.6	39.00	0	-90	YES	
AC93ZG185	ZG185	CRAE	364468.8	5349247.1	61300	47750	149.1	60.00	0	-90	YES	
AC93ZG186	ZG186	CRAE	364448.1	5349260.3	61275	47745	146.2	42.00	0	-90	YES	
AC93ZG187	ZG187	CRAE	364434.0	5349284.3	61250	47750	144.9	14.00	0	-90	YES	
AC93ZG188	ZG188	CRAE	364442.2	5349147.6	61360	47680	153.0	4.00	0	-90	YES	
AC93ZG189	ZG189	CRAE	364426.6	5349161.5	61340	47680	151.3	3.00	0	-90	YES	
AC93ZG190	ZG190	CRAE	364418.6	5349189.6	61315	47690	150.4	9.00	0	-90	YES	
AC93ZG191	ZG191	CRAE	364328.1	5349152.1	61290	47595	145.4	36.00	0	-90	YES	
AC93ZG192	ZG192	CRAE	364323.2	5349157.1	61280	47595	144.9	41.00	0	-90	YES	
AC93ZG193	ZG193	CRAE	364316.2	5349165.1	61270	47595	144.3	30.00	0	-90	YES	
AC93ZG194	ZG194	CRAE	364309.8	5349172.2	61260	47595	144.1	4.00	0	-90	YES	
AC93ZG195	ZG195	CRAE	364387.2	5349169.5	61315	47650	148.6	48.00	0	-90	YES	
AC93ZG196	ZG196	CRAE	364380.1	5349179.7	61300	47645	147.7	32.00	0	-90	YES	
AC93ZG197	ZG197	CRAE	364285.9	5349138.3	61277	47550	142.6	32.00	0	-90	YES	
AC93ZG198	ZG198	CRAE	364281.7	5349144.4	61270	47550	142.0	32.50	0	-90	YES	
AC93ZG199	ZG199	CRAE	364250.1	5349091.2	61280	47495	141.2	20.00	0	-90	YES	
AC93ZG200	ZG200	CRAE	364251.0	5349098.9	61270	47495	140.3	30.00	0	-90	YES	
AC93ZG201	ZG201	CRAE	364244.9	5349108.5	61260	47500	139.5	36.00	0	-90	YES	
AC93ZG202	ZG202	CRAE	364239.0	5349118.4	61250	47500	139.0	30.00	0	-90	YES	
AC93ZG203	ZG203	CRAE	364220.5	5349043.9	61310	47450	146.0	4.00	0	-90	YES	
AC93ZG204	ZG204	CRAE	364225.7	5349036.7	61320	47450	146.6	3.00	0	-90	YES	
AC93ZG205	ZG205	CRAE	364213.8	5349051.4	61300	47450	145.1	23.00	0	-90	YES	
AC93ZG206	ZG206	CRAE	364304.2	5349181.3	61250	47590	143.6	5.50	0	-90	YES	
AC93ZG207	ZG207	CRAE	364283.2	5349208.8	61215	47590	141.5	12.00	0	-90	YES	
AC93ZG208	ZG208	CRAE	364268.6	5349146.2	61260	47540	141.1	3.70	0	-90	YES	
DD93ZG209	ZG209	CRAE	364441.4	5349349.5	61198	47802	143.2	124.20	145	-50	YES	YES
AC93ZG210	ZG210	CRAE	364268.2	5349162.9	61245	47550	141.7	23.00	0	-90	YES	

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Appendix 2: Grieves prospect. Drillhole collar information.

HOLE	PLOTNAME	COMPANY	AMG E	AMG N	LOCAL E	LOCAL N	RL	DEPTH	AZIM (AMG)	INCL	SURVEYED	DH SURVEYS
AC93ZG211	ZG211	CRAE	364256.1	5349178.4	61225	47550	140.7	4.00	0	-90	YES	
AC93ZG212	ZG212	CRAE	364239.9	5349198.2	61200	47550	139.8	4.90	0	-90	YES	
AC93ZG213	ZG213	CRAE	364230.9	5349126.9	61240	47500	139.0	32.80	0	-90	YES	
AC93ZG214	ZG214	CRAE	364225.2	5349133.8	61230	47500	139.1	50.00	0	-90	YES	
AC93ZG215	ZG215	CRAE	364205.6	5349157.3	61200	47500	138.2	18.90	0	-90	YES	
AC93ZG216	ZG216	CRAE	364190.9	5349177.0	61175	47500	137.7	16.80	0	-90	YES	
AC93ZG217	ZG217	CRAE	364209.1	5349059.9	61290	47450	144.6	21.20	0	-90	YES	
AC93ZG218	ZG218	CRAE	364201.8	5349068.2	61280	47450	143.1	30.00	0	-90	YES	
AC93ZG219	ZG219	CRAE	364183.5	5349084.6	61255	47450	140.0	30.00	0	-90	YES	
AC93ZG220	ZG220	CRAE	364173.4	5349108.9	61230	47450	136.6	10.70	0	-90	YES	
AC93ZG221	ZG221	CRAE	364181.6	5349016.0	61308	47400	146.9	23.70	142	-80	YES	
AC93ZG222	ZG222	CRAE	364178.2	5349022.9	61300	47400	145.2	24.20	0	-90	YES	
AC93ZG223	ZG223	CRAE	364172.9	5349031.3	61290	47400	144.2	28.00	0	-90	YES	
AC93ZG224	ZG224	CRAE	364166.4	5349040.6	61280	47400	142.9	38.00	0	-90	YES	
AC93ZG225	ZG225	CRAE	364160.2	5349048.0	61270	47400	141.5	36.00	0	-90	YES	
AC93ZG226	ZG226	CRAE	364148.4	5349062.8	61250	47400	139.2	16.20	0	-90	YES	
AC93ZG227	ZG227	CRAE	364133.3	5349083.2	61225	47400	136.6	20.80	0	-90	YES	
AC93ZG228	ZG228	CRAE	364148.5	5348990.2	61307	47350	145.9	16.80	0	-90	YES	
AC93ZG229	ZG229	CRAE	364151.1	5348981.1	61317	47350	147.8	32.70	0	-90	YES	
AC93ZG230	ZG230	CRAE	364143.7	5348996.1	61299	47350	144.4	12.20	0	-90	YES	
AC93ZG231	ZG231	CRAE	364135.3	5349005.8	61286	47350	140.1	18.70	0	-90	YES	
AC93ZG232	ZG232	CRAE	364128.2	5349013.7	61275	47350	138.5	24.50	0	-90	YES	
AC93ZG233	ZG233	CRAE	364112.5	5349033.9	61250	47350	136.0	28.80	0	-90	YES	
AC93ZG234	ZG234	CRAE	364095.8	5349053.0	61225	47350	133.8	8.00	0	-90	YES	
AC93ZG235	ZG235	CRAE	364067.4	5348965.3	61280	47280	135.4	9.70	0	-90	YES	
AC93ZG236	ZG236	CRAE	364061.8	5348974.1	61270	47280	134.3	17.60	0	-90	YES	
AC93ZG237	ZG237	CRAE	364055.0	5348981.9	61260	47280	133.0	22.20	0	-90	YES	
AC93ZG238	ZG238	CRAE	364048.8	5348989.3	61250	47280	131.6	3.00	0	-90	YES	
AC93ZG239	ZG239	CRAE	364033.7	5349009.3	61225	47280	130.5	2.50	0	-90	YES	
AC93ZG240	ZG240	CRAE	364018.9	5349029.6	61200	47280	130.5	3.50	0	-90	YES	
AC93ZG241	ZG241	CRAE	364117.9	5349107.0	61200	47400	134.2	7.20	0	-90	YES	
AC93ZG242	ZG242	CRAE	364105.8	5349125.4	61175	47400	134.1	3.90	0	-90	YES	
AC93ZG243	ZG243	CRAE	364090.7	5349145.9	61150	47400	134.1	17.80	0	-90	YES	
AC93ZG244	ZG244	CRAE	364075.4	5349165.7	61125	47400	133.5	3.90	0	-90	YES	
AC93ZG245	ZG245	CRAE	364061.0	5349185.6	61100	47400	133.0	13.70	0	-90	YES	

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Appendix 2: Grievies prospect. Drillhole collar information.

HOLE	PLOTNAME	COMPANY	AMG E	AMG N	LOCAL E	LOCAL N	RL	DEPTH	AZIM (AMG)	INCL	SURVEYED	DH SURVEYS
AC93ZG246	ZG246	CRAE	364044.8	5349206.6	61075	47400	132.1	8.20	0	-90	YES	
AC93ZG247	ZG247	CRAE	364030.0	5349226.8	61050	47400	131.9	6.50	0	-90	YES	
AC93ZG248	ZG248	CRAE	364014.4	5349247.7	61025	47400	131.7	3.70	0	-90	YES	
AC93ZG249	ZG249	CRAE	363999.5	5349267.4	61000	47400	131.1	14.80	0	-90	YES	
AC93ZG250	ZG250	CRAE	363984.9	5349286.9	60975	47400	130.5	5.50	0	-90	YES	
AC93ZG251	ZG251	CRAE	363969.6	5349306.9	60950	47400	130.2	2.90	0	-90	YES	
AC93ZG252	ZG252	CRAE	363957.8	5349324.8	60925	47400	129.5	4.90	0	-90	YES	
AC93ZG253	ZG253	CRAE	363939.0	5349348.1	60900	47400	129.2	16.60	0	-90	YES	
AC93ZG254	ZG254	CRAE	363927.2	5349369.7	60875	47400	130.6	26.10	0	-90	YES	
AC93ZG255	ZG255	CRAE	363911.1	5349389.9	60850	47400	128.1	14.50	0	-90	YES	
AC93ZG256	ZG256	CRAE	363896.6	5349408.1	60825	47400	127.8	4.20	0	-90	YES	
AC93ZG257	ZG257	CRAE	363878.6	5349428.2	60800	47400	127.7	18.00	0	-90	YES	
AC93ZG258	ZG258	CRAE	364222.4	5349468.5	60975	47700	135.0	3.10	0	-90		
AC93ZG259	ZG259	CRAE	364207.4	5349488.4	60950	47700	134.2	3.50	0	-90	GRAVITY RL	
AC93ZG260	ZG260	CRAE	364192.3	5349508.4	60925	47700	133.7	4.10	0	-90		
AC93ZG261	ZG261	CRAE	364179.7	5349529.6	60900	47700	133.1	2.10	0	-90	YES	
AC93ZG262	ZG262	CRAE	364839.1	5349679.5	61177	48315	159.2	8.90	0	-90	YES	
AC93ZG263	ZG263	CRAE	364827.9	5349681.8	61165	48315	157.9	12.20	0	-90	YES	
AC93ZG264	ZG264	CRAE	364838.2	5349715.8	61150	48350	156.4	39.00	0	-90	YES	
AC93ZG265	ZG265	CRAE	364834.9	5349731.1	61138	48350	157.0	20.80	0	-90	YES	
AC93ZG266	ZG266	CRAE	364832.8	5349741.6	61127	48350	156.8	12.00	0	-90	YES	
AC93ZG267	ZG267	CRAE	364826.8	5349751.8	61115	48350	156.2	14.10	0	-90	YES	
AC93ZG268	ZG268	CRAE	364816.6	5349761.8	61100	48350	153.9	3.50	0	-90	YES	
AC93ZG269	ZG269	CRAE	364809.7	5349772.4	61090	48350	153.8	8.70	0	-90	YES	
AC93ZG270	ZG270	CRAE	364792.7	5349789.2	61065	48350	153.7	5.10	0	-90	YES	
AC93ZG271	ZG271	CRAE	364778.6	5349805.1	61040	48350	153.4	10.90	0	-90	YES	
AC93ZG272	ZG272	CRAE	364788.2	5349696.3	61134	48300	154.7	4.00	0	-90	YES	
AC93ZG273	ZG273	CRAE	364782.2	5349708.6	61124	48300	154.0	12.70	0	-90	YES	
AC93ZG274	ZG274	CRAE	364778.6	5349721.4	61107	48300	153.4	5.50	0	-90	YES	
AC93ZG275	ZG275	CRAE	364774.3	5349727.2	61100	48300	153.0	4.00	0	-90		
AC93ZG276	ZG276	CRAE	364759.2	5349747.4	61075	48300	152.1	6.00	0	-90	YES	
AC93ZG277	ZG277	CRAE	364873.9	5349765.9	61130	48400	164.5	8.50	0	-90	YES	
AC93ZG278	ZG278	CRAE	364874.8	5349779.0	61120	48407	163.3	6.00	0	-90	YES	
AC93ZG279	ZG279	CRAE	364862.9	5349783.1	61110	48400	160.8	7.00	0	-90	YES	
AC93ZG280	ZG280	CRAE	364854.9	5349789.2	61100	48400	159.5	10.20	0	-90	YES	

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Appendix 2: Grieves prospect. Drillhole collar information.

HOLE	PLOTNAME	COMPANY	AMG E	AMG N	LOCAL E	LOCAL N	RL	DEPTH	AZIM (AMG)	INCL	SURVEYED	DH SURVEYS
AC93ZG281	ZG281	CRAE	364846.3	5349802.0	61085	48400	156.5	2.40	0	-90	YES	
AC93ZG282	ZG282	CRAE	364834.0	5349817.9	61064	48400	157.0	10.80	0	-90	YES	
AC93ZG283	ZG283	CRAE	364624.9	5349769.4	60975	48200	149.5	7.30	0	-90	YES	
AC93ZG284	ZG284	CRAE	364610.1	5349789.7	60950	48200	148.3	2.30	0	-90	YES	
AC93ZG285	ZG285	CRAE	364580.3	5349830.5	60900	48200	149.6	2.50	0	-90	YES	
AC93ZG286	ZG286	CRAE	364565.5	5349850.2	60875	48200	148.7	3.10	0	-90		
AC93ZG287	ZG287	CRAE	364550.5	5349870.2	60850	48200	147.7	3.10	0	-90	GRAVITY RL	
AC93ZG288	ZG288	CRAE	364535.5	5349890.2	60825	48200	147.0	1.10	0	-90		
AC93ZG289	ZG289	CRAE	364520.4	5349910.1	60800	48200	146.4	3.60	0	-90	GRAVITY RL	
AC93ZG290	ZG290	CRAE	364505.4	5349930.1	60775	48200	146.2	10.90	0	-90		
AC93ZG291	ZG291	CRAE	364490.3	5349950.1	60750	48200	145.9	4.30	0	-90	GRAVITY RL	
AC93ZG292	ZG292	CRAE	364475.3	5349970.0	60725	48200	145.2	8.10	0	-90		
AC93ZG293	ZG293	CRAE	364460.2	5349990.0	60700	48200	144.5	4.10	0	-90	GRAVITY RL	
AC93ZG294	ZG294	CRAE	364432.0	5349994.5	60681	48184	144.5	3.40	0	-90		
AC93ZG295	ZG295	CRAE	364407.8	5350000.1	60662	48168	144.5	4.00	0	-90		
AC93ZG296	ZG296	CRAE	364383.6	5350005.6	60643	48152	144.5	5.00	0	-90		
AC93ZG297	ZG297	CRAE	364359.4	5350011.2	60624	48136	144.5	2.50	0	-90		
AC93ZG298	ZG298	CRAE	363834.5	5349489.5	60725	47400	127.8	6.10	0	-90	YES	
AC93ZG299	ZG299	CRAE	363819.3	5349509.5	60700	47400	127.0	5.50	0	-90	GRAVITY RL	
AC93ZG300	ZG300	CRAE	363804.3	5349529.5	60675	47400	126.2	13.10	0	-90		
AC93ZG301	ZG301	CRAE	363795.2	5349541.5	60660	47400	125.8	4.80	0	-90		
AC93ZG302	ZG302	CRAE	363927.3	5349527.8	60750	47500	130.4	22.00	0	-90	GRAVITY RL	
AC93ZG303	ZG303	CRAE	363912.2	5349547.8	60725	47500	128.4	4.00	0	-90		
AC93ZG304	ZG304	CRAE	363897.2	5349567.7	60700	47500	126.3	1.50	0	-90	GRAVITY RL	
AC93ZG305	ZG305	CRAE	363789.2	5349549.5	60650	47400	125.4	4.10	0	-90	GRAVITY RL	
AC93ZG306	ZG306	CRAE	363774.2	5349569.4	60625	47400	124.3	1.50	0	-90		
AC93ZG307	ZG307	CRAE	363768.2	5349577.4	60615	47400	123.8	5.20	0	-90		
AC93ZG308	ZG308	CRAE	363759.1	5349589.4	60600	47400	123.1	10.60	0	-90	GRAVITY RL	
AC93ZG309	ZG309	CRAE	363882.1	5349587.7	60675	47500	126.4	6.50	0	-90		
AC93ZG310	ZG310	CRAE	363867.1	5349607.7	60650	47500	126.4	8.90	0	-90	GRAVITY RL	
AC93ZG311	ZG311	CRAE	363852.0	5349627.6	60625	47500	126.7	0.00	0	-90		
AC93ZG312	ZG312	CRAE	363837.0	5349647.6	60600	47500	126.9	7.00	0	-90	GRAVITY RL	
AC93ZG313	ZG313	CRAE	364011.8	5349748.0	60625	47700	129.4	3.00	0	-90		
AC93ZG314	ZG314	CRAE	363996.7	5349768.0	60600	47700	128.9	6.00	0	-90	GRAVITY RL	
AC93ZG315	ZG315	CRAE	363981.7	5349787.9	60575	47700	129.5	6.00	0	-90		

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Appendix 2: Grievess prospect. Drillhole collar information.

HOLE	PLOTNAME	COMPANY	AMG E	AMG N	LOCAL E	LOCAL N	RL	DEPTH	AZIM (AMG)	INCL	SURVEYED	DH SURVEYS
AC93ZG316	ZG316	CRAE	363966.6	5349807.9	60550	47700	130.1	12.00	0	-90	GRAVITY RL	
AC93ZG317	ZG317	CRAE	364026.8	5349728.0	60650	47700	129.9	4.00	0	-90	GRAVITY RL	
AC93ZG318	ZG318	CRAE	364041.9	5349708.1	60675	47700	131.1	4.20	0	-90		
AC93ZG319	ZG319	CRAE	364056.9	5349688.1	60700	47700	132.3	4.00	0	-90	GRAVITY RL	
AC93ZG320	ZG320	CRAE	364072.0	5349668.1	60725	47700	133.7	13.50	0	-90		
AC93ZG321	ZG321	CRAE	364087.0	5349648.2	60750	47700	134.0	2.40	0	-90	GRAVITY RL	
AC93ZG322	ZG322	CRAE	364102.0	5349628.2	60775	47700	133.0	8.40	0	-90		
AC93ZG323	ZG323	CRAE	364118.8	5349610.2	60800	47700	132.0	15.50	0	-90	YES	
AC93ZG324	ZG324	CRAE	364133.0	5349588.9	60825	47700	131.9	13.20	0	-90	YES	
AC93ZG325	ZG325	CRAE	364186.5	5349848.4	60650	47900	137.5	6.00	0	-90	GRAVITY RL	
AC93ZG326	ZG326	CRAE	364171.5	5349868.3	60625	47900	134.0	26.20	0	-90		
AC93ZG327	ZG327	CRAE	364156.5	5349888.3	60600	47900	130.5	11.20	0	-90	GRAVITY RL	
AC93ZG328	ZG328	CRAE	364241.1	5349942.1	60608	48000	138.8	6.50	0	-90		
AC93ZG329	ZG329	CRAE	364221.3	5349968.5	60575	48000	135.2	28.00	0	-90		
AC93ZG330	ZG330	CRAE	364144.4	5349904.3	60580	47900	130.6	27.60	0	-90		
AC93ZG331	ZG331	CRAE	364126.4	5349928.2	60550	47900	130.8	19.10	0	-90	GRAVITY RL	
AC93ZG332	ZG332	CRAE	364111.3	5349948.2	60525	47900	132.8	21.30	0	-90		
AC93ZG333	ZG333	CRAE	364096.3	5349968.2	60500	47900	134.9	16.20	0	-90	GRAVITY RL	
AC93ZG334	ZG334	CRAE	364081.2	5349988.1	60475	47900	138.2	11.50	0	-90		
AC93ZG335	ZG335	CRAE	364061.4	5350014.5	60442	47900	141.6	24.50	0	-90		
AC93ZG336	ZG336	CRAE	364191.2	5350008.4	60525	48000	131.5	6.50	0	-90		
AC93ZG337	ZG337	CRAE	364176.1	5350028.4	60500	48000	131.5	18.70	0	-90	GRAVITY RL	
AC93ZG338	ZG338	CRAE	364161.1	5350048.3	60475	48000	132.2	14.80	0	-90		
AC93ZG339	ZG339	CRAE	364146.0	5350068.3	60450	48000	132.9	11.00	0	-90	GRAVITY RL	
AC93ZG340	ZG340	CRAE	364131.0	5350088.3	60425	48000	134.2	19.00	320	-73		
AC93ZG341	ZG341	CRAE	364216.9	5350398.5	60275	48600	137.3	13.90	0	-90		
AC93ZG342	ZG342	CRAE	364241.9	5350399.0	60300	48600	139.0	10.60	0	-90	GRAVITY RL	
AC93ZG343	ZG343	CRAE	364266.9	5350399.5	60325	48600	138.8	11.70	0	-90		
AC93ZG344	ZG344	CRAE	364291.9	5350400.0	60350	48600	138.6	43.20	0	-90	GRAVITY RL	
AC93ZG345	ZG345	CRAE	364316.9	5350400.5	60375	48600	138.9	19.00	0	-90		
AC93ZG346	ZG346	CRAE	364688.2	5349623.0	61130	48160	149.2	9.00	0	-90	YES	
AC93ZG347	ZG347	CRAE	364762.3	5349675.7	61133	48250	154.4	4.00	0	-90	YES	
AC93ZG348	ZG348	CRAE	364750.9	5349690.6	61115	48255	153.5	31.00	0	-90	YES	
AC93ZG349	ZG349	CRAE	364768.0	5349665.8	61144	48253	155.0	7.00	0	-90	YES	
AC93ZG350	ZG350	CRAE	364771.3	5349654.5	61155	48251	155.6	10.00	0	-90	YES	

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Appendix 2: Grieves prospect. Drillhole collar information.

HOLE	PLOTNAME	COMPANY	AMG E	AMG N	LOCAL E	LOCAL N	RL	DEPTH	AZIM (AMG)	INCL	SURVEYED	DH SURVEYS
AC93ZG351	ZG351	CRAE	364753.7	5349664.3	61135	48245	154.2	5.50	0	-90	YES	
AC93ZG352	ZG352	CRAE	364697.1	5349580.2	61172	48138	154.8	28.70	0	-90	YES	
AC93ZG353	ZG353	CRAE	364752.9	5349384.6	61365	48050	165.8	25.00	142	-80	YES	
AC93ZG354	ZG354	CRAE	364744.5	5349393.6	61350	48050	162.0	29.30	142	-80	YES	
AC93ZG355	ZG355	CRAE	364737.8	5349401.3	61340	48050	159.6	39.20	142	-85	YES	
AC93ZG356	ZG356	CRAE	364731.3	5349408.3	61330	48050	156.9	51.00	0	-90	YES	
AC93ZG357	ZG357	CRAE	364726.1	5349424.6	61317	48050	153.1	56.80	0	-90	YES	
DD93ZG358	ZG358	CRAE	364353.2	5349283.1	61200	47690	142.3	121.50	142	-50	YES	YES
DD93ZG359	ZG359	CRAE	364492.8	5349295.7	61269	47805	145.5	79.00	143	-45	YES	YES
DD93ZG360	ZG360	CRAE	364492.0	5349296.4	61268	47805	145.5	85.30	143	-70	YES	YES
DD93ZG361	ZG361	CRAE	364563.9	5349375.0	61253	47914	146.2	99.00	142	-45	YES	YES
DD93ZG362	ZG362	CRAE	364643.1	5349421.6	61259	48008	143.3	99.20	142	-60	YES	
DD93ZG363	ZG363	CRAE	364642.7	5349422.1	61258	48008	143.3	129.60	0	-90	YES	YES
DD93ZG364	ZG364	CRAE	364692.5	5349675.4	61090	48200	150.1	88.50	142	-45	YES	
DD93ZG365	ZG365	CRAE	364692.0	5349676.4	61089	48200	150.1	113.00	142	-75	YES	YES
AC94ZG366	ZG366	CRAE	364476.6	5349160.7	61371	47719	160.0	7.50	0	-90	YES	
AC94ZG367	ZG367	CRAE	364470.7	5349169.2	61361	47719	157.8	16.50	0	-90	YES	
AC94ZG368	ZG368	CRAE	364459.7	5349175.2	61350	47719	155.2	12.10	0	-90	YES	
AC94ZG369	ZG369	CRAE	364451.2	5349182.3	61340	47719	154.0	3.50	0	-90	YES	
AC94ZG370	ZG370	CRAE	364442.6	5349189.6	61330	47700	153.4	46.50	0	-90	YES	
AC94ZG371	ZG371	CRAE	364435.7	5349196.3	61320	47700	152.2	30.50	0	-90	YES	
AC94ZG372	ZG372	CRAE	364428.3	5349201.7	61310	47700	151.3	39.60	0	-90	YES	
AC94ZG373	ZG373	CRAE	363612.1	5348991.9	61160	47100	122.8	2.10	0	-90	YES	
AC94ZG374	ZG374	CRAE	363614.9	5348982.8	61170	47100	122.9	4.80	0	-90	YES	
AC94ZG375	ZG375	CRAE	363619.1	5348972.6	61180	47100	122.9	2.50	0	-90	YES	
AC94ZG376	ZG376	CRAE	363622.6	5348964.0	61190	47100	123.0	3.00	0	-90	YES	
AC94ZG377	ZG377	CRAE	363625.6	5348954.1	61200	47100	123.1	2.50	0	-90	YES	
AC94ZG378	ZG378	CRAE	363629.6	5348944.6	61210	47100	123.3	2.10	0	-90	YES	
AC94ZG379	ZG379	CRAE	363633.6	5348936.7	61220	47100	123.8	8.70	0	-90	YES	
AC94ZG380	ZG380	CRAE	363638.0	5348924.1	61235	47100	127.4	4.00	0	-90	YES	
AC94ZG381	ZG381	CRAE	363605.4	5348895.0	61250	47060	128.2	5.50	0	-90	YES	
AC94ZG382	ZG382	CRAE	363600.4	5348903.0	61240	47060	128.1	5.10	0	-90	YES	
AC94ZG383	ZG383	CRAE	363597.8	5348912.0	61230	47060	127.7	8.10	0	-90	YES	
AC94ZG384	ZG384	CRAE	363596.8	5348921.2	61220	47060	125.2	5.20	0	-90	YES	
AC94ZG385	ZG385	CRAE	363593.3	5348930.3	61210	47060	123.4	13.80	0	-90	YES	

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Appendix 2: Grieves prospect. Drillhole collar information.

HOLE	PLOTNAME	COMPANY	AMG E	AMG N	LOCAL E	LOCAL N	RL	DEPTH	AZIM (AMG)	INCL	SURVEYED	DH SURVEYS
AC94ZG386	ZG386	CRAE	363589.7	5348942.5	61200	47060	122.4	2.40	0	-90	YES	
AC94ZG387	ZG387	CRAE	363588.9	5348952.9	61190	47060	122.1	1.20	0	-90	YES	
AC94ZG388	ZG388	CRAE	363588.3	5348960.3	61180	47060	122.2	1.80	0	-90	YES	
AC94ZG389	ZG389	CRAE	363619.8	5348873.7	61275	47060	129.3	14.80	0	-90	YES	
AC94ZG390	ZG390	CRAE	363686.1	5348946.7	61225	47150	129.2	7.40	0	-90	YES	
AC94ZG391	ZG391	CRAE	363677.2	5348960.0	61210	47150	128.1	5.90	0	-90	YES	
AC94ZG392	ZG392	CRAE	363675.1	5348968.9	61200	47150	127.8	7.80	0	-90	YES	
AC94ZG393	ZG393	CRAE	363672.7	5348983.0	61190	47150	125.7	7.50	0	-90	YES	
AC94ZG394	ZG394	CRAE	363668.5	5348991.7	61180	47150	125.4	4.80	0	-90	YES	
AC94ZG395	ZG395	CRAE	363666.8	5349002.1	61170	47150	125.2	12.30	0	-90	YES	
AC94ZG396	ZG396	CRAE	363660.6	5349009.3	61160	47150	124.7	9.30	0	-90	YES	
AC94ZG397	ZG397	CRAE	363658.8	5349018.5	61150	47150	124.6	5.70	0	-90	YES	
AC94ZG398	ZG398	CRAE	363661.6	5349027.6	61140	47150	124.6	2.50	0	-90	YES	
AC94ZG399	ZG399	CRAE	363661.0	5349037.5	61130	47150	124.4	2.60	0	-90	YES	
AC94ZG400	ZG400	CRAE	363660.0	5349048.0	61120	47150	124.1	2.30	0	-90	YES	

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APPENDIX 3

Air-core drill logs and geochemistry - ZG366 to ZG400

## ROCKCHIP AND DRILLING CODES

22/2/1994

## BMLLITH

Rock code as per published geological map  
For-time designation use:-

Q Quaternary	M Permian	P Proterozoic
T Tertiary	C Carboniferous	A Archaean
	S Silurian	
X Cretaceous	D Devonian	
R Triassic	O Ordovician	
J Jurassic	E Cambrian	

## FIELD ID

Field term for rock type  
Broad groupings are:-

S Sedimentary	I Intrusive	C Surficial
M Metamorphic	E Extrusive	O Others

## SEDIMENTARY

Sog Conglomerate	Sls Limestone	Sw Wacke
Sss Sandstone	Scl Dolomite	Sag Agglomerate/mixtite
Ssi Siltstone		
Ssh Shale	Scr Chert	Sbx Breccia
Sbs Black shale	Sif BIF	

## METAMORPHIC

Msl Slate	Mq Quartzite	Mmg Migmatite
Mpn Phyllite	Mm Marble	
Msc Schist	Ma Amphibolite	
Mbs Granitic schist	Mcs Calcilicite	Msk Skarn
Mgn Gneiss	Mh Hornfels	

## INTRUSIVE IGNEOUS

If Felsic undiff.	li Intermed undiff.	lu Ultramafic
Ifa Felsic porphyry	lip Intermed porph	lus Serpentinite
Iap Aplitite	Im Mafic undiff.	
Igr Granite	Ido Dolerite	Ipg Pegmatite
Igd Granodiorite	Igb Gaboro	

## EXTRUSIVE IGNEOUS

Ery Rhyolite	Ean Andesite	Et Tuff undiff
Edc Dacite	Eb Basalt	Elt Felsic tuff
		Emt Maic tuff

## SURFICIAL (COVER) MATERIAL

Ca Alluvium	Clt Laterite	Csg Gessen
Cco Colluvium	Csp Pisolites	
Ca Sand	Cal Ironstone	Coy Clay
Cbs Black soil	Csi Silcrete	
Cg Gravel	Cd Calcrete	Cv Vegetation/beat

## OTHERS

Ovo Vein quartz	Omy Mylonite	Oms Massive sulfide
Ovc Vein carbonate	Oox Breccia	Orc Contamination
Ovs Vein sulphide	OI Fault gouge	Ox Unknown

## TEXTURAL CODES

## WEATHERING/SURFICIAL FEATURES

We Weathered	Fe Ferruginous
Bl Bleached	Fo Fe ox in fract
Le Leached	

## MINERALISATION/ALTERATION FEATURES

Gs Gossensous	Vs Vein sulphide	Al Altered
Vn Veined	Ds Dissem suion	S Silicific
Vc Vein carbonate	Fs Fracture suion	
Vq Vein quartz	Ss Banded suion	Di Disseminated

## GEOLOGICAL FEATURES

Bd Bedded	Fr Fractured	Po Porphyritic
Bn Banded	Ib Interbedded	Sc Schistose
Bx Brecciated	Lm Laminated	Sh Sheared
F Fissile (slatey)	Ma Massive	Vu Vuggy

## DIAGNOSTIC MINERALOGY

## PRIMARY MINERALISATION

Ca Galena	Py Pyrite	Ni Ni sulphides
So Sonalente	Po Pyrrhotite	
Co Chalcocopyrite	Su Unknown suion	

## SECONDARY MINERALISATION

Ls Lead secondanes	Cs Copper sec.	Ni Ni secondanes
Zs Zinc	Us Uranium	

## ALTERATION/DIAGNOSTIC MINERALS

Cy Clay	He Haematite	Gt Garnet
Ep Epidote	Mt Magnetite	Ky Kyanite
Cc Carbonate	Js Jarosite	To Tourmaline
Sd Siderite/Ankerite	Mn Manganese mins	Cl Chlorite
Di Dolomite		

## COLOUR CODES

L Light	A Banded	M Mottled
D Dark		
N Black	P Purple	V Green
G Grey	R Red	K Pink
B Brown	O Orange	E Blue
W White	Y Yellow	S Silver

APPENDIX 3: Grievess prospect. Air-core drill-hole logs and geochemistry - ZG366 to ZG400

APPENDIX 3: Grievess prospect. Air-core drillhole logs and geochemistry - ZG366 to ZG400.																	
Results in ppm unless shown otherwise.																	
HOLE	DFROM	DTO	SAMPNO	DPO	BMRLITH	FIELDID	TEXTURE	ALT/MIN	COLOUR	COMMENTS	Ag	Cu	Fe%	Mn	Pb	5%	Zn
ZG366	0	1			Qha	Cg			K+W	qtzite gravel, no sample							
ZG366	1	4	3983870	77148	Og	Sts	Fe		G	ferrug on fractures	-1	38	1.77	30	73		1005
ZG366	4	6	3983871	77148	Qha	StsMq		Py	DB+K	trace Py	-1	26	1.15	37	92		636
ZG366	6	7.5	3983872	77148	Qha	Mq			LGK		-1	5	0.28	15	15		95
ZG367	0	2			Qha	Cg			K+W	qtzite scree, no sample							
ZG367	2	4	3983873	77148	Og	Ccy	Fe		DBN	hard clay	-1	14	1.18	24	527		3055
ZG367	4	6	3983874	77148	Og	Ccy			DGB	plastic	-1	17	2.62	38	370		1910
ZG367	6	8	3983875	77148	Og	Ccy			DGB	silty	-1	17	1.55	36	137		725
ZG367	8	10	3983876	77148	Og	Ccy			DG	hard clay chips, carbonaceous	-1	19	2.53	45	293		1139
ZG367	10	12	3983877	77148	Og	StsSsh	Vq	Py	DG	some alteration, vein Py	-1	17	2.23	24	115		1166
ZG367	12	14	3983878	77148	Og	CcySts		Sd	DG	abund free qtz	-1	59	2.07	25	397		721
ZG367	14	16.5	3983879	77148	Og	Sts	VqFe		LG	abund free qtz, hard drilling	-1	19	0.67	20	137		261
ZG368	0	2			Qha	Cg			DG	qtzite scree, no sample							
ZG368	2	4	3983880	77148	Og	Ccy			DB+N	sandy & carbonaceous clays	10	394	1.24	40	4600	2.5	26700
ZG368	4	6	3983881	77148	Og	Ccy			LB		19	751	2.29	32	11900	5.9	104000
ZG368	6	8	3983882	77148	Og	Ccy			LB+DG		16	261	18.3	35	45600	29.4	182000
ZG368	8	10	3983883	77148	Og	Ccy			DG	plastic, smooth	20	103	4.99	74	49600	10.7	205000
ZG368	10	12.1	3983884	77148	Og	CcySts	VcFe		DG+G	hematite staining	7	31	23.7	9700	16900	3.9	126000
ZG369	0	2.5			Qha	Cg			K+W	qtzite scree, no sample							
ZG369	2.5	3.5	3983885	77148	Og	CcySts		Sd?	DB+N	hard altered oolitic sls	-1	6	1.02	385	436		2277
ZG370	0	2.5			Qha	Cg			K+W	qtzite scree, no sample							
ZG370	2.5	4	3983886	77148	Og	Ccy	Fe		B+BN	carbonaceous	-1	19	4.9	1801	768	1.7	12100
ZG370	4	6	3983887	77148	Og	Ccy	FeVq		LB	ferrug qtz, limonite veins	-1	25	11.1	5400	507	1	11400
ZG370	6	8	3983888	77148	Og	CcySts			DB	creamy sls - altered?	-1	10	19.6	8800	139	3.7	29000
ZG370	8	10	3983889	77148	Og	Ccy			B+N	gritty brn & smooth black	1	41	16.7	6200	722	7.8	55300
ZG370	10	12	3983890	77148	Og	Ccy			DB	hard carbonaceous chips	1	24	5.53	388	2829	9.1	67200
ZG370	12	14	3983891	77148	Og	Ccy	Fe		LB	ferrug veins	2	21	7.08	595	1514	14.8	174000
ZG370	14	16	3983892	77148	Og	Sts		Sd	LYG	oolitic CO3, weakly sideritic	-1	6	4.81	1789	259		4937
ZG370	16	18	3983893	77148	Og	Sts		Sd	LYG	oolitic CO3, weakly ankeritic	-1	6	5.58	1984	201		4485
ZG370	18	20	3983894	77148	Og	Sts		Sd	LYG	oolitic CO3, weakly ankeritic	-1	5	4.24	1822	198		3160
ZG370	20	22	3983895	77148	Og	Sts		Sd	B+YG	oolitic CO3	-1	14	4.84	1496	975	6.2	91800
ZG370	22	24	3983896	77148	Og	Sts		Sd	B+YG	oolitic CO3, possibly oolitic cave in	-1	9	3.25	1046	361	2.8	32600
ZG370	24	26	3983897	77148	Og	Ccy			MB		3	18	16.4	6400	1443	8.9	106000
ZG370	26	28	3983898	77148	Og	Ccy			G+LB		7	60	20.6	4624	2172	14.2	81900
ZG370	28	30	3983899	77148	Og	StsCcy	Fe	Sd	YG	altered CO3	-1	13	12.9	5700	318	2.75	18800
ZG370	30	32	3983900	77148	Og	StsCcy		Sd	DG+LRB	strongly altered?	-1	20	23.4	9700	441	1.1	10400
ZG370	32	34	3984001	77148	Og	StsOx	Fe	Sd	DG+LB	altered, veined with lt brn FeCO3?	-1	9	32.6	13500	77		1717
ZG370	34	36	3984002	77148	Og	StsCcy	Vc		DG	carbonaceous	-1	8	30	12100	44		1075
ZG370	36	38	3984003	77148	Og	Ccy			DG	carbonaceous, greasy	-1	20	2.16	185	164		784
ZG370	38	40	3984004	77148	Og	Ccy			SDG	carbonaceous	-1	17	2.12	180	75		666
ZG370	40	42	3984005	77148	Og	Ccy			SDG		-1	17	2.11	92	86		708
ZG370	42	44	3984006	77148	Og	Ccy		Py	SG	gritty	-1	23	1.7	55	69		770

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APPENDIX 3: Gneves prospect. Air-core drill-hole logs and geochemistry - ZG366 to ZG400

HOLE	DFROM	DTO	SAMPNO	DPO	BMRLITH	FIELDID	TEXTURE	ALT/MIN	COLOUR	COMMENTS	Ag	Cu	Fe%	Mn	Pb	S%	Zn
ZG370	44	46	3984007	77148	Og	SlsCcy			SG		-1	18	1.06	62	39		563
ZG370	46	46.5	3984008	77148	Qha	MqCcy			G	breccia with clay matrix	-1	15	0.85	46	25		356
ZG371	0	2			Qha	Cg			K+W	qtzite scree, no sample							
ZG371	2	4	3984009	77148	Og	Ccy	Fe		DB+N	ferrug veins	-1	23	4.88	49	383		3191
ZG371	4	6	3984010	77148	Og	Ccy			EG	gritty	-1	20	5.58	108	371		2984
ZG371	6	8	3984011	77148	Og	Ccy			EG		-1	13	7.5	878	133		3438
ZG371	8	10	3984012	77148	Og	Sls		Sd?	LG	spongy CO3 (altered?), skeletal CO3	-1	6	12.7	6000	105		1858
ZG371	10	12	3984013	77148	Og	Sls		Sd	G	spongy looking CO3, minor Sd altern	-1	6	13.4	6000	71		2210
ZG371	12	14	3984014	77148	Og	CcySls		Sd	DG	spongy CO3	-1	14	17.1	7000	39		3621
ZG371	14	16	3984015	77148	Og	CcySls	Fe		DG	minor Fe	-1	19	18.3	7200	83		3573
ZG371	16	18	3984016	77148	Og	Sls	Fe		G+DG	minor clay	-1	7	36.2	12900	18		4084
ZG371	18	20	3984017	77148	Og	Sls		Sd	G+DG		-1	10	37.5	16500	59	2.8	16300
ZG371	20	22	3984018	77148	Og	Sls	Fe	Sd	YG	spongy CO3	-1	7	39.4	16400	387	3.8	24800
ZG371	22	24	3984019	77148	Og	Sls		Sd	LYG	oolitic CO3	-1	8	10.3	3580	143		8000
ZG371	24	26	3984020	77148	Og	Sls		Sd	LYG	oolitic CO3	-1	8	7.33	2500	252	2.1	13300
ZG371	26	28	3984021	77148	Og	SlsCcy		Sd	LYG+LB	oolitic CO3	3	25	15.6	4129	2051	8.4	99000
ZG371	28	30	3984022	77148	Og	Sls	Fe	Sd	LYG	oolitic CO3	1	10	6.25	2103	568	2.4	16800
ZG371	30	30.5	3984023	77148	Og	Sls	Fe	Sd	LYG	hard oolitic CO3	1	12	7.53	2276	455	3.5	17200
ZG372	0	2			Qha	Cg			K+W	qtzite scree, no sample							247
ZG372	2	4	3984024	77148	Og	Ccy			DB		-1	20	1.59	52	127		1028
ZG372	4	6	3984025	77148	Og	Ccy			DG+B	hard	-1	31	2.53	76	47		1623
ZG372	6	8	3984026	77148	Og	Ccy			DG+B	plastic	-1	24	6.74	1100	121		2011
ZG372	8	10	3984027	77148	Og	Ccy			DG	minor grit & brn clay	-1	16	10.1	2886	67		1788
ZG372	10	12	3984028	77148	Og	Ccy			DG		-1	12	15.7	6600	29		1865
ZG372	12	14	3984029	77148	Og	CcySls	Fe		DG+B	ferrug CO3 or veins	-1	6	13.4	4990	32		3833
ZG372	14	16	3984030	77148	Og	Sls		Sd	G+YG	minor Sd alteration	-1	7	15	5800	44		2848
ZG372	16	18	3984031	77148	Og	Ccy			DG	minor grit	-1	9	11	3189	67		8300
ZG372	18	20	3984032	77148	Og	SlsCcy		Sd	G+YG	skeletal CO3 (coral/shells)	-1	6	12.8	4013	30		4321
ZG372	20	22	3984033	77148	Og	SlsCcy		Sd	G+YG	skeletal CO3 (coral/shells)	-1	3	12.1	4068	25		3373
ZG372	22	24	3984034	77148	Og	CcySls			DG+G	spongy CO3, gritty clay	-1	8	11.1	3693	37		6000
ZG372	24	26	3984035	77148	Og	Sls	Fe	Sd	DG+YG		-1	8	20	7800	418		4121
ZG372	26	28	3984036	77148	Og	Sls		Sd	LYG+G	skeletal CO3	-1	12	34.4	13100	484		7700
ZG372	28	30	3984037	77148	Og	Sls	Fe	Sd	DG+LYG	oolitic CO3	1	16	26.6	10900	837	2.75	23200
ZG372	30	32	3984038	77148	Og	Sls	Fe	Sd	LYG+K	strongly altered, hematite stained	1	26	18.1	3587	5600	14.3	70000
ZG372	32	34	3984039	77148	Og	Sls	Fe	Sd	LYG+K	oolitic, altered, hematite stained	-1	7	30.5	13400	871	1.8	12800
ZG372	34	36	3984040	77148	Og	Sls	Fe	Sd	LYG+K	oolitic, strongly altered	-1	8	8.9	3154	311		8000
ZG372	36	38	3984041	77148	Og	Sls	Fe	Sd	LYG+DG	oolitic, hematite	-1	6	11.6	4452	339		4163
ZG372	38	39.6	3984042	77148	Og	Sls	Fe	Sd	LYG	oolitic, hematite, ferrug veins	-1	6	11.6	4158	391		3938
ZG373	0	2.1	3984043	77148	Og	CcySls			DBG	silty textured	1	30	1.19	125	4224		1968
ZG374	0	2	3984044	77148	Qha	CgCcy		Sd	DB	weakly ankeritic	6	11	10.1	2809	36900	4.2	83000
ZG374	2	4	3984045	77148	Og	Sls		SdPy	YG	5% Py	5	10	20	6900	37400	4.4	180000
ZG374	4	4.8	3984046	77148	Og	SlsOvc		PySd	DG	strongly altered	6	15	7.31	2467	35700	9.1	194000
ZG375	0	2	3984047	77148	Qha	CgCcy			B	Mq gravel & sandy clay	-1	5	0.57	131	1136		4118
ZG375	2	2.5	3984048	77148	Og	Sls	Vc		LG+G	shaley CO3	-1	6	0.62	197	216		678

APPENDIX 3: Grievous prospect. Air-core drill-hole logs and geochemistry - ZG366 to ZG400

HOLE	DFROM	DTO	SAMPNO	DPO	BMRLITH	FIELDID	TEXTURE	ALT/MIN	COLOUR	COMMENTS	Ag	Cu	Fe%	Mn	Pb	S%	Zn
ZG376	0	2	3984049	77148	Og	CcyCv			SG+B		-1	6	0.5	50	105		271
ZG376	2	3	3984050	77148	Og	CcySlS		Py	MLGDG	veg	-1	23	3.19	74	277		2968
ZG377	0	2	3984051	77148	Og	CcyCv			DG+N		-1	40	1.06	49	457		1008
ZG377	2	2.5	3984052	77148	Og	SlS		Py	DG	hard CO3	-1	21	1.91	89	54		757
ZG378	0	2.1	3984053	77148	Og	CvCcy			DB+G	minor CO3	-1	35	0.78	38	415		271
ZG379	0	2	3984054	77148	Og	CvCcy			DB		-1	17	0.37	27	95		38
ZG379	2	4	3984055	77148	Og	Ccy			DB		-1	29	1.38	24	351		662
ZG379	4	6	3984056	77148	Og	Ccy			DB	hard clay & grit	-1	29	1.89	42	159		342
ZG379	6	8	3984057	77148	Og	SlS	Fe	Sd	DG		-1	20	2.15	39	68		641
ZG379	8	8.7	3984058	77148	Og	SlSovc		PySd	DG	some alteration	-1	22	1.38	116	41		629
ZG380	0	2	3984059	77148	Og	CvCcy			MLBDB		-1	5	0.29	18	6		13
ZG380	2	4	3984060	77148	Og	CcySlS			LG+B	gritty, minor sls, no E.O.H sample	-1	9	0.34	26	21		28
ZG381	0	2	3984062	77148	Og	CvCcy			B		-1	6	0.28	16	8		18
ZG381	2	4	3984063	77148	Og	Ccy			MBDG	vege	-1	17	0.37	16	21		31
ZG381	4	5.5	3984064	77148	Og	SlS Ccy	Vc		G+DG		-1	19	2	176	149		463
ZG382	0	2	3984065	77148	Qha	Cg			LB+DB	silly, some qtzite	-1	6	0.21	15	4		5
ZG382	2	4	3984066	77148	Og	Ccy			DB		-1	11	0.27	15	15		6
ZG382	4	5.1	3984067	77148	Og	CcySlS	Vc		DG		-1	28	1.33	24	102		240
ZG383	0	2	3984068	77148	Qha	Cg			B+LB	silly, some qtzite	-1	6	0.25	14	5		5
ZG383	2	4	3984069	77148	Og	Ccy			DB	gritty	-1	28	0.3	17	28		8
ZG383	4	6	3984070	77148	Og	Ccy			DB	gritty	-1	39	0.33	16	99		36
ZG383	6	8	3984071	77148	Og	CcySlS			DB+DG	minor CO3	-1	41	1.57	33	82		247
ZG383	8	8.1			Og	SlS	Vc	Py	DG	E.O.H. sample only							
ZG384	0	2	3984072	77148	Qha	CgCcy			DB	minor qtzite	-1	23	0.31	14	28		10
ZG384	2	4	3984073	77148	Og	CcySlS			DG	graphitic	-1	28	1.53	19	111		2917
ZG384	4	5.2	3984074	77148	Og	SlS Ccy	Vc	Sd	G+DG		-1	27	1.78	29	32		521
ZG385	0	2	3984075	77148	Og	CcyCv			DB+DG	silty grit	-1	29	0.57	21	125		241
ZG385	2	4	3984076	77148	Og	CcySlS	Fe		DB+DG		-1	45	1.37	26	358		303
ZG385	4	6	3984077	77148	Og	CcySlS			DG	med-grained CO3	-1	25	2.28	29	35		354
ZG385	6	8	3984078	77148	Og	CcySlS			DG	carbonaceous	-1	30	4.57	39	44		2437
ZG385	8	10	3984079	77148	Og	SlS	Vc		SDG		-1	15	1.1	102	43		1766
ZG385	10	12	3984080	77148	Og	SlS	Vc		DG+LG	shaley CO3	-1	16	1.83	115	19		82
ZG385	12	13.8	3984081	77148	Og	SlS	Vc	PySd	DG+LG	shaley CO3	-1	17	3.24	154	20		64
ZG386	0	2	3984082	77148	Qha	CgCcy			DB		-1	12	0.36	20	78		45
ZG386	2	2.4			Og	SlS	Vc		DG	E.O.H. sample only							
ZG387	0	1.2			Og	SlSovc			DG	veg. E.O.H. sample only							
ZG388	0	1.8	3984083	77148	Og	CvCcySlS	Vc		GB+WK		1	14	1	112	5300	1.6	16000
ZG389	0	2	3984084	77148	Og	CvCcy			B		-1	8	0.39	67	603		719
ZG389	2	4	3984085	77148	Og	Ccy			DB	gritty, hard clay chips	-1	21	0.82	25	324		1314
ZG389	4	6	3984086	77148	Og	CcySlS	Fe		DB	ferrug clay chips	-1	15	6.15	23	321		1349
ZG389	6	8	3984087	77148	Og	Ccy			DGB	hard	-1	19	1.84	22	812		1956
ZG389	8	10	3984088	77148	Og	Ccy			DGB	hard	-1	21	2.13	29	1446		1853
ZG389	10	12	3984089	77148	Og	SlS Ccy	Vc		LG+DB		-1	15	2.1	72	1008		897
ZG389	12	14	3984090	77148	Og	SlSovc			G+LG	slightly shaley CO3. altered?	-1	9	0.38	127	258		266
ZG389	14	14.8	3984091	77148	Og	SlS	Vc	Sd	G		-1	9	0.31	152	209		224

APPENDIX 3: Grieves prospect. Air-core drill-hole logs and geochemistry - ZG366 to ZG400

HOLE	DFROM	DTO	SAMPNO	DPO	BMRLITH	FIELDID	TEXTURE	ALT/MIN	COLOUR	COMMENTS	Ag	Cu	Fe%	Mn	Pb	S%	Zn
ZG390	0	2	3984092	77148	Qha	CgCcy			LB+B		-1	10	0.3	30	67		46
ZG390	2	4	3984093	77148	Og	Ccy			LB+DB	gritty	-1	18	0.25	31	186		58
ZG390	4	6	3984094	77148	Og	Ccy			DB	small hard clay chips	-1	17	1.03	37	172		330
ZG390	6	7.4	3984095	77148	Og	CcySls	Vc		DG+B		-1	16	1.08	49	174		702
ZG391	0	2	3984096	77148	Qha	CgCcy			DB	gravels & clays	-1	7	0.33	22	20		42
ZG391	2	4	3984097	77148	Og	Ccy			DEG		1	16	0.3	20	157		45
ZG391	4	5.9	3984098	77148	Og	Sls	Vc	Py	DG		1	29	0.71	59	2846		854
ZG392	0	2	3984099	77148	Qha	Cg			B	silty with Mq gravel	-1	6	0.24	18	82		42
ZG392	2	4	3984100	77148	Og	Ccy			B+LB	sandy	2	30	0.63	29	3034		980
ZG392	4	6	3984101	77148	Og	Ccy			DGB		1	17	0.3	23	308		137
ZG392	6	7.8	3984102	77148	Og	Sls	VcVs?	Ga?	DG		-1	22	1.43	64	2424		3542
ZG393	0	2	3984103	77148	QhaOg	CvCcy			DB		-1	8	0.3	20	126		212
ZG393	2	4	3984104	77148	Og	Ccy			DB	Grilly	10	25	0.39	18	22400	1.65	15600
ZG393	4	6	3984105	77148	Og	Ccy			DEG		4	28	1.65	33	11900	2.7	17700
ZG393	6	7.5	3984106	77148	Og	SlsCcy	Vc		G+DG		1	22	1.61	83	5000	2.45	20800
ZG394	0	2	3984107	77148	QhaOg	CgCcy			DB		-1	4	0.42	25	611		1747
ZG394	2	4	3984108	77148	Og	Ccy			MDEG		-1	29	0.36	12	510		1861
ZG394	4	4.8	3984109	77148	Og	Sls	VcFeDs	Py	DG		-1	14	1.9	165	2003		8200
ZG395	0	4			Qha	Cg			K+B	qtzite gravels, no sample							
ZG395	4	6	3984113	77148	Og	Ccy			DB		2	39	0.92	12	9000	1.3	16800
ZG395	6	8	3984114	77148	Og	Ccy	Fe		DB		2	19	2.01	15	17300	4.7	32000
ZG395	8	10	3984115	77148	Og	CcySls	Vc		DG+G		1	18	1.83	125	6300		12400
ZG395	10	12	3984116	77148	Og	CcySls			DG		2	16	1.51	256	8900		19700
ZG395	12	12.3			Og	Sls	VcFe		LG+DG								
ZG396	0	2	3984110	77148	Qha	CgCcy					-1	7	0.57	64	942		1848
ZG396	2	4			Qha	Cg			K+B	qtzite gravels, no sample							
ZG396	4	6			Qha	Cg			K+B	qtzite gravels, no sample							
ZG396	6	8	3984111	77148	Og	Ccy			DB		-1	16	1.06	27	1395		2622
ZG396	8	9.3	3984112	77148	Og	Sls	Vc		DG	cave in, poor sample	-1	12	3.87	92	492		1125
ZG397	0	3.5			Qha	Cg			K+B	qtzite gravels, no sample							
ZG397	3.5	5.7	3984117	77148	Og	Sls	VcFe		DG		-1	10	1.1	61	39		505
ZG398	0	2			Qha	Cg			K+B	qtzite gravels, no sample							
ZG398	2	2.5	3984118	77148	Og	Sls	Vc		DG		-1	3	0.63	53	23		88
ZG399	0	2			Qha	CvCg			K+B	qtzite gravels, no sample							
ZG399	2	2.6	3984119	77148	Og	Sls			DG		-1	9	1.93	41	154		346
ZG400	0	2			Qha	Cg			K+B	qtzite gravels, no sample							
ZG400	2	2.3	3984120	77148	Og	Sls	Vc		DG		-1	4	0.5	71	9		18

APPENDIX 4

Diamond drill logs and geochemistry - ZG359 to ZG365

## ROCKCHIP AND DRILLING CODES

22/2/1994

## BMR LITH

Rock code as per published geological map  
For time designation use:-

Q	Quaternary	M	Permian	P	Proterozoic
T	Tertiary	C	Carboniferous	A	Archaean
		S	Silurian		
K	Cretaceous	D	Devonian		
R	Triassic	O	Ordovician		
J	Jurassic	E	Carbonian		

## FIELD ID

Field term for rock type  
Broad groupings are:-

S	Sedimentary	I	Intrusive	C	Surficial
M	Metamorphic	E	Extrusive	O	Others

## SEDIMENTARY

Scq	Conglomerate	Ss	Limestone	Sw	Wacke
Sss	Sandstone	Scl	Dolomite	Sag	Agglomerate/mixite
Ssl	Siltstone			Sbx	Breccia
Ssh	Shale	Scr	Chert		
Sos	Black shale	Sif	SIF		

## METAMORPHIC

Msi	Slate	Wq	Quartzite	Mmg	Migmatite
Mph	Phyllite	Mm	Marble		
Msc	Schist	Ma	Amphibolite	Msk	Skarn
Mbs	Granitic schist	Mcs	Calcsilicate		
Mgn	Gneiss	Mhr	Hornfels		

## INTRUSIVE IGNEOUS

if	Felsic undiff.	ii	Intermed undiff.	iu	Ultramafic
ifo	Felsic porphyry	io	Intermed porph	iur	Serpentinite
iao	Aolite	im	Mafic undiff.	log	Pegmatite
igr	Granite	ido	Dolerite		
igd	Granodiorite	igo	Gabbro		

## EXTRUSIVE IGNEOUS

Ery	Rhyolite	Ean	Andesite	Et	Tuff undiff
Ecc	Dacite	Ebs	Basalt	Eit	Felsic tuff
				Eem	Mafic tuff

## SURFICIAL (COVER) MATERIAL

Ca	Alluvium	Clt	Lignite	Cag	Gossan
Cop	Colluvium	Csp	Pisolites	Coy	Clay
Cs	Sand	Csf	Ironstone	Cv	Vegetation/peat
Cbs	Black soil	Csl	Silcrete		
Cg	Gravel	Ccl	Calcrete		

## OTHERS

Ovq	Vein quartz	Omy	Mylonite	Oms	Massive sulfide
Ovc	Vein carbonate	Obx	Breccia	Oxc	Contamination
Ovs	Vein sulfide	Of	Fault gouge	Ox	Unknown

## TEXTURAL CODES

## WEATHERING/SURFICIAL FEATURES

We	Weathered	Fe	Ferruginous
Bl	Bleached	Fe	Fe ox in fract
Le	Leached		

## MINERALISATION/ALTERATION FEATURES

Gs	Gossanous	Vs	Vein sulfide	Al	Altered
Vn	Veined	Cs	Disseminated	S	Silicified
Vc	Vein carbonate	Fs	Fracture sulfid	Di	Disseminated
Vq	Vein quartz	Es	Banded sulfid		

## GEOLOGICAL FEATURES

Bd	Bedded	F	Fractured	Pp	Porphyritic
Bn	Banded	ib	Interbedded	Sc	Schistose
Bx	Brecciated	Lm	Laminated	Sh	Sheared
F	Fissile (slaty)	Ma	Massive	Vu	Vuggy

## DIAGNOSTIC MINERALOGY

## PRIMARY MINERALISATION

Ca	Galena	Py	Pyrite	Ni	Ni sulfides
Sp	Sphalerite	Po	Pyrrhotite		
Cs	Chalcocopyrite	Su	Unknown sulfid		

## SECONDARY MINERALISATION

Ls	Lead secondaries	Cs	Copper sec.	Ni	Ni secondaries
Zs	Zinc	Us	Uranium		

## ALTERATION/DIAGNOSTIC MINERALS

Cy	Clay	He	Haematite	Gt	Garnet
Ep	Epidote	Mt	Magnetite	Ky	Kyanite
Cc	Carbonate	Ja	Jarosite	To	Tourmaline
Sd	Siderite/Ankerite	Mn	Manganese mins	Ch	Chlorite
Di	Dolomite				

## COLOUR CODES

L	Light	A	Banded	M	Mottled
D	Dark				
N	Black	P	Purple	V	Green
G	Grey	R	Red	X	Pink
B	Brown	O	Orange	E	Blue
W	White	Y	Yellow	S	Silver

Appendix 4: Diamond drill hole logs and geochemistry.

APPENDIX 4: GRIEVES PROSPECT - DIAMOND DRILLING LOGS AND GEOCHEMISTRY										
Results on ppm unless shown otherwise										
HOLE	DFROM	DTO	SAMPNO	DPO	BMRLITH	FIELDID	TEXTURE	ALT/MIN	COLOUR	COMMENTS
ZG359	0.00	13.00			Og?	Ccy?				Roller bit, no core
ZG359	13.00	15.00	3914643	77213	Og	Ssh	We		FP	
ZG359	15.00	17.60	3914644	77213	Og	Ssh	WeFr		LB	
ZG359	17.60	21.50	3914645	77213	Og	Sls	Bx		AGLG	Lime mudstone
ZG359	21.50	25.50	3914646	77213	Og	Sls			AGLG	Lime mudstone
ZG359	25.50	27.50	3914647	77213	Og	Ssh?Sls?	FiWe?		DGN	Carbonaceous decomposed carbonate?
ZG359	27.50	29.50	3914648	77213	Og	Ssh?Sls?	FiWe?		DGN	Carbonaceous decomposed carbonate?
ZG359	29.50	31.50	3914649	77138	Og	Ssh?Sls?	FiWe?		DGN	Carbonaceous decomposed carbonate?
ZG359	31.50	33.50	3914650	77138	Og	Ssh?Sls?	FiWe?		DGN	Carbonaceous decomposed carbonate?
ZG359	33.50	35.50	3914651	77138	Og	Ssh?Sls?	We?		DGN	Carbonaceous decomposed carbonate?
ZG359	35.50	37.50	3914652	77138	Og	Ssh?Sls?	We?		DGN	Carbonaceous decomposed carbonate?
ZG359	37.50	39.50	3914653	77138	Og	Ssh?Sls?	We?		DGN	Carbonaceous decomposed carbonate?
ZG359	39.50	41.50	3914654	77138	Og	Ssh?Sls?	We?		DGN	Carbonaceous decomposed carbonate?
ZG359	41.50	43.50	3914655	77138	Og	Ssh?Sls?	We?		DGN	Carbonaceous decomposed carbonate?
ZG359	43.50	45.00	3914656	77138	Og	Ssh?Sls?	We?		DGN	Carbonaceous decomposed carbonate?
ZG359	45.00	46.50	3914657	77138	Og	SdlCcy	AIBx	Sd	Y+DG	Clay and ankerite altered carbonate
ZG359	46.50	49.50	3914658	77138	Og	SdlCcy	AIBx	Sd	Y+DG	Clay and ankerite altered carbonate
ZG359	49.50	52.75	3914659	77138	Og	SdlCcy	AIBx	Sd	Y+DG	Clay and ankerite altered carbonate
ZG359	52.75	53.60	3914660	77138	Og	Sdl	AIVuBx	Sd	YB	Ankerite altered. Oolites locally visible
ZG359	53.60	55.50	3914661	77138	Og	Sdl	AIVuBx	Sd	YB	Ankerite altered. Oolites locally visible
ZG359	55.50	56.80	3914662	77138	Og	Sdl	AIVuBx	Sd	YB	Ankerite altered. Oolites locally visible
ZG359	56.80	58.50	3914663	77138	Og	Sdl	AIVuBx	Sd	YB	Ankerite altered. Oolites locally visible
ZG359	58.50	59.90	3914664	77138	Og	Sdl	AIVuBx	Sd	YB	Ankerite altered. Oolites locally visible
ZG359	59.90	61.50	3914665	77138	Og	CcyCs	AI	Sd	MYLBDB	Clay and ankeritic sand
ZG359	61.50	63.50	3914666	77138	Og	CcyCs	AI	Sd	MYLBDB	Clay and ankeritic sand
ZG359	63.50	65.50	3914667	77138	Og	Ccy			DG	Carbonaceous clay + cherty bands
ZG359	65.50	67.50	3914668	77138	Og	Ccy			DG	Carbonaceous clay + cherty bands
ZG359	67.50	70.50	3914669	77138	Og	Ccy			DG	Carbonaceous clay + cherty bands
ZG359	70.50	73.50	3914670	77138	Og	Ccy			DG	Carbonaceous clay + cherty bands
ZG359	73.50	76.90	3914671	77213	Om	Ssi	Lm		AWG	
ZG359	76.90	79.00	3914672	77213	Om	Sss	Ma		LGW	

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Appendix 4: Diamond drill hole logs and geochemistry.

HOLE	DFROM	DTO	SAMPNO	Ag	Al%	As	Ba	Ca%	Cu	Fe%	K%	Mg%	Mn	Pb	S%	Zn	magsus x10-3
ZG359	0.00	13.00															
ZG359	13.00	15.00	3914643	-5	7.08	12	291	5.42	38	4.45	1.97	1.47	237	-50		792	0.12
ZG359	15.00	17.60	3914644	-5	6.63	1	250	9.67	35	3.09	1.75	2.72	460	-50		455	0.14
ZG359	17.60	21.50	3914645	-5	1.77	5	72	26.30	22	1.35	0.61	2.78	246	-50		589	0.08
ZG359	21.50	25.50	3914646	-5	1.14	3	54	26.90	19	1.33	0.52	3.41	329	-50		622	0.08
ZG359	25.50	27.50	3914647	-5	2.84	8	133	21.40	22	3.02	1.32	1.18	930	-50		783	0.08
ZG359	27.50	29.50	3914648	-5	2.86	6	131	19.90	21	4.69	1.29	1.30	1670	-50		1450	0.06
ZG359	29.50	31.50	3914649	-5	2.55	-25	141	18.70	8	8.51	1.12	0.91	3150	117		3250	0.25
ZG359	31.50	33.50	3914650	-5	2.43	-25	110	20.50	9	5.50	1.11	0.66	1830	-50		1620	0.48
ZG359	33.50	35.50	3914651	-5	2.21	-25	98	19.90	9	5.49	0.99	1.20	1780	-50		4700	0.04
ZG359	35.50	37.50	3914652	-5	3.64	-25	136	12.90	16	6.25	1.40	1.85	1970	124	1.95	6600	0.09
ZG359	37.50	39.50	3914653	-5	2.80	-25	108	9.61	11	13.80	1.07	4.87	4690	50	1.04	5190	0.23
ZG359	39.50	41.50	3914654	-5	1.93	-25	69	11.00	10	11.60	0.75	6.02	4140	-50	1.18	6620	0.18
ZG359	41.50	43.50	3914655	-5	1.73	-25	65	8.35	9	12.90	0.65	4.65	3760	103	1.71	7110	0.41
ZG359	43.50	45.00	3914656	-5	3.09	-25	106	7.54	20	16.30	0.94	4.13	4620	260		4840	0.70
ZG359	45.00	46.50	3914657	-5	1.76	-25	62	5.26	17	28.00	0.51	2.68	7880	176		3420	0.65
ZG359	46.50	49.50	3914658	-5	2.82	-25	108	4.26	10	23.60	0.96	2.29	7220	199	1.16	6370	0.28
ZG359	49.50	52.75	3914659	-5	3.95	-25	180	5.52	15	20.50	1.36	3.03	6520	497	0.98	9020	0.52
ZG359	52.75	53.60	3914660	-5	0.85	-25	58	2.74	15	32.70	0.26	1.10	12600	245	0.55	12800	0.70
ZG359	53.60	55.50	3914661	-5	0.81	-25	25	5.35	-5	27.60	0.19	2.78	10700	137	0.35	12000	0.65
ZG359	55.50	56.80	3914662	-5	2.90	-25	95	10.20	27	15.70	0.72	5.97	5400	224	0.54	11000	0.30
ZG359	56.80	58.50	3914663	-5	1.20	-25	43	2.85	8	30.50	0.31	1.31	12000	163	0.41	15200	0.68
ZG359	58.50	59.90	3914664	-5	0.67	-25	19	6.44	15	27.50	0.20	3.57	9340	350	1.02	22800	0.15
ZG359	59.90	61.50	3914665	-5	5.19	511	124	2.78	37	14.50	1.97	1.51	851	2140	19.20	97000	0.09
ZG359	61.50	63.50	3914666	-5	4.69	1080	154	0.10	52	12.10	2.41	0.38	96	5430	18.70	86000	0.08
ZG359	63.50	65.50	3914667	-5	1.38	69	190	0.02	21	2.11	2.19	0.25	40	310	2.71	6290	0.05
ZG359	65.50	67.50	3914668	-5	2.19	-25	206	0.02	16	1.24	2.07	0.23	37	67		2070	0.07
ZG359	67.50	70.50	3914669	-5	1.99	37	210	0.02	19	2.45	2.36	0.27	35	131		2240	0.03
ZG359	70.50	73.50	3914670	-5	2.51	-25	214	0.01	266	1.15	2.55	0.25	19	95		302	0.01
ZG359	73.50	76.90	3914671	-5	5.90	1	196	0.14	14	0.40	2.38	0.30	-15	-50		64	0.04
ZG359	76.90	79.00	3914672	-5	1.57	-1	39	0.05	9	0.29	0.52	0.06	37	-50		27	0.02

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Appendix 4: Diamond drill hole logs and geochemistry.

HOLE	DFROM	DTO	SAMPNO	DPO	BMRLITH	FIELDID	TEXTURE	ALT/MIN	COLOUR	COMMENTS
ZG360	0.00	15.00			Og?	Ccy?				Roller bit, no core
ZG360	15.00	19.10	3914673	77213	Og	Ccy			DGB	
ZG360	19.10	24.00	3914674	77213	Og	Sls			AGLG	Lime mudstone
ZG360	24.00	29.00	3914675	77213	Og	Sls			AGLG	
ZG360	29.00	34.00	3914676	77213	Og	Sls	VnFr		AGLG	Dolomite veined
ZG360	34.00	38.00	3914677	77213	Og	Sls	Fr		AGLG	
ZG360	38.00	41.00	3914678	77213	Og	Sls	We?		DG	Decomposed lime mudstone
ZG360	41.00	43.00	3914679	77138	Og	Ssh?Sls?	FiWe?		DGN	Carbonaceous decomposed carbonate?
ZG360	43.00	45.00	3914680	77138	Og	Ssh?Sls?	FiWe?		DGN	Carbonaceous decomposed carbonate?
ZG360	45.00	47.00	3914681	77138	Og	Ssh?Sls?	FiWe?		DGN	Carbonaceous decomposed carbonate?
ZG360	47.00	49.00	3914682	77138	Og	Ssh?Sls?	FiWe?		DGN	Carbonaceous decomposed carbonate?
ZG360	49.00	51.00	3914683	77138	Og	Ssh?Sls?	Bx?We?		DGN	Carbonaceous decomposed carbonate?
ZG360	51.00	53.00	3914684	77138	Og	Ssh?Sls?	AlBx?We?	Sd	LY+DG	Weakly ankeritic, carbonaceous, decomposed
ZG360	53.00	55.00	3914685	77138	Og	Ssh?Sls?	AlBx?We?	Sd	LY+DG	Weakly ankeritic, carbonaceous, decomposed
ZG360	55.00	57.00	3914686	77138	Og	Ssh?Sls?	AlBx?We?	Sd	LY+DG	Weakly ankeritic, carbonaceous, decomposed
ZG360	57.00	59.00	3914687	77138	Og	Ssh?Sls?	AlBx?We?	Sd	LY+DG	Weakly ankeritic, carbonaceous, decomposed
ZG360	59.00	61.00	3914688	77138	Og	Ssh?Sls?	AlBx?We?	Sd	LY+DG	Weakly ankeritic, carbonaceous, decomposed
ZG360	61.00	62.70	3914689	77138	Og	Ssh?Sls?	AlBx?We?	Sd	LY+DG	Weakly ankeritic, carbonaceous, decomposed
ZG360	62.70	65.00	3914690	77138	Og	SdlCcy	AlBx	Sd	Y+DG	Ankeritic carbonate and carbonaceous clay
ZG360	65.00	67.00	3914691	77138	Og	SdlCcy	AlBx	Sd	Y+DG	Ankeritic carbonate and carbonaceous clay
ZG360	67.00	69.00	3914692	77138	Og	SdlCcy	AlBx	Sd	Y+DG	Ankeritic carbonate and carbonaceous clay
ZG360	69.00	71.10	3914693	77138	Og	SdlCcy	AlBx	Sd	Y+DG	Ankeritic carbonate and carbonaceous clay
ZG360	71.10	73.00	3914694	77138	Og	SdlCcy	AlBx	Sd	Y+DG	Ankeritic carbonate and carbonaceous clay
ZG360	73.00	74.75	3914695	77138	Og	SdlCcy	AlBx	Sd	Y+DG	Ankeritic carbonate and carbonaceous clay
ZG360	74.75	76.80	3914696	77138	Og	Ccy			ALGDG	Minor silty/sandy bands
ZG360	76.80	79.20	3914697	77138	Og	Ccy			ALGDG	Minor silty/sandy bands
ZG360	79.20	81.60	3914698	77138	Og	Ccy			ALGDG	Minor silty/sandy bands
ZG360	81.60	84.00	3914699	77213	Om	Ssi	Lm		LG	
ZG360	84.00	85.30	3914700	77213	Om	Sss			WLG	

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Appendix 4: Diamond drill hole logs and geochemistry.

HOLE	DFROM	DTO	SAMPNO	Ag	Al%	As	Ba	Ca%	Cu	Fe%	K%	Mg%	Mn	Pb	S%	Zn	magsus x10-3
ZG360	0.00	15.00															
ZG360	15.00	19.10	3914673	-5	3.55	100	164	2.36	31	4.95	1.57	0.37	55	119	5.55	5590	0.05
ZG360	19.10	24.00	3914674	-5	0.46	10	21	29.50	20	1.01	0.17	3.56	183	-50		456	0.07
ZG360	24.00	29.00	3914675	-5	0.46	4	22	28.00	19	1.03	0.18	4.81	311	-50		148	0.10
ZG360	29.00	34.00	3914676	-5	1.12	4	54	28.60	22	1.01	0.47	1.89	222	-50		776	0.03
ZG360	34.00	38.00	3914677	-5	1.22	2	61	23.80	18	1.64	0.55	5.09	436	-50		279	0.07
ZG360	38.00	41.00	3914678	-5	1.20	6	57	27.70	21	1.81	0.54	2.00	517	-50		378	0.08
ZG360	41.00	43.00	3914679	-5	3.34	-25	157	17.70	8	7.87	1.55	1.54	2550	-50		2040	0.35
ZG360	43.00	45.00	3914680	-5	4.55	27	216	5.27	15	15.90	2.08	2.04	5170	-50		2950	0.89
ZG360	45.00	47.00	3914681	-5	3.92	27	182	1.83	14	24.20	1.78	1.03	7940	-50	1.66	6000	0.43
ZG360	47.00	49.00	3914682	-5	4.20	-25	179	5.70	14	7.32	1.78	2.92	1930	-50		3710	0.21
ZG360	49.00	51.00	3914683	-5	3.80	-25	158	6.49	12	8.93	1.66	3.32	2270	-50		1750	0.34
ZG360	51.00	53.00	3914684	-5	2.86	-25	116	13.20	8	6.40	1.27	6.66	1820	-50		2060	0.11
ZG360	53.00	55.00	3914685	-5	2.43	-25	95	12.00	7	9.32	1.06	6.22	2940	-50		3410	0.27
ZG360	55.00	57.00	3914686	-5	1.85	-25	68	11.40	6	12.90	0.79	6.19	4170	-50		3130	0.24
ZG360	57.00	59.00	3914687	-5	1.53	-25	55	10.40	5	17.20	0.63	5.68	5730	130	0.79	6260	0.38
ZG360	59.00	61.00	3914688	-5	2.42	-25	85	9.93	8	15.20	1.02	5.46	4580	72		4650	0.18
ZG360	61.00	62.70	3914689	-5	3.26	-25	119	6.34	12	17.30	1.38	3.56	4540	115		4870	0.27
ZG360	62.70	65.00	3914690	-5	1.28	-25	47	4.46	7	21.50	0.48	2.33	6930	146	1.19	5490	0.75
ZG360	65.00	67.00	3914691	-5	2.64	-25	96	1.94	13	20.80	0.87	0.91	7070	246	0.67	9690	0.85
ZG360	67.00	69.00	3914692	-5	3.30	-25	117	0.75	13	26.60	1.00	0.32	9590	126	1.27	6970	0.85
ZG360	69.00	71.10	3914693	-5	4.50	-25	163	0.58	21	24.70	1.42	0.33	7750	130	1.47	9480	0.85
ZG360	71.10	73.00	3914694	-5	3.24	-25	163	0.29	31	22.60	1.73	0.33	5990	441	2.38	14700	0.82
ZG360	73.00	74.75	3914695	-5	2.87	124	74	0.31	93	32.80	0.69	0.26	12900	2970	3.90	31300	0.40
ZG360	74.75	76.80	3914696	-5	2.89	101	240	0.02	33	3.24	2.80	0.35	70	4430	3.60	9070	0.07
ZG360	76.80	79.20	3914697	-5	2.97	168	234	0.02	18	1.94	2.38	0.29	40	1080		2220	0.03
ZG360	79.20	81.60	3914698	-5	2.96	43	289	0.01	26	2.43	3.08	0.36	48	210		710	0.07
ZG360	81.60	84.00	3914699	-5	6.82	2	200	0.15	49	0.53	2.08	0.28	18	104		81	0.03
ZG360	84.00	85.30	3914700	-5	2.17	-1	54	0.14	9	0.29	0.72	0.09	19	56		20	0.03

Appendix 4: Diamond drill hole logs and geochemistry.

HOLE	DFROM	DTO	SAMPNO	DPO	BMRLITH	FIELDID	TEXTURE	ALT/MIN	COLOUR	COMMENTS
ZG361	0.00	16.00			Og?	Ccy?				Roller bit, no core
ZG361	16.00	18.00	3917601	77150	Og	Sls			AGDG	Wispy banded lime mudstone
ZG361	18.00	20.00	3917602	77150	Og	Sls			AGDG	Wispy banded lime mudstone
ZG361	20.00	22.00	3917603	77150	Og	Sls			AGDG	Wispy banded lime mudstone
ZG361	22.00	24.00	3917604	77150	Og	Sls			AGDG	Wispy banded lime mudstone
ZG361	24.00	26.00	3917605	77150	Og	Sls			AGDG	Wispy banded lime mudstone
ZG361	26.00	28.00	3917606	77150	Og	Sls			AGDG	Wispy banded lime mudstone
ZG361	28.00	30.00	3917607	77150	Og	Sls			AGDG	Wispy banded lime mudstone
ZG361	30.00	32.00	3917608	77150	Og	Sls			AGDG	Wispy banded lime mudstone
ZG361	32.00	34.00	3917609	77150	Og	Sls			AGDG	Wispy banded lime mudstone
ZG361	34.00	36.00	3917610	77150	Og	Sls			AGDG	Wispy banded lime mudstone
ZG361	36.00	38.00	3917611	77150	Og	Sls			AGDG	Wispy banded lime mudstone
ZG361	38.00	40.00	3917612	77150	Og	Sls			AGDG	Wispy banded lime mudstone
ZG361	40.00	42.00	3917613	77150	Og	Sls			AGDG	Wispy banded lime mudstone
ZG361	42.00	43.40	3917614	77150	Og	Sls	We?		DG	Decomposed carbonate
ZG361	43.40	46.40	3917615	77150	Og	CcySdl				clay, carbonate sand and frags
ZG361	46.40	48.40	3917616	77150	Og	CcySdl				clay, carbonate sand and frags
ZG361	48.40	50.60	3917617	77150	Og	CcySdl				clay, carbonate sand and frags
ZG361	50.60	52.40	3917618	77150	Og	CcySdl				clay, carbonate sand and frags
ZG361	52.40	54.50	3917619	77150	Og	CcySdl				clay, carbonate sand and frags
ZG361	54.50	56.00	3917620	77150	Og	Sdl				
ZG361	56.00	57.50	3917621	77150	Og	Sdl	Al	He	R	Oolitic No rec
ZG361	57.50	59.80								
ZG361	59.80	60.50	3917622	77150	Og	Sdl			LRY	Oolitic, weakly haem, ank altered
ZG361	60.50	61.40	3917623	77150	Og	Sdl			LRY	Oolitic, weakly haem, ank altered
ZG361	61.40	63.00	3917624	77150	Og	Sdl			LRY	Oolitic, weakly haem, ank altered
ZG361	63.00	64.40	3917625	77150	Og	Sdl			LRY	Oolitic, weakly haem, ank altered
ZG361	64.40	66.50	3917626	77150	Og	Sdl			LRY	Oolitic, weakly haem, ank altered
ZG361	66.50	68.90	3917627	77150	Og	Sdl			LRY	Oolitic, weakly haem, ank altered
ZG361	68.90	70.10	3917628	77150	Og	Sdl			LRY	Oolitic, weakly haem, ank altered
ZG361	70.10	72.00	3917629	77150	Og	Sdl			LRY	Oolitic, weakly haem, ank altered
ZG361	72.00	74.00	3917630	77150	Og	Sdl			LRY	Oolitic, weakly haem, ank altered
ZG361	74.00	76.00	3917631	77150	Og	Sdl			LRY	Oolitic, weakly haem, ank altered
ZG361	76.00	77.30	3917632	77150	Og	Sdl			LRY	Oolitic, weakly haem, ank altered
ZG361	77.30	78.60	3917633	77150	Og	Sdl			LRY	Oolitic, weakly haem, ank altered
ZG361	78.60	80.60	3917634	77150	Og	SdlCcy	Al	Sd		Ankerite altn, and clay
ZG361	80.60	82.40	3917635	77150	Og	SdlCcy	Al	Sd		Ankerite altn, and clay
ZG361	82.40	83.90	3917636	77150	Og	SdlCcy	Al	Sd		Ankerite altn, and clay
ZG361	83.90	85.40	3917637	77150	Og	SdlCcy	Al	Sd		Ankerite altn, and clay

Appendix 4: Diamond drill hole logs and geochemistry.

HOLE	DFROM	DTO	SAMPNO	Ag	Al%	As	Ba	Ca%	Cu	Fe%	K%	Mg%	Mn	Pb	S%	Zn	magsus x10-3
ZG361	0.00	16.00															
ZG361	16.00	18.00	3917601	-5	0.97	54	57	30.20	18	0.94	0.45	1.02	351	78		664	0.10
ZG361	18.00	20.00	3917602	-5	0.95	52	48	26.10	19	1.05	0.44	3.65	387	109		273	0.15
ZG361	20.00	22.00	3917603	-5	0.92	47	46	26.90	20	1.57	0.44	3.18	584	53		356	0.10
ZG361	22.00	24.00	3917604	-5	2.03	56	98	25.50	22	1.25	0.96	1.48	145	60		1000	0.07
ZG361	24.00	26.00	3917605	-5	2.37	43	113	25.80	20	1.25	1.08	1.29	399	-50		161	0.13
ZG361	26.00	28.00	3917606	-5	1.67	45	80	28.90	20	1.27	0.77	0.75	473	50		262	0.17
ZG361	28.00	30.00	3917607	-5	1.47	40	70	28.00	18	2.08	0.67	0.99	793	-50		402	0.17
ZG361	30.00	32.00	3917608	-5	0.94	40	43	28.90	18	0.78	0.42	1.34	182	-50		213	0.09
ZG361	32.00	34.00	3917609	-5	1.36	38	56	26.90	20	0.89	0.57	1.36	238	-50		288	0.07
ZG361	34.00	36.00	3917610	-5	2.58	34	97	23.10	18	2.05	1.04	3.03	1160	120		606	0.06
ZG361	36.00	38.00	3917611	-5	1.11	43	41	29.30	26	1.02	0.42	1.38	436	93		738	0.11
ZG361	38.00	40.00	3917612	-5	0.90	30	30	26.50	10	3.05	0.34	3.15	1330	-50		865	0.14
ZG361	40.00	42.00	3917613	-5	0.96	26	32	25.10	10	2.09	0.35	5.46	787	-50		534	0.13
ZG361	42.00	43.40	3917614	-5	1.86	35	68	24.50	18	3.95	0.76	2.85	1560	-50		2840	0.08
ZG361	43.40	46.40	3917615	-5	1.22	33	45	21.80	11	5.15	0.45	2.16	2060	62		3410	0.05
ZG361	46.40	48.40	3917616	-5	1.26	39	48	15.50	11	6.45	0.46	2.55	3020	287	1.90	19400	0.00
ZG361	48.40	50.60	3917617	-5	1.81	39	65	4.61	12	12.10	0.62	2.11	5520	612	3.40	37000	0.00
ZG361	50.60	52.40	3917618	-5	2.12	39	80	6.86	15	5.63	0.76	3.47	1770	410	2.90	24500	0.04
ZG361	52.40	54.50	3917619	-5	2.65	29	103	10.80	18	12.80	1.09	5.60	5590	317	1.10	12700	0.10
ZG361	54.50	56.00	3917620	-5	2.56	-25	138	17.40	12	3.07	0.92	8.92	1330	260		4580	0.12
ZG361	56.00	57.50	3917621	-5	0.46	-25	30	19.20	10	3.24	0.13	10.50	1330	552		3700	0.10
ZG361	57.50	59.80															0.12
ZG361	59.80	60.50	3917622	-5	0.10	-25	8	19.90	7	0.92	-0.05	11.70	435	117		1190	0.05
ZG361	60.50	61.40	3917623	-5	0.08	-25	-5	19.40	7	0.66	-0.05	11.60	283	73		682	0.10
ZG361	61.40	63.00	3917624	-5	0.35	-25	6	19.40	8	0.91	-0.05	11.40	383	156		1350	0.05
ZG361	63.00	64.40	3917625	-5	0.07	-25	-5	19.90	6	0.61	-0.05	12.00	352	112		1160	0.02
ZG361	64.40	66.50	3917626	-5	0.08	-25	-5	20.20	6	0.68	-0.05	12.10	390	127		1590	0.04
ZG361	66.50	68.90	3917627	-5	0.15	-25	-5	20.30	5	0.77	-0.05	12.20	384	240		4200	0.03
ZG361	68.90	70.10	3917628	-5	0.04	-25	-5	19.60	5	0.51	-0.05	11.70	288	81		1460	0.05
ZG361	70.10	72.00	3917629	-5	0.06	-25	-5	20.00	7	0.76	-0.05	12.00	409	93		1000	0.05
ZG361	72.00	74.00	3917630	-5	0.58	31	-5	19.10	10	0.94	-0.05	11.50	391	195	0.45	6210	0.05
ZG361	74.00	76.00	3917631	-5	0.10	-25	-5	19.80	10	0.76	-0.05	11.80	396	196		4270	0.07
ZG361	76.00	77.30	3917632	-5	0.10	-25	-5	20.00	7	0.81	-0.05	12.00	403	141		4310	0.08
ZG361	77.30	78.60	3917633	-5	0.09	-25	-5	20.20	15	0.57	-0.05	12.10	314	111		1380	0.09
ZG361	78.60	80.60	3917634	-5	0.65	32	24	17.40	10	1.85	0.19	10.20	695	762	1.45	23300	0.14
ZG361	80.60	82.40	3917635	-5	1.47	38	57	12.30	14	6.20	0.53	6.19	2360	677	2.00	21100	0.08
ZG361	82.40	83.90	3917636	-5	2.41	26	97	6.50	10	24.50	0.69	3.15	11600	1760	0.39	23300	1.85
ZG361	83.90	85.40	3917637	-5	1.12	39	40	8.97	10	24.40	0.32	4.46	12400	1570	0.56	11300	0.32

303097

Appendix 4: Diamond drill hole logs and geochemistry.

HOLE	DFROM	DTO	SAMPNO	DPO	BMRLITH	FIELDID	TEXTURE	ALT/MIN	COLOUR	COMMENTS
ZG361	85.40	87.20	3917638	77150	Og	Ccy				
ZG361	87.20	89.00	3917639	77150	Og	Ccy				
ZG361	89.00	91.00	3917640	77150	Og	Ccy				
ZG361	91.00	93.00	3917641	77150	Og	Ccy				
ZG361	93.00	94.40	3917642	77150	Om	Sss				
ZG361	94.40	96.00	3917643	77150	Om	Mq	Ma			
ZG361	96.00	99.00	3917644	77150	Om	Mq	Ma			

Appendix 4: Diamond drill hole logs and geochemistry.

HOLE	DFROM	DTO	SAMPNO	Ag	Al%	As	Ba	Ca%	Cu	Fe%	K%	Mg%	Mn	Pb	S%	Zn	magsus x10-3
ZG361	85.40	87.20	3917638	-5	7.61	45	264	0.19	20	1.86	2.70	0.54	142	1180	1.95	5130	0.03
ZG361	87.20	89.00	3917639	-5	6.07	-25	248	0.07	21	1.65	2.36	0.39	110	226		2120	0.22
ZG361	89.00	91.00	3917640	-5	10.10	62	311	0.07	28	3.81	3.11	0.48	42	361		2060	0.04
ZG361	91.00	93.00	3917641	-5	9.90	37	329	0.04	77	2.51	3.40	0.49	86	118		1230	0.05
ZG361	93.00	94.40	3917642	-5	4.16	-25	161	0.02	18	0.78	1.96	0.27	18	58		116	0.04
ZG361	94.40	96.00	3917643	-5	3.47	-25	126	0.05	27	0.53	1.55	0.21	39	-50		43	0.04
ZG361	96.00	99.00	3917644	-5	1.83	-25	66	0.05	-5	0.41	0.79	0.11	25	-50		15	0.04

303099

Appendix 4: Diamond drill hole logs and geochemistry.

HOLE	DFROM	DTO	SAMPNO	DPO	BMRLITH	FIELDID	TEXTURE	ALT/MIN	COLOUR	COMMENTS
ZG362	0.00	15.00			Og?	Ccy?				Roller bit, no core
ZG362	15.00	18.10	3917645	77150	Og	Sls	We		AGDG	Lime mudstone
ZG362	18.10	21.50	3917646	77150	Og	Sls	We		AGDG	Lime mudstone
ZG362	21.50	23.00	3917647	77150	Og	Sls	We		AGDG	Lime mudstone
ZG362	23.00	24.90	3917648	77150	Og	Sls	We		AGDG	Lime mudstone
ZG362	24.90	26.00	3917649	77150	Og	Sls	We		AGDG	Lime mudstone
ZG362	26.00	31.20	3917650	77150	Og	Sls	We		AGDG	Lime mudstone
ZG362	31.20	38.00	3917651	77150	Og	Sls	We		AGDG	Lime mudstone
ZG362	38.00	39.90	3917652	77150	Og	SdlSls	AI	Sd	YG	Weakly ankerite altered lime mudstone
ZG362	39.90	41.00	3917653	77150	Og	SdlSls	AI	Sd	YG	Weakly ankerite altered lime mudstone
ZG362	41.00	43.20	3917654	77150	Og	SdlCcy	AIBx	Sd	YG	Total ankerite altn, + Ccy zones
ZG362	43.20	45.50	3917655	77150	Og	SdlCcy	AIBx	Sd	YG	Total ankerite altn, + Ccy zones
ZG362	45.50	47.70	3917656	77150	Og	SdlCcy	AIBx	Sd	YG	Total ankerite altn, + Ccy zones
ZG362	47.70	49.60	3917657	77150	Og	SdlCcy	AIBx	Sd	YG	Total ankerite altn, + Ccy zones
ZG362	49.60	51.00	3917658	77150	Og	SdlCcy	AIBx	Sd	YG	Total ankerite altn, + Ccy zones
ZG362	51.00	52.50	3917659	77150	Og	SdlCcy	AIBx	Sd	YG	Total ankerite altn, + Ccy zones
ZG362	52.50	54.00	3917660	77150	Og	SdlCcy	AIBx	Sd	YG	Total ankerite altn, + Ccy zones
ZG362	54.00	56.80	3917661	77150	Og	Sdl		He	LRY	Oolitic, weakly haem, ank altered
ZG362	56.80	60.40	3917662	77150	Og	Sdl		He	LRY	Oolitic, weakly haem, ank altered
ZG362	60.40	65.00	3917663	77150	Og	Sdl		He	LRY	Oolitic, weakly haem, ank altered
ZG362	65.00	70.50	3917664	77150	Og	Sdl		He	LRY	Oolitic, weakly haem, ank altered
ZG362	70.50	75.70	3917665	77150	Og	Sdl		He	LRY	Oolitic, weakly haem, ank altered
ZG362	75.70	78.40	3917666	77150	Og	Sdl		He	LRY	Oolitic, weakly haem, ank altered
ZG362	78.40	80.00	3917667	77150	Og	Sdl		He	LRY	Oolitic, weakly haem, ank altered
ZG362	80.00	81.90								No recovery
ZG362	81.90	83.00	3917669	77150	Og	CcyCs				Very poor rec of sand and clay
ZG362	83.00	86.00	3917670	77150	Og	Ccy			G	
ZG362	86.00	88.00	3917671	77150	Og	Ccy			G	
ZG362	88.00	89.00	3917672	77150	Og	Ccy			G	
ZG362	89.00	92.00	3917673	77150	Og	Ccy			G	
ZG362	92.00	95.00	3917674	77150	Og	Ccy			G	
ZG362	95.00	97.90	3917675	77150	Og	Ccy			G	
ZG362	97.90	99.20	3917676	77150	Om	Mq	Ma		LGW	

Appendix 4: Diamond drill hole logs and geochemistry.

HOLE	DFROM	DTO	SAMPNO	Ag	Al%	As	Ba	Ca%	Cu	Fe%	K%	Mg%	Mn	Pb	S%	Zn	magsus x10-3
ZG362	0.00	15.00															
ZG362	15.00	18.10	3917645	-5	0.60	38	41	23.90	7	2.38	0.23	7.56	832	76	1.20	6830	0.00
ZG362	18.10	21.50	3917646	-5	0.82	37	22	23.20	8	2.01	0.14	5.17	743	2250	2.40	55000	0.07
ZG362	21.50	23.00	3917647	-5	1.35	35	67	26.70	11	2.05	0.50	3.01	626	722	1.50	13500	0.06
ZG362	23.00	24.90	3917648	-5	1.09	37	55	21.90	13	3.26	0.48	4.38	1410	58	1.70	15500	0.06
ZG362	24.90	26.00	3917649	-5	1.62	34	73	19.30	14	2.12	0.72	7.29	459	-50	1.45	7810	0.11
ZG362	26.00	31.20	3917650	-5	4.90	84	215	6.48	21	8.19	2.09	3.25	3300	436	4.10	22100	0.06
ZG362	31.20	38.00	3917651	-5	3.48	130	89	7.44	21	22.60	0.75	3.78	5430	-50	14.50	16100	0.10
ZG362	38.00	39.90	3917652	-5	1.57	31	54	14.50	9	9.59	0.56	7.70	5490	-50	1.25	16200	0.45
ZG362	39.90	41.00	3917653	-5	1.32	27	48	11.70	8	15.80	0.48	6.18	9210	-50	0.95	10600	1.00
ZG362	41.00	43.20	3917654	-5	1.75	47	66	5.33	10	27.80	0.66	2.50	15400	140	2.00	17600	0.93
ZG362	43.20	45.50	3917655	-5	1.75	81	64	5.17	11	21.00	0.61	2.62	9300	1100	6.50	42700	0.15
ZG362	45.50	47.70	3917656	-5	1.48	31	24	8.77	10	15.90	0.19	4.28	14000	7620	1.80	47700	0.56
ZG362	47.70	49.60	3917657	-5	0.85	-25	11	7.80	9	19.80	0.07	4.20	16100	7400	0.88	72000	0.33
ZG362	49.60	51.00	3917658	-5	0.91	28	40	7.56	8	21.30	0.35	3.92	23100	1300	1.05	25000	1.40
ZG362	51.00	52.50	3917659	-5	1.02	25	42	7.49	8	20.50	0.38	4.01	21900	3200	0.88	25900	1.07
ZG362	52.50	54.00	3917660	-5	2.94	-25	106	11.00	26	11.50	1.13	5.67	7730	5900	1.45	34600	0.08
ZG362	54.00	56.80	3917661	-5	0.53	-25	23	20.40	9	2.32	0.13	11.10	1130	910	0.09	7180	0.06
ZG362	56.80	60.40	3917662	-5	0.87	-25	43	19.70	7	0.93	0.29	11.40	676	243		3990	0.06
ZG362	60.40	65.00	3917663	-5	0.23	-25	8	20.00	10	0.91	0.05	11.80	519	610	0.42	7920	0.04
ZG362	65.00	70.50	3917664	-5	0.17	-25	5	20.40	11	0.71	-0.05	12.10	582	654		4750	0.06
ZG362	70.50	75.70	3917665	-5	0.13	-25	-5	20.40	7	0.68	-0.05	11.90	415	190		2910	0.04
ZG362	75.70	78.40	3917666	-5	0.29	-25	9	19.90	6	1.27	0.05	11.70	696	911	0.34	5660	0.04
ZG362	78.40	80.00	3917667	-5	1.05	25	35	15.20	14	6.45	0.26	9.32	3730	2070	0.57	37900	0.86
ZG362	80.00	81.90															
ZG362	81.90	83.00	3917669	5	3.46	115	49	4.79	36	15.70	0.35	3.80	5000	13400	7.80	142000	0.62
ZG362	83.00	86.00	3917670	-5	6.73	75	256	0.10	18	2.48	2.39	0.45	289	1380	2.95	17900	0.02
ZG362	86.00	88.00	3917671	-5	7.48	27	301	0.05	21	1.69	2.87	0.43	47	285		3060	0.04
ZG362	88.00	89.00	3917672	-5	4.78	44	225	0.04	29	2.69	1.91	0.27	42	193		1310	0.05
ZG362	89.00	92.00	3917673	-5	3.27	58	167	0.04	24	2.70	1.53	0.23	39	343		2440	0.04
ZG362	92.00	95.00	3917674	-5	10.00	46	313	0.02	118	2.69	3.23	0.45	27	155		1170	0.05
ZG362	95.00	97.90	3917675	-5	7.11	43	214	0.17	43	1.40	2.50	0.40	80	138		233	0.03
ZG362	97.90	99.20	3917676	-5	0.86	-25	49	0.02	9	0.45	0.26	0.04	34	-50		48	0.03

Appendix 4: Diamond drill hole logs and geochemistry.

HOLE	DFROM	DTO	SAMPNO	DPO	BMRLITH	FIELDID	TEXTURE	ALT/MIN	COLOUR	COMMENTS
ZG363	0.00	24.00			Og?	Ccy?				Roller bit, no core
ZG363	24.00	29.00	3984301	77150	Og	SlsCcy	We		LG	Mixed Sls + Ccy, broken
ZG363	29.00	33.30	3984302	77150	Og	SlsCcy	We		LG	Mixed Sls + Ccy, broken
ZG363	33.30	37.20	3984303	77150	Og	Sls	We		AGDG	Lime mudstone
ZG363	37.20	39.50	3984304	77150	Og	Sls	We		AGDG	Lime mudstone
ZG363	39.50	41.30	3984305	77150	Og	SdlSls	AI	Sd	YG	Weakly ankerite altered lime mudstone
ZG363	41.30	43.80	3984306	77150	Og	SdlSls	AI	Sd	YG	Weakly ankerite altered lime mudstone
ZG363	43.80	45.40	3984307	77150	Og	SdlSls	AI	Sd	YG	Weakly ankerite altered lime mudstone
ZG363	45.40	47.00	3984308	77150	Og	SdlCcy	AIBx	Sd	YG	Total ankerite altn, + Ccy zones
ZG363	47.00	49.10	3984309	77150	Og	SdlCcy	AIBx	Sd	YG	Total ankerite altn, + Ccy zones
ZG363	49.10	51.30	3984310	77150	Og	SdlCcy	AIBx	Sd	YG	Total ankerite altn, + Ccy zones
ZG363	51.30	53.00	3984311	77150	Og	SdlCcy	AIBx	Sd	YG	Total ankerite altn, + Ccy zones
ZG363	53.00	54.50	3984312	77150	Og	SdlCcy	AIBx	Sd	YG	Total ankerite altn, + Ccy zones
ZG363	54.50	56.00	3984313	77150	Og	SdlCcy	AIBx	Sd	YG	Total ankerite altn, + Ccy zones
ZG363	56.00	57.50	3984314	77150	Og	SdlCcy	AIBx	Sd	YG	Total ankerite altn, + Ccy zones
ZG363	57.50	59.00	3984315	77150	Og	SdlCcy	AIBx	Sd	YG	Total ankerite altn, + Ccy zones
ZG363	59.00	60.60	3984316	77150	Og	SdlCcy	AIBx	Sd	YG	Total ankerite altn, + Ccy zones
ZG363	60.60	63.00	3984317	77150	Og	SdlCcy	AIBx	Sd	YG	Total ankerite altn, + Ccy zones
ZG363	63.00	65.00	3984318	77150	Og	SdlCcy	AIBx	Sd	YG	Total ankerite altn, + Ccy zones
ZG363	65.00	67.70	3984319	77150	Og	SdlCcy	AIBx	Sd	YG	Total ankerite altn, + Ccy zones
ZG363	67.70	69.50	3984320	77150	Og	SdlCcy	AIBx	Sd	YG	Total ankerite altn, + Ccy zones
ZG363	69.50	72.50	3984321	77150	Og	SdlCcy	AIBx	Sd	YG	Total ankerite altn, + Ccy zones
ZG363	72.50	73.40	3984322	77150	Og	SdlCcy	AIBx	Sd	YG	Total ankerite altn, + Ccy zones
ZG363	73.40	76.10	3984323	77150	Og	SdlCcy	AIBx	Sd	YG	Total ankerite altn, + Ccy zones
ZG363	76.10	77.60	3984324	77150	Og	SdlCcy	AIBx	Sd	YG	Total ankerite altn, + Ccy zones
ZG363	77.60	78.90	3984325	77150	Og	SdlCcy	AIBx	Sd	YG	Total ankerite altn, + Ccy zones
ZG363	78.90	79.80	3984326	77150	Og	SdlCcy	AIBx	Sd	YG	Total ankerite altn, + Ccy zones
ZG363	79.80	81.30	3984327	77150	Og	SdlCcy	AIBx	Sd	YG	Total ankerite altn, + Ccy zones
ZG363	81.30	83.40	3984328	77655	Og	Ccy			DG	Carbonaceous clay + qtz sand
ZG363	83.40	85.50	3984329	77655	Og	Ccy			DG	Carbonaceous clay + qtz sand
ZG363	85.50	87.70	3984330	77655	Og	Ccy			DG	Carbonaceous clay + qtz sand
ZG363	87.70	89.85	3984331	77655	Og	Ccy			DG	Carbonaceous clay + qtz sand
ZG363	89.85	92.00	3984332	77655	Og	Ccy	GsFe		YR	Gossanous clay
ZG363	92.00	94.20	3984333	77655	Og	Ccy	GsFe		YR	Gossanous clay
ZG363	94.20	96.40	3984334	77655	Og	Ccy	GsFe		YR	Gossanous clay
ZG363	96.40	98.60	3984335	77655	Og	Ccy	GsFe		YR	Gossanous clay
ZG363	98.60	101.00	3984336	77655	Og	Ccy			GDG	Partly carbonaceous, becomes sandier with depth
ZG363	101.00	103.00	3984337	77655	Og	Ccy			GDG	Partly carbonaceous, becomes sandier with depth
ZG363	103.00	105.00	3984338	77655	Og	Ccy			GDG	Partly carbonaceous, becomes sandier with depth

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Appendix 4: Diamond drill hole logs and geochemistry.

HOLE	DFROM	DTO	SAMPNO	Ag	Al%	As	Ba	Ca%	Cu	Fe%	K%	Mg%	Mn	Pb	S%	Zn	magsus x10-3
ZG363	0.00	24.00															
ZG363	24.00	29.00	3984301	-5	0.67	41	26	28.60	20	1.37	0.20	0.53	225	81	1.25	5040	0.06
ZG363	29.00	33.30	3984302	-5	0.66	44	26	27.20	15	1.97	0.25	3.27	697	56	1.20	6120	0.09
ZG363	33.30	37.20	3984303	-5	0.59	29	24	22.30	10	2.93	0.21	7.08	1320	283		4310	0.06
ZG363	37.20	39.50	3984304	-5	1.68	26	100	24.10	18	1.77	0.68	3.34	813	1730	0.32	7060	0.02
ZG363	39.50	41.30	3984305	-5	1.13	-25	54	20.20	10	4.81	0.48	6.04	1960	231	0.45	5800	0.30
ZG363	41.30	43.80	3984306	-5	1.13	39	54	19.20	8	6.17	0.46	6.28	2930	309	1.30	12800	0.30
ZG363	43.80	45.40	3984307	-5	1.22	30	55	13.20	7	14.90	0.48	6.25	7790	739	0.47	14600	0.35
ZG363	45.40	47.00	3984308	-5	1.38	33	58	12.00	11	15.00	0.56	6.79	8510	1500	1.35	24400	0.60
ZG363	47.00	49.10	3984309	-5	1.35	37	56	15.10	5	10.30	0.54	4.93	5000	193	2.50	24100	0.60
ZG363	49.10	51.30	3984310	-5	4.53	-25	197	3.59	12	18.80	1.91	1.63	10700	2640	1.75	32400	0.22
ZG363	51.30	53.00	3984311	-5	5.25	-25	237	3.53	14	14.10	2.27	2.03	6170	362	1.70	23800	0.15
ZG363	53.00	54.50	3984312	-5	1.39	28	80	6.81	-5	21.00	0.56	3.42	8060	231	2.70	26900	0.27
ZG363	54.50	56.00	3984313	-5	1.83	64	89	9.26	6	13.40	0.74	4.81	5030	68	7.00	42800	0.12
ZG363	56.00	57.50	3984314	-5	0.52	-25	29	4.94	-5	30.50	0.18	2.28	9870	-50	0.80	20900	1.00
ZG363	57.50	59.00	3984315	-5	0.75	35	33	5.26	-5	26.50	0.28	2.42	7120	-50	1.75	16900	0.45
ZG363	59.00	60.60	3984316	-5	1.28	35	47	5.89	-5	24.60	0.49	2.84	6680	-50	2.00	14000	0.45
ZG363	60.60	63.00	3984317	-5	1.95	-25	75	5.57	10	21.90	0.79	2.86	10700	-50	1.35	14000	0.38
ZG363	63.00	65.00	3984318	-5	2.12	-25	79	3.85	8	25.60	0.84	2.07	14900	-50	0.79	25700	0.90
ZG363	65.00	67.70	3984319	-5	1.76	26	64	5.22	7	23.00	0.67	2.72	17700	103	1.35	36100	1.00
ZG363	67.70	69.50	3984320	-5	2.68	49	99	5.03	10	19.00	0.99	2.62	23100	572	1.60	38500	0.33
ZG363	69.50	72.50	3984321	-5	5.20	105	179	1.45	19	14.70	1.79	0.90	14800	2640	3.80	77000	0.08
ZG363	72.50	73.40	3984322	-5	1.84	32	65	1.19	9	26.60	0.67	0.37	36500	271	1.40	78000	1.00
ZG363	73.40	76.10	3984323	-5	1.51	29	56	1.15	7	27.90	0.58	0.34	42000	76	0.95	80000	1.40
ZG363	76.10	77.60	3984324	-5	0.93	219	33	0.54	5	30.50	0.31	0.21	24600	616	17.80	118000	0.10
ZG363	77.60	78.90	3984325	-5	0.69	34	24	0.87	-5	30.40	0.22	0.34	40600	239	1.30	106000	1.50
ZG363	78.90	79.80	3984326	-5	3.34	122	111	0.60	12	21.50	1.17	0.43	23000	799	5.95	105000	2.40
ZG363	79.80	81.30	3984327	-5	1.87	46	63	0.67	8	24.90	0.65	0.27	33300	1540	3.55	132000	0.30
ZG363	81.30	83.40	3984328	6	9.69	29	223	0.17	24	4.01		0.55	297	9590	4.30	66000	0.10
ZG363	83.40	85.50	3984329	6	6.66	37	182	0.04	48	2.34		0.25	44	11000	3.85	37500	0.05
ZG363	85.50	87.70	3984330	10	8.85	-20	226	0.04	48	1.60		0.38	32	37000	3.20	45000	0.08
ZG363	87.70	89.85	3984331	18	9.37	21	172	0.02	202	5.02		0.37	46	34000	3.30	54000	0.08
ZG363	89.85	92.00	3984332	52	6.69	29	164	0.01	918	31.80		0.16	669	12500	0.17	7000	0.10
ZG363	92.00	94.20	3984333	-5	3.01	50	20	0.01	182	48.80		0.02	894	7140	0.02	10400	0.25
ZG363	94.20	96.40	3984334	-5	4.11	33	80	0.01	257	44.40		0.07	1320	6760	0.02	12000	0.18
ZG363	96.40	98.60	3984335	-5	8.09	28	249	0.02	223	30.10		0.23	582	6910	0.12	8240	0.20
ZG363	98.60	101.00	3984336	7	15.10	-20	352	0.02	65	2.38		0.44	31	16000	2.90	27500	0.04
ZG363	101.00	103.00	3984337	-5	10.30	-20	298	0.03	23	1.61		0.44	34	1520		3130	0.04
ZG363	103.00	105.00	3984338	-5	10.30	-20	316	0.04	44	1.64		0.46	31	5860	1.80	5850	0.04

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Appendix 4: Diamond drill hole logs and geochemistry.

HOLE	DFROM	DTO	SAMPNO	DPO	BMRLITH	FIELDID	TEXTURE	ALT/MIN	COLOUR	COMMENTS
ZG363	105.00	107.00	3984339	77655	Og	Ccy			GDG	Partly carbonaceous, becomes sandier with depth
ZG363	107.00	109.00	3984340	77655	Og	Ccy			GDG	Partly carbonaceous, becomes sandier with depth
ZG363	109.00	111.00	3984341	77655	Og	Ccy			GDG	Partly carbonaceous, becomes sandier with depth
ZG363	111.00	113.00	3984342	77655	Og	Ccy			GDG	Partly carbonaceous, becomes sandier with depth
ZG363	113.00	115.00	3984343	77655	Og	Ccy			GDG	Partly carbonaceous, becomes sandier with depth
ZG363	115.00	117.00	3984344	77655	Og	Ccy			GDG	Partly carbonaceous, becomes sandier with depth
ZG363	117.00	119.00	3984345	77655	Og	Ccy			GDG	Partly carbonaceous, becomes sandier with depth
ZG363	119.00	121.00	3984346	77655	Og	Ccy			GDG	Partly carbonaceous, becomes sandier with depth
ZG363	121.00	123.00	3984347	77655	Og	Ccy			GDG	Partly carbonaceous, becomes sandier with depth
ZG363	123.00	124.90	3984348	77655	Og	Ccy			GDG	Partly carbonaceous, becomes sandier with depth
ZG363	124.90	128.30	3984349	77655	Om	Sss			W	Friable
ZG363	128.30	129.60	3984350	77655	Om	Mg			W	Massive, weakly bedded Moina Sst.

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Appendix 4: Diamond drill hole logs and geochemistry.

HOLE	DFROM	DTO	SAMPNO	Ag	Al%	As	Ba	Ca%	Cu	Fe%	K%	Mg%	Mn	Pb	S%	Zn	magsus x10-3
ZG363	105.00	107.00	3984339	-5	11.50	-20	301	0.04	49	1.40		0.39	27	11500	1.70	7060	0.04
ZG363	107.00	109.00	3984340	-5	7.28	-20	248	0.03	27	1.33		0.31	27	7340	1.50	4640	0.06
ZG363	109.00	111.00	3984341	-5	6.12	-20	215	0.05	18	0.95		0.27	18	2950		1550	0.05
ZG363	111.00	113.00	3984342	-5	7.58	-20	262	0.04	17	1.40		0.34	32	243		475	0.04
ZG363	113.00	115.00	3984343	-5	12.10	-20	389	0.03	19	1.79		0.50	32	316		133	0.03
ZG363	115.00	117.00	3984344	-5	8.35	23	279	0.05	22	2.44		0.36	32	398		496	0.05
ZG363	117.00	119.00	3984345	-5	12.00	29	361	0.03	28	2.87		0.44	39	791		1200	0.03
ZG363	119.00	121.00	3984346	-5	5.76	38	171	0.02	24	2.15		0.21	22	1960		946	0.08
ZG363	121.00	123.00	3984347	-5	9.47	-20	291	0.02	34	1.64		0.43	19	132		952	0.08
ZG363	123.00	124.90	3984348	-5	11.30	-20	309	0.02	127	2.06		0.43	22	119		647	0.04
ZG363	124.90	128.30	3984349	-5	10.00	-20	315	0.01	7	0.54		0.45	17	102		64	0.04
ZG363	128.30	129.60	3984350	-5	2.17	-20	87	0.01	13	0.45		0.11	17	79		173	0.02

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Appendix 4: Diamond drill hole logs and geochemistry.

HOLE	DFROM	DTO	SAMPNO	DPO	BMRLITH	FIELDID	TEXTURE	ALT/MIN	COLOUR	COMMENTS
ZG364	0.00	6.30			Og?	Ccy?				Roller bit, no core
ZG364	6.30	7.30	3984901	77658	Og	Sls				limestone
ZG364	7.30	9.00	3984902	77658	Og	Sls				limestone
ZG364	9.00	11.00	3984903	77658	Og	Sls				limestone
ZG364	11.00	13.00	3984904	77658	Og	Sls				limestone
ZG364	13.00	14.50	3984905	77658	Og	Sls				limestone
ZG364	14.50	17.00	3984906	77658	Og	Sls				limestone
ZG364	17.00	19.00	3984907	77658	Og	Sls				limestone
ZG364	19.00	21.00	3984908	77658	Og	Sls				limestone
ZG364	21.00	23.00	3984909	77658	Og	Sls				limestone
ZG364	23.00	25.00	3984910	77658	Og	Sls				limestone
ZG364	25.00	26.50	3984911	77658	Og	Sls				limestone
ZG364	26.50	28.00	3984912	77658	Og	Sls				limestone
ZG364	28.00	30.00	3984913	77658	Og	Sls				limestone
ZG364	30.00	32.00	3984914	77658	Og	Sls				limestone
ZG364	32.00	34.00	3984915	77658	Og	Sls				limestone
ZG364	34.00	36.00	3984916	77658	Og	Sls				limestone
ZG364	36.00	37.60	3984917	77658	Og	Sls				limestone
ZG364	37.60	39.60	3984918	77658	Og	Sls				limestone
ZG364	39.60	42.00	3984919	77658	Og	Sls				limestone
ZG364	42.00	44.00	3984920	77658	Og	Sls				limestone
ZG364	44.00	47.70	3984921	77658	Og	Sls				limestone
ZG364	47.70	49.00	3984922	77658	Og	Sls				limestone
ZG364	49.00	51.00	3984923	77658	Og	Sls				limestone
ZG364	51.00	52.50	3984924	77658	Og	Sls				limestone
ZG364	52.50	54.00	3984925	77658	Og	Sls				limestone
ZG364	54.00	56.00	3984926	77658	Og	Sls				limestone
ZG364	56.00	57.50	3984927	77658	Og	SdlCcy	Al	Sd		Ankerite altd carbonate and clay
ZG364	57.50	59.00	3984928	77658	Og	SdlCcy	Al	Sd		Ankerite altd carbonate and clay
ZG364	59.00	61.00	3984929	77658	Og	SdlCcy	Al	Sd		Ankerite altd carbonate and clay
ZG364	61.00	63.00	3984930	77658	Og	SdlCcy	Al	Sd		Ankerite altd carbonate and clay
ZG364	63.00	64.80	3984931	77658	Og	SdlCcy	Al	Sd		Ankerite altd carbonate and clay
ZG364	64.80	65.20	3984932	77658	Og	SdlCcy	Al	Sd		Ankerite altd carbonate and clay
ZG364	65.20	68.00	3984933	77658	Og	Ccy			YB	
ZG364	68.00	70.00	3984934	77658	Og	Ccy			YB	
ZG364	70.00	73.00	3984935	77658	Og	Ccy			YB	
ZG364	73.00	75.00	3984936	77658	Og	Ccy			YB	
ZG364	75.00	77.00	3984937	77658	Og	Ccy			YB	
ZG364	77.00	78.50	3984938	77658	Og	Ccy			YB	

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Appendix 4: Diamond drill hole logs and geochemistry.

HOLE	DFROM	DTO	SAMPNO	Ag	Al%	As	Ba	Ca%	Cu	Fe%	K%	Mg%	Mn	Pb	S%	Zn	magsus x10-3
ZG364	0.00	6.30															
ZG364	6.30	7.30	3984901	-5	0.32	-20	16	34.10	22	0.34	0.12	1.33	90	-50		324	0.08
ZG364	7.30	9.00	3984902	-5	1.11	-20	44	31.10	21	0.58	0.44	0.93	176	-50		773	0.07
ZG364	9.00	11.00	3984903	-5	0.89	-20	37	32.50	22	0.41	0.34	0.53	324	-50		600	0.05
ZG364	11.00	13.00	3984904	-5	0.62	-20	28	41.00	24	0.52	0.26	0.58	258	-50		696	0.07
ZG364	13.00	14.50	3984905	-5	1.54	-20	65	27.60	20	0.87	0.64	3.75	199	-50		518	0.07
ZG364	14.50	17.00	3984906	-5	0.84	-20	39	30.70	21	1.20	0.35	1.65	443	-50		1160	0.04
ZG364	17.00	19.00	3984907	-5	1.01	-20	45	32.30	24	0.63	0.43	0.95	222	-50		980	0.10
ZG364	19.00	21.00	3984908	-5	0.32	-20	15	34.70	24	0.21	0.13	0.57	99	-50		256	0.08
ZG364	21.00	23.00	3984909	-5	0.33	-20	16	39.20	24	0.16	0.13	0.57	67	-50		186	0.08
ZG364	23.00	25.00	3984910	-5	0.71	-20	27	30.50	20	0.41	0.29	1.99	88	-50		1010	0.07
ZG364	25.00	26.50	3984911	-5	0.73	-20	28	31.30	22	1.11	0.29	1.83	390	-50		3580	0.10
ZG364	26.50	28.00	3984912	-5	0.39	-20	18	41.10	25	0.16	0.15	0.55	75	-50		531	0.07
ZG364	28.00	30.00	3984913	-5	0.68	-20	25	33.70	23	1.10	0.24	0.82	501	-50		2950	0.03
ZG364	30.00	32.00	3984914	-5	0.39	-20	18	34.20	23	0.33	0.14	0.36	151	-50		1160	0.13
ZG364	32.00	34.00	3984915	-5	0.52	-20	23	40.10	25	0.23	0.20	0.95	131	-50		1480	0.15
ZG364	34.00	36.00	3984916	-5	0.46	-20	19	33.00	18	1.56	0.17	4.30	520	-50	0.40	5170	0.07
ZG364	36.00	37.60	3984917	-5	0.48	-20	22	34.30	23	0.31	0.19	1.73	120	-50		729	0.08
ZG364	37.60	39.60	3984918	-5	1.02	-20	45	29.50	23	0.81	0.41	2.81	277	-50		1570	0.03
ZG364	39.60	42.00	3984919	-5	1.18	-20	51	24.80	20	1.25	0.49	5.00	438	-50		1650	0.13
ZG364	42.00	44.00	3984920	-5	1.20	-20	53	28.20	21	0.94	0.51	3.00	304	-50		1930	0.05
ZG364	44.00	47.70	3984921	-5	1.87	-20	85	27.30	33	0.98	0.83	1.95	311	-50		1700	0.06
ZG364	47.70	49.00	3984922	-5	0.35	-20	17	33.50	24	0.59	0.15	1.16	163	-50		728	0.07
ZG364	49.00	51.00	3984923	-5	0.65	-20	28	30.50	24	0.56	0.28	1.83	214	-50		1010	0.07
ZG364	51.00	52.50	3984924	-5	0.39	-20	18	31.90	24	0.62	0.16	1.38	192	-50		843	0.07
ZG364	52.50	54.00	3984925	-5	1.25	-20	53	29.40	24	0.77	0.53	1.24	179	-50		2450	0.07
ZG364	54.00	56.00	3984926	-5	1.12	-20	50	24.00	19	6.16	0.47	2.11	5600	-50	0.37	26000	0.06
ZG364	56.00	57.50	3984927	-5	2.08	-20	94	23.80	24	2.96	0.90	2.18	1710	-50	0.78	9930	0.06
ZG364	57.50	59.00	3984928	-5	3.19	-20	133	14.50	25	5.32	1.23	4.75	1060	148	1.65	13000	0.05
ZG364	59.00	61.00	3984929	-5	1.16	-20	46	12.90	13	12.10	0.43	7.16	7090	-50	0.62	30000	0.12
ZG364	61.00	63.00	3984930	-5	2.97	-20	123	1.31	8	25.70	1.15	0.71	24600	67	0.92	59000	0.11
ZG364	63.00	64.80	3984931	-5	4.12	-20	169	0.33	15	15.50	1.65	0.36	23300	197	2.05	54000	0.80
ZG364	64.80	65.20	3984932	-5	1.39	47	59	0.36	8	15.50	0.55	0.17	137000	262	3.35	74000	0.15
ZG364	65.20	68.00	3984933	6	6.21	37	226	0.04	55	6.41	2.27	0.35	1760	1110		4530	0.08
ZG364	68.00	70.00	3984934	-5	11.20	54	398	0.04	88	12.60	3.78	0.52	1300	3710		4260	0.10
ZG364	70.00	73.00	3984935	-5	7.63	121	271	0.02	254	30.40	2.39	0.39	2730	5800	0.04	10200	0.16
ZG364	73.00	75.00	3984936	-5	7.73	106	254	0.02	294	25.60	2.11	0.40	2820	7470	0.03	6260	0.20
ZG364	75.00	77.00	3984937	-5	5.05	113	174	0.02	293	39.50	1.45	0.29	3780	9100	0.02	11000	0.19
ZG364	77.00	78.50	3984938	-5	8.25	168	294	0.11	228	32.20	2.46	0.42	2810	19300	0.03	10000	0.11

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Appendix 4: Diamond drill hole logs and geochemistry.

