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185001

PROJECT NAME: COMSTAFF PROPRIETARY LIMITED

TITLE: WILL O'WISP/CAB INTERIM REPORT

(Part 2)

CLOSED

AREA NAME/S, STATE 1:250,000 SHEET NO/S & COORDINATES: 1:250 000 sheets K55 03 (Burnie)
K55 05 (Queenstown)

COMMODITY/IES: Pb, Zn, Ag, Au

TEXT PAGES NO: 11

PLAN NOS: See List of Plans

TABLE NOS: –

APPENDICES: 4

AUTHOR/S: M P EVERETT

DATE: APRIL 1985

AUSTRALIAN ANGLO AMERICAN LIMITED

Incorporated in the State of Victoria

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185002

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COMSTAFF PROPRIETARY LIMITED

WILL O' WISP/CAB INTERIM REPORT

APRIL 1985

1. INTRODUCTION

In September 1984, a report was produced summarising previous work on this project and proposing further work on the basis that the Proterozoic block lying between the Coldstream and Ramsay Rivers had, geological and geochemical characteristics that made the area prospective for sediment-hosted massive Pb/Zn deposits.

This 'September' report recommended further geological, geochemical and geophysical work from which, it was hoped, that either discrete drill targets would emerge or from which the area could be placed on a surer basis for relinquishment.

The current report briefly summarises the work completed since September'84 and establishes the status of this part of EL 5/63 as at the end of March '85.

2. PREVIOUS WORK

For a concise summary of previous exploration in this area, refer to the following report:

"Proposals for Further Work in the Will O'Wisp (CAB) Area of EL 5/63" M. P. Everett, September 1984.

3. WORK ACHIEVED

For ease of description, the work completed in this part of EL 5/63 will be dealt with under two sub-headings: the WOW/CAB area, north of the Huskisson River and the JIT area, south of the Huskisson River (see TAS/2/3786).

3.1 WOW/CAB area

Work in this area concentrated on the evaluation of previously obtained and mostly low priority geochemical and geophysical anomalies. It was hoped that either these anomalies could be upgraded into discrete drilling targets or that they could be eliminated from further consideration. Geological work concentrated on evaluation of the area with reference to a shale-hosted Pb/Zn style of mineralisation. The overall consideration was to reach a firmly-based decision as to whether the WOW/CAB area should be relinquished in June/July 1985.

3.1.1 Geology

The detailed geology of the WOW/CAB area has been adequately described previously in various Comstaff reports (see References).

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During the period now under consideration, attention was given to re-examination of drillholes CR 3, 4 and 6, previously logged by M Pigott in 1973. The original logging was found to be substantially accurate while further evidence was gained of the prospectivity of the area for the envisaged style of mineralisation.

Regional geological traverses and an attempted synthesis of previous field mapping by others (Ramsay River area) failed to add significantly to an understanding of the overall stratigraphy and structure of the area.

As part of a programme that included chip sampling of available outcrops (see section 3.1.3.3) geological traversing was carried out in Kurakoff Creek and 760 Creek (for location see TAS/2/4232).

The objective was to assess the importance and try to locate the source of anomalous stream sediment and heavy concentrate results obtained early in 1984 (see TAS/2/4111 in the September report). Geological mapping of these creeks revealed only a monotonous sequence of generally westerly dipping fine, grey protoquartzites with interbedded sandstones, siltstones and shales and occasional minor quartz veining. There was little apparent indication of mineralisation or alteration of economic significance and no clues as to the source of the anomalous geochemistry. Thin-section descriptions from this area are included as Appendix 1.

3.1.2 Geophysics

In view of the possibility that the target commodities (Pb/Zn) would yield only muted geophysical responses, further GENIE EM and IP surveys were conducted to try to evaluate and obtain better resolution on GENIE anomalies obtained previously.

3.1.2.1 Genie EM

Genie anomaly "D" on CAB line 5700N (see TAS/2/4110, September'84 report) was selected for further traversing since, although it was only a weak response, it was associated with pronounced Pb/Zn soil anomalism (see TAS/2/4112, September '84 report).