ZG364	78.50	81.00	3984939	77658	Og	Ccy			YB	
ZG364	81.00	83.00	3984940	77658	Og	Ccy			YB	
ZG364	83.00	85.00	3984941	77658	Om	Mq	Al?Fo	He	MYRG	
ZG364	85.00	88.50	3984942	77658	Om	Mq	Al?Fo	He	MYRG	

Appendix 4: Diamond drill hole logs and geochemistry.

ZG364	78.50	81.00	3984939	-5	10.30	51	336	0.04	49	10.10	2.93	0.43	685	4220	2620	0.15
ZG364	81.00	83.00	3984940	-5	6.79	40	275	0.03	79	6.63	2.48	0.35	265	654	1470	0.05
ZG364	83.00	85.00	3984941	-5	6.42	25	247	0.03	31	5.34	2.52	0.32	165	167	684	0.07
ZG364	85.00	88.50	3984942	-5	3.97	41	137	0.03	43	5.03	1.42	0.17	84	91	222	0.06

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Appendix 4: Diamond drill hole logs and geochemistry.

HOLE	DFROM	DTO	SAMPNO	DPO	BMRLITH	FIELDID	TEXTURE	ALT/MIN	COLOUR	COMMENTS
ZG365	0.00	6.00			Og?	Ccy?				Roller bit, no core
ZG365	6.00	9.00	3985943	77213	Og	Sls			GDG	limestone
ZG365	9.00	12.00	3985944	77213	Og	Sls			GDG	limestone
ZG365	12.00	15.00	3985945	77213	Og	Sls			GDG	limestone
ZG365	15.00	18.00	3985946	77213	Og	Sls			GDG	limestone
ZG365	18.00	21.00	3985947	77213	Og	Sls			GDG	limestone
ZG365	21.00	24.00	3985948	77213	Og	Sls			LG	limestone
ZG365	24.00	27.00	3985949	77213	Og	Sls			LG	limestone
ZG365	27.00	30.00	3985950	77213	Og	Sls			LG	limestone
ZG365	30.00	33.00	3985951	77213	Og	Sls			LG	limestone
ZG365	33.00	36.00	3985952	77213	Og	Sls			LG	limestone
ZG365	36.00	39.00	3985953	77213	Og	Sls			LG	limestone
ZG365	39.00	42.00	3985954	77213	Og	Sls			LG	limestone
ZG365	42.00	45.00	3985955	77213	Og	Sls			DG	limestone
ZG365	45.00	48.00	3985956	77213	Og	Sls			DG	limestone
ZG365	48.00	51.00	3985957	77213	Og	Sls			DG	limestone
ZG365	51.00	54.00	3985958	77213	Og	Sls			DG	limestone
ZG365	54.00	57.00	3985959	77213	Og	Sls			DG	limestone
ZG365	57.00	60.00	3985960	77213	Og	Sls			DG	limestone
ZG365	60.00	63.00	3985961	77213	Og	Sls			DG	limestone
ZG365	63.00	66.00	3985962	77213	Og	Sls			DG	limestone
ZG365	66.00	68.00	3985963	77213	Og	Sls	AIVc	Cc	GDG	limestone. Weak Cc altn.
ZG365	68.00	70.00	3985964	77213	Og	Sls	AIVc	Cc	GDG	limestone. Weak Cc altn.
ZG365	70.00	72.10	3985965	77213	Og	Sls	AIVc	Cc	GDG	limestone. Weak Cc altn.
ZG365	72.10	74.40	3985966	77213	Og	Sdl	AIBx	Sd	YG	Ankerite altd carbonate and minor clay
ZG365	74.40	76.10	3985967	77213	Og	Sdl	AIBx	Sd	YG	Ankerite altd carbonate and minor clay
ZG365	76.10	77.10	3985968	77213	Og	Sdl	AIBx	Sd	YG	Ankerite altd carbonate and minor clay
ZG365	77.10	79.10	3985969	77213	Og	Sdl	AIBx	Sd	YG	Ankerite altd carbonate and minor clay
ZG365	79.10	81.60	3985970	77213	Og	Sdl	AIBx	Sd	YG	Ankerite altd carbonate and minor clay
ZG365	81.60	82.30				Ox				No core recovery
ZG365	82.30	84.20	3985971	77213	Og	Ccy	AI	Sd	YB	Ankeritic clay
ZG365	84.20	86.00	3985972	77213	Og	Ccy	AI	Sd	YB	Ankeritic clay
ZG365	86.00	88.00	3985973	77213	Og	Ccy	AI	Sd	DGYB	Weakly ankeritic clay
ZG365	88.00	90.00	3985974	77213	Og	Ccy	FeGs?	He	MRYB	Limonitic and hematitic clay
ZG365	90.00	92.00	3985975	77213	Og	Ccy	FeGs?	He	MRYB	Limonitic and hematitic clay
ZG365	92.00	95.00	3985976	77213	Og	Ccy	FeGs?	He	MRYB	Limonitic and hematitic clay
ZG365	95.00	98.00	3985977	77213	Og	Ccy	FeGs?	He	MRYB	Limonitic and hematitic clay
ZG365	98.00	101.00	3985978	77213	Og	Ccy	FeGs?	He	MRYB	Limonitic and hematitic clay
ZG365	101.00	104.00	3985979	77213	Og	Ccy	FeGs?	He	MRYB	Limonitic and hematitic clay

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Appendix 4: Diamond drill hole logs and geochemistry.

HOLE	DFROM	DTO	SAMPNO	Ag	Al%	As	Ba	Ca%	Cu	Fe%	K%	Mg%	Mn	Pb	S%	Zn	magsus x10-3
ZG365	0.00	6.00															
ZG365	6.00	9.00	3985943	-5	0.56	-1	23	32.10	23	0.40	0.23	0.97	172	-50		212	0.05
ZG365	9.00	12.00	3985944	-5	0.70	2	26	30.70	26	0.61	0.22	0.72	205	277		687	0.04
ZG365	12.00	15.00	3985945	-5	1.02	3	40	29.70	22	0.43	0.36	1.17	127	-50		407	0.06
ZG365	15.00	18.00	3985946	-5	1.04	-1	46	27.90	20	0.56	0.45	2.82	170	-50		334	0.08
ZG365	18.00	21.00	3985947	-5	1.28	-1	58	28.20	22	0.57	0.56	1.32	193	-50		485	0.10
ZG365	21.00	24.00	3985948	-5	0.63	-1	27	33.40	30	0.26	0.18	0.59	91	-50		240	0.06
ZG365	24.00	27.00	3985949	-5	0.38	-1	16	32.20	22	0.24	0.15	0.90	90	-50		433	0.06
ZG365	27.00	30.00	3985950	-5	0.53	1	21	32.10	23	0.28	0.21	1.03	133	-50		315	0.22
ZG365	30.00	33.00	3985951	-5	0.32	100	12	33.20	25	1.53	0.11	0.62	588	-50		3880	0.11
ZG365	33.00	36.00	3985952	-5	0.23	6	10	33.20	23	0.28	0.09	0.43	113	-50		508	0.16
ZG365	36.00	39.00	3985953	-5	0.38	1	15	29.50	21	0.89	0.15	2.78	299	-50		1830	0.08
ZG365	39.00	42.00	3985954	-5	0.51	7	21	31.00	20	0.53	0.20	2.57	128	-50		1200	0.10
ZG365	42.00	45.00	3985955	-5	0.88	5	37	28.60	19	1.00	0.38	1.77	449	-50		1990	0.07
ZG365	45.00	48.00	3985956	-5	1.01	-1	39	24.60	19	1.33	0.43	4.25	498	-50		2040	0.08
ZG365	48.00	51.00	3985957	-5	0.80	3	34	28.30	20	0.67	0.35	2.16	208	-50		599	0.09
ZG365	51.00	54.00	3985958	-5	2.05	6	87	25.00	22	0.72	0.96	1.25	218	-50		554	0.06
ZG365	54.00	57.00	3985959	-5	2.58	6	107	23.70	23	1.03	1.21	1.46	204	-50		1220	0.03
ZG365	57.00	60.00	3985960	-5	0.96	6	30	30.40	40	0.95	0.28	1.54	378	380		810	0.06
ZG365	60.00	63.00	3985961	-5	0.63	5	27	28.80	25	0.62	0.30	1.93	212	71		376	0.08
ZG365	63.00	66.00	3985962	-5	0.85	7	33	28.40	24	0.70	0.39	1.38	166	-50		1010	0.07
ZG365	66.00	68.00	3985963	-5	0.84	6	33	29.80	27	0.62	0.39	1.23	170	82		1240	0.07
ZG365	68.00	70.00	3985964	-5	0.93	8	37	29.40	25	0.79	0.45	1.97	245	-50		452	0.09
ZG365	70.00	72.10	3985965	-5	1.21	6	50	26.80	24	1.26	0.55	2.77	403	-50		1460	0.11
ZG365	72.10	74.40	3985966	-5	2.05	6	76	19.10	20	2.54	0.95	5.33	990	-50		1310	0.08
ZG365	74.40	76.10	3985967	-5	2.10	5	74	22.90	28	2.03	0.89	3.26	821	222		2760	0.06
ZG365	76.10	77.10	3985968	-5	0.69	2	24	24.60	24	1.97	0.29	4.50	928	-50		2500	0.10
ZG365	77.10	79.10	3985969	-5	1.63	2	55	20.40	21	2.70	0.70	5.37	1240	62	0.30	9410	0.09
ZG365	79.10	81.60	3985970	-5	1.76	-1	63	24.50	24	1.94	0.79	1.76	1400	63	0.14	11500	0.06
ZG365	81.60	82.30															
ZG365	82.30	84.20	3985971	-5	2.44	30	89	2.81	16	15.90	1.01	1.56	23400	756	0.55	104600	1.36
ZG365	84.20	86.00	3985972	-5	4.98	16	201	0.45	25	9.41	2.23	0.50	28400	2260	1.50	62000	1.30
ZG365	86.00	88.00	3985973	-5	6.17	46	227	0.11	176	9.97	2.72	0.43	38000	1080	1.60	26200	0.70
ZG365	88.00	90.00	3985974	16	7.95	160	283	0.04	286	20.00	3.01	0.41	864	3290	0.53	5500	0.13
ZG365	90.00	92.00	3985975	6	5.11	250	161	0.02	206	35.00	1.74	0.24	3120	4960	0.04	14000	0.23
ZG365	92.00	95.00	3985976	-5	13.30	40	394	0.03	60	13.00	4.71	0.69	807	2060		3010	0.13
ZG365	95.00	98.00	3985977	-5	7.49	33	265	0.03	60	11.40	2.56	0.39	1130	1470		2670	0.09
ZG365	98.00	101.00	3985978	-5	6.70	23	240	0.04	31	5.27	2.38	0.33	478	472		968	0.07
ZG365	101.00	104.00	3985979	-5	7.02	17	268	0.02	29	4.89	2.76	0.35	617	226		952	0.06

303111

Appendix 4: Diamond drill hole logs and geochemistry.

HOLE	DFROM	DTO	SAMPNO	DPO	BMRLITH	FIELDID	TEXTURE	ALT/MIN	COLOUR	COMMENTS
ZG365	104.00	106.00	3985980	77213	Om	Sss	FeVu		YW	Limonite stained vuggy sst
ZG365	106.00	109.00	3985981	77213	Om	SssCcy	lbFe		OKW	Interbedded sst and clay
ZG365	109.00	112.00	3985982	77213	Om	SssCcy	lbFe		OKW	Interbedded sst and clay
ZG365	112.00	113.00	3985983	77213	Om	Mq	Ma			

303112

Appendix 4: Diamond drill hole logs and geochemistry.

HOLE	DFROM	DTO	SAMPNO	Ag	Al%	As	Ba	Ca%	Cu	Fe%	K%	Mg%	Mn	Pb	S%	Zn	magsus x10-3
ZG365	104.00	106.00	3985980	-5	2.22	7	81	0.03	17	2.54	0.77	0.09	152	83		383	0.07
ZG365	108.00	109.00	3985981	-5	3.82	14	122	0.01	13	2.90	1.29	0.14	29	69		76	0.05
ZG365	109.00	112.00	3985982	-5	6.23	15	194	0.01	16	2.64	2.31	0.24	25	312		43	0.06
ZG365	112.00	113.00	3985983	-5	3.04	6	96	0.02	12	3.60	1.18	0.13	41	226		153	0.04

303113

303114

CRA EXPLORATION PTY. LIMITED  
DRILL-HOLE SUMMARY LOG

EL NAME: ZEEHAN 4 HOLE NAME: DD93 ZG 359  
 EL NUMBER: EL38/89 PROSPECT: GRIEVES  
 DATE DRILLED: Dec 1993  
 LOGGED BY: RGP

AMG EAST: \_\_\_\_\_ GRID EAST: 61269  
 AMG NORTH: \_\_\_\_\_ GRID NORTH: 47805  
 RL: \_\_\_\_\_ TOTAL DEPTH: 79.0m

DEPTH	AZIM. ( <del>MAG</del> )	INCLIN.
0	143° AMG	-45
79m	148°	-44

**OBJECTIVES OF HOLE:**

To test for primary stratabound Zn mineralisation at 1st - sst contact.

**LITHOLOGICAL SUMMARY:**

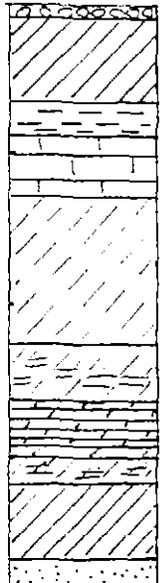
DFROM	DTO	COMMENTS
0	13.0	PRECOLLAR (CLAYS?)
13.0	17.6	SHALE
17.6	25.5	LIME MUDSTONE
25.5	45.0	CARBONACEOUS DECOMPOSED CARBONATE
45.0	52.75	WEAKLY ANKERITE ALTERED CARBONACEOUS UNIT
52.75	59.9	ANKERITE ALTERED CARBONATE
59.9	63.5	ANKERITE ALTERED CARBONATE AND CLAY
63.5	73.5	CLAY
73.5	79.0	MOINA SANDSTONE

**MINERALISATION SUMMARY:**

DFROM	DTO	COMMENTS
52.75	63.5	10.75m @ 4.0% Zn (incl 3.6m @ 9.1% Zn)

**CONCLUSIONS:**

Long-hand log in CRAE 19635



EOH 19.0

303110

CRA EXPLORATION PTY. LIMITED  
DRILL-HOLE SUMMARY LOG

EL NAME: ZEEHAN 4 HOLE NAME: DD93 ZG 360  
 EL NUMBER: EL38/89 PROSPECT: GRIEVES  
 DATE DRILLED: DEC 1993  
 LOGGED BY: RGP

AMG EAST: \_\_\_\_\_ GRID EAST: 61268E  
 AMG NORTH: \_\_\_\_\_ GRID NORTH: 47805N  
 RL: \_\_\_\_\_ TOTAL DEPTH: 85.3m

DEPTH	AZIM. ( <del>MAG</del> )	INCLIN.
0	143° AMG	-70°
85m	144°	-72.5°

**OBJECTIVES OF HOLE:**

To test primary - supergene secondary Zn mineralisation at the 1st-ssst contact.

**LITHOLOGICAL SUMMARY:**

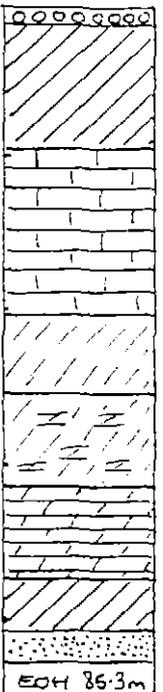
DFROM	DTO	COMMENTS
0	19.1	PRECOLLAR - GRAVEL - CLAY
19.1	41.0	LIME MUDSTONE
41.0	51.0	CARBONACEOUS DECOMPOSED UNIT
51.0	62.7	DITO + WEAKLY ANKERITE ALTERED CARBONATE
62.7	74.75	ANKERITE ALTERED CARBONATE
74.75	81.6	CLAY
81.6	85.3	MOINA SANDSTONE

**MINERALISATION SUMMARY:**

DFROM	DTO	COMMENTS
71.1	74.75	3.65 m @ 2.27% Zn

**CONCLUSIONS:**

Long log CRAE 19635



303116

CRA EXPLORATION PTY. LIMITED  
DRILL-HOLE SUMMARY LOG

EL NAME: ZEEHAN 4 HOLE NAME: DD94 Z4 361  
 EL NUMBER: EL 38/89 PROSPECT: GRIEVES  
 DATE DRILLED: JAN 94  
 LOGGED BY: L.T.V

AMG EAST: \_\_\_\_\_ GRID EAST: 61253  
 AMG NORTH: \_\_\_\_\_ GRID NORTH: 47914  
 RL: \_\_\_\_\_ TOTAL DEPTH: 79.0m

DEPTH	AZIM. (MAG)	INCLIN.
0	130	-45°
50	131	-45°
79	132	-44°

**OBJECTIVES OF HOLE:**

TO TEST FOR PRIMARY STRATHBOUND MINERALISATION AT BASE OF  
 GORDON LIMESTONE ADJACENT TO GRIEVES FAULT.

**LITHOLOGICAL SUMMARY:**

DFROM	DTO	COMMENTS
16	23.0	LIME MUDSTONE - SILTSTONE
23.0	28.5	LIME MUDSTONE
28.5	36.0	LIME SILTSTONE - FINE GR. CALCARENITE
36.0	39.8	HEMATITIC - DOLOMITIC CARBONATE
39.8	42.7	OOLITIC CARBONATE
42.7	43.1	CARBONATE BRECCIA
43.1	48.6	OOLITIC CALCARENITE
48.6	52.0	UNCONSOLIDATED SAND
52.0	55.0	ANKERITIC SULPHIDIC CLAY
55.0	63.0	SANDY SULPHIDIC CLAY
63.0	74.0	INTERBEDDED CLAY - SANDSTONE
74.0	79.0	MOINA SANDSTONE

**MINERALISATION SUMMARY:**

DFROM	DTO	COMMENTS
46.4	54.5	8.1m @ 2.36% Zn
78.6	85.4	6.8m @ 2.02% Zn

**CONCLUSIONS:**

Long log in CRAE 19635

303117

CRA EXPLORATION PTY. LIMITED  
DRILL-HOLE SUMMARY LOG

EL NAME: ZEEHAN 4 HOLE NAME: DD94 ZG362  
 EL NUMBER: EL 38/39 PROSPECT: GRIEVES  
 DATE DRILLED: JAN 1994  
 LOGGED BY: T.C. MOODY

AMG EAST: \_\_\_\_\_ GRID EAST: \_\_\_\_\_  
 AMG NORTH: \_\_\_\_\_ GRID NORTH: \_\_\_\_\_  
 RL: \_\_\_\_\_ TOTAL DEPTH: 99.2

DEPTH	AZIM. (MAG)	INCLIN.
0	142 AMG.	-60
50	144	-62
98	142	-63

OBJECTIVES OF HOLE:

LITHOLOGICAL SUMMARY:

DFROM	DTO	COMMENTS
0	15	NOT RECOVERED/CORED. GORDON LIMESTONE
15	26	CALCAREOUS CLAY & CALC-LUTITE-SILTITE.
26	43.2	DOLOMITIC CLAY, LUTITE-SILTITE
43.2	54.0	GRITTY CLAY & RECRYSTALLISED ? ANKERITIC GRANSTONE.
54.0	80.0	ANKERITIC-(DOLITIC) ALTERED LIMESTONE.
80.0	88.0	CLAY;
88	97.9	SANDY CLAY (MOINA SANDSTONE TRANSITION)
97.9	99.2	MOINA SANDSTONE.

MINERALISATION SUMMARY:

DFROM	DTO	COMMENTS
30	43.2	MOSTLY DECOMPOSED LIMESTONE LOCALLY CONTAINING UP TO 50% PYRITE. STRONGLY ALTERED - SPONGY SIDERITIC SULPHIDIC; LOCALLY PEPPERED WITH 2" FINE WHITE SMITHSONITE/CERRUSITE?
43.2	54.0	LOCALLY ANKERITIC ALTERED - DECOMPOSED LB.
54.0	80.0	STRONGLY ANKERITE REPLACED/ALTD. OOLITIC LS.
80.0	83.0	SULPHIDIC - ? SIDERITIC STR. DECOMPOSED ALTD L.S. ? MINERALIZED.

CONCLUSIONS:

18.1 - 54.0 m    35.9 m @ 2.83% Zn  
 78.4 - 86.0 m    7.6 m @ 3.56% Zn

Long hand log in CRAE 19635

CRA EXPLORATION PTY. LIMITED  
DRILL-HOLE SUMMARY LOG

EL NAME: \_\_\_\_\_ HOLE NAME: DP4 ZG363  
 EL NUMBER: EL38/89 PROSPECT: GRIEVES  
 DATE DRILLED: FEB '94  
 LOGGED BY: RGP

AMG EAST: \_\_\_\_\_ GRID EAST: 61258  
 AMG NORTH: \_\_\_\_\_ GRID NORTH: 48008  
 RL: \_\_\_\_\_ TOTAL DEPTH: 129.6

DEPTH	AZIM. ( <del>MAP</del> ) AMG	INCLIN.
0	-	-90°
65m	042	-89°
129.6m	040	-87°

**OBJECTIVES OF HOLE:**

To test for stratoband mineralisation at limestone-Moina Sandstone contact above intersection in ZG107.

**LITHOLOGICAL SUMMARY:**

DFROM	DTO	COMMENTS
0	24	GRAVEL + CLAYS (PRECOLLAR)
24.0	33.3	WEATHERED LIMESTONE + CLAY
33.3	45.4	WEAKLY ANKERITE ALTERED LIME MUDSTONE
45.4	81.3	TOTALLY ANKERITE ALTERED CARBONATE, + CARBONACEOUS CLAY
81.3	89.85	CARBONACEOUS CLAYS
89.85	98.6	COLOURED CLAYS
98.6	124.9	GREY CLAYS
124.9	129.6	MOINA SANDSTONE

**MINERALISATION SUMMARY:**

DFROM	DTO	COMMENTS
41.3	-	-
41.3	101.0	59.7m @ 4.04% Zn (1% Zn cut-off grade)
incl 65.0	89.85	24.85m @ 6.94% Zn (3% Zn cut-off grade)

**CONCLUSIONS:**

Long-hand log in CRAE 19635.

303119

CRA EXPLORATION PTY. LIMITED  
DRILL-HOLE SUMMARY LOG

EL NAME: \_\_\_\_\_ HOLE NAME: ZG364  
 EL NUMBER: \_\_\_\_\_ PROSPECT: GRIEVES  
 DATE DRILLED: 2/94.  
 LOGGED BY: T.C. MOODY

AMG EAST: \_\_\_\_\_ GRID EAST: \_\_\_\_\_  
 AMG NORTH: \_\_\_\_\_ GRID NORTH: \_\_\_\_\_  
 RL: \_\_\_\_\_ TOTAL DEPTH: 88.5m

DEPTH	AZIM. (MAG)	INCLIN.
43m	135°	-44°
88	136	-45

## OBJECTIVES OF HOLE:

## LITHOLOGICAL SUMMARY:

DFROM	DTO	COMMENTS
6.3	7.35	DOLITIC GRAINSTONE.
7.35	16.7	PELLOIDAL/IRREG. BANDED MICRITE/LUTITE & CALC SILTITE (CARBONACEOUS)
16.7	25	MASSIVE CALC-LUTITE
25	25.6	BANDED/NOODULAR CALC-LUTITE-SILTITE
25.6	46.8	CALC-SILTITE - STYLOLITIC CALC-SILTITE (LOCALLY DOLOMITIC).
46.8	52.7	DOLITIC GRAINSTONE & CALC-LUTITE-SILTITE.
52.7	56.5	WISPY BANDED CALC-SILTITE - (WEAKLY ALTERED & VEINED)
56.5	65.7	BLACK MINERALISED PUG & ALTERED LIMESTONE.
65.7	88.5	MOINA SANDSTONE & CLAY (WEATHERED/OXIDISED AT TOP).

## MINERALISATION SUMMARY:

DFROM	DTO	COMMENTS
16.7	27	LOCAL ZONES OF STRONG FRACTURING WITH IRON-CARBONATE VEINING & BROWN KERGENOUS CLAY.
34	46	LOCAL PUG ZONES; WEAKLY SULPHIDIC/SIDERITIC + WEAKLY ANKERITE ALTERED LIMESTONE.
51	56.5	WEAK-MODERATELY ALTERED (ANKERITE) + SADDLE DOLOMITE VEINED, WITH SIDERITE ALTERATION/VEINING COMMENCING FROM 55.8m.
56.5	65.7	SULPHIDIC/SIDERITIC CARBONACEOUS PUG + STRONGLY SIDERITE-ANKERITE ALTERED L/ST. DISSEM SPA; C/SX SPA FROM 64-64.1m.

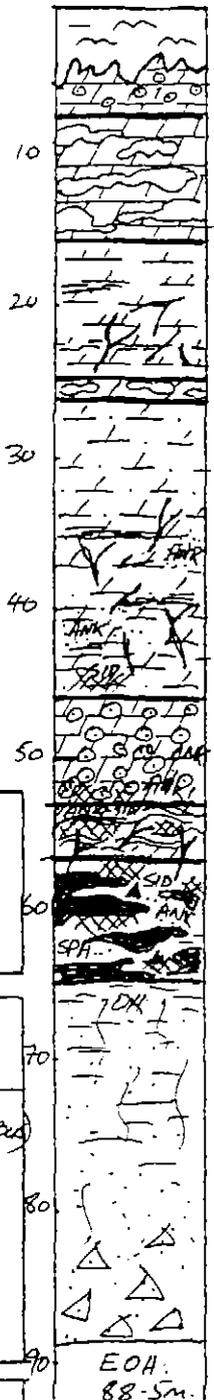
## CONCLUSIONS:

THE DRILL HOLE INTERSECTED ~9.2m OF MINERALIZED & STRONGLY ALTERED LIMESTONE NEAR THE BASE OF THE GORDON LIMESTONE. ADDITIONAL ZONES OF ALTERED LIMESTONE OCCUR WITHIN THE OVERLYING LIMESTONES.

6.3 - 65.7m GORDON LIMESTONE.

65.7 - 88.5m MOINA SANDSTONE.

54.0 - 65.2m = 11.2m @ 3.5% Zn.



EOH:  
88.5m.

DRILL CORE LOG

TENEMENT NAME No.

CO-ORDINATES..... AZIMUTH 142° AMG. 130° MAG. DRILLERS..... COMMENCED..... DEPTH 88.5 m HOLE No. DD94 ZG 364  
 RL COLLAR..... INCLINATION 45° DRILL TYPE..... COMPLETED 16:2:94 CASING LEFT..... DPO No(s).....

PLAN -- MAP REFERENCE.....

DEPTH n	To (M)	Core Rec. IM	Core Size	RA Graphitic Log	CORE DESCRIPTION	SPECIAL FEATURES Weather, Alteration, Fracturing, Veining, Mineralization	Sample No.	From (M)	To (M)	Rec (M)	ASSAY VALUES (Analysed by)						
											FR	TO	REC	RQ			
	6.30				NOT RECOVERED.												
30	7.35	1.05	HQ	4F	OOOLITIC GRAINSTONE. - GORDON LIMESTONE. Grey, fine-med. g., Calcareous; 10cm band/bed of bioclasts/ Shell fragments (6.7-6.8m).	Minor white dolomite-calcite Veins.	3985901	6.3	7.3								
5	11.6	3.1	HQ	4FX	PELOIDAL MICRITE/CALC SILTITE. Irregular bands/peloids of grey limestone intermixed with dark grey carbonaceous calc-dol siltite.	Mod. veined (calcite + Fe Carb); Calcite vein + Pug 9.65-9.8m; larger veins to C.A. 30°.	902 903	7.3 9.0	9.0 11.0								
6	12.8	1.2	HQ	4	CALC-LUTITE. Grey, stylolitic; minor brachiopod shells (replaced by white calcite) Grades down hole to massive light grey lutite (12-12.8m).	Minor white calcite veins - 30°-C.A.; 5°-C.A. 85°. Coarse Ank. vein 12.5-12.6m.	904										
8	12.9	0.1	HQ	5	CARBONATE VEIN + CLAY White calcite vein + light brown clay grit with angular debris of calcite and calc-siltite.												
9	16.65	3.75	HQ	3F	CALC-LUTITE & CALC-DOL LUTITE Irregular discontinuous bands of light grey calc-lutite and grey-dark grey variably calcareous siltite. Minor stylolite; trace calcite replaced shell fossils and burrows. Grades to carbonaceous calc-siltite.	Mod-minor irregular white calcite veins; minor shearing along stylolites; slickenside bound calcite vein at 15.8m 30°-C.A. (has thrust sense of movement.)											
65	16.70	0.05	HQ	5	CALCITE VEIN. Irregular - bounded by stylolites; // to 5°.												
70	25.0	8.3	HQ	34X	MASSIVE CALC-LUTITE. Light grey, top 30cm laminated (algal- lamination?); weakly bioturbated white calcite filling burrows. Becomes micritic & locally clayey (at all. near base)	Local broken/st. fractured zones with Fe-Carb vein + brown org. clay (16.65-17.9, 20.4-21.75, 23.1-25m).											



CRA EXPLORATION PTY. LIMITED  
DRILL-HOLE SUMMARY LOG

EL NAME: \_\_\_\_\_ HOLE NAME: DD94 ZG 365  
 EL NUMBER: FEB 1994 PROSPECT: GRIEVES  
 DATE DRILLED: \_\_\_\_\_  
 LOGGED BY: LTV

AMG EAST: \_\_\_\_\_ GRID EAST: 61089 E  
 AMG NORTH: \_\_\_\_\_ GRID NORTH: 48200 N  
 RL: \_\_\_\_\_ TOTAL DEPTH: 113.00

DEPTH	AZIM. ( <del>MAG</del> ) AMG	INCLIN.
0	143	-75
56	146	-74.5
113	144	-75

OBJECTIVES OF HOLE:

LITHOLOGICAL SUMMARY:

DFROM	DTO	COMMENTS
0	6.1	PEAT, CLAYS + GRAVEL
6.1	72.0	LIMESTONE
72.0	82.3	SIDERITE ZONE?
82.3	87.0	CARBONACEOUS? CLAYS
87.0	104.0	COLOURED CLAYS
104.0	112.0	MOINA SS TRANSITION
112.0	113.0	MOINA SST.

MINERALISATION SUMMARY:

DFROM	DTO	COMMENTS
79.1	88.0	8.9 m @ 4.5% Zn.

CONCLUSIONS:



DRILL CORE LOG

TENEMENT NAME..... No.....

PLAN - MAP REFERENCE.....

CO-ORDINATES..... AZIMUTH..... DRILLERS..... COMMENCED..... DEPTH..... HOLE No. **ZG 365**

RL COLLAR..... INCLINATION..... DRILL TYPE..... COMPLETED..... CASING LEFT..... DPO No(s).....

DEPTH m	To (M)	Core Rec. (M)	Core Size	Graphic Log	CORE DESCRIPTION	SPECIAL FEATURES Weath, Alteration, Fracturing, Veining, Mineralization	Sample No.	From (M)	To (M)	Rec (M)	ASSAY VALUES (Analysed by.....)				
											Zn (%)	FROM (m)	TO (m)	REC (m)	STR. LOGS
0	72.0				<u>LIME MUDSTONE (CALCITULITE)</u>		373, 363	68.0	68.0	2.0		55.5	50.0	0.4	4
					MEDIUM GREY - DARK GREY "WISPY" LIME MUD-		364		70.0	1.8			56.8	0.8	4
					STONE. WEAK, PERVASIVE CALCITE ALTERATION		365		72.1	2.1			57.0	0.2	4
					DEFINED BY THREEDLIKE CALCITE VEINS AND WHITE		366		74.4	2.2			57.1	0.1	4
					CALCITE FLOCKS.		361		76.1	1.6			58.4	1.5	2
							368		77.1	1.0			60.5	1.8	2
0	82.3				<u>ANKERITE ALTERED BRECCIATED LIME MUDSTONE</u>		369		77.1	1.7	0.94		61.5	1.0	2
					YELLOW (GREEN TO GREY), MODERATE TO STRONG PATCHY		370		81.6	1.9	1.15		64.1	2.7	2
					ANKERITE ALTERED, BRECCIATED (IFRACTURED) LIME MUDSTONE.		370		82.3	0.0	-		65.7	1.7	2
					EFFERVESCES IN DIL. HCl ANKERITE ALTERATION INCREASES		371		84.2	1.4	10.46		67.2	1.5	2
					TOWARD BOTTOM OF INTERVAL, EVENTUALLY GRADING INTO		372		86.0	1.6	6.20		69.2	2.0	2
					GN-GY CLAY. THIN (2-3mm) CALCITE VEINS CONTAINED		373	86.0	88.0	2.0	2.60		72.1	1.8	2
					10 CLASTS INDICATE BRECCIATION POST-DATED VEINING								72.5	0.7	3S
					GRAPHITIC POLISHED SURFACES / SHEARS PRESENT								73.3	0.8	3SX
					THROUGHOUT INTERVAL. DISSEMINATED, VERY FINE								74.4	1.0	3SX
					GRAINED SPHALERITE VISIBLE IN ANKERITE-ALTERED								74.8	0.4	3X
					ZONES (1-2%) 81.6 - - 82.3 : CORE LOSS.								76.1	1.4	3X
													77.1	1.0	3X
.3	85.0				<u>PATCHY, MODERATELY ANKERITIC CLAY</u>								77.1	1.3	3X
					YELLOW-GREEN CLAY, RANGING TO GREY/DARK GREY CLAY.								80.0	0.2	5X
					APPEARS TO BE A STRONGLY WEATHERED EXPRESSION OF								81.6	1.0	5X
					PREVIOUS BRECCIATED UNIT. [TOP INTERVAL: GREEN CLAY,								82.3	0.0	5X
					BOTTOM INTERVAL: YELLOW CLAY.]								83.8	1.1	5X
													84.2	0.4	5
0	87.0				<u>PATCHY, WEAKLY ANKERITIC CLAY</u>								86.0	1.0	5
					DARK GREY - YELLOW GREY ANKERITIC CLAY. 20cm								88.1	2.7	5
					WIDE ZONE OF GRAVELLY SAND EMBEDDED WITHIN								91.2	2.3	5
					CLAY AT BASE OF INTERVAL.								92.0	0.7	5
													92.2	0.2	5
													95.8	0.8	5
													96.7	0.3	5

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DRILL CORE LOG

TENEMENT NAME No.

PLAN - MAP REFERENCE

CO-ORDINATES AZIMUTH DRILLERS COMMENCED DEPTH HOLE No. 26365

RL COLLAR INCLINATION DRILL TYPE COMPLETED CASING LEFT DPO No(s)

DEPTH n 1)	To(M)	Core Rec. (M)	Core Size	Graphic Log	CORE DESCRIPTION	SPECIAL FEATURES Weath. Alteration, Fracturing, Veining, Mineralization	Sample No.	From (M)	To (M)	Rec (M)	ASSAY VALUES (Analysed by)				
											Zn%	FROM (M)	TO (M)	REC (M)	STC (M)
0	104.0				MOTTLED LIMONITIC AND HEMATITIC CLAY		3285074	88.0	90.0	2.0	0.55	90.2	90.0	1.7	5
					MOTTLED, STRONGLY LIMONITIC AND HEMATITIC YELLOW		975		92.0	1.7	1.40	101.0	3.0	5	
					- BROWN CLAY. DOES NOT EFFERVESCE WITH HCL.		976		95.0	3.0		104.0	3.0	5	
					HCL CORRS WELL. TOP OF INTERVAL MORE HEMATITIC		977		98.0	3.0		100.0	2.3	3	
					RMOTTLED (87.0-89.5m). NARROW ZONES OF		978		101.0	3.0		100.0	2.4	3	
					WEATHERED LIMONITIC SANDSTONE (10-15cm) OCCUR		979		104.0	3.0		111.0	3.0	3	
					WITHIN YELLOW CLAY.		980		106.0	2.0		111.0	1.1	3	
							981		107.0	3.0		(E.O.H)			
10	105.9				MOENA SANDSTONE		982		112.0	3.0					
					DENSE YELLOW-WHITE LIMONITE STAINED QUARTZITE		3285083	112.0	113.0	1.0					
					ROUGH, INDURATED.				(E.O.H)						
19	112.0				INTERBEDDED CLAY/SANDSTONE										
					ORANGE PINK-WHITE ZONE OF MIXED HEMATITIC										
					AND SANDY CLAY/SANDSTONE INTERBEDS. REPRESENTING										
					A GRABATIONAL CONTACT WITH THE UNDERLYING										
					CRINOIDIAN SANDSTONE. MINERAL LIMONITE-RICH										
					BANDS OCCUR INTERMITTENTLY (UPPER AND LOWER PORTIONS										
					OF INTERVAL). HEMATITIC LAMINATIONS OCCUR (at 90"										
					TO 1.0m).										
10	113.0				MOENA SANDSTONE										
					LIMONITIC FRACTURES AND ROUGH FAULT-GOUGE										
					BANDS PRESENT (MINOR). COMPETENT, INDURATED										
					QUARTZITE.										
					(E.O.H)										

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APPENDIX 5

Relogged EZ Diamond drill hole logs and geochemistry

Appendix 5: EZ drillhole logs and geochemistry.

APPENDIX 5: Grievess prospect. EZ drillhole logs and geochemistry.										
Includes sections resampled by CRAE										
Long-hand logs of relogged sections included in CRAE Rep 19635										
Hole	DFrom	DTo	Sampno	DPO	MRTLith	FieldID	Texture	Alt/Min	Colour	Comments
ZG1001	0.00	3.00		EZ						No rec
ZG1001	3.00	3.70	58514	EZ	Og	Sls			DG	
ZG1001	3.70	5.50	58515	EZ	Og	Sls			DG	
ZG1001	5.50	8.50	58516	EZ	Og	Sls			DG	
ZG1001	8.50	11.50	58517	EZ	Og	Sls	Vn	Cc	G	
ZG1001	11.50	14.50	58518	EZ	Og	Sls	Vn	Cc	G	
ZG1001	14.50	17.50	58519	EZ	Og	Sls			BG	
ZG1001	17.50	20.50	58520	EZ	Og	Sls			DG	
ZG1001	20.50	24.50	58521	EZ	Og	Sls			DG	
ZG1001	24.50	27.60	58522	EZ	Og	Sls			DG	
ZG1001	27.60	30.70	58523	EZ	Og	Sls			DG	
ZG1001	30.70	33.80	58524	EZ	Og	Sls			DG	
ZG1001	33.80	36.70	58525	EZ	Og	Sls			DG	
ZG1001	36.70	39.80	58526	EZ	Og	Sls			DG	
ZG1001	39.80	42.90	58527	EZ	Og	Sls			LG	
ZG1001	42.90	46.00	58528	EZ	Og	Sls			DG	
ZG1001	46.00	50.50	58529	EZ	Og	Sls	Lm		DG	
ZG1001	50.50	53.50	58530	EZ	Og	Sls	Lm		DG	
ZG1001	53.50	56.50	58531	EZ	Og	Sls	Lm		DG	
ZG1001	56.50	59.50	58532	EZ	Og	Sls			DG	
ZG1001	59.50	62.50	58533	EZ	Og	Sls			DG	
ZG1001	62.50	65.50	58534	EZ	Og	Sls	BxVn	Cc	DG	
ZG1001	65.50	68.50	58535	EZ	Og	Sls	BxVn	Cc	DG	
ZG1001	68.50	71.50	58536	EZ	Og	Sls	BxVn	Cc	DG	
ZG1001	71.50	73.50	58537	EZ	Og	Sls			DG	
ZG1001	73.50	77.50	58538	EZ	Og	SlsObx	BxVn	Cc	G	Fault
ZG1001	77.50	79.40	58539	EZ	Og	SlsObx	BxVn	Cc	G	Fault
ZG1001	79.40	81.40	58540	EZ	Og	SlsObx	BxVn	Cc	G	Fault
ZG1001	81.40	83.80	58541	EZ	Og	SlsSsi	Vn	Cc	G	
ZG1001	83.80	85.70	58542	EZ	Og	SlsCcy	VnDs	CcPy	DG	
ZG1001	85.70	88.80	58543	EZ	Og	Sls	LmVn	Cc	DG	
ZG1001	88.80	91.00	58544	EZ	Og	SlsObx	BxVn	Cc	G	Fault
ZG1001	91.00	93.50	58545	EZ	Og	SlsSsi	Vn	Cc	LG	
ZG1001	93.50	95.50	58546	EZ	Og	Sls	Vn	Cc	DG	
ZG1001	95.50	97.50	58547	EZ	Og	SlsObx	BxVn	Cc	LG	Fault

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Appendix 5: EZ drillhole logs and geochemistry.

Hole	DFrom	DTo	Sampno	Ag ppm	Al%	As ppm	Ba ppm	Ca%	Cu ppm	Fe%	K%	Mg%	Mn ppm	Pb ppm	S%	Zn ppm
ZG1001	0.00	3.00														
ZG1001	3.00	3.70	58514						15	1.80			325	30		45
ZG1001	3.70	5.60	58515						15	0.72			210	35		45
ZG1001	5.50	8.50	58516						10	0.67			150	35		45
ZG1001	8.50	11.50	58517						10	0.55			170	35		55
ZG1001	11.50	14.50	58518						10	0.58			230	35		50
ZG1001	14.50	17.50	58519						10	0.32			90	30		70
ZG1001	17.50	20.50	58520						10	0.48			160	25		50
ZG1001	20.50	24.50	58521						10	0.38			110	30		40
ZG1001	24.50	27.60	58522						10	0.64			155	30		60
ZG1001	27.60	30.70	58523						10	0.46			110	25		70
ZG1001	30.70	33.80	58524						10	0.74			160	35		40
ZG1001	33.80	36.70	58525						10	0.41			100	35		135
ZG1001	36.70	39.80	58526						10	0.53			120	30		45
ZG1001	39.80	42.90	58527						10	0.37			100	30		60
ZG1001	42.90	46.00	58528						10	0.50			105	25		45
ZG1001	46.00	50.50	58529						10	0.42			110	25		35
ZG1001	50.50	53.50	58530						10	0.60			165	25		45
ZG1001	53.50	56.50	58531						10	0.42			105	25		50
ZG1001	56.50	59.50	58532						10	0.37			95	30		45
ZG1001	59.50	62.50	58533						10	0.44			125	30		40
ZG1001	62.50	65.50	58534						10	0.37			100	25		75
ZG1001	65.50	68.50	58535						10	0.70			150	30		55
ZG1001	68.50	71.50	58536						10	0.61			140	30		65
ZG1001	71.50	73.50	58537						10	0.45			125	30		90
ZG1001	73.50	77.50	58538						10	0.40			125	25		75
ZG1001	77.50	79.40	58539						5	0.13			70	30		100
ZG1001	79.40	81.40	58540						10	0.16			125	45		160
ZG1001	81.40	83.80	58541						10	0.22			125	25		90
ZG1001	83.80	85.70	58542						15	1.55			205	50		305
ZG1001	85.70	88.80	58543						10	0.38			125	30		95
ZG1001	88.80	91.00	58544						10	0.48			150	45		75
ZG1001	91.00	93.50	58545						10	0.37			120	45		115
ZG1001	93.50	95.50	58546						10	0.41			145	60		125
ZG1001	95.50	97.50	58547						10	0.25			155	30		65

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Appendix 5: EZ drillhole logs and geochemistry.

Hole	DFrom	DTo	Sampno	DPO	MRTLith	FieldID	Texture	Alt/Min	Colour	Comments
ZG1001	97.50	99.70	58548	EZ	Og	SlsObx	BxVn	Cc	LG	Fault
ZG1001	99.70	103.90	58549	EZ	Og	SlsObx	BxVn	Cc	LG	Fault
ZG1001	103.90	105.10	58550	EZ	Og	Sls			DG	
ZG1001	105.10	107.30	58551	EZ	Og	Sls			DG	
ZG1001	107.30	110.50	58552	EZ	Og	Sls			DG	
ZG1001	110.50	113.50	58553	EZ	Og	SlsObx	BxVn	Cc	LG	Fault
ZG1001	113.50	116.50	58554	EZ	Og	Sls	LmVn	Cc	DGN	
ZG1001	116.50	119.50	58555	EZ	Og	Sls	LmVn	Cc	DGN	
ZG1001	119.50	122.50	58556	EZ	Og	Sls			DGN	
ZG1001	122.50	123.90	58557	EZ	Og	Sls			DGN	
ZG1001	123.90	127.00	58558	EZ	Og	Sls			DGN	
ZG1001	127.00	130.40	58559	EZ	Og	SlsObx	BxVn	Cc	LG	Fault
ZG1001	130.40	133.50	58560	EZ	Og	Sls	Lm		DGN	
ZG1001	133.50	137.60	58561	EZ	Og	Sls	Lm		DGN	
ZG1001	137.60	142.60	58562	EZ	Og	Sls	Lm		DGN	
ZG1001	142.60	145.10	58563	EZ	Og	Sls	Lm		DGN	
ZG1001	145.10	146.90	58564	EZ	Og	Sls	Lm		DGN	
ZG1001	146.90	149.40	58565	EZ	Og	Sls			DGN	

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Appendix 5: EZ drillhole logs and geochemistry.

Hole	DFrom	DTo	Sampno	Ag ppm	Al%	As ppm	Ba ppm	Ca%	Cu ppm	Fe%	K%	Mg%	Mn ppm	Pb ppm	S%	Zn ppm
ZG1001	97.50	99.70	58548						10	0.26			150	40		80
ZG1001	99.70	103.90	58549						10	0.34			140	40		125
ZG1001	103.90	105.10	58550						10	0.41			160	30		75
ZG1001	105.10	107.30	58551						10	0.59			150	25		45
ZG1001	107.30	110.50	58552						10	0.53			135	25		50
ZG1001	110.50	113.50	58553						10	0.78			220	50		70
ZG1001	113.50	116.50	58554						10	0.67			190	80		50
ZG1001	116.50	119.50	58555						10	0.48			155	35		60
ZG1001	119.50	122.50	58556						10	0.66			175	30		40
ZG1001	122.50	123.90	58557						15	0.89			195	25		50
ZG1001	123.90	127.00	58558						10	0.96			220	25		50
ZG1001	127.00	130.40	58559						10	0.43			145	30		90
ZG1001	130.40	133.50	58560						10	0.58			165	30		40
ZG1001	133.50	137.60	58561						10	0.67			180	25		50
ZG1001	137.60	142.60	58562						10	0.49			180	25		80
ZG1001	142.60	145.10	58563						10	0.26			95	25		60
ZG1001	145.10	146.90	58564						10	0.70			250	25		50
ZG1001	146.90	149.40	58565						15	0.68			200	25		50

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Appendix 5: EZ drillhole logs and geochemistry.

Hole	DFrom	DTo	Sampno	DPO	MRTLith	FieldID	Texture	Alt/Min	Colour	Comments
ZG1002	0.00	3.00	61198	EZ						No rec
ZG1002	3.00	6.00	61199	EZ						No rec
ZG1002	6.00	9.00	61200	EZ						No rec
ZG1002	9.00	9.50	58583	EZ	Og	Sls	Lm		LG	
ZG1002	9.50	12.00	58584	EZ	Og	Sls	Lm		LG	
ZG1002	12.00	13.50	58585	EZ	Og	Sls			G	
ZG1002	13.50	15.60	58586	EZ	Og	Sls			G	
ZG1002	15.60	17.40	58587	EZ	Og	Sls			G	
ZG1002	17.40	19.10	58588	EZ	Og	Sls			G	
ZG1002	19.10	21.00	58589	EZ	Og	Sls	Vn	Cc	LG	
ZG1002	21.00	24.00	58590	EZ	Og	Sls	Vn	Cc	LG	
ZG1002	24.00	25.50	58591	EZ	Og	Sls	Vn	Cc	LG	
ZG1002	25.50	28.70	58592	EZ	Og	Sls	Vn	Cc	LG	
ZG1002	28.70	30.60	58593	EZ	Og	Sls			DGN	
ZG1002	30.60	33.80		EZ						Cavity
ZG1002	33.80	36.00	58594	EZ	Og	Sls			G	
ZG1002	36.00	39.00	58595	EZ	Og	Sls	Lm		LG	
ZG1002	39.00	42.00	58596	EZ	Og	Sls	Lm		LG	
ZG1002	42.00	44.50	58597	EZ	Og	Sls	Lm		LG	
ZG1002	44.50	46.20	58598	EZ	Og	Sls			G	
ZG1002	46.20	48.60	58599	EZ	Og	Sls			G	
ZG1002	48.60	51.40	58600	EZ	Og	Sls	Lm		LG	
ZG1002	51.40	54.50	58880	EZ	Og	SlsSsi	Fr		LG	
ZG1002	54.50	57.00	58881	EZ	Og	SlsSsi	Fr		LG	
ZG1002	57.00	59.70	58882	EZ	Og	Sls			G	
ZG1002	59.70	62.10	58883	EZ	Og	Sls	LmFr		LG	
ZG1002	62.10	64.90	58884	EZ	Og	SssSsi				
ZG1002	64.90	68.00	58885	EZ	Og	Sls	Vn	Cc	G	
ZG1002	68.00	71.10	58886	EZ	Og	Sls	Vn	Cc	G	
ZG1002	71.10	74.20	58887	EZ	Og	SlsSsi			G	
ZG1002	74.20	76.80	58888	EZ	Og	Sls	Vn	Cc	G	
ZG1002	76.80	79.90	58889	EZ	Og	SlsSbs	ShFr		DG	Carbonaceous
ZG1002	79.90	82.80	58890	EZ	Og	SlsSbs	ShFr		DG	Carbonaceous
ZG1002	82.80	84.80	58891	EZ	Og	Sls			MGDG	
ZG1002	84.80	87.10	58892	EZ	Og	Sls			MGDG	
ZG1002	87.10	89.80	58893	EZ	Og	Sls			MGDG	
ZG1002	89.80	92.90	58566	EZ	Og	SlsSsi	FrBx		DG	Poor rec
ZG1002	92.90	96.00	58567	EZ	Og	SlsSsi	FrBx		DG	Poor rec
ZG1002	96.00	99.00	58568	EZ	Og	SlsSsi	FrBx		DG	Poor rec

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Appendix 5: EZ drillhole logs and geochemistry.

Hole	DFrom	DTo	Sampno	Ag ppm	Al%	As ppm	Ba ppm	Ca%	Cu ppm	Fe%	K%	Mg%	Mn ppm	Pb ppm	S%	Zn ppm
ZG1002	0.00	3.00	61198	-2					-25	-0.01			-25	-25		-25
ZG1002	3.00	6.00	61199	-2					-25	1.63			25	-25		200
ZG1002	6.00	9.00	61200	-2					-25	3.38			175	-25		300
ZG1002	9.00	9.50	58583	-2					-25	0.39			125	-25		25
ZG1002	9.50	12.00	58584	-2					-25	0.73			175	-25		25
ZG1002	12.00	13.50	58585	-2					-25	0.89			200	-25		25
ZG1002	13.50	15.60	58586	-2					-25	0.50			125	-25		50
ZG1002	15.60	17.40	58587	-2					-25	1.15			125	-25		425
ZG1002	17.40	19.10	58588	-2					-25	0.23			100	-25		75
ZG1002	19.10	21.00	58589	-2					-25	0.17			100	-25		150
ZG1002	21.00	24.00	58590	-2					-25	0.46			150	-25		50
ZG1002	24.00	25.50	58591	-2					-25	0.62			100	-25		25
ZG1002	25.50	28.70	58592	-2					-25	0.69			125	-25		25
ZG1002	28.70	30.60	58593	-2					-25	0.71			125	-25		25
ZG1002	30.60	33.80														
ZG1002	33.80	36.00	58594	-2					-25	0.51			125	-25		25
ZG1002	36.00	39.00	58595	-2					-25	0.56			125	-25		50
ZG1002	39.00	42.00	58596	-2					-25	0.51			125	-25		150
ZG1002	42.00	44.50	58597	-2					-25	0.76			150	-25		325
ZG1002	44.50	46.20	58598	-2					-25	0.30			75	-25		200
ZG1002	46.20	48.60	58599	-2					-25	0.55			125	-25		390
ZG1002	48.60	51.40	58600	-2					-25	0.62			150	-25		300
ZG1002	51.40	54.50	58880	-2					-25	0.24			100	-25		400
ZG1002	54.50	57.00	58881	-2					-25	0.50			100	-25		450
ZG1002	57.00	59.70	58882	-2					-25	1.00			250	-25		1000
ZG1002	59.70	62.10	58883	-2					-25	0.60			150	-25		700
ZG1002	62.10	64.90	58884	-2					-25	0.56			200	-25		575
ZG1002	64.90	68.00	58885	-2					-25	0.67			200	-25		150
ZG1002	68.00	71.10	58886	-2					-25	0.56			200	-25		75
ZG1002	71.10	74.20	58887	-2					-25	0.87			225	-25		100
ZG1002	74.20	76.80	58888	-2					-25	0.69			225	-25		50
ZG1002	76.80	79.90	58889	-2					-25	1.53			425	-25		50
ZG1002	79.90	82.80	58890	-2					-25	0.83			225	-25		100
ZG1002	82.80	84.80	58891	-2					-25	0.98			300	-25		350
ZG1002	84.80	87.10	58892	-2					-25	3.99			1700	-25		325
ZG1002	87.10	89.80	58893	-2					-25	1.48			525	-25		375
ZG1002	89.80	92.90	58566	-2					-25	1.91			750	-25		650
ZG1002	92.90	96.00	58567	-2					-25	2.18			975	-25		900
ZG1002	96.00	99.00	58568	-2					-25	2.11			950	-25		1150

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Appendix 5: EZ drillhole logs and geochemistry.

Hole	DFrom	DTo	Sampno	DPO	MRTLith	FieldID	Texture	Alt/Min	Colour	Comments
ZG1002	99.00	102.00	58569	EZ	Og	SlsSsi	FrBx		DG	Poor rec
ZG1002	102.00	105.00	58570	EZ	Og	SlsSbx	AlLe	Sd	B	Poor rec
ZG1002	105.00	106.40	58571	EZ	Og	SlsSbx	AlLe	Sd	B	Poor rec
ZG1002	106.40	107.40	58572	EZ	Og	Sls	AlLe	Sd	B	Oolitic. Poor rec
ZG1002	107.40	108.40	58573	EZ	Og	Sls	AlLe	Sd	B	Oolitic. Poor rec
ZG1002	108.40	109.40	58574	EZ	Og	Sls	AlLe	Sd	B	Oolitic. Poor rec
ZG1002	109.40	110.00	58575	EZ	Og	Sls	AlLe	Sd	B	Oolitic. Poor rec
ZG1002	110.00	110.20	58576	EZ	Og	Sls	AlLe	Sd	B	Oolitic. Poor rec
ZG1002	110.20	113.20		EZ						Cavity
ZG1002	113.20	117.20	58577	EZ	Og	Sls	Al	Sd	LB	Oolitic. Poor rec
ZG1002	117.20	118.00	58578	EZ	Og	Sls			LB	Oolitic. Poor rec
ZG1002	118.00	118.80	58579	EZ	Og	Sls			LB	Oolitic. Poor rec
ZG1002	118.80	119.40	58580	EZ	Og	Sls			LB	Oolitic. Poor rec
ZG1002	119.40	120.70	58581	EZ	Og	Sls			LB	Oolitic. Poor rec
ZG1002	120.70	122.00	58582	EZ	Og	Sls			LB	Oolitic. Poor rec
ZG1002	122.00	124.00	58896	EZ	Og	Sls			LB	Oolitic. Poor rec
ZG1002	124.00	125.40	58897	EZ	Og	Sls			LB	Oolitic. Poor rec
ZG1002	125.40	126.40	58898	EZ	Og	SsiCcy			DGN	Decomposed
ZG1002	126.40	127.60	58899	EZ	Og	SsiCcy			DGN	Decomposed
ZG1002	127.60	129.00	58900	EZ	Og	SsiCcy			DGN	Decomposed
ZG1002	129.00	132.00	61301	EZ	Og	SsiCcy			DGN	Decomposed
ZG1002	132.00	134.00	61302	EZ	Og	SsiCcy			DGN	Decomposed
ZG1002	134.00	137.00	61303	EZ	Og	SsiCcy			DGN	Decomposed
ZG1002	137.00	137.70	61304	EZ	Om	Sss			LG	
ZG1002	137.70	150.00		EZ	Om	Sss			LG	

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Appendix 5: EZ drillhole logs and geochemistry.

Hole	DFrom	DTo	Sampno	Ag ppm	Al%	As ppm	Ba ppm	Ca%	Cu ppm	Fe%	K%	Mg%	Mn ppm	Pb ppm	S%	Zn ppm
ZG1002	99.00	102.00	58569	-2					-25	4.60			1900	25		1775
ZG1002	102.00	105.00	58570	-2					-25	29.02			11200	25		9700
ZG1002	105.00	106.40	58571	-2					-25	32.98			5700	50		11800
ZG1002	106.40	107.40	58572	-2					-25	20.44			9500	25		23200
ZG1002	107.40	108.40	58573	-2					-25	30.52			15000	25		36700
ZG1002	108.40	109.40	58574	-2					-25	29.86			14800	25		33300
ZG1002	109.40	110.00	58575	-2					-25	32.88			15800	50		36900
ZG1002	110.00	110.20	58576	-2					-25	20.20			9500	100		25900
ZG1002	110.20	113.20														
ZG1002	113.20	117.20	58577	-2					-25	3.74			1525	350		220
ZG1002	117.20	118.00	58578	-2					-25	1.01			675	100		1400
ZG1002	118.00	118.80	58579	-2					-25	0.75			525	150		975
ZG1002	118.80	119.40	58580	-2					-25	0.84			550	75		650
ZG1002	119.40	120.70	58581	-2					-25	0.63			450	50		500
ZG1002	120.70	122.00	58582	-2					-25	0.60			425	50		600
ZG1002	122.00	124.00	58896	-2					-25	1.13			675	25		1325
ZG1002	124.00	125.40	58897	-2					-25	2.75			1600	75		6500
ZG1002	125.40	126.40	58898	-2					25	3.06			1000	725		6100
ZG1002	126.40	127.60	58899	-2					25	1.00			25	150		1700
ZG1002	127.60	129.00	58900	-2					25	1.19			25	125		1300
ZG1002	129.00	132.00	61301	-2					-25	1.36			25	25		650
ZG1002	132.00	134.00	61302	-2					25	1.43			25	-25		475
ZG1002	134.00	137.00	61303	-2					75	1.28			25	-25		500
ZG1002	137.00	137.70	61304	-2					-25	0.17			25	50		25
ZG1002	137.70	150.00														

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Appendix 5: EZ drillhole logs and geochemistry.

Hole	DFrom	DTo	Sampno	DPO	MRTLith	FieldID	Texture	Alt/Min	Colour	Comments
ZG1007	0.00	66.00		EZ	Sc	Sss				No rec.
ZG1007	66.00	69.00	61922	EZ	Sc	Ccy			LYW	clay after siltstone?
ZG1007	69.30	73.30	61923	EZ	Sc	Ccy			LYW	clay after siltstone?
ZG1007	73.30	76.80	61924	EZ	Sc	Ccy			LYW	clay after siltstone?
ZG1007	76.80	81.60	61925	EZ	Og	Ccy	Ds	Py	DGN	Carbonaceous clay
ZG1007	81.60	85.20	61926	EZ	Og	Ccy	Ds	Py	DGN	Carbonaceous clay
ZG1007	85.20	89.70	61927	EZ	Og	Sdl			DG	
ZG1007	89.70	92.60	61928	EZ	Og	Sdl			DG	
ZG1007	92.60	96.50	61929	EZ	Og	Sdl			DG	
ZG1007	96.50	98.90	61930	EZ	Og	Sdl			DG	
ZG1007	98.90	101.20	61931	EZ	Og	Sdl			G	
ZG1007	101.20	105.50	61932	EZ	Og	Sdl			G	
ZG1007	105.50	110.50	61933	EZ	Og	Sdl			G	
ZG1007	110.50	115.00	61934	EZ	Og	Sdl			G	
ZG1007	115.00	118.80	61935	EZ	Og	Sdl			G	
ZG1007	118.80	121.50	61936	EZ	Og	Sdl	Fr		G	
ZG1007	121.50	125.00	61937	EZ	Og	Sdl	FrDs	Py	G	
ZG1007	125.00	128.60	61938	EZ	Og	Sdl	FrDs	Py	G	
ZG1007	128.60	133.90	61939	EZ	Og	Sdl			G	
ZG1007	133.90	136.50	61940	EZ	Og	Sbx				Debris Flow.
ZG1007	136.50	140.50	61941	EZ	Og	Sdl			G	
ZG1007	140.50	141.90	61942	EZ	Og	Sbx				Solution breccia
ZG1007	141.90	143.00	61943	EZ	Og	Sdl			DG	
ZG1007	143.00	145.70	61944	EZ	Og	Sdl			DG	
ZG1007	145.70	149.00	61945	EZ	Og	Sdl			DG	
ZG1007	149.00	152.00		EZ						No rec.
ZG1007	152.00	155.70	61946	EZ	Og	Sdl	Lm		G	
ZG1007	155.70	158.80	61947	EZ	Og	Sdl			G	
ZG1007	158.80	164.00	61948	EZ	Og	Sdl			G	
ZG1007	164.00	168.00	61949	EZ	Og	Sdl	Vn	Cc	G	
ZG1007	168.00	170.60	61950	EZ	Og	Sdl	Vn	Cc	G	
ZG1007	170.00	174.00	61951	EZ	Og	Sdl	Vn	Cc	G	
ZG1007	174.00	178.00	61952	EZ	Og	Sdl	Le		G	
ZG1007	178.00	180.40	61953	EZ	Og	Sdl	Vn	Cc	G	
ZG1007	180.40	186.00	61954	EZ	Og	Sdl	Vn	Cc	G	
ZG1007	186.00	189.20	61955	EZ	Og	Sdl	Vn	Cc	G	
ZG1007	189.20	194.00	61956	EZ	Og	Sdl	Vn	Cc	G	
ZG1007	194.00	197.60	61957	EZ	Og	Sdl	Vn	Cc	G	
ZG1007	197.60	203.00	61958	EZ	Og	Sdl	Vn	Cc	G	

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Appendix 5: EZ drillhole logs and geochemistry.

Hole	DFrom	DTo	Sampno	Ag ppm	Al%	As ppm	Ba ppm	Ca%	Cu ppm	Fe%	K%	Mg%	Mn ppm	Pb ppm	S%	Zn ppm
ZG1007	0.00	66.00														
ZG1007	66.00	69.00	61922						25	0.25			10	260		65
ZG1007	69.30	73.30	61923						15	0.33			15	150		30
ZG1007	73.30	76.80	61924						85	1.97			10	35		45
ZG1007	76.80	81.60	61925						70	4.12			35	750		800
ZG1007	81.60	85.20	61926						105	6.67			35	3400		3695
ZG1007	85.20	89.70	61927						5	1.17			210	65		55
ZG1007	89.70	92.60	61928						5	1.07			190	460		165
ZG1007	92.60	96.50	61929						10	1.17			215	155		100
ZG1007	96.50	98.90	61930						5	1.27			190	160		130
ZG1007	98.90	101.20	61931						10	1.42			230	65		55
ZG1007	101.20	105.50	61932						5	1.12			295	80		50
ZG1007	105.50	110.50	61933						5	1.47			270	195		105
ZG1007	110.50	115.00	61934						10	1.27			230	55		75
ZG1007	115.00	118.80	61935						10	0.76			220	65		55
ZG1007	118.80	121.50	61936						5	1.87			210	75		200
ZG1007	121.50	125.00	61937						10	3.22			225	75		40
ZG1007	125.00	128.60	61938						15	2.77			205	55		70
ZG1007	128.60	133.90	61939						5	1.12			198	50		45
ZG1007	133.90	136.50	61940						15	1.37			245	35		35
ZG1007	136.50	140.50	61941						10	1.32			290	45		24
ZG1007	140.50	141.90	61942						5	0.75			225	40		25
ZG1007	141.90	143.00	61943						5	0.75			220	45		90
ZG1007	143.00	145.70	61944						10	0.75			325	205		275
ZG1007	145.70	149.00	61945						5	0.75			350	155		860
ZG1007	149.00	152.00														
ZG1007	152.00	155.70	61946						20	1.62			505	3150		13400
ZG1007	155.70	158.80	61947						10	1.87			360	955		3395
ZG1007	158.80	164.00	61948						10	1.47			310	570		1795
ZG1007	164.00	168.00	61949						5	0.70			220	315		420
ZG1007	168.00	170.60	61950						5	0.36			170	80		150
ZG1007	170.00	174.00	61951						10	0.54			210	195		190
ZG1007	174.00	178.00	61952						10	1.37			245	100		410
ZG1007	178.00	180.40	61953						65	1.07			210	45		115
ZG1007	180.40	186.00	61954						5	0.55			260	50		120
ZG1007	186.00	189.20	61955						5	0.57			285	270		590
ZG1007	189.20	194.00	61956						5	0.63			270	125		255
ZG1007	194.00	197.60	61957						10	0.51			200	50		60
ZG1007	197.60	203.00	61958						5	0.41			190	60		105

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Appendix 5: EZ drillhole logs and geochemistry.

Hole	DFrom	DTo	Sampno	DPO	MRTLith	FieldID	Texture	Alt/Min	Colour	Comments
ZG1007	203.00	207.20	61959	EZ	Og	Sdl	Vn	Cc	G	
ZG1007	207.20	211.50	61960	EZ	Og	Sdl			G	
ZG1007	211.50	215.80	61961	EZ	Og	Sdl			G	
ZG1007	215.80	219.00	61962	EZ	Og	Sdl	FrLe		DG	
ZG1007	219.00	222.00	61963	EZ	Og	Sdl	FrLe		DG	
ZG1007	222.00	223.60	61964	EZ	Og	Sdl	FrLe			
ZG1007	223.60	225.00	61965	EZ	Og	SlsSsi			G	
ZG1007	225.00	229.00	61966	EZ	Og	Sls			G	Calc-rudite
ZG1007	299.00	233.20	61967	EZ	Og	Sls			G	Calc-rudite
ZG1007	233.20	237.00	61968	EZ	Og	Sls			DG	Calc-rudite
ZG1007	237.00	241.00	61969	EZ	Og	Sls			DG	Calc-rudite
ZG1007	241.00	246.00	61970	EZ	Og	Sls			DG	Calc-rudite
ZG1007	246.00	250.50	61971	EZ	Og	Sls			DG	Calc-rudite
ZG1007	250.50	254.40	61972	EZ	Og	Ssi				Calc-rudite
ZG1007	254.40	260.50		EZ	Og	Sls				Calc-rudite
ZG1007	260.50	262.70		EZ	Og	Sls				Calc-rudite
ZG1007	262.70	265.50		EZ	Og	Ssi	Lm			
ZG1007	265.50	272.00		EZ	Og	SlsSsi			DG	Organic/silty mud with lst nodules
ZG1007	272.00	280.00		DOM	Og	SlsSsi			DG	Organic/silty mud with lst nodules
ZG1007	280.00	284.00	4138101	77675	Og	SlsSsi			DG	Organic/silty mud with lst nodules
ZG1007	284.00	296.50		DOM	Og	SlsSsi			DG	Organic/silty mud with lst nodules
ZG1007	296.50	311.00		DOM	Og	Sdl	VnFr			Dolo-rudite, crackled with cc veinlets
ZG1007	311.00	315.00	4138102	77675	Og	Sdl	VnFr			Dolo-rudite, crackled with cc veinlets
ZG1007	315.00	317.00		DOM	Og	Sdl	VnFr			Dolo-rudite, crackled with cc veinlets
ZG1007	317.00	321.55		DOM	Og	Sls				Calc-rudite
ZG1007	321.55	325.55	4138103	77675	Og	Sls				Calc-rudite
ZG1007	325.55	335.15		DOM	Og	Sls			LG	Bioturbated calc-siltite
ZG1007	335.15	339.15	4138104	77675	Og	Sls			LG	Bioturbated calc-siltite
ZG1007	339.15	347.10		DOM	Og	Sls			LG	Bioturbated calc-siltite
ZG1007	347.10	370.20		DOM	Og	Sls	Bn		AGDG	Banded lime mudstone
ZG1007	370.20	374.15	4138105	77675	Og	Sls	Bn		AGDG	Banded lime mudstone
ZG1007	374.15	391.30		DOM	Og	Sls	Bn		AGDG	Banded lime mudstone
ZG1007	391.30	394.10		DOM	Og	Sls				Mixed zone
ZG1007	394.10	398.10	4138106	77675	Og	Sls				Mixed zone
ZG1007	398.10	403.20		DOM	Og	Sls				Mixed zone
ZG1007	403.20	411.50		DOM	Og	Sls	Ma		DG	Organic-rich lime mudstone
ZG1007	411.50	415.50	4138107	77675	Og	Sls	Ma		DG	Organic-rich lime mudstone
ZG1007	415.50	416.80	4138108	77675	Og	Sls	Ma		DG	Organic-rich lime mudstone
ZG1007	416.80	419.00	4138109	77675	Og	Sls	AIVc	SdDI	CG	Lime mudstone with pervasive sid, vein dol

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Appendix 5: EZ drillhole logs and geochemistry.

Hole	DFrom	DTo	Sampno	Ag ppm	Al%	As ppm	Ba ppm	Ca%	Cu ppm	Fe%	K%	Mg%	Mn ppm	Pb ppm	S%	Zn ppm
ZG1007	203.00	207.20	61959						10	0.66			245	95		215
ZG1007	207.20	211.50	61960						5	0.34			230	85		190
ZG1007	211.50	215.80	61961						5	0.98			215	60		145
ZG1007	215.80	219.00	61962						10	0.57			280	125		295
ZG1007	219.00	222.00	61963						5	0.66			250	45		230
ZG1007	222.00	223.60	61964						5	0.47			135	120		90
ZG1007	223.60	225.00	61965						5	0.30			100	35		40
ZG1007	225.00	229.00	61966						10	0.45			110	30		25
ZG1007	299.00	233.20	61967						10	0.41			100	30		25
ZG1007	233.20	237.00	61968						5	0.39			90	25		10
ZG1007	237.00	241.00	61969						10	1.32			210	35		100
ZG1007	241.00	246.00	61970						5	0.78			210	40		130
ZG1007	246.00	250.50	61971						5	1.22			210	35		105
ZG1007	250.50	254.40	61972						10	1.87			255	30		35
ZG1007	254.40	260.50														
ZG1007	260.50	262.70														
ZG1007	262.70	265.50														
ZG1007	265.50	272.00														
ZG1007	272.00	280.00														
ZG1007	280.00	284.00	4138101	-0.5	8.16	-5	517	9.08	12	3.17	3.88	1.86	343	12		40
ZG1007	284.00	296.50														
ZG1007	296.50	311.00														
ZG1007	311.00	315.00	4138102	-0.5	0.36	-5	15	20.78	-5	1.09	0.10	10.48	413	47		134
ZG1007	315.00	317.00														
ZG1007	317.00	321.55														
ZG1007	321.55	325.55	4138103	-0.5	0.63	-5	37	31.36	-5	0.30	0.34	2.98	44	-10		14
ZG1007	325.55	335.15														
ZG1007	335.15	339.15	4138104	-0.5	0.51	-5	28	30.93	-5	0.32	0.28	2.98	51	12		23
ZG1007	339.15	347.10														
ZG1007	347.10	370.20														
ZG1007	370.20	374.15	4138105	-0.5	1.68	-5	98	28.93	-5	0.81	0.86	1.69	173	21		227
ZG1007	374.15	391.30														
ZG1007	391.30	394.10														
ZG1007	394.10	398.10	4138106	-0.5	0.98	-5	45	28.98	-5	0.60	0.51	3.13	108	29		58
ZG1007	398.10	403.20														
ZG1007	403.20	411.50														
ZG1007	411.50	415.50	4138107	-0.5	2.06	-5	88	24.59	-5	0.84	0.97	2.40	130	40		114
ZG1007	415.50	416.80	4138108	-0.5	0.64	-5	29	34.63	-5	0.71	0.17	0.99	315	960		7324
ZG1007	416.80	419.00	4138109	6.6	0.67	-5	15	24.07	-5	6.34	-0.05	1.64	2896	2151	0.30	51200

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Appendix 5: EZ drillhole logs and geochemistry.

Hole	DFrom	DTo	Sampno	DPO	MRTLith	FieldID	Texture	Alt/Min	Colour	Comments
ZG1007	419.00	422.50	4138110	77675	Og	Sls	Ma		DG	Organic-rich lime mudstone
ZG1007	422.50	425.50	4138111	77675	Og	Sls	Ma		DG	Organic-rich lime mudstone
ZG1007	425.50	428.20	4138112	77675	Og	Sls	AIVc	SdDI	OG	Lime mudstone with pervasive sid, vein dol
ZG1007	428.20	431.50	4138113	77675	Og	Sls	AIVc	SdDI	OG	Lime mudstone with pervasive sid, vein dol
ZG1007	431.50	434.60	4138114	77675	Og	Sls	AIVc	SdDI	OG	Lime mudstone with weak patchy sid, vein dol
ZG1007	434.60	435.20	4138115	77675	Og	Ssh	Sh		R+G	Sheared and oxidized shale
ZG1007	435.20	436.10	4138116	77675	Og	Sls			DG	Carbonaceous lime mud
ZG1007	436.10	439.40	4138117	77675	Og	Sls			DG	Carbonaceous lime mud
ZG1007	439.40	449.90		DOM	Og	Sls			DG	Carbonaceous lime mud
ZG1007	449.90	453.35	4138118	77675	Og	Sls	AIBI		LG+OB	Bleached lst with sideritic spots
ZG1007	453.35	454.80		DOM	Og	Sls	AIBI		LG+OB	Bleached lst with sideritic spots
ZG1007	454.80	479.20		DOM	Og	Sls			DG	Nodular lime mudstone
ZG1007	479.20	482.15	4138119	77675	Og	Sls			DG	Nodular lime mudstone
ZG1007	482.15	503.00		DOM	Og	Sls			DG	Nodular lime mudstone
ZG1007	503.00	517.30		DOM	Og	Sls				Bioclastic calcarenite
ZG1007	517.30	521.30	4138120	77675	Og	Sls				Bioclastic calcarenite
ZG1007	521.30	528.00		DOM	Og	Sls				Bioclastic calcarenite
ZG1007	528.00	532.20	4138121	77675	Og	Sls	VcAI	SdDI		Colloform dol veins, and pervasive red siderite
ZG1007	532.20	536.30		DOM	Og	Sls				Bioclastic calcarenite + wispy carb mud
ZG1007	536.30	539.30	4138122	77675	Og	Sls				Bioclastic calcarenite + wispy carb mud
ZG1007	539.30	540.80		DOM	Og	Sls				Bioclastic calcarenite + wispy carb mud
ZG1007	540.80	542.60		DOM	Og	Sls			DG	Heavily bioturbated lime mudstone
ZG1007	542.60	545.15	4138123	77675	Og	Sls	LeAlFr	Sd	LG	sideritic calcarenite with leached, crackled texture
ZG1007	545.15	551.05		DOM	Og	Sls			DG	Heavily bioturbated lime mudstone
ZG1007	551.05	554.15	4138124	77675	Og	Sls			DG	Heavily bioturbated lime mudstone
ZG1007	554.15	557.10		DOM	Og	Sls			DG	Heavily bioturbated lime mudstone
ZG1007	557.10	560.25		DOM	Og	Sls				Mixed limestone units
ZG1007	560.25	564.30	4138125	77675	Og	Sls				Mixed limestone units
ZG1007	564.30	569.70		DOM	Og	Sls				Mixed limestone units
ZG1007	569.70	575.30		DOM	Og	Sls			LG	birds-eye calcarenite
ZG1007	575.30	578.30	4138126	77675	Og	Sls			LG	birds-eye calcarenite
ZG1007	578.30	581.60		DOM	Og	Sls			LG	birds-eye calcarenite
ZG1007	581.60	586.45		DOM	Og	Sls			LG-G	Calcarenite
ZG1007	586.45	589.60	4138127	77675	Og	Sls	AI	Sd	LG-G	Calcarenite. Patchy moderate siderite altn
ZG1007	589.60	592.80	4138128	77675	Og	Sls	AI	Sd	LG-G	Calcarenite. Patchy moderate siderite altn
ZG1007	592.80	599.30		DOM	Og	Sls				Mixed limestone units
ZG1007	599.30	602.35	4138129	77675	Og	Sls				Mixed limestone units
ZG1007	602.35	605.20		DOM	Og	Sls				Mixed limestone units
ZG1007	605.20	608.25		DOM	Og	Sls	Lm		LG	Calcarenite with algal layers

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Appendix 5: EZ drillhole logs and geochemistry.

Hole	DFrom	DTo	Sampno	Ag ppm	Al%	As ppm	Ba ppm	Ca%	Cu ppm	Fe%	K%	Mg%	Mn ppm	Pb ppm	S%	Zn ppm
ZG1007	419.00	422.50	4138110	-0.5	0.43	-5	21	33.42	-5	0.38	0.11	0.78	188	868		3380
ZG1007	422.50	425.50	4138111	-0.5	2.08	-5	69	28.12	-5	1.95	0.51	2.11	642	919	0.41	11700
ZG1007	425.50	428.20	4138112	1.5	1.67	-5	39	21.76	-5	6.68	0.28	2.89	2563	3379	0.45	52800
ZG1007	428.20	431.50	4138113	2.2	1.01	-5	23	20.30	-5	6.62	0.20	4.56	2581	3113	0.40	54500
ZG1007	431.50	434.60	4138114	-0.5	1.33	-5	51	23.81	5	1.94	0.47	2.87	643	904	0.42	13800
ZG1007	434.60	435.20	4138115	-0.5	10.67	6	474	0.91	42	5.19	2.98	1.28	79	76		465
ZG1007	435.20	436.10	4138116	-0.5	1.17	-5	52	31.74	-5	1.34	0.45	1.36	690	107		224
ZG1007	436.10	439.40	4138117	-0.5	2.50	-5	103	26.69	-5	1.29	0.89	1.61	207	36		113
ZG1007	439.40	449.90														
ZG1007	449.90	453.35	4138118	-0.5	1.01	-5	53	32.10	-5	0.50	0.53	1.26	108	-10		20
ZG1007	453.35	454.80														
ZG1007	454.80	479.20														
ZG1007	479.20	482.15	4138119	-0.5	2.10	-5	99	27.23	-5	0.80	1.02	1.46	125	-10		15
ZG1007	482.15	503.00														
ZG1007	503.00	517.30														
ZG1007	517.30	521.30	4138120	-0.5	1.32	-5	57	36.07	-5	0.49	0.54	0.71	80	-10		14
ZG1007	521.30	528.00														
ZG1007	528.00	532.20	4138121	-0.5	1.35	-5	55	37.73	-5	0.79	0.48	1.44	294	46		90
ZG1007	532.20	536.30														
ZG1007	536.30	539.30	4138122	-0.5	0.33	-5	18	30.47	-5	0.40	0.15	0.51	91	23		66
ZG1007	539.30	540.80														
ZG1007	540.80	542.60														
ZG1007	542.60	545.15	4138123	-0.5	0.68	-5	32	33.49	-5	0.56	0.28	4.16	172	38		140
ZG1007	545.15	551.05														
ZG1007	551.05	554.15	4138124	-0.5	1.82	-5	87	27.82	-5	0.80	0.78	2.96	140	16		25
ZG1007	554.15	557.10														
ZG1007	557.10	560.25														
ZG1007	560.25	564.30	4138125	-0.5	1.04	-5	49	29.95	-5	0.48	0.45	2.60	77	10		24
ZG1007	564.30	569.70														
ZG1007	569.70	575.30														
ZG1007	575.30	578.30	4138126	-0.5	1.22	-5	43	38.47	-5	0.27	0.22	0.78	38	10		13
ZG1007	578.30	581.60														
ZG1007	581.60	586.45														
ZG1007	586.45	589.60	4138127	-0.5	0.49	-5	23	41.08	-5	0.20	0.17	0.74	68	-10		18
ZG1007	589.60	592.80	4138128	-0.5	0.47	-5	20	32.55	-5	0.26	0.16	1.25	59	11		25
ZG1007	592.80	599.30														
ZG1007	599.30	602.35	4138129	-0.5	1.07	-5	45	34.03	-5	0.52	0.38	1.71	114	32		82
ZG1007	602.35	605.20														
ZG1007	605.20	608.25														

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Appendix 5: EZ drillhole logs and geochemistry.

Hole	DFrom	DTo	Sampno	DPO	MRTLith	FieldID	Texture	Alt/Min	Colour	Comments
ZG1007	608.25	611.25	4138130	77675	Og	Sls	Lm		LG	Calcarenite with algal layers
ZG1007	611.25	618.40		DOM	Og	Sls	Lm		LG	Calcarenite with algal layers
ZG1007	618.40	623.00		DOM	Og	Sls				Calcarenite and lime mudstone
ZG1007	623.00	626.20	4138131	77675	Og	Sls				Calcarenite and lime mudstone
ZG1007	626.20	631.40		DOM	Og	Sls				Calcarenite and lime mudstone
ZG1007	631.40	640.80		DOM	Og	Sls				Calcarenite and lime mudstone
ZG1007	640.80	643.65	4138132	77675	Og	Sls				Calcarenite and lime mudstone
ZG1007	643.65	645.80		DOM	Og	Sls				Calcarenite and lime mudstone
ZG1007	645.80	647.10		DOM	Og	Sls	Ma		G	Calcarenite
ZG1007	647.10	649.10	4138133	77675	Og	Sls	Ma		G	Calcarenite
ZG1007	649.10	650.00		DOM	Og	Sls	Ma		G	Calcarenite
ZG1007	650.00	655.45		DOM	Og	Sls	Ma		G	Calcarenite
ZG1007	655.45	657.55	4138134	77675	Og	Sls	Ma		G	Calcarenite
ZG1007	657.55	659.10	4138135	77675	Og	Sls	MaLe		G	Calcarenite. Strongly leached
ZG1007	659.10	664.35	4138136	77675	Og	Sdl	MaAl	Sd		Dolarenite with patchy moderate siderite altn
ZG1007	664.35	669.60	4138137	77675	Og	Sdl	MaAl	Sd		Dolarenite with patchy moderate siderite altn
ZG1007	669.60	673.85	4138138	77675	Og	Sdl	Ma			Dolarenite.
ZG1007	673.85	681.00		DOM	Og	Sdl	Ma			Dolarenite.
ZG1007	681.00	701.40		DOM	Og	Sls				Mixed limestone units
ZG1007	701.40	704.40	4138139	77675	Og	Sls				Mixed limestone units
ZG1007	704.40	705.40		DOM	Og	Sls				Mixed limestone units
ZG1007	705.40	716.20		DOM	Og	Sls	Lm		LG	Calcarenite with algal layers
ZG1007	716.20	719.30	4138140	77675	Og	Sls	Lm		LG	Calcarenite with algal layers
ZG1007	719.30	722.30	4138141	77675	Og	Sls	Al	Sd	LG	Calcarenite, weak pervasive siderite altn
ZG1007	722.30	723.50	4138142	77675	Og	Sdl	AlLeVu	Sd	YG	Strongly siderite altd and leached carbonate
ZG1007	723.50	725.30	4138143	77675	Og	Sdl	Al	Sd	YG	Weakly siderite altd dolarenite
ZG1007	725.30	728.30	4138144	77675	Og	Sdl	Al	Sd	YG	Weakly siderite altd dolarenite
ZG1007	728.30	731.30	4138145	77675	Og	Sdl	Al	Sd	YG	Weakly siderite altd dolarenite
ZG1007	731.30	734.60	4138146	77675	OgOm	SdlSsi	Al?	Sd?	GV	Transition. siltst + dolomite? Sid altered?
ZG1007	734.60	737.30	4138147	77675	Om	Sss	MaVc	DI	LYG	Dolomite veined sst

Appendix 5: EZ drillhole logs and geochemistry.

Hole	DFrom	DTo	Sampno	Ag ppm	Al%	As ppm	Ba ppm	Ca%	Cu ppm	Fe%	K%	Mg%	Mn ppm	Pb ppm	S%	Zn ppm
ZG1007	608.25	611.25	4138130	-0.5	0.65	-5	33	39.52	-5	0.27	0.22	1.43	38	-10		15
ZG1007	611.25	618.40														
ZG1007	618.40	623.00														
ZG1007	623.00	626.20	4138131	-0.5	0.46	-5	23	34.60	-5	0.27	0.21	0.72	65	64		257
ZG1007	626.20	631.40														
ZG1007	631.40	640.80														
ZG1007	640.80	643.65	4138132	-0.5	1.52	-5	54	29.55	-5	0.70	0.53	3.60	224	33		82
ZG1007	643.65	645.80														
ZG1007	645.80	647.10														
ZG1007	647.10	649.10	4138133	-0.5	0.10	-5	9	36.19	-5	0.25	0.06	1.22	78	35		484
ZG1007	649.10	650.00														
ZG1007	650.00	655.45														
ZG1007	655.45	657.55	4138134	-0.5	0.45	-5	17	28.99	-5	0.51	0.09	3.67	178	18		127
ZG1007	657.55	659.10	4138135	-0.5	0.49	-5	23	25.51	-5	3.05	0.23	7.10	1207	75		488
ZG1007	659.10	664.35	4138136	-0.5	0.65	-5	20	20.19	-5	1.62	0.05	10.55	579	68		160
ZG1007	664.35	669.60	4138137	-0.5	0.30	-5	11	20.82	7	0.72	-0.05	11.45	318	68		124
ZG1007	669.60	673.85	4138138	-0.5	0.05	-5	5	21.47	-5	0.61	-0.05	12.02	247	63		400
ZG1007	673.85	681.00														
ZG1007	681.00	701.40														
ZG1007	701.40	704.40	4138139	-0.5	1.10	-5	41	29.18	-5	0.52	0.48	2.21	121	10		45
ZG1007	704.40	705.40														
ZG1007	705.40	716.20														
ZG1007	716.20	719.30	4138140	-0.5	1.49	-5	56	32.17	-5	0.89	0.42	1.07	220	47		105
ZG1007	719.30	722.30	4138141	-0.5	0.99	-5	42	27.18	-5	0.86	0.42	2.09	252	34		117
ZG1007	722.30	723.50	4138142	-0.5	1.68	5	60	15.74	5	3.73	0.63	6.22	1542	1933		8620
ZG1007	723.50	725.30	4138143	0.9	1.90	-5	61	14.63	7	3.77	0.55	5.79	1201	5281	1.05	22500
ZG1007	725.30	728.30	4138144	1.3	1.39	-5	47	16.54	7	4.54	0.43	6.57	1556	4082	0.73	16000
ZG1007	728.30	731.30	4138145	1.4	2.96	-5	107	12.36	15	3.77	1.05	5.71	1406	1394		2998
ZG1007	731.30	734.60	4138146	-0.5	4.33	9	150	11.67	22	3.92	1.82	5.03	1168	90		290
ZG1007	734.60	737.30	4138147	-0.5	1.69	-5	58	9.14	6	3.20	0.69	3.93	1103	26		95

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Appendix 5: EZ drillhole logs and geochemistry.

Hole	DFrom	DTTo	Sampno	DPO	MRTLith	FieldID	Texture	Alt/Min	Colour	Comments
ZG1009	0.00	3.00		EZ						No rec.
ZG1009	3.00	19.50		EZ	Og	Sls				
ZG1009	19.50	22.60	70601	EZ	Og	Sls	Vn	Cc		
ZG1009	22.60	24.70	70602	EZ	Og	Sls	Vn	Cc		
ZG1009	24.70	26.90	70603	EZ	Og	Sls	Fr		G	
ZG1009	26.90	30.00	70604	EZ	Og	Sls	VnBx	Cc	G	Fault?
ZG1009	30.00	32.40	70605	EZ	Og	Sls	VnBx	Cc	G	Fault?
ZG1009	32.40	35.40	70606	EZ	Og	Sls	Lm		AGDG	
ZG1009	35.40	41.00		EZ	Og	Sls			GDG	
ZG1009	41.00	45.00	70607	EZ	Og	Sls	Fr		GDG	
ZG1009	45.00	48.00	70608	EZ	Og	Sls			GDG	
ZG1009	48.00	54.00		EZ	Og	Sls			DG	
ZG1009	54.00	55.40		EZ	Og	SlsSsi	Vn	Cc	GLG	
ZG1009	55.40	58.00		EZ	Og	Sls			GDG	
ZG1009	58.00	60.90	70609	EZ	Og	Sls			GDG	
ZG1009	60.90	64.00	70610	EZ	Og	Sls			GDG	
ZG1009	64.00	67.00	70611	EZ	Og	Sls	Fr		GDG	
ZG1009	67.00	70.00	70612	EZ	Og	Sls			DG	
ZG1009	70.00	73.00	70613	EZ	Og	Sls			DG	
ZG1009	73.00	76.00	70614	EZ	Og	Sls			DG	
ZG1009	76.00	109.00		EZ	Og	Sls			GDG	
ZG1009	109.00	112.30	70615	EZ	Og	Sls			G	
ZG1009	112.30	115.00	70616	EZ	Og	Sls			G	
ZG1009	115.00	118.50	70617	EZ	Og	Sls			G	
ZG1009	118.50	121.00	70618	EZ	Og	Sls	Vn	Cc	G	
ZG1009	121.00	124.00	70619	EZ	Og	Sls	Vn	Cc	G	
ZG1009	124.00	127.20	70620	EZ	Og	Sls			G	
ZG1009	127.20	131.00	70621	EZ	Og	Sls			G	
ZG1009	131.00	151.00		EZ	Og	Sls			G	

Appendix 5: EZ drillhole logs and geochemistry.

Hole	DFrom	DTo	Sampno	Ag ppm	Al%	As ppm	Ba ppm	Ca%	Cu ppm	Fe%	K%	Mg%	Mn ppm	Pb ppm	S%	Zn ppm
ZG1009	0.00	3.00														
ZG1009	3.00	19.50														
ZG1009	19.50	22.60	70601						10	0.52			145	30		95
ZG1009	22.60	24.70	70602						10	1.00			155	30		60
ZG1009	24.70	26.90	70603						10	1.00			200	25		65
ZG1009	26.90	30.00	70604						10	1.00			175	35		100
ZG1009	30.00	32.40	70605						10	0.67			250	30		120
ZG1009	32.40	35.40	70606						10	0.74			240	35		60
ZG1009	35.40	41.00														
ZG1009	41.00	45.00	70607						15	0.71			220	35		80
ZG1009	45.00	48.00	70608						15	0.76			190	25		45
ZG1009	48.00	54.00														
ZG1009	54.00	55.40														
ZG1009	55.40	58.00														
ZG1009	58.00	60.90	70609						10	0.30			75	20		45
ZG1009	60.90	64.00	70610						15	0.55			110	30		35
ZG1009	64.00	67.00	70611						15	0.42			150	20		50
ZG1009	67.00	70.00	70612						10	0.52			1600	20		50
ZG1009	70.00	73.00	70613						15	0.64			600	25		45
ZG1009	73.00	76.00	70614						20	0.51			1000	25		55
ZG1009	76.00	109.00														
ZG1009	109.00	112.30	70615						10	0.50			410	20		
ZG1009	112.30	115.00	70616						10	0.40			135	15		
ZG1009	115.00	118.50	70617						10	0.40			160	20		
ZG1009	118.50	121.00	70618						10	0.58			295	15		
ZG1009	121.00	124.00	70619						15	0.70			430	20		
ZG1009	124.00	127.20	70620						10	0.48			571	20		35
ZG1009	127.20	131.00	70621						10	0.50			470	20		50
ZG1009	131.00	151.00														

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Appendix 5: EZ drillhole logs and geochemistry.

Hole	DFrom	DTo	Sampno	DPO	MRTLith	FieldID	Texture	Alt/Min	Colour	Comments
ZG1010	0.00	16.00		EZ						No rec.
ZG1010	16.00	30.30		EZ	Og	SlsSsi				
ZG1010	30.30	34.50		EZ	Og	Sls				
ZG1010	34.50	37.00		EZ	Og	Sls				
ZG1010	37.00	38.30	3984202	77147	Og	Sls				
ZG1010	38.30	42.00	3984203	77147	Og	Sls				
ZG1010	42.00	44.40	3984204	77147	Og	Sls				
ZG1010	44.40	46.40	3984205	77147	Og	Sls				
ZG1010	46.40	72.10		EZ	Og	SlsSdl			G	
ZG1010	72.10	80.10		EZ	Og	Sls			G	
ZG1010	80.10	86.60		EZ	Og	SlsSdl			DG	
ZG1010	86.60	89.00	70622	EZ	Og	SlsSdl			G	
ZG1010	89.00	92.00	70623	EZ	Og	Sls	Vn	Cc	GDG	
ZG1010	92.00	95.00	70624	EZ	Og	Sls	Vn	Cc	GDG	
ZG1010	95.00	99.00		EZ	Og	Sls			G	
ZG1010	99.00	124.40		EZ	Og	SlsSdl			G	
ZG1010	124.40	133.90		EZ	Og	Sls			DG	
ZG1010	133.90	137.00	70625	EZ	Og	Sls			DG	
ZG1010	137.00	140.80	70626	EZ	Og	SlsSsi	Vn	Cc	GB	
ZG1010	140.80	143.00	70627	EZ	Og	SlsSsi	Vn	Cc	GB	
ZG1010	143.00	148.80		EZ	Og	SlsSsi	Vn	Cc	GB	
ZG1010	148.80	151.00		EZ	Og	Sls			GLG	
ZG1010	151.00	153.60	70628	EZ	Og	Sls			GDG	
ZG1010	153.60	156.70	70629	EZ	Og	Sls			GDG	
ZG1010	156.70	158.00		EZ	Og	Sls			GDG	
ZG1010	158.00	167.20		EZ	Og	SlsSsi			GB	
ZG1010	167.20	170.00		EZ	Og	Sls			GDG	

Appendix 5: EZ drillhole logs and geochemistry.

Hole	DFrom	DTo	Sampno	Ag ppm	Al%	As ppm	Ba ppm	Ca%	Cu ppm	Fe%	K%	Mg%	Mn ppm	Pb ppm	S%	Zn ppm
ZG1010	0.00	16.00														
ZG1010	16.00	30.30														
ZG1010	30.30	34.50														
ZG1010	34.50	37.00														
ZG1010	37.00	38.30	3984202	-1		-50			3	0.53			115	12		137
ZG1010	38.30	42.00	3984203	-1		-50			2	0.32			107	11		75
ZG1010	42.00	44.40	3984204	-1		-50			4	0.90			129	14		529
ZG1010	44.40	46.40	3984205	-1		-50			6	0.84			609	45		181
ZG1010	46.40	72.10														
ZG1010	72.10	80.10														
ZG1010	80.10	86.60														
ZG1010	86.60	89.00	70622	10					10	0.78			255	25		105
ZG1010	89.00	92.00	70623	15					15	0.60			330	30		70
ZG1010	92.00	95.00	70624	10					10	0.60			310	30		90
ZG1010	95.00	99.00														
ZG1010	99.00	124.40														
ZG1010	124.40	133.90														
ZG1010	133.90	137.00	70625	10					10	0.62			180	25		45
ZG1010	137.00	140.80	70626	10					10	2.80			250	20		55
ZG1010	140.80	143.00	70627	10					10	0.20			110	15		40
ZG1010	143.00	148.80														
ZG1010	148.80	151.00														
ZG1010	151.00	153.60	70628	10					10	0.61			685	15		45
ZG1010	153.60	156.70	70629	5					5	1.05			265	15		40
ZG1010	156.70	158.00														
ZG1010	158.00	167.20														
ZG1010	167.20	170.00														

Appendix 5: EZ drillhole logs and geochemistry.

Hole	DFrom	DTto	Sampno	DPO	MRTLith	FieldID	Texture	Alt/Min	Colour	Comments
ZG1011	0.00	18.50		EZ						No rec
ZG1011	18.50	20.50	70630	EZ	Og	SlsSsi			GB	
ZG1011	20.50	23.00		EZ	Og	SlsSsi			GB	
ZG1011	23.00	26.00	70631	EZ	Og	SlsSsi			GB	
ZG1011	26.00	28.10	70632	EZ	Og	Sls			GDG	
ZG1011	28.10	30.80	70633	EZ	Og	Sls			GDG	
ZG1011	30.80	33.80	70634	EZ	Og	Sls			GDG	
ZG1011	33.80	38.30	70635	EZ	Og	SlsSsi			GB	
ZG1011	38.30	41.00	70636	EZ	Og	SlsSsi			GB	
ZG1011	41.00	42.60	70637	EZ	Og	SlsSsi			GB	
ZG1011	42.60	44.60	70638	EZ	Og	SlsSsi			GB	
ZG1011	44.60	46.60	70639	EZ	Og	SlsSsi			GB	
ZG1011	46.60	49.70	70640	EZ	Og	SlsSsi			GB	
ZG1011	49.70	52.30	70641	EZ	Og	Sls			GDG	
ZG1011	52.30	54.30	70642	EZ	Og	SlsSsi			GB	
ZG1011	54.30	56.30	70643	EZ	Og	SlsSsi			GB	
ZG1011	56.30	58.00	70644	EZ	Og	Sls			GDG	
ZG1011	58.00	60.50	70645	EZ	Og	SlsSdl	FrLe		GDG	
ZG1011	60.50	62.00	70644	EZ	Og	Sls	FrLe		GDG	
ZG1011	62.00	63.20	70647	EZ	Og	Sls			LG	
ZG1011	63.20	64.80	70648	EZ	Og	Sls			LG	
ZG1011	64.80	66.30	70649	EZ	Og	Sls			LG	
ZG1011	66.30	67.50	70650	EZ	Og	Sls			LG	
ZG1011	67.50	70.00	70651	EZ	Og	Sls			LG	
ZG1011	70.00	72.20	70652	EZ	Og	Sls			GDG	
ZG1011	72.20	76.00		EZ	Og	Sls			GDG	
ZG1011	76.00	77.70	70653	EZ	Og	SlsSdl	FrLe		GDG	
ZG1011	77.70	83.00	70654	EZ	Og	SlsSdl	FrLe		GDG	
ZG1011	83.00	85.40	70655	EZ	Og	SlsSdl	Le		GDG	
ZG1011	85.40	88.00	70656	EZ	Og	SlsSdl	Le		GDG	
ZG1011	88.00	90.00	70657	EZ	Og	SlsSdl	Le		GDG	
ZG1011	90.00	92.00	70658	EZ	Og	SlsSdl	Le		GDG	
ZG1011	92.00	94.00		EZ	Og	SdlSsi	Le		GDGOB	
ZG1011	94.00	97.50	70659	EZ	Og	SdlSsi	Le		GDGOB	
ZG1011	97.50	100.50	70660	EZ	Og	Sls			GDG	
ZG1011	100.50	102.40	70661	EZ	Og	Sls			GDG	
ZG1011	102.40	104.10	70662	EZ	Og	Sls			GDG	
ZG1011	104.10	107.00	70663	EZ	Og	Sls			GDG	
ZG1011	107.00	110.00	70664	EZ	Og	Sls			GDG	

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Appendix 5: EZ drillhole logs and geochemistry.

Hole	DFrom	DTo	Sampno	Ag ppm	Al%	As ppm	Ba ppm	Ca%	Cu ppm	Fe%	K%	Mg%	Mn ppm	Pb ppm	S%	Zn ppm
ZG1011	0.00	18.50														
ZG1011	18.50	20.50	70630						20	3.05			400	40		100
ZG1011	20.50	23.00														
ZG1011	23.00	26.00	70631						15	1.85			325	20		295
ZG1011	26.00	28.10	70632						10	1.60			325	15		110
ZG1011	28.10	30.80	70633						15	1.90			380	20		70
ZG1011	30.80	33.80	70634						10	1.50			300	20		90
ZG1011	33.80	38.30	70635						15	1.00			255	50		230
ZG1011	38.30	41.00	70636						5	1.85			970	40		90
ZG1011	41.00	42.60	70637						5	1.05			625	135		95
ZG1011	42.60	44.60	70638						5	0.60			270	30		70
ZG1011	44.60	46.60	70639						5	0.33			130	25		65
ZG1011	46.60	49.70	70640						5	0.20			250	30		85
ZG1011	49.70	52.30	70641						5	0.33			185	10		60
ZG1011	52.30	54.30	70642						5	0.40			225	25		65
ZG1011	54.30	56.30	70643						5	0.26			235	5		55
ZG1011	56.30	58.00	70644						10	0.50			305	10		55
ZG1011	58.00	60.50	70645						5	0.76			480	10		60
ZG1011	60.50	62.00	70644						5	0.49			235	10		55
ZG1011	62.00	63.20	70647						5	0.71			280	5		55
ZG1011	63.20	64.80	70648						5	0.37			340	<5		60
ZG1011	64.80	66.30	70649						10	1.60			640	5		60
ZG1011	66.30	67.50	70650						5	0.84			390	10		55
ZG1011	67.50	70.00	70651						5	0.37			215	15		55
ZG1011	70.00	72.20	70652						5	0.48			275	15		80
ZG1011	72.20	76.00														
ZG1011	76.00	77.70	70653						5	0.66			160	10		55
ZG1011	77.70	83.00	70654						5	0.43			160	10		60
ZG1011	83.00	85.40	70655						5	0.41			150	5		170
ZG1011	85.40	88.00	70656						5	0.79			190	15		70
ZG1011	88.00	90.00	70657						5	0.92			250	10		75
ZG1011	90.00	92.00	70658						5	1.05			315	10		85
ZG1011	92.00	94.00														
ZG1011	94.00	97.50	70659						5	0.64			240	10		170
ZG1011	97.50	100.50	70660						5	0.67			265	15		240
ZG1011	100.50	102.40	70661						5	0.44			245	20		60
ZG1011	102.40	104.10	70662						5	0.49			185	15		120
ZG1011	104.10	107.00	70663						5	0.76			225	10		45
ZG1011	107.00	110.00	70664						5	0.85			215	15		120

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Appendix 5: EZ drillhole logs and geochemistry.

Hole	DFrom	DTo	Sampno	DPO	MRTLith	FieldID	Texture	Alt/Min	Colour	Comments
ZG1011	110.00	113.00	70665	EZ	Og	Sls			GDG	
ZG1011	113.00	116.00	70666	EZ	Og	Sls	Le		GDG	
ZG1011	116.00	117.80	70667	EZ	Og	Sls	Le		GDG	
ZG1011	117.80	120.00	70668	EZ	Og	Sls	Le		GDG	
ZG1011	120.00	123.20	70669	EZ	Og	Sls	Vn	Cc	G	
ZG1011	123.20	125.00	70670	EZ	Og	Sls	Vn	Cc	G	
ZG1011	125.00	127.40	70671	EZ	Og	Sls	Vn	Cc	G	
ZG1011	127.40	129.50	70672	EZ	Og	SlsSdl			G	
ZG1011	129.50	168.50		EZ	Og	SlsSdl			G	
ZG1011	168.50	173.30		EZ	Og	Sls			G	
ZG1011	173.30	207.00		EZ	Og	SlsSdl			G	
ZG1011	207.00	211.90		EZ	Og	SdlSsi			G	
ZG1011	211.90	300.00		EZ	Og	SlsSdl			G	

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Appendix 5: EZ drillhole logs and geochemistry.

Hole	DFrom	DTo	Sampno	Ag ppm	Al%	As ppm	Ba ppm	Ca%	Cu ppm	Fe%	K%	Mg%	Mn ppm	Pb ppm	S%	Zn ppm
ZG1011	110.00	113.00	70665						5	1.00			250	15		40
ZG1011	113.00	116.00	70666						5	0.85			240	10		40
ZG1011	116.00	117.80	70667						5	1.00			255	10		40
ZG1011	117.80	120.00	70668						5	0.55			200	15		65
ZG1011	120.00	123.20	70669						5	0.81			520	15		280
ZG1011	123.20	125.00	70670						5	1.10			550	25		105
ZG1011	125.00	127.40	70671						5	1.15			600	35		110
ZG1011	127.40	129.50	70672						5	0.57			145	10		55
ZG1011	129.50	168.50														
ZG1011	168.50	173.30														
ZG1011	173.30	207.00														
ZG1011	207.00	211.90														
ZG1011	211.90	300.00														

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Appendix 5: EZ drillhole logs and geochemistry.

Hole	DFrom	DTo	Sampno	DPO	MRTLith	FieldID	Texture	Alt/Min	Colour	Comments
ZG1012	0.00	6.50		EZ						No rec
ZG1012	6.50	42.30		EZ	Og	Sls				
ZG1012	42.30	55.60		EZ	Og	SlsSdl			GLG	
ZG1012	55.60	64.60		EZ	Og	Sls				
ZG1012	64.60	69.00		EZ	Og	SlsSsi			LG	
ZG1012	69.00	94.10		EZ	Og	SlsSdl			LG	
ZG1012	94.10	98.40		EZ	Og	SlsSsi	Lm		AGDG	
ZG1012	98.40	106.70		EZ	Og	Sls			GDG	
ZG1012	106.70	140.60		EZ	Og	SlsSsi	Lm		AGDG	
ZG1012	140.60	143.00	70673	EZ	Og	Sdl			G	
ZG1012	143.00	145.60	70674	EZ	Og	Sdl			G	
ZG1012	145.60	148.80	70675	EZ	Og	Sdl			G	
ZG1012	148.80	152.00	70676	EZ	Og	Sdl			G	
ZG1012	152.00	154.90	70677	EZ	Og	Sdl			G	
ZG1012	154.90	157.50	70678	EZ	Og	Sdl			G	
ZG1012	157.50	160.00	70679	EZ	Og	Sdl			G	
ZG1012	160.00	167.00		EZ	Og	Sdl			G	
ZG1012	167.00	170.50		EZ	Og	SlsSdl			GLG	
ZG1012	170.50	191.60		EZ	Og	Sls			LG	
ZG1012	191.60	195.80		EZ	Og	SlsSdl			G	
ZG1012	195.80	197.40		EZ	Og	SlsSsi			LG	
ZG1012	197.40	201.00		EZ	Og	SlsSdl			G	
ZG1012	201.00	204.40		EZ	Og	SlsSsi			LG	
ZG1012	204.40	233.40		EZ	Og	SlsSdl				
ZG1012	233.40	241.30		EZ	Og	Sls			GLG	
ZG1012	241.30	261.00		EZ	Og	SlsSdl			GDG	
ZG1012	261.00	265.80		EZ	Og	SlsSdl	Vn	Cc	GDG	
ZG1012	265.80	273.80		EZ	Og	Sls	Vn	Cc	GDG	
ZG1012	273.80	276.60		EZ	Og	SlsSsi	Lm		ALGDG	
ZG1012	276.60	282.90		EZ	Og	Sls			GDG	
ZG1012	282.90	307.00		EZ	Og	SlsSdl			G	
ZG1012	307.00	309.50		EZ	Og	SlsSdl	Vn	Cc	G	
ZG1012	309.50	312.00	3984206	77147	Og	SlsSdl	Vn	Cc	G	
ZG1012	312.00	318.50		EZ	Og	SlsSdl	Vn	Cc	G	
ZG1012	318.50	348.90		EZ	Og	SlsSdl			G	

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Appendix 5: EZ drillhole logs and geochemistry.

Hole	DFrom	DTo	Sampno	Ag ppm	Al%	As ppm	Ba ppm	Ca%	Cu ppm	Fe%	K%	Mg%	Mn ppm	Pb ppm	S%	Zn ppm
ZG1012	0.00	6.50														
ZG1012	6.50	42.30														
ZG1012	42.30	55.60														
ZG1012	55.60	64.60														
ZG1012	64.60	69.00														
ZG1012	69.00	94.10														
ZG1012	94.10	98.40														
ZG1012	98.40	106.70														
ZG1012	106.70	140.60														
ZG1012	140.60	143.00	70673						-5	1.00			330	35		225
ZG1012	143.00	145.60	70674						-5	1.00			480	65		165
ZG1012	145.60	148.80	70675						-5	0.63			275	50		120
ZG1012	148.80	152.00	70676						-5	0.61			260	35		75
ZG1012	152.00	154.90	70677						-5	0.67			395	30		40
ZG1012	154.90	157.50	70678						-5	0.73			425	40		65
ZG1012	157.50	160.00	70679						-5	0.50			310	25		60
ZG1012	160.00	167.00														
ZG1012	167.00	170.50														
ZG1012	170.50	191.60														
ZG1012	191.60	195.80														
ZG1012	195.80	197.40														
ZG1012	197.40	201.00														
ZG1012	201.00	204.40														
ZG1012	204.40	233.40														
ZG1012	233.40	241.30														
ZG1012	241.30	261.00														
ZG1012	261.00	265.80														
ZG1012	265.80	273.80														
ZG1012	273.80	276.60														
ZG1012	276.60	282.90														
ZG1012	282.90	307.00														
ZG1012	307.00	309.50														
ZG1012	309.50	312.00	3984206	-1		-50			3	0.84			148	12		97
ZG1012	312.00	318.50														
ZG1012	318.50	348.90														

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Appendix 5: EZ drillhole logs and geochemistry.

Hole	DFrom	DTo	Sampno	DPO	MRTLith	FieldID	Texture	Alt/Min	Colour	Comments
ZG1013	0.00	7.50		EZ						No rec.
ZG1013	7.50	8.30		EZ	Og	SlsSdl	Fr		DG	
ZG1013	8.30	10.60	70680	EZ	Og	SlsSdl	Fr		DG	
ZG1013	10.60	14.00	70681	EZ	Og	SlsSdl	Fr		DG	
ZG1013	14.00	17.00	70682	EZ	Og	SlsSdl	Fr		G	
ZG1013	17.00	19.00	70683	EZ	Og	SlsSdl	Fr		G	
ZG1013	19.00	21.70	70684	EZ	Og	SlsSdl	Fr		G	
ZG1013	21.70	24.00	70685	EZ	Og	SlsSdl	Fr		G	
ZG1013	24.00	27.00	70686	EZ	Og	SlsSdl			LG	
ZG1013	27.00	30.00	70687	EZ	Og	SlsSdl	Fr		G	
ZG1013	30.00	33.20	70688	EZ	Og	SlsSdl	Fr		G	
ZG1013	33.20	35.00	70689	EZ	Og	SlsSdl	Fr		LG	
ZG1013	35.00	38.00	70690	EZ	Og	SlsSdl	Fr		LG	
ZG1013	38.00	40.70	70691	EZ	Og	SlsSdl	Fr		LG	
ZG1013	40.70	43.00	70692	EZ	Og	SlsSdl			LG	
ZG1013	43.00	45.70	70693	EZ	Og	SlsSdl			LG	
ZG1013	45.70	48.40	70694	EZ	Og	SlsSdl	Fr		G	
ZG1013	48.40	51.30	70695	EZ	Og	SlsSdl	Fr		G	
ZG1013	51.30	54.50	70696	EZ	Og	SlsSdl	Fr		LG	
ZG1013	54.50	57.50	70697	EZ	Og	SlsSdl	Fr		G	
ZG1013	57.50	60.50	70698	EZ	Og	SlsSdl	Fr		G	
ZG1013	60.50	63.50	70699	EZ	Og	SlsSdl	Fr		G	
ZG1013	63.50	65.90	70700	EZ	Og	SlsSdl	Vn	Cc	G	
ZG1013	65.90	69.00	58258	EZ	Og	SlsSdl	Vn	Cc	G	
ZG1013	69.00	71.70	58259	EZ	Og	SlsSdl			LG	
ZG1013	71.70	74.00	58260	EZ	Og	SlsSdl			LG	
ZG1013	74.00	76.50	58261	EZ	Og	SlsSdl			LG	
ZG1013	76.50	78.50	58262	EZ	Og	SlsSdl			G	
ZG1013	78.50	81.50	58263	EZ	Og	SlsSdl			LG	
ZG1013	81.50	84.50	58264	EZ	Og	Sls			LG	
ZG1013	84.50	87.50	58265	EZ	Og	Sls			G	
ZG1013	87.50	90.10	58266	EZ	Og	Sls	Vn	Cc	G	
ZG1013	90.10	93.10	58267	EZ	Og	Sls	Vn	Cc	G	
ZG1013	93.10	96.10	58268	EZ	Og	SlsSdl			G	
ZG1013	96.10	99.00	58269	EZ	Og	SlsSdl			G	
ZG1013	99.00	102.50	58270	EZ	Og	SlsSdl	Fr		G	
ZG1013	102.50	105.50		EZ						Cavity
ZG1013	105.50	107.80	58271	EZ	Og	SdlOrms	FrMs	Py	BG	
ZG1013	107.80	110.80	58272	EZ	Og	Ccy			DG	

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Appendix 5: EZ drillhole logs and geochemistry.

Hole	DFrom	DTo	Sampno	Ag ppm	Al%	As ppm	Ba ppm	Ca%	Cu ppm	Fe%	K%	Mg%	Mn ppm	Pb ppm	S%	Zn ppm
ZG1013	0.00	7.50														
ZG1013	7.50	8.30														
ZG1013	8.30	10.60	70680						5	0.72			195	20		40
ZG1013	10.60	14.00	70681						-5	0.58			165	20		40
ZG1013	14.00	17.00	70682						-5	0.35			140	25		80
ZG1013	17.00	19.00	70683						-5	0.63			220	25		40
ZG1013	19.00	21.70	70684						-5	0.36			175	25		65
ZG1013	21.70	24.00	70685						-5	1.00			430	25		70
ZG1013	24.00	27.00	70686						-5	0.12			145	25		65
ZG1013	27.00	30.00	70687						-5	0.47			390	30		95
ZG1013	30.00	33.20	70688						-5	0.63			415	25		75
ZG1013	33.20	35.00	70689						10	1.60			280	55		290
ZG1013	35.00	38.00	70690						-5	0.42			250	4		105
ZG1013	38.00	40.70	70691						-5	0.35			190	45		150
ZG1013	40.70	43.00	70692						-5	0.35			110	40		210
ZG1013	43.00	45.70	70693						-5	0.42			110	25		265
ZG1013	45.70	48.40	70694						-5	0.81			350	25		375
ZG1013	48.40	51.30	70695						-5	0.90			280	30		315
ZG1013	51.30	54.50	70696						-5	0.35			130	40		170
ZG1013	54.50	57.50	70697						-5	0.41			120	25		230
ZG1013	57.50	60.50	70698						-5	0.35			140	40		155
ZG1013	60.50	63.50	70699						-5	0.68			275	30		170
ZG1013	63.50	65.90	70700						5	0.62			320	30		190
ZG1013	65.90	69.00	58258						-5	0.45			385	30		450
ZG1013	69.00	71.70	58259						-5	0.48			430	30		245
ZG1013	71.70	74.00	58260						-5	0.25			610	25		300
ZG1013	74.00	76.50	58261						-5	0.35			260	25		325
ZG1013	76.50	78.50	58262						-5	0.38			130	30		715
ZG1013	78.50	81.50	58263						-5	0.25			140	30		515
ZG1013	81.50	84.50	58264						-5	0.23			105	20		310
ZG1013	84.50	87.50	58265						-5	0.54			195	25		270
ZG1013	87.50	90.10	58266						-5	0.67			275	25		250
ZG1013	90.10	93.10	58267						-5	1.50			630	25		850
ZG1013	93.10	96.10	58268						-5	0.12			450	30		295
ZG1013	96.10	99.00	58269						5	0.73			240	40		1050
ZG1013	99.00	102.50	58270						-5	2.10			970	100		1800
ZG1013	102.50	105.50														
ZG1013	105.50	107.80	58271						-5	29.06			31000	275		91000
ZG1013	107.80	110.80	58272						50	5.25			345	6700		38500

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Appendix 5: EZ drillhole logs and geochemistry.

Hole	DFrom	DTo	Sampno	DPO	MATLith	FieldID	Texture	Alt/Min	Colour	Comments
ZG1013	110.80	112.50	3917677	77147	Og	Ccy			OB	
ZG1013	112.50	115.20	3917678	77147	Og	Ccy			OB	
ZG1013	115.20	117.10	3917679	77147	Og	Ccy			OB	
ZG1013	117.10	119.00	3917680	77147	Og	Ccy			OB	
ZG1013	119.00	121.25	3917681	77147	Og	Ccy			OB	
ZG1013	121.25	123.50	3917682	77147	Og	Ccy			OB	
ZG1013	123.50	125.50	3917683	77147	Og	Ccy			OB	
ZG1013	125.50	127.50	3917684	77147	Og	Ccy			OB	
ZG1013	127.50	129.50	3917685	77147	Og	Ccy			OB	
ZG1013	129.50	131.50	3917686	77147	Og	Ccy			OB	
ZG1013	131.50	133.00	58273	EZ	Og	Ccy			OW	
ZG1013	133.00	134.50	58274	EZ	Og	Ccy	Ds	Py	OW	
ZG1013	134.50	135.70	58275	EZ	Og	Ccy			OW	
ZG1013	135.70	137.40		EZ	Og	Ccy			OW	
ZG1013	137.40	138.50		EZ	Orn		Fe	He	LG	

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Appendix 5: EZ drillhole logs and geochemistry.

Hole	DFrom	DTo	Sampno	Ag ppm	Al%	As ppm	Ba ppm	Ca%	Cu ppm	Fe%	K%	Mg%	Mn ppm	Pb ppm	S%	Zn ppm
ZG1013	110.80	112.50	3917677	-1		90			53	9.13			466	2547	0.65	16200
ZG1013	112.50	115.20	3917678	-1		200			149	34.30			2378	13100	0.09	16100
ZG1013	115.20	117.10	3917679	-1		160			151	24.94			1547	20900	0.06	11300
ZG1013	117.10	119.00	3917680	-1		170			180	42.10			3083	15000	0.05	10900
ZG1013	119.00	121.25	3917681	-1		70			117	15.72			833	4478		4212
ZG1013	121.25	123.50	3917682	-1		60			100	16.30			396	6400		5300
ZG1013	123.50	125.50	3917683	-1		50			95	18.00			482	5400		6500
ZG1013	125.50	127.50	3917684	-1		100			66	25.70			1197	6100		8600
ZG1013	127.50	129.50	3917685	-1		100			309	31.70			573	7400		4500
ZG1013	129.50	131.50	3917686	-1		90			124	12.50			250	2815		1547
ZG1013	131.50	133.00	58273						90	16.08			575	2750		1950
ZG1013	133.00	134.50	58274						425	26.00			200	580		525
ZG1013	134.50	135.70	58275						20	5.30			150	110		235
ZG1013	135.70	137.40														
ZG1013	137.40	138.50														

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Appendix 5: EZ drillhole logs and geochemistry.

Hole	DFrom	DTo	Sampno	DPO	MRTLith	FieldID	Texture	Alt/Min	Colour	Comments
ZG1014	0.00	234.30		EZ						
ZG1014	234.30	236.50	70873	EZ						
ZG1014	236.50	238.90	70874	EZ						
ZG1014	238.90	241.30	70875	EZ						
ZG1014	241.30	243.80	70876	EZ						
ZG1014	243.80	245.80	70877	EZ						
ZG1014	245.80	248.00	70878	EZ						
ZG1014	248.00	269.60		EZ						
ZG1014	269.60	272.70	70879	EZ						
ZG1014	272.70	275.60	70880	EZ						
ZG1014	275.60	280.50	70881	EZ						
ZG1014	278.90	280.30	3917690	77147	Og	Sls	Al	He		
ZG1014	280.30	280.50	3917691	77147	Og	Sch?	SiFe		DB	
ZG1014	280.50	283.50	3917687	77147	Og	Ccy			OBP	
ZG1014	283.50	286.50	3917688	77147	Og	Ccy			OBP	
ZG1014	286.50	289.50	3917689	77147	Og	Ccy			OBP	
ZG1014	289.50	292.30		EZ						
ZG1015	0.00	65.30		EZ						
ZG1015	65.30	67.60	70897	EZ						
ZG1015	67.60	70.60	70897	EZ						
ZG1015	70.60	73.10	70899	EZ						
ZG1015	73.10	75.50	70900	EZ						
ZG1015	75.50	99.50		EZ						
ZG1015	99.50	102.80	70882	EZ						
ZG1015	102.80	105.70	70883	EZ						
ZG1015	105.70	109.60	70884	EZ						
ZG1015	109.60	110.80	3917692	77147	Og	Ccy	Ds	Py	DG	
ZG1015	110.80	112.70	3917693	77147	Og	Ccy	Ds	Py	DG	
ZG1015	112.70	115.70	3917694	77147	Og	Ccy	Ds	Py	DG	
ZG1015	115.70	119.50	3917695	77147	Og	Ccy	Ds	Py	DG	
ZG1015	119.50	120.60	3917696	77147	Og	Ccy			MROBG	
ZG1015	120.60	121.70	3917697	77147	Og	Ccy			MROBG	
ZG1015	121.70	125.60	3917698	77147	Og	Ccy			OB	
ZG1015	125.60	130.20	3917699	77147	Og	Ccy			OB	
ZG1015	130.20	133.60	3917700	77147	Og	Ccy			WP	
ZG1015	133.60	159.80			Og	Ccy			LB	
ZG1015	159.80	177.60		EZ	Om	SssCcy			LB	

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Appendix 5: EZ drillhole logs and geochemistry.

Hole	DFrom	DTo	Sampno	Ag ppm	Al%	As ppm	Ba ppm	Ca%	Cu ppm	Fe%	K%	Mg%	Mn ppm	Pb ppm	S%	Zn ppm
ZG1014	0.00	234.30														
ZG1014	234.30	236.50	70873													255
ZG1014	236.50	238.90	70874													200
ZG1014	238.90	241.30	70875													255
ZG1014	241.30	243.80	70876													
ZG1014	243.80	245.80	70877													345
ZG1014	245.80	248.00	70878													985
ZG1014	248.00	269.60														
ZG1014	269.60	272.70	70879													1550
ZG1014	272.70	275.60	70880													975
ZG1014	275.60	280.50	70881													1450
ZG1014	278.90	280.30	3917690	2		-50			4	4.41			2729	230		1517
ZG1014	280.30	280.50	3917691	1		-50			37	31.80			11200	1576		2954
ZG1014	280.50	283.50	3917687	-1		-50			21	5.27			395	536		785
ZG1014	283.50	286.50	3917688	-1		-50			17	5.06			343	63		177
ZG1014	286.50	289.50	3917689	-1		-50			22	3.98			77	27		56
ZG1014	289.50	292.30														
ZG1015	0.00	65.30														
ZG1015	65.30	67.60	70897						-5				265	30		100
ZG1015	67.60	70.60	70897						-5				460	30		45
ZG1015	70.60	73.10	70899						-5				525	35		125
ZG1015	73.10	75.50	70900						-5				485	45		140
ZG1015	75.50	99.50														
ZG1015	99.50	102.80	70882						-5				525	35		340
ZG1015	102.80	105.70	70883						-5				405	40		395
ZG1015	105.70	109.60	70884						-5				530	60		740
ZG1015	109.60	110.80	3917692	1		520			20	10.10			417	389		4394
ZG1015	110.80	112.70	3917693	1		360			20	5.17			67	426	6.80	15200
ZG1015	112.70	115.70	3917694	10		550			59	9.67			73	5600		2741
ZG1015	115.70	119.50	3917695	5		270			51	8.17			74	2222		2053
ZG1015	119.50	120.60	3917696	2		260			52	11.50			234	3209		2291
ZG1015	120.60	121.70	3917697	2		450			63	22.70			835	6300		7300
ZG1015	121.70	125.60	3917698	-1		240			120	34.40			1934	12400	0.10	10600
ZG1015	125.60	130.20	3917699	3		150			117	32.90			1589	8500		8700
ZG1015	130.20	133.60	3917700	-1		80			28	3.95			62	1497		674
ZG1015	133.60	159.80														
ZG1015	159.80	177.60														

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Appendix 5: EZ drillhole logs and geochemistry.

Hole	DFrom	DTo	Sampno	DPO	MRTLith	FieldID	Texture	Alt/Min	Colour	Comments
ZG1016	0.00	52.50		EZ						
ZG1016	52.50	54.50	70885	EZ						
ZG1016	54.50	139.50		EZ						
ZG1016	139.50	142.20	70886	EZ						
ZG1016	142.20	143.90	70887	EZ						
ZG1016	143.90	145.50	70888	EZ						
ZG1016	145.50	147.40	70889	EZ						
ZG1016	147.40	149.90	70890	EZ						
ZG1016	149.90	154.80		EZ						
ZG1016	154.80	157.80	70891	EZ						
ZG1016	157.80	161.00	70892	EZ						
ZG1016	161.00	163.60	70893	EZ						
ZG1016	163.60	166.00	70894	EZ						
ZG1016	166.00	168.90	70895	EZ						
ZG1016	168.90	170.80	70896	EZ						
ZG1016	170.80	172.50	3984201	77147	Og	Ccy			OB	
ZG1016	172.50	187.50		EZ						

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Appendix 5: EZ drillhole logs and geochemistry.

Hole	DFrom	DTo	Sampno	Ag ppm	Al%	As ppm	Ba ppm	Ca%	Cu ppm	Fe%	K%	Mg%	Mn ppm	Pb ppm	S%	Zn ppm
ZG1016	0.00	52.50														
ZG1016	52.50	54.50	70885						-5				265	210		140
ZG1016	54.50	139.50														
ZG1016	139.50	142.20	70886						-5				195	50		225
ZG1016	142.20	143.90	70887						-5				165	50		285
ZG1016	143.90	145.50	70888						-5				220	70		395
ZG1016	145.50	147.40	70889						-5				400	120		460
ZG1016	147.40	149.90	70890						-5				200	35		140
ZG1016	149.90	154.80														
ZG1016	154.80	157.80	70891						-5				275	30		115
ZG1016	157.80	161.00	70892						-5				460	234		1250
ZG1016	161.00	163.60	70893						-5				635	125		630
ZG1016	163.60	166.00	70894						-5				740	235		1400
ZG1016	166.00	168.90	70895						-5				2250	165		5950
ZG1016	168.90	170.80	70896						60				125	310		2000
ZG1016	170.80	172.50	3984201	-1		70			40	10.40			538	700		4383
ZG1016	172.50	187.50														

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Appendix 5: EZ drillhole logs and geochemistry.

Hole	DFrom	DTo	Sampno	DPO	MRTLith	FieldID	Texture	Alt/Min	Colour	Comments
ZWG1	0.00	7.20		EZ						
ZWG1	7.20	8.25	57427	EZ						
ZWG1	8.25	8.90	57428	EZ						
ZWG1	8.90	11.20	57429	EZ						
ZWG1	11.20	12.25	57430	EZ						
ZWG1	12.25	13.60	57251	EZ						
ZWG1	13.60	15.00	57252	EZ						
ZWG1	15.00	16.00	57253	EZ						
ZWG1	16.00	17.00	57254	EZ						
ZWG1	17.00	18.00	57255	EZ						
ZWG1	18.00	19.00	57256	EZ						
ZWG1	19.00	21.00	57257	EZ						
ZWG1	21.00	22.25	57258	EZ						
ZWG1	22.25	22.75		EZ						
ZWG2	0.00	2.10		EZ						
ZWG2	2.10	4.25	3984207	77147						
ZWG2	4.25	5.10	3984208	77147	Og	Sdl	Al	Sd	EG	
ZWG2	5.10	12.90	3984209	77147						
ZWG2	12.90	16.55		EZ						
ZWG2	16.55	18.05	57259	EZ						
ZWG2	18.05	19.55	57260	EZ						
ZWG2	19.55	20.50	57261	EZ						
ZWG2	20.50	21.35	57262	EZ						
ZWG2	21.35	22.25	57263	EZ						
ZWG2	22.25	23.05	57264	EZ						
ZWG2	23.05	24.40	57288	EZ						
ZWG2	24.40	27.00	57289	EZ						
ZWG2	27.00	30.70	57290	EZ						
ZWG3	0.00	7.55		EZ						
ZWG3	7.55	8.45	57265	EZ						
ZWG3	8.45	9.05	57266	EZ						
ZWG3	9.05	9.90	57267	EZ						
ZWG3	9.90	11.45	57268	EZ						
ZWG3	11.45	12.80	57269	EZ						
ZWG3	12.80	14.55	57286	EZ						
ZWG3	14.55	17.00	57287	EZ						

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Appendix 5: EZ drillhole logs and geochemistry.

Hole	DFrom	DTo	Sampno	Ag ppm	Al%	As ppm	Ba ppm	Ca%	Cu ppm	Fe%	K%	Mg%	Mn ppm	Pb ppm	S%	Zn ppm
ZWG1	0.00	7.20														
ZWG1	7.20	8.25	57427	1.5					20	5.65			2500	16500	1.97	59500
ZWG1	8.25	8.90	57428	3					20	5.40			2200	25000	4.07	56000
ZWG1	8.90	11.20	57429	0.5					35	1.30			525	4350	0.81	7750
ZWG1	11.20	12.25	57430	-0.5					20	1.35			635	3350	0.65	12000
ZWG1	12.25	13.60	57251	2					15	11.00			4850	16500	0.47	85600
ZWG1	13.60	15.00	57252	2					15	13.50			5500	9000	0.24	102600
ZWG1	15.00	16.00	57253	1.5					20	9.25			3900	20500	0.37	70000
ZWG1	16.00	17.00	57254	5					25	10.50			4100	17200	0.39	97400
ZWG1	17.00	18.00	57255	4.5					20	6.95			2850	24000	0.53	59000
ZWG1	18.00	19.00	57256	-0.5					20	11.00			4400	10900	0.46	88200
ZWG1	19.00	21.00	57257	-0.5					15	0.90			325	1900	0.49	4250
ZWG1	21.00	22.25	57258	-0.5					15	1.15			385	1750	0.43	4000
ZWG1	22.25	22.75														
ZWG2	0.00	2.10														
ZWG2	2.10	4.25	3984207	-1		-50			3	0.55			143	49		154
ZWG2	4.25	5.10	3984208	-1		-50			12	4.13			522	260		1291
ZWG2	5.10	12.90	3984209	-1		-50			2	0.22			151	33		43
ZWG2	12.90	16.55														
ZWG2	16.55	18.05	57259	1					5	0.64			180	35		185
ZWG2	18.05	19.55	57260	-1					10	0.73			225	70		425
ZWG2	19.55	20.50	57261	1					5	0.68			300	1525		2000
ZWG2	20.50	21.35	57262	3					10	2.23			860	18500		7200
ZWG2	21.35	22.25	57263	4					10	0.82			495	5125		3350
ZWG2	22.25	23.05	57264	2					10	0.80			365	1675		2350
ZWG2	23.05	24.40	57288	1					10	0.66			305	3300		1800
ZWG2	24.40	27.00	57289	1					5	0.56			185	135		305
ZWG2	27.00	30.70	57290	-1					10	0.58			160	45		95
ZWG3	0.00	7.55														
ZWG3	7.55	8.45	57265	0.5					5	0.20			100	20		140
ZWG3	8.45	9.05	57266	0.5					5	0.28			185	90		460
ZWG3	9.05	9.90	57267	0.5					5	0.40			235	190		530
ZWG3	9.90	11.45	57268	2					5	3.05			1700	6300		30200
ZWG3	11.45	12.80	57269	1					5	0.70			465	2400		8750
ZWG3	12.80	14.55	57286	0.5					5	0.36			325	5050		5050
ZWG3	14.55	17.00	57287	0.5					10	0.40			345	1800		5050

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Appendix 5: EZ drillhole logs and geochemistry.

Hole	DFrom	DTo	Sampno	DPO	MRTLith	FieldID	Texture	Alt/Min	Colour	Comments
ZWG4	0.00	3.65		EZ						
ZWG4	3.65	5.35	57270	EZ						
ZWG4	5.35	6.95	57271	EZ						
ZWG4	6.95	9.75	57272	EZ						
ZWG4	9.75	10.60	57273	EZ						
ZWG4	10.60	12.10	57274	EZ						
ZWG4	12.10	14.00	57275	EZ						
ZWG4	14.00	14.90		EZ						
ZWG4	14.90	15.55	57276	EZ						
ZWG4	15.55	16.85	57277	EZ						
ZWG4	16.85	18.80	57278	EZ						
ZWG5	0.00	10.55		EZ						
ZWG5	10.55	12.00	57291	EZ						
ZWG5	12.00	13.00	57292	EZ						
ZWG5	13.00	13.85	57293	EZ						
ZWG5	13.85	16.05	57279	EZ						
ZWG5	16.05	19.05	57280	EZ						
ZWG5	19.05	22.45	57281	EZ						
ZWG5	22.45	25.15	57282	EZ						
ZWG5	25.15	30.30	57285	EZ						
ZWG5	30.30	33.55		EZ						
ZWG6	0.00	12.90		EZ						
ZWG6	12.90	13.95	57283	EZ						
ZWG7	0.00	9.40		EZ						
ZWG7	9.40	10.60	57294	EZ						
ZWG7	10.60	11.90	57295	EZ						
ZWG7	11.90	14.30		EZ						
ZWG7	14.30	16.30	57296	EZ						
ZWG7	16.30	18.30	57297	EZ						
ZWG7	18.30	20.30	57298	EZ						
ZWG7	20.30	21.30	57299	EZ						
ZWG7	21.30	23.30	57300	EZ						
ZWG7	23.30	25.30	59078	EZ						
ZWG7	25.30	26.50	59079	EZ						
ZWG7	26.50	29.50	59080	EZ						
ZWG7	29.50	31.40	59081	EZ						
ZWG8	0.00	27.40		EZ						
ZWG8	27.40	29.25	57284	EZ						

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Appendix 5: EZ drillhole logs and geochemistry.

Hole	DFrom	DTo	Sampno	Ag ppm	Al%	As ppm	Ba ppm	Ca%	Cu ppm	Fe%	K%	Mg%	Mn ppm	Pb ppm	S%	Zn ppm
ZWG4	0.00	3.65														
ZWG4	3.65	5.35	57270	4					5	2.65			1550	11700		31600
ZWG4	5.35	6.95	57271	1.5					5	0.22			355	3300		4150
ZWG4	6.95	9.75	57272	0.5					5	0.14			165	585		1350
ZWG4	9.75	10.60	57273	0.5					5	0.20			280	945		3150
ZWG4	10.60	12.10	57274	0.5					10	1.25			710	3100		7350
ZWG4	12.10	14.00	57275	1.5					5	0.66			495	4450		5850
ZWG4	14.00	14.90														
ZWG4	14.90	15.55	57276	3					5	1.25			670	8600		10800
ZWG4	15.55	16.85	57277	1					5	0.59			405	1400		4450
ZWG4	16.85	18.80	57278	3					5	4.05			635	5600		12500
ZWG5	0.00	10.55														
ZWG5	10.55	12.00	57291						-5	0.55			125	10		15
ZWG5	12.00	13.00	57292						5	0.47			140	10		15
ZWG5	13.00	13.85	57293						5	0.67			135	15		20
ZWG5	13.85	16.05	57279	-0.5					-5	0.56			170	30		35
ZWG5	16.05	19.05	57280	-0.5					5	0.41			150	15		20
ZWG5	19.05	22.45	57281	0.5					5	0.48			160	30		25
ZWG5	22.45	25.15	57282	-0.5					5	0.22			105	25		25
ZWG5	25.15	30.30	57285	0.5					-5	0.65			185	25		20
ZWG5	30.30	33.55														
ZWG6	0.00	12.90														
ZWG6	12.90	13.95	57283	-0.5					-5	0.22			105	20		20
ZWG7	0.00	9.40														
ZWG7	9.40	10.60	57294						5	0.36			105	10		25
ZWG7	10.60	11.90	57295						5	0.78			230	10		15
ZWG7	11.90	14.30														
ZWG7	14.30	16.30	57296						-5	0.24			115	15		115
ZWG7	16.30	18.30	57297						-5	0.45			190	10		45
ZWG7	18.30	20.30	57298						5	0.58			160	40		45
ZWG7	20.30	21.30	57299						5	0.70			180	20		15
ZWG7	21.30	23.30	57300						5	0.53			160	10		15
ZWG7	23.30	25.30	59078						5	0.52			145	10		10
ZWG7	25.30	26.50	59079						5	0.65			150	10		15
ZWG7	26.50	29.50	59080						5	0.50			140	10		10
ZWG7	29.50	31.40	59081						5	0.58			150	10		10
ZWG8	0.00	27.40														
ZWG8	27.40	29.25	57284	2					5	0.35			495	6200		7650

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Appendix 5: EZ drillhole logs and geochemistry.

Hole	DFrom	DTo	Sampno	DPO	MRTLith	FieldID	Texture	Alt/Min	Colour	Comments
ZWG9	0.00	11.50		EZ						
ZWG9	11.50	15.00	3984210	77147	Og	Sls	AlWe		MDGLG	Decomposed
ZWG9	15.00	19.55	3984211	77147	Og	Sls	VuVc			Decomposed
ZWG10	0.00	16.00		EZ						
ZWG11	0.00	15.30		EZ						
ZWG11	15.30	18.00	3984212	77147	Og	Sdl	Al	DISd	G	Decomposed lime mudstone
ZWG11	18.00	23.25	3984213	77147	Og	Sdl	Al	DISd	G	Decomposed lime mudstone
ZWG11	23.25	25.00	59082	EZ						
ZWG11	25.00	26.65		EZ						
ZWG12	0.00	10.60		EZ						
ZWG12	10.60	12.70	3984214	77147	Og	SlsSdl			LG	
ZWG12	12.70	15.70		EZ						
ZWG20	0.00	14.90		EZ						
ZWG21	0.00	22.00		EZ						
ZWG21	22.00	22.30	3984215	77147	Og	Sdl	Al	Sd		
ZWG21	22.30	35.60		EZ						
ZWG22	0.00	7.70		EZ						
ZWG22	7.70	8.20	65263	EZ						
ZWG22	8.20	9.40	65264	EZ						
ZWG22	9.40	11.40	65265	EZ						
ZWG22	11.40	12.20	65252	EZ						
ZWG22	12.20	14.00	65266	EZ						
ZWG22	14.00	16.00	65267	EZ						
ZWG23	0.00	9.90		EZ						
ZWG23	9.90	13.00	3984216	77147	Og	SlsSdl	Al	Sd	GLG	Weak ankerite altn.
ZWG23	13.00	16.20	3984217	77147	Og	SlsSdl	Al	Sd	GLG	Weak ankerite altn.
ZWG23	16.20	20.00	3984218	77147	Og	SlsSdl	Al	Sd	GLG	Weak ankerite altn.
ZWG23	20.00	21.00	65253	EZ	Og	SlsSdl	Al	Sd	GLG	Weak ankerite altn.
ZWG23	21.00	24.00	3984219	77147	Og	SlsSdl	Al	Sd	GLG	Weak ankerite altn.
ZWG23	24.00	27.00	3984220	77147	Og	SlsSdl	Al	Sd	GLG	Weak ankerite altn.
ZWG23	27.00	28.30	3984221	77147	Og	SlsSdl	Al	Sd	GLG	Weak ankerite altn.
ZWG23	28.30	28.80	3984222	77147	Og	Ccy				
ZWG23	28.80	29.40		EZ						
ZWG24	0.00	10.90		EZ						
ZWG24	10.90	12.40	3984223	77147	Og	Sdl	Al	Sd		Minor altn
ZWG24	12.40	13.00		EZ						

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Appendix 5: EZ drillhole logs and geochemistry.

Hole	DFrom	DTo	Sampno	Ag ppm	Al%	As ppm	Ba ppm	Ca%	Cu ppm	Fe%	K%	Mg%	Mn ppm	Pb ppm	S%	Zn ppm
ZWG9	0.00	11.50														
ZWG9	11.50	15.00	3984210	-1		-50			2	0.62			129	9		72
ZWG9	15.00	19.55	3984211	-1		-50			3	0.78			147	15		196
ZWG10	0.00	16.00														
ZWG11	0.00	15.30														
ZWG11	15.30	18.00	3984212	-1		50			5	1.99			413	12		22
ZWG11	18.00	23.25	3984213	-1		-50			5	1.38			408	14		23
ZWG11	23.25	25.00	59082						5	1.00			305	10		20
ZWG11	25.00	26.65														
ZWG12	0.00	10.60														
ZWG12	10.60	12.70	3984214	-1		-50			-2	0.53			159	12		77
ZWG12	12.70	15.70														
ZWG20	0.00	14.90														
ZWG21	0.00	22.00														
ZWG21	22.00	22.30	3984215	-1		60			3	0.81			225	1854		448
ZWG21	22.30	35.60														
ZWG22	0.00	7.70														
ZWG22	7.70	8.20	65263						10	3.91			350	595		1400
ZWG22	8.20	9.40	65264						15	0.53			240	205		1150
ZWG22	9.40	11.40	65265						10	3.26			420	1985		11500
ZWG22	11.40	12.20	65252						10	13.66			6045	14900		174900
ZWG22	12.20	14.00	65266						10	0.96			380	3635		5900
ZWG22	14.00	16.00	65267						10	0.67			530	3285		5200
ZWG23	0.00	9.90														
ZWG23	9.90	13.00	3984216	-1		90			3	0.69			315	35		241
ZWG23	13.00	16.20	3984217	-1		-50			6	0.81			281	28		149
ZWG23	16.20	20.00	3984218	-1		60			4	0.90			377	780		710
ZWG23	20.00	21.00	65253						10	0.80			285	170		2190
ZWG23	21.00	24.00	3984219	-1		-50			5	0.57			282	776		764
ZWG23	24.00	27.00	3984220	-1		50			4	0.85			344	812		538
ZWG23	27.00	28.30	3984221	-1		70			3	0.90			420	441		994
ZWG23	28.30	28.80	3984222	-1		-50			7	0.87			281	1308		9200
ZWG23	28.80	29.40														
ZWG24	0.00	10.90														
ZWG24	10.90	12.40	3984223	1		50			8	1.51			547	5200		6800
ZWG24	12.40	13.00														

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Appendix 5: EZ drillhole logs and geochemistry.

Hole	DFrom	DTo	Sampno	DPO	MRTLith	FieldID	Texture	Alt/Min	Colour	Comments
ZWG25	0.00	14.30		EZ						
ZWG25	14.30	16.85	3984224	77147	Og	SlsSd	Al	Sd	GDG	Weak ankerite altn.
ZWG25	16.85	22.60		EZ	Og	Sls			G	
ZWG25	22.60	24.20	3984225	77147	Og	Sls			G	Weak ankerite altn.
ZWG26	0.00	5.30		EZ						
ZWG26	5.30	7.90	65254	EZ						
ZWG26	7.90	10.00	65255	EZ						
ZWG26	10.00	11.90	65256	EZ						
ZWG26	11.90	13.90	65257	EZ						
ZWG26	13.90	15.80	65258	EZ						
ZWG26	15.80	17.80	65259	EZ						
ZWG26	17.80	20.40	65260	EZ						
ZWG26	20.40	21.40	65261	EZ						
ZWG26	21.40	22.40	65262	EZ						

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Appendix 5: EZ drillhole logs and geochemistry.

Hole	DFrom	DTo	Sampno	Ag ppm	Al%	As ppm	Ba ppm	Ca%	Cu ppm	Fe%	K%	Mg%	Mn ppm	Pb ppm	S%	Zn ppm
ZWG25	0.00	14.30														
ZWG25	14.30	16.85	3984224	-1		70			7	1.91			250	66		549
ZWG25	16.85	22.60														
ZWG25	22.60	24.20	3984225	-1		50			2	0.69			144	21		314
ZWG26	0.00	5.30														
ZWG26	5.30	7.90	65254						15	2.25			1350	9435		23000
ZWG26	7.90	10.00	65255						10	0.79			295	3335		9495
ZWG26	10.00	11.90	65256						10	5.55			2250	9535		72500
ZWG26	11.90	13.90	65257						10	1.00			315	1785		6170
ZWG26	13.90	15.80	65258						10	0.56			305	3085		6895
ZWG26	15.80	17.80	65259						5	4.70			1650	18000		32000
ZWG26	17.80	20.40	65260						10	1.20			545	5185		8495
ZWG26	20.40	21.40	65261						10	6.60			2500	8485		68500
ZWG26	21.40	22.40	65262						5	2.85			1200	4785		25500

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APPENDIX 6

Report by T. Moody - air-core EOH sample. Geology, alteration and mineralisation



Appendix 6. Grievess prospect. Air-core EOH sample geochemistry.

Hole	SampNo.	east	north	DPO	Lithology	Ag	Al%	As	Ba	Ca%	Cu	Fe%	K%	Mg%	Mn	Pb	Zn	S%
ZG149	3912034	364680.7	5349351.4	77131	dolomite	-5	0.08	-25	-5	19.49	-5	0.68	-0.05	12.20	353	-50	789	
ZG150	3912035	364676.0	5349360.3	77131	dolomite	-5	0.06	-25	-5	19.20	-5	1.19	-0.05	12.10	568	70	681	
ZG151	3912036	364671.3	5349369.3	77131	dolomite	-5	0.60	-25	25	16.03	-5	6.23	0.25	9.69	2520	-50	889	
ZG152	3912037	364666.5	5349378.3	77131	dolomite	-5	2.62	-25	6	14.02	-5	4.14	-0.05	7.85	1110	3690	89000	0.41
ZG153	3912038	364654.6	5349393.4	77131	dolomite	-5	0.25	157	11	16.22	7	7.23	0.08	8.93	1260	1040	34400	7.00
ZG154	3912039	364648.6	5349401.4	77131	dolomite	-5	0.86	-25	27	15.17	6	8.33	0.30	8.29	4380	-50	5060	0.49
ZG155	3912040	364642.5	5349409.4	77131	siderite	-5	1.65	-25	65	8.26	5	20.00	0.72	4.03	11500	-50	12700	0.57
ZG156	3912041	364636.5	5349417.4	77131	limestone	-5	0.38	-25	16	27.65	5	3.00	0.17	3.09	1240	-50	1790	
ZG157	3912042	364617.5	5349439.4	77131	limestone	-5	0.56	-25	28	31.58	6	0.46	0.27	1.00	141	-50	54	
ZG158	3912043	364601.5	5349459.4	77131	dolomite	-5	1.25	-25	63	22.66	6	1.14	0.60	5.16	166	-50	44	
ZG159	3912044	364584.5	5349485.0	77131	limestone	-5	1.11	-25	59	26.98	15	1.51	0.58	1.10	105	-50	47	
ZG160	3912045	364554.3	5349524.6	77131	limestone	-5	0.26	-25	11	29.28	5	0.25	0.12	0.74	66	-50	6	
ZG161	3912046	364543.1	5349548.2	77131	limestone	-5	1.94	-25	104	25.15	8	0.68	1.00	1.14	133	-50	10	
ZG162	3912047	364527.1	5349567.6	77131	limestone	-5	0.76	-25	36	27.17	9	0.73	0.37	0.67	123	-50	13	
ZG163	3912048	364509.7	5349585.4	77131	limestone	-5	0.42	-25	24	31.10	6	0.44	0.22	0.96	99	-50	8	
ZG164	3912049	364492.1	5349609.1	77131	limestone	-5	0.48	-25	28	29.66	7	0.41	0.24	0.49	78	-50	-5	
ZG165	3912050	364477.0	5349629.0	77131	limestone	-5	1.30	-25	86	25.25	7	0.67	0.67	1.14	133	-50	-5	
ZG166	3912051	364599.6	5349383.3	77131	limestone	-5	0.65	-25	25	31.39	8	0.26	0.27	0.59	47	-50	69	
ZG167	3912052	364585.9	5349397.2	77131	limestone	-5	2.25	-25	115	22.75	10	0.91	1.07	1.82	169	-50	39	
ZG168	3912053	364576.7	5349410.7	77131	limestone	-5	1.13	-25	49	27.17	10	0.76	0.50	1.28	81	-50	170	
ZG170	3912054	364524.6	5349234.2	77131	dolomite	-5	0.28	84	8	18.34	11	2.97	0.06	10.80	1130	455	6150	1.89
ZG171	3912055	364518.5	5349240.4	77131	siderite	-5	0.22	162	8	13.34	5	16.00	-0.05	7.13	5780	392	7970	0.93
ZG172	3912056	364517.9	5349245.8	77131	siderite	-5	0.20	-25	6	1.73	-5	38.80	0.06	0.48	15400	-50	13500	0.10
ZG173	3912057	364512.9	5349249.1	77131	dolomite	-5	0.62	-25	54	19.49	7	5.12	0.22	10.30	1970	263	4560	
ZG174	3912058	364509.9	5349253.1	77131	siderite	-5	0.37	-25	14	10.85	6	20.60	0.13	5.44	7280	241	16700	0.17
ZG175	3912059	364506.9	5349257.1	77131	siderite	-5	0.35	-25	8	5.83	-5	30.00	0.08	2.93	12400	117	11300	0.16
ZG177	3912060	364500.9	5349265.1	77131	siderite	-5	3.17	-25	122	0.62	21	32.78	0.85	0.34	12200	668	41700	0.88
ZG178	3912061	364562.2	5349280.9	77131	siderite	-5	0.14	-25	-5	5.92	-5	30.78	-0.05	3.03	11600	-50	19100	0.15
ZG179	3912062	364569.1	5349272.4	77131	dolomite	-5	0.09	-25	-5	19.68	-5	2.55	-0.05	11.40	1170	-50	1320	
ZG180	3912063	364574.7	5349263.6	77131	sandstones	-5	1.01	-25	39	0.06	34	0.72	0.44	0.08	69	-50	108	
ZG181	3912064	364487.1	5349223.4	77131	sandstones	-5	1.29	-25	47	0.03	9	0.35	0.57	0.08	23	199	64	
ZG182	3912065	364489.0	5349213.2	77131	dolomite	-5	0.09	-25	-5	19.87	-5	0.73	-0.05	11.80	396	-50	730	
ZG183	3912066	364484.2	5349221.1	77131	siderite	-5	0.16	-25	-5	13.82	-5	16.20	-0.05	7.05	6380	97	12300	0.68
ZG184	3912067	364479.9	5349229.1	77131	siderite	-5	0.33	-25	9	9.60	-5	24.60	0.11	4.91	9360	-50	11500	0.54
ZG185	3912068	364468.8	5349247.1	77131	siderite	-5	0.56	-25	19	1.52	-5	34.64	0.21	0.19	13100	-50	15000	0.59
ZG186	3912069	364448.1	5349260.3	77131	dolomite	-5	0.63	-25	28	20.45	5	5.18	0.25	7.54	1920	-50	1320	
ZG187	3912070	364434.0	5349284.3	77131	limestone	-5	0.50	-25	26	31.97	5	0.73	0.25	1.01	181	-50	13	
ZG190	3912071	364418.6	5349189.6	77131	siderite	-5	0.32	-25	11	16.13	-5	10.90	0.11	8.20	4790	157	910	
ZG191	3912072	364328.1	5349152.1	77131	dolomite	-5	0.06	-25	-5	19.30	-5	1.86	-0.05	11.70	779	-50	113	
ZG192	3912073	364323.2	5349157.1	77131	dolomite	-5	0.07	-25	-5	16.13	-5	9.02	-0.05	9.53	4340	-50	165	
ZG193	3912074	364316.2	5349165.1	77131	dolomite	-5	0.15	-25	6	18.72	-5	5.79	-0.05	9.34	2340	-50	84	
ZG195	3912075	364387.2	5349169.5	77131	siderite	-5	1.90	-25	70	1.78	9	30.00	0.67	0.41	14000	56	386	
ZG196	3912076	364380.1	5349179.7	77131	dolomite	-5	0.68	-25	32	17.66	-5	6.92	0.11	8.94	3760	74	2270	
ZG197	3912077	364285.9	5349138.9	77131	dolomite	-5	0.31	-25	14	19.39	7	2.07	0.11	10.80	741	-50	6530	0.43
ZG198	3912078	364281.7	5349144.4	77131	limestone	-5	0.35	-25	12	25.25	5	0.88	0.15	5.64	356	-50	75	

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Appendix 6. Grievess prospect. Air-core EOH sample geochemistry.

Hole	SampNo.	east	north	DPO	Lithology	Ag	Al%	As	Ba	Ca%	Cu	Fe%	K%	Mg%	Mn	Pb	Zn	S%
ZG199	3912079	364250.1	5349091.2	77131	dolomite	-5	0.20	-25	5	19.10	7	2.02	0.05	11.20	708	-50	88	
ZG200	3912080	364251.0	5349098.9	77131	dolomite	-5	0.55	-25	17	16.99	-5	6.34	0.15	9.90	872	-50	154	
ZG201	3912081	364244.9	5349108.5	77131	siderite	-5	0.65	45	19	10.85	7	20.10	0.19	5.49	7620	-50	278	
ZG202	3912082	364239.0	5349118.4	77131	limestone	-5	0.40	-25	18	27.07	8	0.93	0.18	3.56	275	-50	47	
ZG203	3912083	364220.5	5349043.9	77131	dolomite	-5	0.22	-25	7	18.72	5	0.85	0.08	11.60	410	-50	51	
ZG204	3912084	364225.7	5349036.7	77131	dolomite	-5	0.11	-25	-5	19.78	-5	0.75	-0.05	12.50	353	-50	65	
ZG205	3912085	364213.8	5349051.4	77131	siderite	-5	0.08	-25	-5	12.67	-5	18.50	-0.05	7.68	10400	-50	216	
ZG207	3912086	364283.2	5349208.8	77131	limestone	-5	0.78	-25	39	28.51	10	0.65	0.36	1.46	237	-50	7	
ZG210	3912087	364268.2	5349162.9	77131	limestone	-5	0.14	-25	6	33.31	6	0.68	0.06	0.74	230	-50	22	
ZG213	3912088	364230.9	5349126.9	77131	dolomite	-5	1.21	-25	45	18.14	7	1.11	0.50	10.10	288	-50	24	
ZG214	3912089	364225.2	5349133.8	77131	limestone	-5	0.55	-25	18	28.03	10	2.32	0.20	2.69	954	-50	10	
ZG216	3912090	364190.9	5349177.0	77131	dolomite	-5	2.05	48	90	16.03	9	2.83	0.82	4.30	135	-50	188	
ZG217	3912091	364209.1	5349059.9	77131	dolomite	-5	0.11	-25	5	19.39	5	2.31	-0.05	11.00	1030	-50	204	
ZG218	3912092	364201.8	5349068.2	77131	dolomite	-5	0.24	-25	10	19.49	-5	1.02	0.10	12.10	474	-50	51	
ZG219	3912093	364183.5	5349084.6	77131	dolomite	-5	0.77	-25	31	23.71	6	1.48	0.33	5.67	506	-50	8	
ZG220	3912094	364173.4	5349108.9	77131	pelites	-5	8.96	-25	302	0.93	30	3.92	2.37	0.97	31	96	393	
ZG221	3912095	364181.6	5349016.0	77131	dolomite	-5	0.14	-25	7	21.40	-5	0.87	-0.05	12.70	392	-50	173	
ZG222	3912096	364178.2	5349022.9	77131	dolomite	-5	0.08	-25	5	21.60	-5	0.61	-0.05	13.20	341	-50	100	
ZG223	3912097	364172.9	5349031.3	77131	dolomite	-5	0.07	-25	5	20.50	-5	0.93	-0.05	12.60	425	-50	162	
ZG224	3912098	364166.4	5349040.6	77131	dolomite	-5	0.09	-25	5	20.50	-5	0.99	-0.05	12.70	469	-50	101	
ZG226	3912099	364148.4	5349062.8	77131	dolomite	-5	1.85	-25	81	20.60	7	1.60	0.88	5.43	372	-50	17	
ZG227	3912100	364133.3	5349083.2	77131	dolomite	-5	2.37	-25	112	17.60	8	2.08	1.09	7.13	324	-50	10	
ZG228	3912101	364148.5	5348990.2	77131	dolomite	-5	0.10	-25	5	20.70	-5	0.90	-0.05	12.80	440	-50	217	
ZG230	3912102	364143.7	5348996.1	77131	siderite	-5	0.41	536	14	14.50	5	11.20	0.09	2.73	728	267	27000	12.50
ZG231	3912103	364135.3	5349005.8	77131	siderite	-5	0.68	-25	32	4.21	-5	36.20	0.28	1.48	17200	-50	94	
ZG232	3912104	364128.2	5349013.7	77131	dolomite	-5	0.23	32	12	17.90	5	5.97	0.08	10.50	2050	116	479	
ZG233	3912105	364112.5	5349033.9	77131	dolomite	-5	1.52	-25	61	16.30	9	3.08	0.59	7.95	365	-50	124	
ZG235	3912106	364067.4	5348965.3	77131	siderite	-5	0.52	-25	34	1.71	-5	41.00	0.21	0.15	19800	-50	95	
ZG236	3912107	364061.8	5348974.1	77131	siderite	-5	0.91	-25	51	1.31	-5	40.00	0.40	0.18	20600	-50	58	
ZG237	3912108	364055.0	5348981.9	77131	siderite	-5	0.83	-25	43	1.84	6	38.70	0.34	0.24	18300	-50	161	
ZG238	3912109	364048.8	5348989.3	77131	limestone	-5	0.89	-25	36	30.70	8	1.56	0.39	1.67	154	-50	17	
ZG239	3912110	364033.7	5349009.3	77131	limestone	-5	0.77	-25	38	26.90	6	2.99	0.36	3.04	1110	-50	-5	
ZG240	3912111	364018.9	5349029.6	77131	limestone	-5	0.14	-25	12	33.70	8	0.11	0.06	0.31	65	-50	17	
ZG241	3912112	364117.9	5349107.0	77131	limestone	-5	0.37	-25	21	33.90	7	0.22	0.13	0.24	260	-50	48	
ZG242	3912113	364105.8	5349125.4	77131	limestone	-5	0.39	-25	26	34.50	7	0.17	0.19	0.30	43	-50	10	
ZG243	3912114	364090.7	5349145.9	77131	limestone	-5	1.56	-25	88	24.00	6	0.80	0.76	3.62	110	-50	23	
ZG245	3912115	364061.0	5349185.6	77131	limestone	-5	1.02	-25	52	30.60	7	0.90	0.52	0.47	312	-50	5	
ZG246	3912116	364044.8	5349206.6	77131	limestone	-5	0.96	-25	52	29.80	8	0.44	0.48	0.35	87	-50	7	
ZG247	3912117	364030.0	5349226.8	77131	limestone	-5	0.48	-25	30	32.00	7	0.53	0.23	1.37	126	-50	20	
ZG248	3912118	364014.4	5349247.7	77131	dolomite	-5	2.25	-25	102	17.90	10	1.99	1.11	7.07	220	-50	31	
ZG249	3912119	363999.5	5349267.4	77131	limestone	-5	3.01	-25	149	22.00	9	1.20	1.48	2.72	176	-50	6	
ZG250	3912120	363984.9	5349286.9	77131	impure carbonate	-5	3.85	-25	193	14.20	8	1.24	1.91	2.34	89	-50	36	
ZG252	3912121	363957.8	5349324.8	77131	limestone	-5	0.78	-25	46	27.80	7	0.33	0.41	0.77	690	-50	12	
ZG253	3912122	363939.0	5349348.1	77131	limestone	-5	0.90	-25	46	31.20	8	0.35	0.48	0.76	86	-50	-5	
ZG254	3912123	363927.2	5349369.7	77131	limestone	-5	1.33	-25	59	25.90	8	1.04	0.68	2.84	192	-50	21	

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Appendix 6. Grievies prospect. Air-core EOH sample geochemistry.

Hole	SampNo.	east	north	DPO	Lithology	Ag	Al%	As	Ba	Ca%	Cu	Fe%	K%	Mg%	Mn	Pb	Zn	S%
ZG255	3912124	363911.1	5349389.9	77131	limestone	-5	0.53	-25	143	32.60	7	0.20	0.27	0.93	50	-50	20	
ZG256	3912125	363896.6	5349408.1	77131	dolomite	-5	0.79	25	45	20.80	-5	1.74	0.35	8.42	497	-50	180	
ZG257	3912126	363878.6	5349428.2	77131	dolomite	-5	0.26	-25	17	19.50	-5	1.05	0.11	10.90	471	-50	41	
ZG258	3912127	364222.4	5349468.5	77131	limestone	-5	0.42	-25	26	32.30	-5	0.23	0.21	0.92	59	-50	-5	
ZG259	3912128	364207.4	5349488.4	77131	dolomite	-5	0.99	-25	49	23.10	-5	1.03	0.50	7.11	138	-50	6	
ZG260	3912129	364192.3	5349508.4	77131	impure carbonate	-5	4.54	-25	250	14.00	14	2.22	2.44	3.69	126	-50	18	
ZG261	3912130	364179.7	5349529.6	77131	limestone	-5	0.54	-25	30	32.20	8	0.53	0.27	0.47	63	-50	-5	
ZG262	3912131	364839.1	5349679.5	77131	sandstones	-5	1.22	-25	40	0.03	5	0.26	0.49	0.06	-15	277	10	
ZG264	3912132	364838.2	5349715.8	77131	sandstones	-5	1.01	-25	39	0.08	12	0.46	0.53	0.10	19	-50	571	
ZG265	3912133	364834.9	5349731.1	77131	dolomite	-5	0.04	-25	5	21.00	-5	0.52	-0.05	13.00	316	-50	324	
ZG266	3912134	364832.8	5349741.6	77131	dolomite	-5	0.06	-25	5	19.80	-5	2.75	-0.05	12.30	1780	-50	1200	
ZG267	3912135	364826.8	5349751.8	77131	dolomite	-5	0.75	-25	40	19.70	-5	1.11	0.34	11.80	527	-50	254	
ZG268	3912136	364816.6	5349761.8	77131	limestone	-5	0.36	70	22	31.30	6	0.70	0.13	1.31	422	-50	142	
ZG269	3912137	364809.7	5349772.4	77131	limestone	-5	0.69	-25	32	32.00	6	0.16	0.29	0.23	251	-50	229	
ZG270	3912138	364792.7	5349789.2	77131	limestone	-5	0.72	87	33	32.90	9	0.41	0.27	0.17	412	68	73	
ZG271	3912139	364778.6	5349805.1	77131	dolomite	-5	0.84	-25	33	24.70	6	0.95	0.37	4.27	311	-50	74	
ZG273	3912140	364782.2	5349708.6	77131	limestone	-5	0.53	-25	28	31.70	7	0.68	0.24	1.32	227	-50	1150	
ZG274	3912141	364778.6	5349721.4	77131	dolomite	-5	1.20	-25	42	17.30	8	1.46	0.39	5.92	99	-50	1900	
ZG275	3912142	364774.3	5349727.2	77131	limestone	-5	0.36	48	20	32.00	6	0.38	0.13	0.28	69	-50	376	
ZG276	3912143	364759.2	5349747.4	77131	limestone	-5	0.18	-25	17	33.60	8	0.11	0.07	0.16	274	-50	346	
ZG277	3912144	364873.9	5349765.9	77131	dolomite	-5	0.07	-25	5	19.10	-5	0.96	-0.05	11.70	349	-50	656	
ZG278	3912145	364874.8	5349779.0	77131	dolomite	-5	0.06	-25	5	19.70	-5	0.66	-0.05	12.30	362	-50	544	
ZG279	3912146	364862.9	5349783.1	77131	dolomite	-5	0.89	-25	34	18.30	5	2.93	0.38	10.00	1290	52	746	
ZG281	3912147	364846.3	5349802.0	77131	limestone	-5	0.16	-25	12	32.10	6	0.23	0.06	0.32	85	-50	46	
ZG281	3912148	364846.3	5349802.0	77131	limestone	-5	0.85	-25	35	26.20	8	1.20	0.37	4.65	389	-50	283	
ZG282	3912149	364834.0	5349817.9	77131	limestone	-5	0.41	-25	27	33.00	8	0.42	0.18	0.75	137	-50	21	
ZG283	3912150	364624.9	5349769.4	77131	limestone	-5	2.07	-25	107	20.70	11	0.86	1.00	0.57	62	-50	29	
ZG287	3912151	364550.5	5349870.2	77131	impure carbonate	-5	4.25	-25	215	16.10	25	0.96	2.16	0.68	66	-50	16	
ZG290	3912152	364505.4	5349930.1	77131	dolomite	-5	1.98	-25	98	18.60	7	2.12	0.88	5.30	179	-50	47	
ZG291	3912153	364490.3	5349950.1	77131	limestone	-5	1.35	-25	70	25.30	9	0.69	0.66	1.91	91	-50	7	
ZG292	3912154	364475.3	5349970.0	77131	dolomite	-5	1.97	-25	101	17.70	7	1.16	1.00	4.88	92	-50	16	
ZG293	3912155	364460.2	5349990.0	77131	limestone	-5	1.12	-25	47	22.30	8	0.64	0.52	0.48	149	66	622	
ZG294	3912156	364432.0	5349994.5	77131	limestone	-5	0.76	-25	45	31.10	9	0.24	0.40	0.43	76	-50	7	
ZG295	3912157	364407.8	5350000.1	77131	sandstones	-5	2.97	-25	154	3.26	19	1.59	1.49	0.53	42	-50	105	
ZG296	3912158	364383.6	5350005.6	77131	limestone	-5	3.41	-25	202	20.00	8	1.45	1.75	2.46	115	-50	21	
ZG297	3912159	364359.4	5350011.2	77131	dolomite	-5	0.95	-25	39	19.10	6	0.46	0.42	8.29	67	-50	16	
ZG298	3912160	363834.5	5349489.5	77131	dolomite	-5	2.87	-25	176	14.90	7	1.20	1.54	7.76	121	128	124	
ZG299	3912161	363819.3	5349509.5	77131	dolomite	-5	3.04	-25	152	17.10	9	1.26	1.57	4.81	80	-50	23	
ZG300	3912162	363804.3	5349529.5	77131	sandstones	-5	3.40	-25	176	4.61	13	1.64	1.71	1.73	72	125	1160	
ZG301	3912163	363795.2	5349541.5	77131	limestone	-5	1.35	-25	69	29.10	8	0.43	0.74	1.01	79	-50	66	
ZG302	3912164	363927.3	5349527.8	77131	pelites	-5	6.56	-25	511	0.11	21	2.16	3.96	0.80	39	-50	200	
ZG303	3912165	363912.2	5349547.8	77131	pelites	-5	6.61	-25	426	6.32	18	2.43	3.49	2.87	94	-50	361	
ZG305	3912166	363789.2	5349549.5	77131	dolomite	-5	2.33	-25	93	19.60	9	1.06	1.27	5.28	90	-50	226	
ZG307	3912167	363768.2	5349577.4	77131	dolomite	-5	3.14	-25	125	14.70	10	4.81	1.61	6.08	248	56	52	
ZG308	3912168	363759.1	5349589.4	77131	pelites	-5	6.03	27	262	7.80	15	2.30	3.07	1.70	56	60	883	

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Appendix 6. Grievs prospect. Air-core EOH sample geochemistry.

Hole	SampNo.	east	north	DPO	Lithology	Ag	Al%	As	Ba	Ca%	Cu	Fe%	K%	Mg%	Mn	Pb	Zn	S%
ZG309	3912169	363882.1	5349587.7	77131	limestone	-5	0.87	-25	47	27.00	9	0.64	0.46	4.15	130	-50	12	
ZG310	3912170	363867.1	5349607.7	77131	limestone	-5	0.73	-25	37	25.60	8	0.72	0.40	5.02	106	-50	16	
ZG312	3912171	363837.0	5349647.6	77131	dolomite	-5	0.35	-25	19	18.80	5	1.16	0.16	11.40	207	-50	379	
ZG313	3912172	364011.8	5349748.0	77131	dolomite	-5	0.79	-25	45	21.70	6	0.64	0.39	8.45	319	734	409	
ZG314	3912173	363996.7	5349768.0	77131	dolomite	-5	0.18	-25	17	19.20	-5	0.24	0.08	12.00	182	-50	116	
ZG315	3912174	363981.7	5349787.9	77131	dolomite	-5	2.32	-25	128	15.60	7	1.16	1.13	8.66	239	179	274	
ZG316	3912175	363966.6	5349807.9	77131	dolomite	-5	0.28	-25	17	18.60	5	1.36	0.11	11.70	236	622	428	
ZG317	3912176	364026.8	5349728.0	77131	dolomite	-5	0.50	-25	32	19.50	5	0.54	0.25	11.10	255	76	179	
ZG318	3912177	364041.9	5349708.1	77131	limestone	-5	0.88	-25	54	29.60	11	0.26	0.47	1.80	104	-50	103	
ZG320	3912178	364072.0	5349668.1	77131	pelites	-5	8.52	-25	417	0.28	11	1.91	3.23	0.81	48	-50	107	
ZG321	3912179	364087.0	5349648.2	77131	pelites	-5	9.19	-25	559	0.05	11	1.19	4.32	0.84	40	-50	25	
ZG322	3912180	364102.0	5349628.2	77131	dolomite	-5	0.17	-25	11	19.60	7	1.72	0.07	11.60	370	216	23	
ZG323	3912181	364118.8	5349610.2	77131	limestone	-5	0.28	-25	17	30.40	8	0.30	0.14	3.13	95	-50	6	
ZG324	3912182	364133.0	5349588.9	77131	dolomite	-5	1.30	-25	56	24.50	8	0.90	0.67	4.51	187	-50	10	
ZG325	3912183	364186.5	5349848.4	77131	pelites	-5	5.58	-25	361	0.52	15	1.44	2.68	0.89	41	-50	31	
ZG326	3912184	364171.5	5349868.3	77131	pelites	-5	6.22	-25	510	0.22	12	2.09	3.80	1.04	54	-50	112	
ZG327	3912185	364156.5	5349888.3	77131	dolomite	-5	1.56	39	91	21.70	7	1.36	0.85	6.58	108	-50	39	
ZG328	3912186	364241.1	5349942.1	77131	pelites	-5	4.63	-25	367	0.13	18	1.21	2.99	0.76	52	-50	55	
ZG329	3912187	364221.3	5349968.5	77131	pelites	-5	6.93	-25	589	0.20	21	2.39	4.67	1.06	62	-50	52	
ZG330	3912188	364144.4	5349904.3	77131	dolomite	-5	1.59	-25	94	19.30	6	0.63	0.83	10.40	121	-50	125	
ZG331	3912189	364126.4	5349928.2	77131	dolomite	5	1.21	144	273	15.80	8	4.70	0.58	8.59	129	97	355	
ZG332	3912190	364111.3	5349948.2	77131	dolomite	-5	2.45	-25	140	16.40	7	1.21	1.30	8.03	131	-50	39	
ZG333	3912191	364096.3	5349968.2	77131	limestone	-5	0.32	-25	20	27.60	6	0.27	0.15	5.69	47	74	100	
ZG334	3912192	364081.2	5349988.1	77131	pelites	-5	12.60	32	253	0.45	52	2.16	3.14	0.77	34	349	328	
ZG335	3912193	364061.4	5350014.5	77131	dolomite	-5	0.33	28	19	19.20	-5	1.22	0.17	11.60	160	-50	66	
ZG336	3912194	364191.2	5350008.4	77131	dolomite	-5	1.53	-25	83	15.50	7	0.70	0.75	7.31	77	-50	16	
ZG337	3912195	364176.1	5350028.4	77131	limestone	-5	0.24	-25	17	27.40	6	0.19	0.13	5.30	91	-50	17	
ZG338	3912196	364161.1	5350048.3	77131	limestone	-5	0.56	-25	24	31.80	8	0.29	0.30	1.12	78	-50	40	
ZG339	3912197	364146.0	5350068.3	77131	dolomite	-5	0.18	-25	13	24.80	5	0.28	0.07	7.18	110	-50	245	
ZG340	3912198	364131.0	5350088.3	77131	limestone	-5	1.69	-25	63	25.00	7	0.62	0.76	2.39	82	-50	65	
ZG341	3912199	364216.9	5350398.5	77131	limestone	-5	0.95	30	40	31.30	8	0.43	0.55	0.38	340	-50	14	
ZG342	3912200	364241.9	5350399.0	77131	limestone	-5	0.84	-25	45	30.00	7	0.43	0.49	1.76	90	-50	27	
ZG343	3912201	364266.9	5350399.5	77131	dolomite	-5	1.85	-25	113	22.30	7	0.88	1.07	4.98	87	-50	19	
ZG344	3912202	364291.9	5350400.0	77131	pelites	-5	4.41	-25	284	7.82	7	2.33	2.27	3.74	206	-50	59	
ZG345	3912203	364316.9	5350400.5	77131	pelites	-5	7.14	-25	559	0.44	16	1.92	4.48	0.80	46	-50	39	
ZG346	3912204	364688.2	5349623.0	77131	limestone	-5	0.80	-25	29	27.50	7	1.35	0.35	2.62	457	-50	1920	
ZG348	3912205	364750.9	5349690.6	77131	siderite	-5	1.08	30	44	0.46	5	37.90	0.43	0.15	10400	-50	22000	2.33
ZG349	3912206	364768.0	5349665.8	77131	dolomite	-5	0.46	-25	20	19.30	7	1.43	0.18	11.20	572	67	1380	
ZG350	3912207	364771.3	5349654.5	77131	siderite	-5	0.31	-25	10	3.54	7	33.90	0.07	2.08	2360	324	48700	0.40
ZG351	3912208	364753.7	5349664.3	77131	siderite	-5	1.17	-25	70	9.76	7	16.50	0.43	5.05	7500	-50	49200	2.41
ZG352	3912209	364697.1	5349580.2	77131	limestone	-5	0.84	-25	33	26.80	9	0.66	0.34	4.33	463	146	2020	
ZG353	3912210	364752.9	5349384.6	77131	sandstones	-5	1.27	-25	54	0.05	7	0.53	0.53	0.09	24	103	141	
ZG354	3912211	364744.5	5349393.6	77131	sandstones	-5	1.63	-25	77	1.23	11	0.31	0.52	0.17	34	111	114	
ZG355	3912212	364737.8	5349401.3	77131	sandstones	-5	1.24	-25	70	0.03	12	0.53	0.58	0.09	18	57	97	
ZG356	3912213	364731.3	5349408.3	77131	sandstones	-5	2.63	61	151	0.12	14	1.00	1.63	0.24	29	57	137	

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Appendix 6. Grievies prospect. Air-core EOH sample geochemistry.

Hole	SampNo.	east	north	DPO	Lithology	Ag	Al%	As	Ba	Ca%	Cu	Fe%	K%	Mg%	Mn	Pb	Zn	S%
ZG357	3912217	364726.1	5349424.6	77131	siderite	-5	3.80	227	153	0.06	142	41.00	0.70	0.12	1080	2460	4500	
ZG366	3984395	364476.6	5349160.7	77149	sandstones	-5	1.22	-25	31	0.01	9	0.23	0.42	0.05	-15	-50	21	
ZG367	3984396	364470.7	5349169.2	77149	sandstones	-5	3.44	-25	100	0.02	9	0.31	1.39	0.18	-15	-50	15	
ZG368	3984397	364459.7	5349175.2	77149	siderite	-5	1.26	431	35	0.88	6	33.70	0.38	0.86	14200	6770	85000	2.50
ZG369	3984398	364451.2	5349182.3	77149	dolomite	-5	0.08	-25	5	21.80	19	0.67	-0.05	12.30	365	-50	423	
ZG370	3984399	364442.6	5349189.6	77149	sandstones	-5	1.65	-25	48	0.13	10	0.50	0.60	0.12	33	-50	294	
ZG371	3984400	364435.7	5349196.3	77149	siderite	-5	0.26	184	8	15.50	22	13.10	0.08	8.00	2840	671	21000	8.95
ZG372	3986001	364428.3	5349201.7	77149	dolomite	-5	0.11	-25	-5	19.20	14	4.84	-0.05	10.20	2000	233	1380	
ZG373	3986002	363612.1	5348991.9	77149	sandstones	-5	3.63	-25	171	10.60	25	4.99	1.47	4.16	1120	8060	24500	0.96
ZG374	3986003	363614.9	5348982.8	77149		-5	1.37	-25	53	18.30	19	8.74	0.46	1.54	4000		102000	2.70
ZG375	3986004	363619.1	5348972.6	77149	limestone	-5	1.68	-25	89	28.30	29	0.84	0.85	1.49	206	-50	421	
ZG376	3986005	363622.6	5348964.0	77149	limestone	-5	2.46	-25	123	23.40	29	2.31	1.19	2.82	266	-50	643	
ZG377	3986006	363625.6	5348954.1	77149	limestone	-5	0.78	-25	43	34.50	29	0.36	0.41	0.59	111	-50	35	
ZG379	3986007	363633.6	5348936.7	77149	limestone	-5	1.67	-25	87	30.20	28	0.77	0.80	1.07	163	-50	185	
ZG381	3986008	363605.4	5348895.0	77149	limestone	-5	1.39	-25	66	30.40	26	0.52	0.67	0.86	141	-50	6	
ZG383	3986009	363597.8	5348912.0	77149	impure carbonate	-5	3.61	-25	164	19.20	28	1.91	1.77	3.70	180	-50	96	
ZG384	3986010	363596.8	5348921.2	77149	pelites	-5	6.47	-25	267	10.20	30	1.75	2.65	1.01	51	-50	342	
ZG385	3986011	363593.3	5348930.3	77149	dolomite	-5	3.92	-25	173	15.50	41	5.09	1.84	4.70	158	-50	67	
ZG386	3986012	363589.7	5348942.5	77149	limestone	-5	1.61	-25	77	25.40	26	1.01	0.74	3.59	161	-50	66	
ZG387	3986013	363588.9	5348952.9	77149	limestone	-5	0.77	-25	39	33.20	27	0.76	0.30	0.37	772	345	1550	
ZG388	3986014	363588.3	5348960.3	77149	limestone	-5	0.87	-25	39	26.30	23	0.92	0.39	2.26	394	4080	2740	
ZG389	3986015	363619.8	5348873.7	77149	limestone	-5	2.06	-25	90	27.80	31	0.39	0.88	0.43	142	264	358	
ZG390	3986016	363686.1	5348946.7	77149	limestone	-5	1.04	-25	50	28.90	27	0.50	0.50	0.72	80	-50	267	
ZG391	3986017	363677.2	5348960.0	77149	limestone	-5	3.25	-25	149	21.80	24	0.82	1.48	1.00	127	2990	808	
ZG392	3986018	363675.1	5348968.9	77149	dolomite	-5	2.02	-25	96	16.30	28	1.92	0.94	5.47	190	176	779	
ZG393	3986019	363672.7	5348983.0	77149	dolomite	-5	2.56	-25	124	20.70	28	1.82	1.27	4.01	188	204	2590	
ZG394	3986020	363668.5	5348991.7	77149	limestone	-5	1.90	-25	100	27.70	28	1.14	0.92	0.61	268	1120	1480	
ZG395	3986021	363666.8	5349002.1	77149	limestone	-5	2.64	-25	119	20.10	25	2.21	1.10	3.17	514	4380	8880	1.35
ZG396	3986022	363660.6	5349009.3	77149	sandstones	-5	2.87	108	146	8.90	24	3.08	1.19	0.35	54	406	823	
ZG397	3986023	363658.8	5349018.5	77149	limestone	-5	1.47	-25	75	27.10	27	0.69	0.72	1.13	118	-50	174	
ZG398	3986024	363661.6	5349027.6	77149	limestone	-5	1.13	-25	52	21.80	47	1.75	0.52	1.48	164	-50	62	
ZG399	3986025	363661.0	5349037.5	77149	limestone	-5	0.83	-25	45	23.20	25	0.39	0.41	0.37	75	-50	22	
ZG400	3986026	363660.0	5349048.0	77149	limestone	-5	1.11	-25	72	26.60	24	0.25	0.59	0.31	152	-50	8	

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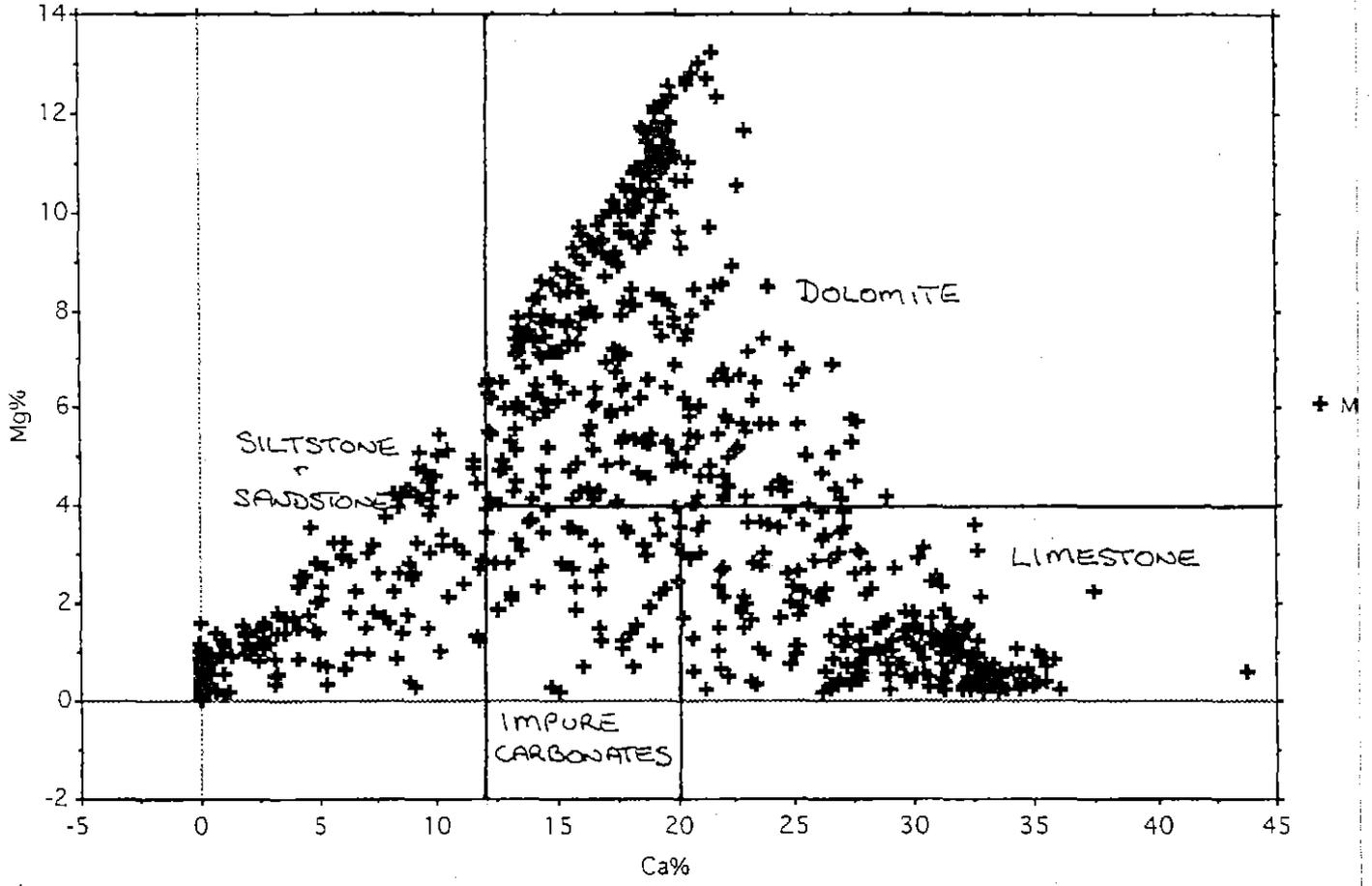
## AIR-CORE END OF HOLE SAMPLES GEOCHEMICAL CHARACTERISTICS

	Percentile	Ca%	Mg%	Fe%	Mn ppm	Al%	K%	Pb ppm	Zn ppm	Ba ppm	number
<b>SIDERITE</b> (>10% Fe)	90%	13.20	5.60	40.70	21640	3.13	1.11	1876	49000	134	69
	median	3.29	1.06	30.00	10900	1.17	0.47	67	2050	59	
	10%	0.64	0.16	0.13	1856	0.28	0.07	-50	72	8	
<b>LIMESTONE</b> (>20% Ca) (<4% Mg)	90%	33.70	30.60	1.50	419	2.14	1.06	70	552	117	241
	median	28.90	1.21	0.64	123	0.86	0.23	-50	57	46	
	10%	23.00	0.32	0.22	68	0.35	0.14	-50	-8	17	
<b>DOLOMITE</b> (>12% Ca) (>4% Mg)	90%	22.00	11.20	4.15	1925	3.13	1.57	715	2832	186	284
	median	18.30	7.47	1.60	338	1.55	0.74	-50	206	88	
	10%	13.70	4.59	0.72	123	0.24	0.08	-50	23	13	
<b>IMPURE CARBONATES</b> (12-20% Ca) (<4% Mg)	90%	19.20	3.69	2.51	363	4.54	2.44	340	889	306	45
	median	16.00	2.73	1.39	146	3.34	1.58	-50	71	164	
	10%	13.00	1.04	0.78	79	1.39	0.53	-50	16	60	
<b>PELITIC SILTSTONES</b> (<12% Ca) (>4% Al)	90%	8.86	3.02	3.90	224	10.64	4.61	553	1930	605	111
	median	1.91	1.15	1.97	59	6.78	3.36	-50	214	380	
	10%	0.05	0.46	1.18	18	4.77	2.28	-50	39	227	
<b>SANDSTONES</b> (<12% Ca) (<4% Al)	90%	8.80	1.87	3.29	167	3.40	1.61	1092	2230	212	93
	median	0.15	0.19	0.76	30	1.63	0.69	57	122	96	
	10%	0.02	0.06	0.29	-15	0.73	0.29	-50	15	39	

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ZEEHAN PROJECT  
AIR-CORE LEOH SAMPLES  
Ca% vs Mg%

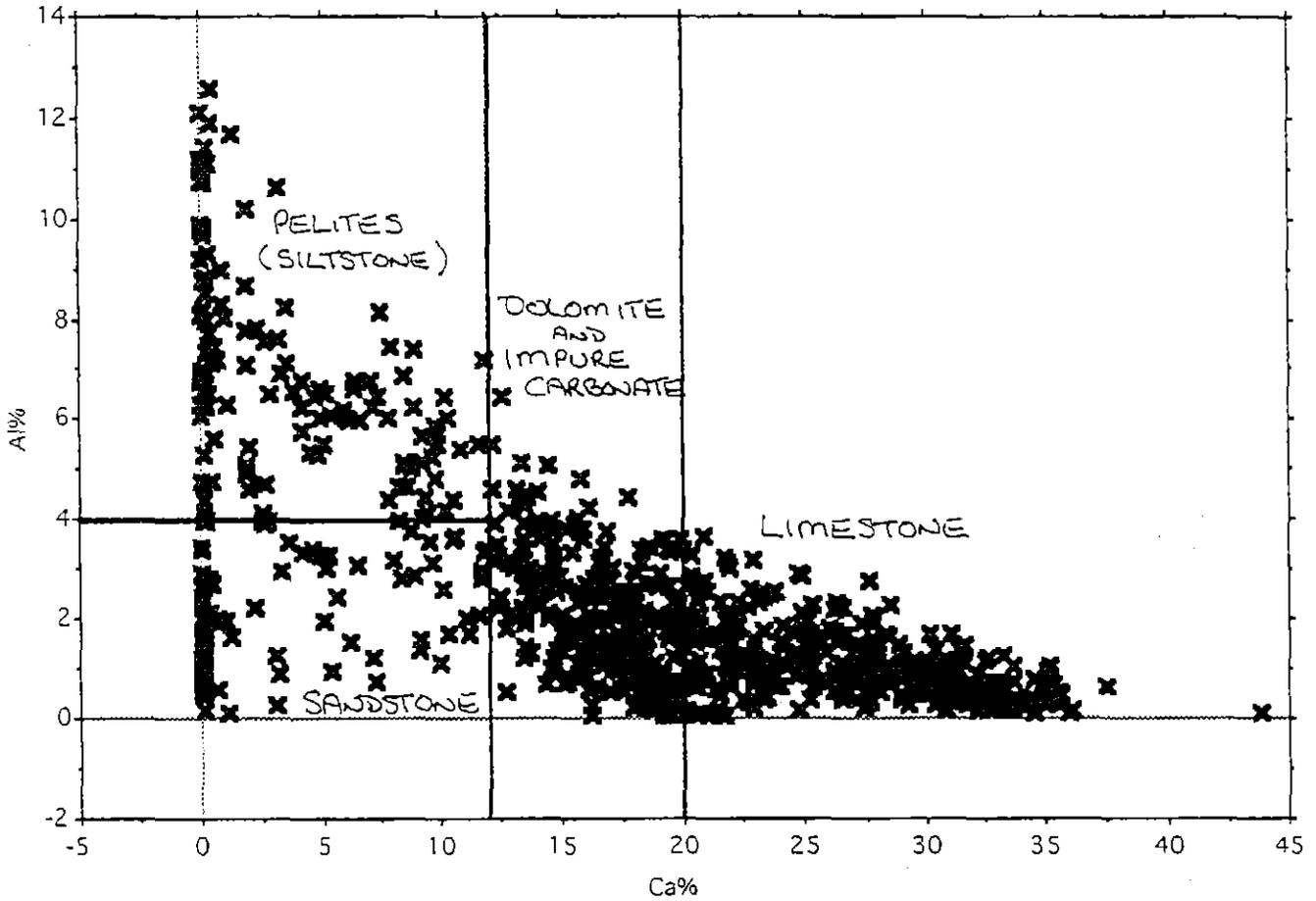
Scattergram for columns: X1Y1 r2 = .01



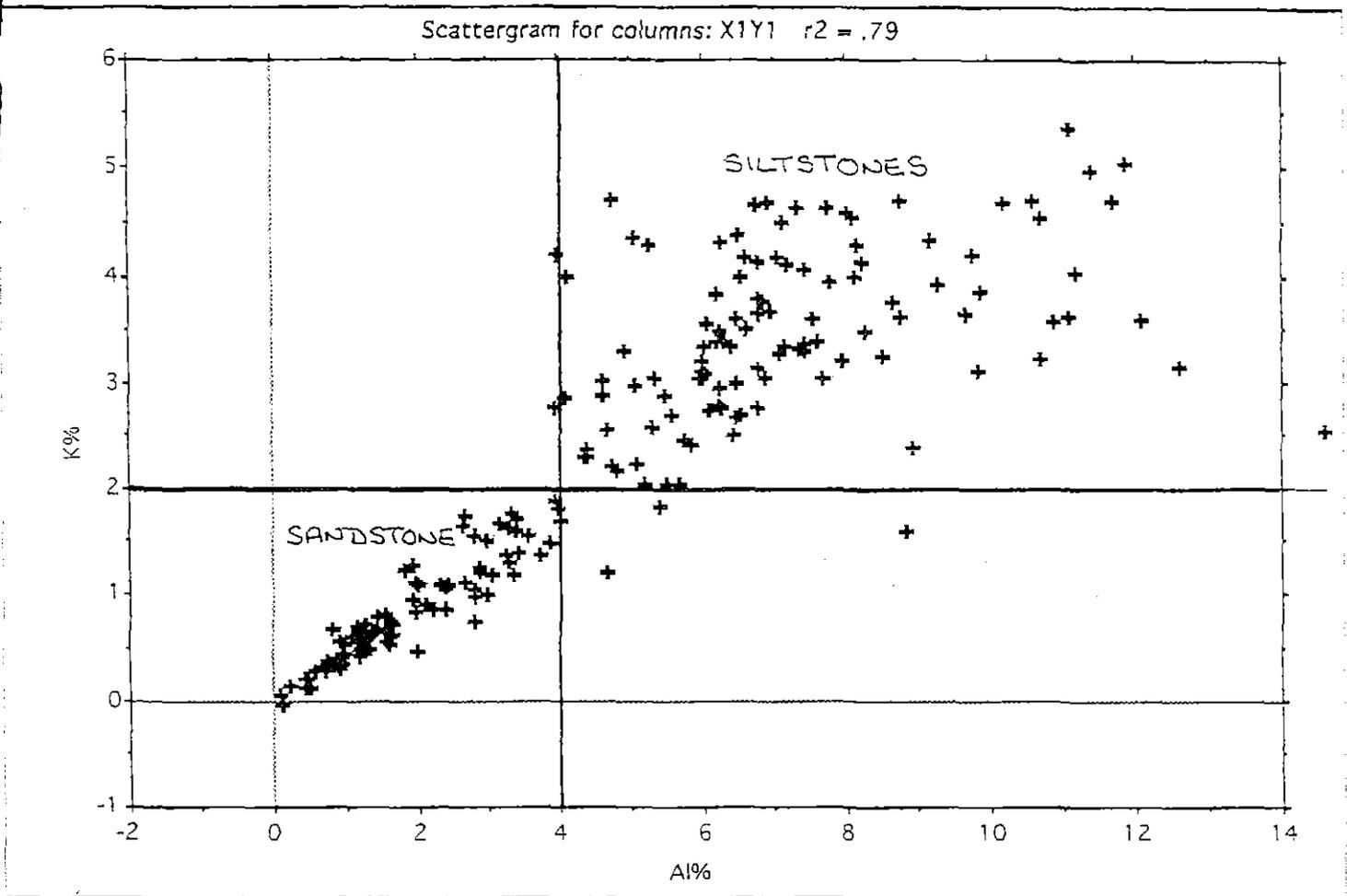
AIR-CORE END-OF-HOLE SAMPLES

Ca% v's Al%

Scattergram for columns: X1Y2 r2 = .4



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# CRA EXPLORATION PTY. LIMITED

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Ph. (077) 43 6355  
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October 1994

Memorandum to : R.G. Parkinson  
copy : D.C. Fielding  
D. Morris  
from : T.C. Moody

## ZEEHAN CARBONATE-HOSTED Zn-(Pb-Ag) MINERALISATION & ALTERATION PATTERNS

### Summary:

A zoned hydrothermal alteration pattern is associated with carbonate-hosted zinc mineralisation in the Zeehan area, Tasmania. The characterisation of the alteration pattern provides a vector for potentially locating high-grade Zn-(Pb-Ag) mineralisation within a broader assemblage of altered limestones.

Alteration characteristics include:

- Zonation from unaltered or "calcite-dominated" limestones to altered "dolomitised" limestones which include an outer dolomite zone (weak alteration), ankerite-dolomite zone (moderate alteration) and siderite-ankerite zone (intense alteration) associated with increasing Zn-Pb-Ag mineralisation.
- Disseminated or pervasive carbonate mineral species become more Zn, Mg, Fe and Mn rich as alteration intensifies.
- Hydrothermal maturation of organic material to pyrobitumen and/or mobilisation of hydrocarbon material is associated with alteration and mineralisation.
- Disseminated, vein and replacement style zinc, lead, silver, iron and rare copper sulphides and barite mineralisation increase with increasing alteration.

Areas of silicification have also been identified, although not as useful as an indicator of proximity to zinc mineralisation. Character of the alteration varies according to primary lithology, porosity and limestone facies distribution.

There is potentially a close spatial relationship of zinc mineralisation in the Gordon Limestone to basement relief or flanks of basement highs in the underlying Moira Sandstone (e.g. as indicated at the Grieves Prospect). There is also some suggestion that faulting and possibly folding/transpression may have influenced mineralisation as indicated at the Sunny Corner and Bannockburn Prospects. Sulphide-pyrobitumen bearing stylolites are also interpreted to indicate some mobilisation of sulphide with hydrocarbon material during deformation.

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TASMANIA DEVELOPMENT AND RESOURCES  
INDUSTRY SAFETY AND MINES

FAX MESSAGE

*From*

Date : 21 June, 1995  
~~TO:~~ Mr R G Parkinson  
Company : CRA Preston  
Fax number :

*TO*

From Gilbert Oakes Mineral Tenements & Reports Section  
phone (002) 338 362 Fax (002) 338 338  
number of pages including this cover :

*PK, melle 03 480 1866*  
*- Zee 004 716 351*

MESSAGE / SUBJECT :

Reference your report on Zeehan No. 4 EL 38/89 1994-95 ( TCR  
95-3714 your ref 20613) - Appendix 6 by T Moody, Zeehan  
carbonate hosted Zn mineralisation.... plans TV 865 - 868  
were not enclosed.  
Could they please be provided?

Industry Safety and Mines, PO Box 56, Rosny Park, Tasmania Australia 7018  
street address — 30 Gordons Hill Road Rosny Park

*Gil,*  
*Plans TV 865-868 cover prospects in*  
*ELs other than EL38/89. The plans appear in CRAES*  
*other upts on the Zeehan area. They are not*  
*relevant for the rept.*

*Regards*  
*PK*

The alteration style and mineralisation characteristics appear more similar to the Irish-type zinc ore deposits than classic MVT type mineralisation. Petrographic and XRD analyses support this conclusion.

Alteration and mineralisation logged in some EZ and Amoco core appears to belong to the peripheral alteration assemblage and occasionally intersected significant mineralisation. Systematic logging of limestone facies and alteration types in all these drill holes is warranted, to possibly determine vectors to blind base metal mineralisation.

### Introduction:

This report details the results of an examination of alteration associated with Ordovician Gordon Limestone-hosted zinc-mineralisation in Western Tasmania at the Grieves, Sunny Corner, Firewood Siding, Mariposa, Myrtle, Bannockburn and Pyramid Prospects. This has involved detailed examination of air core end-of-hole samples, logging recent CRAE diamond drill holes, minor re-logging and sampling diamond drill holes completed by EZ and Amoco and minor field checking. Ledgers for the end-of-hole sample descriptions are provided in Appendix 1.

Several drill core and hand specimen samples were collected for petrographic, XRD and probe analyses to help identify and characterise the geochemistry of the alteration phases associated with the zinc mineralisation. Brief sample descriptions, drill hole and depth information supplied for the petrographic study are provided in Appendix 2. Details of the results of this study are provided in a report by Ashley (1994).

The aim of this report is to describe the alteration styles and spatial distribution of the alteration at some of the prospects from which the data was collected. Maps showing the inferred geology and alteration associated with several of the Zeehan Prospects are provided in Plans Tv 865-869.

### Alteration Characteristics:

An alteration pattern is recognised associated with zinc mineralisation at each of the CRAE zinc-carbonate prospects examined. The Oceana Deposit in the same district exhibits similar alteration characteristics.

The pattern of increasing alteration and Zn-Pb-Ag mineralisation includes:

- Un-mineralised limestones typically display weak dolomitisation and diagenetic silica alteration. Organic matter is less thermally mature than in altered limestones associated with zinc mineralisation.
- *Dolomite zone*. Involves subtle fine grained pervasive dolomitisation and re crystallisation characterised by weak/slow reactivity to dilute HCl. This process may have involved some introduction of carbonate into some less carbonatic facies, rare vein/fracture-hosted Zn-Pb mineralisation and possibly an increase in bituminous stylolites (?due to calcite dissolution);

- *Ankerite-Dolomite zone.* This includes increased and coarser recrystallised dolomite alteration and introduction of fine-medium grained sparry ferroan dolomite and ankerite. Dolomite and ankerite veining and brecciation increase approaching high grade base metal mineralisation. This zone is associated occasionally with development of saddle dolomite lined voids, destruction of primary textures or fabrics and minor disseminated and vein-hosted pyrite±galena±sphalerite±chalcopyrite±marcasite. In the ankerite-dolomite and dolomite zones, field discrimination between ankerite and dolomite is not precise. Visual indicators for this pervasive dolomite ankerite mineralisation include bone or cream coloured veins and/or oxidation of exposed limestones or cut surfaces to a cream colour. In fresh samples the altered limestones in this zone become inert or very weakly reactive to dilute HCl, specific gravity and veining/fracturing increase, and blocky rhombs of bone/opaque ankerite or dolomite can be observed under 10x and 25x magnification.;
- *Siderite-Ankerite zone.* Characterised by intense pervasive iron-carbonate (siderite and ankerite±dolomite) alteration and replacement (completely obliterating primary textures), local intense solution and fracture-controlled brecciation, colloform banded carbonate replacement, sparry colourless calcite, rare barite veining, pervasive and vein/open-space sphalerite-galena-(pyrite) mineralisation. Limestones in this zone may also decompose to a poorly consolidated puggy carbonaceous material (yellow or brownish when zinc mineralised). This alteration is most obvious in the silty-sandy clastic and oolitic limestone facies. In black lutites or "black matrix breccias"/wackestones the alteration and very fine grained *high-grade zinc carbonate & sulphide mineralisation may be very difficult to identify* with the naked eye (e.g. compare sample 3970003 & 3970004, Appendix 2 & Ashley, 1994). Higher grade mineralisation is indicated by inertness to dilute HCl, breccia texture in some samples and oxidation of core or chips to a chocolate brown colour on exposed surfaces.

Organic material/bituminous material in fractures and brown organic staining is more common immediately peripheral to the iron-carbonate alteration zones. Thermal alteration of organic material to pyrobitumen is intimately associated with zinc carbonate and sulphide mineralisation. At least two generations of stylolite development are present with an early set developed along bedding and later "post" stylolite steeply cross cutting the earlier set. The post stylolites contain pyrobitumen and locally traces of pyrite and sphalerite suggesting later deformation linked timing of some of the sphalerite mineralisation.

The petrographic and electron microprobe data highlight the following:

- The limestones are dominantly composed of clastic material often containing preserved fossil fragments and a dark pigmentation due to organic material.
- Almost all mineralised samples submitted have been pervasively altered to dolomite/ferroan dolomite-ankerite assemblages.

- High grade zinc-lead mineralisation is spatially associated with intense hydrothermal zincian-manganian-magnesian siderite, ankerite and local illite-sericite alteration, and volume decrease creating void space.
- Ore-related sulphide mineralisation generally partially succeeds Zn-Mn-Mg-Fe carbonate mineralisation but may partly overlap with a later phase of sparry sulphide-free iron carbonate and calcite mineralisation.
- Sulphide mineralisation is often intimately associated with pyrobitumen aggregates.
- The sulphide mineralisation probably accompanied increased sulfur fugacity, copper activity and salinity during replacement of earlier Zn, Mg, Mn carbonates.
- Sphalerite is generally a pale-coloured, transparent, low-Fe species or has a dark colour due to chalcopyrite disease in the most intensely altered limestones (consistent with Sedex or Irish type mineralisation).
- The most sulphide rich samples also contain traces of marcasite, tetrahedrite and chalcopyrite.
- Some pyrite may have a biogenic or diagenetic origin and was subsequently recrystallised during alteration and ore-related mineralisation.
- Finer grained-silty limestone facies are apparently more susceptible to alteration and mineralisation (e.g. samples 3970003, 3970004, 3970016).
- There is some evidence for migration of organic material coincident with sulphide mineralisation (e.g. sample 3970014).
- There is potential for significant silver credits with zinc mineralisation in zones of intense alteration.

#### **Distribution of Alteration:**

The strongest alteration is most common immediately above the Moina Sandstone and immediately beneath the Crotty Quartzite, but may occur at several levels in the stratigraphy. The alteration is apparently asymmetric and may correspond to an alteration-mineralising front/migration pathway. Boundaries between the alteration zones may also be sharp. The intense alteration and associated base metal mineralisation is often associated with basin margin facies near reef, slope and back-reef mud facies immediately overlying apparent irregularities in the underlying Moina Sandstone and higher in the stratigraphy. This may reflect preparation of limestones by early porosity associated with dolomitisation, limestone composition (finer grained facies more susceptible to alteration), primary and solution porosity, faults and basement architecture (indicated by limestone facies distribution).

The Moina Sandstone is locally haematitic and oxidised (e.g. Pyramid Prospect), and often weathered near the contact with the overlying Gordon Limestone sequence (e.g. Grieves Prospect). The sandstones are a possible source of iron and oxidised fluids potentially important in the ore mineralisation process. The porous nature of the altered, often oolitic, limestone near the base of the Gordon Limestone may have facilitated deep weathering or ground water activity. This may be responsible for development of soft limestone pug to considerable depth.

The association of hydrothermal maturation of organic matter to pyrobitumen observed both in core and thin section, demonstrate alteration and zinc-lead-silver mineralisation are associated with a thermal anomalism. This may be verified by vitrinite reflectance studies and hydrocarbon maturation indices.

#### Comparison with Irish Carbonate-hosted Base metal Deposits:

The Zeehan carbonate-hosted deposits have many similarities with the Irish Zn-Pb-Ag mineralisation, including:

- Mineralisation is hosted by basin margin marine facies deposited during a marine transgression, including platform muds and mixed shallow-water carbonate facies - micritic, oolitic, argillaceous;
- Blanket bogs overlie some of the deposits in Ireland and Zeehan which are also locally mineralised;
- Tectonism and alteration are probably coincident with basin subsidence/deformation as indicated by similar matrix material in both cavity- and fracture-fill material, and in the altered host;
- Proximity to thermal anomalies;
- Stronger similarities with Sedex class deposits than MVT, indicated by significant silver and minor copper, structural control on ore distribution, and absence of fluorite;
- Similar metal zonation and enrichment characteristics, including high Fe, S, Mn, As, Ba, Zn, Pb, Ag  $\pm$  Cu associated with most intense alteration;
- Black matrix breccias have been described at Lisheen and Silvermines.

These similarities suggest a similar exploration rationale may be applied.

#### Discussion and Recommendations:

Zinc mineralisation at Zeehan is associated with well developed hydrothermal alteration systems. The limestone facies are a mix of impure clastic limestones variably endowed with organic material in reef, back reef, fore reef and slope facies. Distribution of the various facies is related to morphology of the underlying Moina Sandstone and basement architecture.

*where is the reef? Not recognised in area!!*

The limestones hosting the zinc-lead mineralisation have been regionally dolomitised and overprinted by ankerite-ferroan dolomite alteration with Zn-Mn-Mg rich siderite, dolomite and ankerite closer to sulphide mineralisation. Sulphide and sparry carbonate mineralisation replace the limestones and overprint earlier zinc carbonate mineralisation in zones of most intense alteration, probably associated with increasing salinity of hydrothermal brines and sulfur activity. Hydrothermal maturation of organic material has accompanied ore related mineralisation and alteration. Some sulphide mineralisation has probably accompanied deformation associated with intense fracturing, post-stylolite development, folding and at least local hydrocarbon migration. Some mineralisation may have accumulated in brine/hydrocarbon trap sites such as fold hinges and pinch-out structures.

Genesis of the deposits is most akin to the Irish type and Sedex class deposits, hence similar exploration rationale for these deposits are valid at Zeehan.

The maps compiled from end-of-hole air core sample information and minor field reconnaissance provide only an approximate guide to the two dimensional distribution of alteration associated with zinc-lead mineralisation at the various prospects examined. The maps are highly interpretive and could be greatly improved with more detailed mapping, incorporation of diamond drill hole information and more detailed air core drilling.

There is room for a large high-grade carbonate-hosted Zn-Pb deposit within the region. With the wealth of information available in diamond drill holes, it is possible to piece together facies variation and alteration pattern, distribution of Pb-Zn mineralisation and limestone facies on a regional scale. New targets for bedrock carbonate-hosted Zn deposits or extensions to known mineralisation in the Zeehan region may arise from a broader view of the region stepping away from the known mineralisation (e.g. wide spaced air-core drill traverses), applying some of the knowledge exposed in this report and guides provided in a previous report by D. Taylor (CRAE Report 14590). Detailed logging of the facies and alteration types of the EZ and Amoco drill holes is recommended.

Interpretation of the alteration mineralogy and discrimination between calcite, dolomite and siderite may be assisted in the field by using dilute HCl and staining samples with Alizarin Red S. Features such as destruction of primary limestone texture, inert or weak reactivity to dilute HCl, increased specific gravity, veining, brecciation and sulphide mineralisation are obvious field criteria for identifying potential zinc mineralisation.

It is possible that not all the zinc resources have been identified at the Oceana Carbonate-hosted Pb-Zn deposit

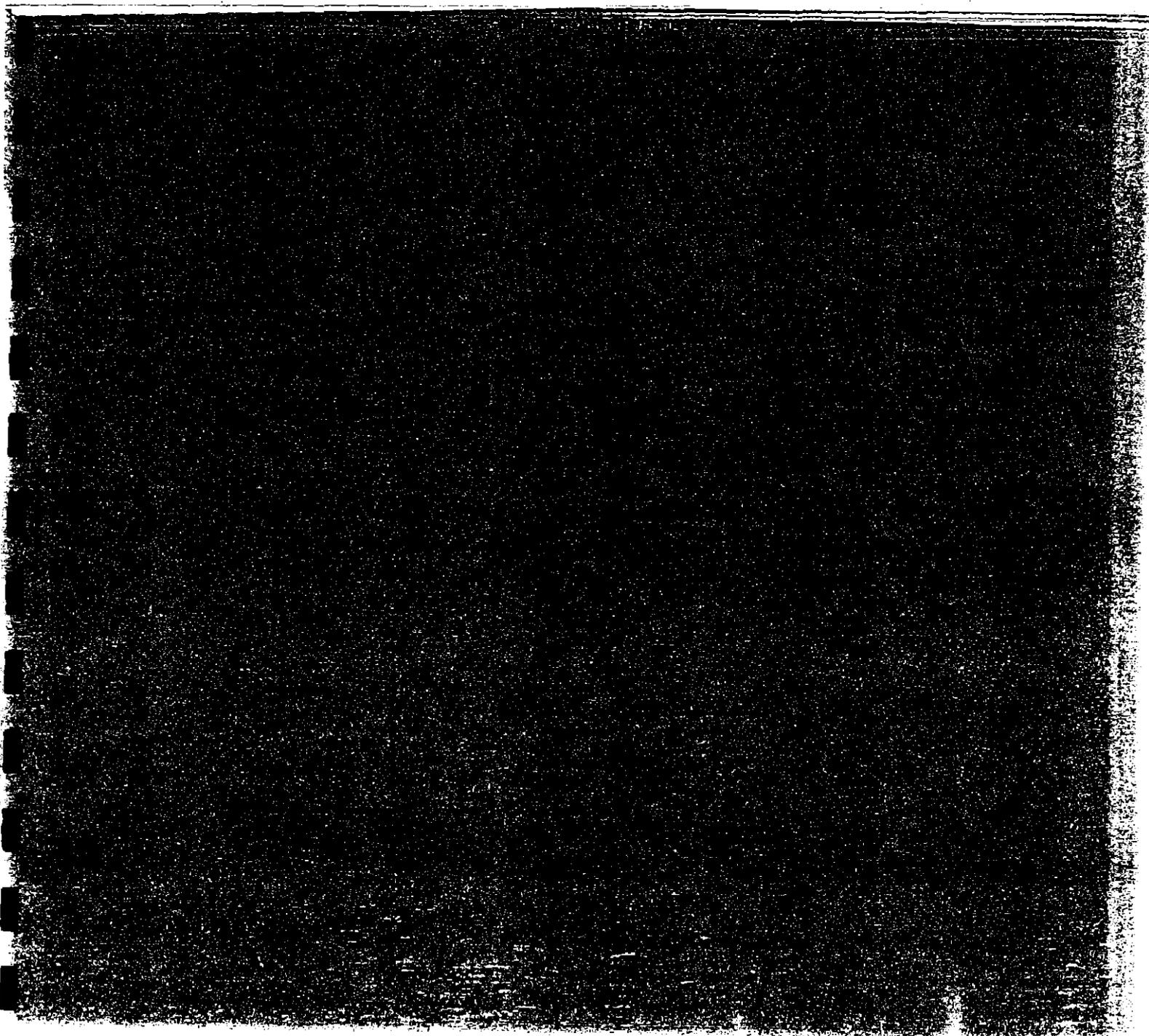
T.C. Moody  
Project Geologist

*Sounds impressive, but many  
gross generalisations - even a few  
total fabrications. Treat with  
caution!*

APPENDIX 1

Zeehan Carbonate-Hosted Zinc Project  
Bottom of Hole Sample Description Ledger

Core No.	Depth (m)	Interval (m)	Strat.	Color	Diag.	Notes
BRIEVES PROSPECT						
35	35'	0-1	S <sub>1</sub>	Red	DG-5	ls. calc-umite (decomposed) (med) ? minor tubular fossils; B pore
36	36'	0-1	S <sub>1</sub>		DG	ls. to argillite-siltite "hard" minor preservation relicts
37	37'	0-1	S <sub>1</sub>			
38	38'	0-1	S <sub>1</sub>			
39	39'	0-1	S <sub>1</sub>			
40	40'	0-1	S <sub>1</sub>			
41	41'	0-1	S <sub>1</sub>		W-DG-6	Calc-umite-siltite
42	42'	0-1	S <sub>1</sub>	Med	DG	Calc-umite; weakly crystalline; minor calcareous
43	43'	0-1	S <sub>1</sub>		DG	Calc-umite; minor fossil fragments
44	44'	0-1	S <sub>1</sub>		DG	Carbonaceous calc-umite



ZG	45	Og	Sls	(Vn)	Cc	M.DG-G	Calc-siltite-lutite: tr. calcite Vn
ZG	46	Og	Sls			DG,G	Irreg. interspersed DG & G calc-siltite
ZG	47	Og	Sls	Fr		DG	Calc-lutite
ZG	48	Og	Sls				
ZG	49	Og	Sls			DG	Calc-siltite-lutite; minor pebbles of porous G calc-arenite & brachiopod shell fossils
ZG	50	Og	Sls			G	Grainy calc-lutite: ?fossiliferous
ZG	51	Og	Sls?	Al	Sd	DGB	V crse. str. recrystallised ankerite airt. rock & spongy-porous intensely sideritic/ferruginous airt. rock: minor ankerite grains: v.heavy: ? mineralised
ZG	52	Og	Sls				
ZG	53	Og	Sls				
ZG	54	Og	Sls				
ZG	55	Og	Sls?/Sl	Al	Sd	G8	Str. siderite-ankerite airt. siltite
ZG	56	Og	Sls-cl			DG,G	DG grainy dol-calc-siltite & irreg. Bn of G calc-siltite-arenite
ZG	57	Og	Sls			LG-G	Styolitic calc-lutite
ZG	58	Og	Sls	Fr,Vn	Cc	LG-G	Styolitic calc-lutite: minor calcite Vn
ZG	59	Og	Sls				
ZG	60	Og	Sls			G,DG	Irreg. interspersed/mixed Calc-siltite-lutite
ZG	61	Og	Sls			G,DG	Irreg. interspersed/mixed Calc-siltite-lutite
ZG	62	Og	Sls			G-DG	Grainy calc-lutite
ZG	63	Og	Sls				
ZG	64	Og	Sls			G-DG	Grainy calc-lutite
ZG	65	Og	Sls				
ZG	66	Og	Sls	Vn	Cc,Sd	M,G-DG	Grainy calc-lutite: tr. cream ankerite/calcite Vn
ZG	67	Og	Sls	Vn	Cc	LG	Calc-lutite, stylolitic: str. calcite veined/cracked
ZG	68	Og	Sls				"Reef-rock", V crse. grainstone/boundstone composed entirely of coral and shell fragments
ZG	69	Og	Sls				
ZG	70	Og	Sls			LG-DG	Irreg. banded LG-G & DG calc-siltite (2-tone)
ZG	71	Og	Sls			G	Calc-lutite-siltite, stylolitic
ZG	72	Og	Sls			LG	Grainy Calc-lutite-siltite: minor-abund. sandy shell frags.
ZG	73	Og	Sls			DG	Cherty calc-lutite
ZG	74	Og	Sls?	Al	Sd	DGB	Str. airt./replaced sideritic siltite: v. heavy
ZG	75	Og	Sls			G,DG	Grainy Calc-lutite, stylolitic: minor DG siltite bands
ZG	76	Og	Sls	Bn,(Vn)	Cc	G-LG	Calc-siltite: locally banded: lesser calc-lutite
ZG	77	Og	Sls	Vn	Cc	G	Calc-siltite
ZG	78	Og	Sls			M,G	nodular calc-siltite
ZG	79	Og	Sls	Vn	Sd/Cc	G	Crse.g. Calc-siltite: minor cream ankerite/calcite Vn
ZG	80	Og?	Sls	Al	Sd	G	weak-mod. airt. siltite-f.g.arenite: pervasive ankerite
ZG	81	Og	Ssl	Ma		G	Crse. siliceous siltstone
ZG	82	Og	Sdl	Al,Vn	Sd,Cc	G-DG	weak-mod. pervasive ankerite altered dol-siltite: abund. Vn
ZG	83	Og	Sdl			DG	Carbonaceous dol-siltite with irreg. voids
ZG	84	Og	Sdl?			G	Mod. airt. siltite-arenite: pervasive ankerite: heavy
ZG	85	Og	Sdl-Ss	Al,Vu		DG	V weakly airt. Calc-dol-siltite-v.f.g.arenite: irreg. voids
ZG	86	Og	Sls			DG-G	Crse. calc-siltite: irreg. voids
ZG	87	Og	Ssl	Ma		DG-B	Crse. Siltite (?decarbonated)
ZG	88	Og	Sls				
ZG	89	Og	Sls				
ZG	90	?	Sss	We		LB-LG	Crse. sandy quartzite
ZG	91	Og	Sdl	Al,Bx,Vn	Sd,Cc	DG	Weak airt. Dol-siltite (cherty in-part): minor ankerite/dol Vn
ZG	92	Og	Sdl?	Al,Vn	Sd	G-DG	Weak-mod pervasive ankerite airt.siltite: minor ank. Vn
ZG	93	Og	Sdl?	Al	Sd	G-DG	Weak-mod.pervasive ankerite airt.siltite
ZG	94	Og	Sdl?	Al,Vu	Sd	G-DG	Mod.pervasive ankerite airt.siltite: minor ankerite lined Vu
ZG	95	Og	Sls	Vu,Ds	Pv	DG,G	Str. pyritic Calc-siltite: Pv also lining voids
ZG	96	Og	Sdl	Al	Ad	DG	V weak pervasive ankerite altered Dol-siltite
ZG	97	Og	Sdl	Ma,Ds	Py	DG	Dol-siltite with non-reworked brachiopod fossils
ZG	98	Og	Sls/dl?	Al,Vn,(Ds)	Sd,Py	G	Mod.pervasive ankerite airt.siltite?, ankerite Vn/cracking & B spongy/str. airt. ?sideritic clast, tr. v.f.fibrous ?cerusite
ZG	99	Og	Sls	Ds	Py	LG,G	G Calc-siltite & LG "reef-rock" with abund. shell fragments with minor Ds Pv

ZG	100	Og	Sls			G	Carbonaceous Calc-siltite, stylonitic
ZG	101	Og	Sls			DG	Calc-siltite-lutite
ZG	102	Og	Sls	Vn	Cc	G-L3	Calc-arenite & calc-lutite; minor calcite Vn
ZG	103	Og	Sls	Vn	Cc	G	Calc-lutite-siltite; minor white-cream Cc vein
ZG	104	Og	Sls				
ZG	105	Og	Sls				
ZG	106	Og	Sls				
ZG	107	Og	Sls				
ZG	108	Og	Sls	(Al)	Sd	DG	Weak fine pervasive ankerite airt. dol-siltite; minor Y stain
ZG	109	Og	Sls	Vn	Cc	G	Calc-siltite; coarse colourless calcite vein
ZG	110	Og	Scl	Vn	Qtz.Cc	LG	Grainy dol-lutite; minor Qtz-carbonate Vn; abund. stylonites
ZG	111	Og	Sls			DG	Calc-siltite; minor angular LG-G calc-lutite clasts
ZG	112	Og	Sls				
ZG	113	Og	Scl-ls			G	Dolomitic-weakly calcareous Oolitic grainstone.
ZG	114	Og	Sls				
ZG	115	Og	S?ls	Al	Sd	DG-B	Sulphidic?, str./intensely siderite-ankerite airt. silty limest. v. heavy; spongy texture; inert to dil HCl
ZG	116	Og	S?ls	Al	Sd	DG	Str. siderite airt./replaced limest?; v. heavy; inert to dil HCl
ZG	117	Og	Scl	Al	Ad	DG	Weakly sideritic dol-siltite
ZG	118	Og	Sls	(Vn)	Cc		2 Samoles: (1) irreg. Bn DG Calc-siltite & G calc-lutite-siltite (2) LG Stylonitic calc-lutite, tr. Cc Vn
ZG	119	Og	Sls				
ZG	120	Og	Sls				
ZG	121	Og	Sls				
ZG	122	Og	Sls				
ZG	123	Og	S?ls	Al	Sd	DG	Str. airt. sideritic-decomposed limestone/siltite; v. heavy
ZG	124	Og	Sls			DG,G	Irreg. Bn DG calc-siltite & G calc-lutite (2-tone); stylonitic.
ZG	125	Og	Sls			LG	Calc-lutite; minor stylonites
ZG	126	Og	Sls	Vn	Cc	G-DG	Crse. Calc-siltite & abund. clear calcite-white dolomite? Vn
ZG	127	Og	Sls			G	Crse. Calc-siltite; minor patches of arenite
ZG	128	Og	Sls				
ZG	129	Og	Sls	Vn	Cc	LG	Calc-lutite & Crse clear calcite-white dolomite? vein
ZG	130	Og	Sls			G	Calc-arenite & Crse clear calcite-white dolomite? vein
ZG	131	Og	Sls	Vn	Cc	LG	Calc-lutite; minor white Cc vein
ZG	132	Og	Sls	We,Vn	Cc	G	Calc-lutite; crse calcite Vn
ZG	133	Og	Sls	Al, Ds?	Sd	DG	Str.-intense siderite airt. porous/spongy ex-limest., v. heavy
ZG	134	Og	Sls			G	Nodular-stylonitic Calc-lutite
ZG	135	Og	Sls	Vn	Cc	LG	Grainy calc-lutite-siltite, stylonitic; tr. white calcite vein
ZG	136	Og	Sls	(Vn)	Cc	G	Calc-arenite, porous; minor-abund. shell fossil frags.
ZG	137	Og	Sls	We,Vn	Cc	DG	Calc-siltite
ZG	138	Og	Sls	Bn,(We)		LG	Calc-lutite; weak banding/algal-mat laminations?
ZG	139	Og	Sls	We,Vn	Cc	DG-G	Cherty calc-siltite
ZG	140	Og	Sls-cl	(We),Vn	Cc	DG-G	Cherty calc-dol lutite-siltite
ZG	141	Og	Sls	Vn	Cc	G-DG	Calc-siltite
ZG	142	Og	Sls	(Vn)	Cc	G	V.f.g. calc-arenite
ZG	143	Og	Sls	(Vn)	Cc	G-DG	F.-m.g. calc-arenite
ZG	144	Og	Sls	(Vn)	Cc	LG	Grainy calc-lutite; stylonitic
ZG	145	Og	Sls	Vn	Cc	G	Calc-siltite & colourless calcite Vn
ZG	146	Og	Ss-ss	(Vn)	Cc	DG	Graphitic siltite-arenite; tr. ?fossil frag.; tr. colourless Cc Vn
ZG	147	Og	Sls/ss?	We		3	Oolitic? sandst. gravel
ZG	148	Og	Sls	Vn	Cc	DG	Calc-siltite-lutite
ZG	149	Og	Sls?	Al,Vu	Sd	L3	Ankerite airt. Oolitic limest./grainst.; inert to dil HCl
ZG	150	Og	Sls?	Al	Sd	L3	Mod. ankerite altered/replaced Oolitic limestone
ZG	151	Og	Sls?	Al	Sd	L3	Mod. ankerite altered/replaced Oolitic limestone
ZG	152	Og?	Sss	Al?		G	Heterolithic m.g. Sandst.; weakly haematitic; heavy
ZG	153	Og	S?ls	Al	Sd	G-R	Haematitic str. pervasive ankerite airt./replaced rock (?Oolitic unit), with round voids filled with crse. ankerite
ZG	154	Og	Ssl/lis	Al	Sd	DYG	Pervasive ankerite airt. siltite; inert to dil HCl
ZG	155	Og	Ssl/lis	Al	Sd	DG	Pervasive ankerite airt. siltite; inert to dil HCl; minor Vu
ZG	156	Og	Scl-ls			DG,G	Irreg. Bn DG dol-calc-siltite & G calc-lutite (2-tone)
ZG	157	Og	Scl			LG	Dol-lutite

ZG	158	Og	Sls			G	Calc-lutite (stylolitic, nodular) & DG siltite whisps/matrix
ZG	159	Og	Sls	(Vn)	Cc	G	Calc-lutite with DG stylolite bands
ZG	160	Og	Sls	9n.Vn	Cc	G-LG	Banded m.g. calc-arenite, stylolitic
ZG	161	Og	Sls			DG	Calc-siltite
ZG	162	Og	Sls			G	Calc-lutite
ZG	163	Og	Sls			G	Calc-lutite
ZG	164	Og	Sls	Vn	Cc	G	Porous calc-siltite
ZG	165	Og	Sls			G	Calc-lutite-siltite
ZG	166	Og	Sls			LG	Calc-lutite, stylolitic; minor white calcite spots
ZG	167	Og	Sls	Ma		DG,G	DG Calc-dol-siltite & G calc-siltite-lutite (2-tone)
ZG	168	Og	Sls	Vn	Cc	G	Calc-siltite, abundant calcite veining/crackle veining
ZG	169	Og	Sls				
ZG	170	Og	Sls?	We,Al		LB	very We ankerite airt? limest.
ZG	171	Og	Sls-arl?	Al	Sd	LB	Ankerite airt. Oolitic grainst. & spongy/porous airt. rock
ZG	172	Og	Sls-arl?	Al	Sd	LB-G	Str. ankerite-siderite airt./replaced ?ex-Oolitic? grainstone
ZG	173	Og	Sls?/ss	Al	Sd	LB-G	Ankerite airt. arenite?: heavy
ZG	174	Og	Sls?/ss	Al	Sd	LB-B	Str. Siderite-ankerite flooded m.g. arenite
ZG	175	Og	Sls?/ss	Al	Sd	3G	Str. ?siderite-ankerite airt./replaced ???Oolitic grainstone
ZG	176	Og	Sls				
ZG	177	Og	Sls?	Al	Sd	LB-G	V.Str. siderite-ankerite airt. spongy rock?
ZG	178	Og	Sls?	Al	Sd	LB-G	V.Str. siderite-ankerite airt. spongy Oolitic rock?
ZG	179	Og?	Sss	We		K-B	Haematitic sandstone ?gravel
ZG	180	?	Sss			G	f.g. Quartzite
ZG	181	?	Sss			LG	Porous, f.g.
ZG	182	?	Sss			LG-LB	Sst with mud matrix
ZG	183	Og	Sdl	Al	Sd	LB	Mod. airt.(ankertic?) Oolitic limestone
ZG	184	Og	Sdl?	Al	Sd	G	Oolitic ls/g?stone; porous, brecciated, str.aitd.(ankertic?)
ZG	185	Og	Sls?	Al	Sd	GB	Spongy, str. Ank. airt./replaced limestone, ex-grainstone?
ZG	186	Og	Sls	Al?		DG	Carbonaceous, part decomposed, weakly airt.?
ZG	187	Og	Sls			LG	calc-grainstone with lutitic matrix
ZG	188	Og	Sls				
ZG	189	Og	Sls	Al	Sd	LG-LB	?Oolitic grainstone; str. ankerite airt./replaced: No reaction to dil HCl (10%)
ZG	190	Og	Sls	Al	Sd	LG-LB	?Oolitic grainstone; str. ankerite airt./replaced: No reaction to dil HCl (10%)
ZG	191	Og	Sdl	Al	Sd	LG-LB	?Oolitic grainstone; str. ankerite airt./replaced:
ZG	192	Og	Sdl	Al,Bx	Sd	LG-LB	Soln? brecciated Oolitic ls: str.aitd. with spongy matrix No reaction to dil HCl (10%); ankertic-(sideritic in matrix?)
ZG	193	Og	Ssd	Al	Sd	W-LB	Bone/cream sparite/ankerite rock
ZG	194	Og	Sls				
ZG	195	Og	Sls?	Al,Vu	Sd	DG-B	?sideritic weak-str. altered limestone; porous-spongy
ZG	196	Og	Sls?	Al	Sd	G-LB	Grainstone, heavy, porous, weak-str. altered
ZG	197	Og	Ssd	Al	Sd	LG-LB	Ankerite recrystallised Sparite: str. altered
ZG	198	Og	Sls			G	Calc-grainstone with broken fossil fragments
ZG	199	Og	Sdl	We		LG-W	Ankeritic-dolomitic limest./grainst. and lutite: weak banded
ZG	200	Og	Sdl	We,Al?		LG	Oolitic grainstone; ?weakly altered
ZG	201	Og	Sdl	Al	Sd	LG	Dolomitic Oolitic limestone; v weakly altered/ankertic
ZG	202	Og	Sls			G	Calc-arenite/reef-rock; colonial corallite and brachiopod fossil fragments, minor ?oolites
ZG	203	Og	Sdl?	We,(Al)	Sd	LG	Oolitic limestone; weakly airt.; no reaction to dil HCl (10%)
ZG	204	Og	Sdl	(Al)	Sd	G	Oolitic -dol arenite: weak-mod. airt./ankertic
ZG	205	Og	Sdl	Al,We	Sd,Si	LB-GB	Lutite?: altered/?ankertic; weakly silicified; heavy
ZG	207	Og	Sls			DG,G	G calc-lutite with DG calc-lutite bands
ZG	210	Og	Sls			G	Crse. g. calc-arenite/grainstone
ZG	213	Og	Sls	Ma,(Al)		DG-G	Dol-siltite; weakly altered?
ZG	214	Og	Sls	(Vn)	Cc	G-DG	Crse.g. calc-arenite/grainstone and calc-siltite
ZG	216	Og	Sls			G	Calc-siltite; fossil bands (brachiopods & ?coral fragments)
ZG	217	Og	Sdl?	Al	Sd	GB	Oolitic limestone; mod. ankerite airt./replacement; heav: No reaction to dil HCl (10%)
ZG	218	Og	Sdl?			G	Grainstone; mod. silicified & ?ankertic /altered.
ZG	219	Og	Sls	Ma		DG	Carbonaceous/graphitic calc-siltite

ZG	220	Og	Ssl			DG	Carbonaceous siltstone
ZG	221	Og	Ssl	Al	Sd	LG-B	?Oolitic dol-grainstone; pervasive Ankerite replacement
ZG	222	Og	Ssl	Al	Sd	LG-B	?Oolitic dol-grainstone; pervasive Ankerite replacement
ZG	223	Og	Ssl?	Al	Sd	LB	Ankerite replaced rock?, heavy
ZG	224	Og	Ssl?	Al	Sd,Si	G	Crse.g. grainstone, angular, poorly std. rare oolites. ankrite altered?, weakly silicified
ZG	226	Og	Sls			DG	Carbonaceous calc-siltite
ZG	227	Og	Sls			DG (LG)	Carbonaceous calc-siltite-lutite, lesser LG lutite patches
ZG	228	Og	Ssl?	Al,Ds	Sd,Py	WB	Cream + lesser pink, str. altd. grainstone; minor Ds Py
ZG	229	Og	Ssl	Vn	Sl,Qtz	DG	Silicified siltstone, minor Qtz. veins
ZG	230	Og	Ssl	Al	Sd	LG	Oolitic limestone, weak-mod. altd., cream ?ankeritic matrix. No reaction to dil HCl (10%)
ZG	231	Og	Ssl?	Al	Sd	D&G	Str./intense sideritic altered rock with patches of cream. ankrite; v.heavy. ?mineralised
ZG	232	Og	Sls			LG-B	Grainstone, recrystallised/ankerite altd., no react. dil HCl.
ZG	233	Og	Sss/ls?	Vu		DG	Decarbonated? f.g. arenite; porous, vughy
ZG	234	Og	Sss			DG	Carbonaceous/kerogenous f.g.arenite
ZG	235	Og	Ssl?	Al	Sd	DB	Str. altd. sideritic rock; v.heavy.
ZG	236	Og	Ssl	Ma		DGB	foliated siltstone, cherty in-part. ?sideritic, heavy
ZG	237	Og	Ssl			DGB	?carbonaceous part-decomposed ?sideritic-?limestone/Ssl No reaction to dil HCl (10%)
ZG	238	Og	Sls	Bx		LG-G	Calc-lutite, stylolitic, local soln./auto brecciation
ZG	239	Og	Sls			DG	DG Calc-siltite, minor patches of LG calc-siltite
ZG	240	Og	Sls	Vn	Cc	G-LG	Calc-lutite, minor siltite-arenite, minor soapy clear calcite Vn
ZG	241	Og	Sls			LG	Calc-lutite
ZG	242	Og	Sls	(Vn)	Cc	LG	Calc-lutite
ZG	243	Og	Sls			DG	Calc-siltite, lesser G laminated calc-siltite bands
ZG	245	Og	Sls			G	Calc-siltite-lutite, minor DG whisps
ZG	246	Og	Sls			G	Calc-siltite-lutite, minor DG whisps
ZG	247	Og	Sls			DG,G	Whispy-banded calc-siltite
ZG	248	Og	Sls	Fr,Bx	Cc	DG-N	Dol-lutite, minor Fr/Bx with calcite fill
ZG	249	Og	Sls	Ma		G-DG	Calc-lutite-siltite, minor stylolites
ZG	250	Og	Sls	Ma		DG	Calc-lutite-siltite
ZG	252	Og	Sls			LG	Reef-rock/colonial corallite, minor white calcite cement
ZG	253	Og	Sls			DG	Granitic calc-lutite-siltite, minor stylolites
ZG	254	Og	Sls	Bx		DG,G	irreg. mixed/banded-weak brecciated grainy calc-siltite
ZG	255	Og	Sls			LG	Calc-lutite, minor stylolite
ZG	256	Og	Sls/ss			DG	f.m.g.Sss./decarbonated arenite; porous, carbonaceous
ZG	257	Og	Ssl	Al	Sd	G-DG	Dol-siltite, minor coral? fragments, bioturb., weak-mod. pervasive v.f. ankeritic alteration; minor dolomite/ankerite lined (?saddle dolomite) vughs and veins
ZG	258	Og	Sls	(Vn)	Cc	DG	Calc-lutite, carbonaceous, part-decomposed; fr. Cc Vn
ZG	259	Og	Sls	Ma	We	DG	Calc-siltite
ZG	260	Og	Sls			DG	Calc-siltite, str. carbonaceous; lesser G Calc-siltite-lutite
ZG	261	Og	Sls			DG	Carbonaceous calc-siltite-lutite, part decomposed
ZG	262	?	Sss			W-LG	Sandy quartzite
ZG	263	Og	Sls				
ZG	264	?	Sss-sl			LG	Clayey sandstone & mudstone
ZG	265	Og	Ssl?	Al?		G	Oolitic limest. with cream ankeritic matrix (wk-mod. altd?) No reaction to dil HCl (10%)
ZG	266	Og	Ssl?	We		G	Oolitic limest. with cream ankeritic matrix (wk-mod. altd?) No reaction to dil HCl (10%)
ZG	267	Og	Ssl			G	Oolitic limest. with cream ankeritic matrix (mod. altd?) Minor saddle dol/ank. lined Vu & Vn; inert to dil HCl (10%)
ZG	268	Og	Sls	Vn	Sd	G	Calc-lutite; minor cream ankerite veins
ZG	269	Og	Sls	We		LG-B	Calc-lutite
ZG	270	Og	Sls	Vn	Cc	G	Calc-lutite-siltite; minor Cc vein
ZG	271	Og	Sls	Fr,Vn	Cc	G	Calc-lutite-siltite
ZG	272	Og	Sls				
ZG	273	Og	Sls	Vn	Cc/Sd	G	Calc-siltite-f.g.-arenite; minor cream ank/Cc Vn
ZG	274	Og	Sls			G	Calc-siltite-f.g.-arenite

ZG	275	Og	Sls	Fr		LG	Calc-lutite
ZG	276	?	Sss			LG	sandstone with mud matrix
ZG	277	Og	Sdl?	Bx,Al,(Ds)	Sd,Py	LB	Mod. ankerite airt./replaced Oolitic limest. iner to dil HCl
ZG	278	?	Sss			LG-B	F.g. sandy quartzite
ZG	279	?	Sss-sl	(Al?)		DG	Crse siltite-f.g. arenite
ZG	280	Og	Sls				
ZG	281A	Og	Sls	(Vn)	Cc	LG-G	Calc-lutite with white calcite bellers/grains: minor calc. Vn
ZG	281B	Og	Sls			G	Crse. calc-grainstone & minor siltite; minor lge. colonial corallite fragments
ZG	282	Og	Sls	Vn	Cc	G	Calc-lutite; tr. calcite veins
ZG	283	Og	Sls	We,Vn	Cc/Sd	LG	Calc-lutite: minor Cc/ankerite veins
ZG	284	Og	Sls				
ZG	285	Og	Sls-cl	Ma		DG	Calc-dol lutite
ZG	286	Og	Sls				
ZG	287	Og	Sls	(We)		G	Calc-lutite
ZG	288	Og	Sls				
ZG	289	Og	Sls	Bx,Vn	Cc	G	Grainy calc-lutite: minor Cc veins
ZG	290	Og	Sdl?	Bx,Vn	Sd?	G	Weak/non dolomitic lutite: minor cream ?ankerite veins
ZG	291	Og	Sls-cl	Bx,Vn	Cc	DG	Silicified dol-calc siltite/cherty arenite; graphitic
ZG	292	Og	Sls			DG	Carbonaceous calc-siltite
ZG	293	Og	Sls-cl			DG	Calc/dol-siltite: carbonaceous/kerogenous
ZG	294	Og	Sls			DG	Carbonaceous calc-siltite
ZG	295	Og	Sls			DG	Carbonaceous calc/dol-siltite
ZG	296	Og	Sdl	Ma,(Ds)	Py	DG	Crse. g. graphitic dol-siltite
ZG	297	?	Sss	(Ds)	Py	DG	Porous arenite: carbonaceous
ZG	298	Og	Sdl?	Al,(Ds)	Sd,Py	DG	V.f.g. sandy textured siltite: pervasive cream ankerite airt.:
ZG	299	Og	Sls			G-DG	F.g-m.g. calc-arenite
ZG	300	Og	Sdl			D.G	Dol-siltite-lutite: partly decomposed
ZG	301	Og	Sls			M,DG-G	Calc-siltite-lutite
ZG	302	Og	Sls			DG	Graphitic/carbonaceous siltite
ZG	303	Og	Sls			DG,LG	DG crse g. calc-siltite; lesser LG crse g. siltite-f.g. arenite
ZG	304	Og	Sls				
ZG	305	Og	Sls			DG	Crse g. calc-siltite; minor patches of f.g. calc-arenite
ZG	306	Og	Sls				
ZG	307	Og	Sdl	Ds,Vs		DG-N	Dol-siltite-lutite: carbonaceous/kerogenous
ZG	308	Og	Sdl	Ma		DG	Dol-siltite with rounded patch of G dol-siltite (2-tone)
ZG	309	Og	Sss			G	Heterolithic granular/v.crse. calc-grainstone: poorly std.
ZG	310	Og	Sls			G	Calc-grainstone. minor shell (gastropod?) fragments: lesser calc-siltite-lutite.
ZG	311	Og	Sls				
ZG	312	Og	Sss-sl	Ds,Al	Py,Si	DG	Cherry heterolithic arenite-siltite; str.silicified; crse Py patch.
ZG	313	Og	Sls	Bx,Vn	Cc	M,G-LG	Calc-siltite: Bx: minor abundant crse.colourless calcite Vn.
ZG	314	Og	Sls/dl?	Al,Vn	Sd	LG-LB	Siltite-arenite/sparte; mod pervasive ankeritic airt.: minor bone ankerite/dolomite lined voids (saddle dolomite?) & Vn
ZG	315	Og	Sls/dl?	Ma,Ds,(Al?)	Py,Sd	G	Siltite;weak v.f.pervasive ?ankerite alteration
ZG	316	Og	Sls/dl?			DG	Carbonaceous siltite: silicified-mod ankerite-(siderite?) airt.
ZG	317	Og	Sls/dl?	Al,Vy	Sd	G	Sparte; mod pervasive sandy textured ankerite: minor slickenside surfaces & vughs
ZG	318	Og	Sls			G	Calc-siltite: minor stylolite
ZG	319	Og					
ZG	320	Og	Sls?	We		G	Lutite
ZG	321	Og	Sls?	We		G	Lutite
ZG	322	Og	Sls/dl?	Al,Vu,(Ds)	Py	G	Mod. airt. siltite-arenite: pervasive cream ankerite airt.
ZG	323	Og	Sdl-s	Vn	Sd	LG	Dol-calc-lutite: str.stylolitic; minor ankerite veins
ZG	324	Og	Sls			M,G	Calc-lutite, stylolitic
ZG	325	Og	Ssl	Ma		G	
ZG	326	Og	Sdl	Ma		G	Dol-siltite
ZG	327	Og	Sls			G	Calc-bioclastic boundstone & calc-siltite: poorly sorted: fossil fragments include brachiopods and corallites
ZG	328	Og	Sss			G	V.f.g. sandstone: minor white streaks/bands; bed dia 5deg
ZG	329	Og	Sss-sl	Ma		G	v.f.g. sandstone-siltstone

ZG	330	Og	Sls/dl?	Ma		G	Weak altd. siltite: pervasive f.g. ankerite alteration.
ZG	331	Og	Sls/dl?	Ma,Vu		G	Weak altd. siltite: pervasive f.g. ankerite alteration.
ZG	332	Og	Sls			G-LG	V. crse. porous bioclastic grainstone
ZG	333	Og	Sls	Ma		M,G	Calc-siltite: abundant ?reef/shell fragments: slump deposit
ZG	334	Og	Ssl?			N	Carbonaceous/kerogenous lutite/?decomposed limestone
ZG	335	Og	Sss/s	Al,Vn,Vu	Sd,Si	G-LG	Weak-mod altd. arenite: pervasive ankerite: weak silicified minor ankerite-atz veins/cracking & saddle dolomite/ ankeritic lined voids: inert to dil. HCl (10%)
ZG	336	Og	Sss-sl			DG-G	V.f.g.arenite/siltite: decarbonated?
ZG	337	Og	Sls			LG,G	Irreg. mixed calc-siltite-arenite, slump? deposit
ZG	338	Og	Sls	Ma,Vn	Cc	G-DG	Calc-siltite; tr. white calcite vein
ZG	339	Og	Sls	Vn	Cc	G-DG	Calc-siltite-arenite: intensa Cc-ankerite veined
ZG	340	Og	Sls-dl			DG,G	DG calc-dol siltite: lesser rounded patches of G calc-siltite
ZG	341	Og	Sls	Vn	Cc	DG	Calc-siltite: intensely bioturbated; tr. Cc Vn
ZG	342	Og	Sls	Ma		DG-G	Calc-siltite: bioturbated, fossiliferous
ZG	343	Og	Sls			LG	Deeply stvilitic calc-lutite: minor calcite filled voids/holes
ZG	344	Og	Sdl	Ma		G	Weakly dolomitic siltite
ZG	345	Og	Sdl	Ma		G	Weak/non dolomitic-siltite
ZG	346	Og	Sls	(Ds)	Py	LG	F.g. calc-arenite
ZG	347	Og	Sls				
ZG	348	Og	Sls?	Al	Sd	DG,B	DG decomposed limest.? heavy; B intensely altd./sideritic cherty rock: inert to dil. HCl
ZG	349	Og	Sdl/s?	Al,(Ds)	Py	LK-B	?Grainstone; replaced by ankerite?
ZG	350	Og	Sdl/s?	Al	Sd	B-G	Str. siderite-ankerite replaced/altred ?Grainstone
ZG	351	Og	Sdl	Al,Bx	Sd	DG	Weak-mod altd. dol-siltite: weak Bx: pervasive f.g. ankerite
ZG	352	Og	Sls-dl	Fr,(Al)?		G	weakly altd.? calc-dol siltite
ZG	353	Og	Sdl			G	V. crse. granular dol-arenite: poorly std.: abund. Qtz. grains
ZG	354	Og	Sss/dl?				As above (non-dolomitic); silicified
ZG	355	Og	Sss/dl?				As above
ZG	356	Og	Ssl			G	Siltite: clayey in-part (v. poor return)
ZG	357	Og	SOx	We			Limonitic ferruginous Fe-stone
ZG	358	Og	Sls				
ZG	359	Og	Sls				
ZG	360	Og	Sls				
ZG	361	Og	Sls				
ZG	362	Og	Sls				
ZG	363	Og	Sls				
ZG	364	Og	Sls				
ZG	365	Og	Sls				
ZG	366	?	Sss			LG	Quartzite
ZG	367	?	Sss,Ovq	Vu		!G	Quartzite
ZG	368	SOx		Vu		W	crse ankerite
ZG	369	Og	Sls	Al		8G	Ankeritic oolitic limestone/grainstone
ZG	370	Og	Ssl/ss			LG	silty quartzite
ZG	371	Og	Sls	Al,Fs,Ds	Sd,Py	LB	Pervasive ankerite-pyrite altd oolitic limestone/grainstone
ZG	372	Og	Sls	Al		LG	weakly altered oolitic limestone/grainstone
ZG	373	Og	Sls-dl			DG	weakly calcareous/dolomitic siltite, graphitic
ZG	374	Og	Sdl	Al,Vn,Ds	Sd,Py	G	Mod. siderite-ankerite altered dol-siltite-f.g. dol-arenite
ZG	375	Og	Sls			G-DG	Stvilitic-peloidal calc-lutite
ZG	376	Og	Sls			G	calc-lutite
ZG	377	Og	Sls			G	calc-lutite
ZG	378	Og	Sls-dl			N	Carbonaceous calc-dol siltite
ZG	379	Og	Sdl	Vn	Cc	N	Carbonaceous cleaved dol-lutite
ZG	380	Og	Sls				
ZG	381	Og	Sls			M,G-DG	Peloidal? calc-lutite
ZG	382	Og	Sls			G-DG	Carbonaceous calc-lutite
ZG	383	Og	Sls			DG	Carbonaceous calc-lutite
ZG	384	Og	Ssl-dl			N,(G)	98% N kerogenous Ssl-dol-siltite: 2% G dol-lutite
ZG	385	Og	Ssh, Ls-Sl	Vn	Cc	DG,G	Graphitic Ssh-sl; G dolomitic silty solitary corallites
ZG	386	Og	Sls	Vn	Cc	G	Calc-siltite, minor peloids; minor vein calcite
ZG	387	Og	Ovc,(Sls)			DG,W	99% coarse calcite: 1% DG calc-siltite



APPENDIX 7

Amdel XRD mineralogical studies and ore-type classification



C R A EXPLORATION PTY. LIMITED

ACN 000 057 125

UNIT 1, 23 BELL STREET, PRESTON, VICTORIA 3072, AUSTRALIA

303197

P.O. BOX 8093

NORTHLAND CENTRE 3072

TELEPHONE: 480 1866

FAX: (03) 484 1375

28th March 1994

Mr M. Till,  
Amdel Limited,  
31 Flemington St,  
FREWVILLE S.A. 5063

### SAMPLES SUBMITTED FOR QUANTITATIVE XRD EXAMINATION

Dear Michael,

Please find enclosed 20 sample pulps that I would like examined by quantitative XRD (method XRD6). As discussed in our phone-call of 28/3/94, the aim is to identify the mineralogy of the samples, and specifically to determine the percentages (if possible) of the Zn-bearing phases.