The following grid lines were traversed using a 150m coil spacing instead of the 70 and 100m spacing originally used:

Line	5600N	4785E - 5025E
"	5700N	4510E - 5150E
"	5800N	4745E - 5025E

Drill profile line (CR 3, 4, 6) 50E - 950E

Geophysical contractor, Dr D B Trussell, interpreted the results as follows:-

"The response at 4825E in the 75m and 100m coil separation data (1983) was also observed in the 1984 data. The general form of the anomaly was similar but the amplitude was less. This implies the source is of limited dimensions. The earlier interpretation of a low conductivity (3 Seimens) deeply buried (40m) conductor dipping to the east still appears reasonable. It should be pointed out however the response is close to the geologic noise level of the data and so the dip estimate of 45° may be too low".

Scintrex commented:

"The additional data (150m spacing) shows a similar anomaly at 4910E, indicating a deep (of the order of 100m?) subsurface horizontal (?) conductor overlain by a slightly conductive surface. The anomaly also occurs on line 5600N at 4880E".

It can be seen from these two interpretations that, although the anomaly persisted, its definition was insufficiently encouraging for drill testing.

3.1.2.2 Induced Polarisation

This survey followed a recommendation from Dr Trussell and was carried out in late November and early December, 1984. A Scintrex IPR 8 receiver and a Huntec transmitter were rented from Geopeko; Comstaff had experienced IP operators on staff.

The following lines were covered using an 80m dipole-dipole array:

Line 4500N	4580E to 5100E	(covers GENIE anomaly 'C')
Line 5200N	4380E to 4940E	(" " " 'E')
Line 5700N	4560E to 5040E	(" " " 'D')

(Copies of the field profiles form Appendix 2 of this report).

Only one line was geophysically surveyed over each anomaly; if significant chargeability anomalies had been encountered, then further work would have been carried out over adjacent lines.

Trussell's discussion of the results is as follows:

"Except for the graphitic conductor off the west end of line 5200N, the chargeability results were all of very low amplitude-generally 15 ms or less. There is no correlation between the weak EM conductors detected in the 1983 GENIE survey and the chargeability data. The EM conductors which were the starting point for the IP survey must be due to conductive shears or massive sulphide sources.
"The only response worthy of any consideration is between 4980E and 5060E on line 4500N. This is due to a weakly chargeable source at a depth of approximately 40m. There is a resistivity low accompanying the chargeability anomaly. If there are other data to support interest in this area then the response is worth further examination.

"The central portions of all three lines are characterised by increased resistivity values - typically over 1000 ohm metres (4580E - 4860E on line 4500N, 4600E - 4940E on line 5200N and 4640E - 4880E on line 5700). The graphitic shales off the west end of line 5200N are very good conductors and have resistivities of less than 20 ohm metres. The resistivity values on the east ends of the lines are typically 400 ohm metres.

"Unless the minor anomaly at 5020E on line 4500N is of interest, no further geophysical work is necessary on the CAB grid. The current survey would have detected significant disseminated sulphides occuring within 160 metres of the surface".

3.1.2.3 General

In October 1984, Dr Trussell was asked to review briefly all previous geophysical work carried out in the WOW/CAB area to see if previous interpretations are still valid (see TAS/2/4114, September '84 report).

Trussell comments:

"Clearly defined SP anomalies are evident on old (WOW) grid lines 0, 6 and 10. The probable cause of these anomalies is carbonaceous material associated with a siliceous dolomite.

"Several lines of Crone shootback EM were carried out (in the early'70s) using a 150m coil separation. Anomalies originally identified are now rejected as being spurious. This is consistent with the more reliable data obtained in the 1983 GENIE survey at CAB. The Crone EM work was the earliest use of the shootback system by Comstaff and the data were not correctly interpreted.