Previous XRD work (see your report G52/94) has identified sphalerite and fraipontite as the main Zn minerals. Other work (optical microscopy) suggests a Zn-Fe-Mn carbonate may be present in some samples. To assist with quantifying the XRD results I have enclosed some microprobe analyses of sphalerite and fraipontite from the same prospect.

Also enclosed are analytical results for the sample pulps. Samples were assayed by AAS (aqua regia-perchloric acid digest) for Ag-Cu-Pb-Zn-Fe-Mn. Over-range samples were subsequently redetermined by AAS (aqua regia-perchloric acid-hydrofluoric acid digest). Samples exceeding 1% Zn were analysed for S by leco furnace.

If necessary, please analyse for carbonate in addition to the whole-rock silicate analysis.

The CRAE DPO number for this job is 77663.

Thankyou for your help.

Yours sincerely,

**ROBERT PARKINSON**  
(Principal Geologist - Tasmania)



# CRA EXPLORATION PTY. LIMITED

(INC. IN N.S.W.)

Head Office: 55 Collins Street, Melbourne, Vic.  
DESPATCH ADVICE, PACKING SLIP & ORDER

A.C.N. 000 057 125

★ DPO No. 77663

303198

ADDRESSEE COPY

★ From CRAE office at PRESTON VIC

★ Date: 28/3/94

★ To Laboratory: AMDEL

★ Lab. address: 31 FLEMINGTON ST

FREWILLE SA 5063

★ No. of samples: 20

COPIES OF THE RESULTS REPORT TO BE FORWARDED TO CRA EXPLORATION PTY LIMITED AT:

1 PO Box 8093 NORTHLAND CENTRE VIC 3072

★ Attn ROBERT PARKINSON

2. -

Attn CRAIG HAYWARD WITH THE INVOICE

3. PO Box 3709, Manuka ACT 2603 Australia  
Attention: CRAE Information Systems

QUOTE DPO NUMBER ON ALL REPORTS AND INVOICE.

Complete on District, CIS & File copies only

Samples despatched per ANSETT AIR

Addressed ATTN MICHAEL TILL

★ Return residues to:

CRAE PRESTON

Copy of (for CRAE laboratory only):

Sample location plan attached

Sample ledger attached

Samples			Work Required
Start No.	<del>End No.</del>	Qty	
3758004		<u>20</u>	<u>PULPS (EX AIR-CORE + DIAMOND CORE)</u>  PLEASE DETERMINE QUANTITATIVE MINERALOGY BY XRD (METHOD XRD6)  WHERE NECESSARY, ANALYSE FOR CARBONATE.  (see attached letter and chemical analyses)
028			
036			
041			
073			
080			
220			
228			
338			
341			
431			
445			
447			
464			
3753650			
659			
663			
3908229			
230			
244			

IMPORTANT — Each sample type must be entered separately with the following clearly shown:

1. Appropriate sample type,
2. Assay methods,
3. Laboratory method codes,
4. Preassay treatment,
5. Any special assay requirements,
6. Elements/minerals to be determined.

Cost code(s) G02594

Authorised by [Signature]

an aluminosilicate  
contains up to  
16wt% Zn

Appendix 2. The high Zn content of the phase is classified as fraipontite. The results of XRD analysis suggest that structurally it is intermediate between fraipontite, baumite, and aluminian lizardite which are all members of the kaolinite-serpentine group. For the purposes of reporting, this phase will continue to be referred to as a Zn-aluminosilicate. The Zn-aluminosilicate occurs as discrete grains in all size fractions and fine grained Zn-aluminosilicate is present in agglomerates. A number of grains of Zn-aluminosilicate were analysed by microprobe at the University of Melbourne. These grains show a range of compositions from 10.1wt% Zn to 16.7wt% Zn with an average Zn content of around 13wt% (Table 2).

303199

Table 2. Microprobe analyses of Zn-aluminosilicate

3753497 (-500+212um)					
(wt%)					
Zn	15.476	10.107	16.674	11.994	3.492
Fe	1.79	1.287	1.883	0.47	1.05
Si	12.544	14.847	12.239	18.832	16.794
Al	11.135	13.069	10.467	16.336	16.694
O (calc)	59.056	60.69	58.736	63.68	65.2
Total	100.001	100	99.999	100	100
(wt%)					
Zn	0.35	14.975	10.942	11.994	
Fe	0.69	2.376	3.191	4.961	
Si	18.832	12.774	13.114	12.425	
Al	17.1	10.79	12.956	11.526	
O (calc)	63.87	59.085	59.796	59.094	
Total	100.001	100	99.999	100	

Results of microprobe analysis at the University of Melbourne indicate that the average Fe content of the sphalerite is <1wt% (Table 3).

Table 3. Microprobe analyses of sphalerite

3753497 (-500+212um)					
(wt%)					
Zn	67.789	67.176	65.388	67.186	66.712
Fe	0.071	0.017	0.836	0.073	0.077
Mn	0.019	0	0	0	0
S	32.825	32.823	32.189	32.319	32.124
Total	100.704	100.016	98.413	99.578	98.913
(wt%)					
Zn	66.625	67.032	66.54	67.475	
Fe	0.071	0.051	0.178	0.066	
Mn	0.003	0	0	0.001	
S	31.977	31.967	31.997	31.89	
Total	98.676	99.05	98.715	99.432	

ANALYTICAL RESULTS FOR SAMPLES SUBMITTED FOR QUANTITATIVE XRD							
DPO 77663							
SAMPNO	Cu ppm	Pb ppm	Zn ppm	Ag ppm	Fe%	Mn ppm	S%
3758004	28	600	103000	1	3.43	24	9.40
3758028	41	2300	93200	2	1.48	131	4.60
3758036	2623	24100	71900	69	12.30	1829	3.50
3758041	82	700	72300	2	21.10	8800	0.83
3758073	16	700	60900	-1	3.90	58	7.70
3758080	19	1500	97800	1	18.10	9600	2.95
3758220	7	62	42200	-1	16.20	1125	16.30
3758228	5	4000	55300	4	12.80	5500	2.40
3758338	43	800	134000	1	1.50	1200	13.90
3758341	5	131	23300	-1	27.80	10500	1.05
3758431	28	1000	41800	1	34.40	13700	1.70
3758445	16	1800	135000	1	1.03	727	9.55
3758447	14	700	108000	1	22.30	5800	6.70
3758464	83	17200	88600	5	6.13	33	9.65
3753650	81	3000	31100	-1	1.41	97	2.8
3753659	26	819	84200	-1	21.2	5600	7.6
3753663	4	38	151000	-1	34.3	20300	0.23
3908229	-5	522	167000	-5	26.57	61000	0.65
3908230	74	20000	298000	7	15.33	7128	15.6
3908244	479	95000	200000	46	4.19	-15	4.8



ANALYTICAL RESULTS FOR SAMPLES SUBMITTED FOR QUANTITATIVE XRD																
DPO 77683																
SAMPNO	Cu ppm	Pb ppm	Zn ppm	Ag ppm	Fe%	Mn ppm	S%									
3758004	28	600	103000	1	3.43	24	9.40									
3758028	41	2300	93200	2	1.48	131	4.60									
3758036	2623	24100	71900	68	12.30	1829	3.50									
3758041	82	700	72300	2	21.10	8800	0.83									
3758073	16	700	80900	-1	3.90	58	7.70									
3758080	19	1500	97800	1	18.10	9600	2.95									
3758220	7	62	42200	-1	16.20	1125	16.30									
3758228	5	4000	55300	4	12.80	5500	2.40									
3758338	43	800	134000	1	1.50	1200	13.90									
3758341	5	131	23300	-1	27.80	10500	1.05									
3758431	28	1000	41800	1	34.40	13700	1.70									
3758445	16	1800	135000	1	1.03	727	9.55									
3758447	14	700	108000	1	22.30	5800	6.70									
3758464	83	17200	88600	5	6.13	33	9.65									

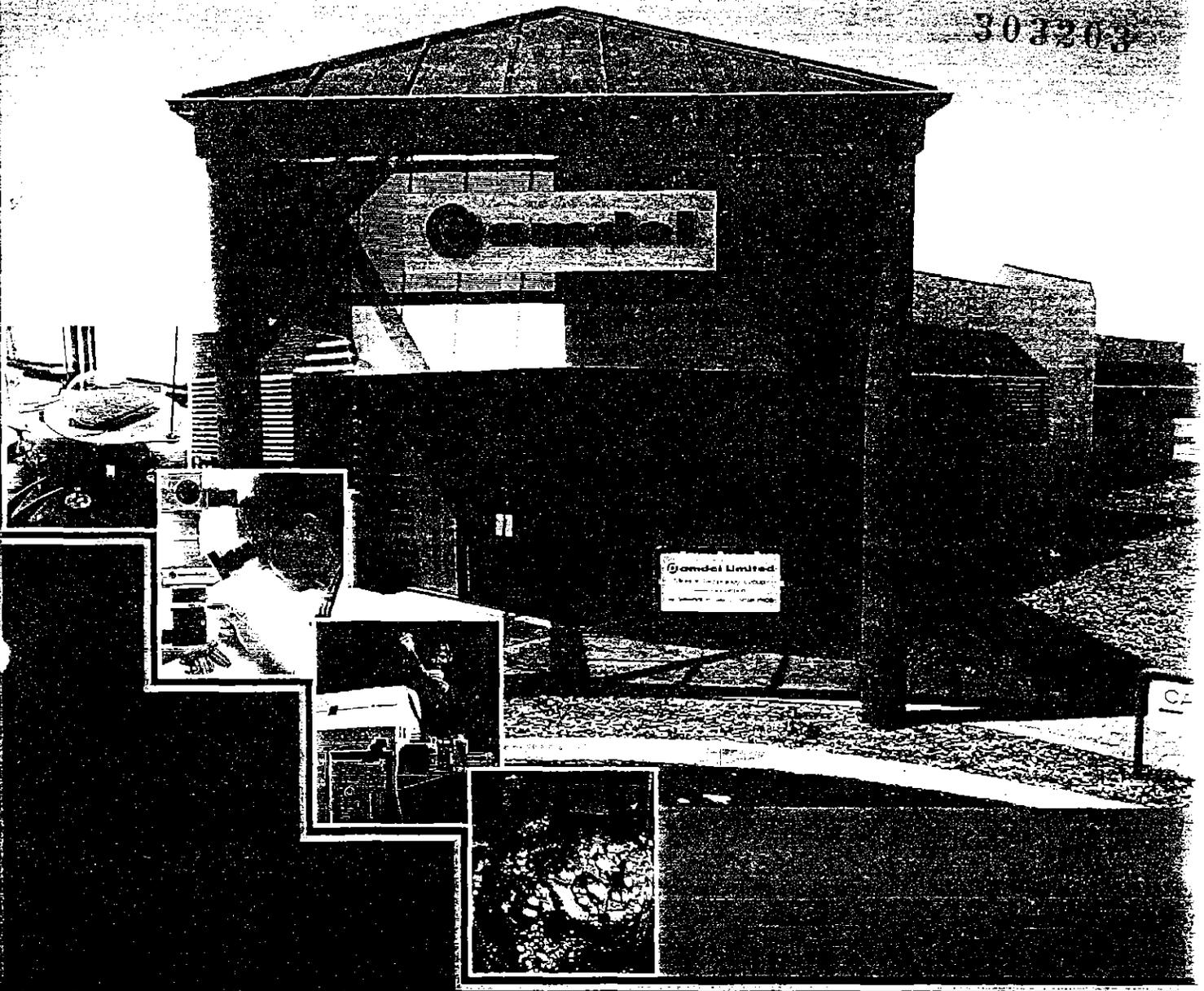
  

HOLE	DFROM	DTO	SAMPNO	DPO	BMRLITH	FIELDID	TEXTURE	ALT/MIN	COLOUR	COMMENTS	Cu ppm	Pb ppm	Zn ppm	Ag ppm	Fe%	Mn ppm	S%
ZG104	12.25	14.35	3753650	77110	Og	Ccy		DG		Poor Rec	81	3000	31100	-1	1.41	97	2.8
ZG104	27.30	29.10	3753659	77110	Og	Ss	Al	Sd	YB	Poor Rec	26	819	84200	-1	21.2	5600	7.6
ZG104	34.00	35.10	3753663	77110	Og	Ss	Al	Sd	YB	Poor Rec	4	38	151000	-1	34.3	20300	0.23
ZG107	127.90	128.85	3908229	77127	Og	Sd	Al	Sd	YG	Strongly ankerite altered	5	522	167000	-5	26.57	61000	0.65
ZG107	128.85	131.10	3908230	77127	Og	Sd/Ccy	AlBx	Sd	DGY	Ankeritic breccia frags in sandy clay	74	20000	298000	7	15.33	7128	15.6
ZG107	156.60	158.70	3908244	77127	Og	Ccy		DGN		Carbonaceous	479	95000	200000	46	4.19	-15	4.8

sp  
Sd  
Ccy

303202

303203



AMDEL REPORT G838800G/94

QUANTITATIVE MINERALOGY OF 20 SAMPLES

 **amdel**



A.C.N. 008 127 802

Amdel Limited  
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303204

29 April 1994

Mr Robert Parkinson  
CRA Exploration Pty Limited  
PO Box 8093  
NORTHLAND CENTRE VIC 3072

REPORT G838800G/94  
QUANTITATIVE MINERALOGY OF 20 SAMPLES

YOUR REFERENCE: DPO 77663

SAMPLE IDENTIFICATION: 3758004-464, 375650-663, 3908229-244

MATERIAL: 20 pulps

DATE RECEIVED: 29 March 1994

WORK REQUIRED: Quantitative determination of mineralogy

Investigation and Report by: Michael Till

Dr Keith J Henley  
Manager, Mineral Services Laboratory

*The results contained in this report relate only to the sample(s) submitted for testing.  
Amdel Ltd accepts no responsibilities for the representivity of the sample(s) submitted.*

hk

cc Mr Craig Hayward  
CRA Exploration Pty Limited  
PO Box 8093  
NORTHLAND CENTRE VIC 3072

CRAE Information Systems  
CRA Exploration Pty Limited  
PO Box 3709  
MANUKA ACT 2603

## QUANTITATIVE MINERALOGY OF 20 SAMPLES

### 1. INTRODUCTION

Sample pulps were received from Mr R Parkinson of CRA Exploration Pty Limited, Preston, with a request for quantitative determination of their mineralogies. Base metal analyses (see Appendix A) and microprobe analyses were also provided. Of particular interest is the Zn-bearing minerals.

### 2. PROCEDURE

The samples were analysed by X-ray diffraction for detection of the crystalline phases, and analysed by ICP for major elements. The mineral contents were calculated using stoichiometric compositions (except where indicated) using the assay results according to the following sequence:

- (a) All  $K_2O$  was allocated to muscovite (assuming 10%  $K_2O$ ).
- (b) All Pb was allocated to galena.
- (c) All MgO was allocated to dolomite (ignoring minor MgO in other minerals).
- (d) Residual CaO was allocated to calcite.
- (e) For samples in which sphalerite was the only Zn-bearing mineral, all Zn was allocated to sphalerite, and residual S to pyrite. The sphalerite composition used was 68% Zn, 32% S.
- (f) A chlorite composition of 26% ZnO, 21%  $Al_2O_3$ , 29%  $SiO_2$ , 9% FeO and 2% MgO was calculated from the analysis results of 3908244 (after subtraction of the other minerals and assuming all S is present in galena and sphalerite).
- (g) A siderite composition was calculated from the analysis results of 375663. Quartz was the only other mineral detected. The siderite composition (Sid A in Table 1) was used for all other samples except for those labelled under Siderite B below.

Sample	Calculated Composition (Wt %)					
	ZnO	FeO	MnO	MgO	CaO	Residual
<b>Siderite A</b>						
375663 and 9 other samples	20	40	3	0.3	1	36
<b>Siderite B</b>						
3758041	15	48	2	-	-	35
3758228 (average of two)	10	53	3	-	-	34
3758341	3	54	2	-	2	39
3758431	4	57	2	-	-	37
3908229	22	40	7	-	0.7	31

- (h) For samples where kaolinite or chlorite was the only Al-bearing mineral (except muscovite) residual  $Al_2O_3$  was allocated to these minerals. In several samples the presence of which of kaolinite or chlorite was present could not be determined. In these samples the siderite content is high and the chlorite/kaolinite content low.
- (i) For sample 3758028 the kaolinite content was estimated to be no more than 2% (by comparison of XRD peak height with 3758036).
- (j) For samples with pyrite, sphalerite and siderite (but no chlorite) the contents of these minerals were calculated using a computer-based mixing program, using the Fe, Zn and S assays. This was not successful for the samples given under Siderite B in Section (g) above. This was partially due to siderite having a different composition to Siderite A. To get around this impasse, the pyrite and sphalerite contents were arbitrarily considered to be in a 1:1 ratio and the S distributed accordingly. The siderite compositions for these samples were subsequently calculated from the residual oxides.
- (k) For sample 3758464 the sphalerite, pyrite and chlorite and kaolinite contents were calculated using a computer-based mixing program using Zn, S, Fe and  $Al_2O_3$ .
- (l) Residual  $SiO_2$  was allocated to quartz.
- (m) The Zn distribution was calculated using the above compositions. Zn in Siderite A and Siderite B was combined.

### 3. RESULTS

The chemical analysis results are given overleaf. The calculated mineralogies (Wt %) are given in Table 1 and the residual oxides and LOI remaining after the calculations are given in Table 2.

Note that although the mineral contents and residual oxides are quoted to one unit or 0.01 for convenience, such a degree of accuracy is not implied; this is because the calculated values are dependent on the assumptions given in the 'Procedure' section and, if the assumed mineral compositions differ from the actual mineral compositions, the calculated values will differ from the true values.

The alumino-silicate mineral in 3908244 has been named a chlorite because it has a very similar XRD pattern to that recorded for a ferroan clinochlore (JCPDS No 16-362) except that the even-order basal peaks are very strong and the odd-order basal peaks are very weak. This may be due to the presence of a heavy element (e.g., Zn). The siderite minerals have an XRD pattern identical to siderite. This is surprising as some shift of the XRD peaks toward the  $ZnCO_3$  XRD pattern would be expected. Sample 3758338 is unusual in that two carbonates are present, neither with an XRD pattern identical to siderite. Amorphous phases are probably present in samples with low totals and high residual LOI (e.g. sample 3758004). Sample 3908230 has a high total due to the assays summing to more than 100%.

TABLE 1: CALCULATED MINERALOGY AND ZN DISTRIBUTION OF 20 SAMPLES

Sample	Mineralogy, wt%											
	Galena	Sphalerite	Pyrite	Muscovite	Kaolinite	Chlorite	Quartz	Dolomite	Calcite	Sid A	Sid B	Total
3758004	0.07	15	9	9	-	-	22	-	-	-	-	54
3758028	0.27	13	1	24	2	-	39	-	-	5	-	83
3758036	3.03	3	4	20	2	-	20	12	6	33	-	103
3758041	0.08	1	1	6	1	-	24	8	2	-	56	100
3758073	0.08	9	9	12	-	-	47	-	-	-	-	77
3758080	0.17	2	4	16	-	-	18	7	-	51	-	99
3758220	0.07	4	28	7	-	2	13	15	17	9	-	96
3758228	0.46	3	3	1	-	8	3	52	5	-	26	100
3758338	0.09	13	18	29	-	18	4	-	-	3	-	86
3758341	0.02	1	1	-	-	-	1	30	-	-	66	100
3758431	0.12	2	2	7	3	-	3	3	-	-	79	100
3758445	0.21	19	7	2	-	-	17	19	1	5	-	68
3758447	0.08	5	10	17	10	-	2	3	-	47	-	93
3758464	1.99	13	10	34	11	-	18	-	-	-	-	88
3753650	0.35	4	3	11	5	1	37	9	5	-	-	75
3753659	0.09	3	12	5	-	0	11	24	9	38	-	103
3753663	0.00	-	-	-	-	-	5	-	-	93	-	98
3908229	0.06	1	1	-	-	6	2	4	-	-	86	99
3908230	2.31	30	11	8	-	19	11	-	-	32	-	114
3908244	10.97	10	-	12	-	60	5	-	-	-	-	98

Sample	Zn Distribution, %		
	Sphalerite	Chlorite	Siderite
3758004	100	-	-
3758028	91	-	8
3758036	26	-	74
3758041	9	-	91
3758073	100	-	-
3758080	16	-	84
3758220	65	10	36
3758228	34	29	37
3758338	68	28	3
3758341	35	-	64
3758431	33	-	67
3758445	94	-	5
3758447	29	-	71
3758464	100	-	-
3753650	93	7	-
3753659	27	1	73
3753663	-	-	100
3908229	3	8	89
3908230	69	13	18
3908244	35	62	-

TABLE 2: RESIDUAL OXIDES/LOI REMAINING AFTER CALCULATION OF MINERALOGY

Sample	TiO2	Al2O3	Fe2O3*	MnO	MgO	CaO	Na2O	K2O	P2O5	LOI	Total
3758004	0.26	9.7	-0.5	-	0.3	0.2	0.04	-	0.05	42.4	52.5
3758028	0.59	4.0	-	-	0.6	0.1	0.10	-	0.35	14.1	19.9
3758036	0.48	-	0.1	-0.7	-	-0.3	0.08	-	0.15	-0.2	-0.5
3758041	0.17	-	0.1	-	-	-	0.02	-	0.12	2.3	2.6
3758073	0.35	1.2	0.5	-	0.4	1.5	0.06	-	0.01	26.4	30.5
3758080	0.37	1.4	-	-	-0.2	-0.3	0.07	-	0.12	0.7	2.2
3758220	0.16	-	-0.2	-	-0.1	-0.1	0.03	-	0.03	15.4	15.2
3758228	0.12	-	-	-	-0.2	-	<0.01	-	0.06	-4.9	-4.9
3758338	0.78	-	-	0.1	0.3	0.7	0.09	-	0.28	20.3	22.5
3758341	0.03	0.7	-	-	-	1.4	<0.01	0.1	0.13	-0.5	1.8
3758431	0.24	-	-	-	-	0.3	<0.01	-	0.28	3.1	3.9
3758445	0.1	2.4	-	-	-	-	<0.01	-	0.26	34.9	37.6
3758447	0.46	-	-	-0.6	-0.1	-0.5	0.04	-	0.37	11.5	11.2
3758464	1.04	-	2.0	-	0.7	0.4	0.11	-	0.31	13.9	18.4
3753650	0.35	0.1	0.2	-	-	-	0.06	-	0.08	25.5	26.3
3753659	0.14	-	-	-0.3	-0.1	-0.4	0.02	-	0.11	2.1	1.5
3753663	0.06	1.2	-	-	0.1	-	<0.01	0.3	0.08	-1.7	0.0
3908229	0.07	-	-	-	-0.1	-	<0.01	0.2	0.11	3.2	3.5
3908230	0.38	-	-1.6	-	0.5	-	0.03	-	0.12	6.8	6.2
3908244	0.89	-	0.3	-	-	-	0.03	-	0.16	5.2	6.6

\* Total Fe as Fe2O3

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Results in percentages

3758004 3758028 3758036 3758041 3758073

SiO <sub>2</sub>	25.6	50.4	29.6	27.3	52.1
TiO <sub>2</sub>	0.26	0.59	0.48	0.17	0.35
Al <sub>2</sub> O <sub>3</sub>	13.1	14.1	8.35	2.82	5.80
Fe <sub>2</sub> O <sub>3</sub>	5.25	2.78	17.6	30.6	6.60
MnO	<0.01	0.02	0.25	1.23	<0.01
MgO	0.25	0.66	2.72	1.79	0.41
CaO	0.17	0.19	7.10	3.58	1.50
Na <sub>2</sub> O	0.04	0.10	0.08	0.02	0.06
K <sub>2</sub> O	0.88	2.40	1.96	0.63	1.19
P <sub>2</sub> O <sub>5</sub>	0.05	0.35	0.15	0.12	0.01
LOI	42.8	17.0	20.9	24.2	26.9

3758080 3758220 3758228 3758338 3758341

SiO <sub>2</sub>	25.7	16.8	5.60	23.0	0.98
TiO <sub>2</sub>	0.37	0.16	0.12	0.78	0.03
Al <sub>2</sub> O <sub>3</sub>	7.60	3.00	2.06	15.2	0.68
Fe <sub>2</sub> O <sub>3</sub>	25.5	23.0	17.9	14.9	40.1
MnO	1.35	0.16	0.81	0.17	1.34
MgO	1.64	3.32	11.3	0.70	6.60
CaO	2.44	14.4	18.4	0.69	10.6
Na <sub>2</sub> O	0.07	0.03	<0.01	0.09	<0.01
K <sub>2</sub> O	1.59	0.67	0.11	2.94	0.08
P <sub>2</sub> O <sub>5</sub>	0.12	0.03	0.06	0.28	0.13
LOI	22.7	34.1	30.8	25.1	33.6

 Total Fe as Fe<sub>2</sub>O<sub>3</sub>

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Results in percentages

3758431 3758445 3758447 3758464 3758650

SiO <sub>2</sub>	7.55	17.6	13.8	38.1	43.9
TiO <sub>2</sub>	0.24	0.10	0.46	1.04	0.35
Al <sub>2</sub> O <sub>3</sub>	3.86	3.14	10.2	17.4	6.60
Fe <sub>2</sub> O <sub>3</sub>	51.3	6.45	27.7	8.55	2.10
MnO	1.74	0.10	0.77	<0.01	0.01
MgO	0.76	4.10	0.56	0.66	2.06
CaO	1.36	6.10	0.76	0.35	5.70
Na <sub>2</sub> O	<0.01	<0.01	0.04	0.11	0.06
K <sub>2</sub> O	0.65	0.20	1.66	3.42	1.14
P <sub>2</sub> O <sub>5</sub>	0.28	0.26	0.37	0.31	0.08
LOI	29.2	45.8	31.3	16.8	33.5

3758659 3758663 3908229 3908230 3908244

SiO <sub>2</sub>	13.4	5.30	3.66	20.5	27.8
TiO <sub>2</sub>	0.14	0.06	0.07	0.38	0.89
Al <sub>2</sub> O <sub>3</sub>	2.16	1.20	1.30	7.25	17.3
Fe <sub>2</sub> O <sub>3</sub>	25.2	41.6	38.9	21.6	6.05
MnO	0.73	2.58	6.25	0.89	<0.01
MgO	5.15	0.34	0.85	1.00	1.35
CaO	12.1	0.89	1.78	0.32	<0.01
Na <sub>2</sub> O	0.02	<0.01	<0.01	0.03	0.03
K <sub>2</sub> O	0.54	0.25	0.21	0.83	1.17
P <sub>2</sub> O <sub>5</sub>	0.11	0.08	0.11	0.12	0.16
LOI	30.7	30.9	31.8	21.2	14.6

 Total Fe as Fe<sub>2</sub>O<sub>3</sub>

## APPENDIX A

ANALYTICAL RESULTS FOR SAMPLES SUBMITTED FOR QUANTITATIVE XRD							
DPO 77663							
SAMPNO	Cu ppm	Pb ppm	Zn ppm	Ag ppm	Fe%	Mn ppm	S%
3758004	28	600	103000	1	3.43	24	9.40
3758028	41	2300	93200	2	1.48	131	4.60
3758036	2623	24100	71900	69	12.30	1829	3.50
3758041	82	700	72300	2	21.10	8800	0.83
3758073	16	700	60900	-1	3.90	58	7.70
3758080	19	1500	97800	1	18.10	9600	2.95
3758220	7	62	42200	-1	16.20	1125	16.30
3758228	5	4000	55300	4	12.80	5500	2.40
3758338	43	800	134000	1	1.50	1200	13.90
3758341	5	131	23300	-1	27.80	10500	1.05
3758431	28	1000	41800	1	34.40	13700	1.70
3758445	16	1800	135000	1	1.03	727	9.55
3758447	14	700	108000	1	22.30	5800	6.70
3758464	83	17200	88600	5	6.13	33	9.65
3753650	81	3000	31100	-1	1.41	97	2.8
3753659	26	819	84200	-1	21.2	5600	7.6
3753663	4	38	151000	-1	34.3	20300	0.23
3908229	-5	522	167000	-5	26.57	61000	0.65
3908230	74	20000	298000	7	15.33	7128	15.6
3908244	479	95000	200000	46	4.19	-15	4.8

GRIEVES PROSPECT - TASMANIA

Zn mineralogy for three "ore" types.

303213

SURFICIAL CLAYS

SAMPLE NO: — 004

028

073

338

445

464

650

ave sphal 92%  
chlorite 5%  
siderite 2%

Zn = 9.23%  
Fe = 2.70%  
S = 8.22%

Zn as sph (prop: of total Zn) calc from assays (= to % metal cations as sulph)  
= >100%

SIDERITE ZONE

041

341

431

467

659

663

229

036

080

220

228

230

ave sphal 29%  
chlorite 12%  
siderite 58%

Zn = 10.11%  
Fe = 20.8%  
S = 4.96%

calc Zn as sph = 29%

STRATABOUND CLAY ZONE

244

sphal 35%  
chlorite 62%  
siderite —

Zn = 20.0%  
Fe = 4.1%  
S = 4.8%

calc Zn as sph = 40%

Table 1: Ore types and Zn distribution.

Table 1: Summary of ore types, average Zn-Fe-S analyses, and calculated Zn mineralogy										
ORE TYPE	LITHOLOGY	Number	Zn%	Fe%	S%	Calculated from analyses		Calculated from XRD		
						Zn as sphal	Zn as other mins	Zn as sphal	Zn as siderite	Zn as clay
TYPE 1	Surficial clays and decomposed limestone	126	3.26	4.6	5.3	100%	0%	92%	2%	5%
TYPE 2	siderite zone	157	4.29	21.7	3.5	24%	76%	29%	58%	12%
TYPE 3	stratabound clays	74	4.89	12.3	4.4	46%	54%	35%	0%	62%
TYPE 4	middle zone	40	5.58	5.7	2.3	38%	62%	-	-	-
TYPE 5	upper dolomite zone	4	1.77	3.1	4.8	100%	0%	-	-	-

Grievess prospect - ore types and Zn as sphalerite calculations

GRIEVES PROSPECT																		
ALL DRILLHOLE SAMPLES WITH +1% Zn																		
Ore types and calculated Zn as sphalerite									To calculate Zn wt% as sphalerite, divide mol% S by sum of mol% Zn-Pb-Fe, then multiply by total Zn wt%.									
ORETYPES	Type 1	sulfidic clay		(Type 1.5 = decomposed ls)					This assumes metal cations partition to S in proportion to their total abundance i.e. ratio of Zn as Sphal : total Zn = ratio of mol% S : mol% total metal cations									
	Type 2	Siderite zone		(Type 2.5 = oolitic)														
	Type 3	Stralabound clay																
	Type 4	Middle of ls																
	Type 5	Top of ls																
HOLE	DFROM	OTO	SAMPNO	FIELDID	TEXTURE	ALT/MIN	COLOUR	COMMENTS	Ore type	Cu	Pb	Zn	Ag	Fe%	Mn	S%	Zn (Sp)	Zn not Sp
ZG36	6.00	8.00	3523430	Ccy			LBG		4.0	20	15400	93500	5	8.18	59			
ZG36	10.00	12.00	3523432	Sls	WeDs	Py	DG		4.0	8	11100	56500	3	6.52	1420	1.3	1.1	4.6
ZG36	12.00	12.20	3523433	Sls	Ds	Py	DG	Bioturbated lime mudstone	4.0	9	20400	90000	6	8.27	2180	1.3	1.2	7.8
ZG4D	8.00	9.80	3523449	Ccy			DB		1.0	15	2500	12900	1	2.52	34	3.6	1.0	0.0
ZG51	50.00	52.00	3523556	Sls	VuAl	Sd	DB	Siderite alln	2.0	2	28	12900	-1	26.92	9700	3	0.2	1.0
ZG54	6.00	8.00	3523562	Ccy			LOB		3.0	28	21900	258000	26	3.06	16	18.6	25.8	0.0
ZG54	8.00	10.00	3523563	Ccy			LOBDG		3.0	30	26100	280000	28	4.66	20	11.6	19.3	8.7
ZG54	10.00	12.00	3523564	Sls	We	Cy	LOG		3.0	14	11000	269000	22	9.82	27	15.3	21.6	5.3
ZG54	12.00	14.00	3523565	Ccy			G		3.0	270	31600	181000	41	4.64	25	6.05	12.1	6.0
ZG54	14.00	16.00	3523566	Sls	We	Cy	LGDG		3.0	44	7700	56100	2	1.9	37	5.2	5.6	0.0
ZG54	16.00	18.00	3523567	Sls	We	Cy	DG		3.0	20	760	23000	-1	2.23	48	4.1	2.3	0.0
ZG54	18.00	20.00	3523568	Ccy			N		3.0	32	1300	10200	-1	1.65	38	2.6	1.0	0.0
ZG54	20.00	22.00	3523569	Ccy			G		3.0	20	251	15300	-1	1.56	42	2.75	1.5	0.0
ZG55	2.00	4.00	3523578	CcyCg			DBLK		1.0	24	1700	17900	12	1.6	52	3.25	1.8	0.0
ZG55	4.00	6.00	3523579	Ccy			DG		1.0	31	1100	13900	1	1.88	72	2.9	1.4	0.0
ZG55	6.00	8.00	3523580	Ccy			DG		1.0	28	323	16800	-1	2.53	50			
ZG55	12.00	14.00	3523583	Sls	VuAlDs	SdPy	YG		2.0	6	131	15300	-1	31.6	8900	1.95	0.2	1.4
ZG55	14.00	16.00	3523584	Sls	VuAl	Sd	YG		2.0	11	156	11200	-1	22.43	6600	1.8	0.1	1.0
ZG74	2.00	3.00	3523682	Cg			LK		1.0	15	331	15000	-1	16.54	2002			
ZG74	3.00	4.00	3523682	Ccy			G		1.0	15	331	15000	-1	16.54	2002			
ZG74	4.00	6.00	3523683	Ccy			G		1.0	24	870	13400	1	4.39	501	1.5	0.6	0.7
ZG74	6.00	8.00	3523684	Ccy			G		1.0	29	750	26000	1	12	1082	1.95	0.6	2.0
ZG74	8.00	10.00	3523685	Ccy			G		1.0	19	257	26000	1	15.32	1794	0.88	0.2	2.4
ZG74	10.00	12.00	3523686	Ccy			G		1.0	28	840	39300	1	11.84	1431	2.95	1.3	2.6
ZG74	12.00	14.00	3523687	CcySls			G	Minor sandy ls	2.0	170	2150	42600	5	18.46	2615	2.55	0.9	3.4
ZG74	14.00	14.50	3523688	Sls	Ma		G	Massive sandy ls + minor clay	2.0	29	990	30900	1	19.33	1761	1.6	0.4	2.7
ZG75	12.00	14.00	3523695	CcySls			BGLG	Fine q/s massive ls	1.5	20	236	34400	-1	3.18	676	3	2.9	0.5
ZG84	6.00	8.00	3523731	Ccy			DB		1.0	30	3600	15400	2	4.87	105	7	1.5	0.0
ZG92	2.00	4.00	3523787	Ccy			GB		1.0	34	15200	12900	5	9.97	51	10.3	1.3	0.0
ZG92	4.00	6.00	3523788	Ccy			GB		1.0	41	13100	10600	5	10.66	62	11.1	1.1	0.0
ZG108	4.00	6.00	3758002	Ccy			DB	decomposed Sls frags	1.0	124	2200	21100	1	1.09	29	2.5	2.1	0.0
ZG108	6.00	8.00	3758003	Ccy			DG	gritty	1.0	90	1500	11700	1	0.91	22	1.55	1.2	0.0
ZG108	8.00	10.00	3758004	Sls			LB	decomposed	1.5	28	600	103000	1	3.43	24	9.4	10.0	0.0
ZG108	10.00	12.00	3758005	Ccy			DB	decomposed Sls frags	1.5	26	500	53800	1	2.55	135	5.5	5.4	0.0
ZG108	12.00	14.00	3758006	Ccy			B	Sls frags	1.0	9	200	10700	1	0.96	212	1.2	1.1	0.0
ZG108	28.00	30.00	3758014	Ccy			DG	lesser Sls with prominent calcite & qtz veining	3.0	9	300	17300	1	4.25	1205	0.97	0.3	1.4
ZG108	30.00	31.00	3758015	Sls			DG	foliated, calcite veined	3.0	9	200	10900	-1	2.86	947	0.69	0.3	0.7
ZG115	2.80	4.00	3758028	Ccy			LGLB		1.0	41	2300	93200	2	1.48	131	4.6	7.8	1.5
ZG115	4.00	6.00	3758029	Ccy			LB		1.0	65	4400	41600	3	1.84	83	2.25	3.0	1.2
ZG115	6.00	8.00	3758030	Ccy			LGLB		1.0	72	3200	49600	3	3.67	493	2.55	2.8	2.2
ZG115	8.00	10.00	3758031	Ccy			LBLG	lesser sandy Sls	1.5	21	600	30200	1	4.24	1427	2.5	1.9	1.1
ZG115	10.00	12.00	3758032	Sls				minor G-B clay	1.0	7	172	52300	1	9.53	5300	0.9	0.6	4.6

303215

Grieves prospect - ore types and Zn as Sphalerite calculations

HOLE	DFROM	DTO	SAMPNO	FIELDID	TEXTURE	ALT/MIN	COLOUR	COMMENTS	Ore type	Cu	Pb	Zn	Ag	Fe%	Mn	S%	Zn (Spl)	Zn not Spl
ZG115	12.00	14.00	3758033	Ccy			DG	lesser sandy Sls	1.0	21	600	26800	1	3.75	910	2.9	2.2	0.4
ZG115	14.00	16.00	3758034	Ccy			DG	lesser sandy Sls	1.0	25	4400	15400	3	2.35	507	1.55	1.1	0.4
ZG115	16.00	18.00	3758035	Ccy			DG	lesser sandy Sls	1.0	1369	4200	41700	24	8.06	2092	1.8	1.1	3.1
ZG115	18.00	20.00	3758036	Ccy	AI	Sd	DG	minor bands of YG sideritic carbonate	2.0	2623	24100	71900	69	12.3	1829	3.5	2.3	4.9
ZG115	20.00	22.00	3758037	Ccy	AI	Sd	LDGG	rare YB carbonate with Sd	2.0	167	6100	32000	7	7.25	620	3	1.6	1.6
ZG115	22.00	24.00	3758038	Ccy	AI	Sd	G	minor Sd carbonate frag.	2.0	53	4300	35800	4	9.37	2672	2.45	1.2	2.4
ZG115	24.00	26.00	3758039	Sls			DG	sandy, lesser DG clay	2.0	23	400	43900	1	17.8	5500	2.8	1.0	3.4
ZG115	26.00	28.00	3758040	Sls	AI	SdSu?		honeycombed, heavy, broken, lesser N clay	2.0	33	300	69700	1	29.4	8800	1.05	0.4	6.6
ZG115	28.00	28.50	3758041	Sls	AI	SdSu?		honeycombed, heavy, broken, lesser N clay	2.0	82	700	72300	2	21.1	8800	0.83	0.4	6.8
ZG116	3.50	6.00	3758042	Ccy			MDGLB		1.0	56	2000	13200	2	3.33	602	1.15	0.6	0.7
ZG116	6.00	8.00	3758043	Ccy	AIDs	SdPy	DG	lesser Sls	2.0	35	1200	84500	1	8.29	3982	1.8	1.7	6.7
ZG116	8.00	10.00	3758044	Ccy	AIDs	SdPy	MG	lesser Sls	2.0	27	900	114000	1	9.39	6200	1.65	1.7	9.7
ZG116	10.00	12.00	3758045	Ccy			MOO	lesser Sls	3.0	228	13000	63700	4	13.1	4839	1.35	0.8	5.6
ZG116	12.00	14.00	3758046	Ccy			MFLB	sim. to clays in DDH106 at same strat. level	3.0	60	2500	21900	3	9.71	2010	0.09	0.0	2.2
ZG117	4.00	6.00	3908998	Ccy			B	peaty	1.0	68	3500	78600	-1	1.39	52	5.68	7.9	0.0
ZG117	6.00	8.00	3908999	Ccy			MLBDG		1.0	15	162	73200	-1	1.7	110	5.47	7.3	0.0
ZG117	8.00	10.00	3909000	Ccy			MLBOG		1.0	22	600	112000	-1	2.39	110	6.09	11.2	0.0
ZG117	10.00	12.00	3909058	Ccy			DG	lesser K fine Sst	1.0	66	9400	13800	2	2.35	351	0.91	0.5	0.9
ZG117	12.00	14.00	3909059	Sls			DG	calc-arenite, lesser K fine Sst + DG clay	1.5	15	516	18100	-1	2.23	421	1.56	1.3	0.5
ZG117	14.00	16.00	3909060	Sls			DG	granular calc-arenite, lesser DG clay	1.5	10	238	15500	-1	2.19	336	1.75	1.3	0.2
ZG117	16.00	18.00	3909061	Sls	Vn		DG	granular calc-arenite, lesser DG clay	1.5	11	333	14100	1	1.97	705	1.2	0.9	0.5
ZG123	8.00	10.00	3758073	Ccy			B	lesser N decomposed Sls	1.0	16	700	60900	-1	3.9	58	7.7	6.1	0.0
ZG123	10.00	12.00	3758074	Ccy			B	lesser N decomposed Sls	1.0	18	200	33800	-1	4.06	498	5.1	3.4	0.0
ZG123	14.00	16.00	3758076	Ccy			MBG		1.0	23	300	27600	1	3.24	534	1.95	1.7	1.1
ZG123	16.00	18.00	3758077	Ccy			DGB	lesser DG Sss	2.0	9	137	28100	-1	15.5	3581	1.9	0.5	2.3
ZG123	18.00	20.00	3758078	Sls				hard with prominent calcite veining, lesser G clay	2.0	5	97	37500	-1	24.7	6000	1.35	0.3	3.4
ZG123	20.00	22.00	3758079	Ccy			DG	lesser hard Sss with prominent calcite veining	2.0	16	4100	68500	1	13.9	2987	2.5	1.5	5.4
ZG123	22.00	24.00	3758080	Ccy	Ds	Py	MBG	lesser hard, silicified? Sls	2.0	19	1500	97800	1	18.1	9600	2.95	1.9	7.9
ZG129	0.00	2.00	3758110	Ccy			B	peal + decomposed N Ist	1.5	11	147	25000	-1	1.36	15	3.5	2.5	0.0
ZG129	2.00	4.00	3758111	Sls			B	decomposed Ist	1.5	12	100	28900	-1	3.39	24	6.55	2.9	0.0
ZG129	4.00	6.00	3758112	Ccy			G		1.0	28	132	11200	-1	3.7	30	4.65	1.1	0.0
ZG149	8.00	10.00	3758187	Ccy			MWDG	lesser decomposed Sls	1.0	87	6800	25100	2	9.26	51	11.1	2.5	0.0
ZG149	10.00	12.00	3758188	Ccy			MDGW	W - sphalerite, lesser decomposed banded & mottled Sls	2.0	17	4600	46200	2	23.5	65	28.7	4.6	0.0
ZG149	12.00	14.00	3758189	Sls	Ds	Py	DG	decomposed Sls, lesser DG clay	2.0	23	5900	67500	2	21.7	145	28.5	6.6	0.0
ZG149	14.00	16.00	3758190	Sls				broken oolitic Sls	2.5	9	560	10500	-1	3.53	506	3.9	1.1	0.0
ZG150	4.00	6.00	3758193	Ccy			DG		1.0	51	2100	12100	2	15.6	3574	6.05	0.8	0.4
ZG150	6.00	8.00	3758194	Sls	Ds	Py	LG	oolitic Sls, lesser DG clay	2.5	31	1400	14400	1	17.6	5200	3.1	0.1	1.0
ZG150	8.00	10.00	3758195	Sls			LG	oolitic Sls, broken	2.5	8	1500	10300	-1	6.7	1695	2.8	0.7	0.4
ZG152	18.00	20.00	3758211	Sls			R	oolitic, with hematitic staining	2.5	10	7100	59800	2	4.51	1338	2.35	2.5	3.5
ZG153	5.00	6.00	3758212	Ccy			DG		1.0	18	87	18000	-1	3.46	639	2.85	1.6	0.0
ZG153	18.00	20.00	3758219	Sls	Ds	Py	DG	lesser DG clay, 5% Py	1.5	7	47	25200	-1	10.8	1401	9.95	2.5	0.0
ZG153	20.00	22.00	3758220	Sls	Ds	Py	DG	lesser DG clay, 5% Py	1.5	7	62	42200	-1	16.2	1125	16.3	4.2	0.0
ZG153	26.00	28.00	3758223	Sls	Ds	Py	DG	3-5% Py	2.0	10	700	10800	-1	16.2	6400	1.7	0.2	0.9
ZG153	28.00	30.00	3758224	Sls	Ds	Py	DG	granular Sls, lesser DG clay	2.0	5	800	11500	1	14.7	5100	2.35	0.3	0.9
ZG153	30.00	32.00	3758225	Sls	Ms	Py	LG	R(hematitic) staining, rdd qtz pebbles	2.0	6	500	14000	1	12.6	2113	7.1	1.3	0.1
ZG153	32.00	34.00	3758226	Sls	Ms	Py	LG	R(hematitic) staining, rdd qtz pebbles	2.0	7	2400	16300	2	8.37	2991	1.2	0.3	1.3
ZG153	34.00	36.00	3758227	Sls	Ms	Py	LG	R(hematitic) staining, rdd qtz pebbles	2.0	8	800	10300	1	3.89	1383	1.2	0.1	0.6
ZG153	36.00	38.00	3758228	Sls	Ds	Py	LG	R(hematitic) staining 5% Py	2.0	5	4000	55300	4	12.8	5500	2.4	1.3	4.2
ZG153	38.00	40.00	3758229	Sls	Ds	Py	LG	R(hematitic) staining	2.0	6	1700	12600	1	10.8	5600	1.4	0.3	1.0
ZG153	40.00	42.00	3758230	Sls	Ds	Py	DG	pitted, lesser DG clay	2.0	12	2400	44900	1	24.7	3050	22.9	4.5	0.0
ZG153	42.00	44.00	3758231	Ccy			DG	lesser R(hematitic) oolitic Sls	2.5	16	1200	32200	-1	9.77	1510	7.65	3.2	0.0
ZG154	4.50	6.00	3758232	Ccy			DG	lesser DG granular Sls	1.0	9	78	20000	-1	2.85	415	2.65	2.0	0.0

303216

Greaves prospect - ore types and Zn as Sphalerite calculations

HOLE	DFROM	DTO	SAMPNO	FIELDID	TEXTURE	ALT/MIN	COLOUR	COMMENTS	Ore type	Cu	Pb	Zn	Ag	Fe%	Mn	S%	Zn (Sp)	Zn not Sp
ZG154	24.00	26.00	3758242	Ccy	Ds	Py	DG	lesser DG granular Sls	2.0	9	26	12800	-	13	3736	5	0.8	0.5
ZG154	26.00	28.00	3758243	SsCs			DG	Sand. poor recovery - cavity?	2.0	7	10	12900	-	11.8	4531	1.8	0.3	1.0
ZG154	28.00	30.00	3758244	Sls	Ds	Py	MG		2.0	5	20	11400	-	11.2	4577	1.4	0.2	0.9
ZG155	6.00	8.00	3758248	Ccy			DG	lesser DG granular Sls	1.0	7	2900	15200	2	2.41	522	1.95	1.4	0.2
ZG155	18.00	20.00	3758254	Sls			MG	granular Sls	1.5	4	29	17400	-	3.4	1163	1.7	1.1	0.7
ZG155	20.00	22.00	3758255	Sls			MG	granular Sls, lesser DG clay	1.5	5	48	17600	-	2.55	806	1.75	1.3	0.4
ZG155	24.00	26.00	3758257	Sls	Ds	Py	MDG	granular Sls, lesser B clay	1.5	5	83	14100	-	6.41	1145	4.65	1.4	0.0
ZG155	26.00	28.00	3758258	Ccy			DG	lesser MDG granular Sls	1.5	13	900	11200	-	5.1	1412	2.65	0.8	0.3
ZG155	28.00	30.00	3758259	Ccy			DG	lesser MDG granular Sls	1.5	17	74	17600	-	3.9	1291	9.7	1.6	0.0
ZG155	30.00	32.00	3758260	Ccy	Ds	Py	DG	lesser MDG granular Sls 5% Py	1.5	8	124	16100	1	1.59	3466	20.7	1.6	0.0
ZG155	32.00	34.00	3758261	Ccy	Ds	Py	DCB	lesser pitted, altered DG Sls	1.5	5	35	20500	-	2.72	3024	21.7	2.1	0.0
ZG155	34.00	36.00	3758262	Sls	Ds	Py	MG		2.0	7	24	17600	-	19.3	6500	4	0.6	1.2
ZG155	36.00	38.00	3758263	Sls	Ds	Py	MG	5%Py	2.0	6	9	13500	-	23	7900	6.5	0.6	0.7
ZG155	38.00	39.00	3758264	Sls	Ds	Py	MG	pitted G Sls	2.0	6	9	12000	-	16.8	9200	0.73	0.1	1.1
ZG156	18.00	20.00	3758273	Sls	Ds	Py	Py	vein calcite returned only - cavity	1.5	3	108	13900	1	12.6	254	11.3	1.4	0.0
ZG156	22.00	24.00	3758275	Sls	Ds	Py	MG	granular Sls, calcite veined	1.5	4	87	20400	-	7.28	629	8.35	2.8	0.0
ZG156	24.00	26.00	3758276	Sls	Ds	Py	MG	granular Sls, calcite veined	1.5	4	60	21000	-	12	2930	6.7	1.8	0.3
ZG157	1.50	3.00	3758278	Sls			LG	fine Sls, lesser pealy clay	1.5	10	38	22600	-	4.16	121	9.8	2.3	0.0
ZG169	4.00	6.00	3758314	Ccy			MMGB		1.0	76	1100	33000	1	1.17	42	4.75	3.3	0.0
ZG170	2.00	4.00	3758331	Ccy			MBG		1.0	124	18800	30900	6	1.24	33	2.7	3.1	0.0
ZG170	4.00	6.00	3758332	Ccy			B	lesser decomposed Sls	1.0	44	12000	73400	2	0.73	48	6.05	7.3	0.0
ZG170	6.00	7.00	3758333	Sls	Ds	Py		oolitic Sls	2.5	91	28600	30700	3	1.72	197	3.3	3.1	0.0
ZG171	4.00	6.00	3758336	Ccy			MDGW		1.0	105	12100	30700	3	1.94	55	3.35	3.1	0.0
ZG171	6.00	8.00	3758337	Ccy			MDGW		1.0	62	1400	33700	2	3.92	585	5.3	3.4	0.0
ZG171	8.00	10.00	3758338	Ccy			MDGW		1.0	43	800	134000	1	1.5	1200	13.9	13.4	0.0
ZG171	10.00	12.00	3758339	Ccy			MDGW	lesser decomposed Sls	2.0	42	221	19200	1	17.6	4240	3.1	0.5	1.4
ZG171	12.00	14.00	3758340	Sls			LB	pitted	2.0	14	304	29700	1	31.5	11000	3.4	0.5	2.5
ZG171	14.00	16.00	3758341	Sls	AI	Sd	MMG	heavy, honeycombed skeletal Sls	2.0	5	131	23300	-	27.8	10500	1.05	0.1	2.2
ZG171	16.00	18.00	3758342	Sls	AI	Sd	MMG	heavy, honeycombed skeletal Sls	2.0	5	160	22700	1	29.3	11100	0.95	0.1	2.2
ZG171	18.00	20.00	3758343	Sls	AI	Sd	MMG	heavy, honeycombed skeletal & oolitic Sls	2.5	10	900	11900	1	12.1	3560	0.87	0.1	1.1
ZG171	20.00	22.00	3758344	Sls	AI	Sd	MMG	heavy, honeycombed skeletal & oolitic Sls	2.5	9	1400	12600	2	10.9	3386	0.74	0.1	1.1
ZG172	4.00	6.00	3758346	Ccy			MDGW		1.0	50	1300	33100	-	1.69	46	4.3	3.3	0.0
ZG172	6.00	8.00	3758347	Ccy			MDGW		1.0	32	1000	11500	1	2.43	405	3.1	1.2	0.0
ZG172	10.00	12.00	3758349	Ccy	AI	Sd	MDGW	lesser altered/ankeritic oolitic Sls	2.5	10	163	12000	-	25.6	8000	1.1	0.1	1.1
ZG172	12.00	14.00	3758350	Sls	Ds	Py	MG	oolitic	2.5	9	171	12100	1	16.9	4134	0.45	0.1	1.2
ZG172	16.00	18.00	3758352	Sls	Ds	Py	MG	oolitic, with R hematitic staining	2.5	6	187	10300	-	12.7	3777	0.32	0.0	1.0
ZG172	18.00	20.00	3758353	Sls	AI	Sd		heavy/ankeritic?, honeycombed oolitic Sls	2.5	8	169	11300	-	20.4	6100	0.48	0.0	1.1
ZG172	20.00	22.00	3758354	Sls	AI	Sd		heavy/ankeritic?, honeycombed oolitic Sls	2.5	7	132	11200	-	16	4593	0.33	0.0	1.1
ZG173	12.00	14.00	3758361	Sls	AIDs	SdPy		honeycombed, ankeritic Sls + rdd qtz pebbles, lesser Ccy	2.0	7	208	14600	-	28.5	10000	1.8	0.2	1.3
ZG173	14.00	16.00	3758362	Sls	AIDs	SdPy		honeycombed, ankeritic Sls + rdd qtz pebbles, lesser Ccy	2.0	14	151	10700	-	25.2	8300	0.97	0.1	1.0
ZG173	16.00	18.00	3758363	Sls	AIDs	SdPy		honeycombed, ankeritic Sls + rdd qtz pebbles, lesser Ccy	2.0	14	127	11800	-	23.1	7700	0.66	0.1	1.1
ZG174	4.00	6.00	3758369	Ccy			DG		1.0	32	370	10500	-	1.41	88	3.4	1.1	0.0
ZG174	16.00	18.00	3758375	Sls	AIDs	SdPy	DG		2.0	5	23	15300	-	28.5	8800	1.85	0.2	1.4
ZG174	26.00	28.00	3758380	Sls	AI	Sd	LB	pitted + heavy	2.0	6	298	10600	-	24.1	7600	0.34	0.0	1.0
ZG175	3.00	6.00	3758384	Ccy				lesser B decomposed Sls	1.0	22	217	14700	1	1.15	55	4.65	1.5	0.0
ZG175	6.00	8.00	3758385	Ccy			B		1.0	27	229	13000	1	1.08	87	5.2	1.3	0.0
ZG175	40.00	42.00	3758402	Ccy			LDG	lesser LG oolitic Sls	2.5	22	281	13900	-	17.1	4595	2.15	0.3	1.1
ZG177	20.00	22.00	3758413	Sls	Ds	Py	DG	foliated, lesser DG clay	2.0	17	123	10300	-	15.5	4231	2	0.2	0.8
ZG177	22.00	24.00	3758414	Ccy			DG	lesser G granular Sls	2.0	9	38	12300	-	20.7	6600	1.4	0.1	1.1
ZG177	48.00	50.00	3758427	Sls			DG	granular, lesser DG clay, pitted	2.0	9	98	12000	-	25.5	7800	1.05	0.1	1.1
ZG177	50.00	52.00	3758428	Ccy	Ds	Py	LG	lesser DG Sls	2.0	20	700	10500	1	19.1	4288	1	0.1	1.0
ZG177	52.00	54.00	3758429	Ccy			LBG	lesser pitted LB Sls	2.0	10	141	27400	-	31.3	10900	1.05	0.1	2.6

303217

Grieves prospect - ore types and Zn as Sphalerite calculations

HOLE	DFROM	DTO	SAMPNO	FIELDID	TEXTURE	ALT/MIN	COLOUR	COMMENTS	Ore type	Qu	Pb	Zn	Ag	Fe%	Mn	S%	Zn (Sp)	Zn not Sp
ZG177	54.00	56.00	3758430	Sls	AI	Sd	DG	honeycombed	2.0	8	343	39000	-1	39.6	16200	0.32	0.1	3.8
ZG177	56.00	57.00	3758431	Sls	AI	Sd	LB	honeycombed	2.0	28	1000	41800	1	34.4	13700	1.7	0.3	3.9
ZG178	2.00	4.00	3758432	Ccy					1.0	20	426	32700	1	1.34	49	3.45	3.3	0.0
ZG178	4.00	6.00	3758433	Ccy			G		1.0	24	122	43200	-1	1.01	139	5.3	4.3	0.0
ZG178	6.00	8.00	3758434	Ccy			DG		1.0	24	145	29900	-1	22	6500	3.6	0.8	2.2
ZG178	8.00	10.00	3758435	Sls			MLB		2.0	4	40	29800	-1	39.5	14800	1.15	0.1	2.8
ZG178	10.00	12.00	3758436	Sls			DG	granular Sls	2.0	4	119	29900	-1	35.5	12900	1.4	0.2	2.8
ZG178	12.00	14.00	3758437	Sls	AI	Sd	MMG	oolitic Sls	2.5	7	259	36300	-1	29.2	9900	3.2	0.6	3.0
ZG178	14.00	16.00	3758438	Sls	AI	Sd	MMG	oolitic Sls, lesser B clay	2.5	6	198	31300	-1	29	9300	2.6	0.4	2.7
ZG178	16.00	17.50	3758439	Sls	AI	Sd	MMG	oolitic, heavy	2.5	4	75	22100	-1	29.9	10700	1	0.1	2.1
ZG179	2.00	4.00	3758440	Ccy			B	peaty	1.0	16	1300	10600	1	1.19	85	1.7	1.1	0.0
ZG179	4.00	5.00	3758441	Sls			R	oolitic, hematite stained	2.5	3	300	13300	-1	3.08	977	1.8	1.0	0.3
ZG180	2.50	4.00	3758442	Ccy					1.0	20	1700	26200	1	1.01	47	2.85	2.6	0.0
ZG180	4.00	6.00	3758443	Ccy			B	peaty	1.0	18	1500	76400	1	0.67	60	6	7.6	0.0
ZG180	6.00	8.00	3758444	Ccy			B	peaty	1.0	15	1100	66900	1	0.88	78	5.6	6.7	0.0
ZG180	8.00	10.00	3758445	Ccy			B	peaty	1.0	16	1800	135000	1	1.03	727	9.55	13.5	0.0
ZG180	10.00	12.00	3758446	Ccy			G		2.0	20	800	148000	1	18.7	3773	9.8	8.0	6.8
ZG180	12.00	14.00	3758447	Ccy			B		2.0	14	700	108000	1	22.3	5800	6.7	4.0	6.8
ZG180	14.00	16.00	3758448	Ccy			B	lesser R(heamitic) oolitic Sls	2.5	20	400	33100	1	34.1	10500	3.4	0.5	2.8
ZG181	1.50	4.00	3758456	Ccy			B	peaty	1.0	52	20200	78100	2	2.9	24	7.6	7.8	0.0
ZG181	4.00	6.00	3758457	Ccy			DG		1.0	51	8500	29600	3	2.34	47	4.1	3.0	0.0
ZG181	12.00	14.00	3758461	Ccy			DG		1.0	62	6900	12000	3	1.62	36	2.2	1.2	0.0
ZG181	14.00	16.00	3758462	Ccy			DG		1.0	45	4400	11700	2	1.69	32	2.4	1.2	0.0
ZG181	16.00	18.00	3758463	Ccy			DG		3.0	44	4800	67900	3	9.88	35	13.6	6.8	0.0
ZG181	18.00	20.00	3758464	Ccy			MDGLB		3.0	83	17200	88600	5	6.13	33	9.65	8.9	0.0
ZG182	4.00	6.00	3758471	Ccy			B	peaty	1.0	22	714	50000	1	0.52	63	9.1	5.0	0.0
ZG182	6.00	8.00	3758472	Ccy			B	peaty, lesser N decomposed Sls	1.0	14	418	74300	-1	0.57	68	9.4	7.4	0.0
ZG182	8.00	10.00	3758473	Ccy			B	peaty, lesser N decomposed Sls	1.0	19	1100	103000	1	4.7	92	10.6	10.3	0.0
ZG182	10.00	12.00	3758474	Sls			B	oolitic	2.5	8	110	16500	-1	1.34	560	1.35	1.4	0.2
ZG182	12.00	13.00	3758475	Sls			B	oolitic	2.5	6	163	16700	-1	1.55	351	1.9	1.7	0.0
ZG183	2.50	6.00	3758476	Ccy			B	peaty	1.0	20	85	19100	-1	2.75	123	3.8	1.9	0.0
ZG183	6.00	8.00	3758477	Ccy			GB		1.0	19	77	19700	-1	2.46	123	3.5	2.0	0.0
ZG183	8.00	10.00	3758478	Ccy			GB		1.0	24	217	26200	-1	4.37	608	3.8	2.6	0.0
ZG183	10.00	12.00	3758479	Ccy			GB		1.0	13	123	29200	-1	25.4	8500	2.85	0.5	2.4
ZG183	12.00	14.00	3758480	Sls			B	granular, lesser GB clay, pitted	2.0	9	269	21900	-1	33.3	11200	1.85	0.2	2.0
ZG183	14.00	16.00	3758481	Sls			B	granular, lesser GB clay, pitted	2.0	23	949	35300	-1	23.2	6900	4.1	1.0	2.6
ZG183	16.00	18.00	3758482	Sls				poor recovery, cavity?	2.0	7	233	19100	-1	38.3	13200	1.8	0.1	1.8
ZG183	18.00	20.00	3758483	Sls			LB	lesser B clay, honeycombed	2.0	6	370	37300	-1	34.7	11300	6	1.0	2.7
ZG183	20.00	21.00	3758484	Sls			MMG	oolitic	2.5	4	220	23600	-1	20.7	6800	3.55	0.6	1.7
ZG184	2.00	4.00	3758485	Ccy			DG		1.0	23	1000	20700	-1	2.52	154	3.4	2.1	0.0
ZG184	4.00	6.00	3758486	Ccy			DG	lesser LB pitted Sls	2.0	17	212	11000	-1	20.4	7300	1.75	0.2	0.9
ZG184	24.00	26.00	3758496	Sls	Ds	Py	MG	pitted oolitic Sls, lesser DG clay	2.5	8	46	11600	-1	22.1	6700	1.3	0.1	1.0
ZG184	26.00	28.00	3758497	Sls			MG	pitted oolitic Sls, lesser DG clay	2.5	13	54	17000	-1	30.5	10200	0.88	0.1	1.6
ZG184	28.00	30.00	3758498	Sls			MG	pitted oolitic Sls, lesser G clay	2.5	7	140	16700	-1	29.1	10200	1.2	0.1	1.6
ZG184	30.00	32.00	3758499	Sls			MG	pitted oolitic Sls, lesser G clay	2.5	10	113	11900	-1	23.8	7900	1.15	0.1	1.1
ZG184	32.00	34.00	3758500	Sls			MLB	pitted, lesser B-G clay	2.0	5	72	15700	-1	21.6	7400	1.15	0.1	1.4
ZG184	34.00	36.00	3758501	Sls			MLB	pitted, lesser B-G clay	2.0	13	300	34100	-1	15.5	4455	3.3	1.1	2.3
ZG184	36.00	38.00	3758502	Sls			MMG	oolitic	2.5	6	75	11000	-1	12.9	3941	0.89	0.1	1.0
ZG184	38.00	39.00	3758503	Sls			MMG	pitted oolitic Sls	2.5	13	93	21400	-1	13.1	3991	1.75	0.4	1.7
ZG185	4.00	6.00	3758504	Sls			N	decomposed	1.5	12	56	10000	-1	7.62	22	9.2	1.0	0.0
ZG185	8.00	10.00	3758506	Ccy			N		1.0	16	73	12200	-1	9.22	46	10.3	1.2	0.0
ZG185	10.00	12.00	3758507	Ccy			N		1.0	16	140	10700	-1	8.58	72	9.4	1.1	0.0

303218

Grievess prospect - ore types and Zn as Sphalerite calculations

HOLE	DFROM	DTO	SAMPNO	FIELDID	TEXTURE	ALT/MIN	COLOUR	COMMENTS	Ore type:	Cu	Pb	Zn	Ag	Fe%	Mn	S%	Zn (Sp)	Zn not Sp	
ZG185	54.00	56.00	3758529	Sis			MG	with rdd qtz pebbles, fossilif., lesser MDG-W clay		2.0	10	73	10600	-1	25.6	8400	1.3	0.1	1.0
ZG185	58.00	60.00	3758531	Sis	AI	Sd	LB	honeycombed, with rdd qtz pebbles, lesser DG clay		2.0	11	56	13500	-1	27.7	9500	1.7	0.1	1.2
ZG228	6.00	8.00	3908532	Ccy			MLDB			3.0	59	3300	21900	2	10.8	28	14.7	2.2	0.0
ZG228	8.00	10.00	3908533	CcySis	Fe		MDG	Plastic clays. Minor ferrug lst		3.0	26	510	15900	1	9.43	125	10.8	1.6	0.0
ZG228	10.00	12.00	3908534	CcySis	Fe		G	Plastic clays. Minor ferrug lst		3.0	25	365	24500	1	13.2	140	14.6	2.5	0.0
ZG230	8.00	10.00	3908559	Ccy			DMBG	Plastic clays		3.0	31	1600	15500	1	16.7	3740	6.88	1.0	0.5
ZG230	10.00	12.20	3908560	SisCcy	We		LG	Oolitic. Minor clay		2.5	9	310	11700	-1	6.9	817	5.68	1.2	0.0
ZG264	3.00	6.00	3908706	CcyCg						1.0	13	700	35800	-1	1.87	201	3.2	3.6	0.0
ZG264	12.00	14.00	3908710	Ccy			CB			3.0	38	5700	31700	5	6.6	927	2.12	1.2	1.9
ZG264	14.00	16.00	3908711	Ccy			BC			3.0	90	3800	10700	27	7.83	104	0.86	0.2	0.9
ZG264	16.00	18.00	3908712	Ccy			CB			3.0	242	5600	10800	29	11.1	240	0.53	0.1	1.0
ZG265	4.00	6.00	3908724	Ccy			DB			1.0	13	700	17100	-1	3.39	284	4.22	1.7	0.0
ZG265	12.00	14.00	3908728	CcySss			LB			3.0	22	1400	31900	-1	7.19	1871	5.77	3.2	0.0
ZG273	6.00	8.00	3908755	Ccy			DB			1.0	41	100	28900	-1	2.5	43	5.58	2.9	0.0
ZG273	8.00	10.00	3908756	Sis			LG			1.0	5	45	10900	-1	1.31	454	1.58	1.1	0.0
ZG277	2.00	4.00	3908763	Ccy			NB			1.0	192	2700	10600	-1	1.9	28	3.59	1.1	0.0
ZG277	4.00	6.00	3908764	Ccy			NB			1.0	30	397	19600	-1	3.73	52	5.67	2.0	0.0
ZG277	6.00	8.00	3908765	Ccy			NB			1.0	38	1100	10700	-1	3.29	85	4.95	1.1	0.0
ZG278	0.00	2.00	3908767	CcyCg			DB			1.0	17	1037	10500	-1	2.24	775	1.58	0.9	0.1
ZG279	2.00	4.00	3908771	Ccy			NDB			1.0	68	5500	13600	-1	1.59	32	1.56	1.3	0.1
ZG279	4.00	6.00	3908772	Ccy			B			1.0	33	1600	13500	-1	6.26	1378	4.04	1.3	0.1
ZG280	2.00	4.00	3908775	Ccy			NDB			1.0	15	103	10900	-1	4.16	52	5.26	1.1	0.0
ZG300	0.00	2.00	3908811	Ccy			DG			5.0	21	145	13400	-1	7.4	31	8.36	1.3	0.0
ZG300	6.00	8.00	3908814	Ccy			NB			5.0	14	1100	10800	2	1.7	102	2.37	1.1	0.0
ZG317	2.00	4.00	3908856	Sis	Ds	Py	LG	Pyritic lst.		5.0	25	3800	33200	9	1.79	72	3.77	3.3	0.0
ZG346	6.00	8.00	3909069	Cg			B			1.0	23	180	10200	-1	2.49	41	3	1.0	0.0
ZG348	10.00	12.00	3909073	Sis			N	decomposed Sis		1.5	20	180	13600	-1	3.7	47	4.7	1.4	0.0
ZG348	20.00	22.00	3909078	Ccy	Vc		MG	lesser carbonate veined granular DG Sis		1.0	36	105	11500	-1	2	437	2.9	1.2	0.0
ZG348	22.00	24.00	3909079	Sis		Py	DG	granular Sis with 30% massive Py, minor MG clay		2.0	8	65	17000	-1	13.02	1598	9.65	1.7	0.0
ZG348	24.00	26.00	3909080	Sis		Py	DG	granular Sis with 30% massive Py		2.0	4	45	17600	-1	14.41	2080	10.9	1.8	0.0
ZG348	26.00	28.00	3909081	Sis		Py	DG	granular Sis with 2% massive Py		2.0	3	15	25700	-1	24.04	7400	4.3	0.7	1.8
ZG348	28.00	30.00	3909082	Sis		Py	DG	granular Sis with 30% massive Py, lesser GW clay		2.0	9	128	58000	-1	29.05	8000	15.9	4.7	1.1
ZG348	30.00	31.00	3909083	Sis		Py	DG	granular calc-arenite with 2% PY, lesser MG-W clay		2.0	13	124	34400	-1	24.59	11000	3.1	0.7	2.8
ZG349	4.40	6.00	3909084	Sis		He	MGK	oolitic Sis, minor clay		2.5	8	211	15400	-1	5.22	2126	0.27	0.1	1.4
ZG350	4.50	6.00	3909086	Sis	AlVu	Sd	LY	Spongey		2.0	25	2817	115300	-1	4.15	2087	0.74	1.1	10.5
ZG350	6.00	8.00	3909087	Sis	AI	SdHe	YFG	Altered oolitic carbonate		2.5	5	663	16000	-1	1.35	800	0.11	0.1	1.5
ZG350	8.00	10.00	3909088	SisCcy	AI	Sd	LY+B	Altered oolitic carbonate		2.5	7	1654	69500	-1	6.42	834	3.1	3.0	3.9
ZG351	4.60	5.50	3909089	Sis	Ma		DG	Granular carbonate		2.0	4	30	67100	-1	16.78	7400	0.64	0.3	6.4
ZG352	8.00	10.00	3909094	Ccy			MBDG	Gritty		3.0	27	1045	49700	1	4.38	27	7.5	5.0	0.0
ZG352	10.00	12.00	3909095	CcySis	Fe		B	Minor ferrug carbonate		3.0	20	1868	61500	-1	5.9	24	10	6.2	0.0
ZG352	12.00	14.00	3909096	CcySis	Fe		B	Minor ferrug carbonate		3.0	24	747	55100	1	4.98	37	8.6	5.5	0.0
ZG352	14.00	16.00	3909097	SisCcy	FeWe		GHDG	Ferrug carbonate		3.0	12	999	112700	-1	5.7	59	12.2	11.3	0.0
ZG352	16.00	18.00	3909098	Ccy			MLBDG			3.0	40	1281	40500	1	2.74	60	3.45	3.9	0.2
ZG352	18.00	20.00	3909099	Ccy			MLGDG	Plastic clay		3.0	26	841	15800	1	1.13	38	1.5	1.6	0.0
ZG352	20.00	22.00	3909100	SisCcy	Ma		DG+LG	Granular carbonate		3.0	35	1563	25800	1	2.98	242	1.65	1.4	1.2
ZG352	22.00	24.00	3909101	SisCcy	Vn		DG+LG	Granular carbonate		3.0	11	603	10600	-1	1.03	344	0.43	0.4	0.7
ZG352	24.00	26.00	3909102	SisCcy	Vn		DG+V	Granular carbonate + green clay		3.0	18	749	12500	-1	1.37	373	0.31	0.3	1.0
ZG352	26.00	28.00	3909103	SisCcy	Vn		DG+V	Granular carbonate + green clay		3.0	20	881	11600	1	2.37	858	0.46	0.3	0.9
ZG352	28.00	28.70	3909104	SisCcy	Vn		DG+V	Granular carbonate + green clay		3.0	12	547	10300	1	1.25	498	0.31	0.3	0.8
ZG356	18.00	20.00	3909154	Ccy		Py	DG	prominent Py		3.0	93	4000	14400	5	11.33	236	12	1.4	0.0
ZG356	20.00	22.00	3909155	Ccy		Py	DG	prominent Py, gritty		3.0	171	4400	23600	11	12.01	90	13.6	2.4	0.0
ZG356	22.00	24.00	3909156	Ccy		Py	DG	carbonaceous, trace Py		3.0	69	3600	11800	4	7.58	68	8.9	1.2	0.0

303219

Grievess prospect - ore types and Zn as Sphalerite calculations

HOLE	DFROM	DTO	SAMPNO	FIELDID	TEXTURE	ALT./MIN	COLOUR	COMMENTS	Ore type	Cu	Pb	Zn	Ag	Fe%	Mn	S%	Zn (Sp)	Zn not Sp
ZG357	16.00	18.00	3909176	Ccy			B	lesser fine granular Sls	1.0	17	106	10200	-1	14.51	1550	8.65	1.0	0.0
ZG357	26.00	28.00	3909181	Ccy		Py	CB	minor Py	3.0	50	1853	14200	3	12.22	2252	9.7	1.4	0.0
ZG357	28.00	30.00	3909182	Ccy		Py	FDG	trace Py	3.0	186	2100	56100	8	15.99	921	14.5	5.6	0.0
ZG357	52.00	54.00	3909194	Ccy			DG+R	lesser rock frags	3.0	469	3500	28900	6	14.64	423	6.15	1.8	1.1
ZG357	54.00	55.80	3909195	Ccy			MGY	drilling abandoned, rods tight	3.0	255	5200	20900	11	20.01	548	8.85	1.5	0.6
ZG368	2.00	4.00	3983880	Ccy			DB+N	sandy & carbonaceous clays	1.0	394	4600	26700	10	1.24	40	2.5	2.7	0.0
ZG368	4.00	6.00	3983881	Ccy			LB		1.0	751	11900	104000	19	2.29	32	5.9	9.3	1.1
ZG368	6.00	8.00	3983882	Ccy			LB+DG		1.0	261	45800	182000	16	18.3	35	29.4	10.2	0.0
ZG368	8.00	10.00	3983883	Ccy			DG	plastic, smooth	1.0	103	49600	205000	20	4.99	74	10.7	16.0	4.5
ZG368	10.00	12.10	3983884	CcySls	VcFe		DG+G	hematite staining	2.0	31	16900	126000	7	23.7	9700	3.9	2.4	10.2
ZG370	2.50	4.00	3983886	Ccy	Fe		B+BN	carbonaceous	1.0	19	768	12100	-1	4.9	1801	1.7	0.6	0.6
ZG370	4.00	6.00	3983887	Ccy	FeVq		LB	ferrug qtz, limonite veins	2.0	25	507	11400	-1	11.1	5400	1	0.2	1.0
ZG370	6.00	8.00	3983888	CcySls			DB	creamy sls - altered?	2.0	10	139	29000	-1	19.6	8800	3.7	0.8	2.1
ZG370	8.00	10.00	3983889	Ccy			B+N	gritty brn & smooth black	2.0	41	722	55300	1	16.7	6200	7.8	3.5	2.0
ZG370	10.00	12.00	3983890	Ccy			DB	hard carbonaceous chips	2.0	24	2829	67200	1	5.53	388	9.1	6.7	0.0
ZG370	12.00	14.00	3983891	Ccy	Fe		LB	ferrug veins	2.0	21	1514	174000	2	7.08	595	14.8	17.4	0.0
ZG370	20.00	22.00	3983895	Sls		Sd	B+YG	oolitic CO3	2.5	14	975	91800	-1	4.84	1496	6.2	7.8	1.4
ZG370	22.00	24.00	3983896	Sls		Sd	B+YG	oolitic CO3, possibly oolitic cave in	2.5	9	361	32600	-1	3.25	1046	2.8	2.6	0.6
ZG370	24.00	26.00	3983897	Ccy			MB		3.0	18	1443	106000	3	16.4	6400	8.9	6.4	4.2
ZG370	26.00	28.00	3983898	Ccy			G+LB		3.0	60	2172	81900	7	20.6	4624	14.2	7.3	0.9
ZG370	28.00	30.00	3983899	SlsCcy	Fe	Sd	YG	altered CO3	2.0	13	318	18900	-1	12.9	5700	2.75	0.6	1.3
ZG370	30.00	32.00	3983900	SlsCcy		Sd	DG+LRB	strongly altered?	2.0	20	441	10400	-1	23.4	9700	1.1	0.1	1.0
ZG371	18.00	20.00	3984017	Sls		Sd	G+DG		2.0	10	59	16300	-1	37.5	16500	2.8	0.2	1.4
ZG371	20.00	22.00	3984018	Sls	Fe	Sd	YG	spongy CO3	2.0	7	387	24800	-1	39.4	16400	3.8	0.4	2.1
ZG371	24.00	26.00	3984020	Sls		Sd	LYG	oolitic CO3	2.5	8	252	13300	-1	7.33	2500	2.1	0.6	0.8
ZG371	26.00	28.00	3984021	SlsCcy		Sd	LYG+LB	oolitic CO3	2.5	25	2051	99000	3	15.6	4129	8.4	6.0	3.9
ZG371	28.00	30.00	3984022	Sls	Fe	Sd	LYG	oolitic CO3	2.5	70	568	16800	1	8.25	2103	2.4	0.9	0.8
ZG371	30.00	30.50	3984023	Sls	Fe	Sd	LYG	hard oolitic CO3	2.5	12	455	17200	1	7.53	2276	3.5	1.2	0.6
ZG372	28.00	30.00	3984037	Sls	Fe	Sd	DG+LYG	oolitic CO3	2.5	16	837	23200	1	26.6	10900	2.75	0.4	1.9
ZG372	30.00	32.00	3984038	Sls	Fe	Sd	LYG+K	strongly altered, hematite stained	2.0	26	5600	70000	1	18.1	3587	14.3	7.0	0.0
ZG372	32.00	34.00	3984039	Sls	Fe	Sd	LYG+K	oolitic, altered, hematite stained	2.5	7	871	12800	-1	30.5	13400	1.8	0.1	1.2
ZG374	0.00	2.00	3984044	CgCcy		Sd	DB	weakly ankeritic	4.0	11	36900	83000	6	10.1	2809	4.2	3.3	5.0
ZG374	2.00	4.00	3984045	Sls	Di	SdPy	YG	5% Py	4.0	10	37400	180000	5	20	6900	4.4	3.8	14.2
ZG374	4.00	4.80	3984046	SlsOvc		PySd	DG	strongly altered	4.0	15	35700	194000	6	7.31	2467	9.1	12.4	7.0
ZG388	0.00	1.80	3984083	CvCcySls	Vc		GB+WK		4.0	14	5300	16000	1	1	112	1.6	1.6	0.0
ZG393	2.00	4.00	3984104	Ccy			DB	Gritty	4.0	25	22400	15600	10	0.39	18	1.65	1.6	0.0
ZG393	4.00	6.00	3984105	Ccy			DEG		4.0	28	11900	17700	4	1.65	33	2.7	1.8	0.0
ZG393	6.00	7.50	3984106	SlsCcy	Vc		G+DG		4.0	22	5000	20800	1	1.61	83	2.45	2.1	0.0
ZG395	4.00	6.00	3984113	Ccy			DB		4.0	39	9000	16800	2	0.92	12	2.3	1.7	0.0
ZG395	6.00	8.00	3984114	Ccy	Fe		DB		4.0	19	17300	32000	2	2.01	15	4.7	3.2	0.0
ZG395	8.00	10.00	3984115	CcySls	Vc		DG+G		4.0	18	6300	12400	1	1.83	125			
ZG395	10.00	12.00	3984116	CcySls			DG		4.0	16	8900	19700	2	1.51	256			
ZG104	9.50	10.60	3753648	Ccy			DG	Poor Rec	1.0	71	752	13300	2	1.22	58	1.5	1.3	0.0
ZG104	10.60	12.25	3753649	Ccy			DG	Poor Rec	1.0	78	3800	27300	-1	1.22	91	2.55	2.7	0.0
ZG104	12.25	14.35	3753650	Ccy			DG	Poor Rec	1.0	81	3000	31100	-1	1.41	97	2.8	3.1	0.0
ZG104	27.30	29.10	3753659	Sls	Al	Sd	YB	Poor Rec	2.0	26	819	84200	-1	21.2	5600	7.6	3.9	4.5
ZG104	29.10	31.50	3753660	Sls	Al	Sd	YB	Poor Rec	2.0	13	510	53100	-1	37.7	3268	2.9	0.6	4.7
ZG104	31.50	32.60	3753661	Sls	Al	Sd	YB	Poor Rec	2.0	9	163	36200	-1	45	4749	1.4	0.2	3.4
ZG104	32.60	34.00	3753662	Sls	Al	Sd	YB	Poor Rec	2.0	6	40	92100	-1	38	13800	0.39	0.1	9.1
ZG104	34.00	35.10	3753663	Sls	Al	Sd	YB	Poor Rec	2.0	4	38	151000	-1	34.3	20300	0.23	0.1	15.0
ZG104	35.10	36.70	3753664	Sls	Al	Sd	YB	Poor Rec	2.0	5	49	123000	-1	34.9	15200	0.28	0.1	12.2
ZG105	3.20	4.40	3753665	Ccy			DG		1.0	36	9300	25000	-1	1.74	67	3.35	2.5	0.0

303220

Gieves prospect - ore types and Zn as Sphalerite calculations

HOLE	DFROM	DTO	SAMPNO	FIELDID	TEXTURE	ALT/MIN	COLOUR	COMMENTS	Ore type	Cu	Pb	Zn	Ag	Fe%	Mn	S%	Zn (Sp)	Zn not Sp
ZG105	4.40	4.95	3753666	Ccy			DG		1.0	30	14500	30300	-1	2.43	45	4.55	3.0	0.0
ZG105	4.95	5.60	3753667	Ccy			DG	Poor Rec	1.0	26	39300	28700	-1	1.16	44	5.65	2.9	0.0
ZG105	5.60	6.65	3753668	Ccy			DG	Poor Rec	1.0	25	6100	13400	-1	1.52	42	3	1.3	0.0
ZG105	7.30	8.30	3753670	Ccy	AI	Sd	YB	Poor Rec	1.0	22	451	11000	-1	1.61	38	1.9	1.1	0.0
ZG105	10.30	11.80	3753673	CcySlis			DG	Poor Rec	2.0	13	299	10400	-1	38.4	12000	0.95	0.0	1.0
ZG105	13.90	14.60	3753676	CcySlis			DG	Poor Rec	2.0	4	4	16900	-1	53.5	16700	0.11	0.0	1.7
ZG105	14.60	15.10	3753676	Slis	AI	Sd	YB	Poor Rec	2.0	4	4	16900	-1	53.5	16700	0.11	0.0	1.7
ZG105	15.10	15.85	3753677	Slis	AI	Sd	YB	Poor Rec	2.0	42	115	19000	-1	50.4	13700	0.25	0.0	1.9
ZG105	15.85	16.90	3753679	Slis	AI	Sd	YB	Poor Rec	2.0	7	198	17800	-1	48.6	13600	0.83	0.1	1.7
ZG105	16.90	17.70	3753681	Slis	AI	Sd	YB	Poor Rec	2.0	7	313	17100	-1	48.1	14000	1.4	0.1	1.6
ZG105	17.70	18.90	3753683	Slis	AI	Sd	YB	Poor Rec	2.0	4	131	17900	-1	51.7	14500	0.12	0.0	1.8
ZG105	18.90	20.30	3753685	Slis	AI Ds	SoGa	YB	Poor Rec	2.0	6	4500	14400	4	28.4	8600	0.25	0.0	1.4
ZG105	28.90	30.30	3753701	Slis			LG	Oolitic	2.5	10	1500	11900	-1	13	4050	0.38	0.1	1.1
ZG105	39.25	40.45	3753717	Slis			LG	Poor Rec	2.0	14	800	13500	-1	11.8	3185	0.22	0.0	1.3
ZG106	49.50	49.80	3757913	Oms		Py	YB	Low angle fault		-5	-50	10100	-5	25.2	60	29.2	1.0	0.0
ZG106	128.20	129.20	3757941	Ccy			LGADG		3.0	91	2340	11800	-5	9.4	505	1.15	0.2	1.0
ZG106	129.20	130.20	3757942	Ccy			LGADG		3.0	123	3540	16000	11	12.3	30600	1.9	0.4	1.2
ZG106	138.10	139.30	3757951	CcyCsg	VuBn		AYB		3.0	255	5340	15700	-5	51.5	3410	0.016	0.0	1.6
ZG106	139.30	140.50	3757952	CcyCsg	VuBn		AYB		3.0	523	7380	14300	-5	50.7	4330	0.023	0.0	1.4
ZG107	123.95	125.00	3757999	Sd	AI	Sd	YG	Strongly ankerite altered	2.0	-5	-50	39600	-5	34.34	17710	0.25	0.0	3.9
ZG107	125.00	127.90	3758000	SdCcy	AI Bx	Sd	DGY	Ankeritic breccia frags in sandy clay	2.0	8	1520	60000	-5	11.34	1969	7.77	4.9	1.1
ZG107	127.90	128.85	3908229	Sd	AI	Sd	DGY	Strongly ankerite altered	2.0	-5	522	167000	-5	26.57	61000	0.65	0.5	16.2
ZG107	128.85	131.10	3908230	SdCcy	AI Bx	Sd	DGY	Ankeritic breccia frags in sandy clay	2.0	74	20000	298000	7	15.33	7128	15.6	19.6	10.2
ZG107	131.10	133.10	3908231	Ccy			DG		3.0	74	9640	155000	6	3.78	239	8.97	14.0	1.5
ZG107	133.10	135.10	3908232	Ccy			DG		3.0	21	1250	23600	-5	1.68	45	2.71	2.4	0.0
ZG107	135.10	137.10	3908233	Ccy			DG		3.0	23	13800	61000	7	1.87	42	1.02	5.7	0.4
ZG107	137.10	139.10	3908234	Ccy			DG		3.0	27	1420	27500	-5	2.01	41	3.22	2.8	0.0
ZG107	148.40	150.50	3908240	Ccy	GsBxFe		MFRP	Gossanous clay breccia	3.0	216	6350	14100	-5	39.27	2332	0.135	0.0	1.4
ZG107	154.55	156.60	3908243	Ccy			DGN	Carbonaceous	3.0	434	79000	125000	30	4.38	20	2	2.5	10.0
ZG107	156.60	158.70	3908244	Ccy			DGN	Carbonaceous	3.0	479	95000	200000	16	4.19	-15	4.8	7.0	13.0
ZG107	158.70	160.80	3908245	Ccy			DGN	Carbonaceous	3.0	249	122000	174000	30	2.85	18	3.28	4.7	12.7
ZG107	160.80	162.90	3908246	Ccy			DGN	Carbonaceous	3.0	57	43000	56000	12	0.85	15	1.51	2.2	3.4
ZG209	109.50	110.70	3908288	CcySd	AI VuBx	Sd	DGY	Carbonaceous clay + brecciated ankerite rock	2.0	12	61	11000	-5	27.3	9540	0.96	0.1	1.0
ZG209	110.70	111.80	3908289	CcySd	AI VuBx	Sd	DGY	Carbonaceous clay + brecciated ankerite rock	2.0	7	-50	17200	-5	31.3	10500	0.9	0.1	1.6
ZG359	52.75	53.60	3914660	Sd	AI VuBx	Sd	YB	Ankerite altered. Oolites locally visible	2.5	15	245	12800	-5	32.7	12600	0.55	0.0	1.2
ZG359	53.60	55.50	3914661	Sd	AI VuBx	Sd	YB	Ankerite altered. Oolites locally visible	2.5	-5	137	12000	-5	27.6	10700	0.35	0.0	1.2
ZG359	55.50	56.80	3914662	Sd	AI VuBx	Sd	YB	Ankerite altered. Oolites locally visible	2.5	27	224	11000	-5	15.7	5400	0.54	0.1	1.0
ZG359	56.80	58.50	3914663	Sd	AI VuBx	Sd	YB	Ankerite altered. Oolites locally visible	2.5	8	163	15200	-5	30.5	12000	0.41	0.0	1.5
ZG359	58.50	59.90	3914664	Sd	AI VuBx	Sd	YB	Ankerite altered. Oolites locally visible	2.5	15	350	22800	-5	27.5	9340	1.02	0.1	2.1
ZG359	59.90	61.50	3914665	CcyCs	AI	Sd	MYLBDB	Clay and ankeritic sand	2.0	37	2140	97000	-5	14.5	851	19.2	9.7	0.0
ZG359	61.50	63.50	3914666	CcyCs	AI	Sd	MYLBDB	Clay and ankeritic sand	2.0	52	5430	86000	-5	12.1	96	18.7	8.6	0.0
ZG360	71.10	73.00	3914694	SdCcy	AI Bx	Sd	Y+DG	Ankeritic carbonate and carbonaceous clay	2.0	31	441	14700	-5	22.6	5990	2.38	0.3	1.2
ZG360	73.00	74.75	3914695	SdCcy	AI Bx	Sd	Y+DG	Ankeritic carbonate and carbonaceous clay	2.0	93	2970	31300	-5	32.8	12900	3.9	0.6	2.5
ZG361	46.40	48.40	3917616	CcySd				clay, carbonate sand and frags	2.0	11	287	19400	-5	6.45	3020	1.9	0.8	1.2
ZG361	48.40	50.60	3917617	CcySd				clay, carbonate sand and frags	2.0	12	612	37000	-5	12.1	5520	3.4	1.4	2.3
ZG361	50.60	52.40	3917618	CcySd				clay, carbonate sand and frags	2.0	15	410	24500	-5	5.63	1770	2.9	1.6	0.9
ZG361	52.40	54.50	3917619	CcySd				clay, carbonate sand and frags	2.0	18	317	12700	-5	12.8	5590	1.1	0.2	1.1
ZG361	78.60	80.60	3917634	SdCcy	AI	Sd		Ankerite altn. and clay	2.0	10	762	23300	-5	1.85	595	1.45	1.5	0.8
ZG361	80.60	82.40	3917635	SdCcy	AI	Sd		Ankerite altn. and clay	2.0	14	677	21100	-5	6.2	2360	2	0.9	1.2
ZG361	82.40	83.90	3917636	SdCcy	AI	Sd		Ankerite altn. and clay	2.0	10	1760	23300	-5	24.5	11600	0.39	0.1	2.3
ZG361	83.90	85.40	3917637	SdCcy	AI	Sd		Ankerite altn. and clay	2.0	10	1570	11300	-5	24.4	12400	0.56	0.0	1.1
ZG362	18.10	21.50	3917646	Slis	We		AGDG	Lime mudstone	1.5	8	2250	55000	-5	2.01	743	2.4	3.4	2.1

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Gieves prospect - ore types and Zn as Sphaerite calculations

HOLE	DFROM	DTO	SAMPNO	FIELDID	TEXTURE	ALT/MIN	COLOUR	COMMENTS	Ore type	Cu	Pb	Zn	Ag	Fe%	Mn	S%	Zn (Sp)	Zn not Sp
ZG362	21.50	23.00	3917647	Sls	We		AGDG	Lime mudstone	1.5	11	722	13500	-5	2.05	626	1.5	1.1	0.3
ZG362	23.00	24.90	3917648	Sls	We		AGDG	Lime mudstone	1.5	13	58	15500	-5	3.26	1410	1.7	1.0	0.6
ZG362	26.00	31.20	3917650	Sls	We		AGDG	Lime mudstone	1.5	21	436	22100	-5	8.19	3300	4.1	1.6	0.6
ZG362	31.20	38.00	3917651	Sls	We		AGDG	Lime mudstone	1.5	21	-50	16100	-5	22.6	5430	14.5	1.6	0.0
ZG362	38.00	39.90	3917652	SdSls	A1	Sd	YG	Weakly ankerite altered lime mudstone	2.0	9	-50	16200	-5	9.59	5490	1.25	0.3	1.3
ZG362	39.90	41.00	3917653	SdSls	A1	Sd	YG	Weakly ankerite altered lime mudstone	2.0	8	-50	10600	-5	15.8	9210	0.95	0.1	1.0
ZG362	41.00	43.20	3917654	SdCcy	AIBx	Sd	YG	Total ankerite altn, + Ccy zones	2.0	10	140	17600	-5	27.8	15400	2	0.2	1.6
ZG362	43.20	45.60	3917655	SdCcy	AIBx	Sd	YG	Total ankerite altn, + Ccy zones	2.0	11	1100	42700	-5	21	9300	6.5	2.0	2.3
ZG362	45.50	47.70	3917656	SdCcy	AIBx	Sd	YG	Total ankerite altn, + Ccy zones	2.0	10	7620	47700	-5	15.9	14000	1.8	0.7	4.0
ZG362	47.70	49.60	3917657	SdCcy	AIBx	Sd	YG	Total ankerite altn, + Ccy zones	2.0	9	7400	72000	-5	19.8	16100	0.88	0.4	6.8
ZG362	49.60	51.00	3917658	SdCcy	AIBx	Sd	YG	Total ankerite altn, + Ccy zones	2.0	8	1300	25000	-5	21.3	23100	1.05	0.2	2.3
ZG362	51.00	52.50	3917659	SdCcy	AIBx	Sd	YG	Total ankerite altn, + Ccy zones	2.0	8	3200	25900	-5	20.5	21900	0.88	0.2	2.4
ZG362	52.50	54.00	3917660	SdCcy	AIBx	Sd	YG	Total ankerite altn, + Ccy zones	2.0	26	5900	34600	-5	11.5	7730	1.45	0.6	2.9
ZG362	78.40	80.00	3917667	Sd		Ha	LRY	Oolitic, weakly haem. ank altered	2.5	14	2070	37900	-5	6.45	3730	0.57	0.4	3.4
ZG362	81.90	83.00	3917669	CcyCs				Very poor rec of sand and clay	2.0	36	13400	142000	-5	15.7	5000	7.8	6.8	7.4
ZG362	83.00	86.00	3917670	Ccy			G		3.0	18	1380	17900	-5	2.48	289	2.95	1.8	0.0
ZG363	41.30	43.80	3984306	SdSls	A1	Sd	YG	Weakly ankerite altered lime mudstone	2.0	8	309	12800	-5	6.17	2930	1.3	0.4	0.9
ZG363	43.80	45.40	3984307	SdSls	A1	Sd	YG	Weakly ankerite altered lime mudstone	2.0	7	739	14600	-5	14.9	7790	0.47	0.1	1.4
ZG363	45.40	47.00	3984308	SdCcy	AIBx	Sd	YG	Total ankerite altn, + Ccy zones	2.0	11	1500	24400	-5	15	8510	1.35	0.3	2.1
ZG363	47.00	49.10	3984309	SdCcy	AIBx	Sd	YG	Total ankerite altn, + Ccy zones	2.0	5	193	24100	-5	10.3	5000	2.5	0.8	1.6
ZG363	49.10	51.30	3984310	SdCcy	AIBx	Sd	YG	Total ankerite altn, + Ccy zones	2.0	12	2640	32400	-5	18.8	10700	1.75	0.5	2.8
ZG363	51.30	53.00	3984311	SdCcy	AIBx	Sd	YG	Total ankerite altn, + Ccy zones	2.0	14	362	23800	-5	14.1	6170	1.7	0.4	1.9
ZG363	53.00	54.50	3984312	SdCcy	AIBx	Sd	YG	Total ankerite altn, + Ccy zones	2.0	5	231	26900	-5	21	8060	2.7	0.5	2.1
ZG363	54.50	56.00	3984313	SdCcy	AIBx	Sd	YG	Total ankerite altn, + Ccy zones	2.0	6	68	42800	-5	13.4	5030	7	3.1	1.2
ZG363	56.00	57.50	3984314	SdCcy	AIBx	Sd	YG	Total ankerite altn, + Ccy zones	2.0	5	-50	20900	-5	30.5	9870	0.8	0.1	2.0
ZG363	57.50	59.00	3984315	SdCcy	AIBx	Sd	YG	Total ankerite altn, + Ccy zones	2.0	5	-50	16900	-5	26.5	7120	1.75	0.2	1.5
ZG363	59.00	60.60	3984316	SdCcy	AIBx	Sd	YG	Total ankerite altn, + Ccy zones	2.0	5	-50	14000	-5	24.6	6680	2	0.2	1.2
ZG363	60.60	63.00	3984317	SdCcy	AIBx	Sd	YG	Total ankerite altn, + Ccy zones	2.0	10	-50	14000	-5	21.9	10700	1.35	0.1	1.3
ZG363	63.00	65.00	3984318	SdCcy	AIBx	Sd	YG	Total ankerite altn, + Ccy zones	2.0	8	-50	25700	-5	25.6	14900	0.79	0.1	2.4
ZG363	65.00	67.70	3984319	SdCcy	AIBx	Sd	YG	Total ankerite altn, + Ccy zones	2.0	7	103	36100	-5	23	17700	1.35	0.3	3.3
ZG363	67.70	69.50	3984320	SdCcy	AIBx	Sd	YG	Total ankerite altn, + Ccy zones	2.0	10	572	38500	-5	19	23100	1.6	0.5	3.4
ZG363	69.50	72.50	3984321	SdCcy	AIBx	Sd	YG	Total ankerite altn, + Ccy zones	2.0	19	2640	77000	-5	14.7	14800	3.8	2.4	5.3
ZG363	72.50	73.40	3984322	SdCcy	AIBx	Sd	YG	Total ankerite altn, + Ccy zones	2.0	9	271	78000	-5	26.6	36500	1.4	0.6	7.2
ZG363	73.40	76.10	3984323	SdCcy	AIBx	Sd	YG	Total ankerite altn, + Ccy zones	2.0	7	76	80000	-5	27.9	42000	0.95	0.4	7.6
ZG363	76.10	77.60	3984324	SdCcy	AIBx	Sd	YG	Total ankerite altn, + Ccy zones	2.0	5	616	118000	-5	30.5	24600	17.8	9.0	2.8
ZG363	77.60	78.90	3984325	SdCcy	AIBx	Sd	YG	Total ankerite altn, + Ccy zones	2.0	5	239	106000	-5	30.4	40600	1.3	0.6	10.0
ZG363	78.90	79.80	3984326	SdCcy	AIBx	Sd	YG	Total ankerite altn, + Ccy zones	2.0	12	799	105000	-5	21.5	23000	5.95	3.6	6.9
ZG363	79.80	81.30	3984327	SdCcy	AIBx	Sd	YG	Total ankerite altn, + Ccy zones	2.0	8	1540	132000	-5	24.9	33300	3.55	2.2	11.0
ZG363	81.30	83.40	3984328	Ccy			DG	Carbonaceous clay + qtz sand	3.0	24	9590	66000	6	4.01	297	4.3	5.0	1.6
ZG363	83.40	85.50	3984329	Ccy			DG	Carbonaceous clay + qtz sand	3.0	48	11000	37500	6	2.34	44	3.85	3.8	0.0
ZG363	85.50	87.70	3984330	Ccy			DG	Carbonaceous clay + qtz sand	3.0	48	37000	45000	10	1.6	32	3.2	3.9	0.6
ZG363	87.70	89.85	3984331	Ccy			DG	Carbonaceous clay + qtz sand	3.0	202	34000	54000	18	5.02	46	3.3	2.9	2.5
ZG363	92.00	94.20	3984333	Ccy	GsFe		YR	Gossanous clay	3.0	182	7140	10400	-5	48.8	894	0.02	0.0	1.0
ZG363	94.20	96.40	3984334	Ccy	GsFe		YR	Gossanous clay	3.0	257	6760	12000	-5	44.4	1320	0.015	0.0	1.2
ZG363	98.60	101.00	3984336	Ccy			DG	Partly carbonaceous, becomes sandier with depth	3.0	65	16000	27500	7	2.36	31	2.9	2.7	0.1
ZG364			3984926						2.0	19	-50	26000	-5	6.16	5600	0.37	0.2	2.4
ZG364			3984928						2.0	25	148	13000	-5	5.32	1060	1.65	0.6	0.7
ZG364			3984929						2.0	13	-50	30000	-5	12.1	7090	0.62	0.2	2.8
ZG364			3984930						2.0	8	67	59000	-5	25.7	24600	0.92	0.3	5.6
ZG364			3984931						2.0	15	197	54000	-5	15.5	23300	2.05	1.0	4.4
ZG364			3984932						2.0	8	262	74000	-5	15.5	137000	3.35	2.0	5.4
ZG364			3984935						3.0	254	5800	10200	-5	30.4	2730	0.035	0.0	1.0

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Grievess prospect - ore types and Zn as Sphalerite calculations

HOLE	DFROM	DTO	SAMPNO	FIELDID	TEXTURE	ALT/MIN	COLOUR	COMMENTS	Ore type	Cu	Pb	Zn	Ag	Fe%	Mn	S%	Zn (Sp)	Zn not Sp	
ZG364			3984937						3.0	293		9100		-5	39.5	3780	0.02	0.0	1.1
ZG364			3984938						3.0	228	19300	10000		-5	32.2	2810	0.025	0.0	1.0
ZG365	79.10	81.60	3985970	Sdl	AIBx	Sdl	YG	Ankerite alid carbonate and minor clay	2.0	24	63	11500		-5	1.94	1400	0.14	0.1	1.1
ZG365	82.30	84.20	3985971	Ccy	AI	Sdl	YB	Ankeritic clay	2.0	16	756	104600		-5	15.9	23400	0.55	0.4	10.1
ZG365	84.20	86.00	3985972	Ccy	AI	Sdl	YB	Ankeritic clay	2.0	25	2260	62000		-5	9.41	28400	1.5	1.1	5.1
ZG365	86.00	88.00	3985973	Ccy	AI	Sdl	DGYB	Weakly ankeritic clay	2.0	176	1080	26200		-5	9.97	38000	1.6	0.6	2.0
ZG365	90.00	92.00	3985975	Ccy	FeGs?	He	MRYB	Limonitic and heamaltitic clay	3.0	206	4960	14000		6	35	3120	0.035	0.0	1.4
ZG1002	105.00	106.40	58571	SlsSbx	AILe	Sdl	B	Poor rec	2.0	-25	50	11800		-2	32.98	5700			
ZG1002	106.40	107.40	58572	Sls	AILe	Sdl	B	Oolitic. Poor rec	2.5	-25	25	23200		-2	20.44	9500			
ZG1002	107.40	108.40	58573	Sls	AILe	Sdl	B	Oolitic. Poor rec	2.5	-25	25	36700		-2	30.52	15000			
ZG1002	108.40	109.40	58574	Sls	AILe	Sdl	B	Oolitic. Poor rec	2.5	-25	25	33300		-2	29.86	14800			
ZG1002	109.40	110.00	58575	Sls	AILe	Sdl	B	Oolitic. Poor rec	2.5	-25	50	36900		-2	32.88	15800			
ZG1002	110.00	110.20	58576	Sls	AILe	Sdl	B	Oolitic. Poor rec	2.5	-25	100	25900		-2	20.20	9500			
ZG1007	152.00	155.70	61946	SlsSdl	Lm		G		5.0	20	3150	13400			1.62	505			
ZG1007	415.50	417.50	65277	Sls	AI	Sdl	LG		4.0	10	2145	55900		3.5	7.92	2450			
ZG1007	417.50	419.50	65278	Sls	AI	Sdl	LG		4.0	5	3595	41900		2	3.92	1700			
ZG1007	422.50	425.50	65280	Sls	AI	Sdl			4.0	10	1645	12400		0.5	2.32	570			
ZG1007	425.50	427.50	65281	Sls	AI	Sdl			4.0	10	4545	60900		2	7.42	2400			
ZG1007	428.10	431.20	65282	Sls	AI	Sdl	B		4.0	10	3195	53400		1	6.02	2100			
ZG1007	431.20	434.20	65283	Sls	AI	Sdl	B		4.0	25	1695	34400		1	4.77	1550			
ZG1013	105.50	107.80	58271	SdlOrms	FrmS	Py	BB		2.0	-5	275	91000			29.06	31000			
ZG1013	107.80	110.80	58272	Ccy			CB		3.0	50	6700	38500			5.25	345			
ZG1013	110.80	112.50	3917677	Ccy			CB		3.0	53	2547	16200		-1	9.13	466	0.65	0.2	1.4
ZG1013	112.50	115.20	3917678	Ccy			CB		3.0	149	13100	16100		-1	34.3	2378	0.09	0.0	1.6
ZG1013	115.20	117.10	3917679	Ccy			CB		3.0	151	20900	11300		-1	24.94	1547	0.055	0.0	1.1
ZG1013	117.10	119.00	3917680	Ccy			CB		3.0	180	15000	10900		-1	42.1	3083	0.05	0.0	1.1
ZG1015	110.80	112.70	3917693	Ccy	Ds	Py	CB		3.0	20	426	15200		1	5.17	67	6.8	1.5	0.0
ZG1015	121.70	125.60	3917698	Ccy			CB		3.0	120	12400	10600		-1	34.4	1934	0.1	0.0	1.1
ZWG1	7.20	8.25	57427						4.0	20	16500	59500		1.5	5.65	2500	1.968	1.8	4.1
ZWG1	8.25	8.90	57428						4.0	20	25000	56000		3	5.40	2200	4.07	3.7	1.9
ZWG1	11.20	12.25	57430						4.0	20	3350	12000		-0.5	1.35	635	0.654	0.6	0.6
ZWG1	12.25	13.60	57251						4.0	15	16500	85600		2	11.00	4850	0.469	0.4	8.2
ZWG1	13.60	15.00	57252						4.0	15	9000	102600		2	13.50	5500	0.243	0.2	10.1
ZWG1	15.00	16.00	57253						4.0	20	20500	70000		1.5	9.25	3900	0.365	0.3	6.7
ZWG1	16.00	17.00	57254						4.0	25	17200	97400		5	10.50	4100	0.386	0.3	9.4
ZWG1	17.00	18.00	57255						4.0	20	24000	59000		4.5	6.95	2850	0.528	0.4	5.5
ZWG1	18.00	19.00	57256						4.0	20	10900	88200		-0.5	11.00	4400	0.459	0.4	8.4
ZWG3	9.90	11.45	57268						4.0	5	6300	30200		2	3.05	1700			
ZWG4	3.65	5.35	57270						4.0	5	11700	31600		4	2.65	1550			
ZWG4	14.90	15.55	57276						4.0	5	8600	10800		3	1.25	670			
ZWG4	16.85	18.80	57278						4.0	5	5600	12500		3	4.05	635			
ZWG22	9.40	11.40	65265						4.0	10	1985	11500			3.26	420			
ZWG22	11.40	12.20	65252						4.0	10	14900	174900			13.66	6045			
ZWG26	5.30	7.90	65254						4.0	15	9435	23000			2.25	1350			
ZWG26	10.00	11.90	65256						4.0	10	9535	72500			5.55	2250			
ZWG26	15.80	17.80	65259						4.0	5	18000	32000			4.70	1650			
ZWG26	20.40	21.40	65261						4.0	10	8485	68500			6.60	2500			
ZWG26	21.40	22.40	65262						4.0	5	4785	25500			2.85	1200			

303223

APPENDIX 8

Report by P. Ashley - petrographic study of alteration

303225

REPORT ON PETROGRAPHIC OBSERVATIONS AND ELECTRON  
MICROPROBE RESULTS ON CARBONATE-HOSTED LEAD-ZINC  
MINERALISATION, ZEEHAN DISTRICT, TASMANIA

for

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July, 1994

20159

**ZEEHAN CARBONATE-HOSTED Zn-Pb DEPOSITS**  
**DESCRIPTIONS OF SELECTED CORE/HAND SPECIMEN SAMPLES &**  
**INSTRUCTIONS/SUGGESTED WORK**

**3970001**

ZWG 1, 8 mbc. 2% Pb & 6% Zn: Strong ?cream ankerite altered, veined & brecciated limestone with minor pyrite and 2-5% galena filling veins or breccia matrix.

TS/PTS describe alteration and Pb-Zn mineralisation and identify where the Zn is. What was this limestone?. Photograph polished slab/cut surface.

**3970002**

ZWG 1, 13.8 mbc. 10% Zn & 1% Pb. Strong siderite-ankerite replaced/altered limestone.

TS/PTS describe alteration and Pb-Zn mineralisation and identify where the Zn is. Probe/XRD?. Photograph polished slab/cut surface.

**3970003**

ZWG 1, 9.7 mbc. <1% Zn. Carbonaceous carbonatic-dolomitic black matrix breccia. Weak very fine iron-carbonate alteration (only apparent in weathered core surfaces or barely discernable at 25x magnification).

TS/PTS describe alteration and Pb-Zn mineralisation and identify where the Zn is. Probe/XRD?.

**3970004**

ZWG 1, 15.1 mbc. 7% Zn & 2% Pb. Carbonaceous carbonatic-dolomitic black matrix breccia. Weak very fine iron-carbonate alteration (only apparent in weathered core surfaces or barely discernable at 25x magnification. Decarbonated/less reactive to 10% HCl than 3970003 and probably hosts more iron carbonate. [difficult to identify as Zn mineralised in fresh core, clues include high S.G, inert to 10% HCl and fine iron-carbonate speckling visable under 25x hand lens].

TS/PTS describe alteration and Pb-Zn mineralisation and identify where the Zn is. Probe/XRD?. Photograph polished slab/cut surface. Compare with 3970003.

**3970005**

DTM 84-2, 133.7-133.9 mbc. 8% Pb & 1% Zn. Colloform banded and cavern fill siderite, ankerite, 5-10% galena & 2% sphalerite and totally replaced/altered limestone fragments.

TS/PTS describe alteration and Pb-Zn mineralisation and identify where the Zn is. Probe/XRD?. Photograph polished slab/cut surface.

**3970006**

ZG1002, 108 mbc. Intense brown siderite and creak ankerite altered oolitic grainstone/limestone. Moderately decomposed and spongy. Probably grades up to % levels Zn.

TS/PTS describe alteration. Photograph TS.

**3970007**

DTM 84-2, 77.7 mbc. Weak-moderately pervasive ankerite altered siltite-limestone. Weak cream/white carbonate veining and spectacular curved saddle dolomite lined voids. Trace of sphalerite in vein intersection.

Too good a sample to cut-up, reference sample only. Photograph.

**3970008**

DTM 84-2, 74 mbc. Intensely iron-carbonate veined-brecciated and moderate-intense pervasive cream ankerite altered heavy onchalitic? bioclastic limestone.

TS/PTS describe alteration and Pb-Zn mineralisation. Probe/XRD?. Photograph cut surface.

**3970009**

ZG 1012, 48 mbc. Mottled moderate-strong pervasive ankerite altered, recrystallised and weakly veined limestone with 2-3% rootless carbonate veinlets and carbonate filled voids.. Probably anomalous in Zn.

TS/PTS describe alteration and Pb-Zn mineralisation and identify where the Zn is. What was this limestone?. Photograph polished slab/cut surface.

**3970010**

DTM 84-2, 77 mbc. Moderately pervasive ankerite altered onchalitic skeletal boundstone/limestone with interstitial carbonate veining or open-space cement with traces of pyrite.

Reference sample, Photograph.

**3970011**

DTM 84-2, 90.1 mbc. Pervasive moderately ankerite altered & carbonate veined limestone.

Reference sample only.

**3970012**

ZG 1012, 67.6 mbc. Unaltered/weakly ankerite altered algal laminated micrite/lutite limestone. Former crusts/algal mats show some development of ?compaction and ?dehydration brecciation.

TS, describe and photograph TS and cut hand-specimen surface.

**3970013**

Massive galena ore with balls/aggregates of sphalerite. Probably cavern fill mineralisation

PTS, describe texture etc. and identify any sulphides other than galena and sphalerite. Photograph polished slab.

**3970014**

ZG 1012, 143 mbc. Weak-moderate pervasive ankerite altered calc-siltite limestone, ? weakly dolomitised?. Minor disseminated pyrite, weak post-stylolites and voids.

Reference sample only.

**3970015**

ZG 1012, 166 mbc. Weakly ankerite altered and ? dolomitised fossiliferous black matrix breccia with cherty micrite clasts and deep post-stylolites and local intense - colloform carbonate replacement; former debris flow deposit/ wave base breccia? Fossils include broken corralite and spiral gastropod fragments.

Reference sample, photograph cut surface.

**3970016**

ZG 1012, 137 mbc. Weakly ankerite altered dark siltite and pelloidal-irregularly bands of micrite.

Reference sample only.

## SUMMARY

Eighteen samples of drill core from the Zeehan district of western Tasmania were submitted for petrographic examination, and where necessary, for electron microprobe analysis to determine the composition of representative carbonate minerals. Polished thin sections were prepared of each sample and the offcuts of these sections were etched with dilute HCl then stained with Alizarin Red S solution in order to obtain information on carbonate species. Following petrographic examination, eight samples (3970002, -04, -05, -06, -08, -10, -17 and 3970018) were selected for electron microprobe analysis, using a JEOL electron microprobe at the University of New England. Subsequently, most of the samples were photographed, involving several of the handspecimens and polished thin sections.

Summary descriptions of each of the samples are listed below:

3970001. Brecciated limestone which has been altered to fine grained sideritic carbonate, then partly replaced by fine grained low-Fe sphalerite, pyrite and galena, and infilled by white sparry ferroan dolomite/ankerite containing traces of sulphides.

3970002. Intensely hydrothermally altered and mineralised limestone containing turbid brownish zincian magnesian siderite aggregates infilled by sparry white calcite. Minor disseminated galena and traces of Fe-poor sphalerite are disseminated throughout but are concentrated at the margins of the turbid carbonate aggregates where sulphides have locally replaced the carbonate.