"The 1983 GENIE EM survey detected five conductors (A, B, C, D and E - see TAS/2/4110, September '84 report). Anomalies A and B are due to near surface conductors. They are coincident with mapped graphitic sediments. Since they have no geochemical response, conductors A and B may be rejected. Conductors C, D and E are in an area of anomalous lead geochemistry. The responses are of low amplitude and on only one line. It would be risky to drill test these responses on the present information since it would be quite possible to drill off the end of the conductor".

Although not specifically mentioned by Trussell, a re-interpretation of the ground magnetic data did not help in elucidating geological features within the grid area.

3.1.3 Geochemistry

The main geochemical work carried out in the CAB area during the period September '84 to March '85 was the extension and sampling of the CAB soil grid to the north until the basalt cover was reached and the investigation of the anomalous geochemistry in Kurakoff Creek and 760 Creek.

3.1.3.1 Soil

CAB grid lines 6000N, 6100N, 6200N and 6300N were cut and the baseline was extended northwards accordingly (see TAS/2/4232). "C" horizon auger sampling was carried out at 20m intervals along these lines and analysed by Analabs for Pb and Zn only. Using the Pb results as an indication, the WOW/CAB anomaly is traceable only as far north as line 6100N; lines 6200N and 6300N are thought to be largely underlain by Tertiary basalt but this has not been confirmed in the field.

To the south, in the vicinity of 760 Creek and Kurakoff Creek, auger sampling to 'C' horizon was carried out on grid line 4600N from 5000E to 5200E. In addition, previously collected soil pulps from lines 4300N to 5100N (5000E to 5200E) were re-analysed for Au only. The object of this was to try to get a quick lead into the source of the stream sediment Au anomalies in 760 Creek. The results of these re-analyses did not produce values greater than 0.01 ppm. However, the sampling of the eastern end of line 4600N returned one value of 0.51 ppm at grid point 5080E 4600N. This still remains to be investigated.

3.1.3.2 Stream Sediment

In order to evaluate and confirm previously reported anomalous values - Au, Pb, Zn, Ag and Ba (see TAS/2/4111, September '84 report), stream sediments were collected at 100m intervals along Kurakoff Creek from its confluence with the Coldstream River for a distance of almost one kilometre.
Similarly, the 760m tributary was sampled at 60m intervals for a distance of 420m. Heavy concentrates were also collected from 760 Ck (2), Kurakoff Ck (1) and 730 Ck (1). The results from the stream-sediment sampling did not repeat the previous anomalous Au values and neither were Zn values of over 200 ppm repeated (see TAS/2/4232). However, the presence of low order Pb and Ba anomalies was re-confirmed. The heavy concentrate samples were sent to Central Mineralogical Services (Adelaide) for microscopic-examination of the constituent minerals (Appendix 1) after which the sample 'sink fractions' were composited and analysed for Au. The sample value was 0.2 g/t Au.

A previously recognised tin anomaly in Slippery Rock Creek (see TAS/2/4111, September '84 report) was not followed up.

3.1.3.3 Rocks

As part of the investigation of the low order stream sediment gold values in 760 Ck, an outcrop chip/channel sampling programme was completed. Chip samples were taken from small outcrops while larger outcrops were crudely channel sampled. Forty-four samples were collected from 108m of almost continuous rock outcrop; the average weight of sample per metre was 0.65 kg. Of the forty-four samples despatched, forty-two returned 'no gold detected'. The positive samples were from the headwaters of 760 Ck (420-430m; 437-447m) but revealed only trace amounts of gold (0.03 and 0.05 g/t respectively). There is no apparent geological reason for gold being present in small quantities in these two samples in preference to the others. This area was not investigated further.

A specimen of massive pyrite, found as a large nodule in greywacke float (from 760 Ck) was analysed;

	Cu	Pb	Zn	Ag	As	Au	Ba
Z 5104 (ppm)	x	175	25	x	51	0.03	1190

3.2 Just-In-Time Area

3.2.1 Geology

The Just-In-Time prospect (as described on pages 98 and 99 of GSB No 28 by A McIntosh Reid, 1918) was re-discovered. It consists of three, possibly four, shallow trenches exposing a narrow (up to 1m), silicified barite-galena fault breccia zone, near-vertical and striking 140^{o} within shales, siltstones and sandstones of the Proterozoic Oonah Formation.

Preliminary grab specimens dispatched to CMS were described as follows:-

"All three rocks may be classified as altered breccias and exhibit variably silicified clasts of carbonaceous pelites within a matrix consisting variously of mylonitised pelite, 'hydrothermal' quartz and quartz-barite composites. Relict features are consistent with a tectonic breccia mode of origin and non-penetrative post-alteration stress effects are evident in relatively baritic rocks.

"Observed mineralisation comprises relics of 'syngenetic' pyrite in pelite clasts and as mechanical inclusions in the matrix, supplemented by barite-hosted disseminations of galena. A minor secondary mineral assemblage of witherite (after barite), hedyphane (galena) and jarosite (pyrite)".

The breccia zone was traced by float examination for about 80m to the south but the Huskisson River flood-plain swamps obscured its exposure immediately to the north. To the south, galena mineralisation was weaker than in the original trenches but barite was still strongly developed.

Bulldozing, for one day, helped to confirm the presence of the breccia to the south and the costeans have provided three further exposures of the lode for sampling. In addition, bulldozing uncovered a fold-nose of alternating thinly-bedded, black (carbonaceous) pelites and fine-grained dolostones; the pelites are very finely laminated and contain 10-20% syngenetic pyrite. Barite and quartz veining were conspicuous but there were no visible traces of base metal mineralisation. CMS describes these pelites as being typical of the Oonah Formation pyritic pelite facies and, consistent with them, reflect a stable, low energy depositional environment. A summary of the geology of the trenches and costeans is on plan TAS/2/4233>

3.2.2 Geophysics

There has been no geophysical work at the Just-In-Time prospect.

3.2.3 Geochemistry

3.2.3.1 Soil Grid

In January/February 1985, a small grid was constructed across the Just-In-Time prospect and 'C' horizon auger sampled at 20m intervals. Analysis was carried out by Analabs for Cu, Pb, Zn and Ba. The full set of results is contained in Appendix 3 while Pb, Zn and Ba values, around the Just-In-Time prospect are shown in more detail on plan (TAS/2/4233). (These grid lines have not been mapped geologically).

3.2.3.2 Heavy Concentrates

To complete regional coverage and to assist in locating the Just-In-Time prospect, eight heavy concentrate samples were collected from various creeks south of the Huskisson River (see TAS/2/4234).

Results are as follows:-

Sample No	Cu ppm	Pb ppm	Zn ppm	Ba ppm	Au g/t
Z4640	10	30	280	35	<0.01
Z4641	4	< 5	38	370	<0.01
Z4642	8	22	435	130	0.15
Z4643	16	< 5	35	1960	<0.01
Z4644	6	< 5	16	30	<0.01
Z4645	5	40	60	105	<0.01
Z4646	12	< 5	40	>450	<0.01
Z4647	26	84	285	125	0.16
Method	A1/1	A1/1	A1/1	X1	A7/2

Those samples apparently anomalous in Ba or Au have not been investigated further.

3.2.3.3 Rocks

Two grab samples taken from the Just-In-Time workings returned the following values:-

	Cu	Pb	Zn	Ag	Sn	As	Au	Ba
Z5101	1525	0.59%	100	x	x	120	0.01	15.7%
Z5102	300	4.11%	50	6	x	22	x	23.2%

[results in ppm unless otherwise indicated; Ag was analysed by a 'silver sensitive' method]

The Just-In-Time trenches and costeans were channel sampled (chip sampled where hard and siliceous rocks occurred) and analysed (Analabs) for Cu, Pb, Zn, Ag, Au and Ba. Pb results peaked at 3775 ppm in costean D in sheared pyritic black shales adjacent to the lode material, while the highest Zn value of 825 ppm occurred in the same sample. Where sampled, the actual Just-In-Time 'lode' peaked at 3450 ppm Pb and a surprisingly low 75 ppm Zn. Cu and Ag values peaked overall at 225 ppm Cu (siltstones) and 5 ppm Ag (yellow/red ochre stained black shales in costean D). Costean C returned the highest Ba values (5.07% to 9.11%) while Au values peaked at 0.032 ppm in Costean A. It is notable that Pb values increase steadily from a very low background towards the lode in costean E while anomalous levels of Ba occur in sediments adjacent to the lode where there is no visible mineralisation (eg Trench A). The full set of results can be seen on plan TAS/2/4233.