3970003. Brecciated limestone which has been hydrothermally altered to ankerite/ferroan dolomite with deposition of minor disseminated Fe-poor sphalerite and traces of galena, pyrite and pyrobitumen. Interstices of the breccia have been infilled with early ankerite/ferroan dolomite and later coarser, sparry calcite.

3970004. Recrystallised, hydrothermally altered and mineralised wackestone, locally grading to carbonate-bearing carbonaceous siltstone. Rock has been replaced by zincian ankerite, grading to ferroan dolomite and dolomite, with deposition of minor fine grained galena and Fe-poor sphalerite. Former organic material has been hydrothermally matured to pyrobitumen.

3970005. Intensely hydrothermally altered and mineralised limestone with complete replacement by turbid brown manganous magnesian siderite, followed by disseminated and veinlet galena, Fe-poor sphalerite and pyrite, overlapping with white sparry calcite (plus minor galena, sphalerite) and late infilling manganous ankerite. All carbonates are cut by thin veinlets of marcasite and pyrite.

3970006. Intensely hydrothermally altered ?bioclastic limestone with initial replacement by zincian siderite, with development of abundant open space voids. Partial infilling by fine grained crystalline dolomite has occurred. Traces of disseminated pyrite are found in both types of carbonate, with rare fine grained marcasite and sphalerite in the dolomite infillings.

3970007. Massive recrystallised micritic limestone with alteration to ferroan dolomite/ankerite. Rock is locally fractured and contains veins and vugh infillings of white, sparry ferroan dolomite (locally "saddle dolomite"). Minor fine grained pyrite is disseminated in the recrystallised limestone, along with traces of Fe-poor sphalerite, galena and pyrobitumen. Sparry dolomite infillings contain traces of disseminated pyrite and sphalerite.

3970008. Strongly fractured and dolomitised limestone, originally rich in bioclastic fragments dominated by oncolitic material. Rock has been totally recrystallised and contains a little fine

ZLG 1

EL38/89

EL45/92

ZG1002

EL38/89

EL45/92

grained disseminated pyrite, plus traces of pyrobitumen and galena. Fractures are filled with white, sparry slightly ferroan dolomite.

3970009. Recrystallised ?bioclastic limestone with a few carbonaceous siltstone fragments. Sample has been altered to ferroan dolomite, with precipitation of minor disseminated pyrite, sphalerite, galena and pyrobitumen. Fractures and vuggy patches contain sparry ankerite, with minor quartz, sphalerite and galena.

ZG1012  
EL38/89

3970010. Oncolitic grainstone which underwent alteration to dolomite-ferroan dolomite and development of sparry cement of ferroan dolomite-ankerite with minor quartz and pyrite. Traces of galena and sphalerite have slightly replaced pyrite.

ZG  
EL45/92

3970011. Massive limestone which has been recrystallised and altered to ferroan dolomite/ankerite. Strong fracturing has resulted in the formation of numerous veins and dilational infillings of white sparry ferroan dolomite/ankerite. Minor pyrite is concentrated along stylolites and traces of low-Fe sphalerite and galena have been introduced with the ferroan dolomite/ankerite alteration and veining.

3970012. Laminated and locally stylolitic micritic limestone with partial recrystallisation to fine to medium grained aggregates of ferroan dolomite. Sample contains minor disseminated fine grained pyrite and a trace of sphalerite.

ZG1012  
EL38/89

3970013. Semi-massive medium to coarse grained sulphide-rich rock, dominated by galena, with subordinate low-Fe sphalerite and minor to trace amounts of tetrahedrite, marcasite, pyrite and chalcopyrite. Sulphides (especially galena) have partly replaced illite/sericite-altered mudstone-siltstone and minor sideritic carbonate.

EL45/92

3970014. Recrystallised and altered micritic limestone. Alteration is dominated by ferroan dolomite/ankerite. Rock is rather dark due to fine bituminous material interstitial to carbonate grains. A few stylolites have developed, forming concentrations of bituminous material and finely disseminated pyrite.

3970015. Strongly fossiliferous wackestone with abundant partly recrystallised fossil fragments in a micritic matrix which is also partly recrystallised. The matrix is locally darkly pigmented by fine organic matter and contains traces of disseminated pyrite.

ZG1012  
EL38/89

3970016. Bedded packstone with intercalated recrystallised silty carbonate. The packstone is rich in broken fossil fragments and the silty layers have been altered to crystalline sparry ferroan dolomite/ankerite. Fine grained pyrite is disseminated throughout, but along with traces of bituminous material, tends to be concentrated in the recrystallised silty carbonate layers.

Alteration and mineralisation has been imposed upon facies of the Ordovician Gordon Limestone. The sample suite is dominated by different limestone types, including micrite, grainstone, packstone and wackestone. Several samples

preserve fossil fragments. Much of the original limestone was slightly impure and appears to have contained a minor component of organic material and fine disseminated pyrite. The latter may have been of biogenic/diagenetic origin and is locally framboidal. A few samples show gradation into carbonaceous calcareous siltstone, whereas others contain scattered small grains of detrital quartz. The organic material and pyrite have caused a dark pigmentation in many samples and are locally concentrated along thin anastomosing stylolites.

Several samples have been fractured (with local dilational jogs and breccia zones being formed), with infillings of sparry carbonate, in places accompanied by sulphides and minor quartz. It is likely that all samples have undergone pervasive alteration to dolomite/ferroan dolomite-ankerite (hereafter termed "dolomitisation"), but whether this alteration is related to fracturing is unclear. The fact that many unfractured rocks are dolomitised may suggest that the pervasive alteration preceded fracturing. Dolomitisation is characterised by complete recrystallisation of the rocks; this is best manifested in fine micritic material, but bioclastic material is also variably recrystallised, with some preservation of outlines. Ultimately, a fine polygonal texture results.

Following the pervasive dolomitisation of limestone, more restricted and intense alteration occurred, with complete destruction of primary bedding and bioclastic textures, as well as stylolites. Several samples show replacement by strongly Fe-bearing carbonates, in places with significant Mn, Mg and Zn contents (ferroan dolomite, ankerite, siderite). Minor quartz is locally associated. Early pyrite has probably recrystallised into coarser grains and organic material hydrothermally matured into small aggregates of pyrobitumen. In these intensely altered rocks, relict siltstone (e.g. as small breccia clasts) has been replaced by illite/sericite and siderite.

It appears as though little sulphide was deposited as this stage and interestingly, several samples contain strongly zincian carbonates (e.g. up to 21.6 mol. %  $ZnCO_3$  in 3970002). Deposition of the ferroan carbonates (with Mn, Mg, Zn) was succeeded by a sulphide stage. This has ranged from tiny traces of sphalerite and galena in some samples, to development of semi-massive sulphides in others (e.g. 3970013). In many samples, the amount of sulphide, especially sphalerite, is not immediately obvious, due to fine grain size and the fact that sphalerite is a pale-coloured, transparent, low-Fe variety. There is good textural evidence for the partial replacement of ferroan carbonate by sulphides.

There is a considerable range in sphalerite/galena ratios in the mineralised samples. However, sphalerite is generally subordinate to galena, with the latter being locally abundant (e.g. 3970005, 3970013). High Zn assays in several samples (e.g. 3970002, 3970004) are explained by the presence of zincian carbonates, rather than by abundant sphalerite. Although pyrite is present in small amounts in most samples, the most sulphide-rich rocks also contain traces of marcasite, chalcopyrite and tetrahedrite.

Deposition of sulphides overlapped with a succeeding stage of sparry carbonate deposition. This may have taken place in void space created by

3970001. Brecciated limestone which has been altered to fine grained sideritic carbonate, then partly replaced by fine grained low-Fe sphalerite, pyrite and galena, and infilled by white sparry ferroan dolomite/ankerite containing traces of sulphides.

Handspecimen is a rather heterogeneous carbonate-rich rock with textural indications that former limestone had been brecciated and altered, then infilled with sparry white carbonate. A fragmental texture is evident with irregular clasts up to several centimetres across of dark brownish-grey altered limestone containing a few aggregates of pyrite and traces of galena, enclosed in a white sparry carbonate cement. Staining of the section offcut with Alizarin Red S showed that the sparry carbonate is ferroan dolomite/ankerite whereas the dark carbonate in the clasts may be magnesian siderite.

In the section, it is clear that two main textural types of carbonate exist, corresponding to that observed in handspecimen. About 70 volume % of the section is composed of irregular clasts containing fine grained intergrown rhombs of rather turbid carbonate, with relatively abundant sulphides, plus a few small subrounded grains of detrital quartz. These clasts are enclosed in a cement of clear, medium to coarse grained (typically 0.5 - 2 mm) sparry carbonate in which small 2-phase (liquid + vapour) fluid inclusions are common.

The clasts containing the fine grained carbonate have been partly replaced by sulphides (Photo 1), locally leading to rhombic pseudomorphs composed of pyrite and/or sphalerite ( $\pm$  galena)(Photo 2). Sulphides are generally very fine grained and show intergranular and replacement textures towards carbonate. Patchy replacement of carbonate by almost colourless low-Fe sphalerite is characteristic and in places sphalerite is accompanied by, and intergrown with galena (Photo 1). The sphalerite is not particularly obvious in handspecimen because of its fine grain size and pale colour, but is it rather abundant, forming about 7-8 volume % of the sample. Galena probably forms about 2 volume % and pyrite 5 volume %. The latter is mostly fine grained and locally forms almost perfect pseudomorphs after replaced carbonate rhombs.

Sparry carbonate cement only contains minor sulphide, mostly fine grained galena (locally outlining growth zoning), with a few grains of sphalerite and pyrite. One coarse grained mass of pyrite 4 mm across occurs in sparry carbonate.

The sample is interpreted to represent a former limestone which was brecciated, then intensely altered and mineralised. Early alteration resulted in replacement of limestone clasts by fine grained sideritic carbonate. This was followed by partial replacement by low-Fe sphalerite, pyrite and galena, plus infilling by white sparry carbonate (probably ferroan dolomite/ankerite). Minor disseminated sulphides occur in the sparry carbonate. It is likely that the relatively high Zn assay value is mostly accommodated in the fine grained sphalerite which has partly replaced sideritic carbonate.

volume decrease during replacement of the original rock, and in tectonically prepared fractures. The late carbonates include calcite, dolomite, ferroan dolomite, ankerite and siderite. They tend to be medium to coarse grained and contain scattered tiny 2-phase (liquid + vapour) fluid inclusions. Small amounts of sulphide minerals are locally intergrown, but in many samples the late sparry carbonate is sulphide-free.

In conclusion, it is interpreted that the original rocks were dominated by clastic limestone, locally grading into siltstone. They contained minor carbonaceous organic material and biogenic/diagenetic pyrite. Limestone underwent pervasive dolomitisation, with development of fracturing. Subsequently there was fracture-controlled and pervasive replacement of the rocks, probably caused by the incursion of hotter, more saline, metal-bearing fluids. This resulted in alteration to strongly Fe-bearing carbonates, with locally high Mn, Mg and Zn contents, plus minor quartz. Pyrite was recrystallised and organic material matured into pyrobitumen. The Fe-bearing carbonate stage was apparently followed by an increase in sulphur fugacity of the fluid, leading to partial replacement of carbonate by sulphides. The latter are dominated by galena, with subordinate Fe-poor sphalerite, minor pyrite and maracsite, and traces of chalcopyrite and tetrahedrite. A late fracture- and void-filling stage of sparry carbonate of diverse compositions completed the alteration-mineralisation episodes. The characteristics of the alteration-mineralisation are most consistent with SEDEX mineralisation, specifically with the so-called "Irish-type". There is little direct analogy with Mississippi Valley-type mineralisation when the characteristics are examined in detail (e.g. the abundance of Fe-rich carbonate alteration, the presence of zincian and manganoan carbonates, the occurrence of pyrobitumen and the fact that higher grade sulphides contain tetrahedrite). It is likely that assaying of the mineralisation would reveal significant Ag values. It is proposed that alteration-mineralisation has been caused by moderate temperature SEDEX-type brines (e.g. at ~ 150-200°C) reacted in the subsurface with suitable host rocks, e.g. dolomitised and fractured limestone.

3970002. Intensely hydrothermally altered and mineralised limestone containing turbid brownish zincian magnesian siderite aggregates infilled by sparry white calcite. Minor disseminated galena and traces of Fe-poor sphalerite are disseminated throughout but are concentrated at the margins of the turbid carbonate aggregates where sulphides have locally replaced the carbonate.

Handspecimen is a massive speckled brownish-grey and white carbonate rock with a chocolate brown weathering surface on the brownish-grey areas. The sample is cut by a few thin veins of white carbonate. Both types of carbonate are fine to medium grained and staining of the section offcut with Alizarin Red S indicated that the brownish-grey type is likely to be sideritic whereas the white type is calcite. Traces of fine grained galena occur around the margins of brownish-grey carbonate aggregates. The rock appears to be a strongly hydrothermally altered and mineralised limestone.

In the section, two main types of carbonate are apparent; both are well crystallised and there is no evidence of preservation of original limestone textures. It is considered that the original rock has been completely recrystallised with initial formation of a fine to medium grained, crystalline, brownish turbid carbonate (55-60 volume % of the sample), surrounded and infilled by fine to locally coarse grained clear, sparry carbonate. The turbid carbonate forms aggregates up to several millimetres across, plus isolated rhombs, enclosed in clear carbonate (Photo 3). Turbid carbonate grains are typically 0.2-0.5 mm across, are commonly zoned and contain about 1 volume % of finely disseminated galena with traces of Fe-poor sphalerite. There are also a few grains of quartz up to 0.1 mm across; these may be relict detrital. The clear carbonate is paragenetically later and infills around turbid carbonate grains (Photo 3). It occurs in two grainsize populations, a fine to medium grained granular type, plus a medium to coarse grained type with a typical grainsize of 0.5-2.5 mm. The coarser type appears to be paragenetically later and contains sparsely scattered tiny 2-phase liquid + vapour fluid inclusions.

Sulphides are concentrated around the margins of the turbid carbonate aggregates (Photo 3) but are also found in both the turbid and clear carbonates as sparse disseminations. At the margins of the turbid carbonate aggregates, galena occurs in anhedral up to 0.4 mm across and is accompanied by minor Fe-poor sphalerite; both sulphides have textures indicative of marginal replacement of turbid carbonate (Photos 3 and 4). Within the latter, uncommon grains of galena and Fe-poor sphalerite up to 0.1 mm across are sparsely scattered with the sulphides again showing replacive textures towards the carbonate (Photo 4). Sulphide grainsize increases in the clear sparry carbonate, but away from the margins of the turbid carbonate aggregates, sulphides are sparse.

Approximately 1-2 volume % of galena occurs in the sample and <0.5 volume % of Fe-poor sphalerite. There is clearly insufficient sphalerite in the section to account for the high Zn assay value and Zn must be accommodated in the carbonate. High power microscopic observation did not reveal any ultrafine sphalerite inclusions in the carbonate.

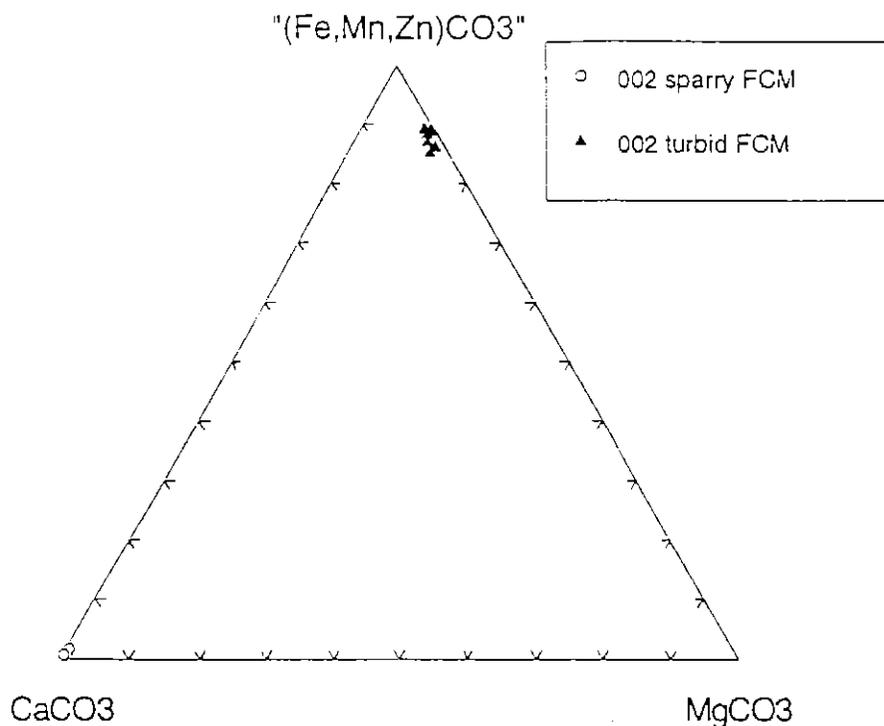


Figure 1a. Electron microprobe analytical data of carbonate minerals for sample 3970002, showing results in terms of the system (Fe,Mn,Zn)CO<sub>3</sub>-CaCO<sub>3</sub>-MgCO<sub>3</sub>.

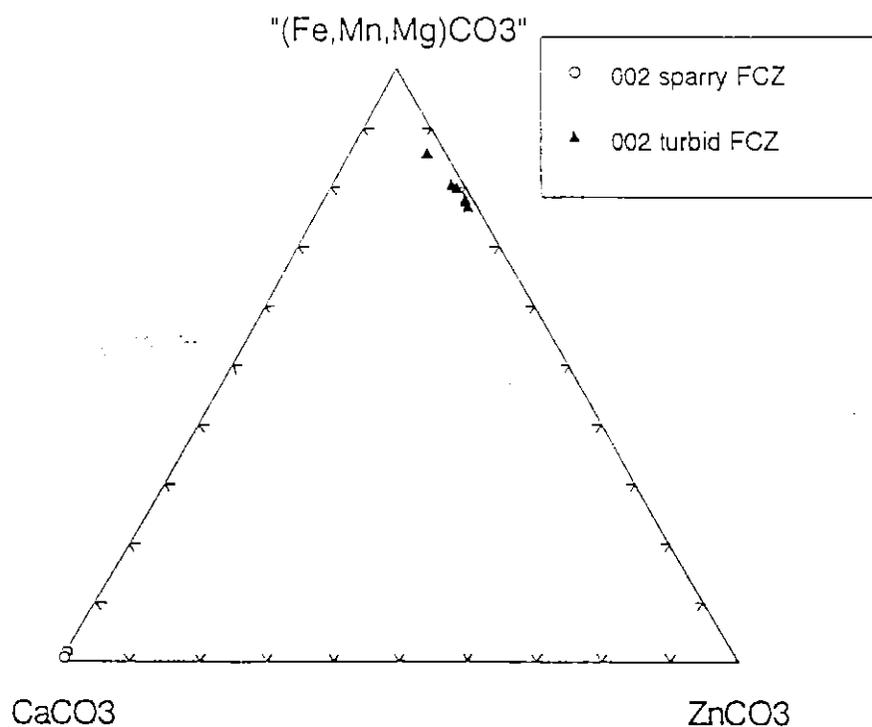


Figure 1b. Electron microprobe analytical data of carbonate minerals for sample 3970002, showing results in terms of the system (Fe,Mn,Mg)CO<sub>3</sub>-CaCO<sub>3</sub>-ZnCO<sub>3</sub>.

Electron microprobe analyses were carried out on the two types of carbonate. Results (Fig. 1; Appendix) indicate that the turbid carbonate is zincian magnesian siderite (with 11.4-21.6 mol. %  $\text{ZnCO}_3$ ), also containing minor  $\text{CaCO}_3$  and  $\text{MnCO}_3$  components. The white, sparry carbonate is a slightly ferroan calcite.

The sample is interpreted to represent an intensely hydrothermally altered and mineralised limestone. Initial alteration/mineralisation caused replacement of the limestone by zincian magnesian siderite (i.e. Zn is contained in the carbonate), accompanied by very minor galena and Fe-poor sphalerite. There was probably a volume reduction attending alteration, leading to development of void space. This was subsequently filled with sparry calcite, with minor galena and traces of sphalerite. Sulphide deposition is concentrated around the margins of sideritic carbonate aggregates, with evidence of sulphides replacing the carbonate.

3970003. Brecciated limestone which has been hydrothermally altered to ankerite/ferroan dolomite with deposition of minor disseminated Fe-poor sphalerite and traces of galena, pyrite and pyrobitumen. Interstices of the breccia have been infilled with early ankerite/ferroan dolomite and later coarser, sparry calcite.

Handspecimen shows a brecciated, dark grey limestone which appears to have been altered to an Fe-bearing carbonate type, with interclast infilling dominated by white, sparry carbonate. Clasts are angular to subangular and are up to at least 25 mm across; they contain dark fine grained stylolitic wisps adjacent to their margins. Carbonate in the clasts and in some of the matrix is brown-weathering and takes a mauve stain with Alizarin Red S. This carbonate is considered to be ankerite/ferroan dolomite, whereas the white, sparry carbonate infill takes a dark red stain and is likely to be calcite.

In the section, the fragmental texture of the handspecimen is apparent. Clasts comprise about 70 volume % of the sample and are composed of a fine grained aggregate of interlocking rhombs of a rather turbid carbonate, probably ankerite/ferroan dolomite, with about 1-2 volume % of fine grained low-Fe sphalerite and traces of galena, pyrite and a low-reflectance, near-isotropic, grey, soft substance interpreted to be pyrobitumen. Clasts are commonly bordered by thin, wispy stylolitic masses containing disseminated and veinlet low-Fe sphalerite, minor galena and traces of pyrite and pyrobitumen. There are also a few angular clasts up to 2 mm across of ?vein quartz which are fractured and veined by carbonate. Quartz contains scattered two-phase liquid + vapour fluid inclusions.

In between the clasts, there are two types of carbonate-dominated infilling. Early infilling is by fine to medium grained, slightly turbid carbonate (ankerite/ferroan dolomite) with minor disseminated sphalerite and galena, plus thin stylolitic concentrations of fine grained sulphides and pyrobitumen. This infilling has been subsequently veined by irregular masses of sparry medium to coarse grained (up to 2.5 mm) calcite in which there are sparse two-phase liquid + vapour fluid inclusions.

Sulphides form about 1-2 volume % of the sample and are finely disseminated in the altered clasts, the early infilling and in stylolites. Largest sulphide aggregates tend to be in the infilling and are up to 0.2 mm across. Sulphides are dominated by Fe-poor sphalerite, with subordinate galena showing local replacive textures towards the former. In stylolites, the sulphides are closely associated with traces of disseminated pyrobitumen.

The original rock is interpreted to have been a rather massive limestone containing traces of organic material and biogenic/diagenetic pyrite. Hydrothermal alteration effects followed brecciation of the limestone, causing complete replacement by fine grained turbid carbonate of ankerite/ferroan dolomite composition, accompanied by deposition of minor Fe-poor sphalerite, traces of galena and maturation of the organic material into pyrobitumen. Partial dissolution of the limestone caused stylolitic concentrations of sulphides and pyrobitumen to develop. Infilling of the breccia clasts was by

ankerite/ferroan dolomite, followed by late sparry calcite. The zinc assay value of the sample is consistent with it being accommodated in the minor disseminated sphalerite.

3970004. Recrystallised, hydrothermally altered and mineralised wackestone, locally grading to carbonate-bearing carbonaceous siltstone. Rock has been replaced by zincian ankerite, grading to ferroan dolomite and dolomite, with deposition of minor fine grained galena and Fe-poor sphalerite. Former organic material has been hydrothermally matured to pyrobitumen.

Drill core sample is a dark grey to black silty limestone, with angular fragments of recrystallised ?bioclastic material up to 20 mm across supported by a black, carbonaceous, silty matrix. There are a few scattered medium grained carbonate crystals in the matrix, plus traces of very fine grained galena. Staining of the section offcut with Alizarin Red S indicated that the original wackestone has been largely altered to ferroan dolomite/ankerite.

In the section, the wackestone texture is partly preserved, despite strong recrystallisation. Angular to subrounded clasts up to 6 mm across comprise 25-30 volume % of the section and are enclosed in a weakly laminated, fine grained silty matrix with local stylolitic aggregations. Clasts are recrystallised to fine to medium grained granular carbonate with a clear to slightly turbid appearance. Typical grainsize range is 0.02-0.2 mm and there are minor amounts of fine grained disseminated galena, Fe-poor sphalerite, traces of detrital quartz and small aggregates of a soft, grey, low-reflectance, somewhat anisotropic substance interpreted to be pyrobitumen. The silty matrix is dominated by fine grained recrystallised carbonate of generally turbid aspect, but there are gradations into domains dominated by fine grained quartz, scattered detrital quartz grains up to 0.2 mm across, minor muscovite flakes and disseminated sulphides. The sulphides, together with minor pyrobitumen interstitial to carbonate and quartz, cause the dark colour of the matrix (Photo 5). Scattered throughout the matrix are porphyroblasts, aggregates and veinlets of turbid carbonate (Photo 5). Individual grains are up to 1.5 mm across and comprise about 5 volume % of the sample. The silty matrix with pyrobitumen pigmentation locally grades into thin stylolitic laminations occurring around margins of some clasts.

About 5 volume % of sulphides occur in the sample and are disseminated throughout. They are more common, however, in the silty matrix and in places show replacive relationships towards the porphyroblastic turbid carbonate. Galena is slightly more abundant than Fe-poor sphalerite and forms about 3 volume %, occurring as anhedral up to 0.25 mm across. It is locally intergrown with sphalerite. There is insufficient sphalerite in the sample to account for the high Zn assay result and some of the Zn must be held in the carbonate.

Electron microprobe analyses showed that the turbid carbonate in the matrix, including the porphyroblastic type, is zincian ankerite with 8.9 - 16.5 mol. %  $ZnCO_3$  (Fig. 2; Appendix). The clear to slightly turbid carbonate in the recrystallised clasts ranges from zincian ankerite through ferroan dolomite to dolomite (Fig. 2; Appendix).

It is interpreted that the sample was originally a silty limestone, with bioclastic fragments largely supported in a calcareous, carbonaceous silty matrix (i.e. a wackestone). The rock was then hydrothermally altered and mineralised, with

3970004. Recrystallised, hydrothermally altered and mineralised wackestone, locally grading to carbonate-bearing carbonaceous siltstone. Rock has been replaced by zincian ankerite, grading to ferroan dolomite and dolomite, with deposition of minor fine grained galena and Fe-poor sphalerite. Former organic material has been hydrothermally matured to pyrobitumen.

Drill core sample is a dark grey to black silty limestone, with angular fragments of recrystallised ?bioclastic material up to 20 mm across supported by a black, carbonaceous, silty matrix. There are a few scattered medium grained carbonate crystals in the matrix, plus traces of very fine grained galena. Staining of the section offcut with Alizarin Red S indicated that the original wackestone has been largely altered to ferroan dolomite/ankerite.

In the section, the wackestone texture is partly preserved, despite strong recrystallisation. Angular to subrounded clasts up to 6 mm across comprise 25-30 volume % of the section and are enclosed in a weakly laminated, fine grained silty matrix with local stylolitic aggregations. Clasts are recrystallised to fine to medium grained granular carbonate with a clear to slightly turbid appearance. Typical grainsize range is 0.02-0.2 mm and there are minor amounts of fine grained disseminated galena, Fe-poor sphalerite, traces of detrital quartz and small aggregates of a soft, grey, low-reflectance, somewhat anisotropic substance interpreted to be pyrobitumen. The silty matrix is dominated by fine grained recrystallised carbonate of generally turbid aspect, but there are gradations into domains dominated by fine grained quartz, scattered detrital quartz grains up to 0.2 mm across, minor muscovite flakes and disseminated sulphides. The sulphides, together with minor pyrobitumen interstitial to carbonate and quartz, cause the dark colour of the matrix (Photo 5). Scattered throughout the matrix are porphyroblasts, aggregates and veinlets of turbid carbonate (Photo 5). Individual grains are up to 1.5 mm across and comprise about 5 volume % of the sample. The silty matrix with pyrobitumen pigmentation locally grades into thin stylolitic laminations occurring around margins of some clasts.

About 5 volume % of sulphides occur in the sample and are disseminated throughout. They are more common, however, in the silty matrix and in places show replacive relationships towards the porphyroblastic turbid carbonate. Galena is slightly more abundant than Fe-poor sphalerite and forms about 3 volume %, occurring as anhedral up to 0.25 mm across. It is locally intergrown with sphalerite. There is insufficient sphalerite in the sample to account for the high Zn assay result and some of the Zn must be held in the carbonate.

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It is interpreted that the sample was originally a silty limestone, with bioclastic fragments largely supported in a clacareous, carbonaceous silty matrix (i.e. a wackestone). The rock was then hydrothermally altered and mineralised, with

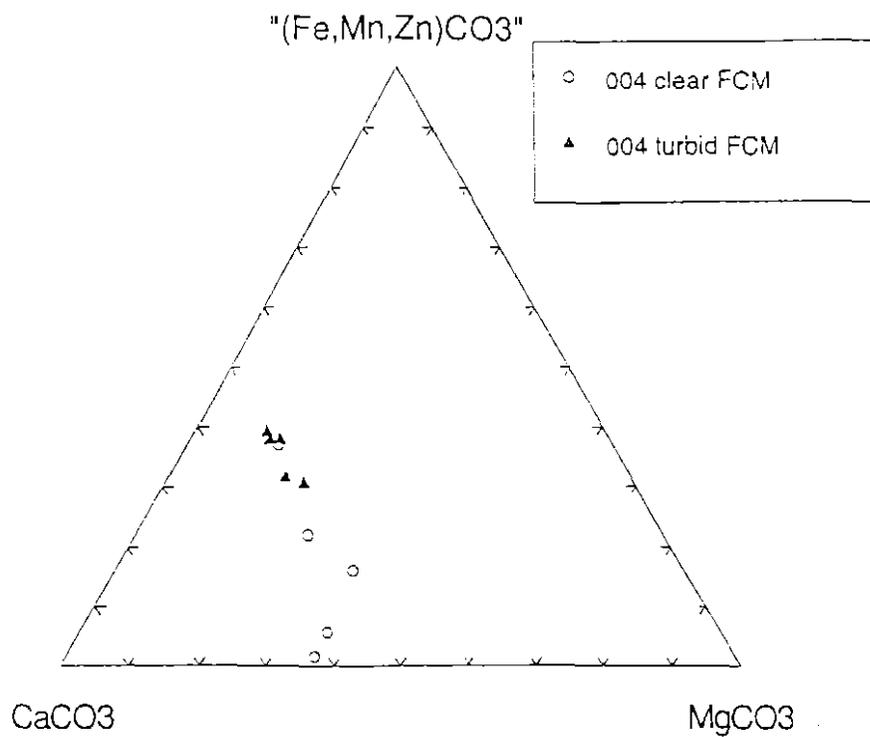


Figure 2a. Electron microprobe analytical data of carbonate minerals for sample 3970004, showing results in terms of the system (Fe,Mn,Zn)CO<sub>3</sub>-CaCO<sub>3</sub>-MgCO<sub>3</sub>.

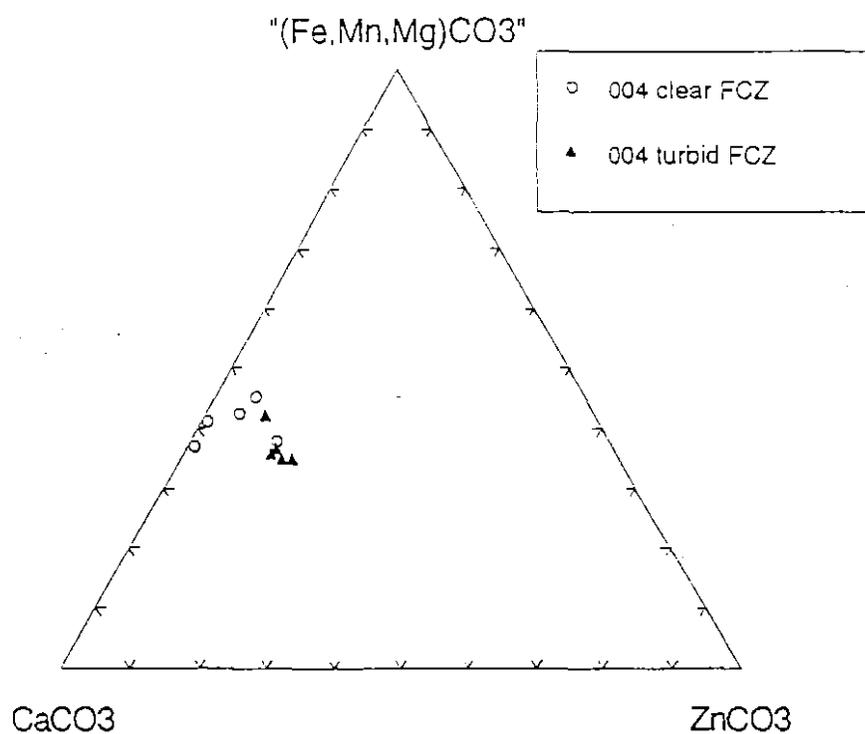


Figure 2b. Electron microprobe analytical data of carbonate minerals for sample 3970004, showing results in terms of the system (Fe,Mn,Mg)CO<sub>3</sub>-CaCO<sub>3</sub>-ZnCO<sub>3</sub>.

total replacement of original carbonate by zincian ankerite, grading to ferroan dolomite and dolomite. There is some evidence that the hydrothermal fluid subsequently carried more sulphur and commenced depositing sulphides, in part causing replacement of porphyroblastic zincian ankerite by galena and Fe-poor sphalerite. Former organic material in the dark matrix was hydrothermally matured to produce pyrobitumen aggregates.

3970006. Intensely hydrothermally altered ?bioclastic limestone with initial replacement by zincian siderite, with development of abundant open space voids. Partial infilling by fine grained crystalline dolomite has occurred. Traces of disseminated pyrite are found in both types of carbonate, with rare fine grained marcasite and sphalerite in the dolomite infillings.

Drill core sample is a speckled, light brown and dark brown, porous carbonate rock. Pale brown domains are up to 10 mm across and are partly infilled with dark brown carbonate with scattered open space voids, locally stained by goethite. Formation of the latter may be a result of incipient weathering due to extreme permeability of the rock. Staining of the section offcut with Alizarin Red S suggested that the pale brown domains were sideritic and that the dark brown infill may have been ferroan dolomite. A trace of fine grained pyrite is evident in the sample.

In the section, two domains of carbonate are obvious. About 30-40 volume % of the rock is comprised of a relatively clear, medium grained carbonate with interlocking texture, commonly occurring in ovoid aggregates up to 6 mm across (Photo 9). Some of the grains, which have a typical size range of 0.2-1 mm, are slightly zoned and have curved crystal faces. Traces of fine grained pyrite are disseminated in these aggregates, with a few irregular masses up to 0.3 mm across. Surrounding the relatively clear carbonate is a fine grained, crystalline aggregate of slightly turbid, pale yellow-brown carbonate with a grain size of <0.3 mm. Crystals of this type project into the commonly developed vughs (Photos 9 and 10). Again, traces of fine disseminated pyrite, locally in small elongate masses, are sparsely scattered. There are a few framboids of pyrite up to 30  $\mu\text{m}$  across and one or two tiny grains of Fe-poor sphalerite and marcasite enclosed in the yellow-brown carbonate.

Both carbonate types are locally stained by goethite (Photo 10), probably as a result of weathering effects due to the permeability of the rock. In places, a weak relict texture is apparent, with indications of pseudomorphs after former fossil fragments up to a few millimetres across. However, most of the rock is strongly recrystallised and there is no strong evidence for a former oolitic texture.

Only a tiny trace of sphalerite has been noted in the sample, certainly insufficient to account for percent levels of Zn. Electron microprobe analyses, however, revealed that the relatively clear carbonate domains are mostly zincian siderite with 2.9-16.2 mol. %  $\text{ZnCO}_3$  (Fig. 4; Appendix). These domains also contain minor dolomite and the latter phase comprises the fine grained pale yellow-brown carbonate surrounding the relatively clear carbonate and projecting into vughs. The dolomite is slightly ferroan (Fig. 4; Appendix).

It is interpreted that the original rock was a limestone, possibly with a considerable bioclastic component. However, hydrothermal alteration has caused total replacement of the rock, with initial development of zincian siderite and the formation of abundant void space. This was partly infilled with fine grained, slightly ferroan dolomite. A little pyrite is disseminated in both carbonate types, with traces of marcasite and sphalerite in the dolomite.



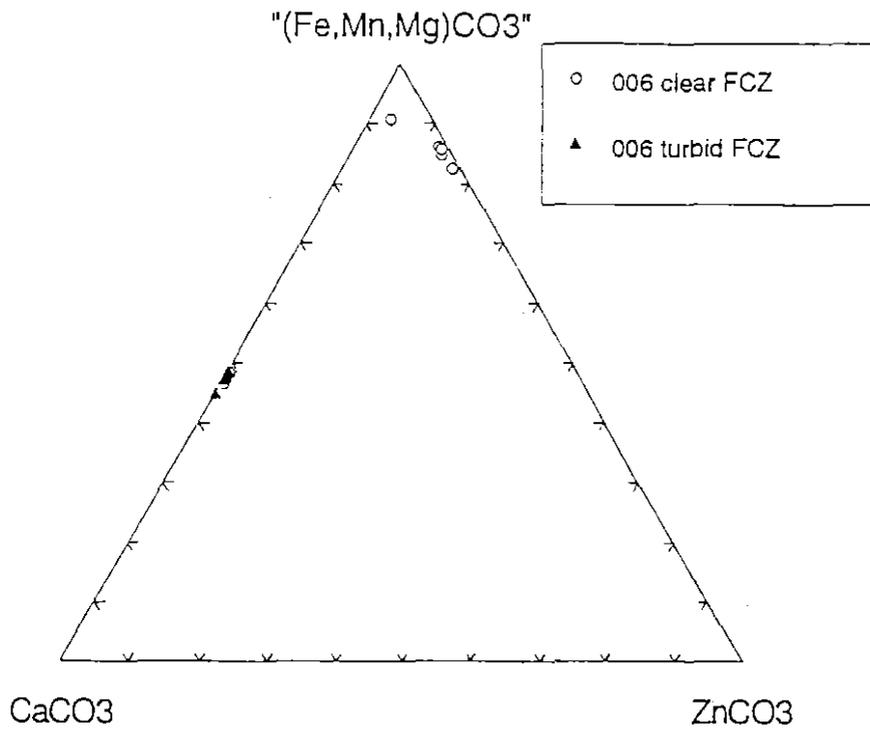


Figure 4c. Electron microprobe analytical data of carbonate minerals for sample 3970006, showing results in terms of the system  $(\text{Fe,Mn,Mg})\text{CO}_3$ - $\text{CaCO}_3$ - $\text{ZnCO}_3$ .

3970009. Recrystallised ?bioclastic limestone with a few carbonaceous siltstone fragments. Sample has been altered to ferroan dolomite, with precipitation of minor disseminated pyrite, sphalerite, galena and pyrobitumen. Fractures and vughy patches contain sparry ankerite, with minor quartz, sphalerite and galena.

Drill core sample is a dark grey fine to medium grained recrystallised limestone with thin veins and irregular patches up to 25 mm across of white sparry medium grained carbonate. The latter has weathered to an orange colour on drill core faces. The rock also contains a few fragments of dark grey fine grained carbonaceous calcareous siltstone up to 20 mm across. The sparry carbonate patches and veins are locally vughy and contain a few crystals of pale brown sphalerite up to 1-2 mm across. Staining of the section offcut with Alizarin Red S indicated that the recrystallised limestone may have been altered to ferroan dolomite and that the sparry carbonate is ankeritic. Relict textures in the limestone are poorly preserved, but there are vague outlines of former fossil fragments.

In the section, about 90 volume % of the sample is composed of an interlocking aggregate of fine to medium grained turbid, pale brown carbonate. This material represents the bulk of the altered and recrystallised limestone, but no relict textures are preserved. Typical grainsize of the turbid carbonate is 0.1-0.5 mm and there is very minor pyrite, sphalerite, galena and a soft, grey, low-reflectance, slightly anisotropic substance, interpreted to be pyrobitumen, disseminated throughout, mainly interstitial to the carbonate grains (Photo 16).

The turbid carbonate contains patches up to several millimetres across, and veins of similar dimension, of medium grained sparry carbonate, distinctly clearer than that forming the bulk of the rock. The sparry carbonate has a typical grainsize range of 0.2-1 mm and locally contains infillings of quartz (up to 0.8 mm across), Fe-poor sphalerite (vein aggregates up to 4.5 mm long) and galena (up to 0.5 mm across). Tiny 2-phase liquid + vapour fluid inclusions are sparsely distributed in quartz and clear carbonate.

Sulphides constitute about 2 volume % of the sample, being disseminated in both the turbid carbonate and the sparry carbonate patches and veins. Fe-poor sphalerite is the most abundant, forming about 1 volume %, and locally occurring at about the 10 volume % level in a few of the sparry carbonate veins (Photo 17). Pyrite is mostly restricted to disseminations in the turbid carbonate, where it forms tiny subhedra, locally overgrown by a second generation of pyrite, or by galena and sphalerite. In places, tiny multigrain aggregates of pyrite are found, intergrown with galena or sphalerite and forming spheroidal framboidal structures up to 0.1 mm across (Photo 18). In the turbid carbonate, sulphides are locally associated with tiny aggregates of pyrobitumen. In the sparry carbonate areas, sulphides tend to be coarser in grainsize and occur interstitially to carbonate and quartz (Photo 17).

The rock is interpreted to have originally been a bioclastic limestone, with a few fragments of dark carbonaceous, calcareous siltstone. The rock underwent alteration to ferroan dolomite, with total recrystallisation. Minor organic matter

was hydrothermally matured to pyrobitumen and ?biogenic/diagenetic pyrite recrystallised. It is possible that minor sphalerite, galena and further pyrite were introduced during this event. Fracturing was probably coeval with alteration, leading to formation of veins and vughy patches dominated by white sparry ankerite. A little quartz, sphalerite and galena were also deposited with the sparry carbonate.

3970012. Laminated and locally stylolitic micritic limestone with partial recrystallisation to fine to medium grained aggregates of ferroan dolomite. Sample contains minor disseminated fine grained pyrite and a trace of sphalerite.

Drill core sample shows a pale to medium grey, fine grained limestone, with the paler patches having a faint brownish tint. The rock is moderately laminated, with wavy lighter and darker layers (probably bedding) up to several millimetres thick (Photo 23). Anastomosing stylolites occur parallel to as well as cutting across the laminations (Photo 23) and the sample contains traces of fine grained disseminated pyrite. The darker laminations appear to be slightly coarser grained than the paler laminations. Staining of the section offcut with Alizarin Red S indicated that the original limestone is likely to have been replaced by ferroan dolomite.

In the section, two textural domains are apparent. About half the rock (the paler component in handspecimen) is composed of a very fine grained aggregate of turbid carbonate, interpreted to be former micrite. Within this material are very sparsely scattered aggregates and isolated grains of pyrite and traces of sphalerite. Pyrite aggregates are up to 0.3 mm across and locally have spheroidal outlines (framboids). The fine grained turbid carbonate also contains scattered rhombs of relatively clear carbonate 0.1-0.2 mm across (Photo 24). In places, the rhombs become more abundant and grade into domains of total recrystallisation (the darker component in handspecimen). The recrystallised domains are composed of an interlocking mass of rhombs of clear to slightly turbid carbonate with a typical grainsize range of 0.1-0.5 mm. This coarser, recrystallised carbonate also contains sparsely disseminated aggregates of pyrite and a trace of sphalerite.

In the section, a few anastomosing stylolites occur. These are up to 0.3 mm wide and cut across the crude laminations defined by the turbid and clear carbonate domains. Stylolites contain a dark pigmentation, possibly organic material, as well as a few tiny grains of pyrite, sphalerite and rutile (the last being a possible detrital phase in the limestone).

The rock is interpreted to have been a micritic limestone. It could have had an algal origin but microtextures are not diagnostic. Pervasive alteration to ferroan dolomite has occurred, along with partial recrystallisation of very fine grained turbid micritic carbonate to rhombs and aggregates of clearer, sparry carbonate. A little fine grained pyrite, possibly originally ?biogenic/diagenetic, is disseminated throughout, along with a trace of sphalerite.

3970014. Recrystallised and altered micritic limestone. Alteration is dominated by ferroan dolomite/ankerite. Rock is rather dark due to fine bituminous material interstitial to carbonate grains. A few stylolites have developed, forming concentrations of bituminous material and finely disseminated pyrite.

Handspecimen is a dark grey, fine to medium grained, recrystallised limestone. It appears to contain a few recrystallised fossil fragments up to 5 mm across and dark, slightly laminated, silty intercalations, perhaps pigmented by bituminous material. A few thin dark wavy stylolites characterise the rock and there are traces of disseminated pyrite. Veins of white carbonate up to 0.5 mm wide occur sparsely. Staining of the section offcut with Alizarin Red S indicates that the entire sample is composed of ferroan dolomite/ankerite.

In the section, there is essentially no primary rock texture preserved. The rock could have been relatively fine grained (i.e. micritic) with a few scattered fossil fragments, but it has been totally recrystallised to an interlocking aggregate of fine to medium grained (0.1-0.5 mm) rhombs of carbonate. The mineral has a relatively turbid, pale brown colour and locally grains are zoned (turbid interiors and clearer margins). From staining it is interpreted that the carbonate is ferroan dolomite/ankerite, which has probably replaced former calcite. Interstitial to the carbonate grains is rare detrital quartz up to 0.2 mm across. Disseminated throughout, but concentrated into anastomosing stylolitic masses up to 0.2 mm wide, are dark bituminous material and fine grained disseminated pyrite (Photo 30). The bituminous material (likely to be pyrobitumen) occurs interstitially to carbonate and in stylolites (Photo 30). In places it is evident as a low-reflectance, slightly anisotropic substance closely associated with fine grained pyrite and traces of rutile (the latter representing relict detrital grains).

Pyrite is disseminated throughout, but as mentioned above, tends to be concentrated into stylolites. The mineral forms ~0.5-1 volume % of the rock and occurs commonly as subhedra up to 0.05 mm across, in places overgrown by irregular pitted pyrite. (i.e. possibility of two generations of pyrite deposition). Locally pyrite has aggregated together to form masses up to 0.3 mm across; in places these are closely associated with small grains of pyrobitumen (Photo 30).

The sample is cut by several veins up to 0.5 mm wide. These are planar to anastomosing and are dominated by relatively clear fine to medium grained carbonate, accompanied rarely by fine grained quartz.

The sample is interpreted to have originally been a micritic limestone, with finely dispersed organic material and biogenic/diagenetic pyrite. It was subsequently replaced by fine to medium grained crystallised ferroan dolomite/ankerite with organic material being converted into pyrobitumen by the alteration. Pyrobitumen and pyrite are now concentrated into stylolites.

3970015. Strongly fossiliferous wackestone with abundant partly recrystallised fossil fragments in a micritic matrix which is also partly recrystallised. The matrix is locally darkly pigmented by fine organic matter and contains traces of disseminated pyrite.

Handspecimen is a mottled dark and light grey strongly fossiliferous wackestone. It contains abundant broken fossil fragments (corals, bryozoans, algal material (?stromatoporoids), gastropods and brachiopods) up to 20 mm across in a dark micritic matrix which may be pigmented by carbonaceous organic material (Photo 31). A single thin carbonate vein cuts the sample. Staining of the section offcut with Alizarin Red S indicates that the limestone is composed dominantly of calcite.

In the section, the rock retains a strongly bioclastic texture despite partial recrystallisation (Photo 32). Approximately 50 volume % of the rock is composed of fossil fragments > 0.5 mm across, with members of the above-mentioned phyla. Delicate internal textures of fossils are commonly preserved, but there is patchy recrystallisation (especially of corals, gastropods, bryozoans and brachiopods) to form polygonal carbonate aggregates with an average grain size of 0.05 mm (Photo 32). Apart from calcite, rare fine grained traces of pyrite comprise the only other component noted in the fragments. The matrix of the rock is micritic and composed dominantly of fine grained calcite. However, in places it shows variable recrystallisation to isolated aggregates, grading into extensive domains of polygonal or rhombic form with an average grain size of 0.05 mm (Photo 32). Unrecrystallised micrite is fine grained and likely to be pigmented by traces of dark organic material and disseminated pyrite. In recrystallised domains, organic material has been concentrated into intergranular areas, forming a dark, turbid matrix containing traces of disseminated pyrite (Photo 32).

A few stylolites are manifest as irregular, anastomosing, but essentially subplanar thin aggregates of dark organic material. These are up to 0.2 mm thick and also contain scattered fine granules of pyrite and a trace of ?rutile.

The sample represents a close to "background" bioclastic limestone. It is dominated by calcite and retains well preserved fossil fragments. The rock has only been patchily affected by recrystallisation. Dark pigmentation of the micritic matrix is probably due to finely dispersed organic matter and traces of pyrite. The latter is likely to be of biogenic/diagenetic origin.

3970016. Bedded packstone with intercalated recrystallised silty carbonate. The packstone is rich in broken fossil fragments and the silty layers have been altered to crystalline sparry ferroan dolomite/ankerite. Fine grained pyrite is disseminated throughout, but along with traces of bituminous material, tends to be concentrated in the recrystallised silty carbonate layers.

Handspecimen is a massive fine to medium grained grey limestone, evidently composed of abundant bioclastic material, and intercalated with darker grey-brown silty carbonate layers up to 10 mm in thickness. The latter contain traces of fine grained pyrite and may be pigmented by bituminous material. Oxidised surfaces of the drill core show a brown weathering effect on the silty layers, suggesting that these layers contain ferroan dolomite/ankerite. Staining of the section offcut with Alizarin Red S indicates that the bioclastic limestone is probably dominated by calcite, whereas the silty carbonate layers are ferroan dolomite/ankerite.

In the section, there are two clearly distinct rock types. Somewhat irregular layers up to 10 mm thick are composed of recrystallised silty carbonate with only a few recrystallised vestiges of fossil fragments. The silty layers form about 10-15 volume % of the sample and typically contain tightly packed rhombs of carbonate with an average grain size of 0.1 mm. There are also traces of fine grained detrital quartz along with dark intergranular material. The latter is dominated by fine grained pyrite, as disseminated isolated grains, and as aggregates of tiny grains up to 0.6 mm across. The recrystallised silty layers also contain traces of finely dispersed bituminous material (anisotropic; probably pyrobitumen), rutile (?original detrital component) and sphalerite.

The majority of the rock is a finely recrystallised packstone, dominated by broken fossil fragments (corals, brachiopods, bryozoans) with a typical grain size range of 0.1 - 2 mm (Photo 33). These fragments are set in a micritic matrix which is now finely recrystallised. There are also a few irregular patches up to 4 mm across of fine to medium grained quartz enclosed by sparry carbonate. Quartz has an unusual radiating and prismatic interlocking texture, characteristic of low-temperature hydrothermal/diagenetic silica deposition (?originally chalcedony). Many of the fossil fragments have acted as sites for accumulation of fine grained pyrite, causing dark pigmentation (Photo 33).

About 0.5 - 1 volume % of pyrite occurs in the sample, along with tiny traces of sphalerite. Pyrite is slightly more concentrated into the recrystallised silty layers, but is otherwise disseminated throughout. Fine grained aggregates are conspicuous (e.g. within fossil fragments)(Photo 33) and it is considered that pyrite deposition was mediated by biogenic/diagenetic processes. In the silty layers, pyrite is locally accompanied by dark pyrobitumen interstitial to the carbonate rhombs.

The rock is interpreted to be an interbedded packstone/siltstone with the silty layers having been altered to form ferroan dolomite/ankerite. Packstone is finely recrystallised but appears to be still mostly calcite. Biogenic/diagenetic pyrite, plus minor pyrobitumen, tends to be more concentrated into the silty layers.

## APPENDIX

## Tables of electron microprobe analyses for eight carbonate samples

Analyses are expressed in molecular percent of carbonate end-members  $\text{FeCO}_3$ ,  $\text{MnCO}_3$ ,  $\text{CaCO}_3$ ,  $\text{MgCO}_3$  and  $\text{ZnCO}_3$ .

## 3970010

	type	mol% $\text{FeCO}_3$	mol% $\text{MnCO}_3$	mol% $\text{CaCO}_3$	mol% $\text{MgCO}_3$	mol% $\text{ZnCO}_3$
a	clear, sparry	5.3		51.0	43.7	
b	clear, sparry	8.4	0.3	51.2	40.1	
c	clear, sparry	2.5		52.5	45.0	
d	clear, sparry	9.4	0.4	51.2	39.0	
e	oncolite			55.0	45.0	
f	oncolite	5.7		52.0	42.3	
g	oncolite	0.6		63.8	35.6	
h	oncolite	0.3		52.6	47.1	
i	oncolite	1.4		55.0	43.6	

## 3970002

	type	mol% $\text{FeCO}_3$	mol% $\text{MnCO}_3$	mol% $\text{CaCO}_3$	mol% $\text{MgCO}_3$	mol% $\text{ZnCO}_3$
a	turbid	66.7	2.1	1.2	9.1	20.9
b	turbid	67.7	2.2	2.0	10.7	17.4
c	sparry	1.6		98.1	0.3	
d	sparry	0.8		99.2		
e	sparry	0.9		99.1		
f	sparry	0.8		99.2		
g	turbid	72.1	1.9	2.5	12.1	11.4
h	turbid	66.0	1.9	1.0	10.1	21.0
i	turbid	63.0	1.8	1.4	12.2	21.6
j	turbid	68.0	2.0	1.5	10.0	18.5

## 3970004

	type	mol% FeCO <sub>3</sub>	mol% MnCO <sub>3</sub>	mol% CaCO <sub>3</sub>	mol% MgCO <sub>3</sub>	mol% ZnCO <sub>3</sub>
a	clear	10.3	0.4	48.8	34.8	5.7
b	turbid	24.2	2.1	50.0	10.5	13.2
c	clear	16.8	0.7	52.7	25.0	4.8
d	clear	5.4		58.0	36.1	0.5
e	clear	23.1	1.7	49.5	13.3	12.4
f	turbid	17.8	1.0	51.2	17.0	13.0
g	turbid	20.2	1.6	48.6	13.1	16.5
h	turbid	20.6	1.3	48.7	20.5	8.9
i	clear	1.3		62.2	36.0	0.5
j	turbid	21.6	1.8	50.2	11.4	15.0

## 3970008

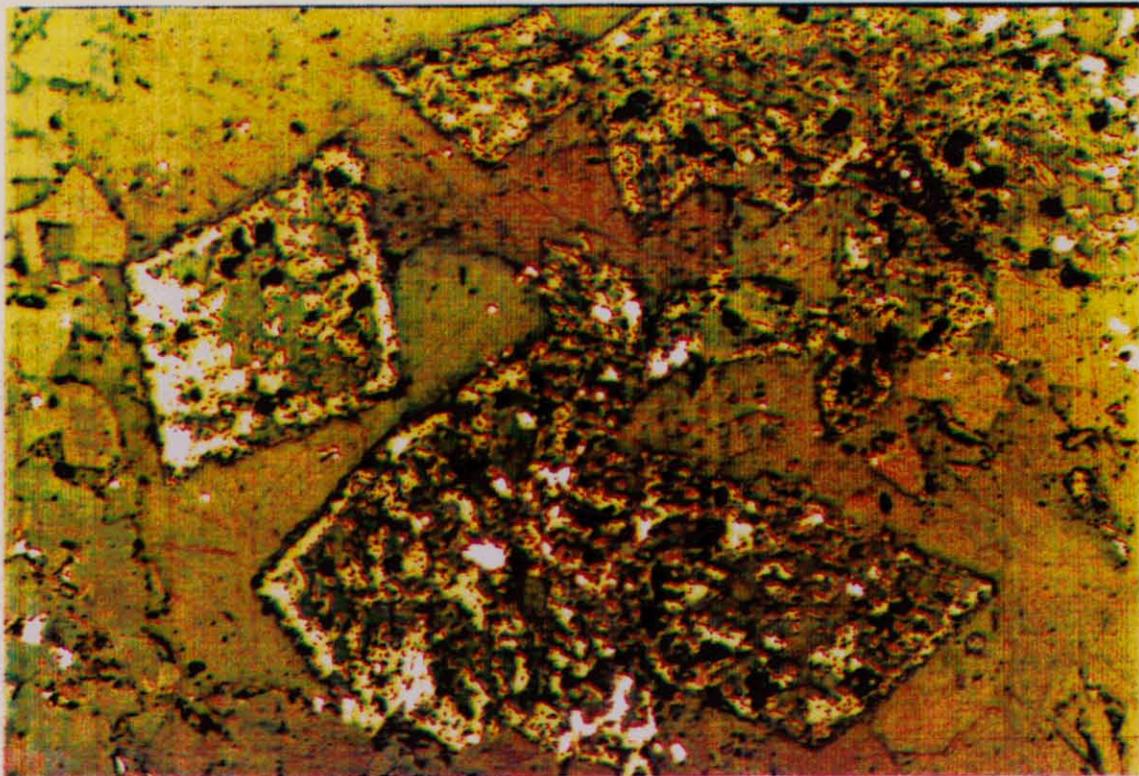
	type	mol% FeCO <sub>3</sub>	mol% MnCO <sub>3</sub>	mol% CaCO <sub>3</sub>	mol% MgCO <sub>3</sub>	mol% ZnCO <sub>3</sub>
a	sparry	2.8		52.7	44.5	
b	sparry	2.1		52.2	45.7	
c	turbid	0.5		62.5	37.0	
d	turbid			54.1	45.9	
e	turbid			75.0	25.0	
f	sparry	2.9		53.4	43.7	
g	sparry	2.0		53.0	45.0	
h	turbid			56.3	43.7	

## 3970006

	type	mol% FeCO <sub>3</sub>	mol% MnCO <sub>3</sub>	mol% CaCO <sub>3</sub>	mol% MgCO <sub>3</sub>	mol% ZnCO <sub>3</sub>
a	turbid	1.4		52.7	45.9	
b	turbid	1.3		52.0	46.7	
c	turbid	1.0		55.2	43.8	
d	turbid	1.8		51.5	46.7	
e	clear	80.7	3.8	1.2	2.0	12.3
f	clear	78.8	4.0	1.5	2.4	13.3
g	clear	84.6	4.0	6.4	2.1	2.9
h	turbid	0.9		52.1	47.0	
i	clear	76.1	4.3	1.3	2.1	16.2
j	clear	1.2		51.5	47.3	
k	clear	0.4		53.0	46.6	
l	clear	79.8	3.8	1.3	2.1	13.0

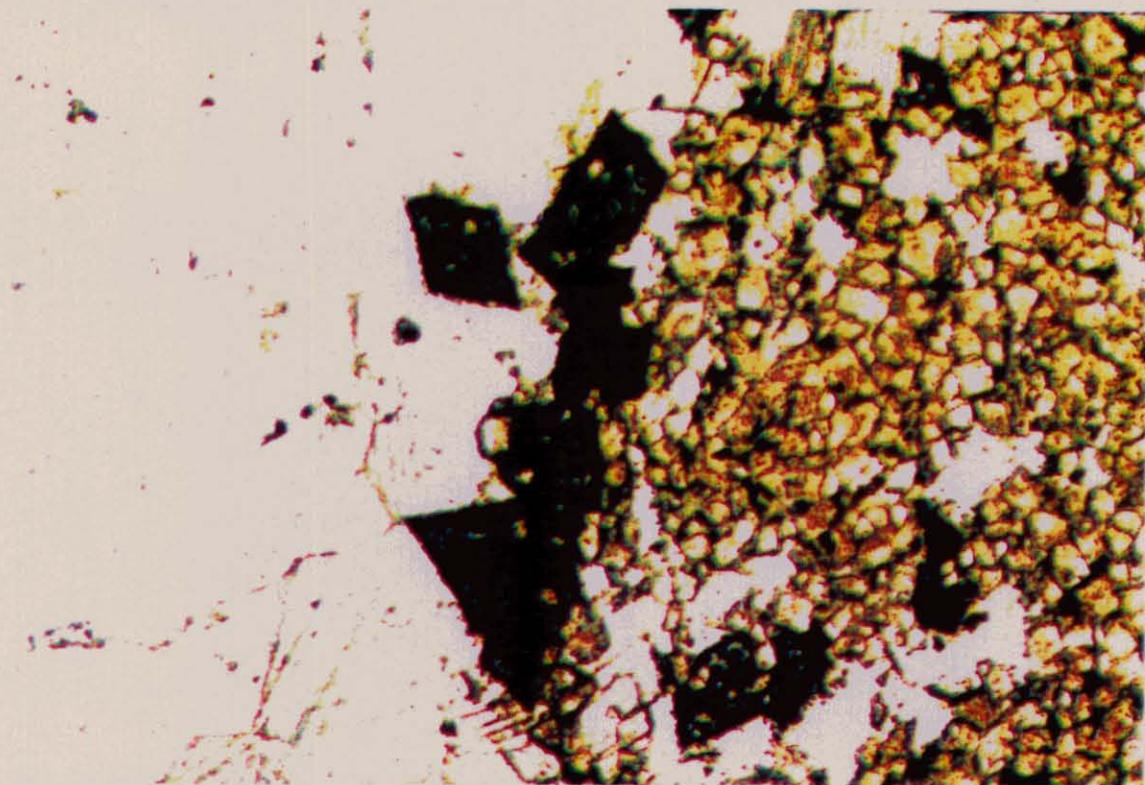
## 3970005

	type	mol% FeCO <sub>3</sub>	mol% MnCO <sub>3</sub>	mol% CaCO <sub>3</sub>	mol% MgCO <sub>3</sub>	mol% ZnCO <sub>3</sub>
a	clear	2.3	1.3	95.5	0.9	
b	turbid	67.0	21.0	2.7	9.3	
c	turbid	66.2	20.4	3.7	9.7	
d	turbid	68.6	23.3	1.0	7.1	
e	turbid	65.2	22.5	3.6	8.7	
f	clear, zoned	15.7	12.0	57.1	15.2	
g	clear, zoned	8.2	5.0	61.5	25.3	
h	turbid	67.4	19.1	2.0	11.5	
i	clear, zoned	13.3	9.2	57.7	19.8	
j	clear, zoned	0.5	2.6	96.4	0.5	
k	clear, zoned	11.7	9.9	59.2	19.2	



ZLG-1

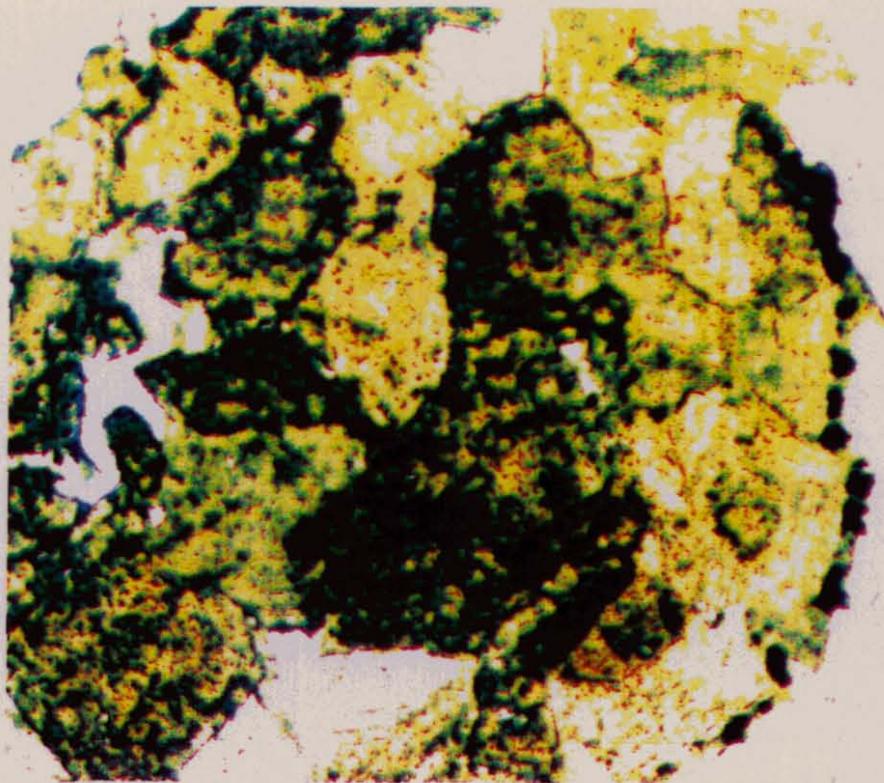
**Photo 1:** Sample 3970001. Rhombs of sideritic carbonate, partly replaced by fine grained sphalerite (pale grey) and minor galena (white), and enclosed in sparry ferroan dolomite/ankerite. Reflected light photomicrograph, field of view 1 mm across.



ZLG-1

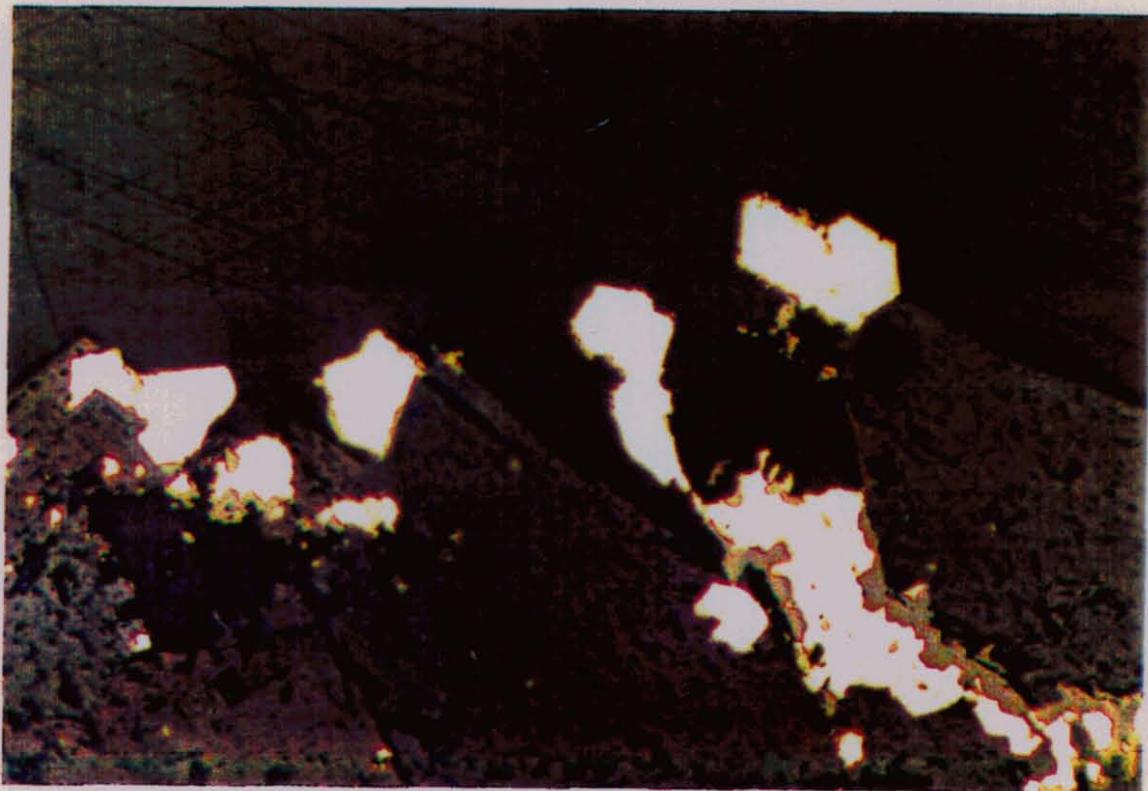
**Photo 2:** Sample 3970001. Rhombs of sideritic carbonate, partly replaced by fine grained galena and sphalerite (black), abutting granular recrystallised limestone (altered to ferroan dolomite/ankerite) and coarser, clear, sparry ferroan dolomite. Transmitted light photomicrograph, field of view 2 mm across.

303255



ZLG-1

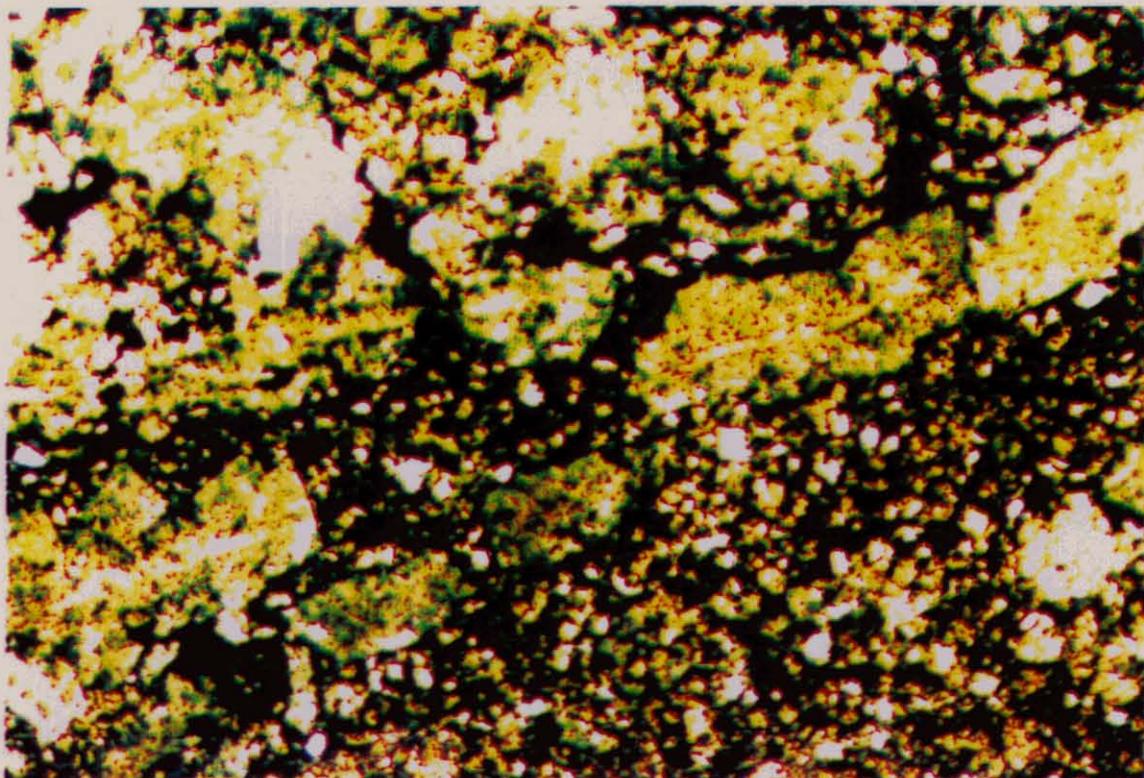
Photo 3: Sample 3970002. Turbid aggregate of zincian magnesian siderite with a few grains of galena scattered about the margins, surrounded by clear sparry calcite. Transmitted light photomicrograph, field of view 2 mm across.



ZLG-1

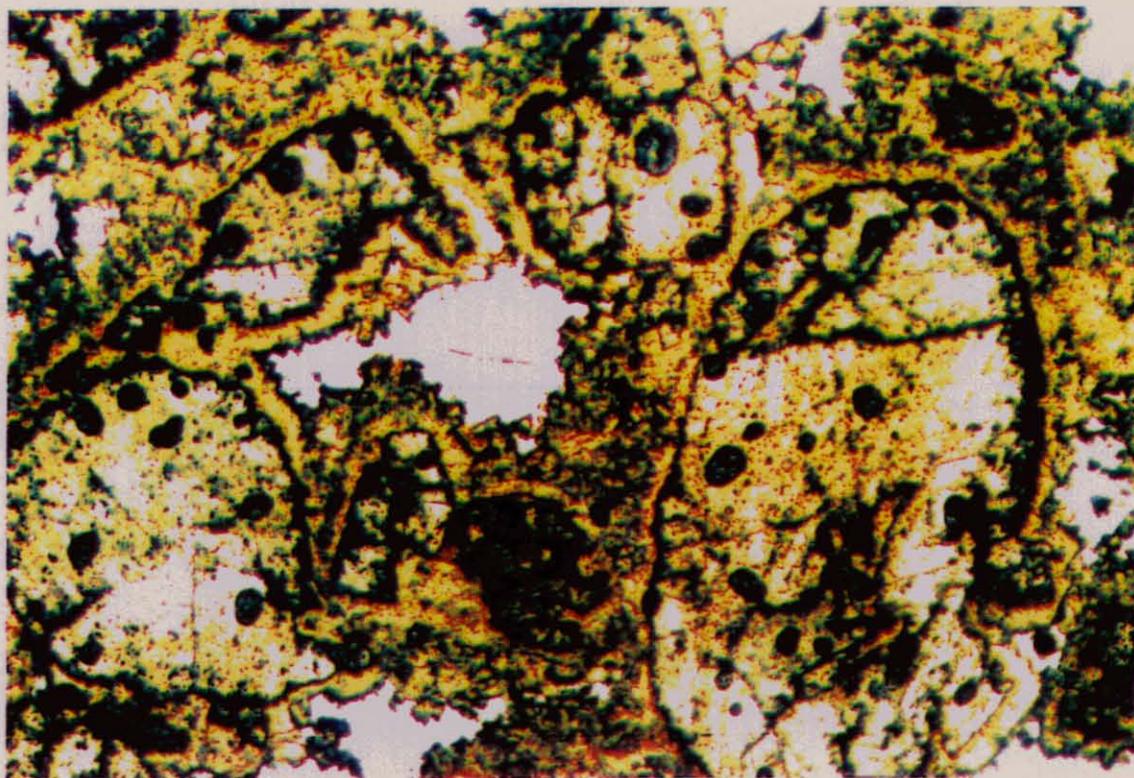
Photo 4: Sample 3970002. Grains of galena (white) and minor sphalerite (pale grey) at the margins of, and replacing, zincian magnesian siderite (grey, high relief). Sulphides project into coarse sparry calcite (grey, twinned). Reflected light photomicrograph, field of view 1 mm across.

303256



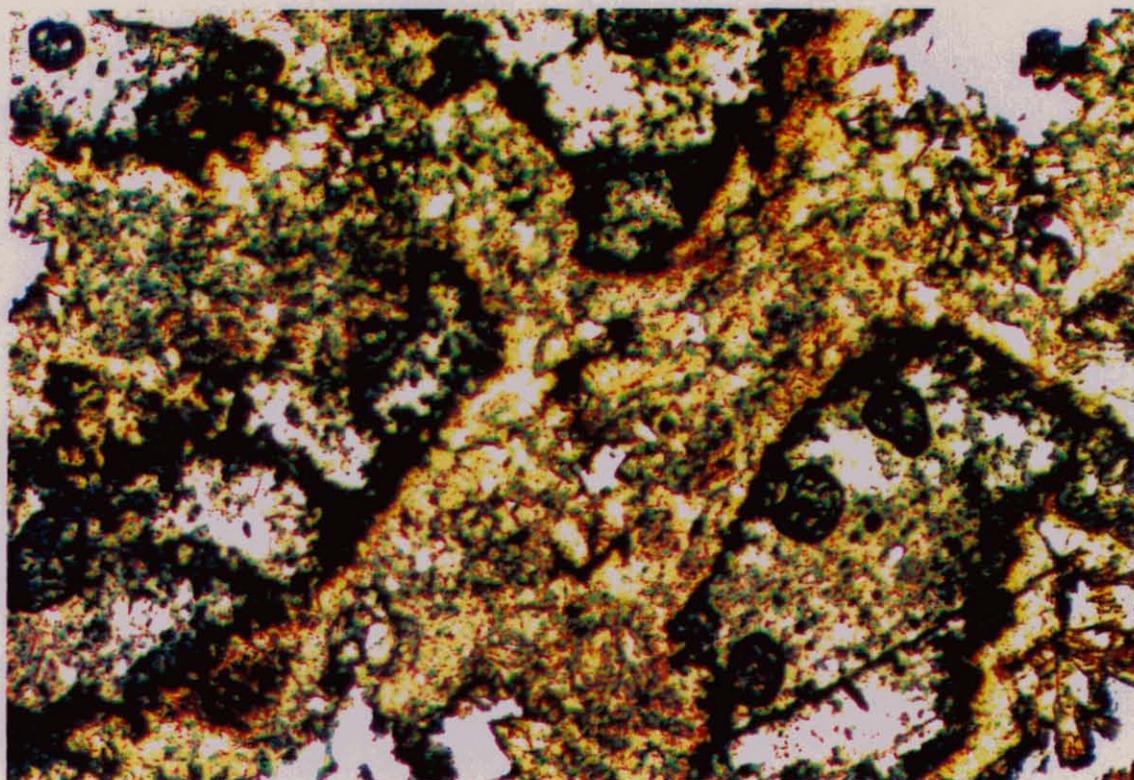
ZLSG 1

**Photo 5: Sample 3970004.** Diffuse turbid porphyroblasts of zincian ankerite which have partly replaced carbonaceous wackestone/siltstone. In the latter, carbonate rhombs and detrital quartz are evident, with pyrobitumen causing the dark pigmentation of the matrix. Transmitted light photomicrograph, field of view 2 mm across.



2G1002

Photo 9: Sample 3970006. Ovoid to subangular aggregates of medium grained zincian siderite surrounded by finer grained, turbid crystalline dolomite. Note abundant vughy patches in the latter. Transmitted light photomicrograph, field of view 2 mm across.



2G1002

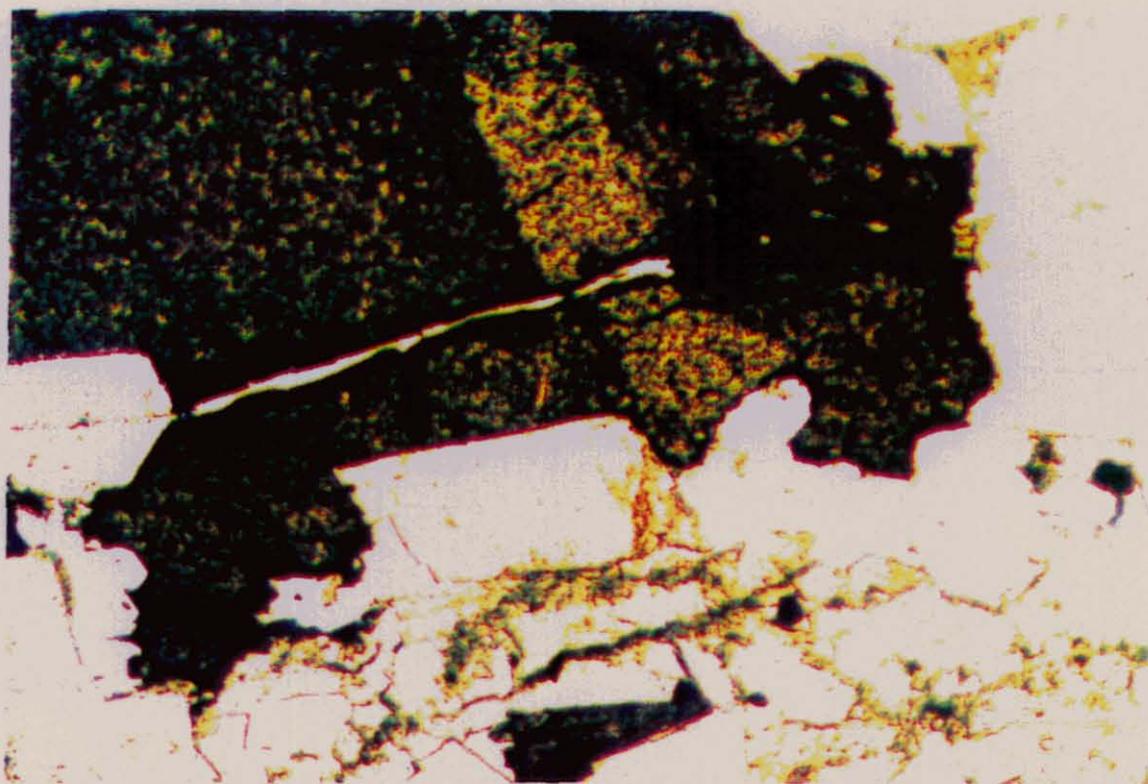
Photo 10: Sample 3970006. Detail from above, showing interlocking, crystalline nature of the dolomite (slightly stained orange-brown by goethite) surrounding masses of zincian siderite. Transmitted light photomicrograph, field of view 1 mm across.

303258



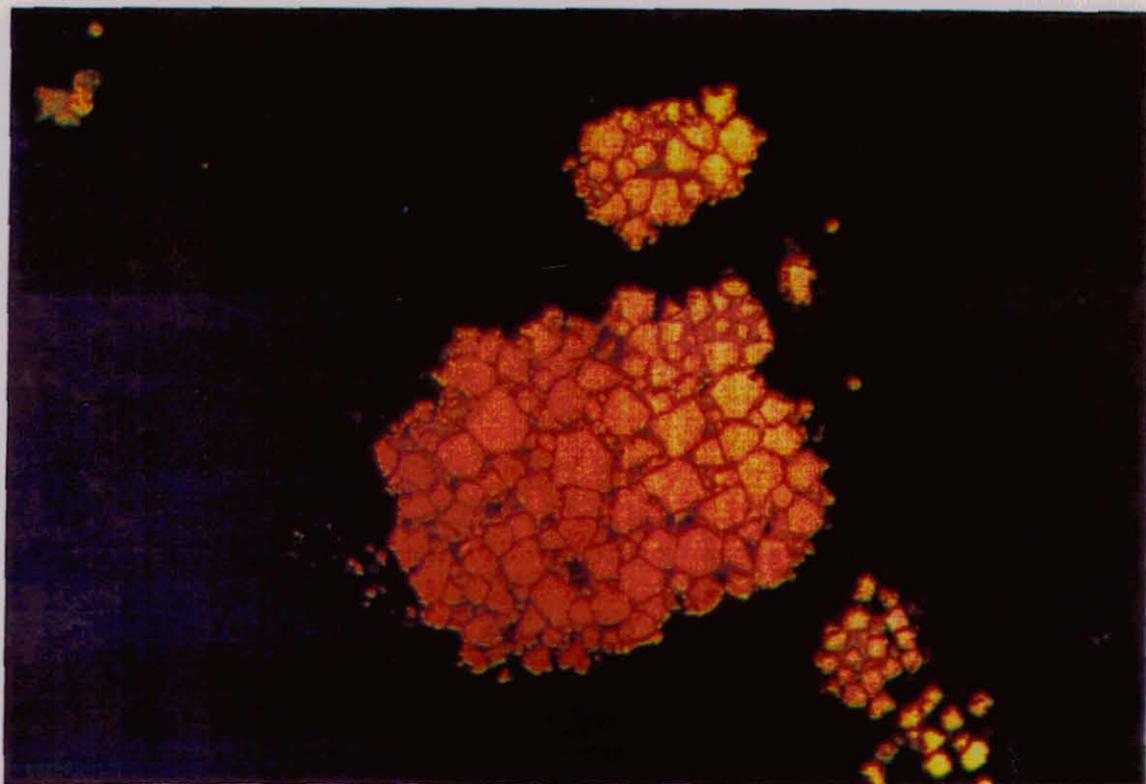
ZG-1012

Photo 16: Sample 3970009. Aggregate of ferroan dolomite containing elongate masses of pyrobitumen (pale brownish-grey) and a grain of sphalerite (pale grey). Reflected light photomicrograph, field of view 0.5 mm across.



2G1012

Photo 17: Sample 3970009. Aggregate of Fe-poor sphalerite (dark) adjacent to medium grained sparry ankerite (pale brown, cleaved) and minor quartz (clear grains). Transmitted light photomicrograph, field of view 2 mm across.



2G1012

Photo 18: Sample 3970009. Spheroidal sulphide aggregates in ferroan dolomite. These framboidal masses contain pyrite subhedra (creamy), sphalerite (mid-grey) and galena (pale grey). Reflected light photomicrograph, field of view 0.2 mm across.

303260



ZG1012

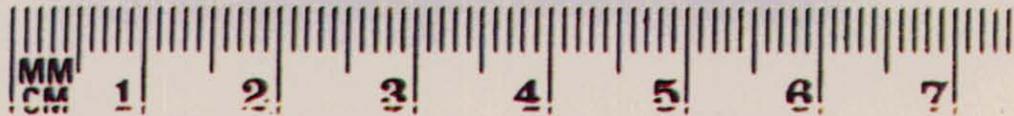
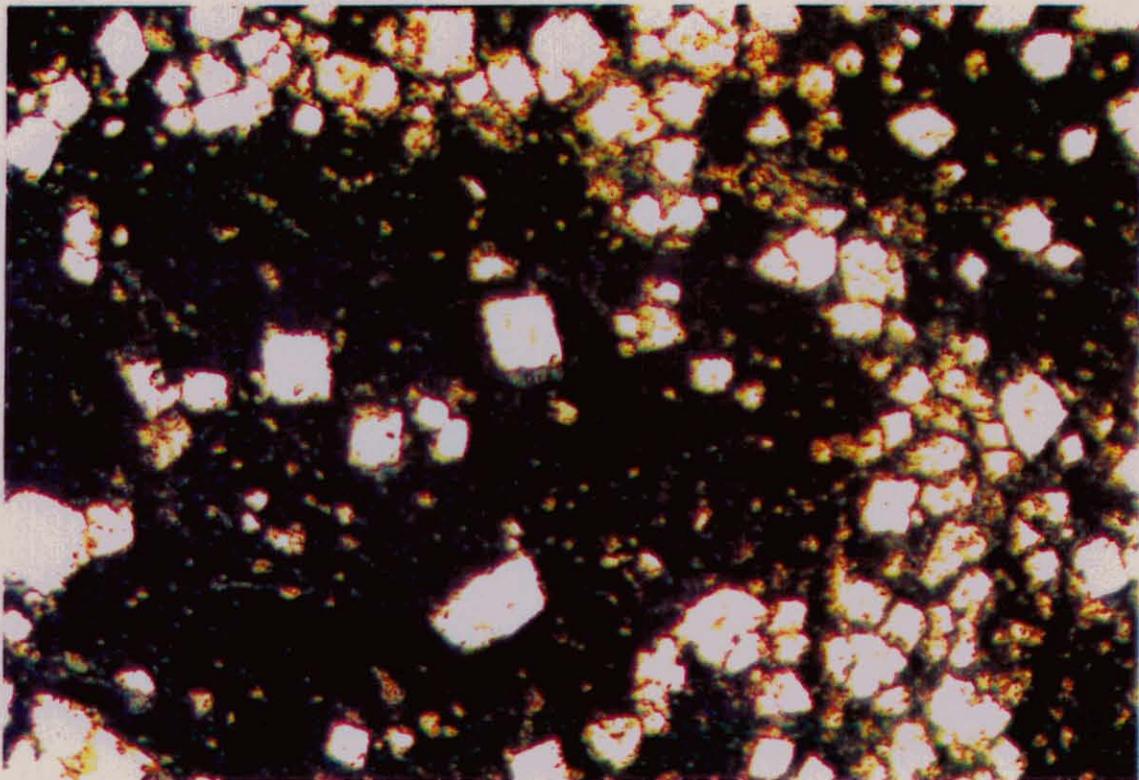
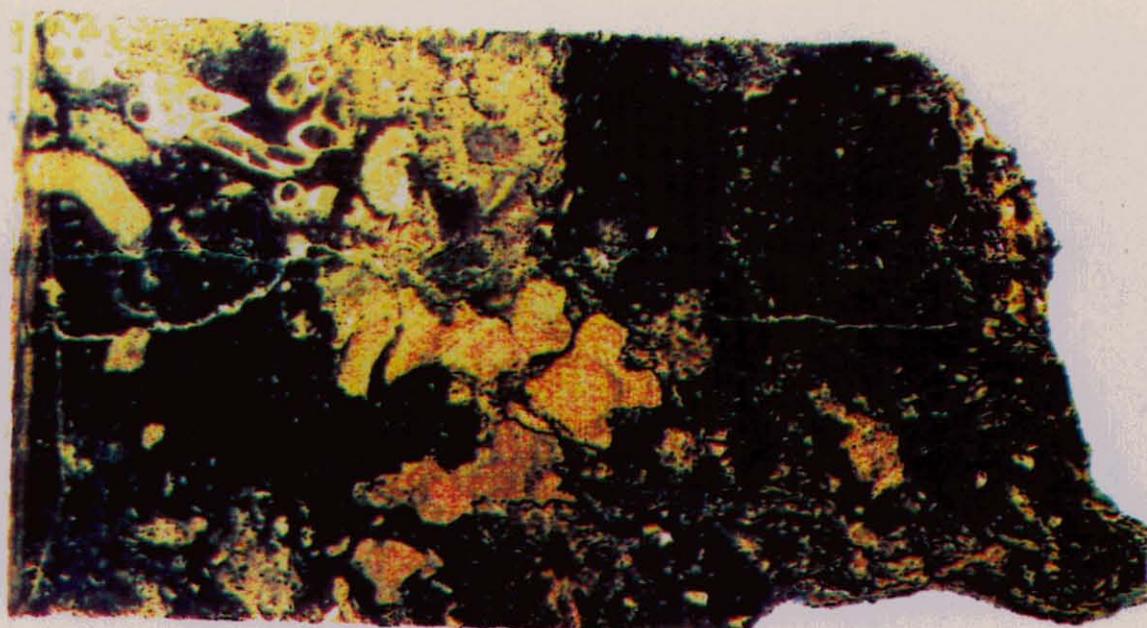


Photo 23: Sample 3970012. Cut drill core slab showing lighter and darker domains in dolomitised limestone. Anastomosing stylolites occur parallel to interpreted bedding laminations as well as cutting across them. Thin section examination reveals that the darker domains contain recrystallised dolomite.



ZG1012

Photo 24: Sample 3970012. Development of dolomite rhombs in fine grained turbid dolomitised micrite. Note the gradation into recrystallised dolomitic domains. Transmitted light photomicrograph, field of view 2 mm across.



ZG1012



Photo 31: Sample 3970015. Cut drill core slab showing clasts of fossils (bryozoa, corals, algal material) in a dark micritic matrix. The matrix is pigmented by a bituminous organic substance.



ZG1012

Photo 32: Sample 3970015. Fossil fragments including a gastropod (finely recrystallised with relict septa) and algal material (dark, turbid) are set in interstitial granular recrystallised calcite. Note the dark bituminous pigmentation in the recrystallised calcite domain. Transmitted light photomicrograph, field of view 2 mm across.



ZG-1012

Photo 33: Sample 3970016. Richly fossiliferous packstone with broken fossil fragments in a micritic matrix. Note concentration of fine grained pyrite (dark) in certain fossil fragments. Transmitted light photomicrograph, field of view 2 mm across.



ZG-1012

Photo 30: Sample 3970014. Scattered grains of pyrobitumen (pitted, pale yellowish-grey) and pyrite (creamy) disseminated in recrystallised ferroan dolomite/ankerite. Note close association of pyrobitumen and pyrite with a stylolite (irregular black line). Reflected light photomicrograph, field of view 1 mm across.

APPENDIX 9

Report by R & PD - economic studies



RESOURCES AND PROCESSING DEVELOPMENTS

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Memorandum

22nd August 1994

File 1.Z1  
Brian Wilson  
Richard Olive  
~~Tom Dickson~~

To : R J Batterham

From : Michael Lavery

Subject : Zeehan Zinc Prospect,  
Tasmania

In response to the brief preliminary economic assessment/discussion study of the Zeehan zinc prospects currently being explored by CRAE, Ian Gould raised the question of alternative transport options. The original study considered transporting concentrate by road to Rosebery, rail to Burnie, sea to Risdon and made use of existing infrastructure that transports Hellyer, Rosebery and Mt Lyell concentrates.

Please find attached an addendum titled "Concentrate Transport Addendum" prepared for R&PD by Minenco. Five options of transporting concentrate from Zeehan to Risdon were found to be technically feasible.

- (i). Road/rail/sea via Burnie ( as selected in original study)
- (ii). Road via Burnie
- (iii). Sea via Strahan or Pilot Bay
- (iv). Road via Queenstown
- (v). Slurry Pipeline to Gormanston/road via Tarraleah

Use of the Lyell highway south of Zeehan to Risdon is not recommended with or without a partial replacement by a slurry pipeline (option iv and v). A pipeline for the entire distance to Risdon could be of interest for a large project.

Road via Burnie (option ii) is the most reliable but holds not significant cost benefit over the original study.

Several possible schemes for shipping by sea from the Macquarie Harbour area (Strahan for small concentrate tonnages or Pilot Bay for larger concentrate tonnages) have been developed which at first pass seem both technically feasible and of lower cost than going through Burnie.

The impact of the lower cost options on the minimum ore grade for project viability is however quite small. For a ten year life, 5 million tonne per annum, zinc ore project, the minimum head grade for viability reduces from 5.3% to 5.2% Zn equivalent and at a 10% Zn equivalent head grade the project net present value would improve from about \$570M to \$605M.

The major uncertainties for the shipping options (option iii and iv) are,

- (a). Possible low availability of Macquarie Harbour or Pilot Bay because of weather and tidal patterns.
- (b). Shallow depth and poor dredging effectiveness of dredging in Macquarie Harbour.
- (c). Large infrastructure cost (especially with high plant capacity).
- (d). Use of motorised barges on West Coast of Tasmania for low to medium capacities (1 to 2.5 Mt/y). This type of vessel has not been used in Tasmanian waters.

The transport study has identified some potential cost benefit alternatives that could be considered in future evaluations of the Zeehan zinc deposits, the timing of which will be governed by exploration needs.

Michael Laverty

303266

CRATER & CO

ZEEHAN ZINC

CONCENTRATE TRANSPORT  
ADDENDUM

Prepared by:

Minenco Pty Limited  
111 Coventry Street  
South Melbourne Vic 3205

Report No. R3204A

File Ref. 5098.001

August 1994

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## APPENDICES

Appendix A - Design Criteria

Appendix B - People Contacted

## SUMMARY

This report summarises preliminary investigations into zinc concentrate transport options between Zeehan and Risdon. The range of capacities considered was:

		Ore Production (Mt/y)		
		1	2.5	5
Concentrate	(wmt/y)	188 000	470 000	940 000
	(wmt/wk)	4 000	10 000	20 000

The following five options were found to be technically feasible:

- 1 - Road/rail/sea via Burnie
- 2 - Road via Burnie
- 3 - Sea via Strahan or Pilot Bay
- 4 - Road via Queenstown
- 5 - Slurry Pipeline to Gormanston/road via Tarraleah

The routes are shown in Figures 1 and 2 and order of magnitude cost estimates are given in Table 1.

Table 1: Cost Estimates for Concentrate Transport Options to Risdon  
(5 Mt/y Ore, 10% Zn Equivalent, 940 000 wmt/y Concentrate)

Option	Description	Capital Cost (\$M)	Capital Depreciation (\$/wmt)	Operating Cost (\$/wmt)	Capital Depreciation + Operating Cost	
					(\$/wmt)	(\$/t Ore)
1 - Base Case	Road/rail/sea via Burnie	-	-	39.6	39.6	7.4
2	Road via Burnie	-	-	37.4	37.4	7.0
3	Sea via Strahan/Pilot Bay	41.1	8.7	11.8	20.5	3.9
4	Road via Queenstown (Lyell Highway)	-	-	31.4	31.4	5.9
5	Slurry pipeline to Gormanston, Road via Tarraleah (Lyell Highway)	8.6	1.8	23.7	25.5	4.8

The last two options rely on major sections of the Lyell Highway. This highway is very steep in many places and is of a low standard. Almost all heavy transport to the Zeehan district from Hobart (Risdon) uses the longer distance route via Launceston and Burnie. Therefore, these options are not recommended for further consideration.

There is potential for significant cost savings over the base case for options using sea transport from Strahan (smaller concentrate tonnages) or Pilot Bay (larger concentrate tonnages).

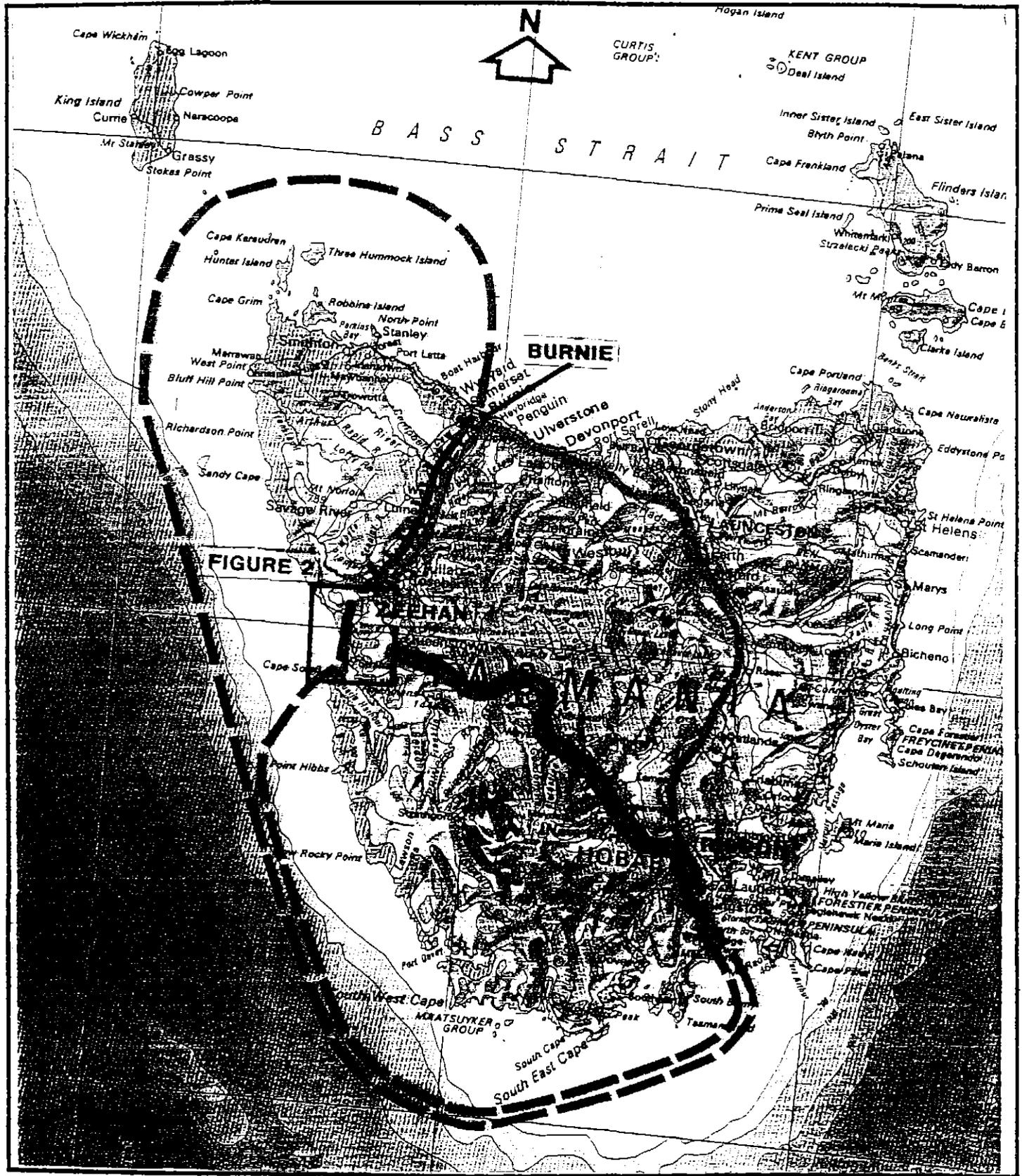
Economic analysis of this option for a ten year 5 Mt/y zinc ore project indicates:

- for a 10% Zn equivalent ore grade the project net present value would improve from about \$570 M to \$605 M;
- the minimum ore reserve grade for viability reduces from 5.3% to 5.2% Zn equivalent.

The major uncertainties identified with this option are:

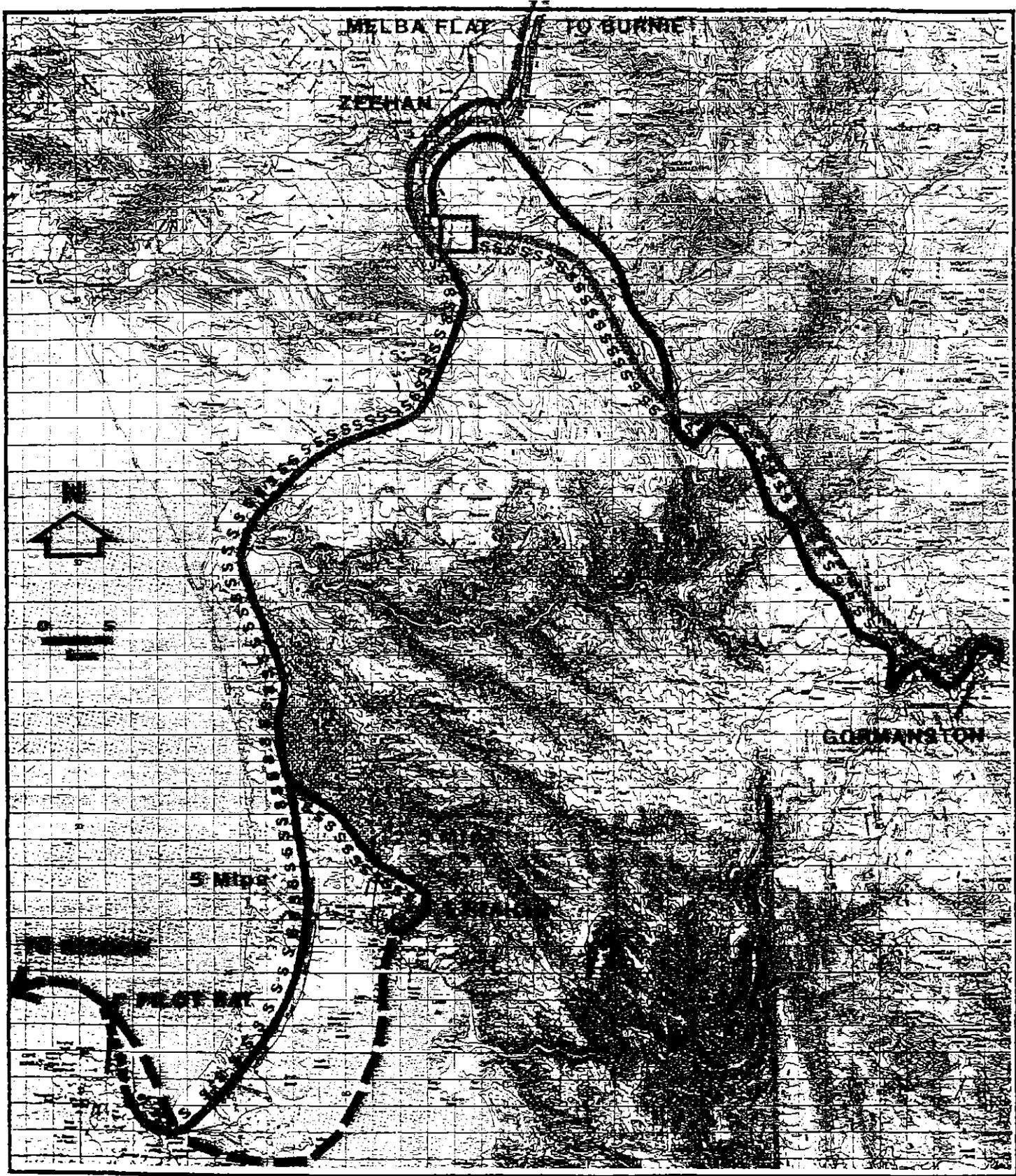
- Possible low availability of Macquarie Harbour and Pilot Bay because of weather and tidal patterns.
- Shallow depth and poor dredging effectiveness in Macquarie Harbour.
- Large infrastructure cost, especially with high plant capacity.
- Use of motorised barges on West Coast of Tasmania for low to medium capacities (1 to 2.5 Mt/y). This type of vessel has not been used in Tasmanian waters.

Figure 1 ZEEHAN ZINC CONCENTRATE TRANSPORT  
 Zeehan to Risdon Map 303270



- |  |                      |  |                 |
|--|----------------------|--|-----------------|
|  | Option 1 - Base Case |  | Road            |
|  | Option 2             |  | Rail            |
|  | Option 3             |  | Slurry Pipeline |
|  | Option 4             |  | Sea             |
|  | Option 5             |  |                 |

Figure 2 ZEEHAN ZINC CONCENTRATE TRANSPORT  
Zeehan/Macquarie Harbour/Melba Flat Area Map



- |  |                      |  |                 |
|--|----------------------|--|-----------------|
|  | Option 1 - Base Case |  | Road            |
|  | Option 2             |  | Rail            |
|  | Option 3             |  | Slurry Pipeline |
|  | Option 4             |  | Sea             |
|  | Option 5             |  |                 |

## 1. BACKGROUND

In a recent Minenco Report (R3204) on the financial viability of zinc deposits near Zeehan only one concentrate transport option was considered: Road to Rosebery/Rail to Burnie/Sea to Risdon. It made use of existing infrastructure that transports Hellyer, Rosebery and Mt Lyell concentrates.

CRA Resource & Processing Developments has asked that Minenco examine other options for concentrate transport to Risdon. It was suggested that sea transport from Macquarie Harbour could be a viable alternative and that slurry pipelines could have a role in some options.

This report summarises preliminary investigations and costing of possible concentrate transport options:

- road transport to Risdon both directly and via Burnie,
- slurry pipeline over the mountainous section of the Lyell Highway, then road transport to Risdon,
- road transport or slurry pipeline to Strahan then by sea to Risdon,
- slurry pipeline to Pilot Bay then by sea to Risdon.

## 2. MODES OF TRANSPORT

### 2.1 General

The principal features of each transport mode are discussed below.

### 2.2 Sea

- Macquarie Harbour area is the only sheltered area on the West Coast that is suitable for ship loading.
- Present infrastructure in Macquarie Harbour can only service a small fishing boat fleet.
- Within Macquarie Harbour the maximum draft allowed is 3.7 m, which will only allow 1 200 t vessels or 2 000 t barges. Major dredging of the harbour is uneconomic because of quick moving sands and large expense.
- Pilot Bay, which lies to the south side of Macquarie Harbour, can be dredged economically to 11 m. This will allow 20 000 t vessels to be anchored for lighterage or moored at a jetty. A past study that investigated shipping quartzite from south of Macquarie Harbour recommended using Pilot Bay for the mooring of 20 000 t vessels.
- Macquarie Harbour is controlled by the Hobart Marine Board which is keen to attract business away from Burnie.

### 2.3 Road

- 6-axle 42.5 t (28 t pay load) trucks are permitted all over Tasmania.
- B-Double (45 t pay load) trucks are being operated on a trial basis on the Midlands and Bass Highways until September 1994. These have not been considered because there is no guarantee of acceptance.
- There should be no restrictions to 7 day/week operation, however there may be night curfews.

- It is possible to drive a 42.5 t truck from Zeehan to Risdon via Queenstown, however there would be a prohibitive maintenance cost imposed if the frequency exceeded 20 to 40 trucks per day. At present only 250 light vehicles (and occasional trucks) use the highway each day.
- The 280 km route (Zeehan Highway, Lyell Highway) to Risdon is very slow and could take up to 12 hours for a return trip (55 km/h average). On this route there are approximately 85 km of sub-standard, hilly roads in four separate locations: Queenstown to Gormanston, Mt Arrowsmith to Derwent, Ouse to Bradys Lake, New Norfolk to Granton. These sections have forced almost all West Coast truck deliveries to go via Burnie, (430 km Zeehan to Risdon).
- The Queenstown to Gormanston truck route (10 km) would use a private Mt Lyell Mine road and a toll could be expected.
- A major road transport group in Tasmania (Brambles) recommends the Burnie route for road transport of large tonnages of concentrate, however, the Queenstown route was not ruled out. Freight rates of 8¢/laden km/t (good standard road), 10¢/laden km/t (poor standard road) have been indicated by Brambles.
- Whilst the Tasmanian Department of Works permitted truck usage of the Lyell Highway to Risdon, it strongly recommended alternative routes.

#### 2.4 Slurry Pipeline

- Slurry pipelines can be considered as an alternative to road transport, particularly if road infrastructure costs are large.
- Savage River pipeline (85 km, 229 mm diameter) was installed a remote part of North West Tasmania, and has transported iron ore concentrates successfully for many years.
- 200 mm pipeline (cf Century) is technically feasible across Zeehan terrain.
- Zeehan area is less environmentally sensitive than Savage River, therefore suitable for a pipeline.

- An alternative to the difficult Queenstown/Gormanston road section is to use a 36 km slurry pipeline from the mine to Gormanston. This increases the initial capital cost, but still does not connect with a good and reliable road. The high standard road only starts about 50 km from Risdon.
- There is no direct road route from Zeehan to Pilot Bay . If the heads had to be crossed a slurry pipeline would be the only viable alternative. Both a span across the heads (650 m) and an underwater passage (1.5 to 2.5 km) are technically possible. The underwater option is more viable because of its significantly lower cost (\$2 M vs \$5 M).

## 2.5 Rail

- Mt Lyell rails concentrate from Melba Flat to Burnie. Melba Flat is only 7 km north of Zeehan.
- The Emu Bay rail line originally ran to Zeehan, therefore an easement should be available for a rail extension.

### 3. OPTIONS FOR TRANSPORTING CONCENTRATE

#### 3.1 Selection Process

Each transportation mode was examined, and four options to the base case were selected. The options are described and order of magnitude costs presented below.

The design criteria used are in Appendix A. Capacities are presented in Table 2.

Table 2: Concentrate Production Rates

	Ore Production Rates (Mt/y)		
	1	2.5	5
<b>Processing</b>			
Recovery %	90	90	90
Grade Zn - Ore %	10	10	10
Grade Zn - Conc %	52	52	52
t Conc/t Ore	0.17	0.17	0.17
<b>Concentrate Production Rates</b>			
Dry (dmt/y)	173 000	433 000	865 000
Wet - 8% moisture (wmt/y)	188 000	470 000	940 000
(wmt/wk)	3 618	9 045	18 089
incl 10% contingency (wmt/wk)	4 000	10 000	20 000

#### 3.2 Description of Transport Options and Costing

##### Option 1 - Base Case-Road/rail/sea via Burnie

Road trip could be shortened by a small amount by trucking to Melba Flat in preference to Rosebery. This does not significantly affect the overall cost.

Table 3 : Option 1 - Base Case - Road/Rail/Sea Via Burnie - Costing

		Ore Production Rates (Mt/y)		
		1	2.5	5
Capital Costs	\$	-	-	-
Operating Costs				
Zeehan to Rosebery (road)	(\$/wmt)	3.0	3.0	3.0
Rosebery to Burnie (rail)	(\$/wmt)	13.2	13.3	13.3
Burnie (handling)	(\$/wmt)	7.6	7.6	7.6
Burnie to Risdon (sea, handling)	(\$/wmt)	15.7	15.7	15.7
Sub-total	(\$/wmt)	39.6	39.6	39.6
TOTAL	(\$/wmt)	39.6	39.6	39.6
	(\$/t ore)	7.4	7.4	7.4
	(\$M/y)	7.5	18.6	37.2

## Option 2 - Road via Burnie

Concentrate is taken to Risdon via Burnie and Launceston in 28 t payload 6-axle trucks. (Murchison, Hampshire, Bass, Midland Highways approx 430 km). For 1 to 5 Mt/y there are 20 to 100 return trips per day with a 7 day/week operation with the possibility of night curfews. A return trip takes about 12 hours.

Table 4 : Option 2 - Road via Burnie - Costing

		Ore Production Rates (Mt/y)		
		1	2.5	5
Capital Costs	\$	-	-	-
Operating Costs				
Zeehan to Risdon <sup>1</sup> (road)	(\$/wmt)	37.4	37.4	37.4
TOTAL	(\$/wmt)	37.4	37.4	37.4
	(\$/t ore)	7.0	7.0	7.0
	(\$M/y)	7.0	17.6	35.2

<sup>1</sup> Rate 8¢/laden km/t.

### Option 3 - Sea via Strahan or Pilot Bay

#### *1 Mt/y (4 000 t concentrate/week)*

The concentrate is filtered at site, transferred into transportable boxes at the mine site and trucked to Strahan along the recently sealed Henty Highway (42 km). These boxes are loaded on to a purpose built 2 000 t motorised barge at a new jetty located at Regatta Point (2 km south of Strahan). This barge makes two round trips to Risdon each week (480 km per round trip).

#### *2.5 Mt/y (10 000 t concentrate/week)*

Thickened concentrate slurry is pumped to Regatta Point along a 40 km 150 mm pipeline and then filtered. The filtercake is transferred to boxes and shipped by barge as for 1 Mt/y. Two or three barges are required.

#### *5 Mt/y (20 000 t concentrate/week)*

Thickened concentrate slurry is pumped to Pilot Bay through a 50 km 200 mm pipeline. The pipeline passes under Macquarie Harbour, where it is bedded into rock at 6 m depth. At Pilot Bay the slurry is filtered and stored in bulk. 20 000 t vessels will be loaded at a new jetty on the south side of the bay. One round trip to Risdon will be made per week.

Table 5: Option 3 - Sea via Strahan or Pilot Bay - Costing

		Ore Production Rates (Mt/y)		
		1	2.5	5
<b>Capital Costs</b>				
Zeehan to Strahan upgrade (road/bridge)	(\$M)	-	-	-
Zeehan to Pilot Bay (slurry)	(\$M)	-	6.1	7.6
Macquarie Heads Crossing	(\$M)	-	-	2.0
Pilot Bay jetty	(\$M)	-	-	28.5
Strahan jetty	(\$M)	6.0	6.0	-
Tug Boat	(\$M)	-	-	3
Total	(\$M)	6.0	12.1	41.1
Capital Cost Depreciation <sup>1</sup>	(\$/wmt)	6.4	5.1	8.7
<b>Operating Cost</b>				
Zeehan to Strahan (road) <sup>2</sup>	(\$/wmt)	4.0	-	-
Zeehan to Pilot Bay (slurry)	(\$/wmt)	-	0.5	0.3
Port Handling	(\$/wmt)	3.0	3.0	3.0
Sea freight	(\$/wmt)	10.0	10.0	6.5
Unload	(\$/wmt)	2.0	2.0	2.0
Sub-Total	(\$/wmt)	19.0	15.5	11.8
<b>TOTAL<sup>3</sup></b>	<b>(\$/wmt)</b>	<b>25.4</b>	<b>20.6</b>	<b>20.6</b>
(Capital Depreciation	(\$/t ore)	4.8	3.9	3.9
and Operating)	(\$M/y)	4.8	9.7	19.4

<sup>1</sup> Depreciated over five years.

<sup>2</sup> Rate 8¢/laden km/t.

<sup>3</sup> No additional cost has been allowed for operating filter plant remote from mine (2.5, 5 Mt/y capacity).

#### Option 4 - Road via Queenstown

This option is only applicable to mine outputs up to 2.5 Mt/y (40 trucks per day) because of a restriction imposed by Tasmanian Department of Transport and Works.

The trucks leave Zeehan and travel along Zeehan/Lyell Highways to Queenstown. The next 10 km is along the private Mt Lyell mine road. From Gormanston to Risdon the journey is along the Lyell Highway. Regular road maintenance of this road is envisaged because it has only been used by light vehicles in recent years. Despite the one way distance of 280 km being significantly shorter than the 430 km via Burnie, the travel time is still 12 hours. This slow average speed of 55 km/h is caused by the poor standard of the road and its steep slopes.

Table 6 : Option 4 - Road via Queenstown - Costing

		Ore Production Rates (Mt/y)		
		1	2.5	5
Capital Costs	(\$M)	-	-	-
Operating Cost				
Zeehan to Risdon (road) †	(\$/wmt)	30.4	30.4	30.4
Mt Lyell private road toll	(\$/wmt)	1.0	1.0	1.0
Sub-Total	(\$/wmt)	31.4	31.4	31.4
TOTAL	(\$/wmt)	31.4	31.4	31.4
	(\$/t ore)	5.9	5.9	5.9
	(\$M/y)	5.9	14.8	29.6

† Rate 10¢/laden km/t.

#### Option 5 - Slurry Pipeline to Gormanston, Road via Tarraleah

This option replaces the first section of road travel of Option 4 with a slurry pipeline. Slurry is thickened at the mine site and pumped to the filter plant located at Gormanston. The concentrate is then trucked to Risdon as per Option 4.

Table 7: Option 5 - Slurry Pipeline to Gormanston, Road via Tarraleah  
Costing

		Ore Production Rates (Mt/y)		
		1	2.5	5
<b>Capital Costs</b>				
Zeehan to Gormanston Hill (slurry)	(\$M)	4.5	6.6	8.6
Capital Cost Depreciation <sup>i</sup>	(\$/wmt)	4.8	2.8	1.8
<b>Operating Cost</b>				
Zeehan to Gormanston Hill (slurry)	(\$/wmt)	1.3	0.9	0.5
Gormanston Hill to Risdon (road) <sup>ii</sup>	(\$/wmt)	23.0	23.0	23.0
Sub-Total	(\$/wmt)	24.3	23.9	23.7
<b>TOTAL <sup>iii</sup></b>	(\$/wmt)	29.1	26.7	25.5
(Capital Depreciation and	(\$/t ore)	5.5	5.0	4.8
Operating)	(\$M/y)	5.5	12.6	24.0

<sup>i</sup> Depreciated over five years.

<sup>ii</sup> Rate 10¢/laden km/t.

<sup>iii</sup> No additional cost has been allowed for operating filter plant remote from mine.

#### 4. CONCLUSIONS AND RECOMMENDATIONS

Road via Queenstown and slurry pipeline to Gormanston/road via Tarraleah (Options 4 and 5) should not be considered further because of their reliance on the sub-standard Lyell Highway. At present almost all of the goods trucked from Hobart to the West Coast are supplied via Burnie.

The options that should be considered in future studies of Zeehan deposits are listed below with suggestions for further evaluation steps.

##### Option 1 - Base Case - Road to Melba Flat/Rail to Burnie/Sea to Risdon

During optimisation it may be possible to make small improvements to the Base Case costing with two changes:

- refurbish and extend the rail line to the mine or Zeehan;
- replace road transport to rail line with a slurry pipeline.

##### Option 2 - Road via Burnie

Road via Burnie and Launceston is the most reliable road option. There is no significant cost benefit over the base case at present. It is recommended not to follow this option further, unless the base case cost increases or B-double trucks are permitted on this route.

##### Option 3 - Slurry Pipeline or Truck to Macquarie Harbour/Sea to Risdon

This is the cheapest option evaluated and has potential to halve the base transport cost. There are several areas of risk that require further attention:

- effect of weather conditions on the availability of harbour and port for loading,
- depths and dredging suitability of Macquarie Harbour,
- suitability of motorised barges for Tasmania's west coast,
- all capital and operating costs are of order of magnitude standard and need review.

## APPENDIX A - DESIGN CRITERIA

### General

See section 3.1

### Sea

- 3.7 m depth in Macquarie Harbour allows 2 000 t barges.
- 11.5 m depth in Pilot Bay allows 20 000 t vessels.

Round trip to Risdon is 480 km and takes 4 days for all boats at 10 knots.  
 - load 1 day, south 1 day, unload 1 day, north 1 day.

### Road

- 42.5 t truck gross carries 28 t payload.
- 7 day/week operation.
 

4 000	10 000	20 000	wmt of concentrate/week
20	50	100	return trips per week

### Slurry Pipeline

- 70% solids, solid SG 3.6, slurry SG 2.8 (cf Century).
- safe operating velocity 1.13 m/s (cf Century).

## APPENDIX B - PEOPLE CONTACTED

## SEA

*Bernie Dirikis (Principal Consultant - Shipping, CRA Technological Resources-Studies)*

*Captain John Hodgson (Harbour Master - Hobart Marine Board)*

John is responsible for Macquarie Harbour, and referred Minenco to North West Shipping & Towage for detailed information on the area.

*Graeme Phillips (Manager - North West Shipping & Towage)*

Graeme participated in the quartzite study 20 years ago, and has many contacts with Macquarie Harbour/Pilot Bay shipping knowledge.

## ROAD

Tasmanian Department of Transport and Works

*Jack Lane (Manager- Public Vehicle Maintenance)*

Jack is responsible for maintaining vehicle standards and issuing permits.

*Michael Bushby (Systems Engineer - Traffic and Road Assets)*

Michael assesses road condition in the Zeehan/Risdon areas and determines acceptable road usage.

## Brambles

*Glen Wright (Sales Support - Hobart)*

Glen has experience in bulk road transport to the West Coast.

## SLURRY PIPELINE

*Norman Cowper - (Slurry Systems)*

Norman has been involved in many slurry pipeline designs (eg Savage River, Century).

CRA RESOURCE AND PROCESSING DEVELOPMENTS

ZEEHAN ZINC

FINANCIAL VIABILITY PARAMETERS

Prepared by

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111 Coventry Street  
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Report No. R3204  
File Ref. 5098.001  
June 1994

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## SUMMARY

A limestone-hosted primary zinc resource which can deliver ore from an underground mine of 10% zinc equivalent would need to supply at least 0.7 Mt/y for ten years to be financially viable. Lower grade resources would need higher production rates eg 6% equivalent zinc needs about 3.5 Mt/y for ten years to be viable. These outcomes are shown in Figures 1 and 2.

This conclusion is based on a conceptual target lying between 200 and 600 m below surface, having a near vertical dip and ore thicknesses of 10 m to 20 m. The mining method proposed is open stoping, without backfilling, which will achieve about 65% ore recovery.

The concentrator is envisaged as two stage fully autogenous grinding followed by lead and zinc flotation.

The zinc price assumed is US\$0.56/lb and exchange rate of A\$1 = US\$0.70.

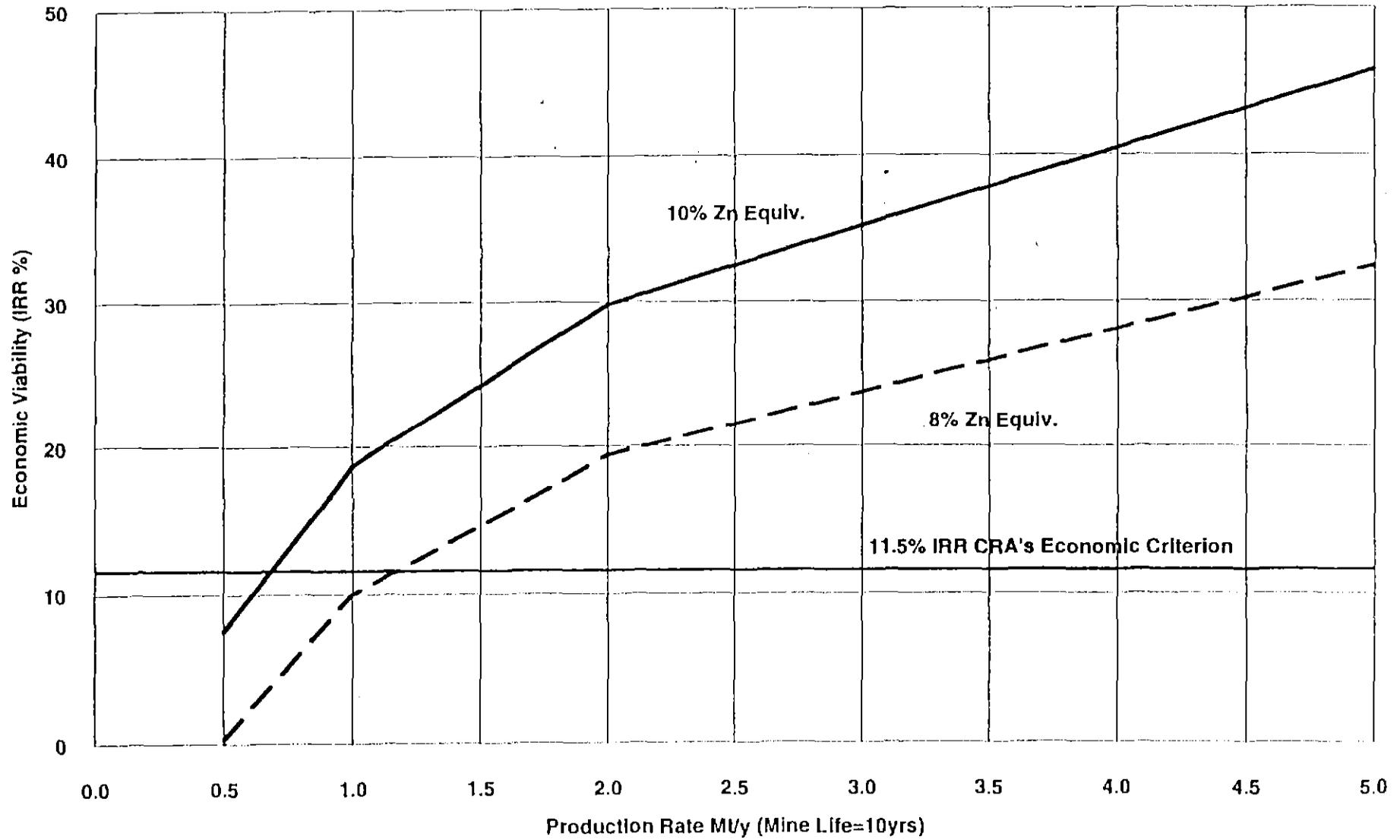
The surficial clays appear to have about 90% of contained zinc as sphalerite. Although the mining of the clay will pose some problems, a number of 500 000 t deposits containing 3% to 4% Zn equivalent has the potential to underpin a viable project treating 1 Mt/y of clay. Figure 3 shows the operating margin as a function of the proportion of zinc as sphalerite. Figure 4 shows the tonnes of reserves needed for project viability range from about 4 Mt at 3.4% Zn equivalent to about 20 Mt at 2.4% Zn equivalent.

Altered (sideritic) limestone underlying the mineralised clays could be mined after the clays are removed but if only 30% of zinc is as sphalerite much higher grades will be needed for viability. Figure 5 shows the operating margin as a function of the proportion of zinc as sphalerite for grades of 4% and 6% zinc equivalent.

Some detailed test work is recommended to check the metallurgical response of the various surface mineralisation types.

Fig. 1 : Zeehan Zinc - Limestone Hosted Primary Sulphide Ore

IRR vs. Production Rate



**Fig. 2 : Zeehan Zinc - Limestone Hosted Primary Sulphide Ore  
Mineable Reserve for Viability**

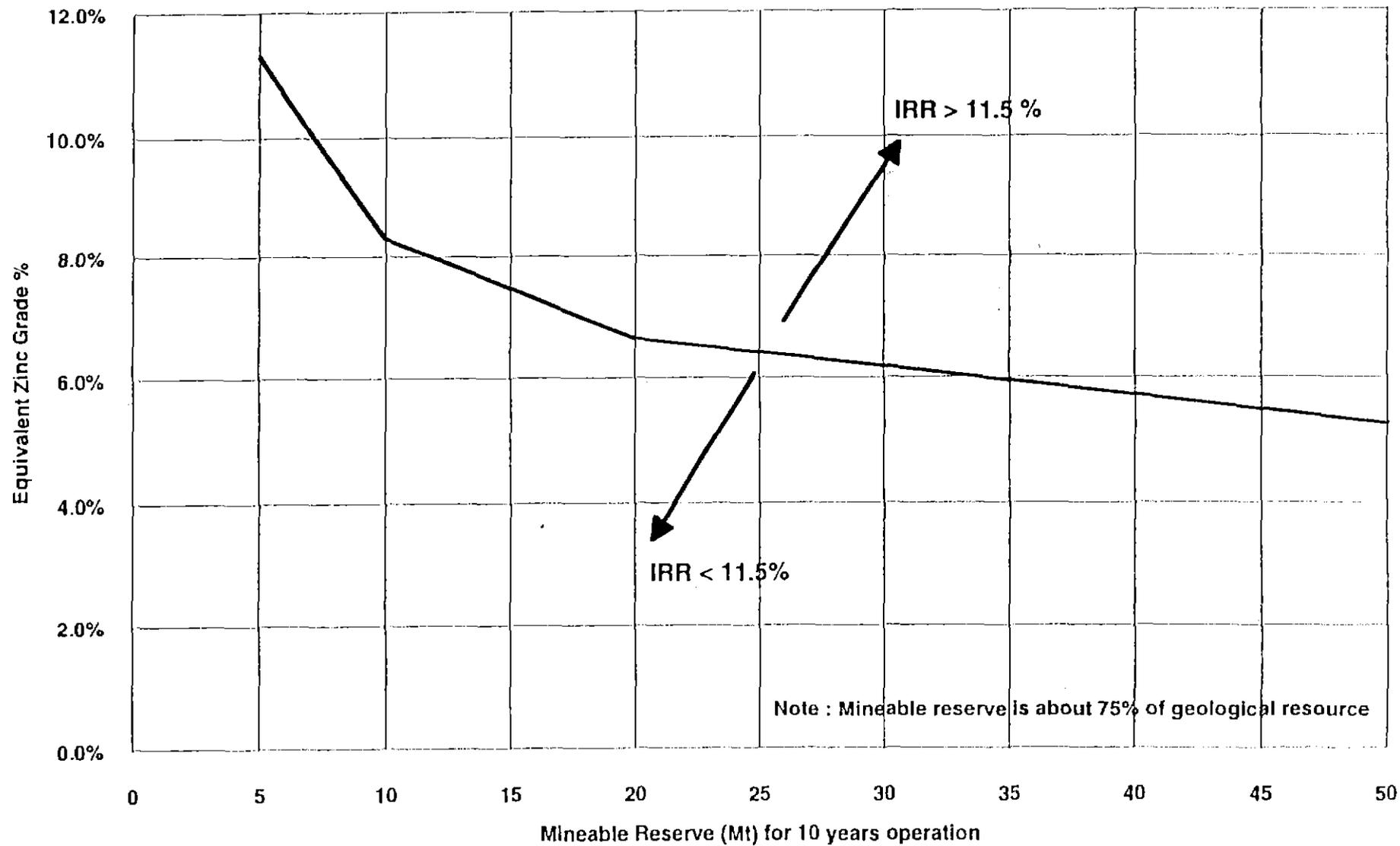
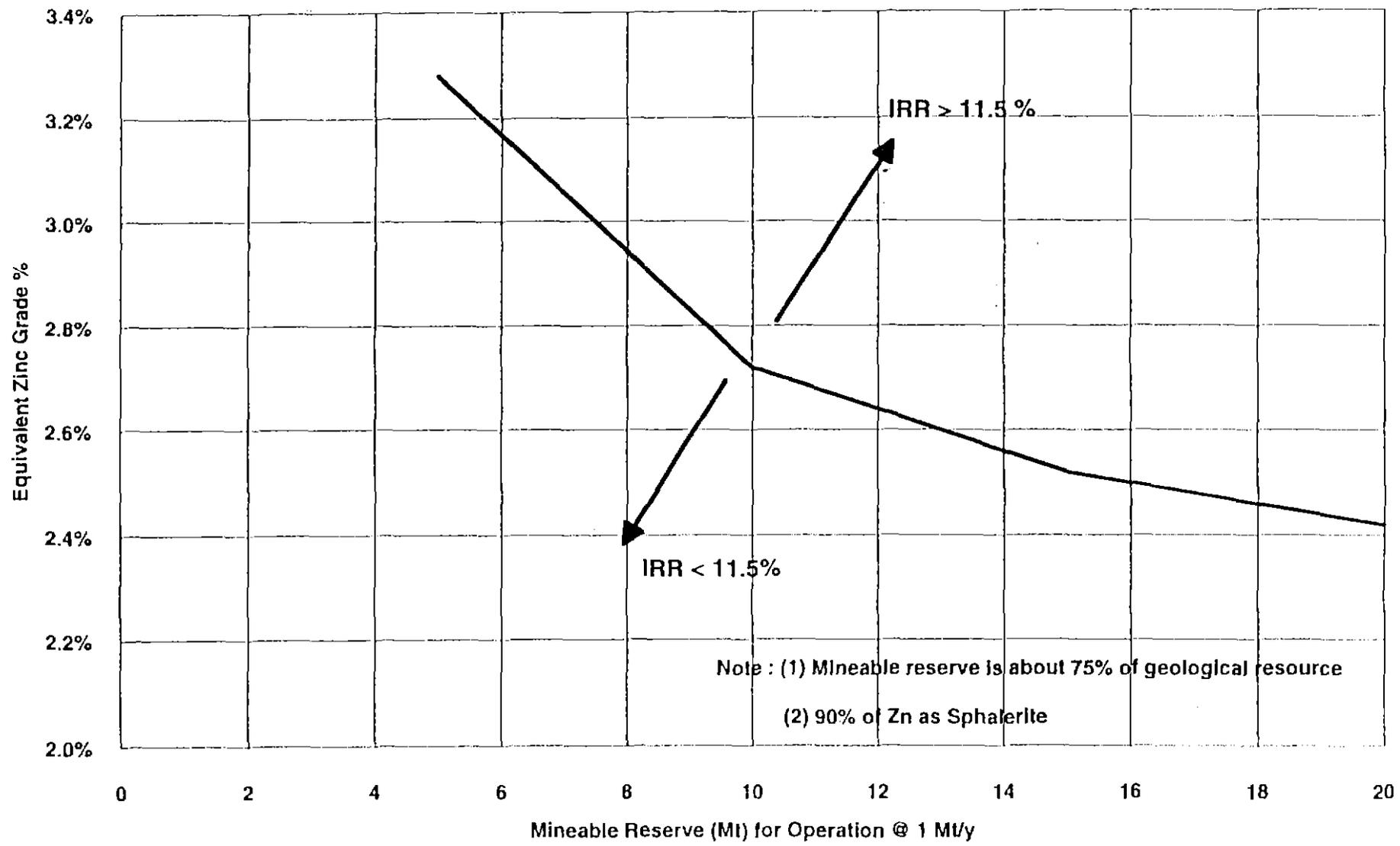


Fig. 4 : Zeehan Zinc - Surficial Clay  
Mineable Reserve for Viability



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Fig. 3 : Zeehan Zinc - Surficial Clay  
Operating Margin vs. % of Zn in Sphalerite

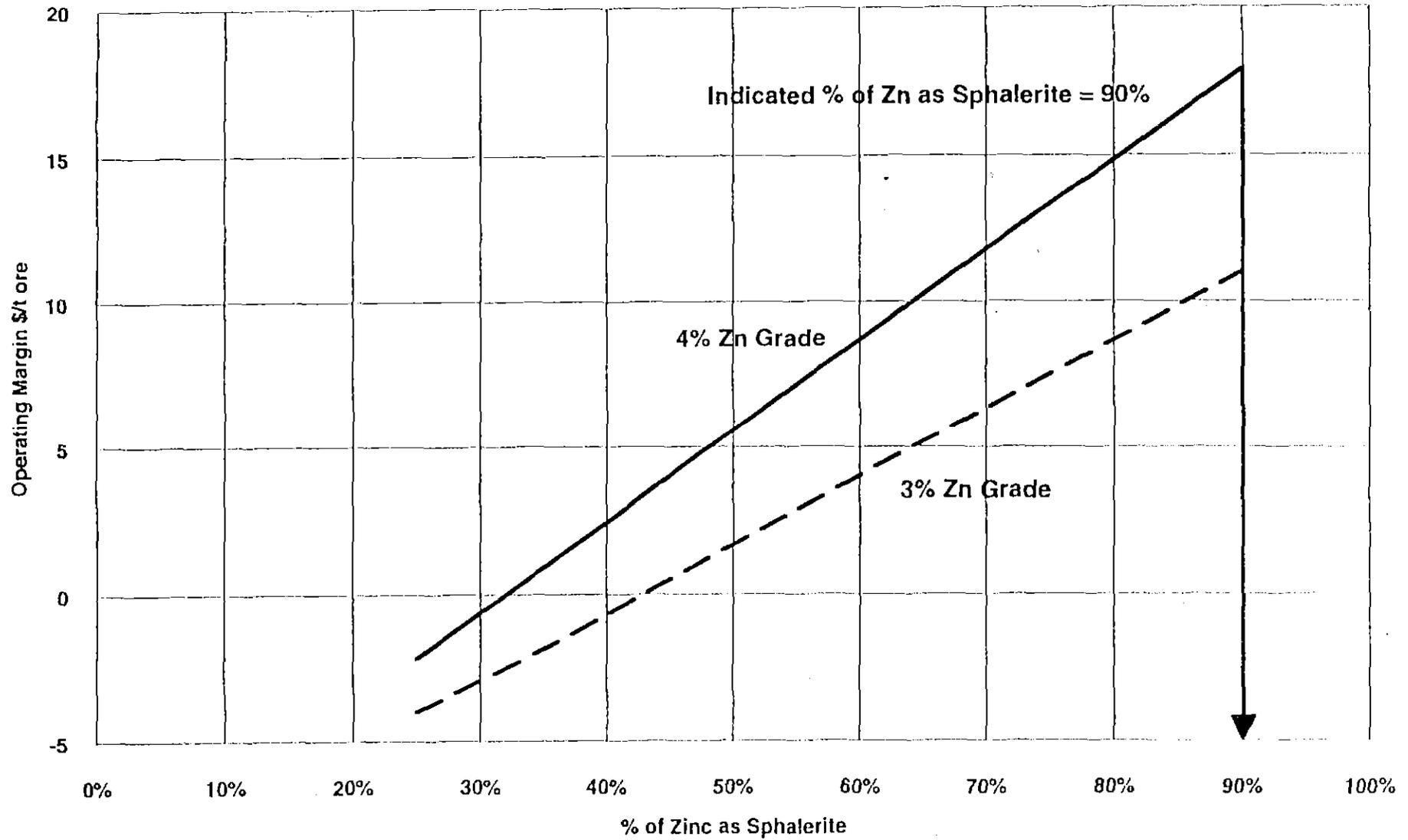
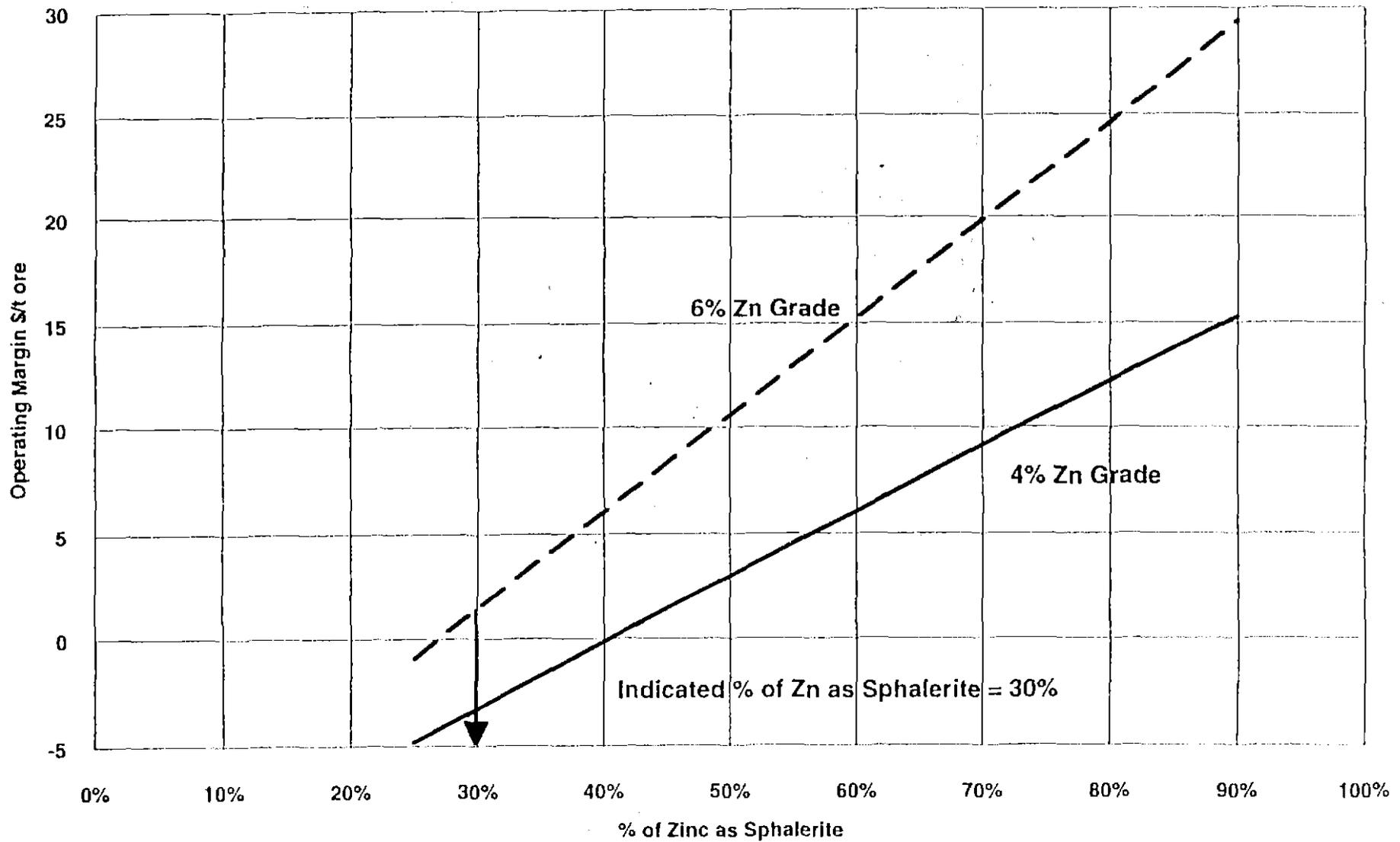


Fig. 5 : Zeehan Zinc - Sideritic Carbonate  
Operating Margin vs. % of Zn in Sphalerite



## 1 BACKGROUND

CRA Resource & Processing Developments has asked Minenco to provide a financial evaluation framework which can be used as a guide to the economic viability of various zinc resources in the Zeehan area of Tasmania.

The main exploration objective is the discovery of major limestone hosted primary zinc sulphide resources.

The known occurrence of near surface zinc deposits in clays derived from weathering of the underlying limestones is also relevant to potential project development.

This report presents some preliminary concepts and costs for a range of deposits and develops parameters for project viability.

## 2 GEOLOGICAL SETTING

The Zeehan basin lies between the Mt Read volcanics and the Heemskirk granite.

It has conglomerates at the base, then the Gordon Limestone which outcrops over about 60 strike km, 50 km of which CRAE has under tenure either outright or in joint venture with Allegiance. Other leases are held by Renison Goldfields and Pasmafinco.

The Oceana deposit (4 Mt at 19.4% Pb, 4% Zn, 106 g/t Ag) is within the Pasmafinco lease.

The Gordon Limestone is considered prospective for major primary zinc resources.

## 3.1 Conceptual Target

The conceptual target is a vertical deposit 10 to 20 m wide containing 10% Zn equivalent which commences 200 m below surface and extends to 600 m below surface. The resource tonnages generated are shown below.

Table 1 : Primary Sulphide Ore Conceptual Resources

Strike Length, m	Million of Tonnes of Ore		
	500	1 000	2 000
10 m wide	6	12	24
20 m wide	12	24	48

## 3.2 Mining Method and Cost

The mining method proposed is long hole open stoping without backfill because of the expected good ground conditions. Ore recovery of 65% and mining dilution of 10% at zero grade are nominated.

Access is by decline from the surface. Ore is hoisted from the mine.

Mine dewatering requirement is likely to be substantial. (The small Oceana mine is reported to have been pumping 11 400 tonnes of water per day when it closed in 1960.)

Operating cost estimates for mining rates of 0.5, 1, 2 and 5 Mt/y are \$22.50/t, \$20.25, \$18.25 and \$15.50/t respectively.

Order of magnitude capital costs are shown in Table 3.

## 3.3 Ore Processing Concept and Cost

The conceptual plant provided to prepare zinc (and lead) concentrates comprises:

- Primary crushing
- Two stage autogenous grinding with pebble crushing
- Lead flotation



## 3.4 Total Operating Costs

Table 1 : Total Operating Costs, A\$/t Ore

Mt/y	Mining \$/t	Concentrator \$/t	Admin and Services		Conc Trans \$/t	Total Op Cost \$/t
			People	\$/t		
0.5	22.50	6.9	30	6.3	7.4	43.1
1	20.25	5.8	34	4.5	7.4	38.0
2	18.25	4.8	40	3.5	7.4	34.0
5	15.50	4.1	60	3.0	7.4	30.0

The total operating costs expressed in US\$/lb of contained zinc in concentrate are shown in Table 2 for 10% Zn equivalent ore.

Table 2 : Total Operating Costs, US\$/lb Contained Zinc

Mt/y	Cost US\$/lb Contained Zinc			
	Site Operating	Freight	Smelter Charges	Total
0.5	12.6	2.7	26.0	41.3
1	10.8	2.7	26.0	39.5
2	9.4	2.7	26.0	38.1
5	8.0	2.7	26.0	36.7

## 3.5 Total Capital Costs

Table 3 : Total Capital Costs, A\$ M

Mt/y	Mine	Conc'r	Conc Transp	Infra	Const and EPCM	Location Adjust	Total
0.5	80	14	1	6	15	3	119
1	100	22	1	8	23	5	159
2	140	36	1	12	39	9	237
5	240	69	2	21	81	17	430

### 3.6 Revenue

Mined Ore grade	10% Zn equivalent
Zinc recovery, %	90
Conc grade, % Zn	52
t conc/t ore	0.173
A\$/t concentrate (excluding freight)	490 (Zn US\$0.56/lb, A\$1 = US\$0.70)
A\$/t ore (excluding freight)	85

### 3.7 Financial Viability Parameters

Figure 1 shows a plot of internal rate of return against production rate. For grades of 10% and 8% equivalent zinc, the production rates needed to meet CRA's hurdle rate of 11.5% are 0.7 and 1.2 Mt/y respectively.

Figure 2 shows the general curve for financial viability (as 11.5% IRR) relating ore grade and mineable ore reserve. If a mineable reserve of 50 Mt was available the viable grade is less than 6% zinc equivalent.

### 3.8 Financial Assumptions

#### *Economic assumptions*

Key assumptions in 1993 dollars are based on CRA's long term forecasts of August 1993.

Zinc price, US\$/lb	0.56
US\$/A\$ exchange rate	0.70
Australian CPI	3%
US GDP	3%

#### *Zinc concentrate sales terms to Risdon*

Sales terms assumed for zinc concentrate to Risdon include a treatment charge of US\$200/tonne of concentrate, at a zinc price of US\$1 235, CIF Risdon. Metal paid is 85% of zinc content with a minimum deduction of 8 units.

These terms are equivalent to a payment of 53.5% of contained zinc or US\$343 per tonne of zinc concentrate.

### *Zinc concentrate transport costs*

The analysis assume the zinc concentrate to be road hauled from Zeehan to Rosebery, railed to Burnie and from there shipped to Risdon (a similar route to that used for Rosebery zinc concentrates). A breakdown of the costs is shown in the table below.

	Cost A\$/wmt
Zeehan to Rosebery by road	3.00
Rosebery to Burnie by rail	13.30
Port handling charges at Burnie	7.60
	23.90
Sea freight from Burnie to Risdon (US\$11.0/wmt, includes unloading at Risdon)	15.70
	39.60

Zinc concentrate is assumed to have an 8% moisture content for the calculation of transport cost.

### *Capital deductions for tax allowances*

Costs associated with mine, mine services and infrastructure are deducted on a straight line basis over ten years, with the benefits commencing in the same year as the expenditure is incurred.

All plant and equipment costs associated with the concentrator are deducted using a depreciation rate of 30% on a declining balance basis. Benefits are taken from the commencement of mining operations.

### *Taxation rate*

Corporate income tax is calculated at 33% of taxable income, with franking imputation included. The actual tax rate for tax calculation is 16.5%.

### *Timing of tax payments*

Where taxes are payable, it is assumed that 30% of the liability is paid in the same year it is incurred and the balance in the following year.

Where the project generates an annual loss, the project is credited with the tax benefit immediately.

### *Royalty*

Royalty is calculated in accordance with the current guidelines in Tasmania. It is assessed at 1% of net sales plus a percentage of annual net profits, the percentage varying in direct proportion to the rate of annual profit to net sales in accordance with the following formula.

$$\text{Royalty} = 1\% \text{ of net sales} + \text{profit} \times \left[ 0.3 \text{ of } \frac{\text{profit}}{\text{net sales}} \right]$$

Net sales is assumed to be defined as revenue after the deduction of smelter charges.

Profit is assumed to be defined as book profit which is before tax and after depreciation.

### *Working capital*

In addition to the capital costs associated with bringing the mine on line, a working capital allowance is also required to fund the production and transport of zinc concentrate to Risdon until payments are received. This allowance takes into consideration the impact of debtors, creditors, operating stores holding and concentrate stocks. Working capital costs for the four production rates investigated are shown in the table below.

Mt/y Ore	\$M
0.5	3.2
1	5.7
2	10.4
5	23.7

## 4 NEAR-SURFACE MINERALISATION

### 4.1 Mineralisation Types

#### 1. Surficial clays and very weathered limestones

These are remnants of the Gordon limestone and are in the form of black clays which are highly acidic and highly reducing.

The highest grade areas of the Grieves surficial clay contain a minor part of the zinc as zinc-bearing clay (fraipontite, chlorite, serpentinite), some in zinc bearing siderite, but more than 90% of the zinc occurs as low iron sphalerite.

#### 2. Altered sideritic carbonate

A dipping and plunging zone often/usually exists below the surficial clay which contains siderite altered carbonate. The rock texture is "rubbly" or "coarse sandy".

The zinc is mostly in solid solution in the (Ca, Fe, Mn, Zn) carbonate with only about 30% as sphalerite.

#### 3. Stratabound clay

Beneath the siderite alteration there may exist a stratabound clay unit which can also carry zinc as sphalerite and, to a major extent, a zinc-rich clay.

### 4.2 Potential for Metallurgical Recovery

20 samples have been looked at for mineralogy by "quantitative" XRD (Amdel Report G838800G/94).

A summary of the zinc distribution is shown in Table 4. Of the 20 samples, only three were estimated to contain zinc solely as sphalerite. Siderite is the other major form of zinc.

Table 4 : Zinc Occurrence by Mineralisation Type

Mineralisation Type	Sample No.	% Zn	Distribution of Zinc, %		
			Sphalerite	Chlorite	Siderite
1. Surficial clays and very weathered limestones	004	10.3	100	-	-
	028	9.3	91	-	8
	073	6.1	100	-	-
	338	13.4	68	28	3
	445	13.5	94	-	6
	464	8.9	100	-	-
	650	3.1	93	7	-
	Arithmetic average			92	5
2. Sideritic carbonate	036	7.2	26	-	74
	041	7.2	9	-	91
	080	9.8	16	-	84
	220	4.2	65	10	26
	228	5.5	34	29	37
	229	16.7	3	8	89
	230	29.8	69	13	18
	341	2.3	35	-	64
	431	4.2	33	-	67
	447	10.8	29	-	71
	659	8.4	27	1	73
	663	15.1	-	-	100
	Arithmetic average			29	5
3. Stratabound Clay	244	20.0	35	62	-

The potential for zinc recovery is likely to be governed by the proportion present as sphalerite.

#### 1. Surficial clays and very weathered limestones

An expectation of 90% of the zinc in the form of sphalerite is supported by the Amdel quantitative mineralogy. This suggests zinc flotation recovery could be about 80%, assuming about 90% of sphalerite is recovered by flotation.

A concentrate grade of 52% Zn could be assumed, taking an optimistic view of pyrite depression.

The amount of grinding required can be estimated from an available sizing analysis but flotation reagent requirements and performance are not able to be forecast with any surety. The most favourable reagent assumptions are that flotation can be carried out at the natural pH and that only xanthate collector and copper sulphate activator will be needed.

This is too optimistic because the reported natural pH is acidic, the pyrite in the ore may float readily and the sphalerite may not. pH adjustment to the 7 to 8 range will probably be needed.

## 2. Altered sideritic carbonate

The proportion of zinc as sphalerite in the 12 samples examined varies between 0 and 69%, and averages 29%.

The other major source of zinc is siderite and while this may be able to be recovered by flotation after sulphidisation the low and variable amount of zinc in the carbonate (2-18% Zn) makes production of a high grade concentrate from this material impossible. Treatment cost for this stage will be higher than for sphalerite flotation.

Some grinding will be required but flotation at natural pH is more likely to be possible because of the carbonate in the ore.

Recovery of zinc by acid leaching is a less likely option because most of the materials have appreciable acid consuming carbonates (calcite, dolomite and siderite).

## 3. Stratabound clays

The proportion of zinc as sphalerite is not well defined at present because only one sample has been examined. This sample contained 35% of the zinc as sphalerite and 62% in chlorite. Reagent cost and recovery features are likely to be similar to the surficial clays.

A sphalerite recovery of 90% can again be assumed in a concentrate of 52% Zn. The other zinc seems to be as chlorite (for which selective recovery is not very likely) and as higher grade (still <20% Zn) siderite. Recovery of zinc to saleable concentrates from chlorite and siderite can be disregarded.

#### 4.3 Annual Production Estimates

The annual production of concentrate and contained zinc assuming 90% recovery of sphalerite and no recovery of zinc from clay or carbonate is shown below for 1 Mt/y of 4% Zn.

% of Zinc as Sphalerite	Zinc Recovery %	Concentrate dmt/y	Contained Zinc t/y
25	22.5	17 310	9 000
50	45	34 620	18 000
75	67.5	51 920	27 000
90	81	62 310	32 400

#### 4.4 Mining Concepts for Near-Surface Mineralisation

##### 1. Clay

Averaging the three Grieves prospect cross sections provided for 48200N, 48000N and 47800N, (see attached spreadsheet) one could infer the black clay mineralisation develops around 1 500 tonnes per metre of strike. If the strike length is say 500 metres then the Grieves resource (and yet to be delineated other resources along strike) contains around 650 000 tonnes of the black sphalerite bearing clay. An indicative tonnage estimate of around 500 000 tonnes of black clay per deposit is proposed.

Topographically, the region is flat and experiences a relatively temperate to cool climate with significant rainfall. The clay by definition is puggy. Excavation from surface by mechanical load/haul means will require extremely low bearing pressure equipment. The combined effect of the clay's material handling characteristics, the local hydrology and the climate will make the operation of such equipment in this way very difficult.

Entering the deposit from the east where the basal limestone comes nearest to surface could be an approach. The clay would be excavated by equipment running on the top of the limestone working to a full height clay ore face.

Other concepts for mining/processing the black clays include:

- (i) Hydraulic monitors to feed the black clay/water slurry to multi stage centrifugal pumps to pump the ore to a central permanent processing plant.
  - Clay may be difficult to slurry. Assume that slurry will be directed to a screening and thickening plant at the mine for water recovery. Assume 40% solids pulp density for transfer to plant.
  - At the plant the slurry is delivered to a surge tank and hence to the grinding mill and flotation.
  - Tailings to be pumped from the process plant, dewatered and placed back into a previously mined out resource. Particle distribution of the tailings will govern how efficiently this activity can be performed. A tailings dam of say 1.0 Mt capacity adjacent to the process plant is required for periodic use.
  - Mine planning will involve detailed design of water management, pumping and piping design, dewatering and permanent placement of tailings, final topography contouring and flora revegetation.
- (ii) The Marconaflo system, say from a crane or large jib, could replace the monitor/pump arrangement.
- (iii) Rather than a permanent process plant, a modular mobile process plant temporarily located to serve say three or four resources could be contemplated.
  - Allows reduced pumping distances to plant for ore and from plant to tailings disposal areas.
  - Grinding capacity will need to be provided in three or four units to facilitate relocation (a 900 kW mill is not easily moved).
  - Relocation, loss of production, environmental demands etc probably offset any perceived benefits when compared to a permanently located process plant.

- (iv) Similarly a floating, modular process plant(s) located on pontoons immediately behind the Marconaflo/cutter suction dredging system is another option. The flotation process plant would be designed around minimum floor space flotation techniques.

There are several difficulties with this concept.

- A floating plant is not well suited to a number of small deposits because of the need to move when each is mined out.
  - Tailings disposal may need to be in another site to avoid mixing with newly mined ore.
  - The floating plant would be quite large because of the need to either thicken before flotation or have a large flotation capacity to handle dilute pulps.
- (v) Dewatering dredged black clay slurry onto a stockpile pad whereby the clay has the opportunity to be further dewatered before being loaded and hauled by rubber tyre equipment to a permanent processing plant may be worth considering. This would introduce additional water management problems.

To accommodate the bulk style mining concept, ideally the resource mineralisation needs to be relatively continuous and limited at its base by fresh limestone.

#### *Mining capital cost estimate*

A preliminary capital cost estimate for establishing a 1 Mt/y mining system using hydraulic monitoring has been based on the following concepts:

- A central grinding/flotation plant located, on average 3 km from each of about ten deposits each containing 0.5 Mt of clay ore.
- Two deposits are equipped for mining at all times.
- An active deposit has -
  - water supply pond,
  - pumps to recover the dilute (10% solids) clay slurry,
  - a screening and thickening plant,
  - pump sets to deliver thickened (40% solids) clay slurry to the grinding/flotation plant,

- pipelines to supply water, deliver slurry to the plants, tailings to previously mined areas and reclaim water from the tailings areas,
  - power transmission lines from the grinding/flotation plant.
- Twice a year one of the screening/thickening plants will need to be moved to a new deposit to maintain ore supply.
  - About every five years, the grinding flotation plant would be moved to a new location.

The costing of this concept is a preliminary order of magnitude estimate of unspecified accuracy which is probably adequate for the purpose of indicating the size of the cumulative resource needed to make a viable stand-alone project from mining surficial clays.

	\$M
Mechanical equipment	5.3
Pipelines	2.0
Transmission lines and sub-station	0.7
Tailings dam and ponds	0.3
<b>Total initial capital</b>	<b>8.3</b>

In addition, an annual cost of \$0.25 M has been provided to prepare two new resources for mining.

#### *Mining operating cost estimate*

A preliminary mining cost estimate of \$2.3/t of clay based on the hydraulic monitoring concepts described above is shown below.

	\$/t Ore
Mining	1.20
Screening/thickening	0.45
Pumping ore/tailings/water supply	0.40
	<hr/>
	2.05
Contingency	0.25
	<hr/>
<b>TOTAL</b>	<b>2.30</b>
	<hr/> <hr/>

## 2. Siderite altered carbonate

Traditional hard rock drill/blast/load mining techniques will be employed to excavate the limestone and expose the iron carbonate altered limestone and the strata bound clays. Removal of non mineralised or sub economic black clay is necessary - note the permanent placement of such material may be difficult and expensive exercise. Mining of the sandy iron carbonate and strata bound clay ores to be by similar load/haul methods employed for the limestone with possibly additional dozer assistance.

The following average (from the three Grieves cross sections) open pit profiles are based on a 500 metre strike resource.

Depth	Ore Tonnes	Waste Tonnes	Waste/Ore Ratio
down to 50 metres	1 880 000	3 370 000	1.8 : 1
down to 100 metres	3 230 000	8 560 000	2.6 : 1

Note: Includes black clay tonnage of 750 000 t.

CRAE's prediction of 0.5 Mt of black clay and 0.5 Mt of iron carbonate/stratabound clays per resource looks reasonable. An overall stripping ratio of say 2:1 might be possible. This could escalate owing to haul road placement and removal of mobile clays away from the pit limits.

A preliminary estimate of a contractor's rate for mining of \$5/t ore has been made, based on \$5/m<sup>3</sup> and 2 : 1 stripping ratio.

## 4.5 Processing Plant Concepts

### 1. Mining by excavation

The two plants described below envisage 1 Mt/y of ores being mined from several deposits and transported in daylight hours to a central facility which operates continuously.

At this stage of the assessment, there is no provision for a second stage of "oxide zinc" flotation to attempt recovery of zinc bearing clays and carbonates. Such a process may be technically possible but it seems likely to be uneconomic because of the relatively low zinc content (less than 20% Zn) of the clay and carbonate minerals.

### *Clays*

The clay ores will be stacked on the ground and reclaimed by front end loader to a wash hopper and trommel plant similar to those operated on gold and sapphire ores in the Inverell district of NSW.

The clays are assumed to have a feed sizing of 80% passing 0.6 mm (as per sample 3753497 sized by CRA ATD).

Grinding to 80% -100 micron is by a 900 kW ball mill.

Two operators per shift are needed to feed the plant and prepare flotation feed slurry.

The flotation plant is estimated to require 25% solids pulp and 30 minutes pulp residence time.

Flotation concentrate is thickened and filtered on shift and loaded to transport on day shift.

27 personnel are required to operate and maintain the plant and laboratory.

Installed power is 1 870 kW.

### *Altered carbonate*

Ores from mines are dumped through a twin shaft sizer on day shift and conveyed to a conical stockpile at -250 mm size.

One operator on day shift can handle and crush the ore.

Grinding is by single stage SAG mill to produce flotation feed of 80% - 100 micron. A Work Index of 10 kWh/t is assumed which requires an installed mill power of 1 600 kW.

The flotation and concentrate dewatering plant is similar to that of the clay ore.

A total of 22 people are required.

Installed power is 2820 kW.

## 2. Mining by Hydraulic Monitoring

### *Pumping and pipeline sizes*

For 125 t/h ore (1 Mt/y) and 10% solids the pulp flow is 1 167 m<sup>3</sup>/h (0.32 m<sup>3</sup>/s) and required pipeline diameter is 350 mm (to maintain a flow velocity of 3.5 m/sec).

When this slurry is thickened to 40% solids, the slurry flow reduces to 230 m<sup>3</sup>/h and the required pipeline diameter to 150 mm.

The benefit of thickening adjacent to the mine is in the lower cost of smaller pipelines and the lower power required to pump ore slurry to the plant and tailings water back to the mine.

The thickener for plant feed would be about 20 m diameter (assuming area required is 0.1 m<sup>2</sup>/t/d).

The grinding and flotation sections plant would be similar to that described for excavated clay.

### 4.6 Capital Cost Estimates

By comparison with the \$22 M estimate for the capital cost of a 1 Mt/y primary sulphide concentrator assumptions of \$20 M and \$22 M have been made for clay and altered carbonate ores respectively.

### 4.7 Processing Cost Estimates

Preliminary estimates are summarised below.

	Clay Ores \$/t Ore	Altered Carbonate \$/t Ore
Labour	1.62	1.32
Power	0.74	1.05
Operating supplies	1.10	0.92
Maintenance supplies	0.60	0.66
Sub-total	4.06	3.95
Contingency, 10%	0.41	0.40
<b>Total</b>	<b>4.47</b>	<b>4.35</b>

#### 4.8 Value of the Mineralisation

Table 5 shows the net value (as \$/t operating margin) of the two main mineralisation types for a total zinc grade of 4% Zn at a range of proportions of zinc in the form of sphalerite. The main assumptions in this table are shown below.

Recovery of sphalerite	90%
Zinc price	US\$0.56/lb
Smelter treatment charge	US\$200/t of conc.
Smelter reference price	US\$1235/t zinc (= US\$0.56/lb)
Concentrate freight to Risdon	A\$40/wet tonne of conc
US\$ : A\$	0.70

The surficial clays with 90% of the zinc as sphalerite have an operating margin of about A\$18/t of ore which can be used to pay for the capital, royalty and taxes and provide a profit.

The sideritic carbonates have no operating margin if less than 50% of the zinc is present as sphalerite (compared with the estimate of 30% zinc as sphalerite).

Figures 3 and 5 show the operating margins as a function of percentage of zinc in sphalerite for two ore grades.

#### 4.9 Size of Clay Resources Needed for Viability

A project based on 1 Mt/y of surficial clays could have an initial capital cost of about \$45 M.

The operating cost estimate (from Table 5) is A\$9.9/tonne.

The financial outcome is expressed in Figure 4 as ore grade vs total mineable reserve for an IRR of 11.5%.

Total reserves of about 16 Mt and 8 Mt are required for viability for 2.5% and 3% Zn equivalent ore respectively.

#### 4.10 Value of Clay Resources to an Underground Ore Project

If an underground resource is discovered, it would probably be an advantage to start the project by treating clays in the plant while the underground mine was being developed. Subsequent treatment in separate circuits would probably be required.

Table 5 : Indicative Value and Operating Margin of Each Near-Surface Mineralisation Type

Clay

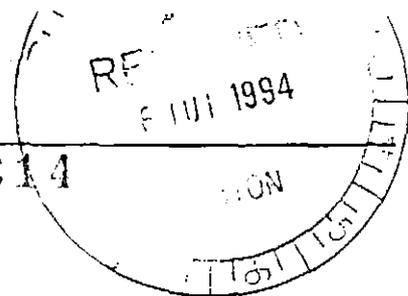
% of Zinc as Sphalerite	Head Grade % Zn	% Recovery	Conc Grade % Zn	Smelter Payment %	Value of Deposit		t Conc/t Ore	Freight US\$/t Ore	Net Value of Ore		Mining Incl Pre-strip A\$/t Ore	Processing A\$/t Ore	Admin & Services Cost A\$/t Ore	Total Cost A\$/t Ore	Operating Margin A\$/t Ore
					US\$/t Conc	US\$/t Ore			US\$/t Ore	A\$/t Ore					
90	4.0	90.0	52.0	53.5	343.2	21.4	0.0623	1.9	19.5	27.8	2.3	4.5	3.1	9.9	17.9
75	4.0	90.0	52.0	53.5	343.2	17.8	0.0519	1.6	16.2	23.2	2.3	4.5	3.1	9.9	13.3
50	4.0	90.0	52.0	53.5	343.2	11.9	0.0346	1.1	10.8	15.5	2.3	4.5	3.1	9.9	5.6
35	4.0	90.0	52.0	53.5	343.2	8.3	0.0242	0.7	7.6	10.8	2.3	4.5	3.1	9.9	0.9
25	4.0	90.0	52.0	53.5	343.2	5.9	0.0173	0.5	5.4	7.7	2.3	4.5	3.1	9.9	-2.2
90	4.0	90.0	56.0	56.1	387.7	22.4	0.0579	1.8	20.7	29.5	2.3	4.5	3.1	9.9	19.6

Sideritic Carbonate

% of Zinc as Sphalerite	Head Grade % Zn	% Recovery	Conc Grade % Zn	Smelter Payment %	Value of Deposit		t Conc/t Ore	Freight US\$/t Ore	Net Value of Ore		Mining Incl Pre-strip A\$/t Ore	Processing A\$/t Ore	Admin & Services Cost A\$/t Ore	Total Cost A\$/t Ore	Operating Margin A\$/t Ore
					US\$/t Conc	US\$/t Ore			US\$/t Ore	A\$/t Ore					
90	4.0	90.0	52.0	53.5	343.2	21.4	0.0623	1.9	19.5	27.8	5.0	4.4	3.1	12.5	15.3
75	4.0	90.0	52.0	53.5	343.2	17.8	0.0519	1.6	16.2	23.2	5.0	4.4	3.1	12.5	10.7
50	4.0	90.0	52.0	53.5	343.2	11.9	0.0346	1.1	10.8	15.5	5.0	4.4	3.1	12.5	3.0
35	4.0	90.0	52.0	53.5	343.2	8.3	0.0242	0.7	7.6	10.8	5.0	4.4	3.1	12.5	-1.7
25	4.0	90.0	52.0	53.5	343.2	5.9	0.0173	0.5	5.4	7.7	5.0	4.4	3.1	12.5	-4.8
90	4.0	90.0	56.0	56.1	387.7	22.4	0.0579	1.8	20.7	29.5	5.0	4.4	3.1	12.5	17.0

#### 4.11 Next Steps

An important step in assessing the near-surface deposits will be to determine the value of the mineralisation by investigating the metallurgical performances of a number of samples of each type. This work would be aimed at confirming conditions for sphalerite flotation, sphalerite recovery rate, and grade of concentrate produced. It would also be useful to establish acid consumption figures to check the assumption that acid leaching is not feasible.



19.

303314

# MEMORANDUM

DATE: July 1, 1994

TO: IG Gould  
WJ Atkinson CRAE Perth  
TW Dickson CRAE Eastern Region

COPY: JA Innes  
MD Lavery

FROM: RJ Batterham

SUBJECT: **Zeehan Zinc Prospect**

Attached is Mick Lavery's summary comments on this prospect.

R&PD recognises the value of early comment on exploration prospects and offers comments in the expectation that they may be of some use in guiding what is still obviously an exploration target.

## Surficial Clays

At this stage it would appear that the surficial clays could sustain a viable operation if the resource were of the order of 6-8 million tonnes (it is presently at 0.5 million tonnes). While the mining method is relatively straight forward the water and slurry management in and between the open pits and the central processing plant adds to the cost.

The dipping altered siderite carbonates and strata bound clays do not look too promising as the fraction of zinc appearing as sphalerite is too low. Zinc associated with the chloride and siderite is unable to be upgraded to a marketable zinc product.

## Limestone Hosted Primary Zinc Sulphide Resource

A steeply dipping 10 to 20 metre wide resource, located between 200 and 600 metres below the surface, producing around 0.7 mtpa at a head grade of 10% Zn would support a viable operation, i.e. a 10 million tonne resource striking over 500 metres.

Conventional mining methods have been assumed with excessive water being a potential threat.

First indications, surprisingly, are that there is no great location advantage for Zeehan as concentrates must be transported to Rosebery by road whence they go by rail to Burnie and then by sea to Risdon.

RJ Batterham

RESOURCES AND PROCESSING DEVELOPMENTS

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## Memorandum

6th June 1994

File 1.Z1  
Tom Dickson

To : ~~R J Batterham~~

From : Michael Lavery

Subject : Zeehan Zinc Prospect,  
Tasmania

## 1. Task

A brief preliminary economic assessment/discussion of the Zeehan zinc prospects currently being explored by CRAE was sought by Ian Gould. A limestone hosted primary zinc sulphide resource being the main prize.

## 2. Approach

Taking into account a description of the current exploration status and long term objectives, as provided by Tom Dickson and Rod Parkinson of CRAE Victoria/Tasmania, R&PD was invited to carry out a financial evaluation framework for use as a guide to the economic variability of various zinc resources in the Zeehan prospect. Minenco's study, R3204 dated June 1994, detailing the basis of the estimate is attached.

## 3. Conclusions

## 3.1. Limestone Hosted Primary Zinc Sulphide Resource

A conceptualised steeply dipping 10 to 20 metre wide limestone hosted primary zinc sulphide resource located between 200 and 600 metres below the surface, producing 700,000 tonnes of ore per annum at a head grade of 10% equivalent zinc will sustain an economically viable operation.

Lower head grade demands a higher production rate and based on a ten year mine life, a larger resource. At 8% equivalent zinc head grade a production rate of 1.2 million tonnes is suggested, ie a geological resource of around 16 million tonnes. At 6% equivalent zinc head grade a production rate of 3.4 million tonnes is implied, ie a geological resource of around 45 million tonnes.

Production rate sensitivity based on a 10% and 8% equivalent zinc head grade and a ten year mine life with project internal rate of return is given in figure 1. Equivalent zinc grade and mineable reserve sensitivities based on a ten year mine life with CRA's 11.5% internal rate of return criteria are given in figure 2.

Excess water may be encountered in the underground mining and impact on operating costs.

### 3.2. Zinc Bearing, Black Surficial Clays, Altered Siderite Carbonates and Stratabound Clays.

Subordinate to the limestone hosted primary zinc sulphide resource target are the drill intersected, zinc bearing black surficial clays (~90% sphalerite) and the steeply dipping, zinc bearing, altered siderite carbonate (~30% sphalerite) and stratabound clay zones (~35% sphalerite).

The potential for producing a saleable concentrate is governed by the proportion of zinc present as sphalerite. Economic assessment was focused on the surficial clays given that zinc flotation concentrate from the siderite and zinc chlorite mineralisation is unlikely to exceed ~20% Zn grade and be deemed unsaleable.

Sensitivity of zinc associated with sphalerite at a 4% and 3% zinc head grade with operating margins (net value available to pay for capital expenditure, royalty, tax and return on investment) is given in figure 3. At a 4% zinc head grade an operating margin of around \$18.00 is reported.

To sustain an economically viable operation, a series of surficial black clay resources totalling around 5.5 million tonnes, being processed at a production rate of 1 million tonnes per annum at a head grade of between 3 and 4% zinc of which 90% of the zinc reports as sphalerite is required.

Equivalent zinc grade and mineable reserve sensitivity based on a 1 million tonne per annum production rate with CRA's 11.5% internal rate of return criteria is given in figure 4.

## 4. Summary

### 4.1. Limestone Hosted Primary Zinc Sulphide Resource

Resource tonnages generated by a conceptual underground target (200 to 600 metres below surface) are as follows,

Strike Length, metres	Million of Tonnes of Resource		
	500	1,000	2000
10 metre Resource Width	6	12	24
20 metre Resource Width	12	24	48

Proposed mining method is by long hole open stoping without back fill. Ore recovery of 65% and mining dilution of 10% at zero grade are nominated. Access is by decline and ore will be shaft hoisted.

A conceptual plant will involve, primary crushing, two stage autogenous grinding with pebble crushing, lead flotation, zinc flotation, concentrate thickening and filtration and tailings thickening.

A summary of production and cost details based on a 10% equivalent zinc head grade follow,

Item	Annual Production Rate			
	0.5 Mt/y	1.0 Mt/y	2.0 Mt/y	5.0 Mt/y
Zinc Recovery	90%	90%	90%	90%
Tonnes of Zinc Concentrate Produced	86,538	173,077	346,154	865,384
Grade of Zinc Concentrate	52%	52%	52%	52%
Tonnes of Zinc Produced	45,000	90,000	180,000	450,000
Zeehan/Risdon Transport Cost				
Per wet tonne of Concentrate	\$39.60	\$39.60	\$39.60	\$39.60
Per tonne of ore milled	\$7.40	\$7.40	\$7.40	\$7.40
Total Operating Cost				
Per tonne of ore milled	\$43.10	\$38.00	\$34.00	\$30.00
US Cents per Pound of Zinc Recovered	US41.3c	US39.5c	US38.1c	US36.7c
Total Project Capital Cost	\$119M	\$159M	\$237M	\$430M

#### 4.2. Zinc Bearing, Black Surficial Clays, Altered Siderite Carbonates and Stratabound Clays.

Drilling has intersected zinc mineralisation associated with surficial black clays, and steeply dipping altered siderite carbonates and stratabound clays. Present knowledge suggests the following average zinc mineralogical distribution.

Mineralisation Type	Distribution of Zinc %		
	Sphalerite	Chlorite	Siderite
Surficial Clays and very weathered limestones (based on 7 samples)	92	5	3
Siderite Carbonate (based on 12 samples)	29	5	66
Stratabound Clay (based on 1 sample)	35	62	-

The potential for economic viability is governed by the proportion of zinc present as sphalerite. Siderite may be recovered by flotation but the low variable amount of zinc in the carbonate (2-18% Zn) makes production of a high grade concentrate from this material impossible. Selective recovery of a zinc chlorite is also considered unlikely. Recovery of zinc by acid leaching is a less likely option given most of the material comprises of acid consuming carbonates (calcite, dolomite and siderite).

Various mining concepts were contemplated. The preliminary capital and operating cost estimate for establishing a 1 million tonne per annum operation is based on a hydraulic mining system servicing a central grinding/flotation process plant located on average 3 kms from each of about 10 deposits each containing 0.5 million tonnes of surficial clay. Two deposits are needed to be available for mining at all times and be equipped with a water supply pond, pumps to recover the

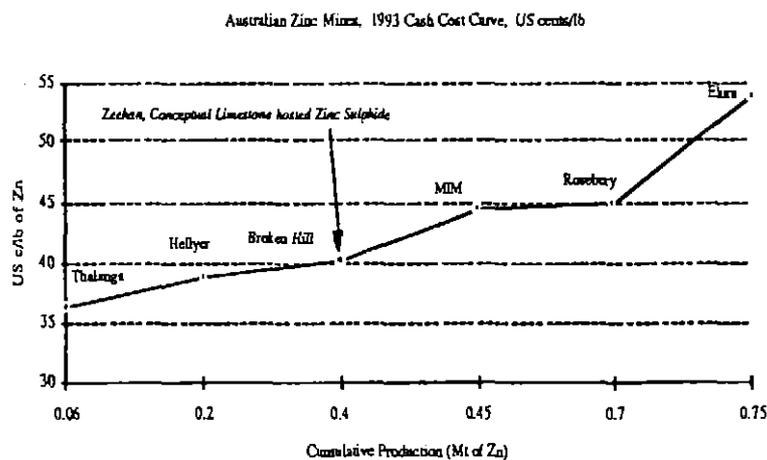
dilute (10% solids) clay slurry, a screening and thickening plant, pumps to deliver thickened (40% solids) clay slurry to the process plant, pipelines to supply water, deliver slurry to the plant, tailings to previously mined out areas and reclaim water from the tailings areas, power transmission from the process plant. To maintain ore supply, the screening and thickening plants will be relocated twice a year to a new deposit. Envisaged about every five years the process plant will be moved to a suitable new location.

A summary of production and cost details based on a 4% equivalent zinc head grade follows,

Item	1 Million Tonne per Annum Production Rate			
	90% Zn as Sphalerite	75% Zn as Sphalerite	50% Zn as Sphalerite	35% Zn as Sphalerite
Recovery of Zinc as Sphalerite	90%	90%	90%	90%
Tonnes of Zinc Concentrate Produced	62,300	51,923	34,615	24,231
Grade of Zinc Concentrate	52%	52%	52%	52%
Tonnes of Zinc Produced	32,400	27,000	18,000	12,600
<i>Zeehan/Risdon Transport Cost</i>				
Per wet tonne of Concentrate	\$39.60	\$39.60	\$39.60	\$39.60
Per tonne of ore milled	\$7.40	\$7.40	\$7.40	\$7.40
<i>Total Operating Cost</i>				
Per tonne of ore milled	\$11.80	\$11.50	\$11.00	\$10.60
US Cents per Pound of Zinc Recovered	US18.4c	US29.5c	US45.4c	US52.7c
Total Project Capital Cost	~\$45M	~\$45M	~\$45M	~\$45M

##### 5. "Look alike"

A comparison of the Zeehan primary sulphide zinc cash operating cost with various Australian base metal operating mines follows.



A general comparison of the envisaged Zeehan project with potential Australian non ferrous base metal projects is depicted in attachment No 1.

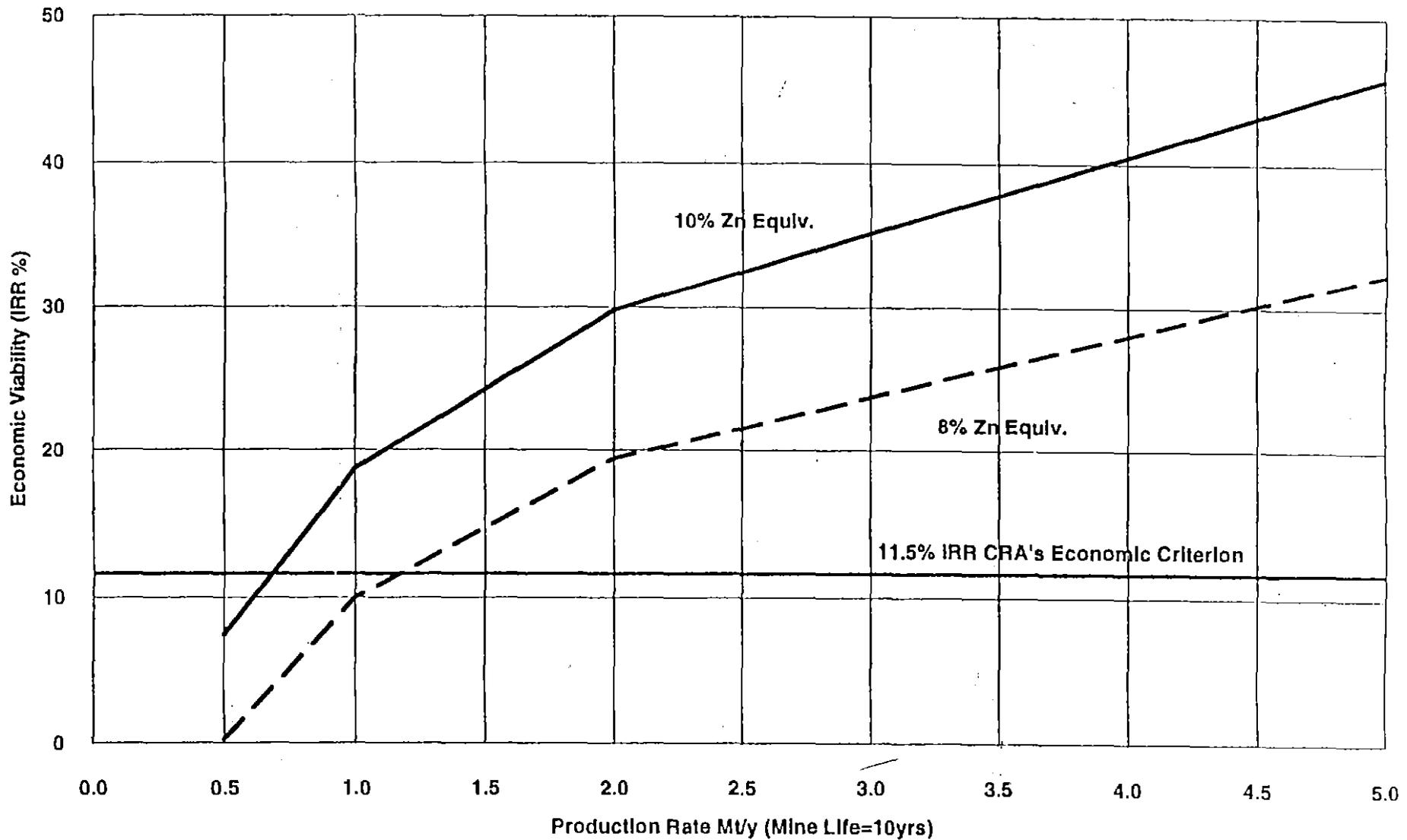
Based on present knowledge the "order of magnitude" estimates applied to the Zeehan resources seem reasonable.

4

Michael Laverty

Resource and Processing Developments

Fig. 1 : Zeehan Zinc - Limestone Hosted Primary Sulphide Ore  
IRR vs. Production Rate



**Fig. 2 : Zeehan Zinc - Limestone Hosted Primary Sulphide Ore**  
**Mineable Reserve for Viability**

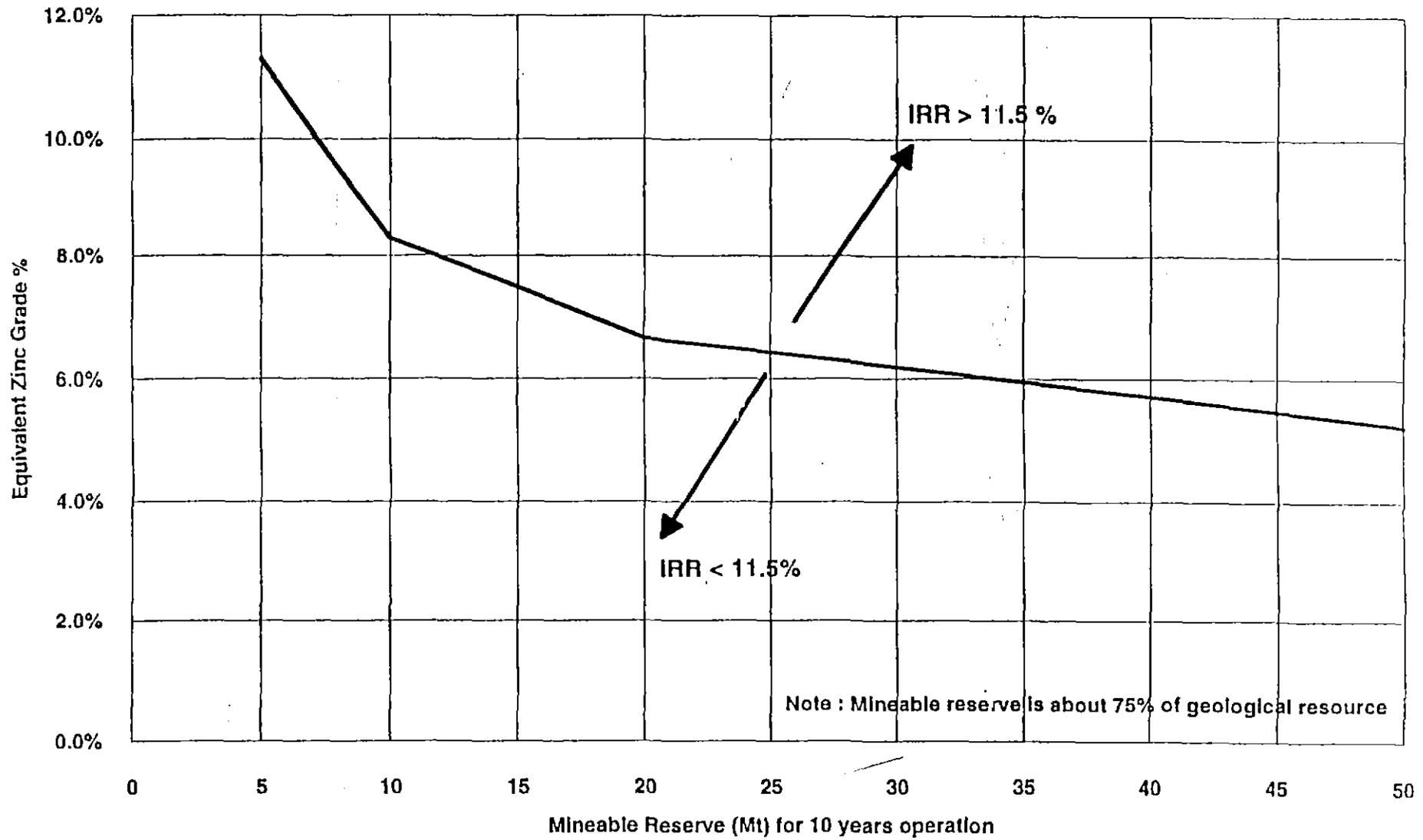
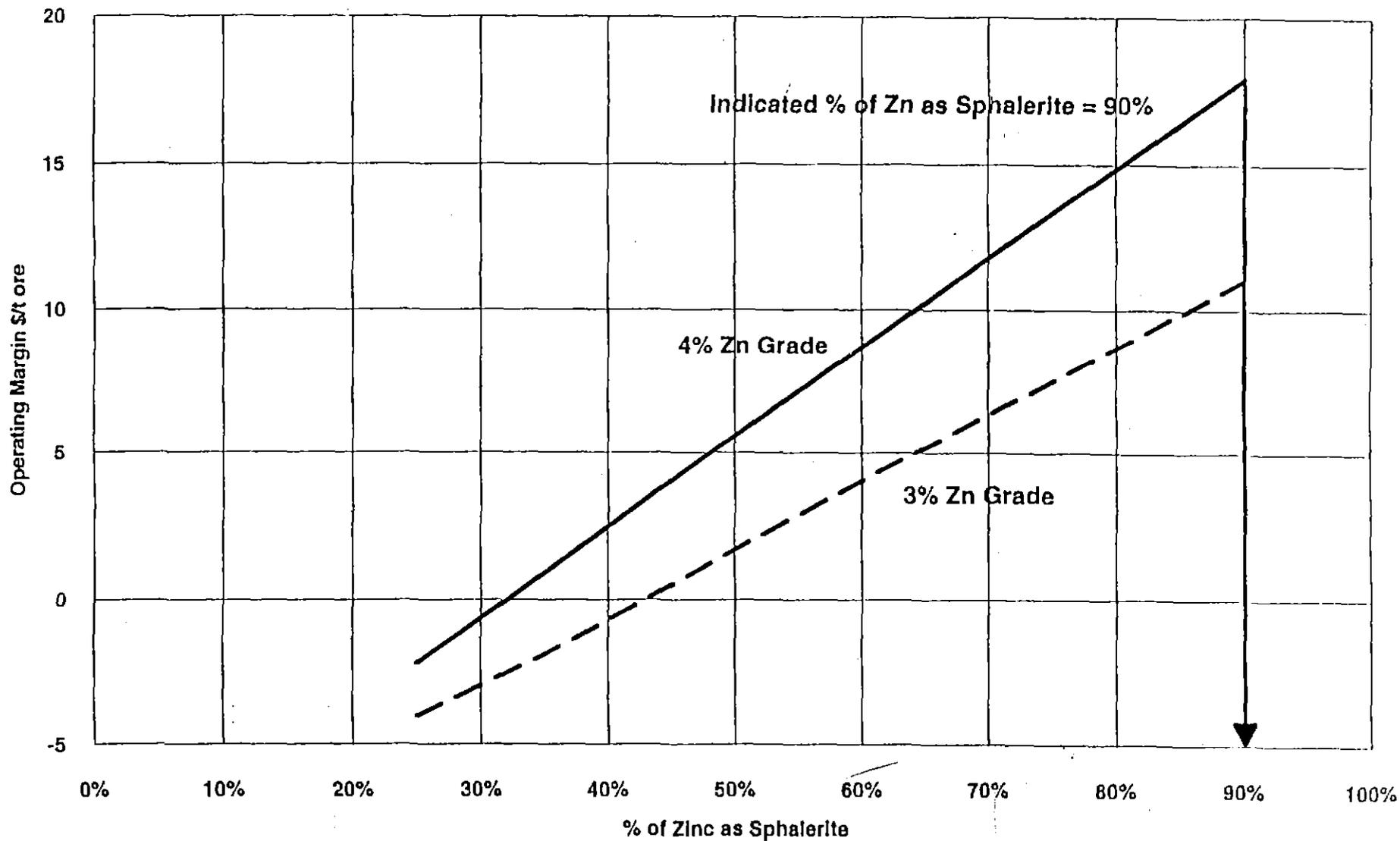
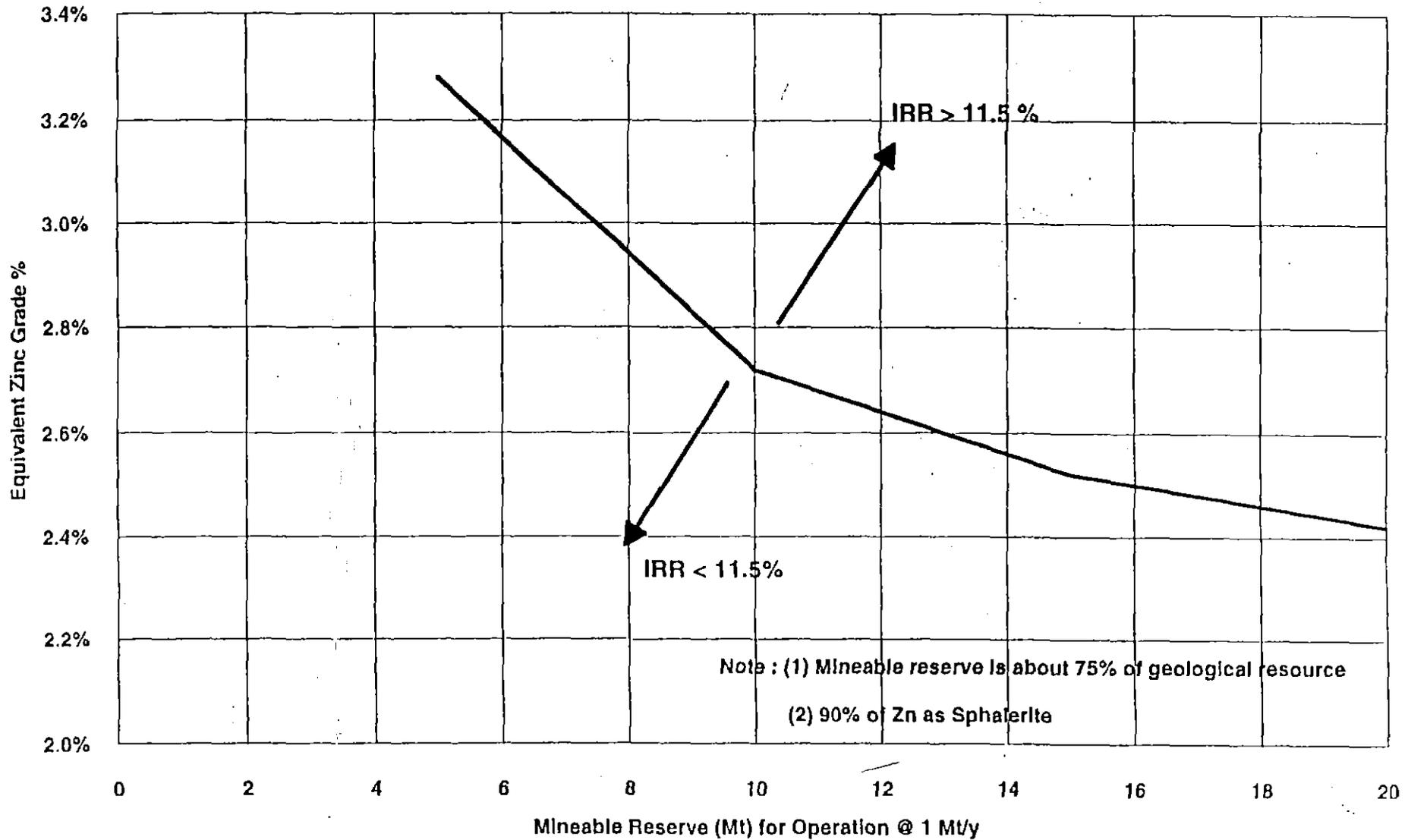


Fig. 3 : Zeehan Zinc - Surficial Clay  
Operating Margin vs. % of Zn in Sphalerite



303322

Fig. 4 : Zeehan Zinc - Surficial Clay  
Mineable Reserve for Viability



303323

## Australian Base Metal Projects General Description

Project	Method	Tonnes treated per year (Mt)	Capital Cost ASM	Operating Cost A\$/t
<b>1. Under Construction</b>				
Mt Keith, - nickel	open pit/float	6.6	450	?
McArthur River, - lead/zinc	ug/float	1.2	290	53.30
NBH Peko, - copper/gold	open pit/ug/float	3.7	220	?
<b>2. Under Consideration</b>				
Honeymoon Well, - nickel	open pit/ug/float	3.0	300	25.00
Dugald River, - lead/zinc	ug/float	0.8	110	45.00
Ernest Henry, - copper/gold	open pit/float	6.0	250	14.00
Cannington, - silver/lead/zinc	ug/float	1.5	225	40.00
Bulong, - nickel/copper	open pit/float	1.2	135	?
Lady Loretta, silver/lead/zinc	ug/float	0.5	115	55.00
<b>3. Zeehan Zinc, primary sulphide</b>				
	ug/float	0.5	119	43.10
		1.0	159	38.00
		2.0	237	34.00
		5.0	430	30.00

## Various Australian Base Metal Operating Mines Production/Grade Performance

Item	Hellyer	Rosebery	Broken Hill.	Elura	MIM	Thalanga	Zeehan
Tonnes Mtpa	1.25	0.56	2.5	0.95	5.23	0.65	1.00
<b>Head grades</b>							
Zinc, %	13.5	10.4	9.0	8.8	7.0	10.4	10.0
Lead, %	7.3	3.2	6.7	5.7	5.6	2.4	-
Silver, g/t	156	104	77	90	132	115	-
Zinc Recovery, %	53	89.5	92.5	75	62	86.8	90
Concentrate Grade, %Zn	51	54.2	52.5	49.0	50.3	56.0	52
Tonnes of Conc pa	174,000	106,000	376,000	90,800	385,000	93,000	173,000
Tonnes of Zinc pa	88,900	57,500	198,300	37,200	255,800	54,900	90,000

APPENDIX 10

Diamond drill core magnetic susceptibility measurements

## Appendix 10: Grievaa prospect. Magnetic susceptibility measurements on CRAE drill core.

susceptibility readings are x10<sup>-3</sup> SI

HOLE	DFROM	DTO	SAMPNO	FIELDID	TEXTURE	ALT/MIN	COLOUR	COMMENTS	Fe%	Zn	M Sus
ZG104	0.00	5.35		Cg							
ZG104	5.35	6.70		Ccy				No Rec.			0.04
ZG104	6.70	9.50	3753647	Sls			G	Poor Rec	2.02	9300	0.12
ZG104	9.50	10.60	3753648	Ccy			DG	Poor Rec	1.22	13300	0.00
ZG104	10.60	12.25	3753649	Ccy			DG	Poor Rec	1.22	27300	0.10
ZG104	12.25	14.35	3753650	Ccy			DG	Poor Rec	1.41	31100	0.03
ZG104	14.35	15.50	3753651	CcySls			DGN	Poor Rec	0.99	9200	0.05
ZG104	15.50	16.95	3753652	SlsCcy			NV		0.38	3416	0.07
ZG104	16.95	18.55	3753653	SlsCcy			DG	Poor Rec	1.07	6300	0.05
ZG104	18.55	19.50	3753654	SlsCcy			DG	Poor Rec	1.85	2737	0.02
ZG104	19.50	20.50	3753655	Sls			DG		1.62	2049	0.10
ZG104	20.50	21.80	3753656	Sls			DG		1.39	2956	0.20
ZG104	21.80	22.60		Ccy?				No Rec.			
ZG104	22.60	23.80	3753657	SlsCcy			DG		1.17	2857	1.00
ZG104	23.80	25.05	3753658	SlsCcy			DG	Poor Rec	1.66	3249	0.35
ZG104	25.05	27.30		Ccy?				No Rec.			
ZG104	27.30	29.10	3753659	Sls	Al	Sd	YB	Poor Rec	21.20	84200	0.30
ZG104	29.10	31.50	3753660	Sls	Al	Sd	YB	Poor Rec	37.70	53100	1.00
ZG104	31.50	32.60	3753661	Sls	Al	Sd	YB	Poor Rec	45.00	36200	1.00
ZG104	32.60	34.00	3753662	Sls	Al	Sd	YB	Poor Rec	38.00	92100	0.60
ZG104	34.00	35.10	3753663	Sls	Al	Sd	YB	Poor Rec	34.30	151000	0.70
ZG104	35.10	36.70	3753664	Sls	Al	Sd	YB	Poor Rec	34.90	123000	0.50
ZG105	0.00	2.80		Cg				No rec.			
ZG105	2.80	3.20		Ccy				Poor Rec			0.03
ZG105	3.20	4.40	3753665	Ccy			DG		1.74	25000	0.00
ZG105	4.40	4.95	3753666	Ccy			DG		2.43	30300	0.00
ZG105	4.95	5.60	3753667	Ccy			DG	Poor Rec	1.16	28700	0.02
ZG105	5.60	6.65	3753668	Ccy			DG	Poor Rec	1.52	13400	0.05
ZG105	6.65	7.30	3753669	Ccy			DG	Poor Rec	1.65	8300	0.00
ZG105	7.30	8.30	3753670	Ccy	Al	Sd	YB	Poor Rec	1.61	11000	0.00
ZG105	8.30	9.30	3753671	CcySls			DG		2.03	9700	0.00
ZG105	9.30	10.30	3753672	CcySls	Al	Sd	DGY		9.16	9200	0.30
ZG105	10.30	11.80	3753673	CcySls			DG	Poor Rec	38.40	10400	0.30
ZG105	11.80	13.90		CcySls?				No rec.			
ZG105	13.90	14.60	3753676	CcySls			DG	Poor Rec	53.50	16900	0.90
ZG105	14.60	15.10	3753676	Sls	Al	Sd	YB	Poor Rec	53.50	16900	1.50
ZG105	15.10	15.85	3753677	Sls	Al	Sd	YB	Poor Rec	50.40	19000	1.10
ZG105	15.85	16.90	3753679	Sls	Al	Sd	YB	Poor Rec	48.60	17800	0.70
ZG105	16.90	17.70	3753681	Sls	Al	Sd	YB	Poor Rec	49.10	17100	0.40
ZG105	17.70	18.90	3753683	Sls	Al	Sd	YB	Poor Rec	51.70	17900	0.50
ZG105	18.90	20.30	3753685	Sls	AlDs	SdGa	YB	Poor Rec	28.40	14400	0.15
ZG105	20.30	22.00	3753687	Sls	AlDs	SdGa	YB		9.98	8100	0.05
ZG105	22.00	23.20	3753689	Sls			LG	Oolitic	4.01	2294	0.03
ZG105	23.20	24.75	3753691	Sls			LG	Oolitic	1.20	2056	0.05
ZG105	24.75	25.90	3753693	Sls			LG	Oolitic	1.41	2335	0.05
ZG105	25.90	27.10	3753695	Sls			LG	Oolitic	7.50	7300	0.25
ZG105	27.10	28.20	3753697	Sls			LG	Oolitic	1.45	7100	0.06
ZG105	28.20	28.90	3753699	Sls			LG	Oolitic	1.47	1120	0.06
ZG105	28.90	30.30	3753701	Sls			LG	Oolitic	13.00	11900	0.15
ZG105	30.30	31.70	3753703	Ccy			DG		1.67	9300	0.05
ZG105	31.70	33.15	3753704	Ccy			DG		1.57	2647	0.00
ZG105	33.15	34.50	3753706	Ccy			DG		1.14	2363	0.00
ZG105	34.50	35.50	3753708	Ccy			DG	Poor Rec	1.40	2237	0.00
ZG105	35.50	36.30	3753710	Ccy			DG		2.02	2142	0.00
ZG105	36.30	37.00		Ccy?				No rec.			0.00
ZG105	37.00	38.25	3753713	Ccy			DG	Poor Rec	1.78	2046	0.00
ZG105	38.25	39.25	3753715	Ccy			DG	Poor Rec	2.03	1370	0.00
ZG105	39.25	40.45	3753717	Sls			LG	Poor Rec	11.80	13500	0.04
ZG105	40.45	40.90	3753719	Mg?			LG		0.54	160	0.00
ZG106	0.00	2.90		Cg				Peat and gravel			
ZG106	2.90	4.40	3757901	Sls			G	In situ?	1.15	95	0.05
ZG106	4.40	5.90		CgSls							0.00
ZG106	5.90	7.90						No rec.			
ZG106	7.90	8.90	3757902	Ccy			DB		1.08	299	0.00
ZG106	8.90	9.80						No rec.			0.00
ZG106	9.80	10.60	3757903	CgCcy					14.60	1870	0.00
ZG106	10.60	10.85	3757903	CcyOms		Py	DB	Massive Py in clay	14.60	1870	0.00
ZG106	10.85	14.80	3757904	Sls			G	Lime mudstone	0.62	32	0.07
ZG106	14.80	18.80	3757905	CcySls	WeVnFr	Cc	DGDB		1.28	530	0.03
ZG106	18.80	23.00	3757906	Sls			G	Lime mudstone	0.35	85	0.07
ZG106	23.00	27.00	3757907	Sls			G	Lime mudstone	0.60	68	0.10
ZG106	27.00	31.15	3757908	Sls			G	Lime mudstone	0.57	27	0.04
ZG106	31.15	35.90	3757909	Sls	Fr		G	Lime mudstone	0.72	144	0.06
ZG106	35.90	40.50	3757910	Sls	Fr		G	Lime mudstone	0.84	101	0.05
ZG106	40.50	45.00	3757911	Sls	Fr		G	Lime mudstone	0.62	83	0.07
ZG106	45.00	49.50	3757912	SlsObx	BxVn	DI	G	Low angle fault	2.27	1160	0.06
ZG106	49.50	49.80	3757913	Oms		Py	YB	Low angle fault	25.20	10100	0.06
ZG106	49.80	51.50	3757914	SlsObx	BxVn	DI	G	Low angle fault	0.93	632	0.06

HOLE	DFROM	DTO	SAMPNO	FIELDID	TEXTURE	ALT/MIN	COLOUR	COMMENTS	Fe%	Zn	M Sus
ZG106	51.50	56.50	3757915	Sls	Fr		LG	Lime mudstone	0.33	105	0.07
ZG106	56.50	58.30	3757916	Sls	Fr		AGDG	Lime mudstone	0.62	194	0.05
ZG106	58.30	59.75	3757917	Scl	BxVn	Di	LG		0.25	173	0.05
ZG106	59.75	64.55	3757918	Sls	Fr		G	Calcarenite	0.44	75	0.07
ZG106	64.55	69.45	3757919	Sls	Fr		G	Calcarenite	0.43	110	0.07
ZG106	69.45	71.90	3757920	Ovc		Di	W	Dolomite vein	0.39	489	0.06
ZG106	71.90	75.50	3757921	Sls			AGDG	Lime mudstone	0.76	355	0.11
ZG106	75.50	80.00	3757922	Sls	Ma		LG	Lime mudstone	0.46	209	0.08
ZG106	80.00	84.60	3757923	Sls	Ma		LG	Lime mudstone	0.27	85	0.07
ZG106	84.60	86.65	3757924	Sls			AGDG	Lime mudstone	1.22	297	0.09
ZG106	86.65	88.25	3757925	Scl	Lm		LG	Dolomite mudstone	0.15	154	0.05
ZG106	88.25	93.00	3757926	Scl			LG	Dolomite mudstone	0.16	194	0.09
ZG106	93.00	96.75	3757927	SlsScl			AGDG	Partly dolomitised lime mudstone	0.35	123	0.13
ZG106	96.75	100.00	3757928	SlsScl	Fr		AGDG	Partly dolomitised lime mudstone	0.37	224	0.11
ZG106	100.00	103.00	3757929	Oi			DG	Fault zone, high angle to C.A.	0.37	263	0.05
ZG106	103.00	106.50	3757930	Sls	Vn	Di	AGDG	Lime mudstone	0.67	216	0.10
ZG106	106.50	109.90	3757931	Sls	Vn	Di	AGDG	Lime mudstone	0.41	276	0.06
ZG106	109.90	113.60	3757932	SlsSbs	Fs		DG	Carbonaceous lst	0.73	344	0.07
ZG106	113.60	118.65	3757933	Sls	Ma		G	Calcarenite	0.63	198	0.18
ZG106	118.65	121.00	3757934	Sls	Fr		G	Bioclastic lst	0.67	1330	0.25
ZG106	121.00	122.70	3757935	SlsSbs	Fs		DG	Carbonaceous lst	1.39	2340	0.17
ZG106	122.70	123.70	3757936	Scl	AlBx	SdHe	LG	Ankerite/haematite altered skeletal dolomite	1.53	1180	0.12
ZG106	123.70	124.90	3757937	Scl	AlBx	SdHe	LG	Ankerite/haematite altered skeletal dolomite	1.24	1930	0.10
ZG106	124.90	126.10	3757938	Scl	AlBx	SdHe	LG	Ankerite/haematite altered skeletal dolomite	0.69	1010	0.07
ZG106	126.10	127.10	3757939	Scl	AlBx	SdHe	LG	Ankerite/haematite altered skeletal dolomite	0.58	2010	0.05
ZG106	127.10	128.20	3757940	Ccy			LG		3.67	6700	0.08
ZG106	128.20	129.20	3757941	Ccy			LGFDG		9.40	11800	0.25
ZG106	129.20	130.20	3757942	Ccy			LGFDG		12.30	16000	0.10
ZG106	130.20	131.20	3757943	Ccy			YOBR		7.59	2690	0.05
ZG106	131.20	132.20	3757944	Ccy			YOBR		6.62	2450	0.05
ZG106	132.20	133.20	3757945	Ccy			YOBR		6.79	2220	0.10
ZG106	133.20	134.20	3757946	Ccy			YOBR		19.10	3940	0.05
ZG106	134.20	135.20	3757947	Ccy			YOBR		34.30	7550	0.15
ZG106	135.20	136.20	3757948	Ccy			YOBR		35.00	6820	0.15
ZG106	136.20	137.40	3757949	Ccy			YOBR		26.00	5340	0.20
ZG106	137.40	138.10	3757950	Ccy			YOBR		22.30	4370	0.35
ZG106	138.10	139.30	3757951	CcyCsg	VuBn		AYB		51.50	15700	0.40
ZG106	139.30	140.50	3757952	CcyCsg	VuBn		AYB		50.70	14300	0.30
ZG106	140.50	141.50	3757953	Ccy			YO		23.80	5420	0.20
ZG106	141.50	142.50	3757954	Ccy			YO		28.40	5570	0.15
ZG106	142.50	143.50	3757955	Ccy			YO		27.20	5530	0.15
ZG106	143.50	144.50	3757956	Ccy			YO		30.50	5780	0.20
ZG106	144.50	145.50	3757957	Ccy			YO		25.40	4780	0.20
ZG106	145.50	146.50	3757958	Ccy			YO		26.70	4540	0.15
ZG106	146.50	147.50	3757959	Ccy			YO		28.90	4480	0.25
ZG106	147.50	149.15	3757960	Ccy			YO		25.60	5090	0.12
ZG106	149.15	150.20		Ccy?				No rec. Clay?			0.20
ZG106	150.20	151.70	3757961	Ccy		He	DFP		23.63	4150	0.15
ZG106	151.70	152.70	3757962	Ccy			YB		15.44	3420	0.12
ZG106	152.70	153.70	3757963	Ccy			YB		23.00	3660	0.30
ZG106	153.70	154.70	3757964	Ccy			YB		12.81	1680	0.15
ZG106	154.70	155.70	3757965	Ccy			YB		5.31	1030	0.16
ZG106	155.70	156.70	3757966	Ccy			YB		5.49	634	0.00
ZG106	156.70	157.90	3757967	Ccy			YB		8.69	1200	0.22
ZG106	157.90	161.00	3757968	Sss			LLG		3.44	300	0.09
ZG107	0.00	2.00					Cg	Peat and gravel			0.04
ZG107	2.00	6.00	3757969	Ccy	We		DG	Carbonaceous	2.68	156	0.07
ZG107	6.00	9.50	3757970	CcySls	WeFr		DG	Carbonaceous	2.31	408	0.10
ZG107	9.50	13.00	3757971	CcySls	WeFr		DG	Carbonaceous	4.41	476	0.07
ZG107	13.00	15.20	3757972	Sls			LG		1.07	171	0.05
ZG107	15.20	19.50	3757973	Sls			DG		0.93	42	0.06
ZG107	19.50	23.30	3757974	Sls			GDG		1.09	28	0.10
ZG107	23.30	27.15	3757975	Sls			GDG		1.10	28	0.08
ZG107	27.15	29.10	3757976	Sls			DGB		0.76	16	0.07
ZG107	29.10	32.50	3757977	Sls	Fr		DB	Algal lst?	1.11	34	0.09
ZG107	32.50	37.00	3757978	Sls			GDG	Wispy banded lime mudstone	0.61	27	0.06
ZG107	37.00	41.00	3757979	Sls			GDG	Wispy banded lime mudstone	0.83	13	0.07
ZG107	41.00	45.00	3757980	Sls	Bs	Py	GDG	Wispy banded lime mudstone	1.59	95	0.07
ZG107	45.00	50.00	3757981	Sls			GDG	Wispy banded lime mudstone	0.89	45	0.07
ZG107	50.00	55.00	3757982	Sls			GDG	Wispy banded lime mudstone	0.61	15	0.05
ZG107	55.00	60.00	3757983	Sls	Lm		LG	Finely laminated lime mud	0.96	91	0.11
ZG107	60.00	65.00	3757984	Sls	Lm		LG	Finely laminated lime mud	0.61	59	0.08
ZG107	65.00	70.00	3757985	Sls	Lm		LG	Finely laminated lime mud	0.82	105	0.09
ZG107	70.00	75.00	3757986	Sls	LmBs	Py	LG	Finely laminated lime mud	1.10	901	0.04
ZG107	75.00	80.00	3757987	Sls	Lm		LG	Finely laminated lime mud	0.54	189	0.07
ZG107	80.00	84.00	3757988	Sls	Lm		LG	Finely laminated lime mud	0.92	667	0.05
ZG107	84.00	87.75	3757989	Sls	Lm		LG	Finely laminated lime mud	0.85	735	0.07
ZG107	87.75	92.00	3757990	Sls			G		1.01	878	0.16
ZG107	92.00	96.00	3757991	Sls			G		4.03	9530	0.09
ZG107	96.00	100.00	3757992	Sls			G		1.69	3190	0.08
ZG107	100.00	105.00	3757993	Sls			G		1.13	167	0.12
ZG107	105.00	109.15	3757994	Sls			DG	Wispy banded lime mudstone?	1.41	832	0.10

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HOLE	DFROM	DTO	SAMPNO	FIELDID	TEXTURE	ALT/MIN	COLOUR	COMMENTS	Fe%	Zn	MSus
ZG107	109.15	113.30	3757995	Sls			DG	Wispy banded lime mudstone?	1.85	1740	0.16
ZG107	113.30	117.00	3757996	Sdl	Al	He	LG	Dolomitised carbonate mudstone	1.11	1820	0.08
ZG107	117.00	120.60	3757997	Sdl	Al	He	LG	Dolomitised carbonate mudstone	2.65	5540	0.07
ZG107	120.60	123.95	3757998	Sdl	Al	Sd	LYG	Weakly ankerite altered	9.66	4400	0.85
ZG107	123.95	125.00	3757999	Sdl	Al	Sd	YG	Strongly ankerite altered	34.34	39600	1.40
ZG107	125.00	127.90	3758000	SdlCcy	AlBx	Sd	DGY	Ankeritic breccia frags in sandy clay	11.34	60000	0.09
ZG107	127.90	128.85	3908229	Sdl	Al	Sd	YG	Strongly ankerite altered	26.57	167000	1.80
ZG107	128.85	131.10	3908230	SdlCcy	AlBx	Sd	DGY	Ankeritic breccia frags in sandy clay	15.33	298000	1.15
ZG107	131.10	133.10	3908231	Ccy			DG		3.78	155000	0.04
ZG107	133.10	135.10	3908232	Ccy			DG		1.68	23600	0.03
ZG107	135.10	137.10	3908233	Ccy			DG		1.87	61000	0.04
ZG107	137.10	139.10	3908234	Ccy			DG		2.01	27500	0.03
ZG107	139.10	140.40	3908235	Ccy			DG		2.00	2210	0.15
ZG107	140.40	142.60	3908236	Ccy	GsBxFe		MYFP	Gossanus clay breccia	19.32	5240	0.22
ZG107	142.60	144.20	3908237	Ccy	Bx		MLGDG	Clay breccia	2.00	5190	0.00
ZG107	144.20	146.30	3908238	Ccy	GsBxFe		MYFP	Gossanus clay breccia	35.49	8610	0.32
ZG107	146.30	148.40	3908239	Ccy	GsBxFe		MYFP	Gossanus clay breccia	40.53	8730	0.24
ZG107	148.40	150.50	3908240	Ccy	GsBxFe		MYFP	Gossanus clay breccia	39.27	14100	0.11
ZG107	150.50	152.50	3908241	Ccy	GsBxFe		MYFP	Gossanus clay breccia	32.34	6840	0.20
ZG107	152.50	154.55	3908242	Ccy	GsBxFe		MYFP	Gossanus clay breccia	31.92	7750	0.23
ZG107	154.55	156.60	3908243	Ccy			DGN	Carbonaceous	4.38	125000	0.12
ZG107	156.60	158.70	3908244	Ccy			DGN	Carbonaceous	4.19	200000	0.12
ZG107	158.70	160.80	3908245	Ccy			DGN	Carbonaceous	2.85	174000	0.10
ZG107	160.80	162.90	3908246	Ccy			DGN	Carbonaceous	0.85	56000	0.04
ZG107	162.90	164.90	3908247	Ccy			DGN	Carbonaceous	2.36	3680	0.07
ZG107	164.90	167.00	3908248	CcySss	Ds	Py	DG	Transition to Moine Sst	2.23	1300	0.05
ZG107	167.00	169.10	3908249	CcySsa	Ds	Py	DG	Transition to Moine Sst	1.86	1880	0.04
ZG107	169.10	171.20	3908250	CcySsa	Ds	Py	DG	Transition to Moine Sst	1.83	1110	0.04
ZG107	171.20	175.00	3908251	Sss	Ma		LLG	Moine Sst	0.47	97	0.05
ZG209	0.00	3.00		Cg?				Precollar, no core			
ZG209	3.00	6.10	3908252	Ccy	FeGs?		YG	Light and spongy. Looks gossanus?	4.32	1080	0.05
ZG209	6.10	9.20	3908253	Ccy	FeGs?		YG	Light and spongy. Looks gossanus?	4.22	1320	0.07
ZG209	9.20	13.50	3908254	Ccy	Ds	Py	GLG	!Py 2%	6.58	188	0.08
ZG209	13.50	16.50	3908255	Ccy			DGN	Carbonaceous	2.09	83	0.06
ZG209	16.50	19.50	3908256	Ccy			DGN	Carbonaceous	2.40	117	0.05
ZG209	19.50	22.40	3908257	Ccy			DGN	Carbonaceous	2.23	65	0.13
ZG209	22.40	28.50	3908258	Sls			LGDG	Lime mudstone	1.10	34	0.09
ZG209	28.50	31.50	3908259	Ccy			DEG		2.65	528	0.07
ZG209	31.50	35.10	3908260	Ccy			DEG		4.21	506	0.05
ZG209	35.10	39.00	3908261	Sls			LG	Lime mudstone	0.57	60	0.12
ZG209	39.00	43.00	3908262	Sls			LG	Lime mudstone	0.97	886	0.11
ZG209	43.00	45.80	3908263	Sls	Lm		LG	Very fine g/s lime mudstone	0.97	114	0.12
ZG209	45.80	49.60	3908264	Sls			AGDG	wispy banded lime mudstone	0.90	87	0.10
ZG209	49.60	53.40	3908265	Sls			AGDG	wispy banded lime mudstone	0.70	273	0.09
ZG209	53.40	58.00	3908266	Sls			G	Calcarenit	1.23	40	0.07
ZG209	58.00	62.90	3908267	Sls			G	Calcarenit	0.72	104	0.05
ZG209	62.90	66.40	3908268	Sls			AGDG	wispy banded lime mudstone	0.76	69	0.08
ZG209	66.40	69.95	3908269	Sls			AGDG	wispy banded lime mudstone	0.67	31	0.11
ZG209	69.95	74.10	3908270	Sls	LmFr		LG	Very fine g/s lime mudstone	1.17	129	0.08
ZG209	74.10	78.25	3908271	Sls	LmFr		LG	Very fine g/s lime mudstone	1.04	632	0.09
ZG209	78.25	82.40	3908272	Sls	LmFr		LG	Very fine g/s lime mudstone	0.40	165	0.06
ZG209	82.40	86.00	3908273	Sls			AGDG	wispy banded lime mudstone	0.64	240	0.08
ZG209	86.00	89.60	3908274	Sls			AGDG	wispy banded lime mudstone	1.07	852	0.08
ZG209	89.60	93.10	3908275	Sls			AGDG	wispy banded lime mudstone	1.27	171	0.09
ZG209	93.10	95.00	3908276	Sdl	AlBx	Sd	DG	Patchy weak ankerite alteration	6.61	1700	0.48
ZG209	95.00	97.50	3908277	Sdl	AlBx	Sd	DG	Patchy weak ankerite alteration	12.30	5210	0.35
ZG209	97.50	98.60	3908278	Sdl	AlBx	Sd	DG	Patchy weak ankerite alteration	23.90	5770	1.29
ZG209	98.60	99.80	3908279	Ccy			N	Carbonaceous	18.80	3220	0.06
ZG209	99.80	101.00	3908280	Ccy			N	Carbonaceous	18.80	3470	0.36
ZG209	101.00	102.10	3908281	Ccy			N	Carbonaceous	12.10	3730	0.26
ZG209	102.10	103.50	3908282	CcySdl	AlVuBx	Sd	DGY	Carbonaceous clay + brecc ankerite rock	17.20	4490	0.38
ZG209	103.50	104.60	3908283	CcySdl	AlVuBx	Sd	DGY	Carbonaceous clay + brecc ankerite rock	21.20	5310	0.34
ZG209	104.60	105.70	3908284	CcySdl	AlVuBx	Sd	DGY	Carbonaceous clay + brecc ankerite rock	15.00	3860	0.31
ZG209	105.70	107.00	3908285	CcySdl	AlVuBx	Sd	DGY	Carbonaceous clay + brecc ankerite rock	11.70	3930	0.83
ZG209	107.00	108.25	3908286	CcySdl	AlVuBx	Sd	DGY	Carbonaceous clay + brecc ankerite rock	23.20	8160	0.99
ZG209	108.25	109.50	3908287	CcySdl	AlVuBx	Sd	DGY	Carbonaceous clay + brecc ankerite rock	25.90	7590	0.59
ZG209	109.50	110.70	3908288	CcySdl	AlVuBx	Sd	DGY	Carbonaceous clay + brecc ankerite rock	27.30	11000	2.33
ZG209	110.70	111.80	3908289	CcySdl	AlVuBx	Sd	DGY	Carbonaceous clay + brecc ankerite rock	31.30	17200	0.75
ZG209	111.80	112.45	3908290	CcySdl	AlVuBx	Sd	DGY	Carbonaceous clay + brecc ankerite rock	3.19	3830	0.07
ZG209	112.45	113.80	3908291	Ccy	GsFe		MOBG	Gossanus clay	9.36	3290	0.12
ZG209	113.80	114.80	3908292	Ccy	GsFe		MOBG	Gossanus clay	12.20	1000	0.08
ZG209	114.80	115.80	3908293	Ccy	GsFe		MOBG	Gossanus clay	6.49	984	0.12
ZG209	115.80	117.90	3908294	Ccy			LLG	Plastic	1.00	657	0.05
ZG209	117.90	118.65	3908295	Ccy				Carbonaceous and plastic	2.08	2680	0.06
ZG209	118.65	119.65	3908296	CcySss			DG	Transition to Moine Sst	1.75	312	0.03
ZG209	119.65	124.20	3908297	Sss	Fr		WLG	Moine Sst	0.46	41	0.02

HOLE	DFROM	DTO	SAMPNO	FIELDID	TEXTURE	ALT/MIN	COLOUR	COMMENTS	Fe%	Zn	M Sus
ZG358	0.00	44.00		Ox				Roller bit, no core			
ZG358	44.00	49.50	3908298	SlS			GLG	Calcareous and oolitic carbonate	0.68	16	0.08
ZG358	49.50	54.50	3908299	SlS			AGDG	Wispy banded lime mudstone	0.98	36	0.06
ZG358	54.50	59.50	3908300	SlS			AGDG	Wispy banded lime mudstone	1.51	38	0.12
ZG358	59.50	64.50	3914601	SlS			AGDG	Wispy banded lime mudstone	0.96	15	0.08
ZG358	64.50	69.50	3914602	SlS	We?		ALGB	Partly decomposed lime mudstone	1.82	217	0.05
ZG358	69.50	72.50	3914603	SlS	We?		ALGB	Partly decomposed lime mudstone	1.56	123	0.02
ZG358	72.50	74.60	3914604	SlS	We?		ALGB	Partly decomposed lime mudstone	1.96	49	0.01
ZG358	74.60	75.60	3914605	SlS	We?Al	Sd	LG	Weak ankerite alt in lime mudstone	2.69	39	0.35
ZG358	75.60	76.60	3914606	SlS	We?Al	Sd	LG	Weak ankerite alt in lime mudstone	2.17	32	0.20
ZG358	76.60	77.60	3914607	SlS	We?Al	Sd	LG	Weak ankerite alt in lime mudstone	4.05	81	0.20
ZG358	77.60	79.30	3914608	SlS	We?Al	Sd	LG	Weak ankerite alt in lime mudstone	7.74	63	0.18
ZG358	79.30	80.00	3914609	SlS	We?Al	Sd	LG	Weak ankerite alt in lime mudstone	7.02	25	0.05
ZG358	80.00	82.50	3914610	CcySd	We?Al?	Sd?	DG	Carbonaceous clay + minor ankeritic rock	7.35	19	0.05
ZG358	82.50	84.00	3914611	CcySd	We?Al?	Sd?	DG	Carbonaceous clay + minor ankeritic rock	7.61	32	0.22
ZG358	84.00	85.50	3914612	CcySd	We?Al?	Sd?	DG	Carbonaceous clay + minor ankeritic rock	7.02	44	0.07
ZG358	85.50	86.70	3914613	CcySd	We?Al?	Sd?	DG	Carbonaceous clay + minor ankeritic rock	7.15	20	0.05
ZG358	86.70	88.50	3914614	CcySd	We?Al?	Sd?	DG	Carbonaceous clay + minor ankeritic rock	8.14	38	0.07
ZG358	88.50	89.50	3914615	CcySd	We?Al?	Sd?	DG	Carbonaceous clay + minor ankeritic rock	8.64	55	0.00
ZG358	89.50	90.50	3914616	CcySd	We?Al?	Sd?	DG	Carbonaceous clay + minor ankeritic rock	6.36	47	0.00
ZG358	90.50	91.50	3914617	CcySd	We?Al?	Sd?	DG	Carbonaceous clay + minor ankeritic rock	6.02	26	0.04
ZG358	91.50	92.50	3914618	CcySd	We?Al?	Sd?	DG	Carbonaceous clay + minor ankeritic rock	11.40	23	0.00
ZG358	92.50	93.30	3914619	CcySd	We?Al?	Sd?	DG	Carbonaceous clay + minor ankeritic rock	9.91	22	0.60
ZG358	93.30	94.30	3914620	CcySd	We?Al?	Sd?	DG	Carbonaceous clay + minor ankeritic rock	10.20	16	0.03
ZG358	94.30	95.30	3914621	CcySd	We?Al?	Sd?	DG	Carbonaceous clay + minor ankeritic rock	6.27	14	0.15
ZG358	95.30	96.30	3914622	CcySd	We?Al?	Sd?	DG	Carbonaceous clay + minor ankeritic rock	15.70	60	0.30
ZG358	96.30	98.10	3914623	CcySd	We?Al?	Sd?	DG	Carbonaceous clay + minor ankeritic rock	20.20	42	0.55
ZG358	98.10	99.10	3914624	CcySd	We?Al?	Sd?	DG	Carbonaceous clay + minor ankeritic rock	21.30	440	0.50
ZG358	99.10	100.10	3914625	CcySd	We?Al?	Sd?	DG	Carbonaceous clay + minor ankeritic rock	29.10	105	1.50
ZG358	100.10	101.10	3914626	CcySd	We?Al?	Sd?	DG	Carbonaceous clay + minor ankeritic rock	19.60	219	0.10
ZG358	101.10	102.10	3914627	CcySd	We?Al?	Sd?	DG	Carbonaceous clay + minor ankeritic rock	14.80	234	0.50
ZG358	102.10	103.00	3914628	CcySd	We?Al?	Sd?	DG	Carbonaceous clay + minor ankeritic rock	15.80	250	0.47
ZG358	103.00	104.00	3914629	CcySd	We?Al?	Sd?	DG	Carbonaceous clay + minor ankeritic rock	18.30	267	0.65
ZG358	104.00	105.60	3914630	CcySd	We?Al?	Sd?	DG	Carbonaceous clay + minor ankeritic rock	16.70	241	0.45
ZG358	105.60	106.50	3914631	CcySd	We?Al?	Sd?	DG	Carbonaceous clay + minor ankeritic rock	28.40	355	0.16
ZG358	106.50	107.50	3914632	CcySd	We?Al?	Sd?	DG	Carbonaceous clay + minor ankeritic rock	29.90	284	0.66
ZG358	107.50	108.50	3914634	CcySd	We?Al?	Sd?	DG	Carbonaceous clay + minor ankeritic rock	27.60	172	0.36
ZG358	108.50	109.50	3914635	CcySd	We?Al?	Sd?	DG	Carbonaceous clay + minor ankeritic rock	23.10	98	0.22
ZG358	109.50	110.50	3914636	CcySd	We?Al?	Sd?	DG	Carbonaceous clay + minor ankeritic rock	26.90	262	0.22
ZG358	110.50	112.50	3914637	CcySd	We?Al?	Sd?	DG	Carbonaceous clay + minor ankeritic rock	32.60	183	0.36
ZG358	112.50	114.50	3914638	CcySd	We?Al?	Sd?	DG	Carbonaceous clay + minor ankeritic rock	36.00	290	0.30
ZG358	114.50	117.45	3914639	CcySd	We?Al?	Sd?	DG	Carbonaceous clay + minor ankeritic rock	30.90	526	0.37
ZG358	117.45	118.60	3914640	Ccy			AWDG	Minor sst interbeds	3.95	1250	0.05
ZG358	118.60	120.20	3914641	Ccy			AWDG	Minor sst interbeds	2.07	557	0.07
ZG358	120.20	121.50	3914642	Sss				Moina Sandstone	1.53	83	0.04
ZG359	0.00	13.00		Ccy?				Roller bit, no core			
ZG359	13.00	15.00	3914643	Ssh	We		FP		4.45	792	0.12
ZG359	15.00	17.60	3914644	Ssh	WeFr		LB		3.09	455	0.14
ZG359	17.60	21.50	3914645	SlS	Bx		AGLG	Lime mudstone	1.35	589	0.08
ZG359	21.50	25.50	3914646	SlS			AGLG	Lime mudstone	1.33	622	0.08
ZG359	25.50	27.50	3914647	Ssh?SlS?	FiWe?		DGN	Carbonaceous decomposed carbonate?	3.02	783	0.08
ZG359	27.50	29.50	3914648	Ssh?SlS?	FiWe?		DGN	Carbonaceous decomposed carbonate?	4.69	1450	0.06
ZG359	29.50	31.50	3914649	Ssh?SlS?	FiWe?		DGN	Carbonaceous decomposed carbonate?	8.51	3250	0.25
ZG359	31.50	33.50	3914650	Ssh?SlS?	FiWe?		DGN	Carbonaceous decomposed carbonate?	5.50	1620	0.48
ZG359	33.50	35.50	3914651	Ssh?SlS?	We?		DGN	Carbonaceous decomposed carbonate?	5.49	4700	0.04
ZG359	35.50	37.50	3914652	Ssh?SlS?	We?		DGN	Carbonaceous decomposed carbonate?	6.25	5600	0.09
ZG359	37.50	39.50	3914653	Ssh?SlS?	We?		DGN	Carbonaceous decomposed carbonate?	13.80	5190	0.23
ZG359	39.50	41.50	3914654	Ssh?SlS?	We?		DGN	Carbonaceous decomposed carbonate?	11.60	6620	0.18
ZG359	41.50	43.50	3914655	Ssh?SlS?	We?		DGN	Carbonaceous decomposed carbonate?	12.90	7110	0.41
ZG359	43.50	45.00	3914656	Ssh?SlS?	We?		DGN	Carbonaceous decomposed carbonate?	16.30	4840	0.70
ZG359	45.00	46.50	3914657	SdICcy	AlBx	Sd	Y+DG	Clay and ankerite altered carbonate	28.00	3420	0.65
ZG359	46.50	49.50	3914658	SdICcy	AlBx	Sd	Y+DG	Clay and ankerite altered carbonate	23.60	6370	0.28
ZG359	49.50	52.75	3914659	SdICcy	AlBx	Sd	Y+DG	Clay and ankerite altered carbonate	20.50	9020	0.52
ZG359	52.75	53.60	3914660	Sd	AlVuBx	Sd	YB	Ankerite altered. Oolites locally visible	32.70	12800	0.70
ZG359	53.60	55.50	3914661	Sd	AlVuBx	Sd	YB	Ankerite altered. Oolites locally visible	27.60	12000	0.65
ZG359	55.50	56.80	3914662	Sd	AlVuBx	Sd	YB	Ankerite altered. Oolites locally visible	15.70	11000	0.30
ZG359	56.80	58.50	3914663	Sd	AlVuBx	Sd	YB	Ankerite altered. Oolites locally visible	30.50	15200	0.68
ZG359	58.50	59.90	3914664	Sd	AlVuBx	Sd	YB	Ankerite altered. Oolites locally visible	27.50	22800	0.15
ZG359	59.90	61.50	3914665	CcyCs	Al	Sd	MYLDB	Clay and ankeritic sand	14.50	97000	0.09
ZG359	61.50	63.50	3914666	CcyCs	Al	Sd	MYLDB	Clay and ankeritic sand	12.10	86000	0.08
ZG359	63.50	65.50	3914667	Ccy			DG	Carbonaceous clay + cherty bands	2.11	6290	0.05
ZG359	65.50	67.50	3914668	Ccy			DG	Carbonaceous clay + cherty bands	1.24	2070	0.07
ZG359	67.50	70.50	3914669	Ccy			DG	Carbonaceous clay + cherty bands	2.45	2240	0.03
ZG359	70.50	73.50	3914670	Ccy			DG	Carbonaceous clay + cherty bands	1.15	302	0.01
ZG359	73.50	76.90	3914671	Ss	Lm		AWG		0.40	64	0.04
ZG359	76.90	79.00	3914672	Sss	Ma		LGW		0.29	27	0.02

HOLE	DFROM	DTO	SAMPNO	FIELDID	TEXTURE	ALT/MIN	COLOUR	COMMENTS	Fe%	Zn	M Sus
ZG360	0.00	15.00		Ccy?				Roller bit, no core			
ZG360	15.00	19.10	3914673	Ccy			DGB		4.95	5590	0.05
ZG360	19.10	24.00	3914674	SlS			AGLG	Lime mudstone	1.01	456	0.07
ZG360	24.00	29.00	3914675	SlS			AGLG		1.03	148	0.10
ZG360	29.00	34.00	3914676	SlS	VnFr		AGLG	Dolomite veined	1.01	776	0.03
ZG360	34.00	38.00	3914677	SlS	Fr		AGLG		1.64	279	0.07
ZG360	38.00	41.00	3914678	SlS	We?		DG	Decomposed lime mudstone	1.81	379	0.08
ZG360	41.00	43.00	3914679	Ssh?SlS?	FiWe?		DGN	Carbonaceous decomposed carbonate?	7.87	2040	0.35
ZG360	43.00	45.00	3914680	Ssh?SlS?	FiWe?		DGN	Carbonaceous decomposed carbonate?	15.90	2950	0.89
ZG360	45.00	47.00	3914681	Ssh?SlS?	FiWe?		DGN	Carbonaceous decomposed carbonate?	24.20	6000	0.43
ZG360	47.00	49.00	3914682	Ssh?SlS?	FiWe?		DGN	Carbonaceous decomposed carbonate?	7.32	3710	0.21
ZG360	49.00	51.00	3914683	Ssh?SlS?	Bx?We?		DGN	Carbonaceous decomposed carbonate?	8.93	1750	0.34
ZG360	51.00	53.00	3914684	Ssh?SlS?	AlBx?We?	Sd	LY+DG	Weakly ankeritic, carbonaceous, decomposed	6.40	2060	0.11
ZG360	53.00	55.00	3914685	Ssh?SlS?	AlBx?We?	Sd	LY+DG	Weakly ankeritic, carbonaceous, decomposed	9.32	3410	0.27
ZG360	55.00	57.00	3914686	Ssh?SlS?	AlBx?We?	Sd	LY+DG	Weakly ankeritic, carbonaceous, decomposed	12.90	3130	0.24
ZG360	57.00	59.00	3914687	Ssh?SlS?	AlBx?We?	Sd	LY+DG	Weakly ankeritic, carbonaceous, decomposed	17.20	6260	0.38
ZG360	59.00	61.00	3914688	Ssh?SlS?	AlBx?We?	Sd	LY+DG	Weakly ankeritic, carbonaceous, decomposed	15.20	4650	0.18
ZG360	61.00	62.70	3914689	Ssh?SlS?	AlBx?We?	Sd	LY+DG	Weakly ankeritic, carbonaceous, decomposed	17.30	4870	0.27
ZG360	62.70	65.00	3914690	SdlCcy	AlBx	Sd	Y+DG	Ankeritic carbonate and carbonaceous clay	21.50	5490	0.75
ZG360	65.00	67.00	3914691	SdlCcy	AlBx	Sd	Y+DG	Ankeritic carbonate and carbonaceous clay	20.80	9690	0.85
ZG360	67.00	69.00	3914692	SdlCcy	AlBx	Sd	Y+DG	Ankeritic carbonate and carbonaceous clay	26.60	6970	0.85
ZG360	69.00	71.10	3914693	SdlCcy	AlBx	Sd	Y+DG	Ankeritic carbonate and carbonaceous clay	24.70	9480	0.85
ZG360	71.10	73.00	3914694	SdlCcy	AlBx	Sd	Y+DG	Ankeritic carbonate and carbonaceous clay	22.60	14700	0.82
ZG360	73.00	74.75	3914695	SdlCcy	AlBx	Sd	Y+DG	Ankeritic carbonate and carbonaceous clay	32.80	31300	0.40
ZG360	74.75	76.80	3914696	Ccy			ALGDG	Minor silty/sandy bands	3.24	9070	0.07
ZG360	76.80	79.20	3914697	Ccy			ALGDG	Minor silty/sandy bands	1.94	2220	0.03
ZG360	79.20	81.60	3914698	Ccy			ALGDG	Minor silty/sandy bands	2.43	710	0.07
ZG360	81.60	84.00	3914699	Ss	Lm		LG		0.53	81	0.03
ZG360	84.00	85.30	3914700	Sss			WLG		0.29	20	0.03
ZG361	0.00	16.00		Ccy?				Roller bit, no core			
ZG361	16.00	18.00	3917601	SlS			AGDG	Wispy banded lime mudstone	0.94	664	0.10
ZG361	18.00	20.00	3917602	SlS			AGDG	Wispy banded lime mudstone	1.05	273	0.15
ZG361	20.00	22.00	3917603	SlS			AGDG	Wispy banded lime mudstone	1.57	356	0.10
ZG361	22.00	24.00	3917604	SlS			AGDG	Wispy banded lime mudstone	1.25	1000	0.07
ZG361	24.00	26.00	3917605	SlS			AGDG	Wispy banded lime mudstone	1.25	161	0.13
ZG361	26.00	28.00	3917606	SlS			AGDG	Wispy banded lime mudstone	1.27	262	0.17
ZG361	28.00	30.00	3917607	SlS			AGDG	Wispy banded lime mudstone	2.08	402	0.17
ZG361	30.00	32.00	3917608	SlS			AGDG	Wispy banded lime mudstone	0.78	213	0.09
ZG361	32.00	34.00	3917609	SlS			AGDG	Wispy banded lime mudstone	0.89	289	0.07
ZG361	34.00	36.00	3917610	SlS			AGDG	Wispy banded lime mudstone	2.05	606	0.06
ZG361	36.00	38.00	3917611	SlS			AGDG	Wispy banded lime mudstone	1.02	738	0.11
ZG361	38.00	40.00	3917612	SlS			AGDG	Wispy banded lime mudstone	3.05	865	0.14
ZG361	40.00	42.00	3917613	SlS			AGDG	Wispy banded lime mudstone	2.09	534	0.13
ZG361	42.00	43.40	3917614	SlS	We?		DG	Decomposed carbonate	3.95	2840	0.08
ZG361	43.40	46.40	3917615	CcySdl				clay, carbonate sand and frags	5.15	3410	0.05
ZG361	46.40	48.40	3917616	CcySdl				clay, carbonate sand and frags	6.45	19400	0.00
ZG361	48.40	50.60	3917617	CcySdl				clay, carbonate sand and frags	12.10	37000	0.00
ZG361	50.60	52.40	3917618	CcySdl				clay, carbonate sand and frags	5.63	24500	0.04
ZG361	52.40	54.50	3917619	CcySdl				clay, carbonate sand and frags	12.80	12700	0.10
ZG361	54.50	56.00	3917620	Sdl					3.07	4580	0.12
ZG361	56.00	57.50	3917621	Sdl	Al	He	R	Oolitic	3.24	3700	0.10
ZG361	57.50	59.80						No rec			0.12
ZG361	59.80	60.50	3917622	Sdl			LYR	Oolitic, weakly haem, ank altered	0.92	1190	0.05
ZG361	60.50	61.40	3917623	Sdl			LYR	Oolitic, weakly haem, ank altered	0.66	582	0.10
ZG361	61.40	63.00	3917624	Sdl			LYR	Oolitic, weakly haem, ank altered	0.91	1350	0.05
ZG361	63.00	64.40	3917625	Sdl			LYR	Oolitic, weakly haem, ank altered	0.61	1160	0.02
ZG361	64.40	66.50	3917626	Sdl			LYR	Oolitic, weakly haem, ank altered	0.68	1590	0.04
ZG361	66.50	68.90	3917627	Sdl			LYR	Oolitic, weakly haem, ank altered	0.77	4200	0.03
ZG361	68.90	70.10	3917628	Sdl			LYR	Oolitic, weakly haem, ank altered	0.51	1460	0.05
ZG361	70.10	72.00	3917629	Sdl			LYR	Oolitic, weakly haem, ank altered	0.76	1000	0.05
ZG361	72.00	74.00	3917630	Sdl			LYR	Oolitic, weakly haem, ank altered	0.94	6210	0.05
ZG361	74.00	76.00	3917631	Sdl			LYR	Oolitic, weakly haem, ank altered	0.76	4270	0.07
ZG361	76.00	77.30	3917632	Sdl			LYR	Oolitic, weakly haem, ank altered	0.81	4310	0.08
ZG361	77.30	78.60	3917633	Sdl			LYR	Oolitic, weakly haem, ank altered	0.57	1380	0.09
ZG361	78.60	80.60	3917634	SdlCcy	Al	Sd		Ankerite altn, and clay	1.85	23300	0.14
ZG361	80.60	82.40	3917635	SdlCcy	Al	Sd		Ankerite altn, and clay	6.20	21100	0.08
ZG361	82.40	83.90	3917636	SdlCcy	Al	Sd		Ankerite altn, and clay	24.50	23300	1.85
ZG361	83.90	85.40	3917637	SdlCcy	Al	Sd		Ankerite altn, and clay	24.40	11300	0.32
ZG361	85.40	87.20	3917638	Ccy					1.86	5130	0.03
ZG361	87.20	89.00	3917639	Ccy					1.65	2120	0.22
ZG361	89.00	91.00	3917640	Ccy					3.81	2060	0.04
ZG361	91.00	93.00	3917641	Ccy					2.51	1230	0.05
ZG361	93.00	94.40	3917642	Sss					0.78	116	0.04
ZG361	94.40	96.00	3917643	Mq	Ma				0.53	43	0.04
ZG361	96.00	99.00	3917644	Mq	Ma				0.41	15	0.04