3.3 Lead Isotope Studies

Sirotope was commissioned to undertake a lead isotope study (see Appendix 4) of rocks from the WOW/CAB and JIT area which, it was hoped, would answer the following questions:-

- Could the disseminated sulphide mineralisation in sediments, with values of up to 5000 ppm, represent the distal portion of a significant shale or carbonate hosted deposit?

- Is the observed vein mineralisation, a result of metamorphic remobilisation of stratiform sulphides or are they primary veins related to much younger tectonism (eg similar to the Devonian age veins found commonly in the region)?

- Can the lead isotopic information give any indication of the age of the various mineralising events?

For this study, Sirotope requested four specimens of galena, four sediments of 'high' lead content (>100 ppm) and four sediments of 'low' lead content (<100ppm). These specimens were duly selected from Just-In-Time surface material and from surface material and drillholes in the WOW/CAB area. For the purposes of the following extracts from the report, the specimens can be re-grouped as follows:-

Group 1 (Veins with barite)

Z5105	JIT	Vein galena with barite
Z5108	"	" " " "

Group 2 (Veins without barite)

Z5106	CR4 (DDH) - massive vein galena
Z5107	" (drillsite) - traces of galena in stylolites in dolomite

Group 3 (Sediments from JIT costeans)

			Pb(ppm)
COS E	(21-23m)	mudstone	500
COS D	(28-30m)	black shale	3775
COS E	(11-13m)	mudstone/siltstone	75
COS D	(37-39m)	black shale	75

Group 4 (sediments from CR drillholes)

			Pb(ppm)
CR 3	(83-107')	dolomite	2100
CR 2	(124-130')	black shale	4850
CR 2	(376-381')	dolomite	25
CR 3	(130-136')	black shale breccia	45

The results show that the vein samples plot in two distinct groups displaced on either side of the Cambrian reference fields (see Figs 1 and 2, Appendix 4). The Group 2 samples (WOW/CAB veins without barite) are more radiogenic than the reference signature and have values typical of the Devonian Queen Hill/Tullah-style mineralisation. The barite vein samples from Just-In-Time (Group 1) are considerably less radiogenic than the Cambrian signature, and are similar to other barite associated, uneconomic veins found in the northern end of the Dundas Trough.

The Group 1 206 Pb/204 Pb ratios of about 18.15 are compatible with an Upper Proterozoic model age but they could also have formed during a Phanerozoic orogeny as a result of the remobilisation of Upper Proterozoic sulphide lead (ie galena or rocks with lead contents of greater than 1000ppm) or mixing of leads from lower in the Proterozoic with younger leads. Similar isotopic ratios have been found in unmineralised shales of the Oonah Formation at Queen Hill and in uneconomic vein mineralisation at Elliot Bay and possible Precambrian rocks in the East McIntosh EL.

The samples containing disseminated sulphides also show a wide distribution of lead isotopic ratios. Group 3 (JIT costean sediments) are less radiogenic than the Cambrian signatures and range down to the ratios of the barite associated veins (Group 1). A distinctly different mineralising event, however, is responsible for the Group 4 results. Samples CR 2 (124'-130') and CR 3 (130'-136') with 4850 ppm and 50 ppm Pb respectively have indistinguishable ratios and fall within the Hellyer reference field. Another Group 4 sample (CR 3 83'-107') with 2100 ppm Pb lies close to the previous two samples but outside the reference field while sample CR 2 (376'-381') had highly radiogenic ratios. An explanation for Group 4 samples is that they are part of a population with a similar isotopic signature to Hellyer and the lead was deposited from a closely related mineralising event. However, this proposal of a Cambrian age is in disagreement with the currently accepted Precambrian age for these rocks. This enigma remains to be solved.