HOLE	DFROM	DTO	SAMPNO	FIELDID	TEXTURE	ALT/MIN	COLOUR	COMMENTS	Fe%	Zn	M Sus
ZG362	0.00	15.00		Ccy?				Roller bit, no core			
ZG362	15.00	18.10	3917645	Sls	We		AGDG	Lime mudstone	2.38	6830	0.00
ZG362	18.10	21.50	3917646	Sls	We		AGDG	Lime mudstone	2.01	55000	0.07
ZG362	21.50	23.00	3917647	Sls	We		AGDG	Lime mudstone	2.05	13500	0.06
ZG362	23.00	24.90	3917648	Sls	We		AGDG	Lime mudstone	3.26	15500	0.06
ZG362	24.90	26.00	3917649	Sls	We		AGDG	Lime mudstone	2.12	7810	0.11
ZG362	26.00	31.20	3917650	Sls	We		AGDG	Lime mudstone	8.19	22100	0.06
ZG362	31.20	38.00	3917651	Sls	We		AGDG	Lime mudstone	22.80	16100	0.10
ZG362	38.00	39.90	3917652	SdSls	Al	Sd	YG	Weakly ankerite altered lime mudstone	9.59	16200	0.45
ZG362	39.90	41.00	3917653	SdSls	Al	Sd	YG	Weakly ankerite altered lime mudstone	15.80	10600	1.00
ZG362	41.00	43.20	3917654	SdCcy	AlBx	Sd	YG	Total ankerite altn, + Ccy zones	27.80	17600	0.93
ZG362	43.20	45.50	3917655	SdCcy	AlBx	Sd	YG	Total ankerite altn, + Ccy zones	21.00	42700	0.15
ZG362	45.50	47.70	3917656	SdCcy	AlBx	Sd	YG	Total ankerite altn, + Ccy zones	15.90	47700	0.56
ZG362	47.70	49.60	3917657	SdCcy	AlBx	Sd	YG	Total ankerite altn, + Ccy zones	19.80	72000	0.33
ZG362	49.60	51.00	3917658	SdCcy	AlBx	Sd	YG	Total ankerite altn, + Ccy zones	21.30	25000	1.40
ZG362	51.00	52.50	3917659	SdCcy	AlBx	Sd	YG	Total ankerite altn, + Ccy zones	20.50	25900	1.07
ZG362	52.50	54.00	3917660	SdCcy	AlBx	Sd	YG	Total ankerite altn, + Ccy zones	11.50	34600	0.08
ZG362	54.00	56.80	3917661	Sd		He	LRY	Oolitic, weakly haem, ank altered	2.32	7180	0.06
ZG362	56.80	60.40	3917662	Sd		He	LRY	Oolitic, weakly haem, ank altered	0.93	3990	0.06
ZG362	60.40	65.00	3917663	Sd		He	LRY	Oolitic, weakly haem, ank altered	0.91	7920	0.04
ZG362	65.00	70.50	3917664	Sd		He	LRY	Oolitic, weakly haem, ank altered	0.71	4750	0.06
ZG362	70.50	75.70	3917665	Sd		He	LRY	Oolitic, weakly haem, ank altered	0.68	2910	0.04
ZG362	75.70	78.40	3917666	Sd		He	LRY	Oolitic, weakly haem, ank altered	1.27	5660	0.04
ZG362	78.40	80.00	3917667	Sd		He	LRY	Oolitic, weakly haem, ank altered	6.45	37900	0.86
ZG362	80.00	81.90						No recovery			
ZG362	81.90	83.00	3917669	CcyCs				Very poor rec of sand and clay	15.70	142000	0.62
ZG362	83.00	86.00	3917670	Ccy			G		2.48	17900	0.02
ZG362	86.00	88.00	3917671	Ccy			G		1.69	3060	0.04
ZG362	88.00	89.00	3917672	Ccy			G		2.69	1310	0.05
ZG362	89.00	92.00	3917673	Ccy			G		2.70	2440	0.04
ZG362	92.00	95.00	3917674	Ccy			G		2.69	1170	0.05
ZG362	95.00	97.90	3917675	Ccy			G		1.40	233	0.03
ZG362	97.90	99.20	3917676	Mq	Ma		LGW		0.45	48	0.03
ZG363	0.00	24.00		Ccy?				Roller bit, no core			
ZG363	24.00	29.00	3984301	SlsCcy	We		LG	Mixed Sls + Ccy, broken	1.37	5040	0.06
ZG363	29.00	33.30	3984302	SlsCcy	We		LG	Mixed Sls + Ccy, broken	1.97	6120	0.09
ZG363	33.30	37.20	3984303	Sls	We		AGDG	Lime mudstone	2.93	4310	0.06
ZG363	37.20	39.50	3984304	Sls	We		AGDG	Lime mudstone	1.77	7060	0.02
ZG363	39.50	41.30	3984305	SdSls	Al	Sd	YG	Weakly ankerite altered lime mudstone	4.81	5800	0.30
ZG363	41.30	43.80	3984306	SdSls	Al	Sd	YG	Weakly ankerite altered lime mudstone	6.17	12800	0.30
ZG363	43.80	45.40	3984307	SdSls	Al	Sd	YG	Weakly ankerite altered lime mudstone	14.90	14600	0.35
ZG363	45.40	47.00	3984308	SdCcy	AlBx	Sd	YG	Total ankerite altn, + Ccy zones	15.00	24400	0.60
ZG363	47.00	49.10	3984309	SdCcy	AlBx	Sd	YG	Total ankerite altn, + Ccy zones	10.30	24100	0.60
ZG363	49.10	51.30	3984310	SdCcy	AlBx	Sd	YG	Total ankerite altn, + Ccy zones	18.80	32400	0.22
ZG363	51.30	53.00	3984311	SdCcy	AlBx	Sd	YG	Total ankerite altn, + Ccy zones	14.10	23800	0.15
ZG363	53.00	54.50	3984312	SdCcy	AlBx	Sd	YG	Total ankerite altn, + Ccy zones	21.00	26900	0.27
ZG363	54.50	56.00	3984313	SdCcy	AlBx	Sd	YG	Total ankerite altn, + Ccy zones	13.40	42800	0.12
ZG363	56.00	57.50	3984314	SdCcy	AlBx	Sd	YG	Total ankerite altn, + Ccy zones	30.50	20900	1.00
ZG363	57.50	59.00	3984315	SdCcy	AlBx	Sd	YG	Total ankerite altn, + Ccy zones	26.50	16900	0.45
ZG363	59.00	60.60	3984316	SdCcy	AlBx	Sd	YG	Total ankerite altn, + Ccy zones	24.60	14000	0.45
ZG363	60.60	63.00	3984317	SdCcy	AlBx	Sd	YG	Total ankerite altn, + Ccy zones	21.90	14000	0.38
ZG363	63.00	65.00	3984318	SdCcy	AlBx	Sd	YG	Total ankerite altn, + Ccy zones	25.60	25700	0.90
ZG363	65.00	67.70	3984319	SdCcy	AlBx	Sd	YG	Total ankerite altn, + Ccy zones	23.00	36100	1.00
ZG363	67.70	69.50	3984320	SdCcy	AlBx	Sd	YG	Total ankerite altn, + Ccy zones	19.00	38500	0.33
ZG363	69.50	72.50	3984321	SdCcy	AlBx	Sd	YG	Total ankerite altn, + Ccy zones	14.70	77000	0.08
ZG363	72.50	73.40	3984322	SdCcy	AlBx	Sd	YG	Total ankerite altn, + Ccy zones	26.60	78000	1.00
ZG363	73.40	76.10	3984323	SdCcy	AlBx	Sd	YG	Total ankerite altn, + Ccy zones	27.90	80000	1.40
ZG363	76.10	77.60	3984324	SdCcy	AlBx	Sd	YG	Total ankerite altn, + Ccy zones	30.50	118000	0.10
ZG363	77.60	78.90	3984325	SdCcy	AlBx	Sd	YG	Total ankerite altn, + Ccy zones	30.40	106000	1.50
ZG363	78.90	79.80	3984326	SdCcy	AlBx	Sd	YG	Total ankerite altn, + Ccy zones	21.50	105000	2.40
ZG363	79.80	81.30	3984327	SdCcy	AlBx	Sd	YG	Total ankerite altn, + Ccy zones	24.90	132000	0.30
ZG363	81.30	83.40	3984328	Ccy			DG	Carbonaceous clay + qtz sand	4.01	66000	0.10
ZG363	83.40	85.50	3984329	Ccy			DG	Carbonaceous clay + qtz sand	2.34	37500	0.05
ZG363	85.50	87.70	3984330	Ccy			DG	Carbonaceous clay + qtz sand	1.60	45000	0.08
ZG363	87.70	89.85	3984331	Ccy			DG	Carbonaceous clay + qtz sand	5.02	54000	0.08
ZG363	89.85	92.00	3984332	Ccy	GsFe		YR	Gossanous clay	31.80	7000	0.10
ZG363	92.00	94.20	3984333	Ccy	GsFe		YR	Gossanous clay	48.80	10400	0.25
ZG363	94.20	96.40	3984334	Ccy	GsFe		YR	Gossanous clay	44.40	12000	0.18
ZG363	96.40	98.60	3984335	Ccy	GsFe		YR	Gossanous clay	30.10	8240	0.20
ZG363	98.60	101.00	3984336	Ccy			DG	Part carbonaceous, gets sandier with depth	2.38	27500	0.04
ZG363	101.00	103.00	3984337	Ccy			DG	Part carbonaceous, gets sandier with depth	1.61	3130	0.04
ZG363	103.00	105.00	3984338	Ccy			DG	Part carbonaceous, gets sandier with depth	1.64	5850	0.04
ZG363	105.00	107.00	3984339	Ccy			DG	Part carbonaceous, gets sandier with depth	1.40	7060	0.04
ZG363	107.00	109.00	3984340	Ccy			DG	Part carbonaceous, gets sandier with depth	1.33	4640	0.06
ZG363	109.00	111.00	3984341	Ccy			DG	Part carbonaceous, gets sandier with depth	0.95	1550	0.05
ZG363	111.00	113.00	3984342	Ccy			DG	Part carbonaceous, gets sandier with depth	1.40	475	0.04
ZG363	113.00	115.00	3984343	Ccy			DG	Part carbonaceous, gets sandier with depth	1.79	133	0.03
ZG363	115.00	117.00	3984344	Ccy			DG	Part carbonaceous, gets sandier with depth	2.44	496	0.05
ZG363	117.00	119.00	3984345	Ccy			DG	Part carbonaceous, gets sandier with depth	2.87	1200	0.03
ZG363	119.00	121.00	3984346	Ccy			DG	Part carbonaceous, gets sandier with depth	2.15	946	0.08
ZG363	121.00	123.00	3984347	Ccy			DG	Part carbonaceous, gets sandier with depth	1.64	952	0.08
ZG363	123.00	124.90	3984348	Ccy			DG	Part carbonaceous, gets sandier with depth	2.06	647	0.04

HOLE	FROM	TO	SAMPNO	FIELDID	TEXTURE	ALT/MIN	COLOUR	COMMENTS	Fe%	Zn	M Sus
ZG363	124.90	128.30	3984349	Sss		W		Frable	0.54	64	0.04
ZG363	128.30	129.60	3984350	Mq		W		Massive, weakly bedded Moira Sst.	0.45	173	0.02
ZG364	0.00	6.30		Ccy?				Roller bit, no core			
ZG364	6.30	7.30	3984901	Ss				limestone	0.34	324	0.08
ZG364	7.30	9.00	3984902	Ss				limestone	0.58	773	0.07
ZG364	9.00	11.00	3984903	Ss				limestone	0.41	600	0.05
ZG364	11.00	13.00	3984904	Ss				limestone	0.52	696	0.07
ZG364	13.00	14.50	3984905	Ss				limestone	0.87	518	0.07
ZG364	14.50	17.00	3984906	Ss				limestone	1.20	1160	0.04
ZG364	17.00	19.00	3984907	Ss				limestone	0.63	980	0.10
ZG364	19.00	21.00	3984908	Ss				limestone	0.21	256	0.08
ZG364	21.00	23.00	3984909	Ss				limestone	0.16	186	0.08
ZG364	23.00	25.00	3984910	Ss				limestone	0.41	1010	0.07
ZG364	25.00	26.50	3984911	Ss				limestone	1.11	3580	0.10
ZG364	26.50	28.00	3984912	Ss				limestone	0.16	531	0.07
ZG364	28.00	30.00	3984913	Ss				limestone	1.10	2950	0.03
ZG364	30.00	32.00	3984914	Ss				limestone	0.33	1160	0.13
ZG364	32.00	34.00	3984915	Ss				limestone	0.23	1480	0.15
ZG364	34.00	36.00	3984916	Ss				limestone	1.56	5170	0.07
ZG364	36.00	37.60	3984917	Ss				limestone	0.31	729	0.08
ZG364	37.60	39.60	3984918	Ss				limestone	0.81	1570	0.03
ZG364	39.60	42.00	3984919	Ss				limestone	1.25	1650	0.13
ZG364	42.00	44.00	3984920	Ss				limestone	0.94	1930	0.05
ZG364	44.00	47.70	3984921	Ss				limestone	0.98	1700	0.06
ZG364	47.70	49.00	3984922	Ss				limestone	0.59	728	0.07
ZG364	49.00	51.00	3984923	Ss				limestone	0.56	1010	0.07
ZG364	51.00	52.50	3984924	Ss				limestone	0.62	843	0.07
ZG364	52.50	54.00	3984925	Ss				limestone	0.77	2450	0.07
ZG364	54.00	56.00	3984926	Ss				limestone	6.16	26000	0.06
ZG364	56.00	57.50	3984927	Sd/Ccy	Al	Sd		Ankerite altd carbonate and clay	2.96	9930	0.06
ZG364	57.50	59.00	3984928	Sd/Ccy	Al	Sd		Ankerite altd carbonate and clay	5.32	13000	0.05
ZG364	59.00	61.00	3984929	Sd/Ccy	Al	Sd		Ankerite altd carbonate and clay	12.10	30000	0.12
ZG364	61.00	63.00	3984930	Sd/Ccy	Al	Sd		Ankerite altd carbonate and clay	25.70	59000	0.11
ZG364	63.00	64.80	3984931	Sd/Ccy	Al	Sd		Ankerite altd carbonate and clay	15.50	54000	0.80
ZG364	64.80	65.20	3984932	Sd/Ccy	Al	Sd		Ankerite altd carbonate and clay	15.50	74000	0.15
ZG364	65.20	68.00	3984933	Ccy			YB		6.41	4530	0.08
ZG364	68.00	70.00	3984934	Ccy			YB		12.60	4260	0.10
ZG364	70.00	73.00	3984935	Ccy			YB		30.40	10200	0.16
ZG364	73.00	75.00	3984936	Ccy			YB		25.60	6260	0.20
ZG364	75.00	77.00	3984937	Ccy			YB		39.50	11000	0.19
ZG364	77.00	78.50	3984938	Ccy			YB		32.20	10000	0.11
ZG364	78.50	81.00	3984939	Ccy			YB		10.10	2620	0.15
ZG364	81.00	83.00	3984940	Ccy			YB		6.63	1470	0.05
ZG364	83.00	85.00	3984941	Mq	Al?Fo	He	MFRG		5.34	684	0.07
ZG364	85.00	88.50	3984942	Mq	Al?Fo	He	MFRG		5.03	222	0.06
ZG365	0.00	6.00		Ccy?				Roller bit, no core			
ZG365	6.00	9.00	3985943	Ss			GDG	limestone	0.40	212	0.05
ZG365	9.00	12.00	3985944	Ss			GDG	limestone	0.61	687	0.04
ZG365	12.00	15.00	3985945	Ss			GDG	limestone	0.43	407	0.06
ZG365	15.00	18.00	3985946	Ss			GDG	limestone	0.56	334	0.08
ZG365	18.00	21.00	3985947	Ss			GDG	limestone	0.57	485	0.10
ZG365	21.00	24.00	3985948	Ss			LG	limestone	0.26	240	0.06
ZG365	24.00	27.00	3985949	Ss			LG	limestone	0.24	433	0.06
ZG365	27.00	30.00	3985950	Ss			LG	limestone	0.29	315	0.22
ZG365	30.00	33.00	3985951	Ss			LG	limestone	1.53	3880	0.11
ZG365	33.00	36.00	3985952	Ss			LG	limestone	0.28	508	0.16
ZG365	36.00	39.00	3985953	Ss			LG	limestone	0.89	1830	0.08
ZG365	39.00	42.00	3985954	Ss			LG	limestone	0.53	1200	0.10
ZG365	42.00	45.00	3985955	Ss			DG	limestone	1.00	1990	0.07
ZG365	45.00	48.00	3985956	Ss			DG	limestone	1.33	2040	0.08
ZG365	48.00	51.00	3985957	Ss			DG	limestone	0.67	599	0.09
ZG365	51.00	54.00	3985958	Ss			DG	limestone	0.72	554	0.06
ZG365	54.00	57.00	3985959	Ss			DG	limestone	1.03	1220	0.03
ZG365	57.00	60.00	3985960	Ss			DG	limestone	0.95	910	0.06
ZG365	60.00	63.00	3985961	Ss			DG	limestone	0.62	376	0.08
ZG365	63.00	66.00	3985962	Ss			DG	limestone	0.70	1010	0.07
ZG365	66.00	68.00	3985963	Ss	AIVc	Cc	GDG	limestone. Weak Cc altn.	0.62	1240	0.07
ZG365	68.00	70.00	3985964	Ss	AIVc	Cc	GDG	limestone. Weak Cc altn.	0.79	452	0.09
ZG365	70.00	72.10	3985965	Ss	AIVc	Cc	GDG	limestone. Weak Cc altn.	1.26	1460	0.11
ZG365	72.10	74.40	3985966	Sd	AIBx	Sd	YG	Ankerite altd carbonate and minor clay	2.54	1310	0.08
ZG365	74.40	76.10	3985967	Sd	AIBx	Sd	YG	Ankerite altd carbonate and minor clay	2.03	2760	0.06
ZG365	76.10	77.10	3985968	Sd	AIBx	Sd	YG	Ankerite altd carbonate and minor clay	1.97	2500	0.10
ZG365	77.10	79.10	3985969	Sd	AIBx	Sd	YG	Ankerite altd carbonate and minor clay	2.70	9410	0.09
ZG365	79.10	81.60	3985970	Sd	AIBx	Sd	YG	Ankerite altd carbonate and minor clay	1.94	11500	0.06
ZG365	81.60	82.30		Ox				No core recovery			
ZG365	82.30	84.20	3985971	Ccy	Al	Sd	YB	Ankeritic clay	15.90	104600	1.36
ZG365	84.20	86.00	3985972	Ccy	Al	Sd	YB	Ankeritic clay	9.41	62000	1.30
ZG365	86.00	88.00	3985973	Ccy	Al	Sd	DGYB	Weakly ankeritic clay	9.97	26200	0.70
ZG365	88.00	90.00	3985974	Ccy	FeGs?	He	MFRB	Limonic and hematitic clay	20.00	5500	0.13
ZG365	90.00	92.00	3985975	Ccy	FeGs?	He	MFRB	Limonic and hematitic clay	35.00	14000	0.23
ZG365	92.00	95.00	3985976	Ccy	FeGs?	He	MFRB	Limonic and hematitic clay	13.00	3010	0.13
ZG365	95.00	98.00	3985977	Ccy	FeGs?	He	MFRB	Limonic and hematitic clay	11.40	2670	0.09

HOLE	DFROM	DTO	SAMPNO	FIELDID	TEXTURE	ALT/MIN	COLOUR	COMMENTS	Fe%	Zn	M Sus
ZG365	98.00	101.00	3985978	Ccy	FeGs?	He	MRYB	Limonitic and hematitic clay	5.27	968	0.07
ZG365	101.00	104.00	3985979	Ccy	FeGs?	He	MRYB	Limonitic and hematitic clay	4.89	952	0.06
ZG365	104.00	106.00	3985980	Sss	FeVu		YW	Limonite stained vuggy sst	2.54	383	0.07
ZG365	106.00	109.00	3985981	SssCcy	lbFe		OKW	Interbedded sst and clay	2.90	76	0.05
ZG365	109.00	112.00	3985982	SssCcy	lbFe		OKW	Interbedded sst and clay	2.64	43	0.06
ZG365	112.00	113.00	3985983	Mg	Ma				3.60	153	0.04

# GRIEVES PROJECT

303334

## MAG SUSC STUDY ON DD CORE

no of readings =  $\frac{546}{539}$

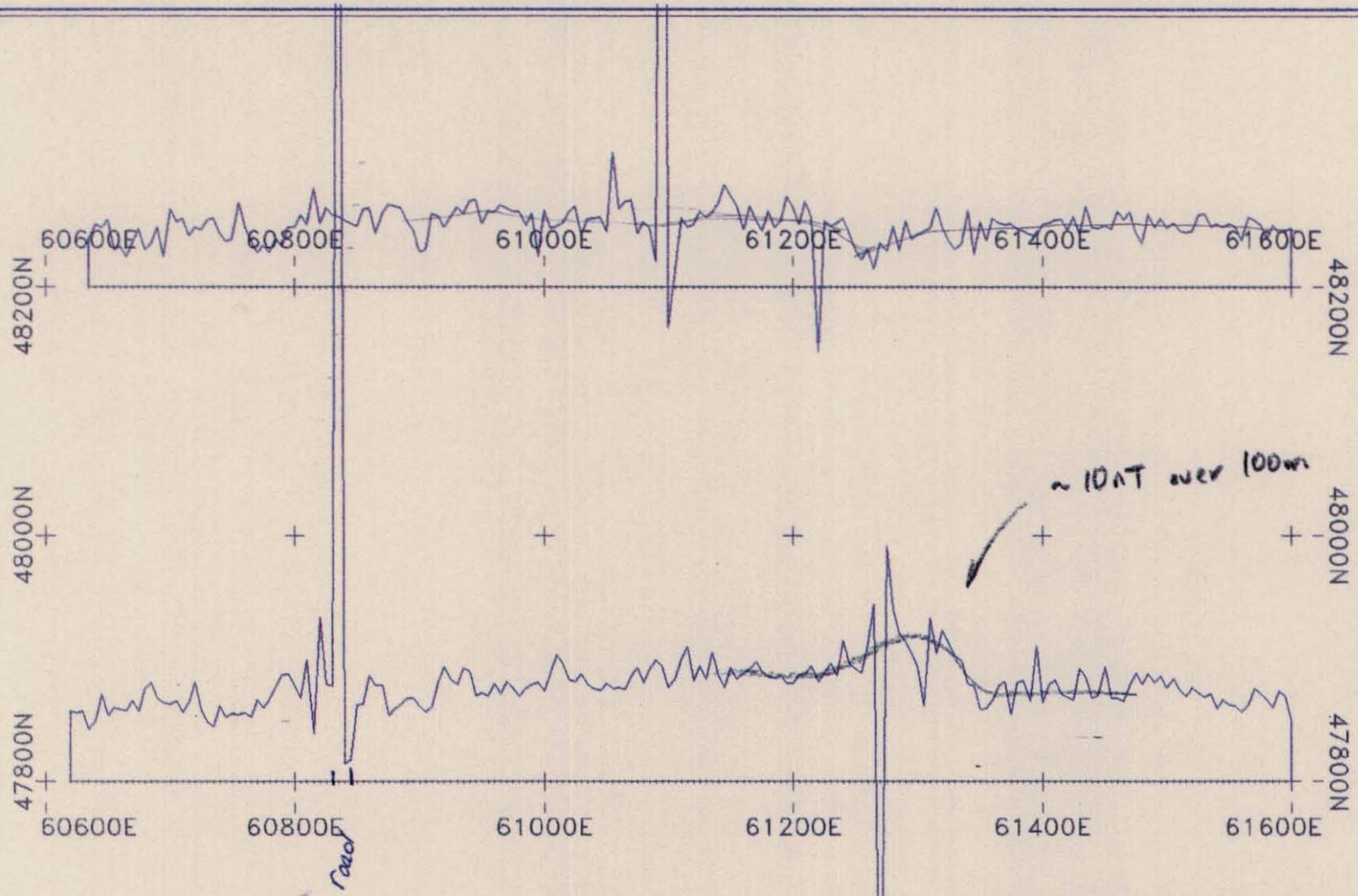
MAX = 2.4

	MEAN. AVE. MAG SUSC $\times 10^{-3}$	PERCENTILES 50% ile.	
Sidrite alt. logged	0.50	0.36	75% > 0.15
not logged	0.10	0.07	75% < 0.11
Fe > 10%	0.47	0.30	75% > 0.15
Fe < 10%	0.09	0.07	75% < 0.1

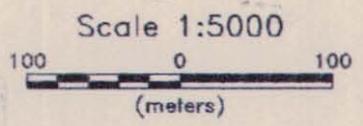
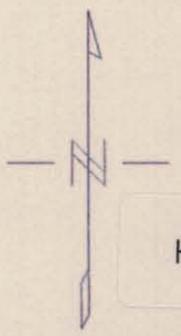
Results are similar for sidrite alt. usually logged or determined by Fe assays.

Altered zone is 5x more magnetic than remainder of 1st sequence.

Ave  $\sim 0.50 \times 10^{-3}$  si for altered, against  
ave  $\sim 0.10$  " unaltered



Vertical scale  
10nT/cm



CRA EXPLORATION PTY. LIMITED		
ZEEHAN CARBONATE PROJECT		
<b>GREIVES</b>		
GROUND MAGNETIC STACKED PROFILES		
QUEENSTOWN SK55-05		
GEO:	TA	SCALE: 1:5000
REPORT:		
DRAWN:	TA	DATE: 13/1/95
PLAN:	Vv	

303335

APPENDIX 11

Wacker sampling ledgers and geochemistry

Appendix 11: Wacker sampling ledgers and geochemistry.

Appendix 11: Wacker sampling ledgers and geochemistry.													
Results in ppm unless shown otherwise.													
Sampno	Prospect	LocalE	LocalN	AMGE	AMGN	Depth	B/rock?	MRTLith	FieldID	Texture	Alt/Min	Colour	Comments
3987320	GRIEVES	61425	47300	363889	5348807	10.7	Y	Og	Sls			LG/LB	Oolitic carbonate.
3987321	GRIEVES	61450	47300	363897	5348784	2.5	?	Om	Sss			WK	Medium grained quartzarenite.
3987322	GRIEVES	61475	47300	363905	5348760	3.5	Y	Om	Sss			WK	Medium grained quartzarenite.
3987323	GRIEVES	61500	47300	363913	5348736	1.5	Y	Om	Sss			WK	Medium grained quartzarenite.
3987324	GRIEVES	61400	47200	363786	5348798	5.7	Y	Og	SlsCcy	We		G/N	Strongly weathered 1st, approaching clay.
3987325	GRIEVES	61425	47200	363794	5348775	13	Y	Og	SlsCcy	We	Py	G/DG	Weakly pyritic calcilutite.
3987326	GRIEVES	61450	47200	363803	5348751	8.5	Y	Og	SlsCcy	WeBn		DG/LG	Banded calcilutite.
3987327	GRIEVES	61475	47200	363811	5348728	12	Y	Og	Sls	WeAl	Sd	YG	Weak, patchy ankerite alteration.
3987328	GRIEVES	61507	47195	363816	5348696	5	Y	Og	Sls	WeAl	Sd	YG	Weak, patchy ankerite alteration.
3987329	GRIEVES	61525	47200	363827	5348680	2.7	Y	Og	Sls	WeAlFe	SdPySp	YG	Weak, patchy sid. altd Sls. Fe-stained, 1-2% sph?
3987330	GRIEVES	61532	47196	363825	5348672	1.5	Y	Om	Sss	WeFe		WK	Medium grained quartzarenite.
3987331	GRIEVES	61575	47100	363749	5348600	4	Y	Om	Sss	We		W	Medium-coarse grained quartzarenite.
3987332	GRIEVES	61550	47100	363741	5348624	2.7	?	Og	SlsCcy	WeFe		DB/N	Strongly weath. Sls residue, Fe-rich clay marbling.
3987333	GRIEVES	61525	47100	363732	5348648	6.2	Y	Om	Sss	We		LB/DB	Coarse grained quartzarenite.
3987334	GRIEVES	61425	47000	363605	5348710	16	N	Og	Ccy			DB/N	Minor LG Ccy bands.
3987335	GRIEVES	61450	47000	363613	5348686	11	N	Og	Ccy	Vu		LY/W	Ab. 2-3mm calcite crystals infilling vughs.
3987336	GRIEVES	61475	47000	363622	5348662	10.2	Y	Og	Sls	WeFeAl	Sd	G	We siderite? veining present.
3987337	GRIEVES	61500	47000	363630	5348639	13	Y	Og	SlsCcy	We		DG/LB	Bladed calcite infilling vughs.
3987338	GRIEVES	61525	47000	363638	5348615	5.2	?	Og	CcySls	We		DB/N	Sandy interbeds, close to gradational contact with Or
3987339	GRIEVES	61550	47000	363646	5348592	10.5	Y	Og	SlsCcy	WeAl	SdSp?	DB/N	Fine g/s siderite crystals present, trace of 1 g. sph?
3987340	GRIEVES	61575	47000	363654	5348568	1.2	Y	Om	Sss			KW	Coarse grained quartzarenite.
3987341	GRIEVES	61525	46900	363543	5348583	20	N	Og	Ccy			DB/N	Out of rods.
3987342	GRIEVES	61550	46900	363551	5348559	10	Y	Og	SlsCcy	WeAl	Sd	G	Patchy, weak ankerite alteration
3987343	GRIEVES	61570	46900	363558	5348540	12.5	Y	Og	CcySls	WeFe		DG/Y	Yellow Fe-staining = We ankerite-altered Sls?
3987344	GRIEVES	61600	46900	363568	5348512	1.7	Y	Om	Sss			WK	Medium to coarse grained quartzarenite.
3987345	GRIEVES	61700	46700	363411	5348352	7.5	?	Og	Sls?	Fe	Py	DB/N	Highly ferruginous and graphitic 'peaty' material.
3987346	GRIEVES	61720	46700	363418	5348333	7	?	Og	Sls?	Fe		DB/N	As above.
3987347	GRIEVES	61750	46675	363404	5348297	8.2	?	Og	Ccy	Fe	Py	DB	(off-section to avoid gully.). "bog Fe" appearance.
3987348	GRIEVES	61775	46675	363412	5348273	9.5	?	Og	Ccy	Fe		DB	Similar to previous sample.
3987349	GRIEVES	61800	46680	363425	5348251	4.2	Y	Om	Sss	We		W	Med. gr. quartzarenite.
	GRIEVES	61700	46500	363222	5348287	3.5	N		Cg				Hole abandoned: could not penetrate gravel.
3987350	GRIEVES	61725	46500	363230	5348263	14.8	N	Og	Ccy	Fe		DB/N	Ferruginous clay.
3987351	GRIEVES	61750	46500	363238	5348240	9.5	Y	Og	SlsCcyOvc	We		DG/DB	Abundant 1-2mm cc crystals-weath vughy cc veins.
3987352	GRIEVES	61775	46500	363247	5348216	7	Y	Og	SlsOvc	We		DG/LG	Abundant fine gr. calcite veining.
3987353	GRIEVES	61800	46500	363255	5348192	9	Y	Og	SlsOvc		Sd	G	Calcite and ankerite veined Sls.
3987354	GRIEVES	61825	46500	363263	5348169	15	Y	Og	Sls	Al	Sd	YG	Oolitic CO3, weak patchy ank. alt., 3-4mm veining.
3987355	GRIEVES	61850	46500	363271	5348145	2	?	Om	Sss			LB/W	Unconsolidated sand, angular quartzarenite frags.
3987385	GRIEVES	60900	48600	364896	5350070	1.7	Y	Om	Sss	WeFe		DB/LB	Iron-stained, strongly weath Sss,approaching sand.

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Appendix 11: Wacker sampling ledgers and geochemistry.

Appendix 11: Wacker sampling ledgers and geochemistry.													
Results in ppm unless shown otherwise.													
Sampno	LocalE	LocalIN	Depth	B/rock?	DPO	Ag ppm	As ppm	Cu ppm	Fe%	Mn ppm	Pb ppm	Zn ppm	
3987320	61425	47300	10.7	Y	77668	-1	13	3	1.30	465	14	58	
3987321	61450	47300	2.5	?	77668	-1	1.5	8	0.80	47	3	16	
3987322	61475	47300	3.5	Y	77668	-1	0.5	5	0.36	20	-3	22	
3987323	61500	47300	1.5	Y	77668	-1	0.5	12	0.58	35	-3	18	
3987324	61400	47200	5.7	Y	77668	-1	21	9	1.01	53	23	45	
3987325	61425	47200	13	Y	77668	-1	4	6	0.64	122	7	21	
3987326	61450	47200	8.5	Y	77668	-1	4	10	0.69	173	11	56	
3987327	61475	47200	12	Y	77668	-1	12.5	7	1.56	592	108	441	
3987328	61507	47195	5	Y	77668	-1	14	7	0.84	339	35	173	
3987329	61525	47200	2.7	Y	77668	-1	18.5	21	1.45	21	23	617	
3987330	61532	47196	1.5	Y	77668	-1	2.5	5	0.86	35	5	32	
3987331	61575	47100	4	Y	77668	-1	0.5	5	0.39	21	3	28	
3987332	61550	47100	2.7	?	77668	-1	1	6	0.35	11	139	34	
3987333	61525	47100	6.2	Y	77668	-1	0.5	5	0.53	30	13	36	
3987334	61425	47000	16	N	77668	-1	17.5	10	1.85	43	36	98	
3987335	61450	47000	11	N	77668	-1	4.5	6	0.20	193	39	89	
3987336	61475	47000	10.2	Y	77668	-1	5.5	9	0.52	87	17	85	
3987337	61500	47000	13	Y	77668	-1	6.5	10	0.82	211	686	785	
3987338	61525	47000	5.2	?	77668	-1	3.5	12	0.44	19	26	36	
3987339	61550	47000	10.5	Y	77668	-1	49	39	3.20	43	298	762	
3987340	61575	47000	1.2	Y	77668	-1	3	3	0.25	10	-3	21	
3987341	61525	46900	20	N	77668	-1	9	37	1.21	55	26	61	
3987342	61550	46900	10	Y	77668	-1	17	8	1.08	111	238	467	
3987343	61570	46900	12.5	Y	77668	-1	190	42	10.90	490	570	2807	
3987344	61600	46900	1.7	Y	77668	-1	1.5	5	0.31	12	-3	26	
3987345	61700	46700	7.5	?	77668	-1	100	25	5.80	13	250	417	
3987346	61720	46700	7	?	77668	-1	27.5	38	1.50	4	291	830	
3987347	61750	46675	8.2	?	77668	-1	44	31	4.05	14	442	700	
3987348	61775	46675	9.5	?	77668	-1	2.5	24	16.40	7	564	1711	
3987349	61800	46680	4.2	Y	77668	-1	18	6	0.64	32	11	32	
	61700	46500	3.5	N									
3987350	61725	46500	14.8	N	77668	-1	34	20	2.32	45	97	824	
3987351	61750	46500	9.5	Y	77668	-1	60.5	9	4.08	138	39	75	
3987352	61775	46500	7	Y	77668	-1	7.5	10	0.72	195	15	58	
3987353	61800	46500	9	Y	77668	-1	34	7	2.20	116	7	43	
3987354	61825	46500	15	Y	77668	-1	4.5	6	0.25	145	81	189	
3987355	61850	46500	2	?	77668	-1	2	8	0.45	22	30	65	
3987385	60900	48600	1.7	Y	77673	-1	2	6	0.32	12	-3	37	

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Appendix 11: Wacker sampling ledgers and geochemistry.

Sampno	Prospect	LocalE	LocalN	AMGE	AMGN	Depth	B/rock?	MRTLith	FieldID	Texture	Alt/Min	Colour	Comments
3987386	GRIEVES	60875	48600	364881	5350090	5.4	Y	Og	Sls	WeAl	Sd	DB/N	Minor 0.5mm LB/Y siderite crystals present.
3987387	GRIEVES	60850	48600	364866	5350110	7.7	N	Og	Ccy		Sp?	DG/B	Mottled clay, trace very fine grained sphalerite?.
3987388	GRIEVES	60825	48600	364851	5350130	4.2	Y	Og	SlsCcy	WeFe		LB	Oolitic carbonate, Fe-stained, lesser black clay.
3987389	GRIEVES	60800	48600	364836	5350150	8	Y	Og	Sls	Al	Sd	G/LG	Trace ankerite veining.
3987390	GRIEVES	60775	48600	364821	5350170	8.5	Y	Og	Sls			DG	Minor calcite veining.
3987391	GRIEVES	60750	48600	364806	5350190	9.8	Y	Og	SlsCcy	We		LG	Strongly weathered calcilutite, lesser clay.
3987392	GRIEVES	60725	48600	364791	5350210	4	Y	Og	Sls			G	Unaltered calcilutite, minor calcite veining.
3987393	GRIEVES	60700	48600	364776	5350230	2.7	Y	Og	SlsCcy	We		LG/DB	Strongly weathered Sls, approaching clay.
3987394	GRIEVES	60675	48600	364761	5350250	10.2	N	Og	Ccy	Lm		W/LG	Trace carbonaceous laminations.
3987395	GRIEVES	60650	48600	364746	5350270	7.5	Y	Og	Sls			G/LG	Unaltered calcilutite.
3987396	GRIEVES	60625	48600	364731	5350290	14.2	Y	Og	Sls	We		G	Unaltered calcilutite.
3987397	GRIEVES	60600	48600	364715	5350310	5	Y	Og	Sls	Fe		DB/N	Peaty, ferruginous Sls.
3987398	MYRTLE	60850	48550	364793	5350358	8.9	N	Og	Ccy	Fe		N	Compacted clay, minor ferruginous bands.
3987399	MYRTLE	60875	48550	364818	5350359	8.6	Y	Og	SlsCcy	We		LG/DB	Oolitic carbonate, minor DB clay.
3987400	MYRTLE	60900	48550	364843	5350359	3.2	Y	Om	Sss	Fe		DB/W	Ferruginous quartzarenite.
3989268	MYRTLE	60875	48750	364814	5350559	4	Y	Og	Sls		Sd	DB/N	Carbonaceous, peaty Sls + graphite shears, tr sid.
	MYRTLE	60850	48750	364789	5350558	1	N		Cg				4 attempts, could not penetrate gravels.
3989269	MYRTLE	60900	48750	364839	5350559	1.8	Y	Om	Sss			W	Coarse-grained quartzarenite.
3989270	MYRTLE	60925	48750	364864	5350559	0	Y	Om	Sss			LK/W	Current-rippled, poor sorted pebbly Sss, hematitic.

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Appendix 11: Wacker sampling ledgers and geochemistry.

Sampno	LocalE	LocalN	Depth	B/rock?	DPO	Ag ppm	As ppm	Cu ppm	Fe%	Mn ppm	Pb ppm	Zn ppm
3987386	60875	48600	5.4	Y	77673	-1	7	35	0.38	12	51	44
3987387	60850	48600	7.7	N	77673	-1	51	40	10.30	891	580	320
3987388	60825	48600	4.2	Y	77673	-1	31	3	1.41	241	103	786
3987389	60800	48600	8	Y	77673	-1	51.5	6	2.45	693	57	72
3987390	60775	48600	8.5	Y	77673	-1	15.5	-2	0.90	213	31	51
3987391	60750	48600	9.8	Y	77673	-1	5.5	-2	0.54	114	45	43
3987392	60725	48600	4	Y	77673	-1	6.5	-2	0.79	70	25	39
3987393	60700	48600	2.7	Y	77673	-1	6	-2	0.51	23	17	37
3987394	60675	48600	10.2	N	77673	-1	7.5	4	0.35	80	98	433
3987395	60650	48600	7.5	Y	77673	-1	10.5	-2	1.13	135	28	43
3987396	60625	48600	14.2	Y	77673	-1	4.5	-2	0.81	151	23	37
3987397	60600	48600	5	Y	77673	-1	16	9	2.40	36	29	359
3987398	60850	48550	8.9	N	77673	-1	63	17	5.10	63	65	122
3987399	60875	48550	8.6	Y	77673	-1	13	-2	1.24	452	25	70
3987400	60900	48550	3.2	Y	77673	-1	4.4	-2	0.35	16	17	41
3989268	60875	48750	4	Y	77673	-1	50	82	1.45	21	49	133
	60850	48750	1	N								
3989269	60900	48750	1.8	Y	77673	-1	1	-2	0.32	14	8	40
3989270	60925	48750	0	Y	77673	-1	3	-2	0.32	13	8	37

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APPENDIX 12

Orientation peat sampling ledgers and geochemistry

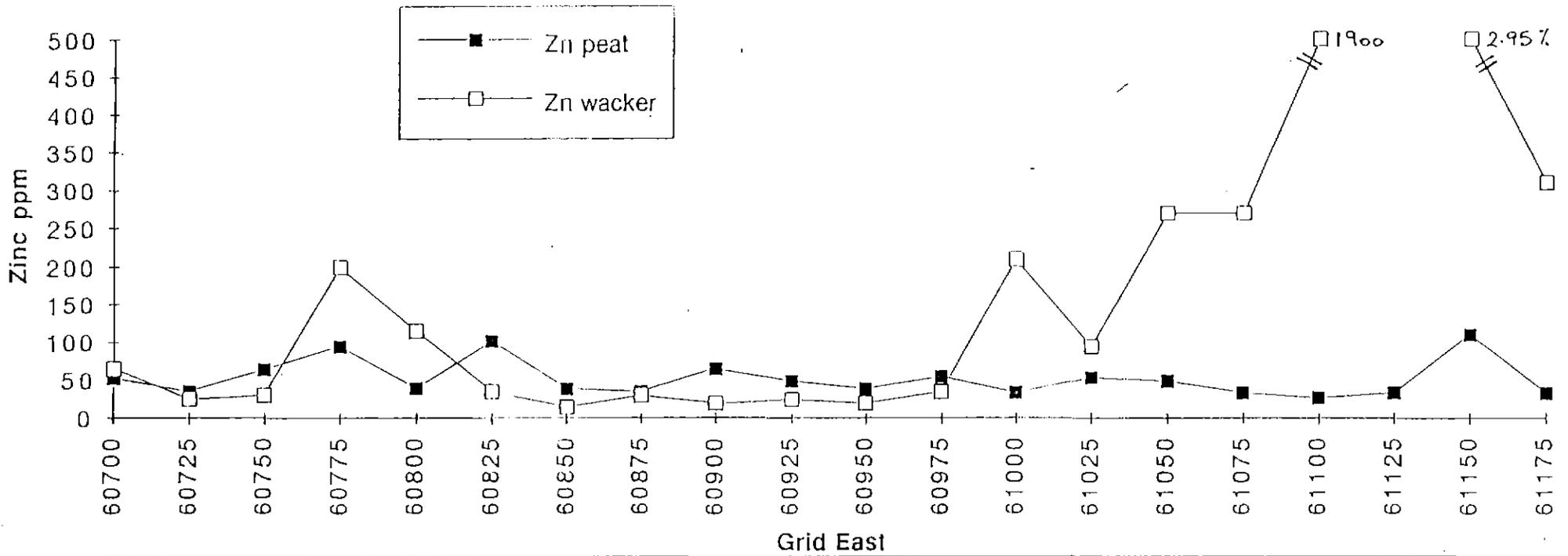
Appendix 12: Orientation peat sampling.

Appendix 12: Orientation peat sampling												corresponding wacker samples						
DPO 77672																		
Samples are of "A" horizon at 0.3m depth.																		
Results in ppm (Fe in %)																		
Sampno	Prospect	Locale	LocalN	AMG E	AMG N	Ag peat	Cu peat	Fe% peat	Mn peat	Pb peat	Zn peat	Sampno	Depth	Cu wack	Fe wack	Mn wack	Pb wack	Zn wack
3992401	GRIEVES	60700	48200	364456	5349989	-1	4	0.42	13	20	52	61755	4.9	5	1.97	205	35	65
3992402	GRIEVES	60725	48200	364471	5349969	-1	3	0.32	9	9	35	61756	10.6	-5	1.12	105	25	25
3992403	GRIEVES	60750	48200	364486	5349949	-1	6	0.25	7	25	64	61757	5.1	-5	0.45	85	25	30
3992404	GRIEVES	60775	48200	364501	5349929	-1	6	0.25	9	28	95	61758	3.7	15	1.42	130	100	200
3992405	GRIEVES	60800	48200	364516	5349909	-1	4	0.19	3	25	40	61759	4.1	5	0.71	155	220	115
3992406	GRIEVES	60825	48200	364531	5349889	-1	10	0.23	9	89	102	61760	5.2	5	0.84	110	35	35
3992407	GRIEVES	60850	48200	364546	5349869	-1	3	0.16	4	16	39	61761	5.8	5	0.45	95	25	15
3992408	GRIEVES	60875	48200	364562	5349849	-1	2	0.22	5	6	35	61762	2.9	5	0.91	105	35	30
3992409	GRIEVES	60900	48200	364577	5349829	-1	2	0.2	-3	30	66	61763	3.2	-5	0.39	65	25	20
3992410	GRIEVES	60925	48200	364592	5349809	-1	5	0.24	-3	40	49	61764	1.7	-5	0.69	140	30	25
3992411	GRIEVES	60950	48200	364607	5349789	-1	3	0.18	-3	4	39	61765	3	-5	0.82	85	25	20
3992412	GRIEVES	60975	48200	364622	5349769	-1	3	0.16	-3	17	55	61766	6.1	5	0.89	90	30	35
3992413	GRIEVES	61000	48200	364637	5349749	-1	2	0.22	-3	12	34	61767	10.8	-5	1.37	90	30	210
3992414	GRIEVES	61025	48200	364652	5349729	-1	3	0.41	6	27	54	61768	4.6	-5	0.53	130	35	95
3992415	GRIEVES	61050	48200	364667	5349709	-1	4	0.32	6	34	49	61769	21.3	5	1.17	155	45	270
3992416	GRIEVES	61075	48200	364682	5349690	-1	3	0.24	5	9	34	61770	6.3	-5	0.43	125	45	270
3992417	GRIEVES	61100	48200	364697	5349670	-1	3	0.18	-3	14	27	61771	6.1	5	0.5	75	75	1350
3992418	GRIEVES	61125	48200	364712	5349650	-1	3	0.16	-3	19	34							
3992419	GRIEVES	61150	48200	364727	5349630	-1	4	0.24	6	88	110	61772	9	25	8.57	1400	720	29500
3992420	GRIEVES	61175	48200	364742	5349610	-1	2	0.16	-3	8	33	61773	6.4	30	0.31	10	290	310
3992421	GRIEVES	61150	47700	364328	5349329	-1	4	0.22	4	42	58	65163	9.4	5	1.27	100	50	50
3992422	GRIEVES	61175	47700	364343	5349309	-1	4	0.3	9	21	46	65123	6.1	10	2.02	10	75	290
3992423	GRIEVES	61225	47700	364373	5349269	-1	2	0.14	-3	14	31	65164	2.8	-5	0.2	10	30	5
3992424	GRIEVES	61250	47700	364388	5349249	-1	4	0.16	3	24	38	65165	6.3	10	3.07	15	90	1600
3992425	GRIEVES	61275	47700	364403	5349229	-1	2	0.19	7	6	38	65166	2.9	-5	0.18	5	45	10
3992426	GRIEVES	61300	47700	364418	5349209	-1	-2	0.2	6	8	214	65167	22.6	5	16.37	5250	75	3700
3992427	GRIEVES	61325	47700	364433	5349189	-1	-2	0.19	3	-3	38	65168	6.3	-5	3.22	1400	85	2000
3992428	GRIEVES	61350	47700	364448	5349169	-1	3	0.17	-3	19	50	65169	9.2	20	3.87	35	270	1100
3992429	GRIEVES	61300	47800	364498	5349269	-1	6	0.67	7	265	1115	65164	10.3	5	1.22	330	55	2350
3992430	GRIEVES	61325	47800	364513	5349249	-1	6	0.32	7	48	55	65160	6.6	10	11.57	3950	545	5350
3992431	GRIEVES	61350	47800	364528	5349229	-1	14	0.2	3	79	205	65151	5.5	45	3.47	35	1350	45000
3992432	MYRTLE	60500	49200	364431	5351002	-1	2	0.21	3	-3	31	64544	1	5	0.98	125	20	5
3992433	MYRTLE	60525	49200	364456	5351003	-1	-2	0.26	3	6	31	64543	1.8	5	0.98	135	25	-5
3992434	MYRTLE	60550	49200	364481	5351003	-1	-2	0.18	-3	8	29	64542	2.9	5	0.39	140	25	-5
3992435	MYRTLE	60575	49200	364506	5351004	-1	2	0.16	4	3	39	64541	11.7	5	0.55	140	15	10
3992436	MYRTLE	60600	49200	364531	5351004	-1	2	0.23	6	22	38	64540	3.8	10	0.54	100	20	15

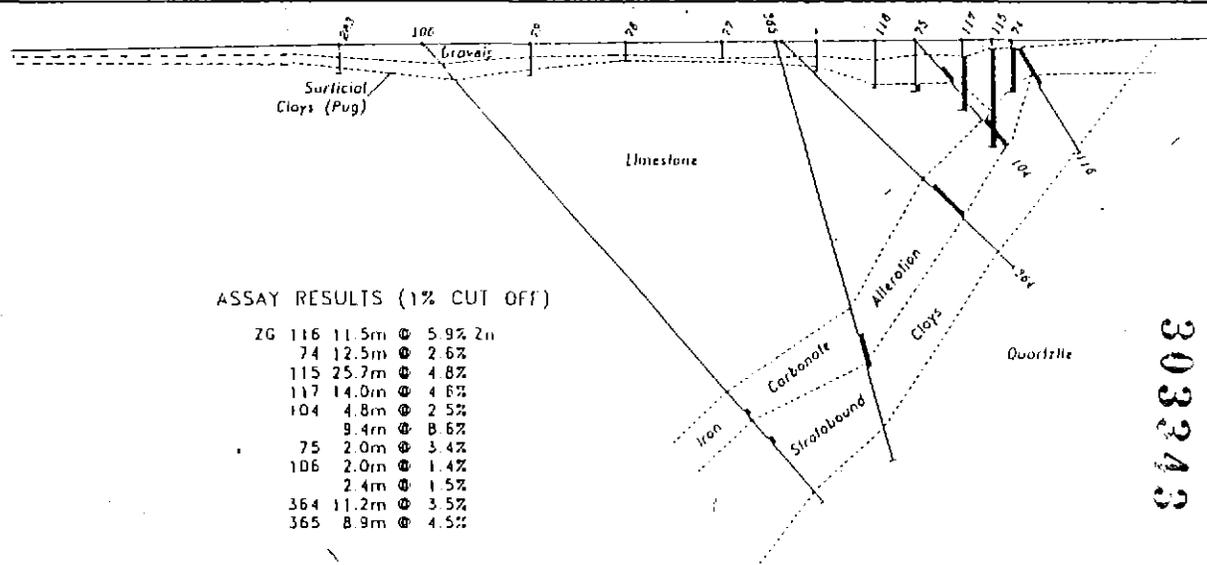
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# ZEEHAN 4 EL 38/89 GRIEVES PROSPECT

## PEAT vs WACKER GEOCHEMISTRY - Line 48200N

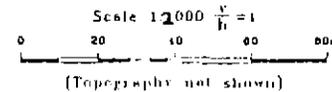


### GEOLOGICAL SECTION



#### ASSAY RESULTS (1% CUT OFF)

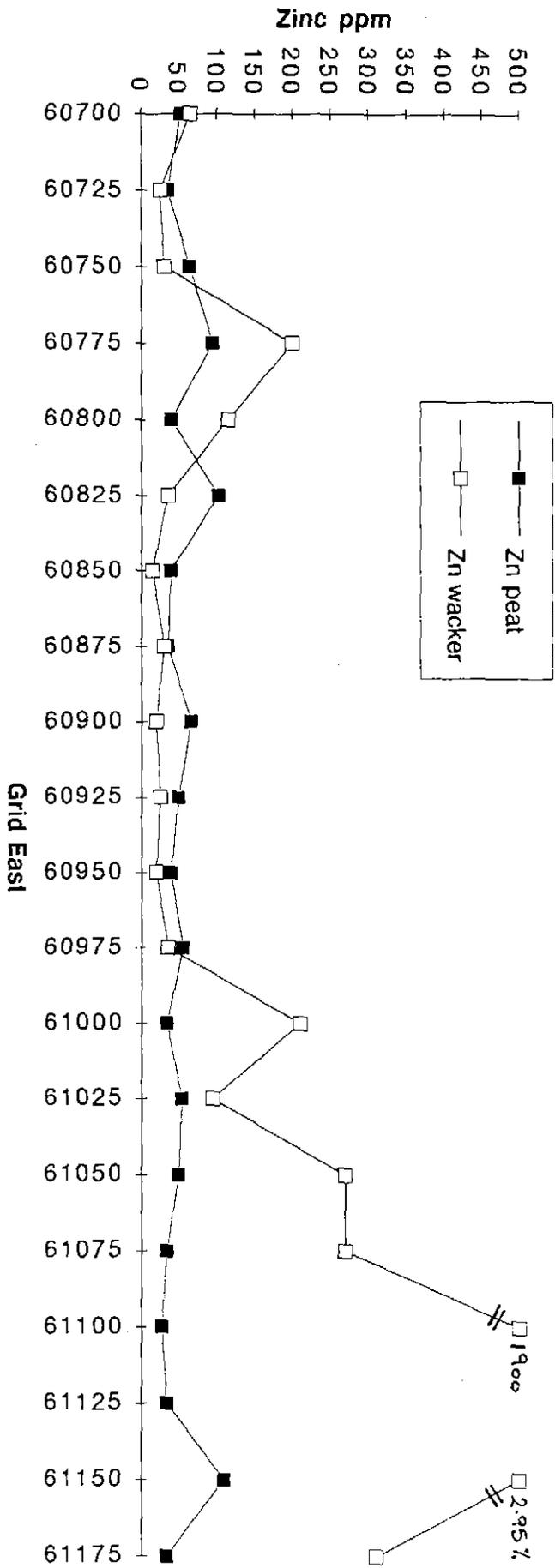
ZG 116	11.5m @	5.9% Zn
74	12.5m @	2.6%
115	25.7m @	4.8%
117	14.0m @	4.6%
104	4.8m @	2.5%
75	9.4m @	8.6%
75	2.0m @	3.4%
106	2.0m @	1.4%
	2.4m @	1.5%
364	11.2m @	3.5%
365	8.9m @	4.5%



ZEEHAN 4 EL 38/89  
GRIEVES PROSPECT  
Section 48200N

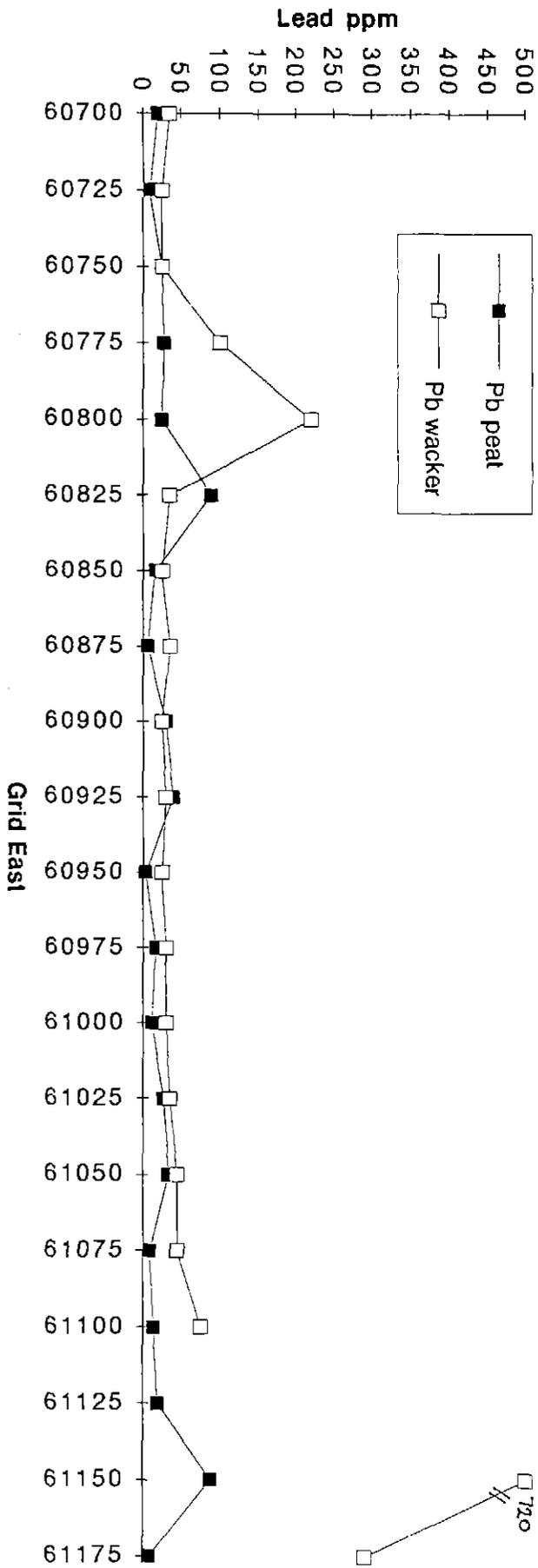
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PEAT VS WACKER GEOCHEMISTRY - Line 48200N

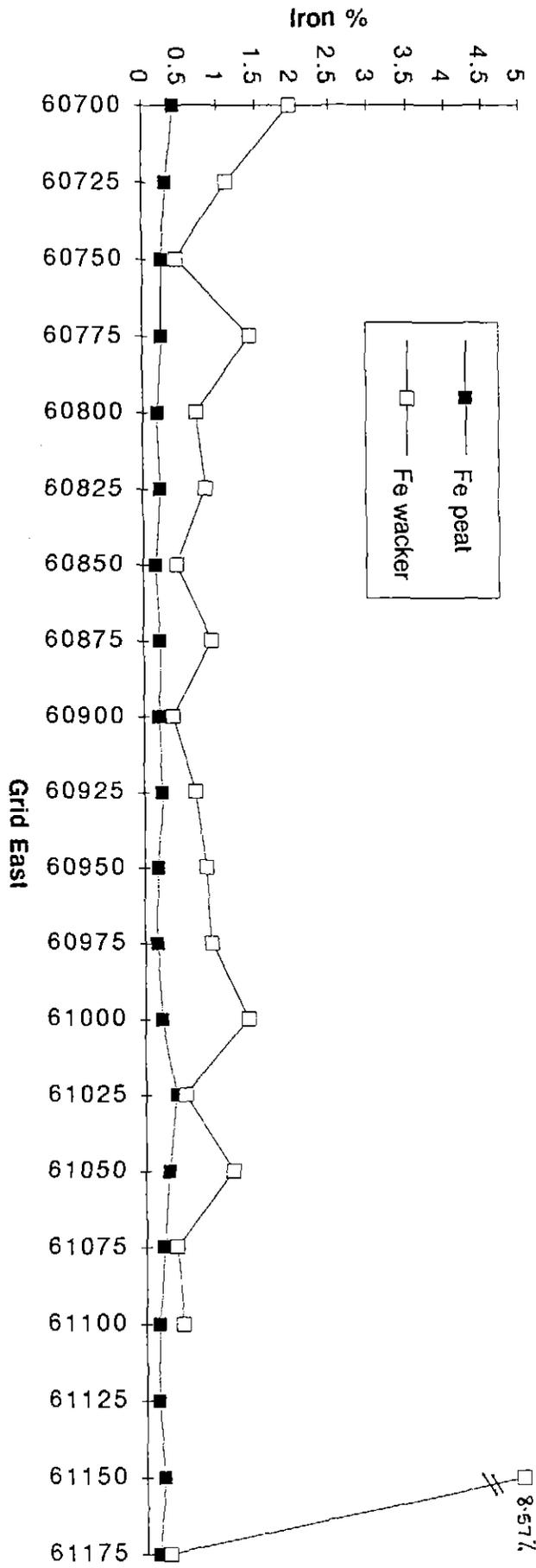


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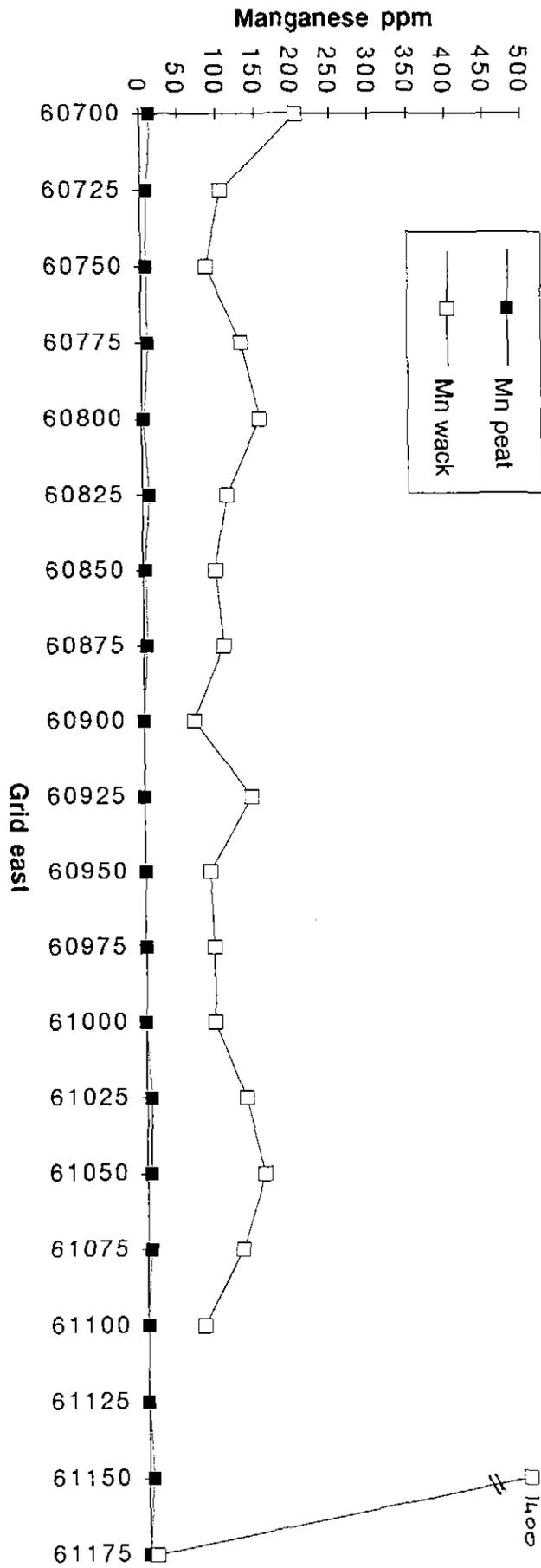
PEAT VS WACKER GEOCHEMISTRY - Line 48200N



PEAT VS WACKER GEOCHEMISTRY - Line 48200N



PEAT VS WACKER GEOCHEMISTRY - Line 48200N



503347

APPENDIX 13

Gravity interpretation and modelling results

*LEAMAN GEOPHYSICS*

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Mr. T. Aravanis,  
CRA Exploration Pty. Limited,  
PO Box 8093,  
Northland Centre,  
Vic 3072.

Re: Badger River gravity data processing

Dear Theo,

The attached brief outline describes the various stages of processing completed in order to extract as much detail as possible from the Badger River data set.

Due to your scheduling it has not been possible to allocate or spend the time necessary to fully optimise the evaluation process but it has been generally effective, regardless of current limitations. The critical separations relate to assumptions about the Silurian sequence and the properties of the Gordon Limestone in the northern and western parts of the grid. Other separations are either valid, outright, or more than acceptable for the current purpose.

Further analysis is possible but would require full testing of the 3D geological model assembled. Ideally both this testing, and any further 2D modelling, requires some additional gravity coverage in the hills east and west of the valley. As few as 15 or 20 stations would make a considerable difference to definition of the field peripherally.

The present 3D model used in these separations is considered by me to be very basic, not unreasonable, of unknown reliability and initial/preliminary. Even so, it may have achieved its purpose. No current 2D model can be valid due to the three dimensional nature of the structures west of 364 000 mE and should only be regarded as indicative. Lines such as your 47900 are especially suspect in this regard. More crucial is the need for data values outside the valley.

I hope these comments are of help.

Regards,



Dr. D.E. Leaman

23 Nov 94

*LEAMAN GEOPHYSICS*

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PROCESSING OF THE BOUGUER GRAVITY DATA IN THE BADGER RIVER REGION  
SOUTH OF ZEEHAN IN TASMANIA

Gravity coverage of the Badger River region was completed by Amoco in 1981. Several surveys were accreted and cover the entire valley floor for several kilometres. Each survey was grid-based and, although all positions were levelled, no comprehensive and precise survey of pegs was completed. It has been found subsequently that the positions are nominal and may carry location errors of about 50 m in absolute terms.

This gravity data base was added to the Tasmanian gravity data base some years later but these problems were not recognised until 1991 when Pasminco attempted to re-observe some stations and infill gaps between others. All stations were terrain corrected at the time of addition to the data base using the presumed positions and elevations. Some small deficiencies may exist in these corrections due to the location problem and the absence of any detailed observer notes on meter positions and local topography near the stations. These errors are unlikely to exceed 0.1 mgal and for most stations the correction applied will be wholly valid.

There is a moral here. If considerable funds are to be expended on a gravity survey, and especially if that survey is actually levelled, then it should be accorded high status and future data base accretion value by properly completing it; this includes calculation of terrain corrections, normalised processing, and accurate definition of station position. Failure to do this degrades the data.

Regardless of these problems the data is of pure geological and structural value but may not offer ultimate resolution in prospect evaluation terms.

The raw Bouguer data reveal a general gross gradient from west to east which tends to disguise fine character in the field. It is not possible to simply compare features around the survey although it is clear that some crude response may be associated with the valley and the exposed limestones along its floor.

This view of the data can be sharpened by regional removal of the interfering sources which generate the gradients. Unfortunately, no simple procedure or filter can do this reliably in the complex conditions of western Tasmania. The contributions to the field must be directly assessed and then removed.

This process has been largely perfected for very long wavelength contributions; such as those generated deep in the crust, or in the

ocean nearby. The procedure currently known as MANTLE91 uses a crustal model defined by the entire data set and a very large array of 2D and 3D model calculations to estimate the contributions of continental effects at each station; This effect is then removed to produce a residual. The process has been upgraded twice as new data and more extensive control of the model have become available and has been shown to be both reliable and very useful. There are no side effects or uncertainties of the type which dog most filter processes. The residuals produced recover the fine detail in the data set although the amount of detail depends on the nature of basic coverage.

This type of process can be extended to include an estimation of the attraction of all the contributory sources in a sub region provided a 3D model exists for each source and a reasonable estimate of density contrast can be offered. If the geological models and properties are valid, and there are no anomalous internal or unexpected variations, then the final result is a zero residual plan. Each stage of such a stripping process should remove part of the anomalous field pattern.

This sequence has been applied to the Badger River data set in order to identify any anomalous zones.

Note that the calculation is undertaken at the actual position of the observed station and its value is directly adjusted. There is no interpolation.

The raw data was supplied as an Excel file containing the gravity data and wacker bedrock depths.

(It may be commented here that while such a presentation is neat it leaves much to be desired if the data are to be fed to flexible programmes not produced by Microsoft. Even after ASCII conversion and primary editing the irregularities of number formatting - and the inclusion of non standard line formats - the entire files must be inspected for oddities). In this case the file was reduced to a ten column format giving AMG (2), grid coordinates (2), station numbering codes (2), height (1), observed and residual Bouguer (2) and wacker depth (1). The residual Bouguer value is updated with each source pass. The raw file has been named CRADATA.

The residual file, after estimation of mantle and ocean effects is named CRADATA.WAT.

This residual file removes the large regional gradients in the Tasmanian data base.

The local geological sources have been estimated and removed in an order which reflects either the assurance of the 3D models or their impact on the Badger River area.

The largest local source is the Heemskirk-Granite Tor granitoid axis. This is a much evolved and well established model and can be considered very reliable in terms of this area. The resulting revised residual file is named CRADATA.GRA.

It must be noted, in terms of model evaluation and reliability, that the subsequent stages are less certain.

3D models prepared for the local Devonian, Silurian, Ordovician and Cambrian-Precambrian suites have been based on a set of geological sections drawn using regional mapping. Normal practice would take these sections and exhaustively integrate and test them against the gravity data base. Several iterative cycles are normally required to sculpt an initial model to a satisfactory quality as tested against a random array of at least 5 to 7 profiles. Time has not permitted this refinement here although the Ordovician component has been passed through three iterations. This reflects the dominance of coverage in the valley and the important contribution from the limestones. Any reliable iteration of the entire group of source components is restricted by the limited data coverage outside the valley.

Any further refinement is not justified until some extra data control is observed in the region.

Given these constraints and the risk that the initial model may be inadequate the next stage of processing has drawn first on the only other facts: the wacker depths.

Overburden depths range up to 12 m and this equates to no more than 0.4 mgal adjustment in the Bouguer anomaly assuming a density of about 2.00 gm/cc. This is not a significant bulk correction, since most adjustments are very small, in the context of all other sources. It does contribute some significant, local, high frequency modifications in the valley.

The data file includes all gravity stations but not all positions are associated with a hole depth. All relevant locations have been corrected. No adjustment was applied to other stations. No interpolations were attempted due to the extreme variability in depths. As noted above this is a minor effect in the present context. The revised file after this adjustment is CRADATA.GRO.

The folded Devonian units have been modelled using an average density of 2.75. The Bell Shale may be denser but is of limited development in this area. The revised residual is CRADATA.DEV.

The basement complex including the Cambrian and Precambrian units which have densities in excess of 2.74 bulk average was estimated next. The revised residual is CRADATA.CAM.

Both Devonian and Basement contributions are not especially significant in terms of the valley surveys due to limited effect (DEVON) and overall spread of effect (CAMBRIAN). Any expansion of coverage, however, would require some review of these models.

It may be assumed that CRADATA.CAM presents a reasonable view regardless of any deficiencies in the models.

The final contributions are crucial since they are local and specific to the surveyed areas.

The Silurian rocks have been modelled at a bulk density of about 2.6 gm/cc and the Ordovician limestone at at least 2.75 gm/cc. The estimates for the Silurian rocks is a combined value for the

formations exposed and is based on local experience. The limestone, however, has been shown to have densities ranging from 2.72 to 2.84 gm/cc. This range reflects clastic and dolomitic content. No lower values are credible and significant segments of the formation may exceed 2.79 gm/cc.

The residuals after Silurian and Limestone corrections are filed as CRADATA.SIL and CRADATA.GOR.

No correction or calculation has been associated with the siliceous sandstones and conglomerates of the Lower Ordovician. These have bulk densities in the range 2.64 to 2.70 gm/cc (i.e., approximately the Bouguer reduction density). No correction is therefore necessary. It should be noted, however, that some dense units do exist within the haematitic sandstones and in the region of Oceana these have densities as high as 2.78 gm/cc. There is no suggestion that these densities are required here but there is very limited coverage across the relevant exposures.

This processing, which must be considered preliminary, has removed all regional gradients and identified two anomalous valley segments. The valley section between 5351 and 5352 000 N at 364 000 E and near 361 000 E, 5350 000 N.

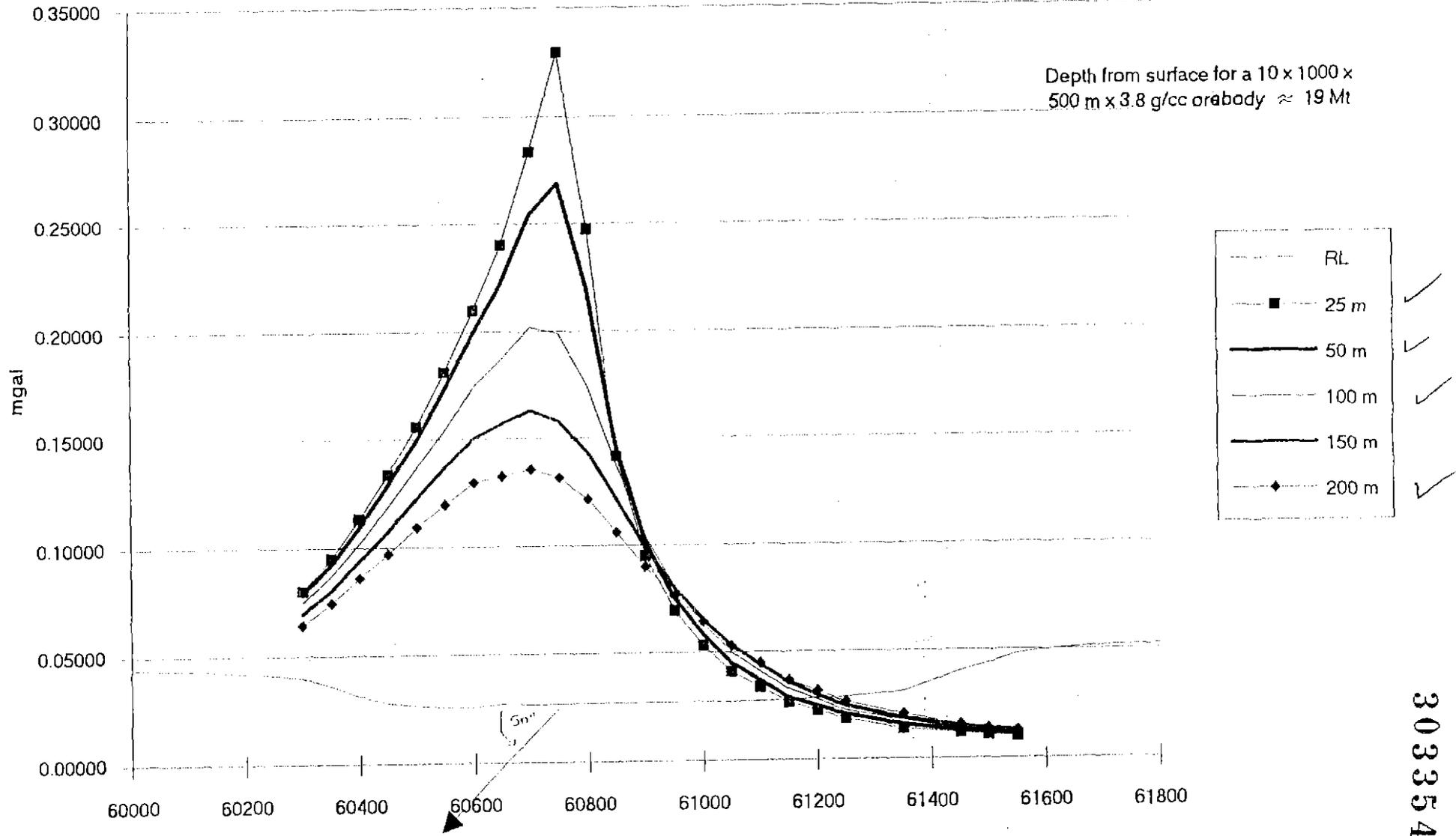
This may be a real effect or it may be due to deficiencies in assumptions or models. The northern anomaly may indicate a locally denser variant of the limestone since the model adequately accounts for structure and units elsewhere. The northern zone is of interest since the sectional analysis, initial models and gravity field all suggest anomalous structure and deposition patterns. This might be linked to late Cambrian basin margin faulting which has been rejuvenated. This could be a critical observation and the association may be important for any exploration evaluation.

No further work can be recommended at this stage since satisfactory refinement of the local models is dependent on some additional gravity coverage outside the valley.



D.E. Leaman  
Nov 23 1994

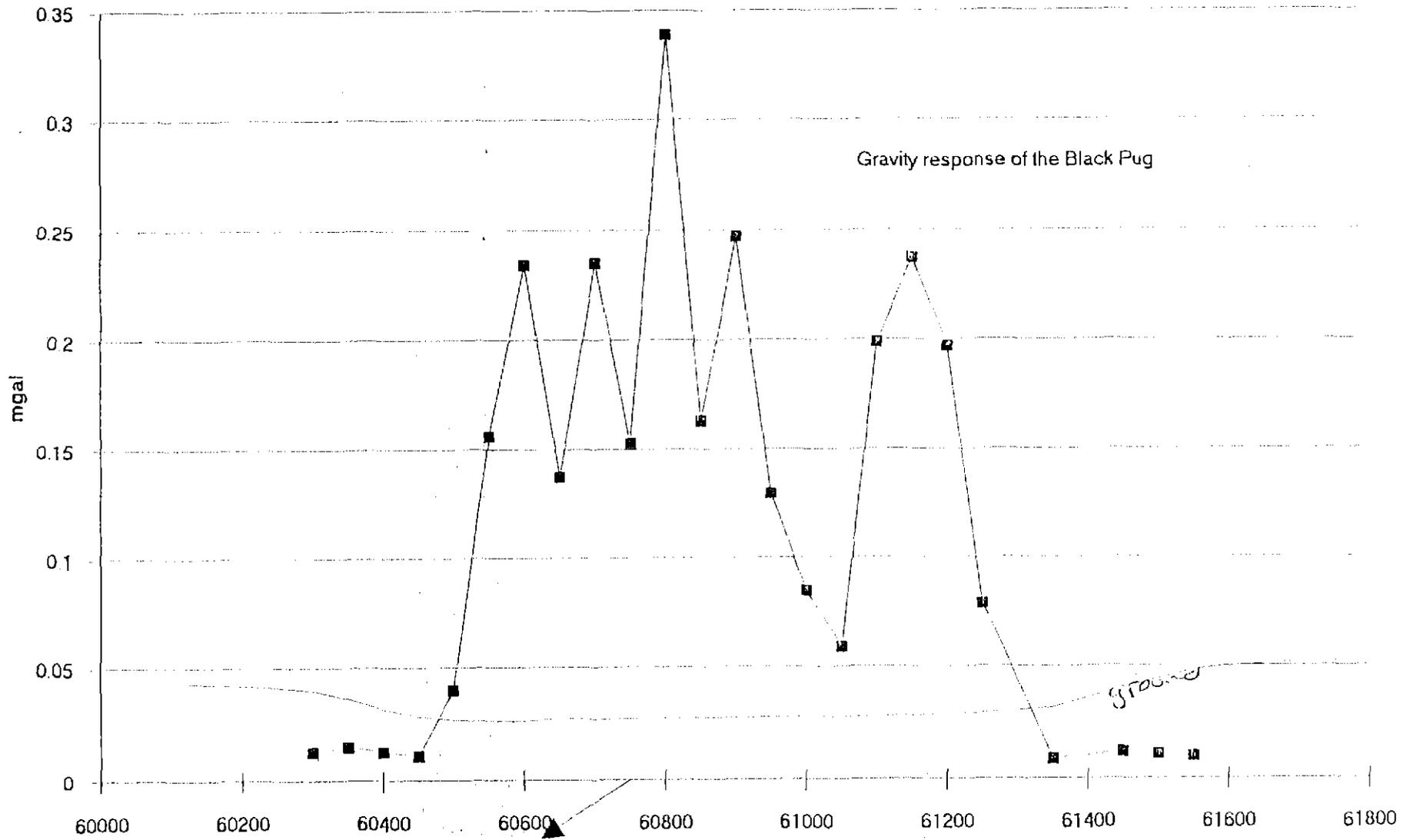
# ZEEHAN CARBONATE ZINC PROJECT



303354

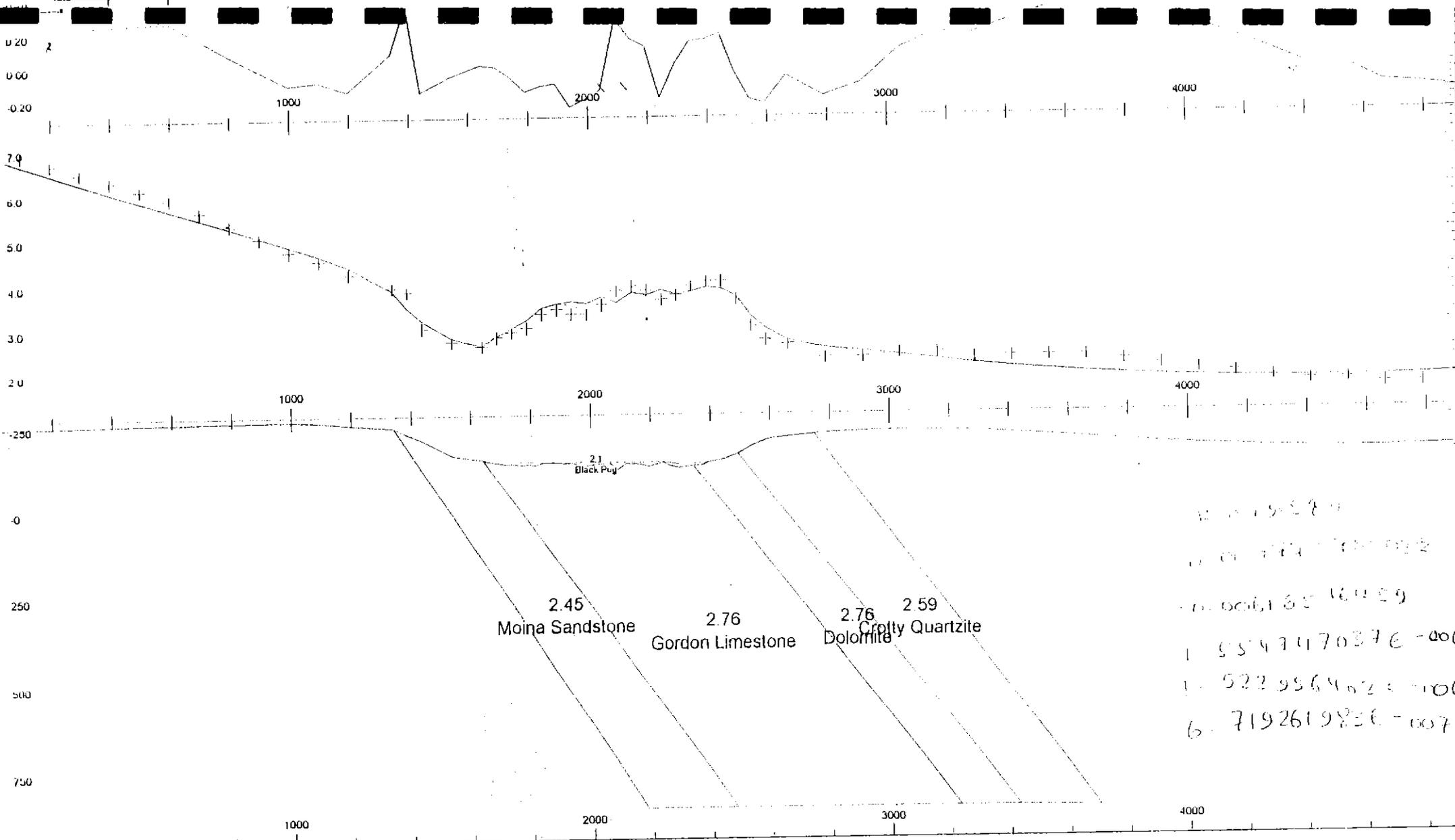
GT 2014  
301512

# ZEEHAN CARBONATE ZINC PROJECT



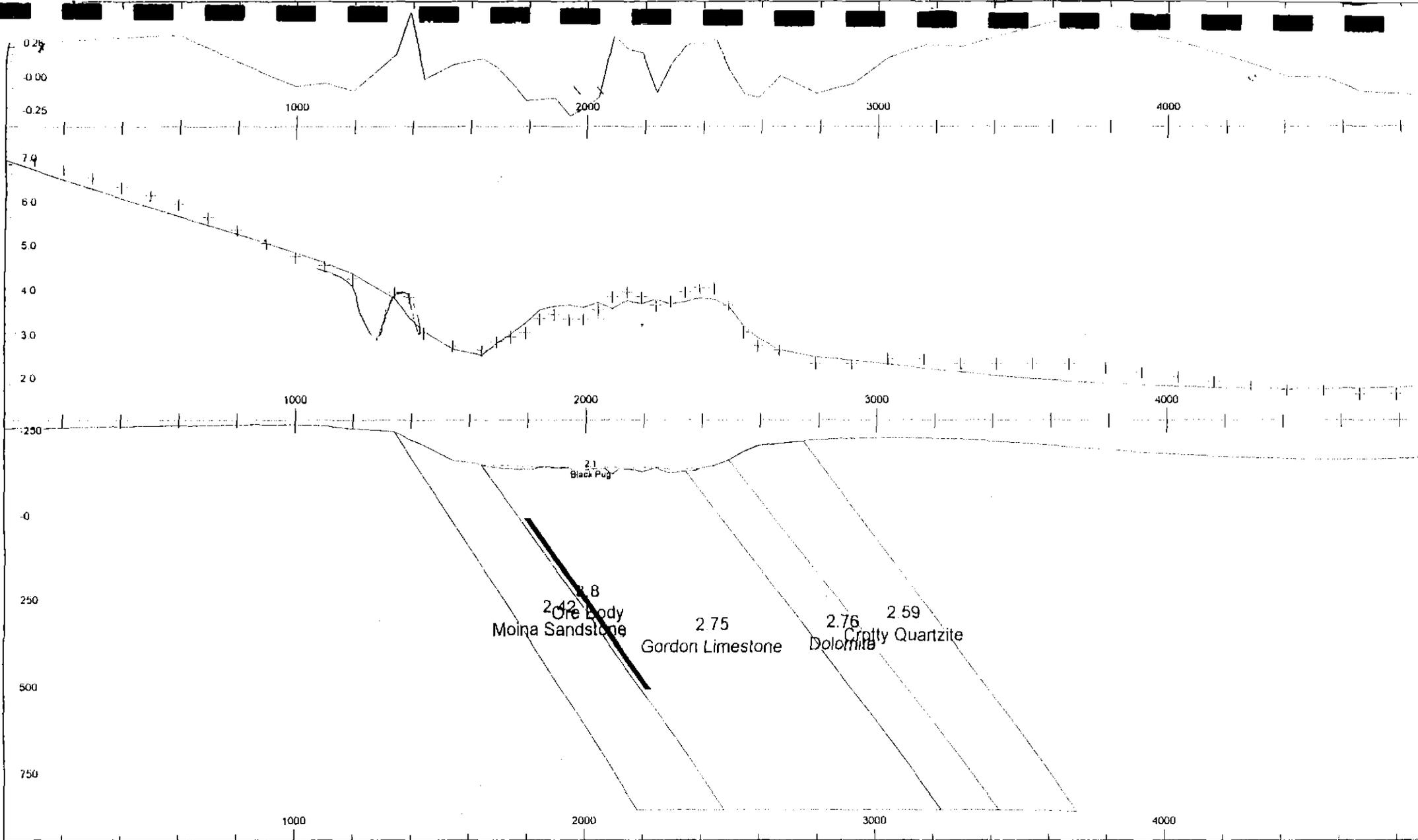
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 The Black Pug is a...  
 ...  
 ...

303351



GRIEVES  
 LINE 47900N  
 OBS + CALC GRAMTY

303356



GRIEVES  
 LINE 47900 N  
 OBS + CALC GRANTY  
 INCL "OREBODY"

303357



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303358

95-3714

Zeehan No. 4 EL 38/89, Tasmania  
Report on Exploration for the Fifth Year of Tenure  
1/3/94 to 28/2/95

**MICROFILMED**  
FICHE No. 013577-88

Author: R.G. Parkinson

Date: March, 1995

Licence Holder: CRA Exploration Pty. Limited

Submitted to: Chief Geologist

Copies to: Tasmanian Development and Resources  
CRAE ETIG Box Hill  
CRAE Preston  
CRAE Zeehan  
Allegiance Mining NL

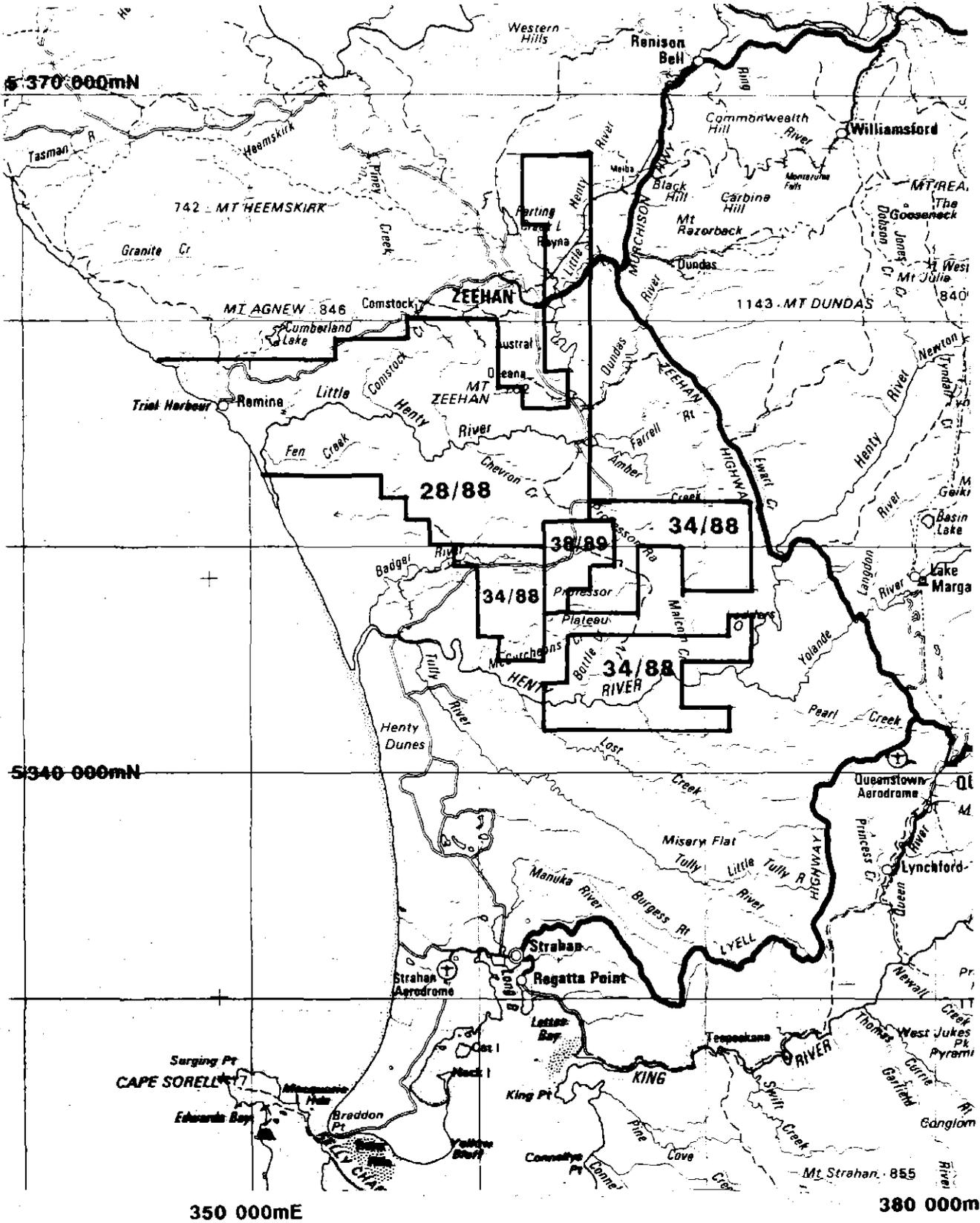
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Accepted by:

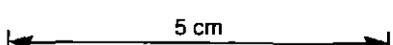
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Vol 2/3

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CRAE Report No. 20613



# 95-3714



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## ZEEHAN JOINT VENTURES

### LOCALITY DIAGRAM

Ref.: SK 55 - 5	Scale: 1:250 000
Author: T. Summons	Report No.: 20613
Drawn: R. Traverso	Plan No.: TV 431



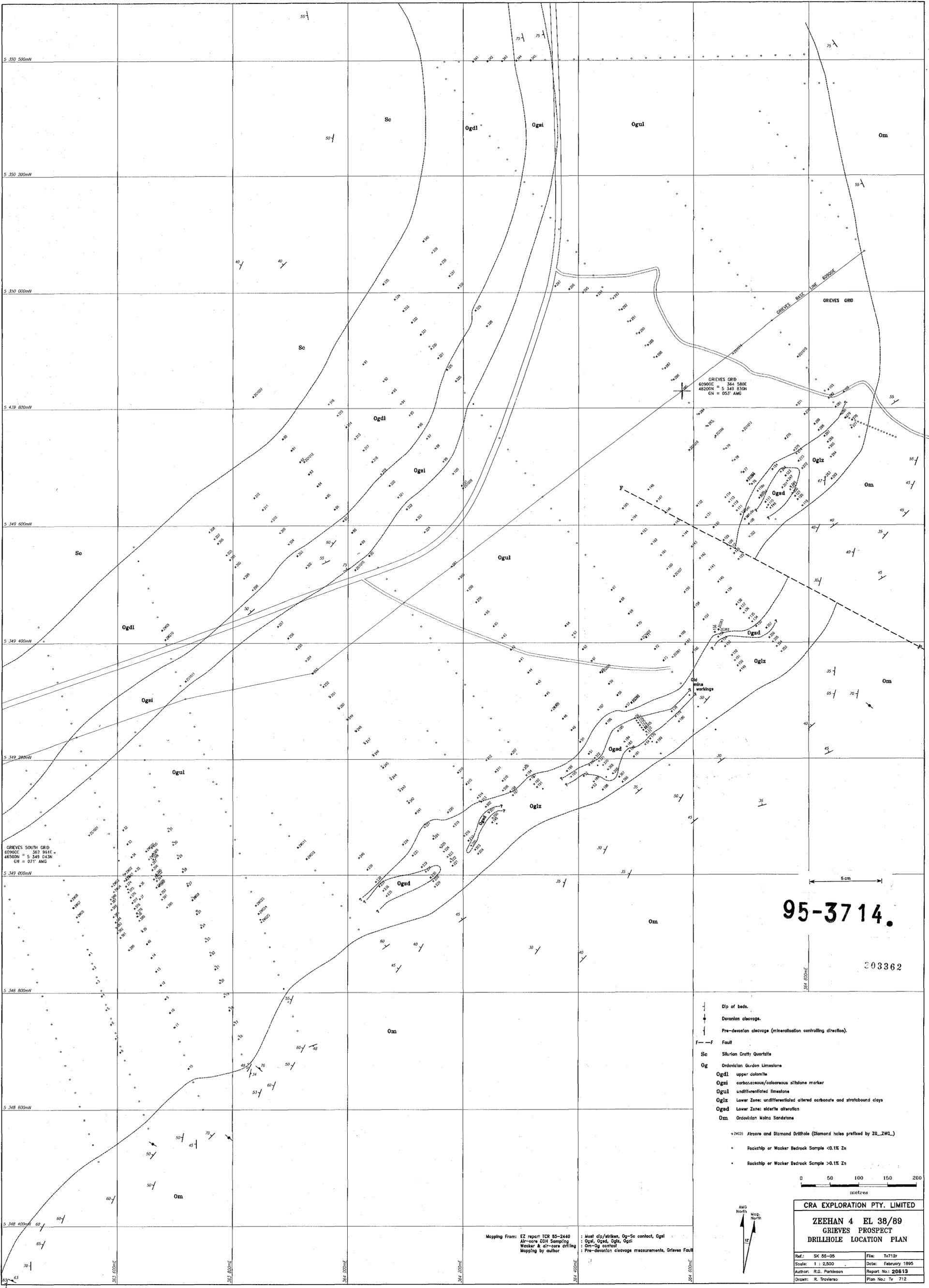
95-3714

- Ordovician Gordon Limestone (usually covered by peat and gravels)
- Major Faults
- DrillHole Collar Location
- Wacker Collar Location
- CRAE Tenement Boundaries



303360

CRA EXPLORATION PTY. LIMITED	
<b>ZEEHAN PROJECT Gordon Limestone Prospect and Drillhole Location Plan</b>	
Ref.: SK55 - 5	File: ZEEHAN 761
Scale: 1 : 50000	Date: July 1994
Author: Rob Parkinson	Report No.: 20613
Drawn: R. Traverso	Plan No.: Tv 761



95-3714.

303362

- Dip of beds.
- Devonian cleavage.
- Pre-devonian cleavage (mineralisation controlling direction).
- F—F Fault
- Sc Silurian Crotty Quartzite
- Og Ordovician Gordon Limestone
- Ogdl upper dolomite
- Ogsi carbonaceous/calcareous siltstone marker
- Ogul undifferentiated limestone
- Ogiz Lower Zone: undifferentiated altered carbonates and stratabound clays
- Ogad Lower Zone: alderite alteration
- Om Ordovician Molta Sandstone

0 50 100 150 200 metres

**CRA EXPLORATION PTY. LIMITED**

**ZEEHAN 4 EL 38/89**  
**GRIEVES PROSPECT**  
**DRILLHOLE LOCATION PLAN**

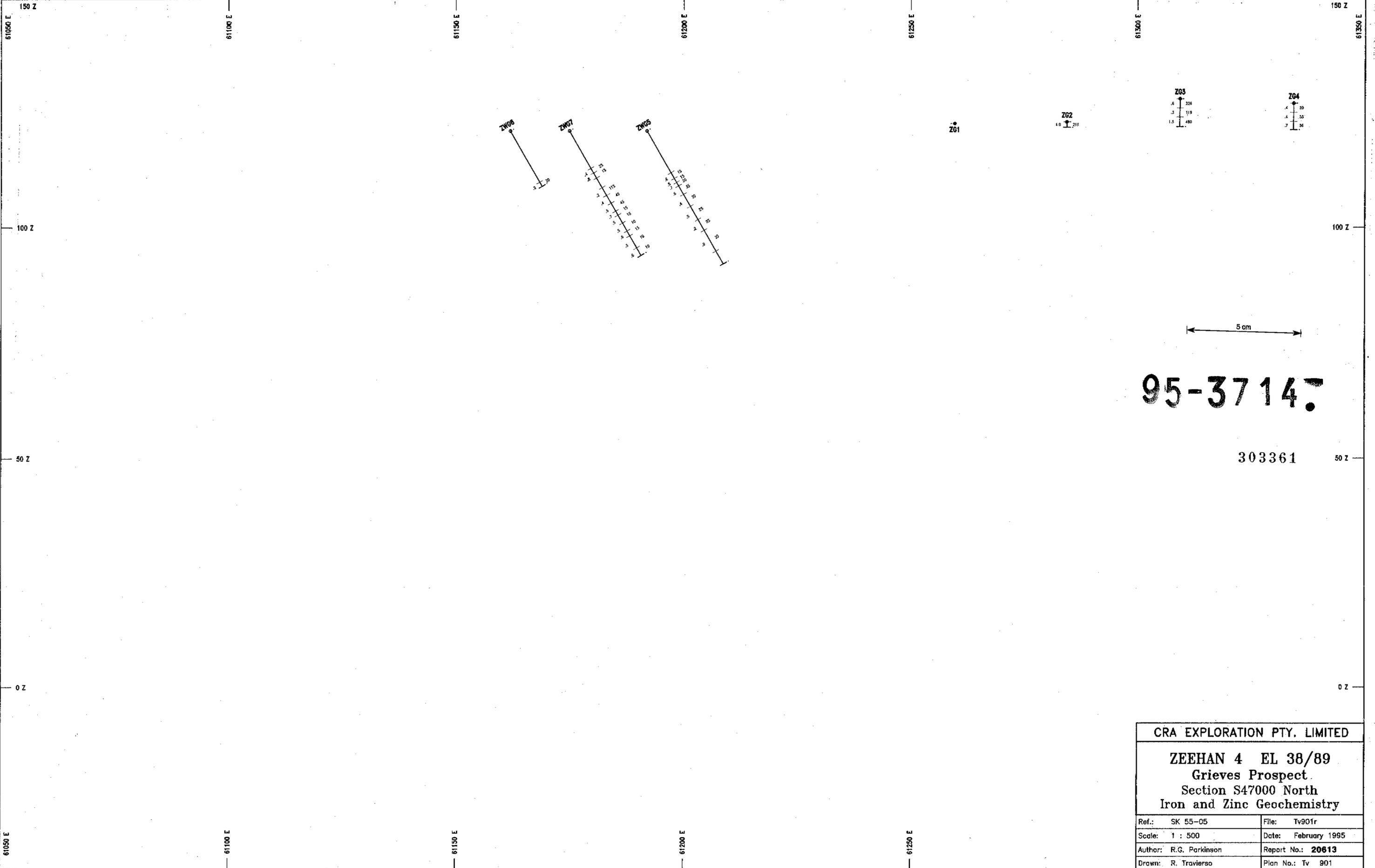
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Scale: 1 : 2,500	Date: February 1995
Author: R.G. Parkinson	Report No.: 20613
Drawn: R. Traverso	Plan No.: Tv 712

Mapping From: EZ report TCR 85-2440  
 Air-core EDH Sampling  
 Wacker & air-core drilling  
 Mapping by author

• Most dip/strikes, Og-Sc contact, Ogdl  
 • Ogdl, Ogad, Ogiz, Ogsi  
 • Om-Og contact  
 • Pre-devonian cleavage measurements, Greives Fault

GRIEVES SOUTH GRID  
 60900E = 362 981E  
 46500N = 5 349 043N  
 GN = 071° AMG

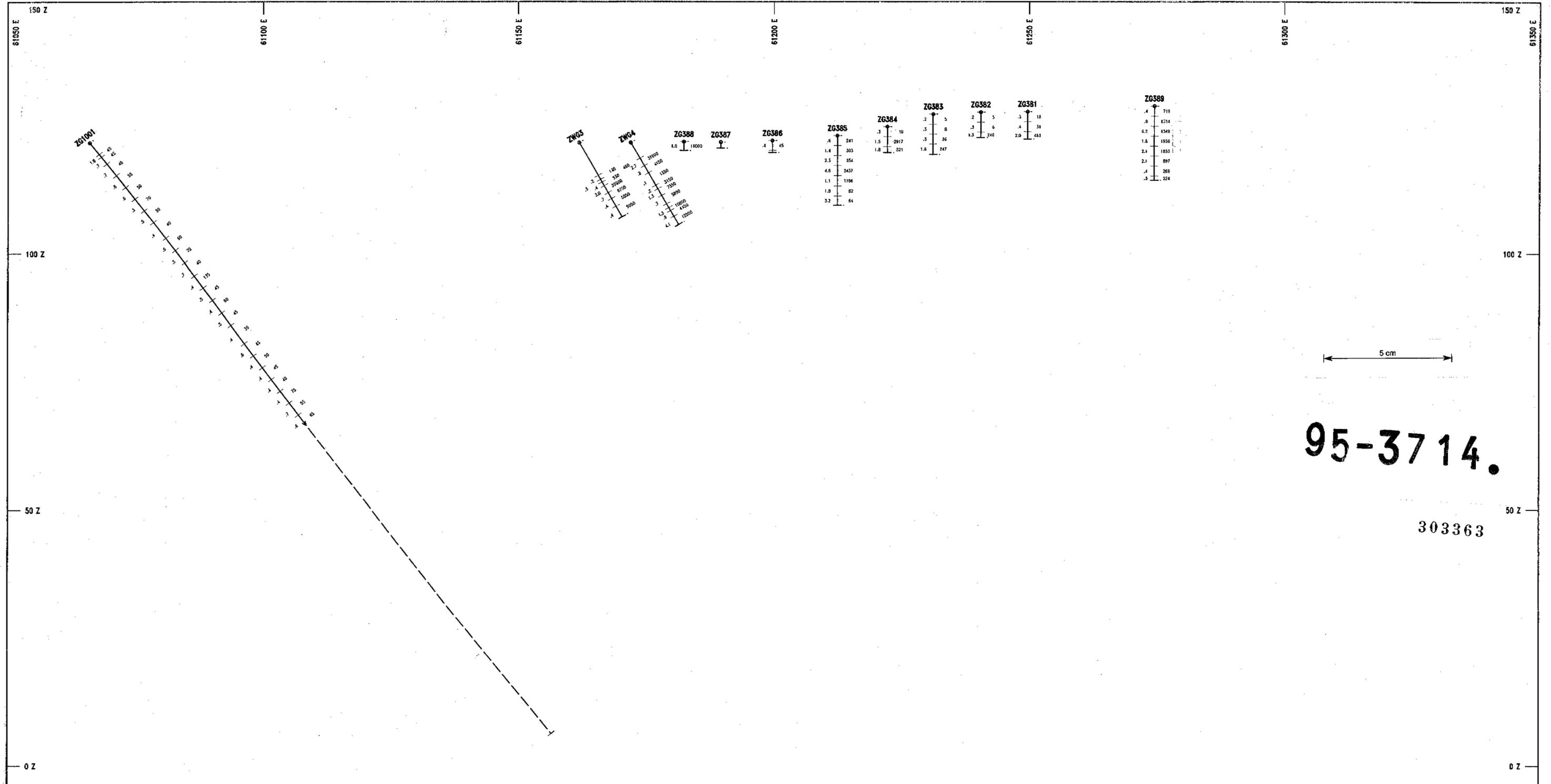
GRIEVES GRID  
 60900E = 364 580E  
 46200N = 5 349 330N  
 GN = 055° AMG



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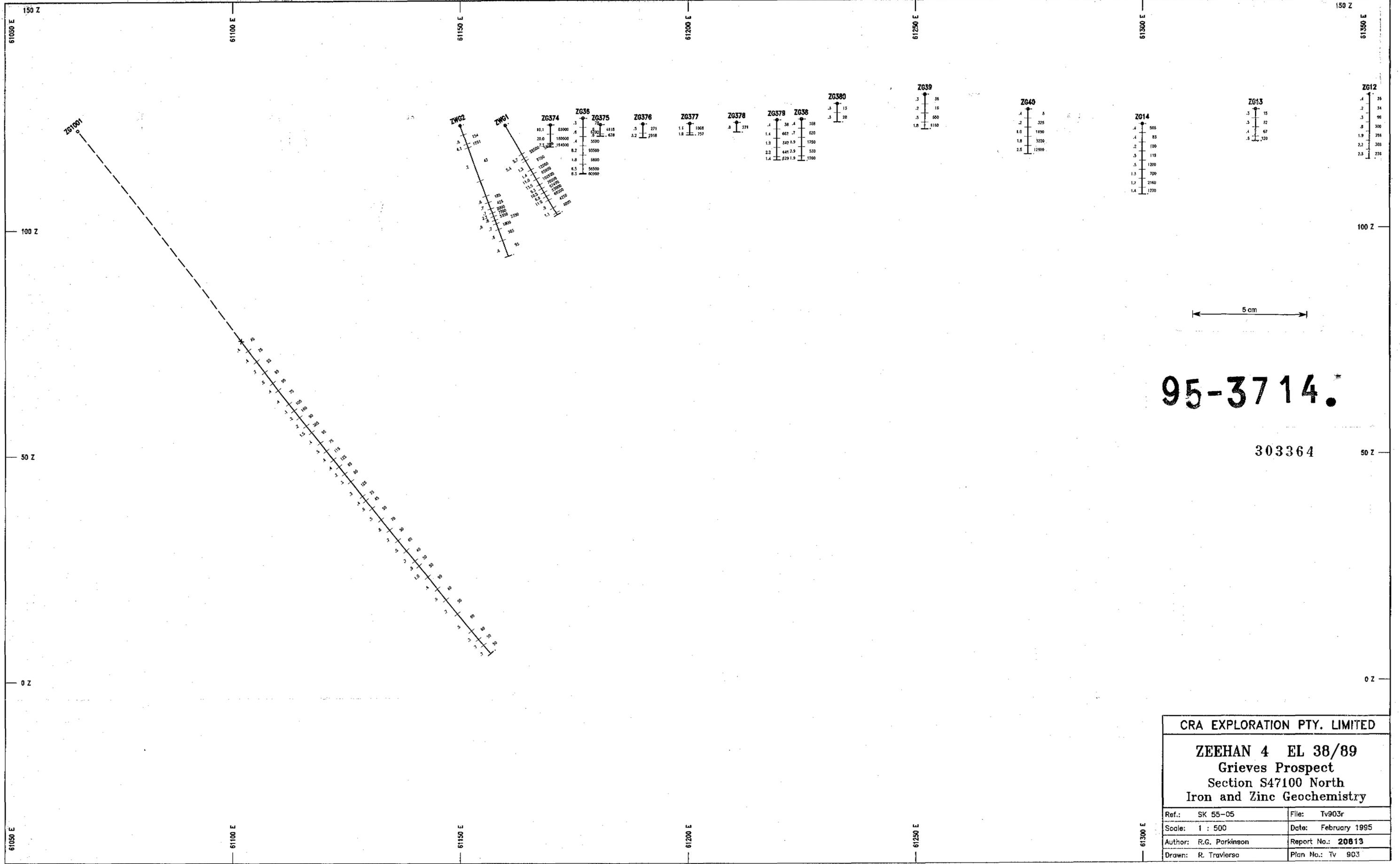
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Ref.: SK 55-05	File: Tv901r
Scale: 1 : 500	Date: February 1995
Author: R.G. Parkinson	Report No.: 20613
Drawn: R. Traverso	Plan No.: Tv 901



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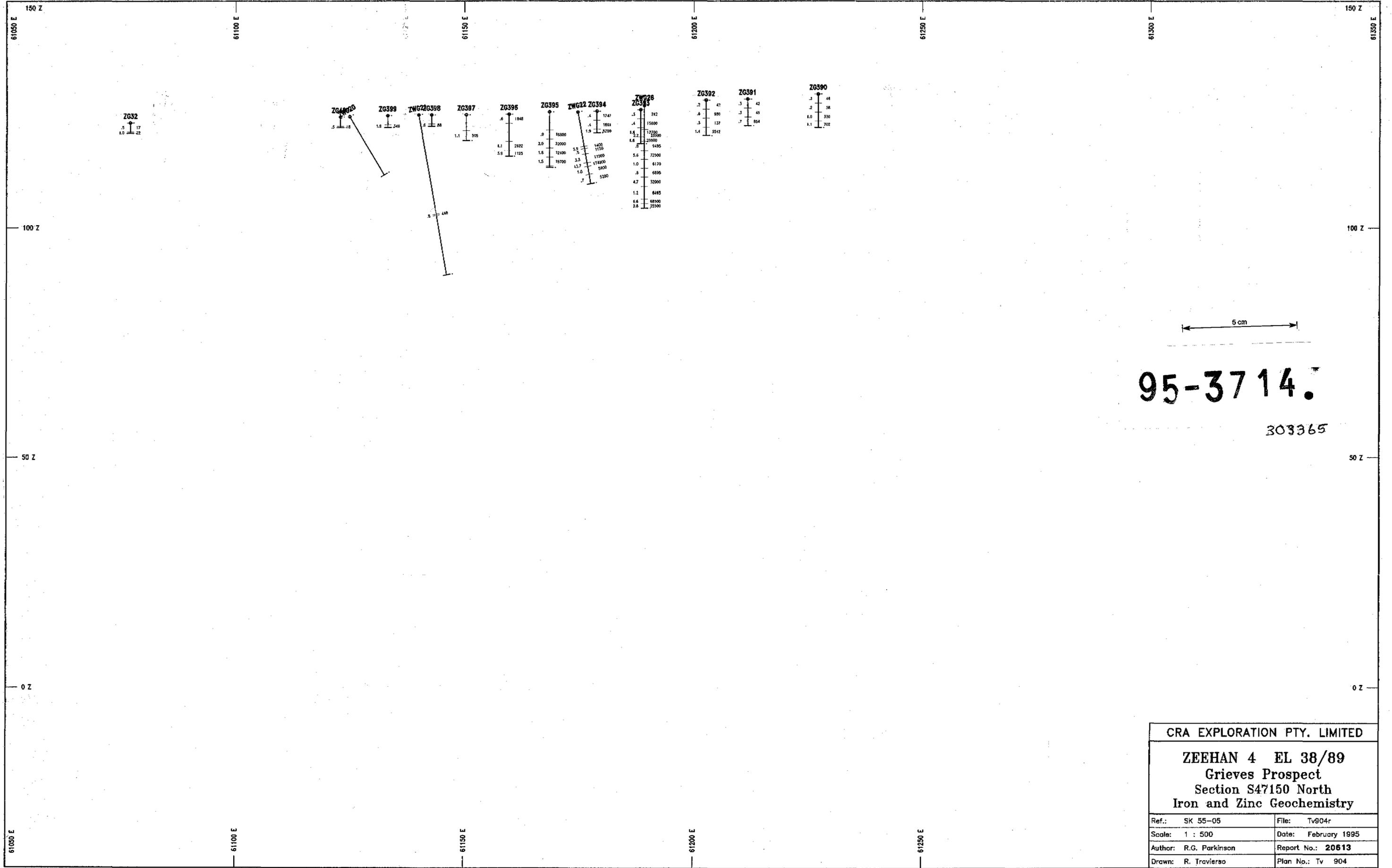
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Ref.: SK 55-05	File: Tv902r
Scale: 1 : 500	Date: February 1995
Author: R.G. Parkinson	Report No.: 20613
Drawn: R. Traverso	Plan No.: Tv 902



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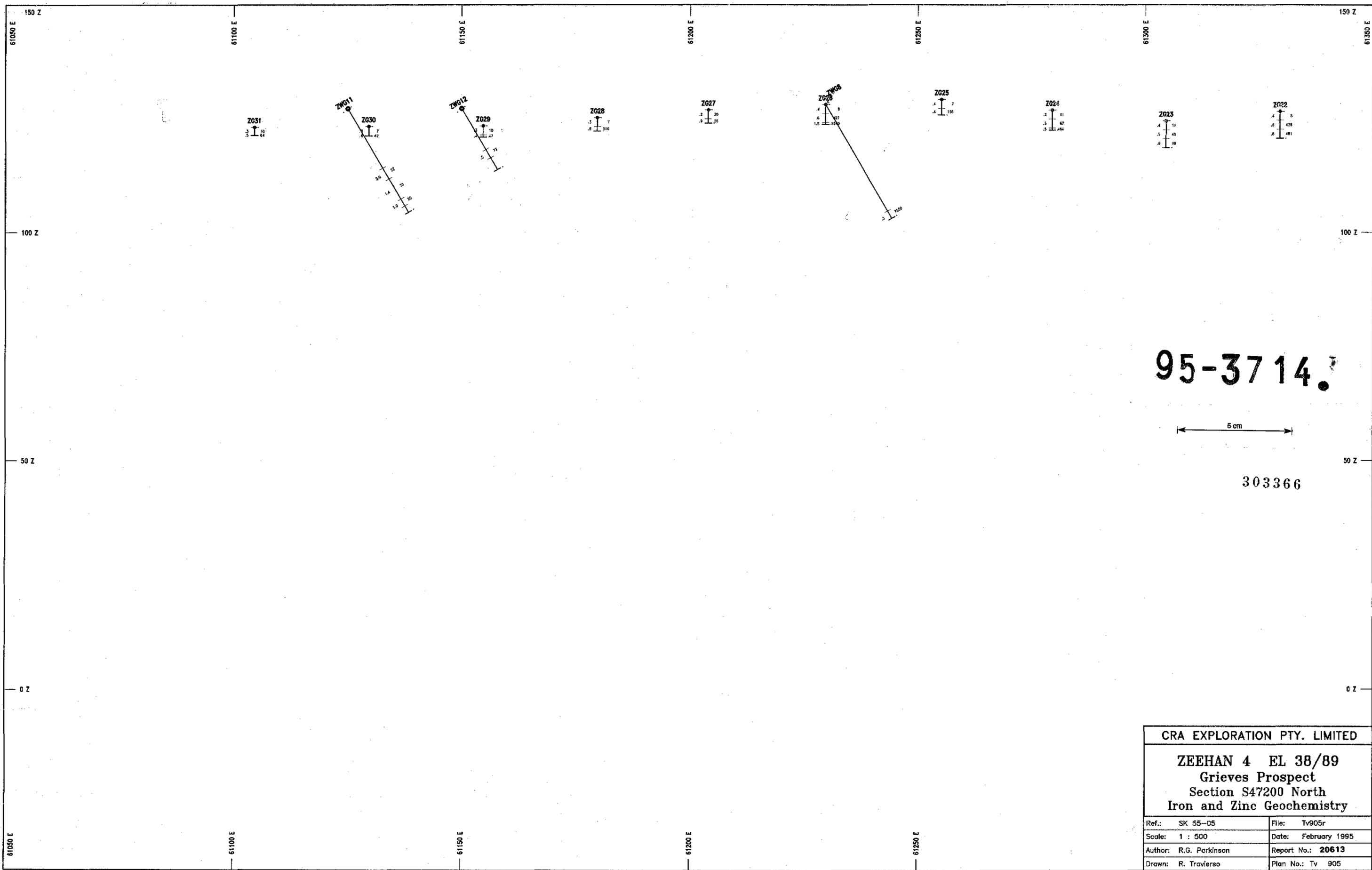
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Ref.: SK 55-05	File: Tv903r
Scale: 1 : 500	Date: February 1995
Author: R.G. Parkinson	Report No.: 20813
Drawn: R. Travlerso	Plan No.: Tv 903



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Author: R.G. Parkinson	Report No.: 20613
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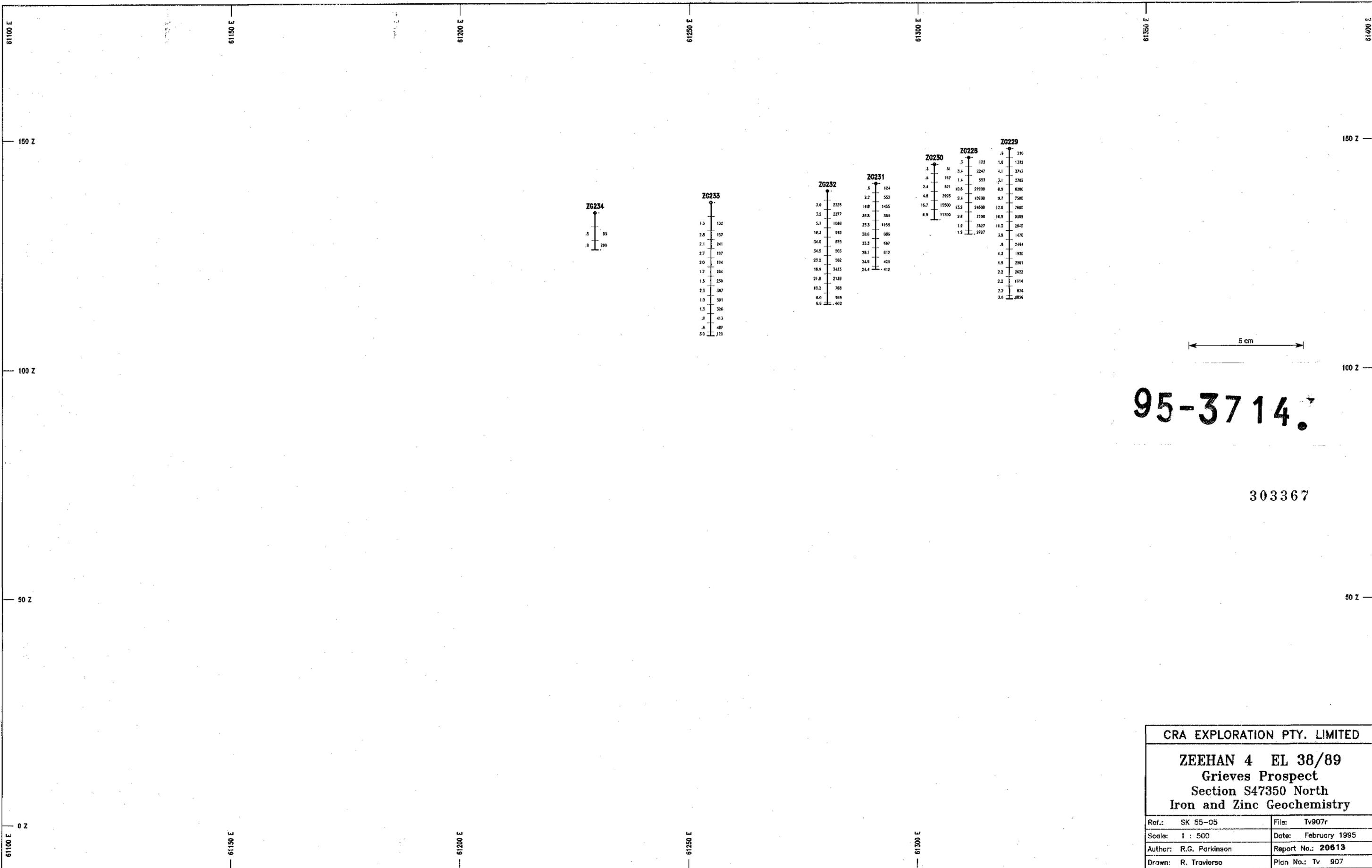


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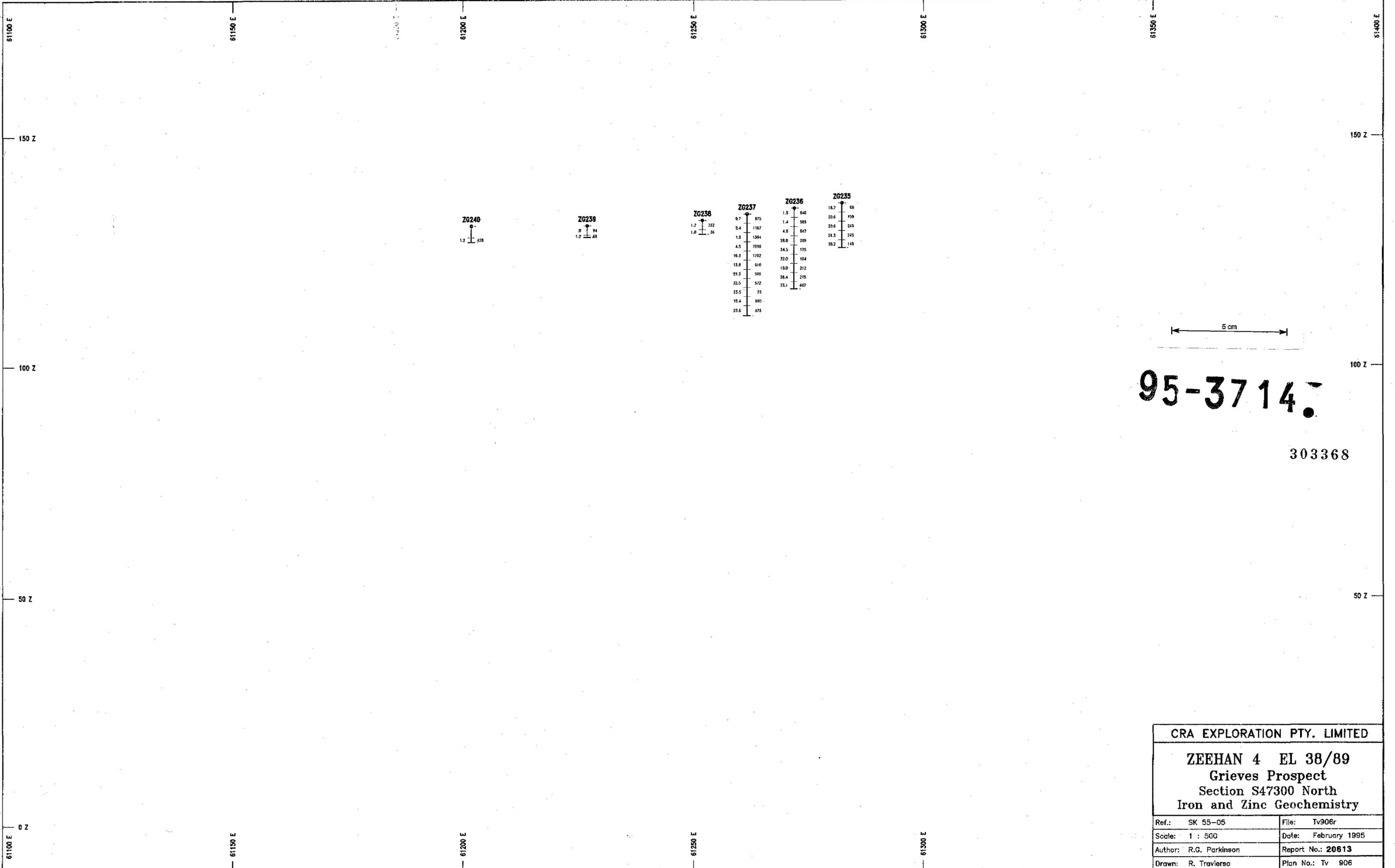
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Author: R.G. Parkinson	Report No.: 20613
Drawn: R. Trovierso	Plan No.: Tv 905



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Scale: 1 : 500	Date: February 1995
Author: R.C. Parkinson	Report No.: 20613
Drawn: R. Traverso	Plan No.: Tv 907

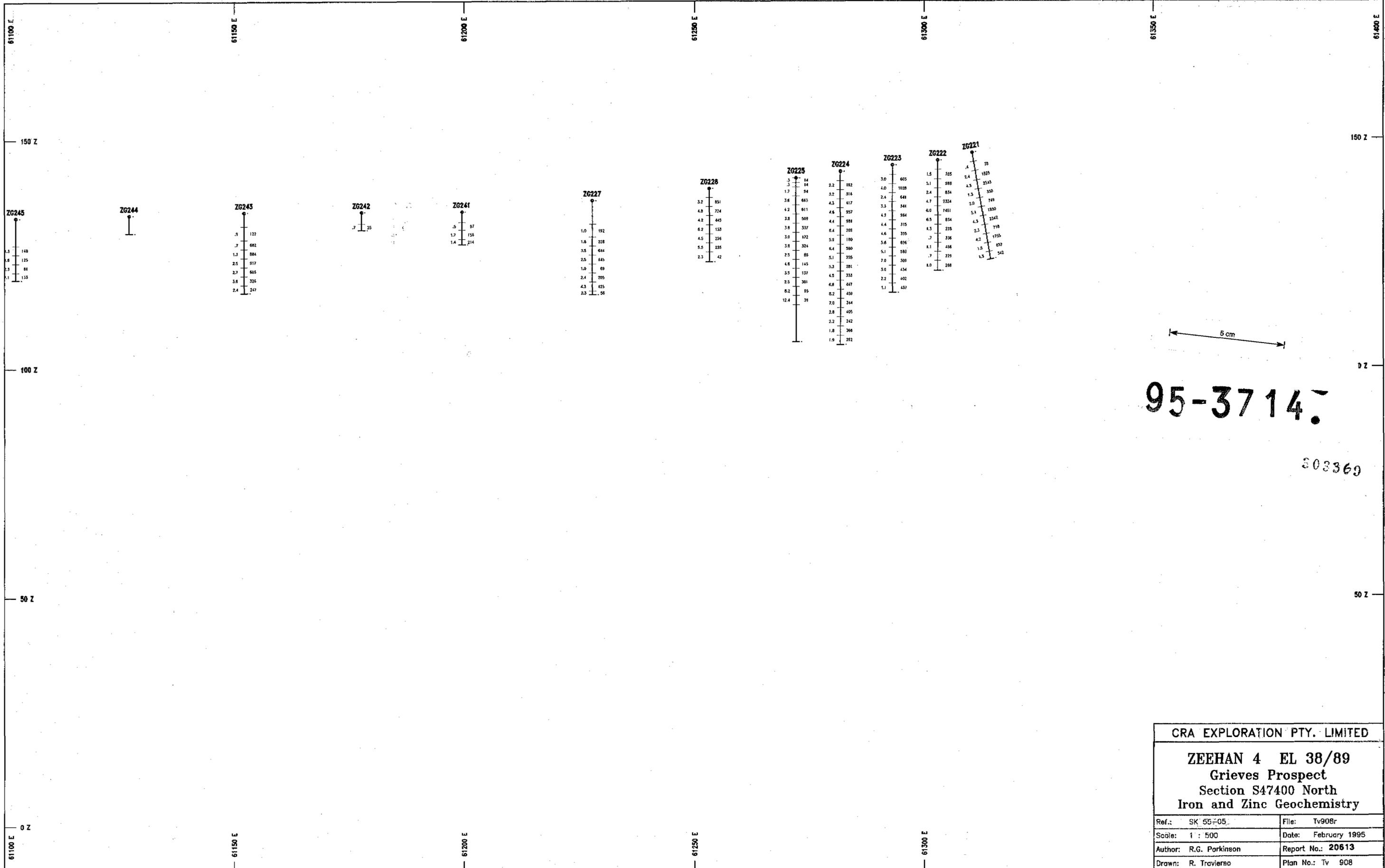


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Author: R.G. Parkinson	Report No.: 20613
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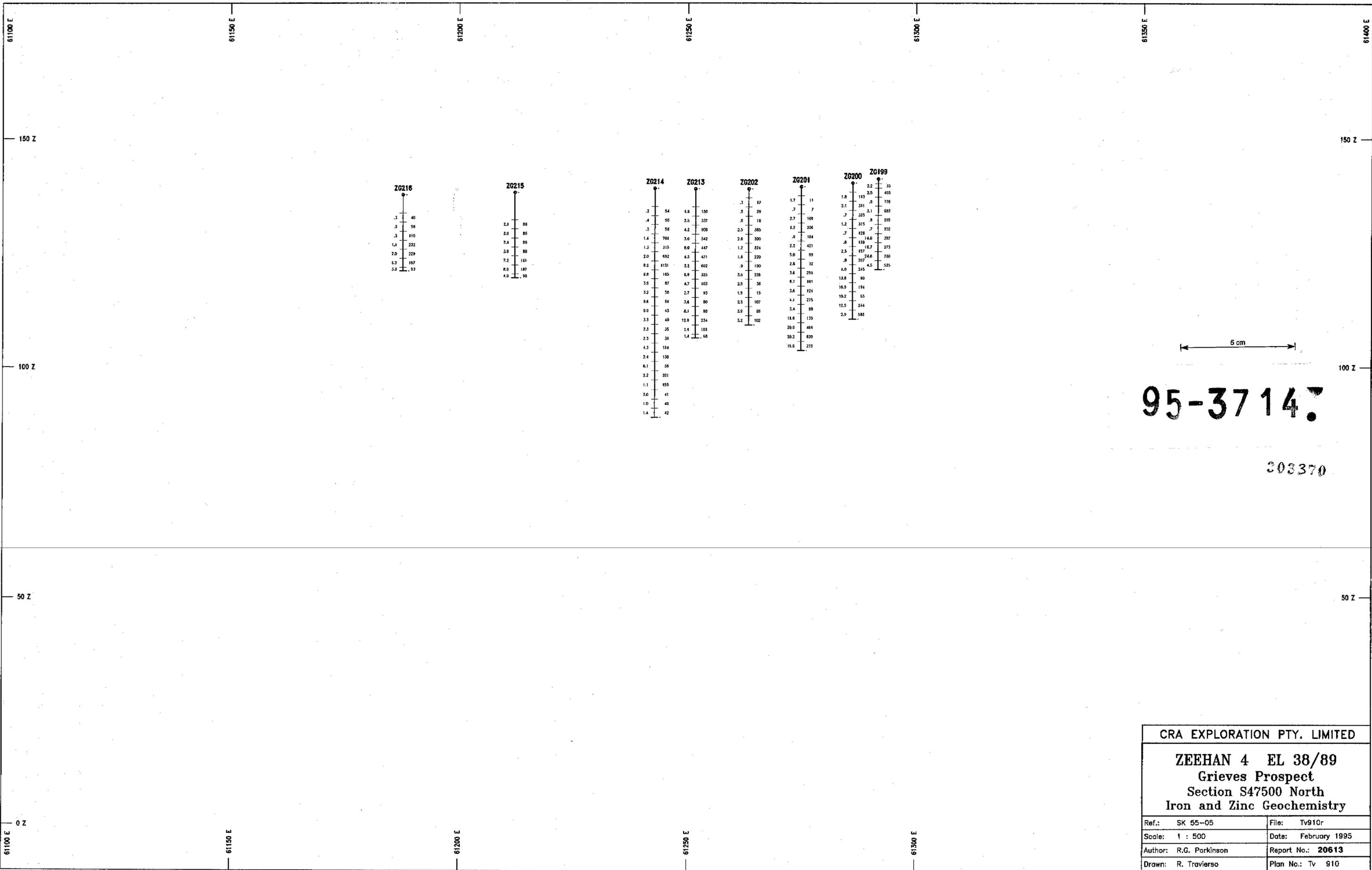


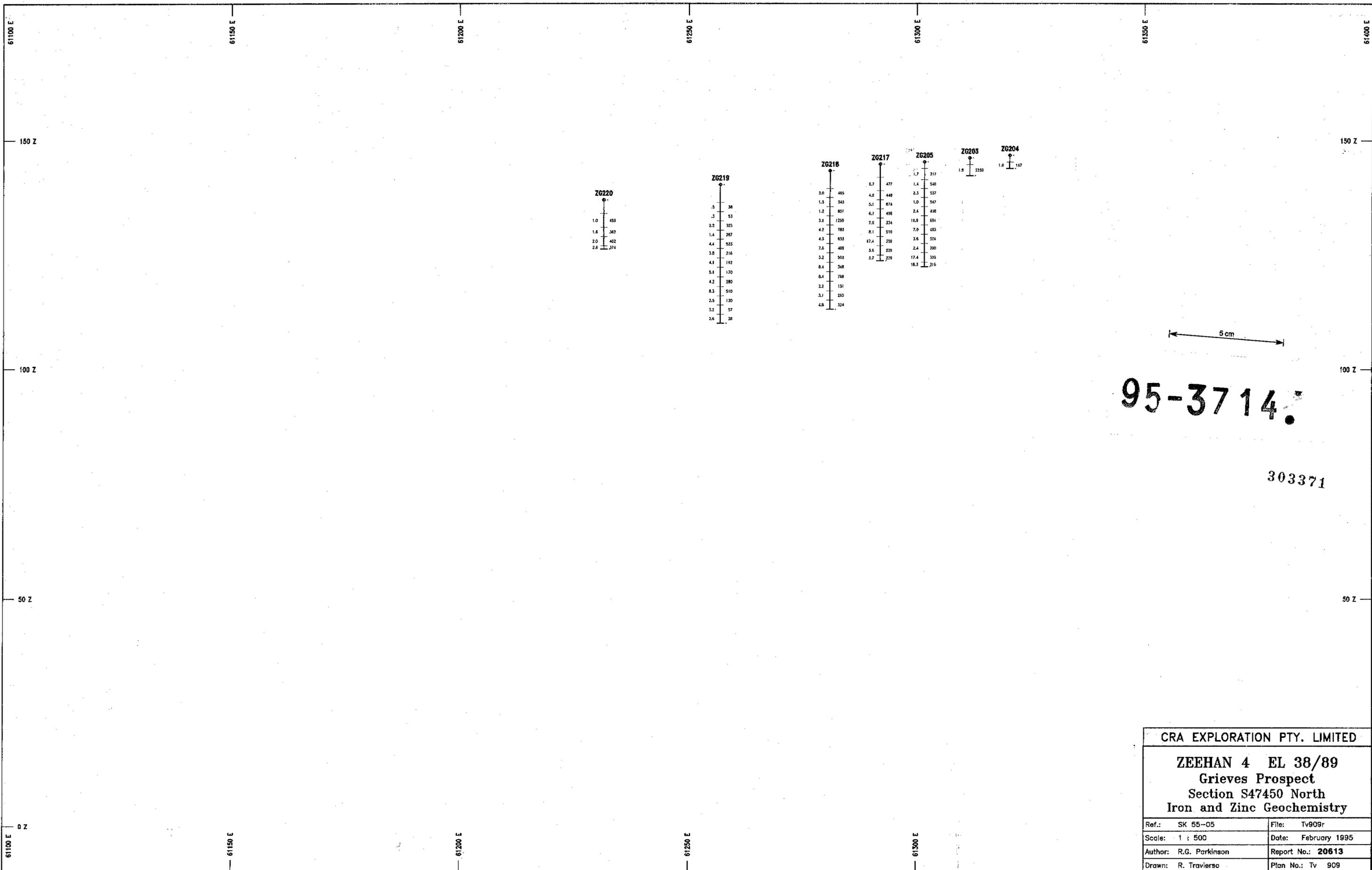
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Scale: 1 : 500	Date: February 1995
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Drawn: R. Travieso	Plan No.: Tv 908



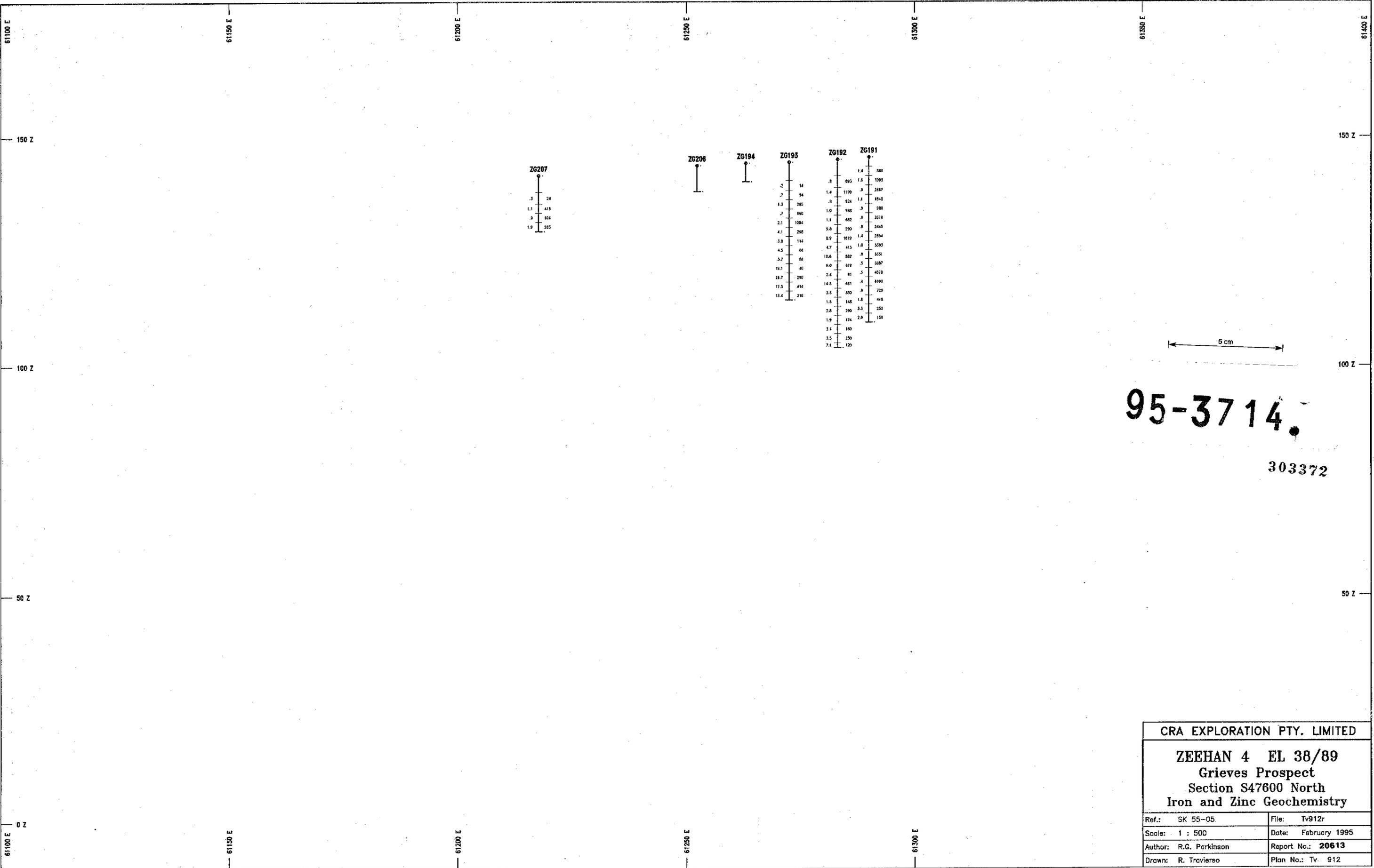


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Author: R.G. Parkinson	Report No.: 20613
Drawn: R. Traverso	Plan No.: Tv 909



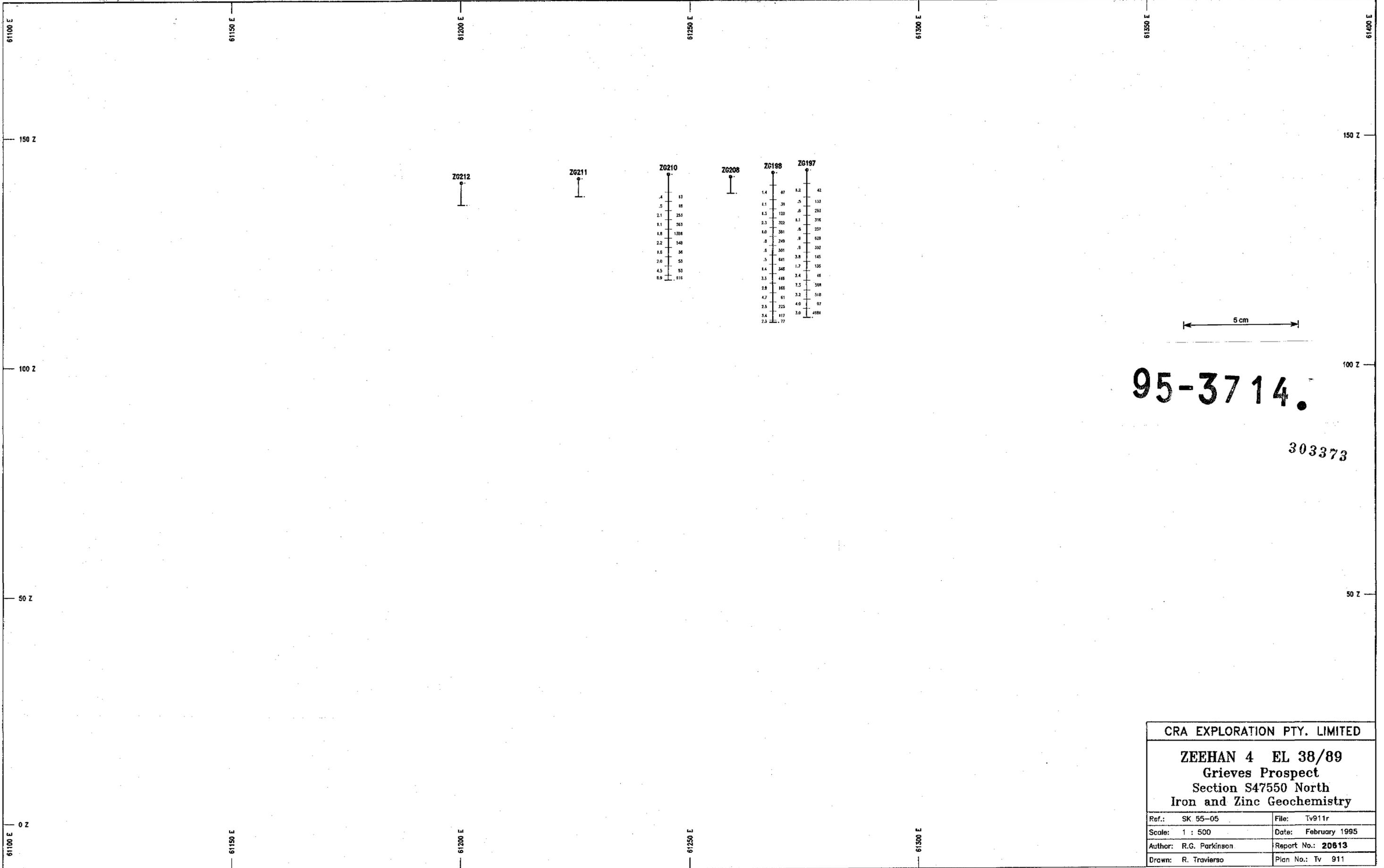
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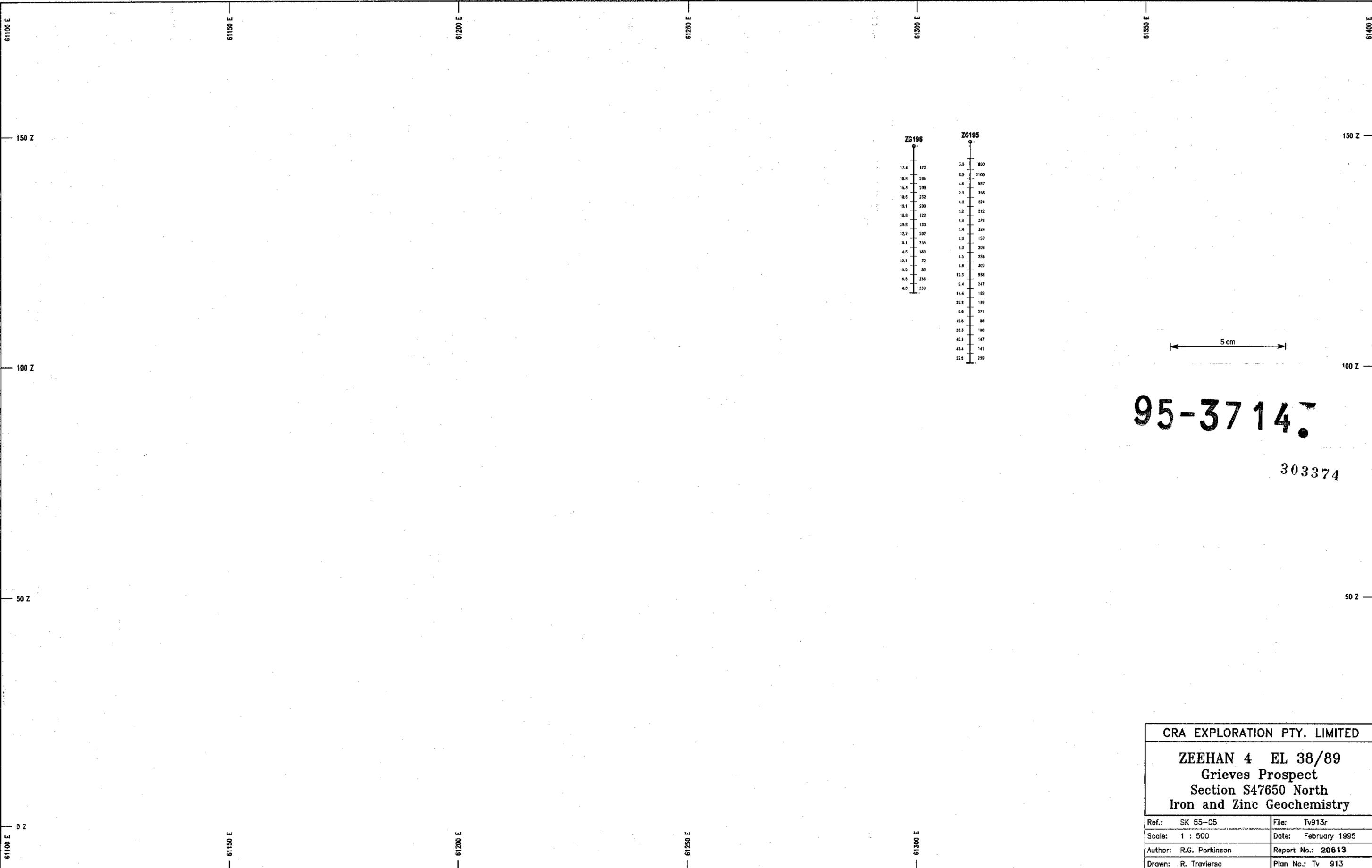
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ZEEHAN 4 EL 38/89  
 Grieves Prospect  
 Section S47600 North  
 Iron and Zinc Geochemistry

Ref.: SK 55-05.	File: Tv912r
Scale: 1 : 500	Date: February 1995
Author: R.G. Parkinson	Report No.: 20613
Drawn: R. Traverso	Plan No.: Tv. 912



CRA EXPLORATION PTY. LIMITED	
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Scale: 1 : 500	Date: February 1995
Author: R.G. Parkinson	Report No.: 20613
Drawn: R. Traverso	Plan No.: Tv 911



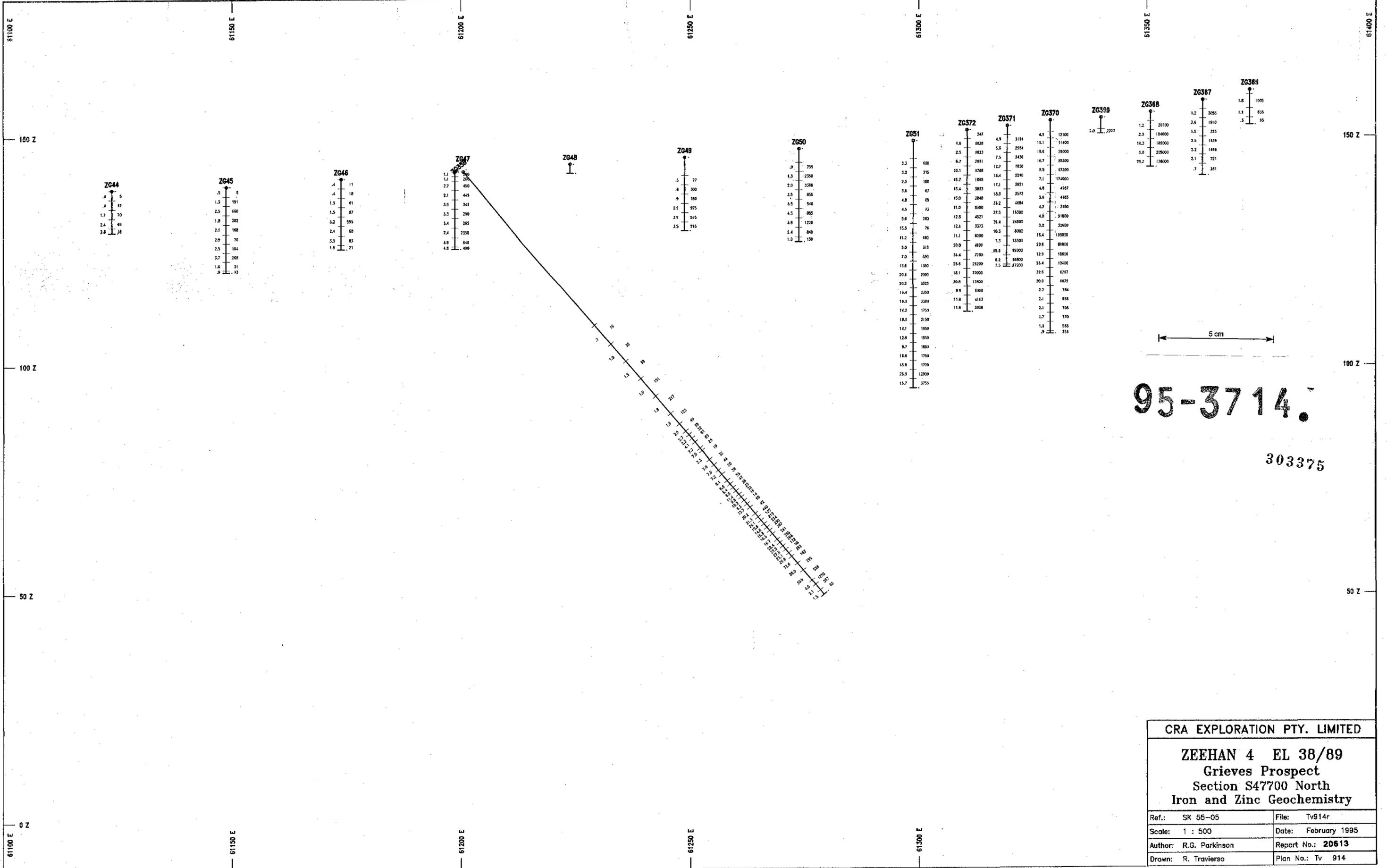
ZG196	ZG195
17.4	3.0
18.8	6.0
15.5	4.4
10.6	2.3
19.1	1.3
19.8	5.2
20.8	1.9
12.2	1.4
8.1	4.0
4.6	1.0
12.1	6.5
9.9	1.8
6.8	12.3
4.8	9.4
	14.4
	22.8
	9.5
	19.8
	28.3
	40.1
	41.4
	22.2
	800
	1100
	587
	386
	221
	212
	278
	324
	157
	209
	276
	302
	538
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	189
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	86
	108
	147
	141
	299

5 cm

95-3714

303374

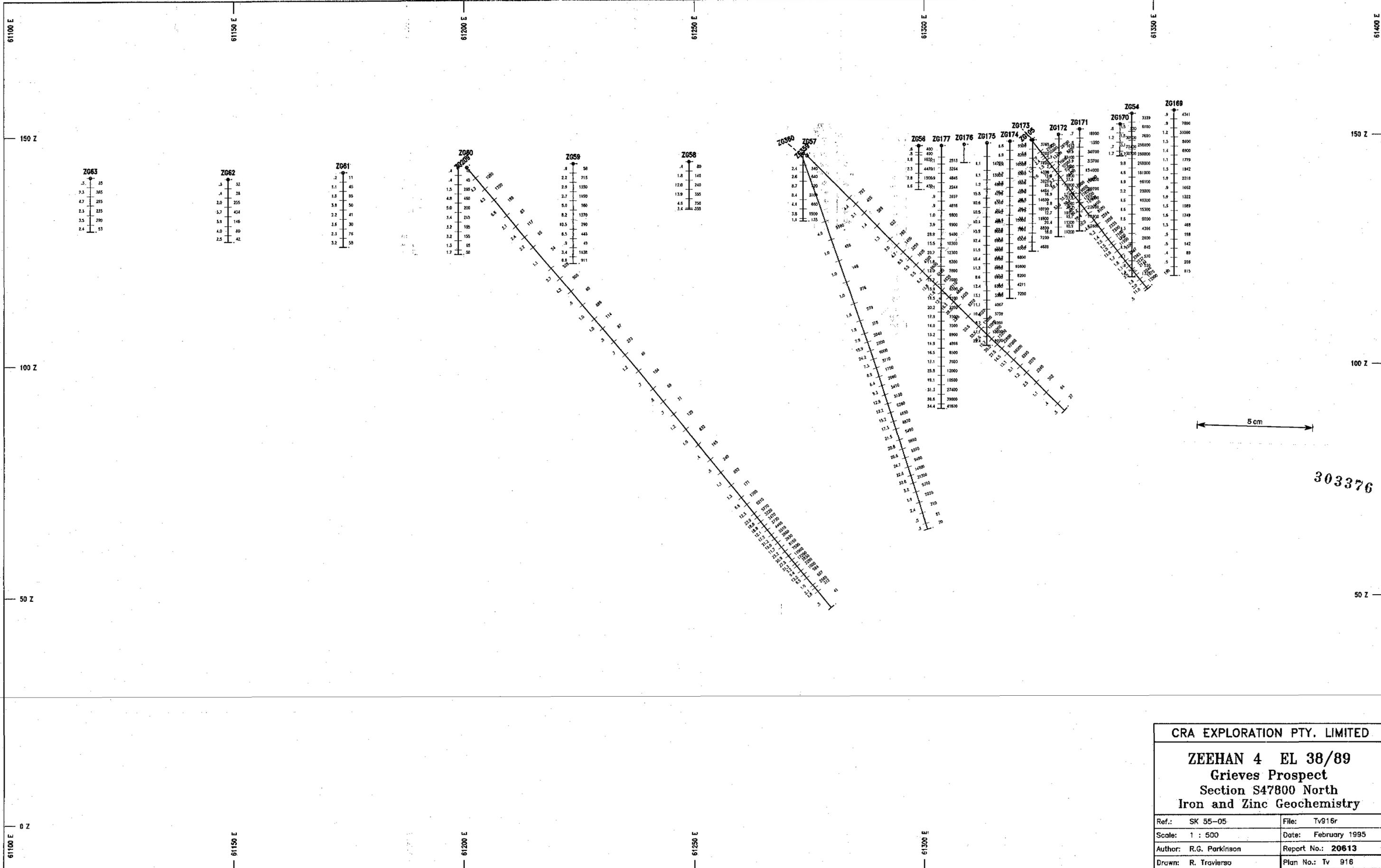
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Grieves Prospect	
Section S47650 North	
Iron and Zinc Geochemistry	
Ref.: SK 55-05	File: Tv913r
Scale: 1 : 500	Date: February 1995
Author: R.G. Parkinson	Report No.: 20613
Drawn: R. Traverso	Plan No.: Tv 913



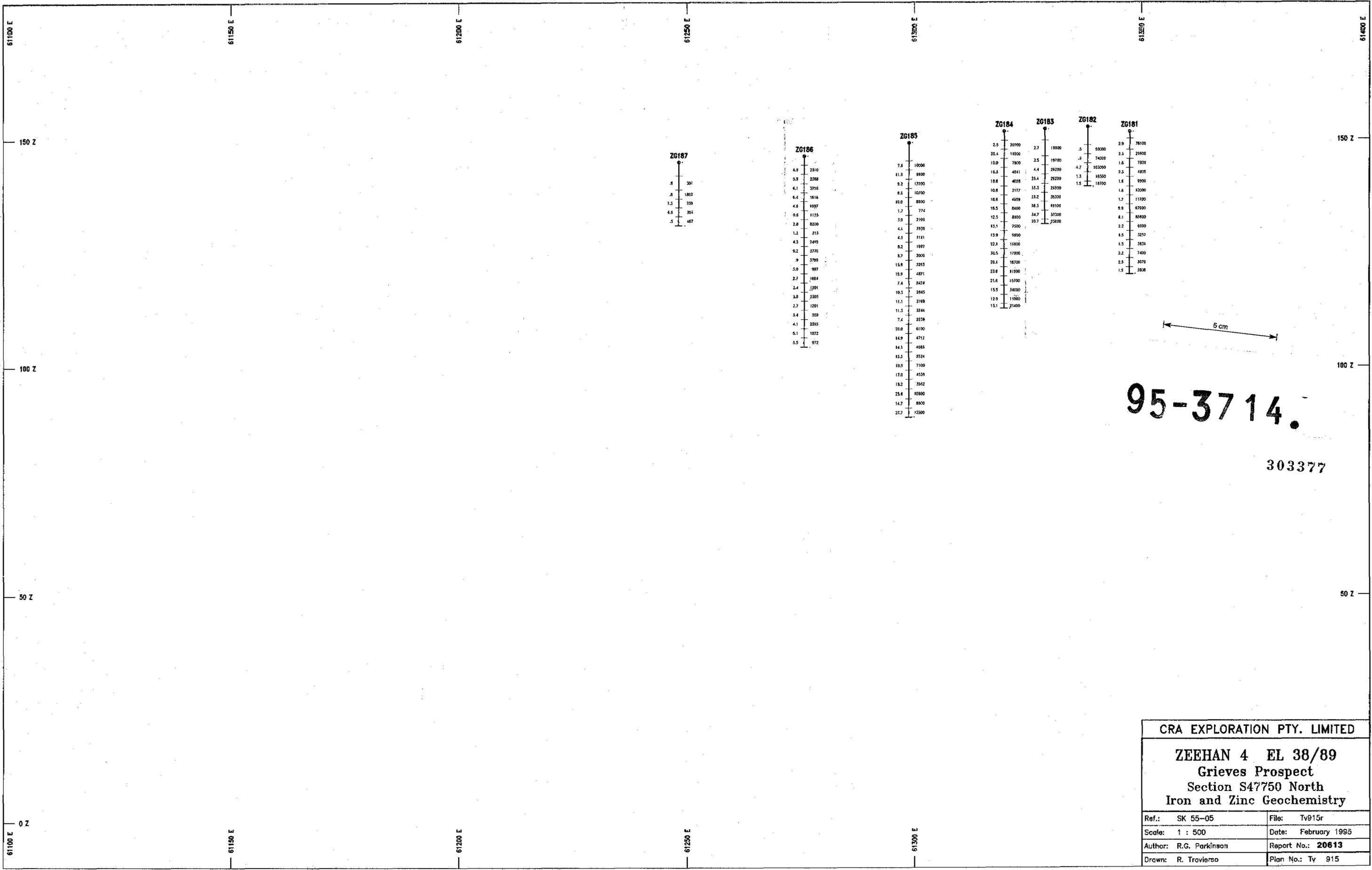
95-3714.

303375

CRA EXPLORATION PTY. LIMITED	
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Grieves Prospect	
Section S47700 North	
Iron and Zinc Geochemistry	
Ref.: SK 55-05	File: Tv914r
Scale: 1 : 500	Date: February 1995
Author: R.G. Parkinson	Report No.: 20613
Drawn: R. Traverso	Plan No.: Tv 914



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<b>ZEEHAN 4 EL 38/89</b> <b>Grieves Prospect</b> <b>Section S47800 North</b> <b>Iron and Zinc Geochemistry</b>	
Ref.: SK 55-05	File: Tv916r
Scale: 1 : 500	Date: February 1995
Author: R.G. Parkinson	Report No.: 20613
Drawn: R. Traverso	Plan No.: Tv 916



ZG187

8	301
7.8	1802
7.3	239
6.6	304
5	487

ZG186

6.9	2310
5.9	2388
4.1	3256
6.4	1614
4.6	4997
9.6	1125
2.8	8200
1.3	315
4.3	2419
9.2	3770
9	3789
3.0	987
2.7	1084
2.4	1201
3.8	2305
2.7	1201
3.4	559
4.1	2595
5.1	1922
5.5	972

ZG185

7.6	10000
11.6	9100
9.2	12700
8.6	10700
10.0	8800
1.7	774
3.0	2109
4.1	3958
4.3	1111
8.2	1897
6.7	3000
15.8	3283
19.9	4871
7.4	2428
10.5	2845
11.1	2189
11.5	3244
7.4	2259
20.0	6100
14.9	4712
14.5	4085
13.5	5524
18.9	7100
17.0	4538
19.2	3852
23.4	10600
14.7	8800
27.7	33300

ZG184

2.5	20700
20.4	11000
10.0	7900
18.3	4541
18.8	4028
10.8	3177
18.6	4459
15.5	8400
12.5	8109
13.1	7500
13.9	5600
22.1	11600
30.5	17000
29.1	18700
23.8	11300
21.8	15700
15.5	24100
12.9	11000
15.1	21400

ZG183

2.7	19100
2.5	19700
4.4	28200
25.4	21200
33.5	21900
23.2	35300
38.5	19100
34.7	37300
20.7	23400

ZG182

5	50000
5	74300
4.7	103000
1.3	16500
1.5	16700

ZG181

2.9	78100
2.1	21600
1.4	7800
2.3	4605
1.4	9900
1.6	10200
1.7	11700
9.9	67900
4.1	88400
2.2	6900
8.5	3259
6.5	1854
2.2	7400
2.5	3078
1.5	368

5 cm

95-3714.

303377

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ZEEHAN 4 EL 38/89 Grieves Prospect Section S47750 North Iron and Zinc Geochemistry	
Ref.: SK 55-05	File: Tv915r
Scale: 1 : 500	Date: February 1995
Author: R.G. Parkinson	Report No.: 20613
Drawn: R. Trovierso	Plan No.: Tv 915



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308878

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Zeehan No. 4 EL 38/89, Tasmania  
Report on Exploration for the Fifth Year of Tenure  
1/3/94 to 28/2/95

**MICROFILMED**  
FICHE No. 013577-88

Author: R.G. Parkinson

Date: March, 1995

Licence Holder: CRA Exploration Pty. Limited

Submitted to: Chief Geologist

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CRAE Preston  
CRAE Zeehan  
Allegiance Mining NL

Submitted by:

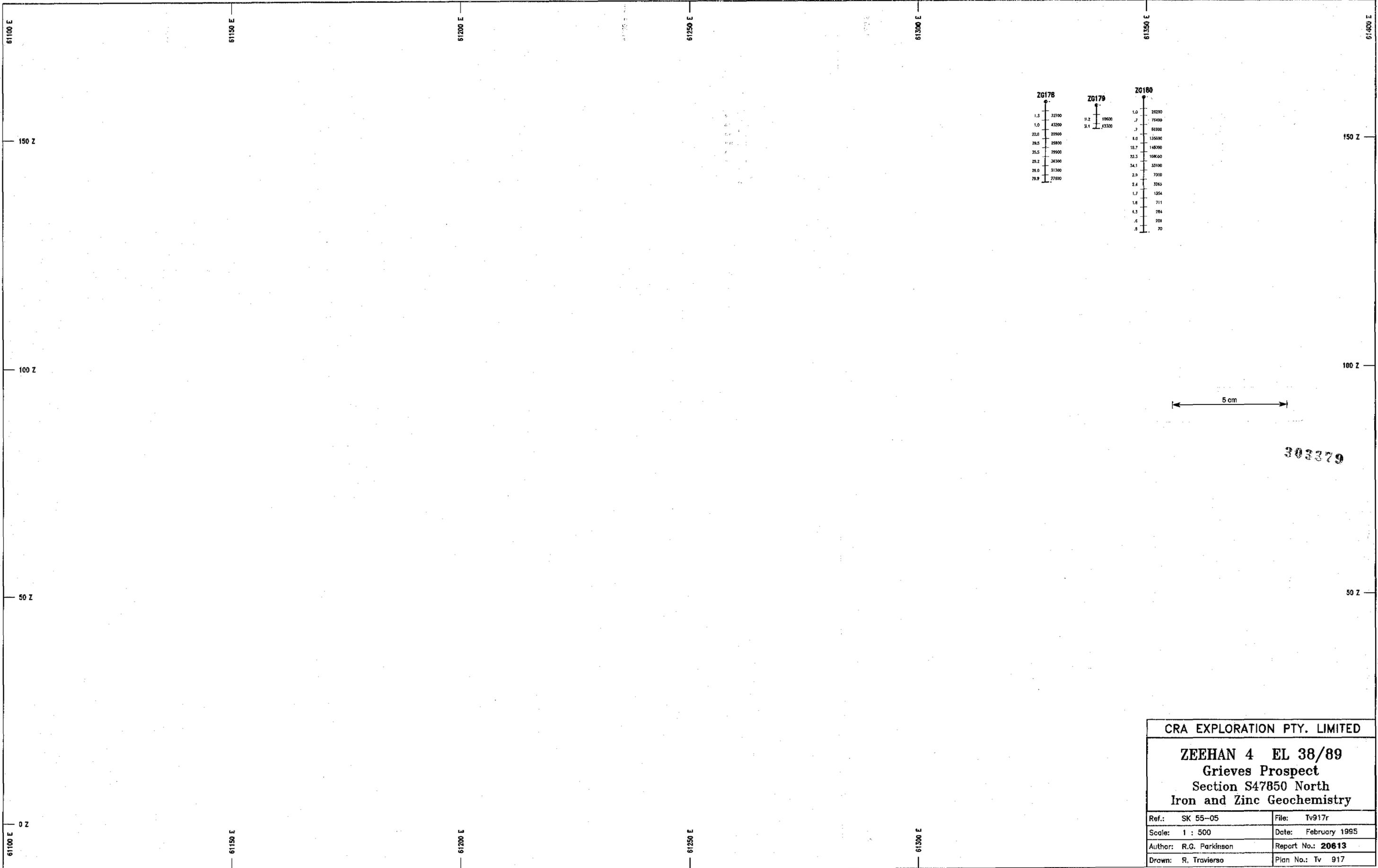
Accepted by:

95-3714.

Vol 3/3

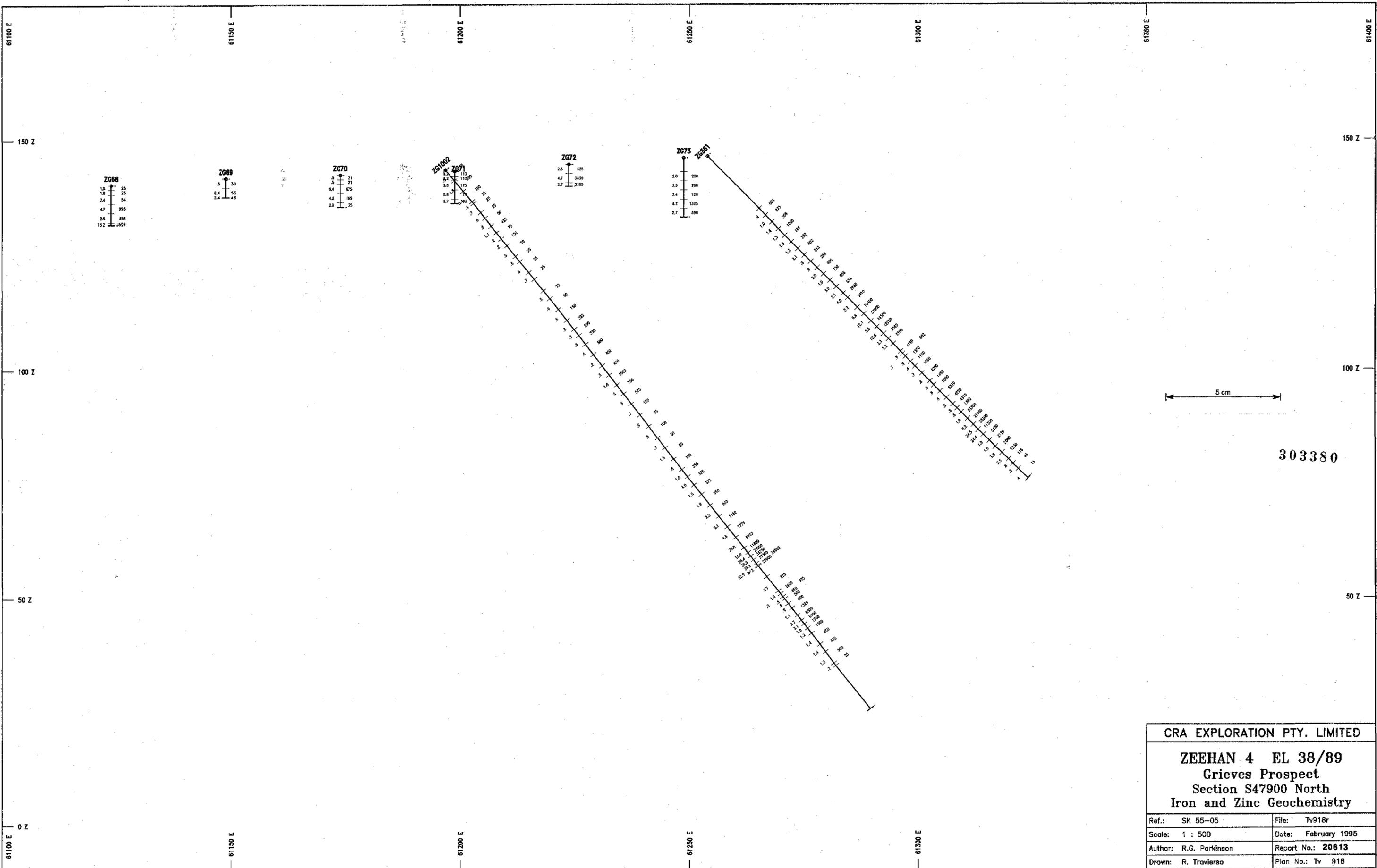
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CRAE Report No. 20613



303379

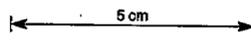
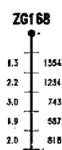
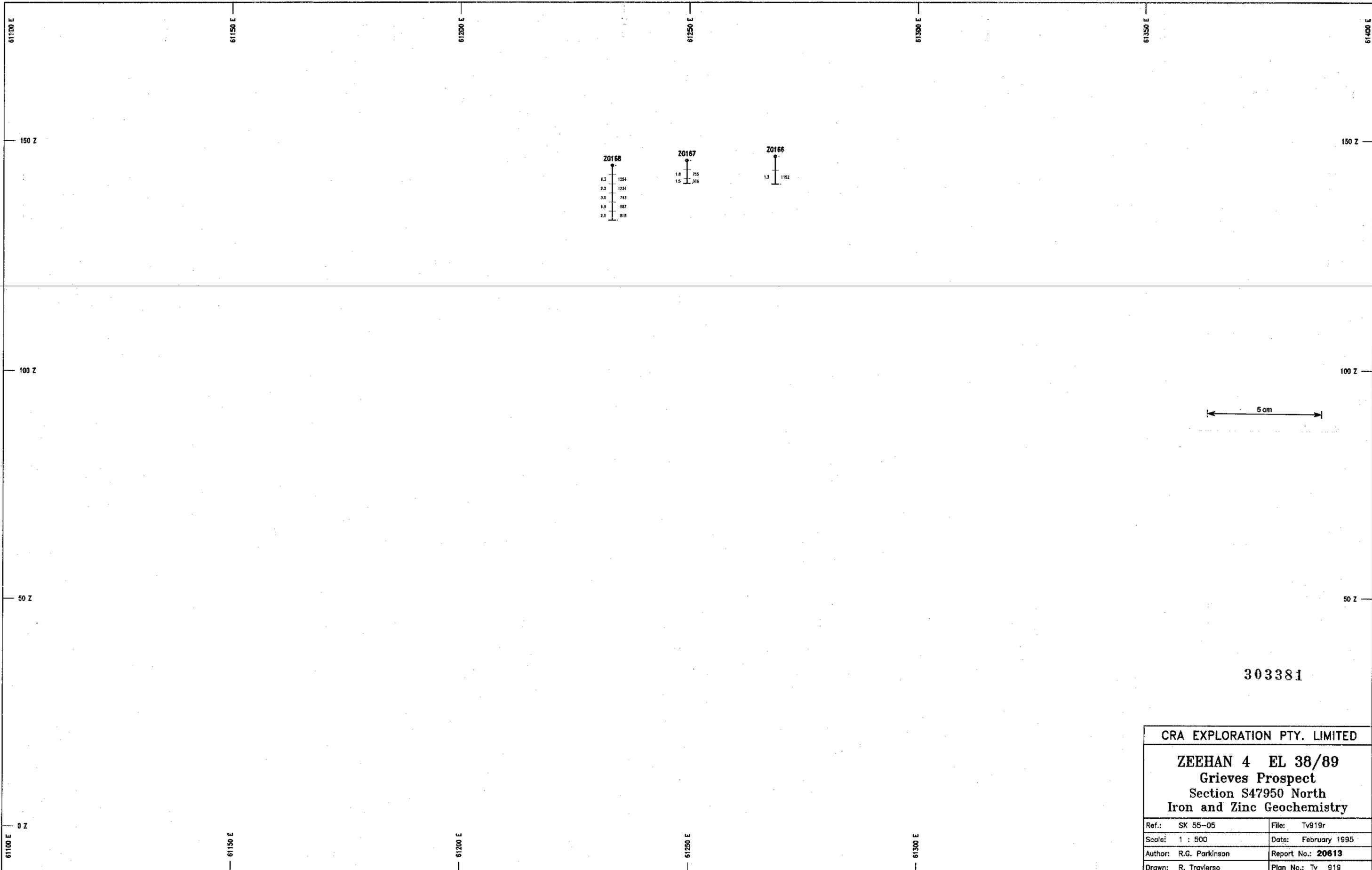
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<b>ZEEHAN 4 EL 38/89</b> <b>Grieves Prospect</b> <b>Section S47850 North</b> <b>Iron and Zinc Geochemistry</b>	
Ref.: SK 55-05	File: Tv917r
Scale: 1 : 500	Date: February 1995
Author: R.G. Parkinson	Report No.: <b>20613</b>
Drawn: R. Travieso	Plan No.: Tv 917



5 cm

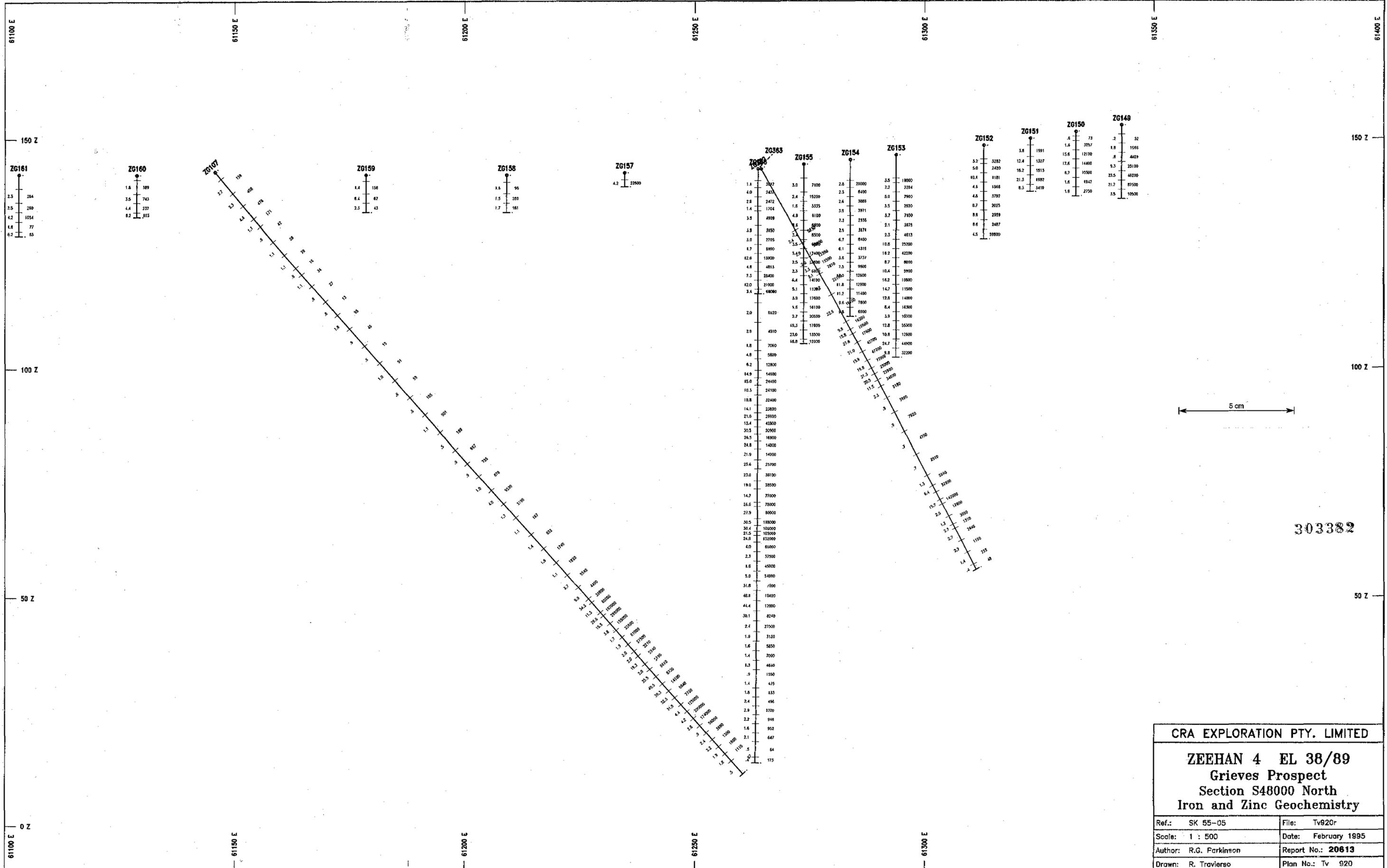
303380

CRA EXPLORATION PTY. LIMITED	
<b>ZEEHAN 4 EL 38/89</b> <b>Grieves Prospect</b> <b>Section S47900 North</b> <b>Iron and Zinc Geochemistry</b>	
Ref.: SK 55-05	File: Tv918r
Scale: 1 : 500	Date: February 1995
Author: R.G. Parkinson	Report No.: 20613
Drawn: R. Traverso	Plan No.: Tv 91B



303381

CRA EXPLORATION PTY. LIMITED	
ZEEHAN 4 EL 38/89 Grieves Prospect Section S47950 North Iron and Zinc Geochemistry	
Ref.: SK 55-05	File: Tv919r
Scale: 1 : 500	Date: February 1995
Author: R.G. Parkinson	Report No.: 20613
Drawn: R. Travieso	Plan No.: Tv 919

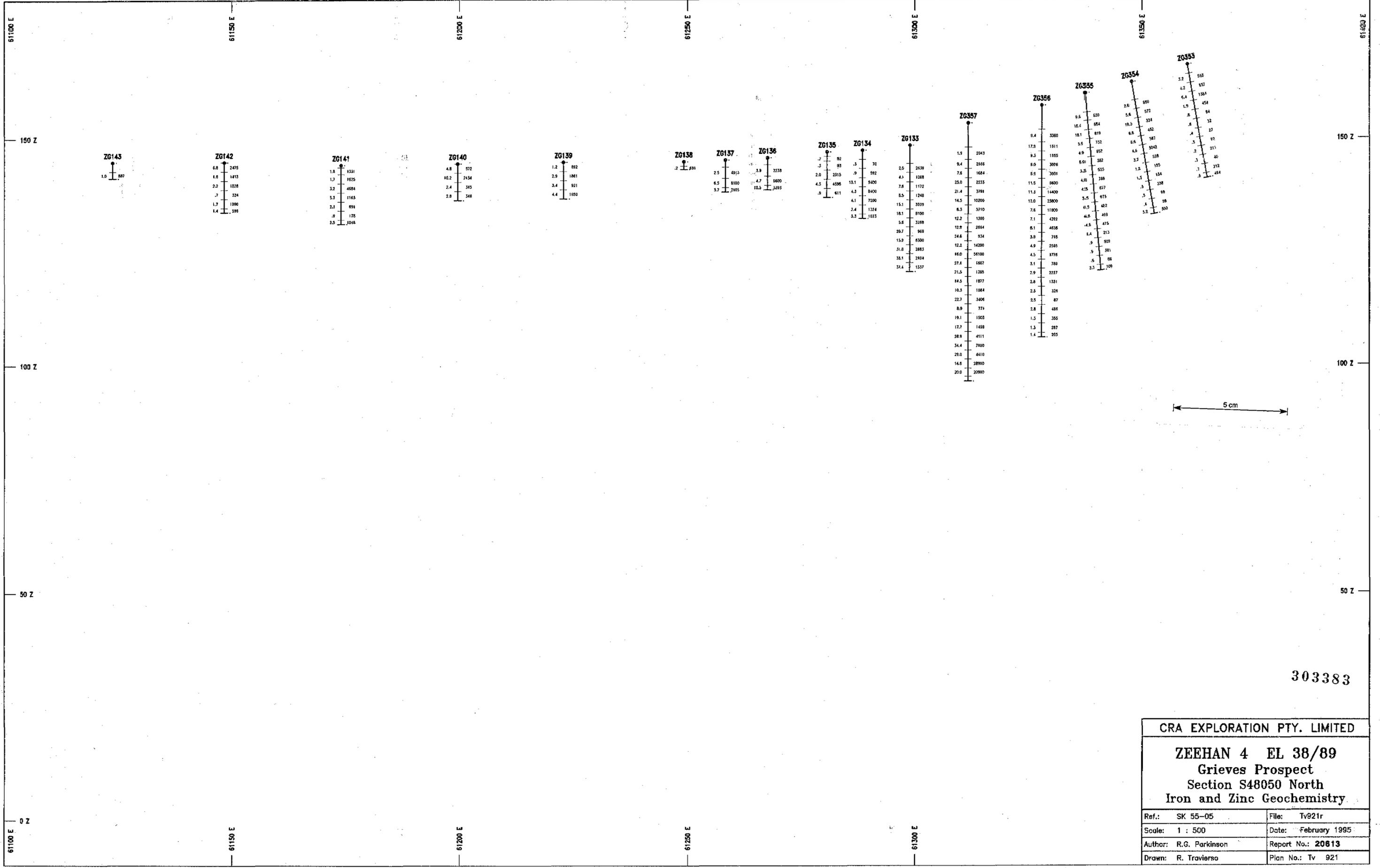


303382

CRA EXPLORATION PTY. LIMITED

ZEEHAN 4 EL 38/89  
 Grieves Prospect  
 Section S48000 North  
 Iron and Zinc Geochemistry

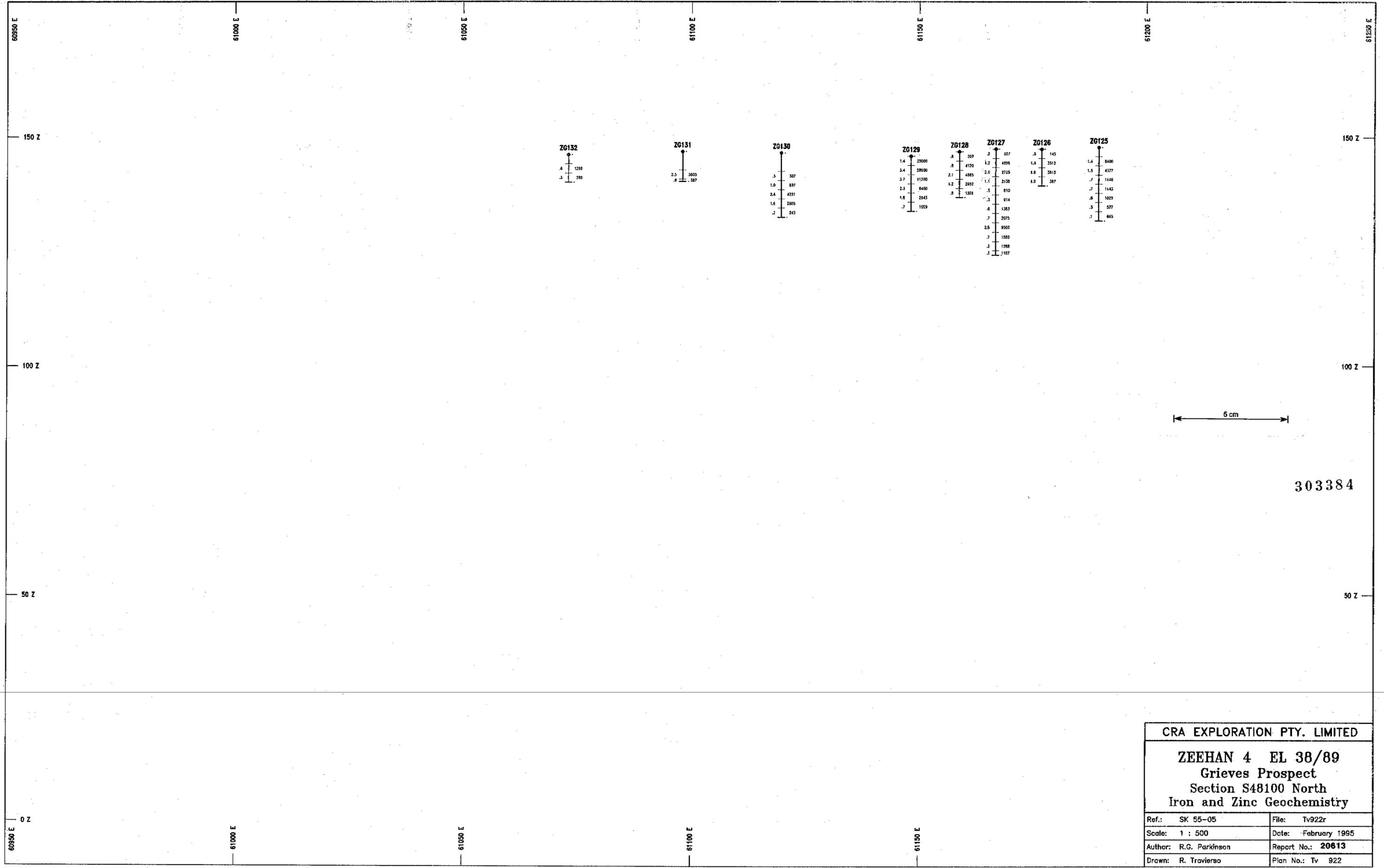
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Scale: 1 : 500	Date: February 1995
Author: R.G. Parkinson	Report No.: 20613
Drawn: R. Travlerso	Plan No.: Tv 920



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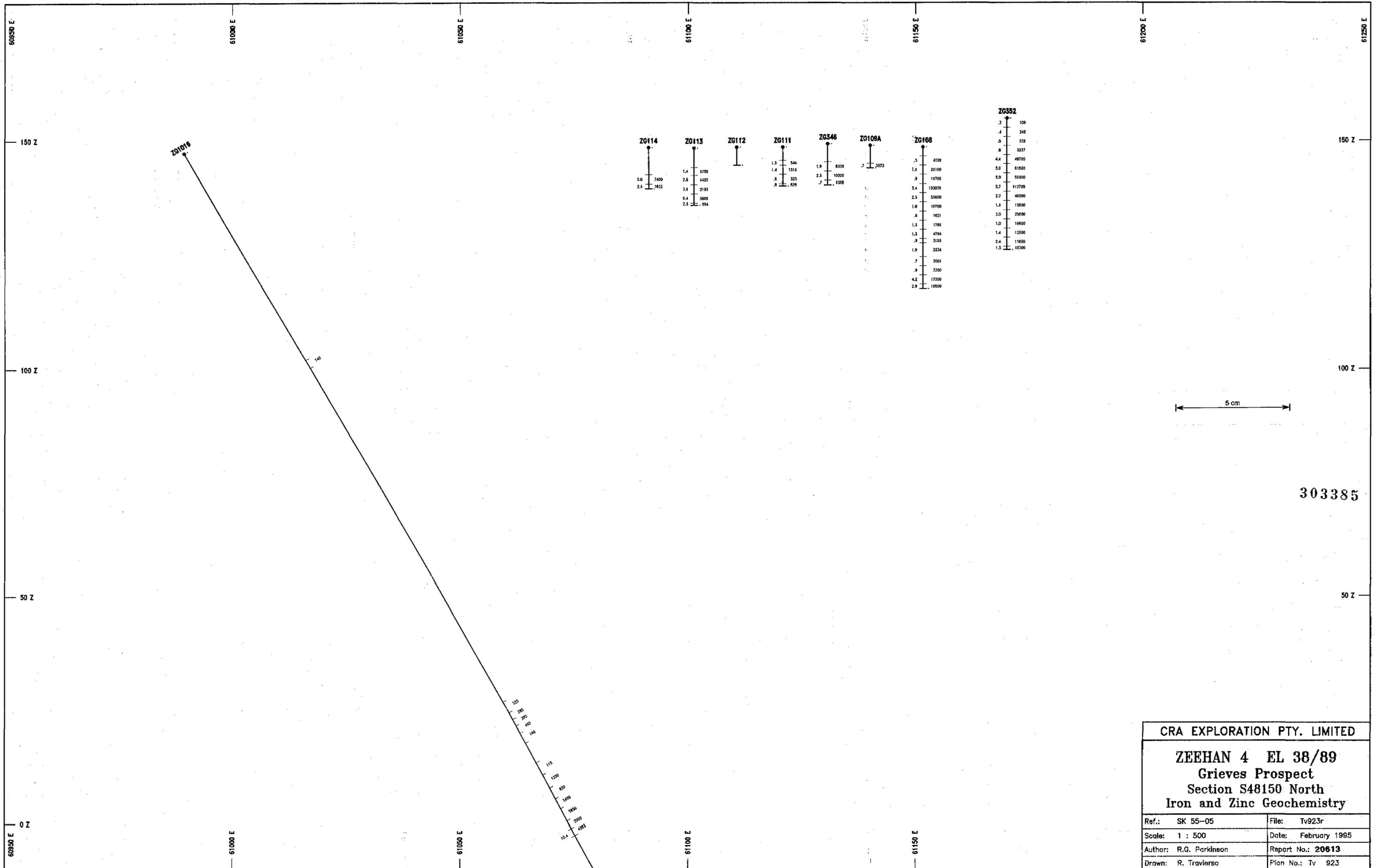
303383

CRA EXPLORATION PTY. LIMITED	
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Ref.: SK 55-05	File: Tv921r
Scale: 1 : 500	Date: February 1995
Author: R.G. Parkinson	Report No.: 20613
Drawn: R. Traverso	Plan No.: Tv 921



303384

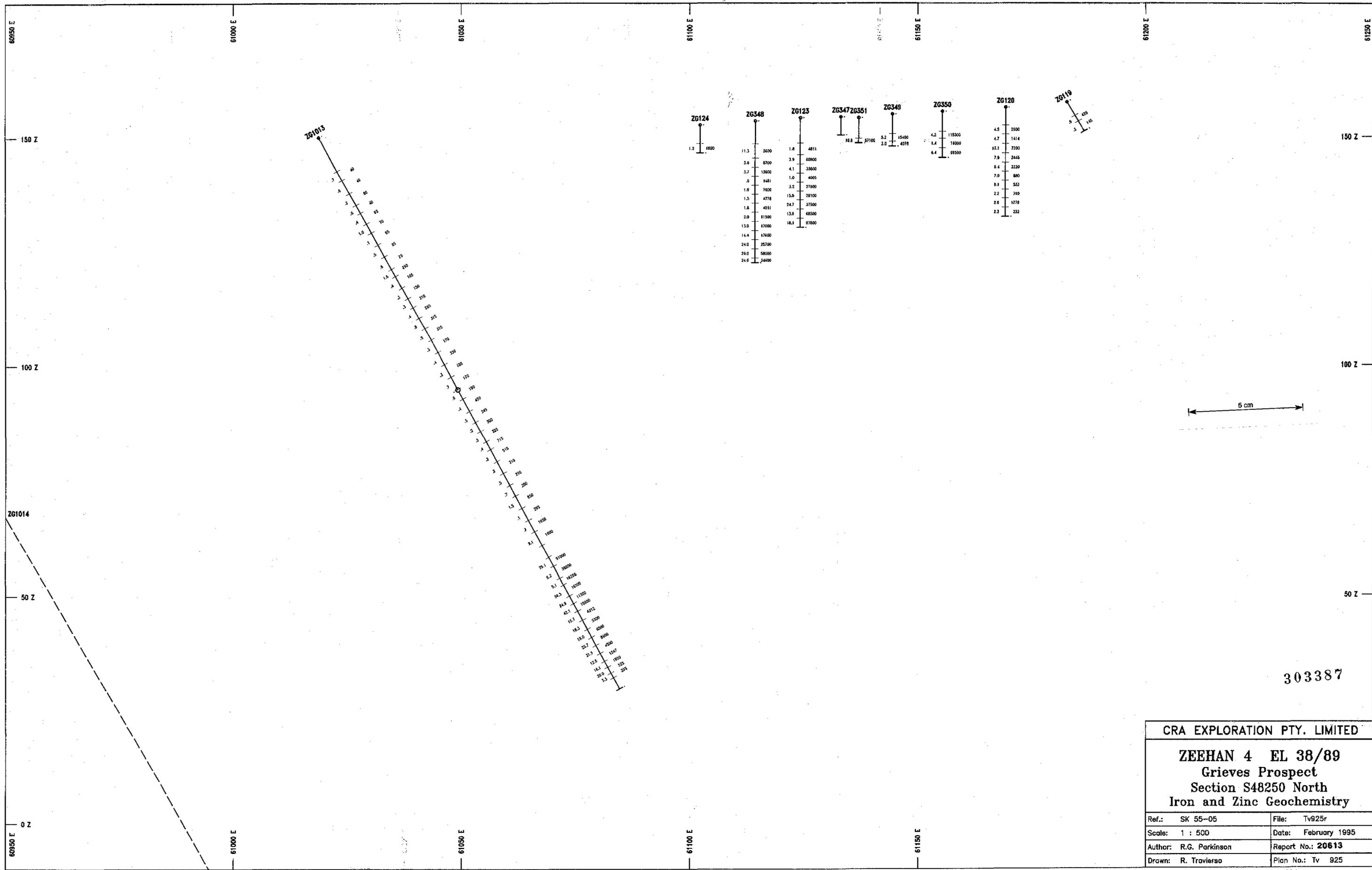
<b>CRA EXPLORATION PTY. LIMITED</b>	
<b>ZEEHAN 4 EL 38/89</b>	
<b>Grieves Prospect</b>	
<b>Section S48100 North</b>	
<b>Iron and Zinc Geochemistry</b>	
Ref.: SK 55-05	File: Tv922r
Scale: 1 : 500	Date: February 1995
Author: R.G. Parkinson	Report No.: 20613
Drawn: R. Travieso	Plan No.: Tv 922



303385

<b>CRA EXPLORATION PTY. LIMITED</b>	
<b>ZEEHAN 4 EL 38/89</b>	
<b>Grieves Prospect</b>	
<b>Section S48150 North</b>	
<b>Iron and Zinc Geochemistry</b>	
Ref.: SK 55-05	File: Tv923r
Scale: 1 : 500	Date: February 1995
Author: R.G. Parkinson	Report No.: 20613
Drawn: R. Traverso	Plan No.: Tv 923

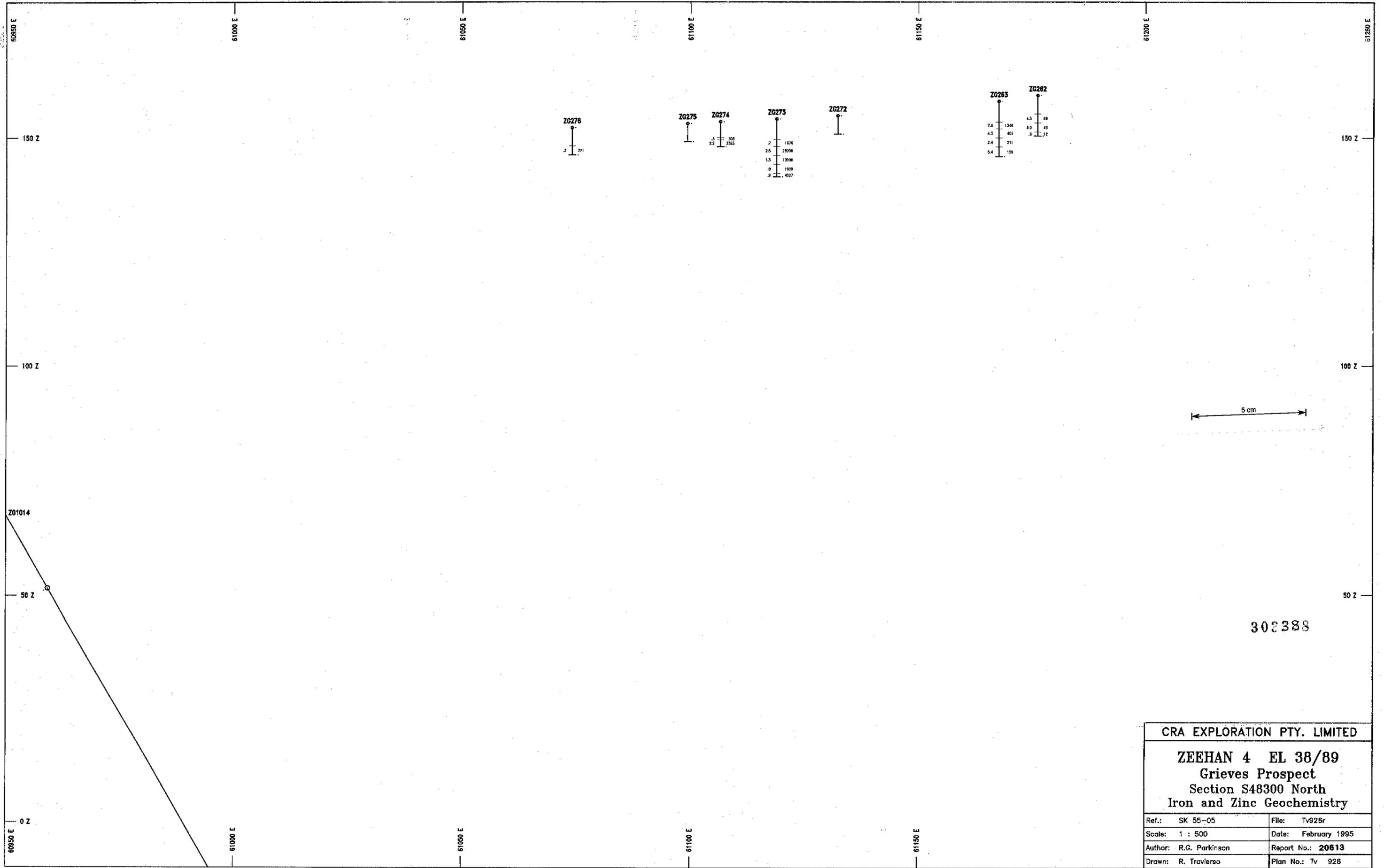




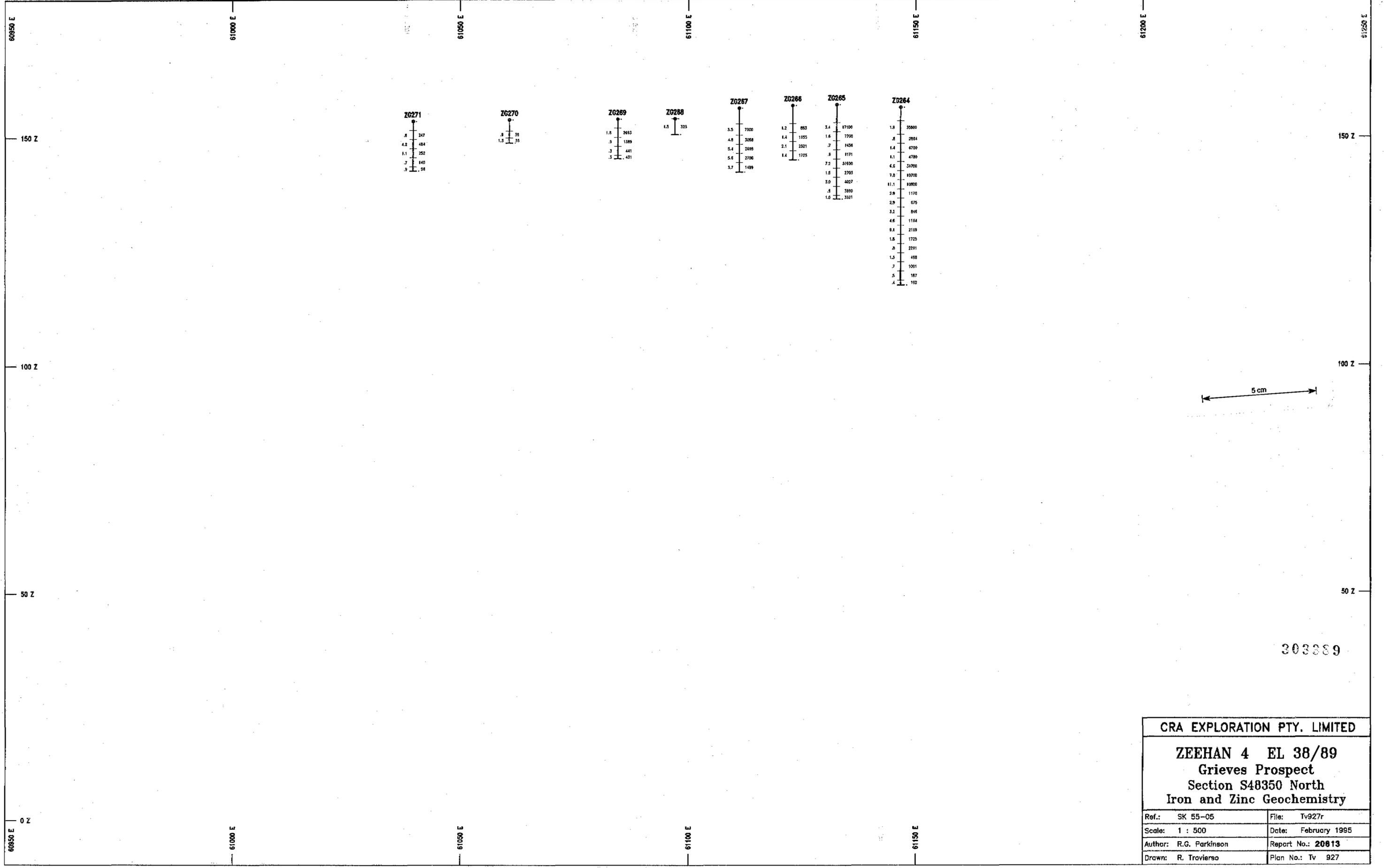
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303387

CRA EXPLORATION PTY. LIMITED	
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Grieves Prospect	
Section S48250 North	
Iron and Zinc Geochemistry	
Ref.: SK 55-05	File: Tv925r
Scale: 1 : 500	Date: February 1995
Author: R.G. Parkinson	Report No.: 20613
Drawn: R. Traverso	Plan No.: Tv 925

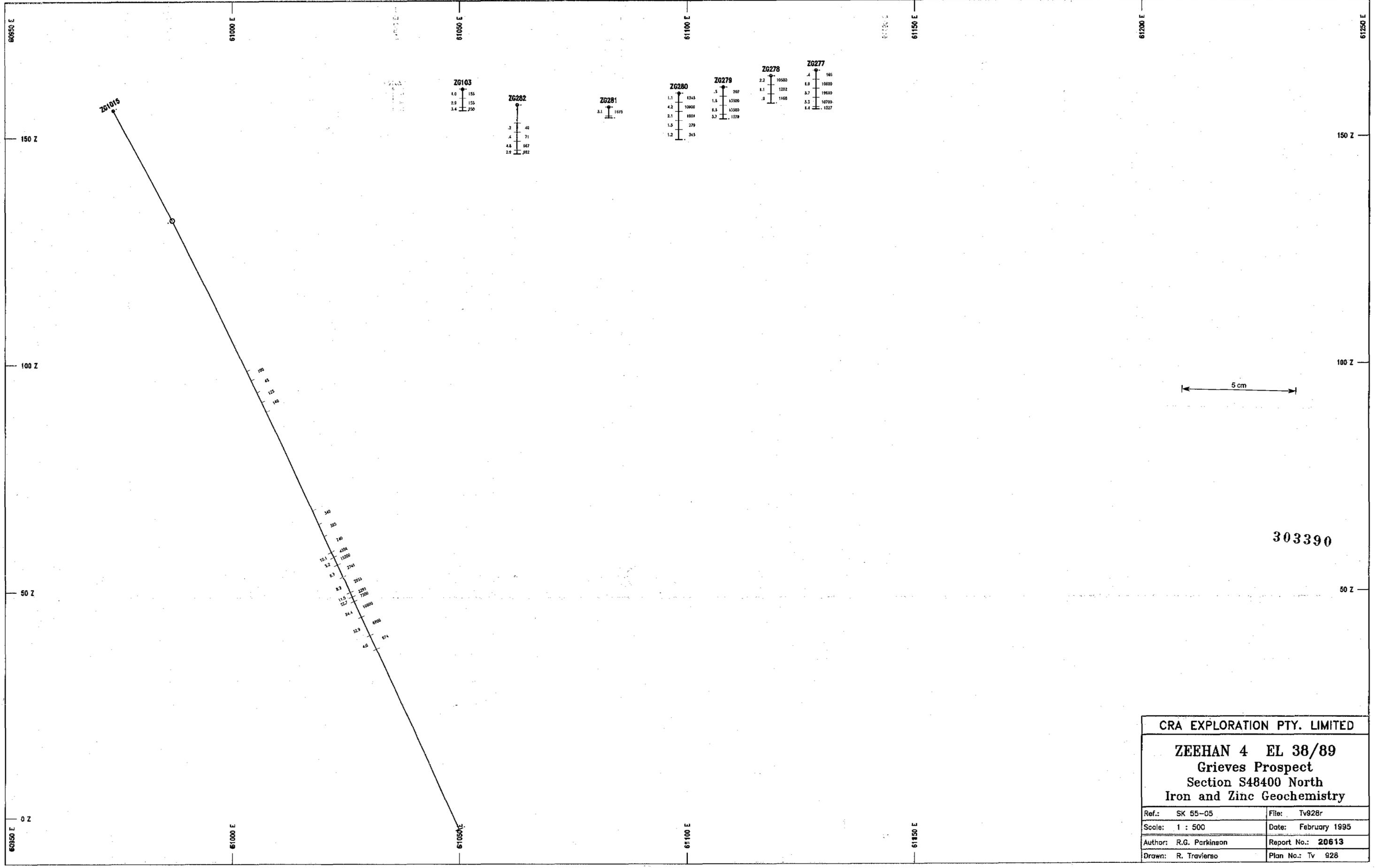


<b>CRA EXPLORATION PTY. LIMITED</b>	
<b>ZEEHAN 4 EL 38/89</b>	
<b>Grieves Prospect</b>	
<b>Section S48300 North</b>	
<b>Iron and Zinc Geochemistry</b>	
Ref.: SK 55-05	File: Tv926r
Scale: 1 : 500	Date: February 1995
Author: R.G. Parkinson	Report No.: 20613
Drawn: R. Traverso	Plan No.: Tv 926



303389

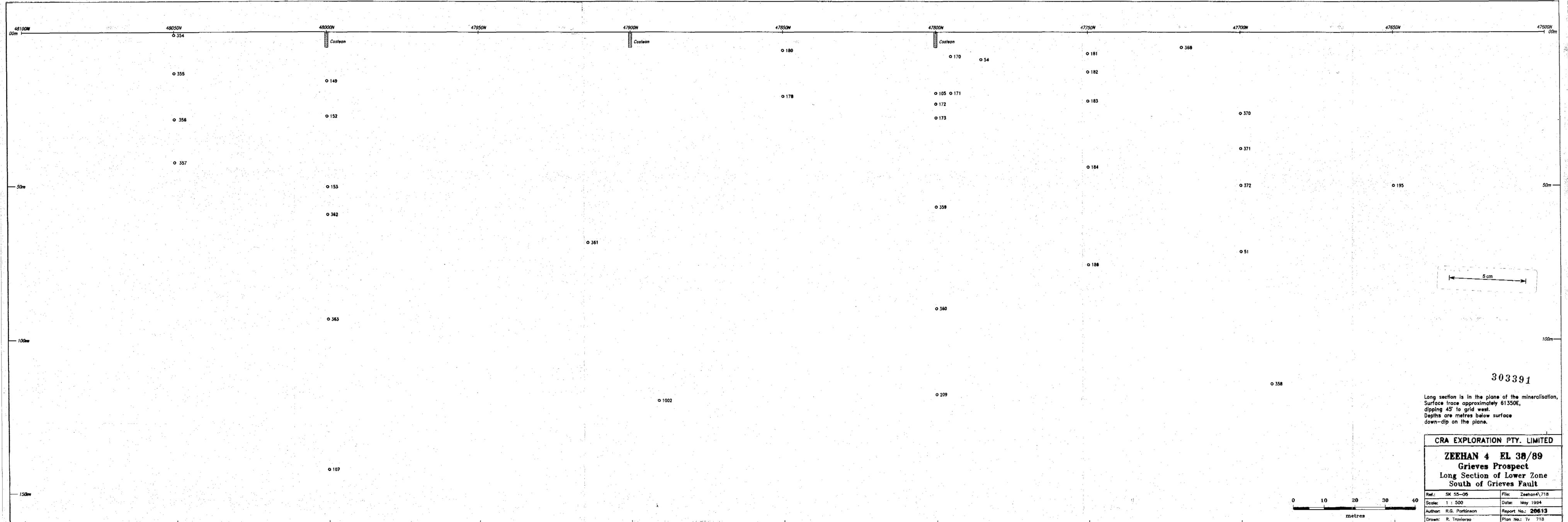
<b>CRA EXPLORATION PTY. LIMITED</b>	
<b>ZEEHAN 4 EL 38/89</b>	
<b>Grieves Prospect</b>	
<b>Section S48350 North</b>	
<b>Iron and Zinc Geochemistry</b>	
Ref.: SK 55-05	File: Tv927r
Scale: 1 : 500	Date: February 1995
Author: R.G. Parkinson	Report No.: 20613
Drawn: R. Trovierso	Plan No.: Tv 927



CRA EXPLORATION PTY. LIMITED

**ZEEHAN 4 EL 38/89  
Grieves Prospect  
Section S48400 North  
Iron and Zinc Geochemistry**

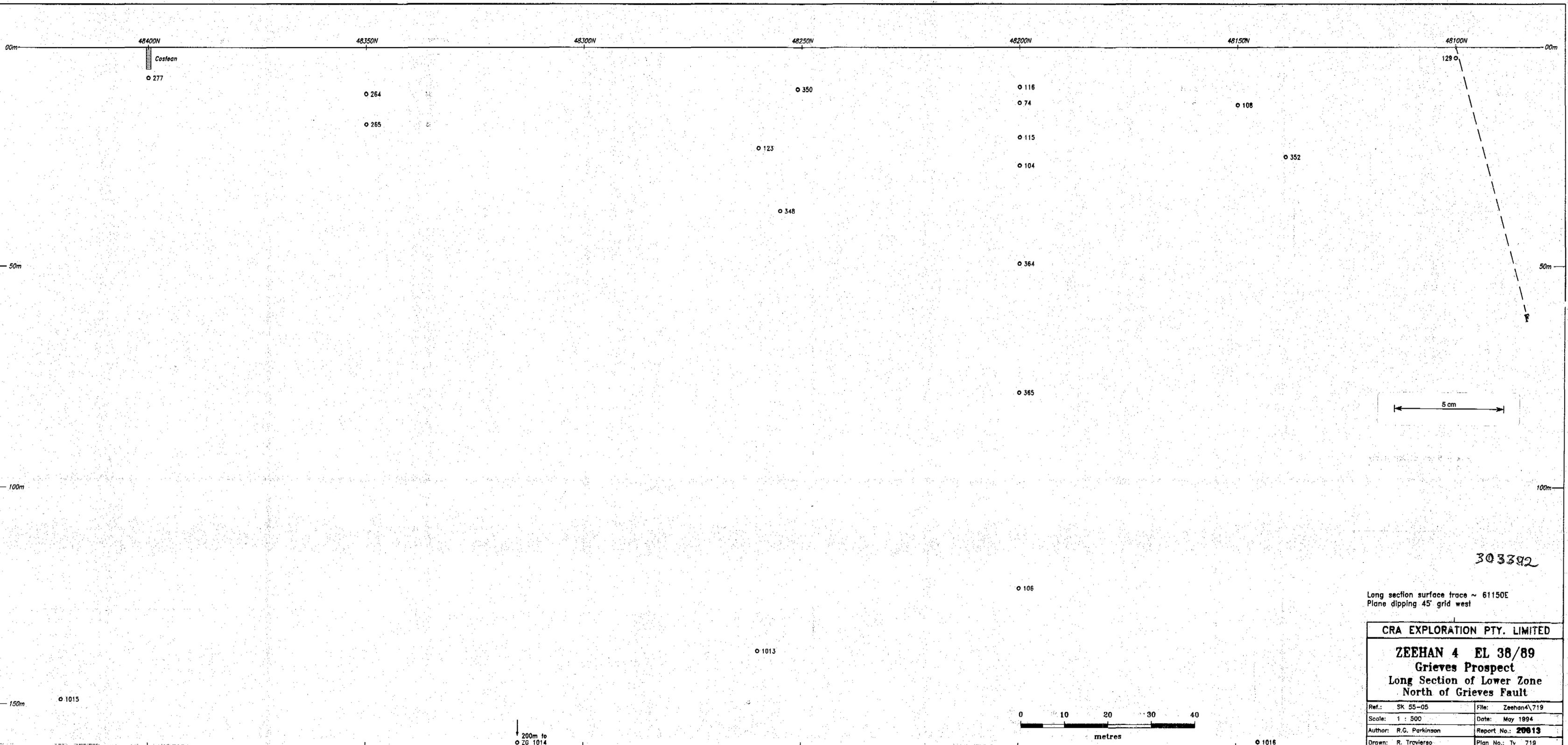
Ref.: SK 55-05	File: Tv928r
Scale: 1 : 500	Date: February 1995
Author: R.G. Parkinson	Report No.: 20613
Drawn: R. Traverso	Plan No.: Tv 928



303391

Long section is in the plane of the mineralisation, surface trace approximately 61350E, dipping 45° to grid west. Depths are metres below surface down-dip on the plane.

CRA EXPLORATION PTY. LIMITED	
<b>ZEEHAN 4 EL 38/89</b>	
<b>Grieves Prospect</b>	
<b>Long Section of Lower Zone</b>	
<b>South of Grieves Fault</b>	
Ref.: SK 55-06	File: Zeehan\718
Scale: 1 : 500	Date: May 1994
Author: R.G. Parkinson	Report No.: 20613
Drawn: R. Traverso	Plan No.: TV 718



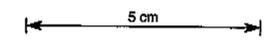
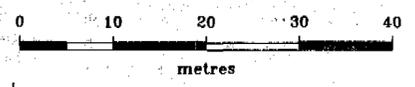
Long section surface trace ~ 61150E  
 Plane dipping 45° grid west

CRA EXPLORATION PTY. LIMITED

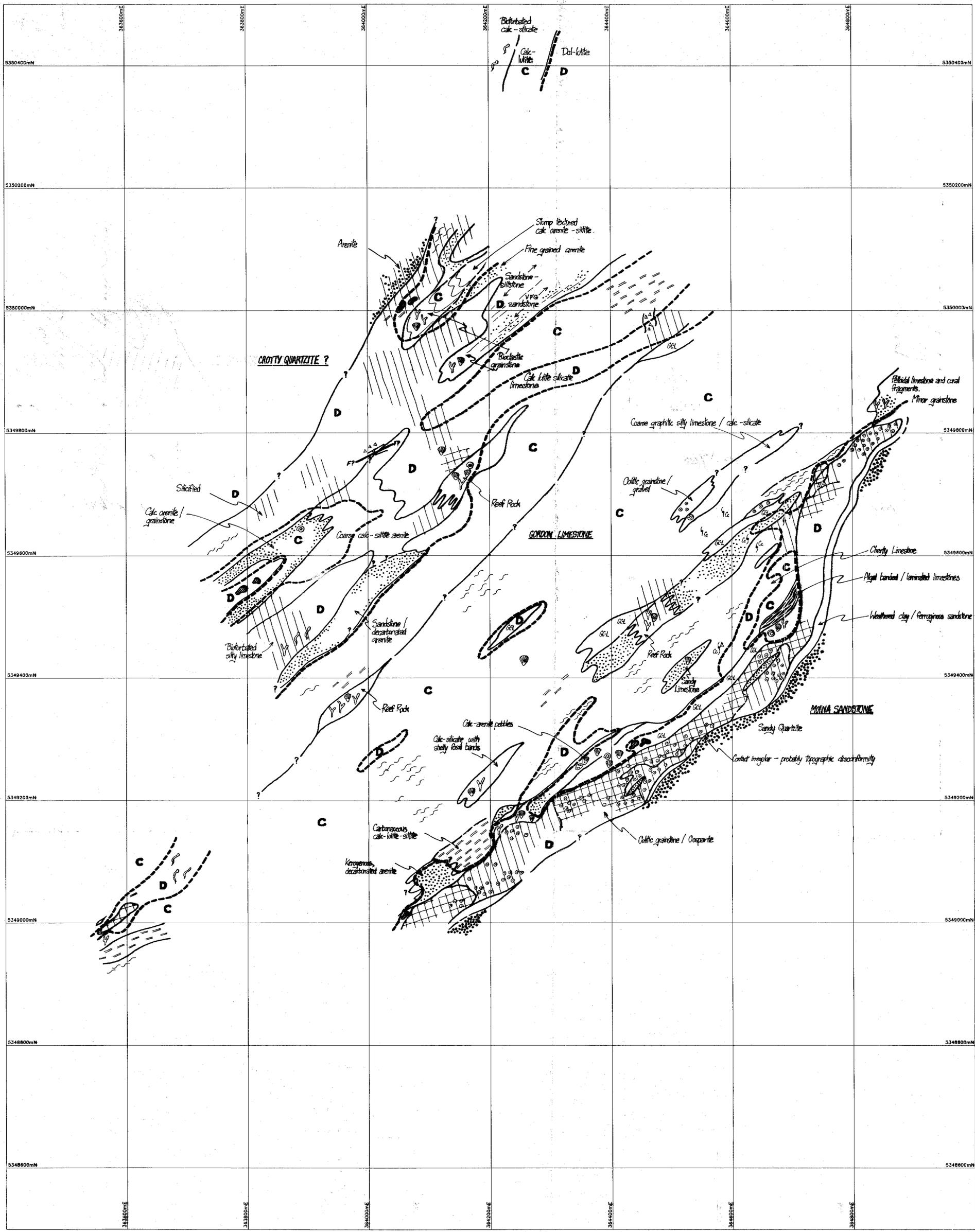
**ZEEHAN 4 EL 38/89**  
**Grieves Prospect**  
 Long Section of Lower Zone  
 North of Grieves Fault

Ref.: SK 55-05	File: Zeehan4\719
Scale: 1 : 500	Date: May 1994
Author: R.G. Parkinson	Report No.: 20013
Drawn: R. Travieso	Plan No.: Tv 719

200m to  
 ○ ZG 1014



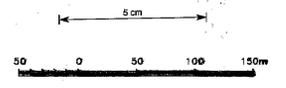
303392



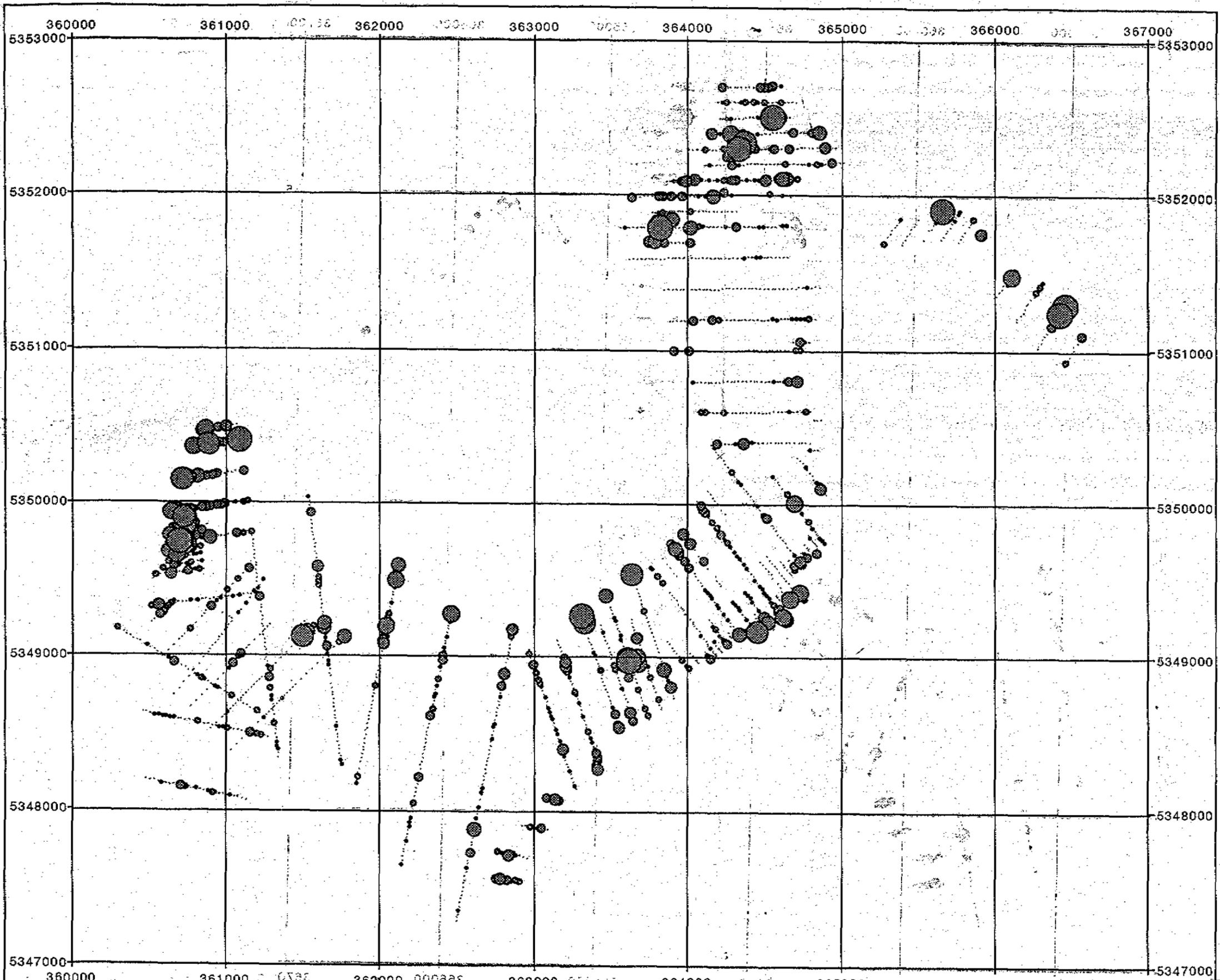
**LEGEND**

- (C) Calcareous Limestone
- (D) Dolomitic/Non-Calcareous Limestone / Sediment
- GCL Grainsy Limestone
- Coilites
- Wavy banded / Irregular banded light and dark grey Limestone-siltstone
- Silicified carbonaceous / Keragenous Limestone / Siltstone
- Strongly decomposed limestone / Siltstone (Carbonaceous)
- Coral fossil / fragment
- Brachiopod fossil
- Bioturbation
- Mollusc / Gastropod or unidentified fossil / fragment
- Breccia / Vein (Cc-Calcite)
- Calc arenite / arenite
- Facies Boundary / Bedding Contact
- Slumped Rock
- Weak - moderate alteration -  
Arenite veining / Pervasive arenite (fine grained)  
Minor pyrite = subtle chromite vein voids  
Rare Pb/Zn
- Moderate - Intense alteration -  
Pervasive arenite + veining  
Fine - coarse grained sideritic replacement where most intense  
Local Pb/Zn mineralization / ore  
Local decomposed limestone

303393



CNA EXPLORATION PTY LIMITED				
ZEEMAN 4 EL38/88				
GRIEVES PROSPECT				
GEOLOGY				
INTERPRETED FROM KIND OF HOLE				
AND CORE SAMPLES				
AUTHOR	DRAWN	DATE	SCALE	REPORT
T. Moody	C. Seville	12/5/94	1:2500	20685
REF: Queenstown	SK55-08	SUB-DWG	PLAN NO	T-989



5 cm

303394

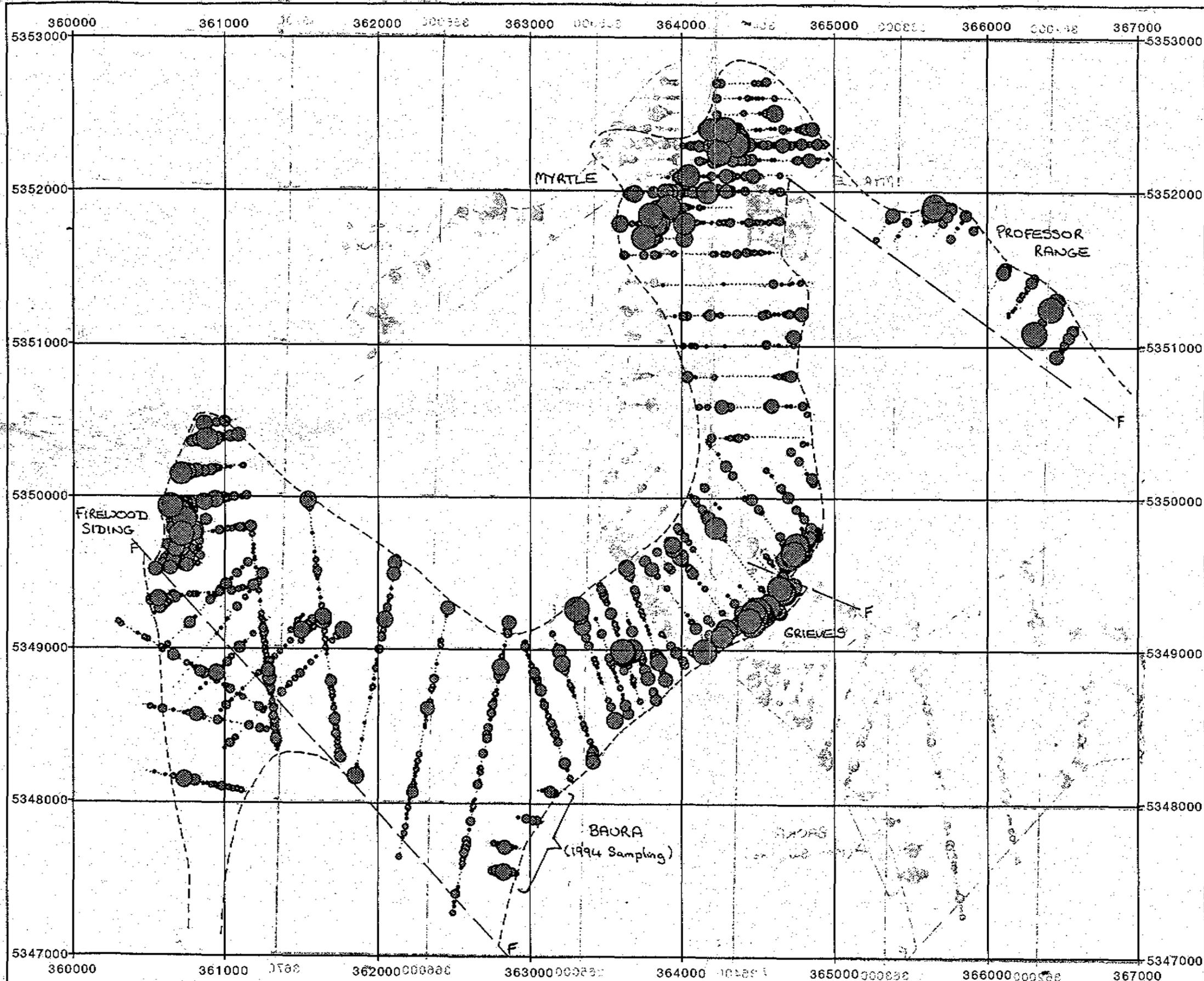
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5347000 5348000 5349000 5350000 5351000 5352000 5353000

wacker and air-core EOH samples

- 50-100
- 100-200
- 200-500
- 500-1000
- 1000-2000
- 2000-5000
- 5000-10000
- 10000-50000

jmap 100m

GWA Exploration Pty Limited		
ZEEHAN EL28/88, EL34/88 & EL38/89		
<b>BEDROCK GEOCHEMISTRY - Pb ppm</b>		
Geol: RGP	Scale: 1:25000	Report: 20613
Drawn: RGP	Date: 10/11/94	Plan: Tv 879



303395

CRA Exploration Pty Limited

ZEEHAN EL28/88, EL34/88 & EL38/89  
**BEDROCK GEOCHEMISTRY - Zn ppm**

wacker and air-core EOH samples

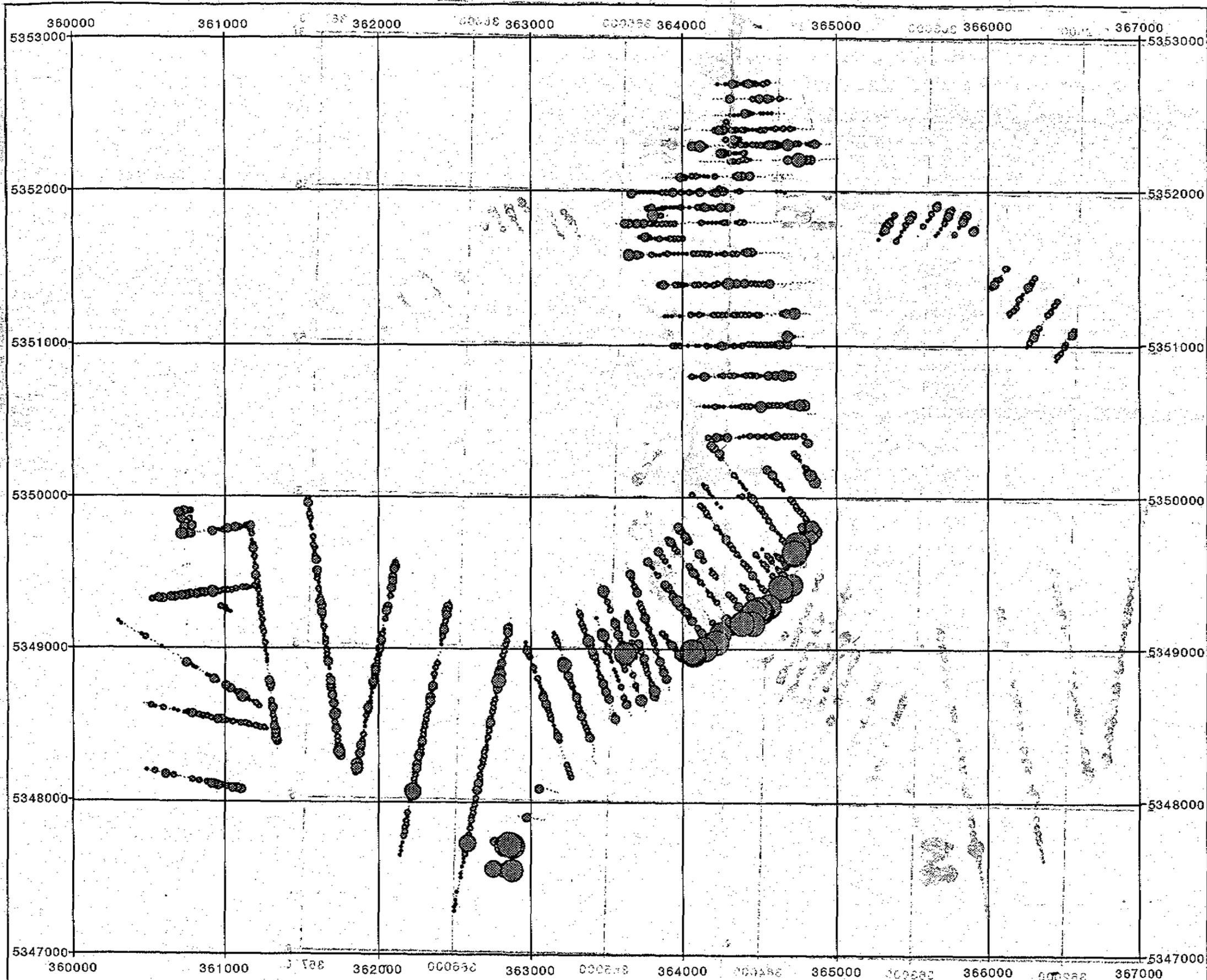
- 50 50-100 100-200 200-500

● 500-1000 ● 1000-2000 ● 2000-5000 ● 5000-10000 ● >10000

jmap 100m

Geol: RGP	Scale: 1:25000	Report: 20613
Drawn: RGP	Date: 10/11/94	Plan: Tv 878





5 cm

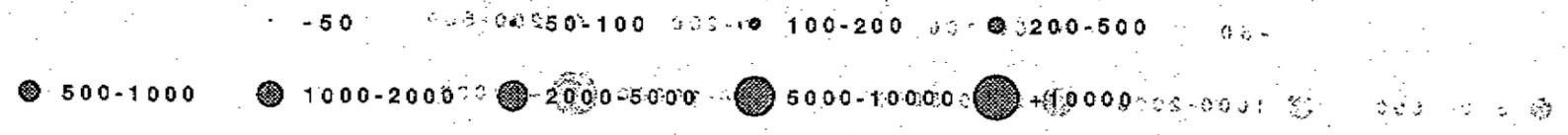
303397

CRA Exploration Pty Limited

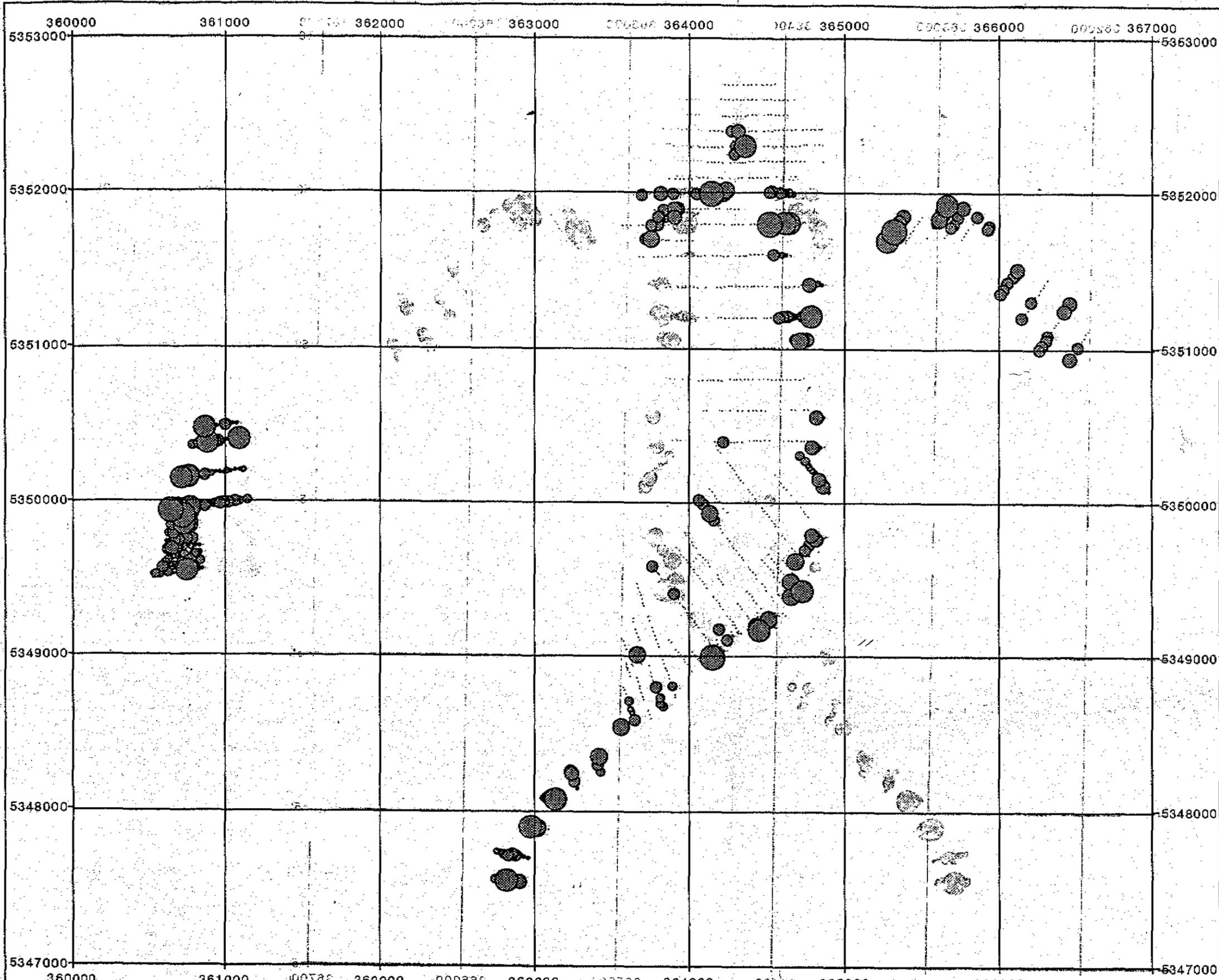
ZEEHAN EL28/88, EL34/88 & EL38/89  
**BEDROCK GEOCHEMISTRY - Mn ppm**

wacker and air-core EOH samples

jmap 100m

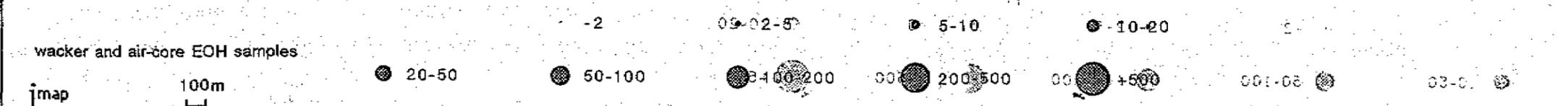


Geol: RGP	Scale: 1:25000	Report: 20613
Drawn: RGP	Date: 10/11/94	Plan: Tv 881



5 cm

303398



wacker and air-core EOH samples

jmap 100m

● 20-50	● 50-100	● 100-200	● 200-500	● +500
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CRA Exploration Pty Limited		
ZEEHAN EL28/88, EL34/88 & EL38/89		
<b>BEDROCK GEOCHEMISTRY - As ppm</b>		
Geol: RGP	Scale: 1:25000	Report: 20613
Drawn: RGP	Date: 10/11/94	Plan: Tv 882