4. CONCLUSIONS

The significance of the 'anomalous' Group 4 isotopic ratios has to be evaluated and further isotopic work may be necessary to confirm the existing results. Until this work is completed, this part of EL 5/63 should not be relinquished if it can be avoided.

for M P EVERETT
APRIL 1985.

REFERENCES

M.P.Everett. (Sept '84) *	Proposals for Further Work in the Will O'Wisp (CAB) Area of EL 5/63.
M.P.Everett, M.Pigott (June'73)	Will O'Wisp Project, Report on Drilling Programme.
M.P.Everett. (June'73)	Will O'Wisp Follow-Up Project Report for March-December 1972.
M.P.Everett. (March'72)	Coldstream-Hatfield-Que Regional Reconnaissance Project.

A P P E N D I X 1

REPORT CMS 84/9/22

At the request of M.P. Everett nine rock samples were received for brief petrological examination, together with a suite of eight panned stream sediment concentrates for mineralogical examination.

Representative thin-sections were prepared from the rock chips and examined together with their respective offcuts, with carbonate stainings tests carried out as warranted.

Pan concentrates were concentrated by means of TBE (S.G. = 2.95) heavy liquid separations on minus 10 mesh fractions. The +10 mesh fractions, and heavy liquid light fractions, were briefly examined, confirmed as barren and discarded. Sink fractions were retained and will be returned for potential assay confirmation of the gold content.

Summary

The rock chips, with the exception of a single example of weakly mineralised dolomite (sample No. 4), represent a sequence of protoquartzites, typically fine-grained and very uniform in terms of the clastic components.

These rocks are weakly acid-volcanomict. Individual examples reflect varying degrees of sideritic carbonation, reflecting variations in primary (diagenetic) accessory carbonate content. Siderite is locally pseudomorphous after fine carbonate rhombs on which basis the original carbonate is reasonably interpreted as dolomite.

Associated quartz-siderite veins locally include traces of sphalerite and galena. These features predate a mild non-penetrative stress phase and appear to represent [redacted]eralisation pattern.

Heavy mineral concentrates may be subdivided into two groups:

1. Samples exhibiting a high proportion of detrital chromite, variously euhedral to abraded, with optical characteristics delineating the source as the "Serpentine Hill-type" ultramafic complexes of N.W. Tasmania.

   This group comprises samples Z 4628, Z 4629 and Z 4630. Apart from chromite, the major constituent is ferruginised rock fragments. Accessories, determined under a stereobinocular, include topaz, zircons (both locally derived euhedra (rare) and distally derived well-rounded grains), oxidised very fine pyritohedral pyrite, green to green-brown tourmaline, dark red rutile, martitised magnetite and anatase. Non-opaques were confirmed in a grain-mount prepared from sample Z 4630.

2. Samples consisting virtually entirely of weathered and ferruginised rock fragments, notably limonitic pelite (slate, phyllite clasts). Apart from minor traces of chromite and rare tourmaline, these samples are devoid of heavy mineral components. This group comprises samples Z 4631 to Z 4635 inclusive.

Close examination of the various concentrates revealed no stereobinocular-detectable gold. A few of the tarnished to variably oxidised pyritohedra in sample Z 4628 are bright brassy yellow in colour. Further work may be warranted on the basis of assay confirmation of anomalous gold.

D. Cowan, B. Sc.

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[redacted]

mple .	Classification - Composition	Fabric	Accessories	Comments
0/40 .S. 507)	Protoquartzite. Framework of fine sand-sized subangular to subround quartz grains, subordinate sericitic pelite clasts, minor white muscovite, chloritised biotite flakes. Overgrowth and intergranular quartz cement.	Well-sorted, weakly bedded, fine-grained sandstone.	Pervasive carbonaceous matter in pelite clasts. Minor detrital leucoxenic semi-opaques, schorl, zircon.	Well-lithified, but essentially unmetamorphosed protoquartzite (Pettijohn's classification).
,0/55	Altered Siltstone. Semi-sericitic white mica and silt-sized detrital quartz in near-equant proportions with conspicuous detrital muscovite flakes. Pervasive fine sideritic carbonate, sporadic siderite-quartz veinlets.	Weakly laminated, incipiently concordantly sheared siltstone. Incipiently stressed discordant veinlets.	Carbonaceous matter. Rare microscopic blebs of chalcopyrite in veinlets.	Primarily a calc- or dolomitic siltstone. Primary carbonate replaced by siderite contemporaneously with siderite-quartz veining.
'0/98	Protoquartzite. Framework of subangular to subround quartz, subordinate carbonaceous, sericitic pelite clasts, minor sericitic feldspar clasts, muscovite flakes. Overgrowth and intergranular quartz cement.	Similar to 760/40, slightly coarser-grained, relatively massive (unbedded).	Detrital leucoxenic semi-opaques, schorl, rare zircon. Thinly pervasively disseminated siderite rhombs.	Close affinities with 760/40, but primarily weakly dolomitic. Reflects sideritic carbonation analogous to 760/55.
'0/ 62	Protoquartzite. Framework of subangular to subround quartz, subordinate carbonaceous/sericitic pelite clasts, minor sericite felsite, chert clasts, muscovite flakes. Weakly siderite-stained overgrowth-intergranular quartz cement.	Very similar to 760/98	Detrital leucoxenic semi-opaques, schorl. Minor variably sideritic quartz veinlets.	Close affinities with 760/98; similarly but relatively weakly sideritised-dolomitic; weakly quartz-siderite veined.
50/ 85	Protoquartzite. Framework of subangular to subround quartz, subordinate carbonaceous, sericitic pelite, minor felsite clasts. Overgrowth-intergranular quartz cement. Minor quartz veinlets.	Very similar to 760/40, 760/98, 760162.	Detrital leucoxenic semi-opaques, muscovite flakes, minor schorl. Traces of siderite in matrix, quartz veinlets.	Close affinities with 760/40 etc. Incipiently sideritised; primarily relatively weakly dolomitic.
60/ 85	Protoquartzite. Framework of subangular to rounded quartz, subordinate carbonaceous, sericitic pelite, minor felsite clasts. Siderite-stained quartz cement. Sporadic irregular quartz-siderite veinlets.	Poorly (trend bimodally) sorted fine to medium sandstone. Moderately stressed veinlets.	Chert clasts. Detrital leucoxenic opaques, muscovite, schorl. Rare sphalerite in veinlets.	Relatively poorly sorted protoquartzite Reflects relatively marked sideritic carbonation, with weakly sphalerite-mineralised quartz-siderite veinlets predating mild stress.
	Dolomite. Medium sparry to fine-grained spherulitic radiating dolomite. Thinly disseminated fine-grained, extensively oxidised pyrite. Sporadic microscale dolomite veinlets.	Spherulitic, with interspersed vug-like masses of sparry dolomite.	Minor discontinuous films of galena in dolomite veinlets.	Unusual spherulitic dolomite with disseminated "syngenetic" pyrite and accessory carbonate veinlet-hosted galena.
65	Protoquartzite. Framework of subangular to subround quartz, subordinate carbonaceous pelite clasts, minor muscovite flakes. Overgrowth-intergranular quartz cement. Minor quartz veinlets.	Analogous to 760/98.	Leucoxenic semi-opaques, traces detrital schorl. Traces of syngenetic pyrite.	Weakly quartz-veined protoquartzite. Pelite clasts are incipiently silicified. Devoid of replacement and vein siderite in contrast to 760/98 etc.

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APPENDIX 2

Sample No.	Classification - Composition	Fabric	Accessories	Comments
498 (T.S. 1515)	Protoquartzite. Framework of subangular overgrown quartz, subordinate carbonaceous pelite clasts, minor muscovite flakes. Quartz cement with degraded-ferruginised fine-grained carbonate (?siderite).	Weakly shale-parted, fine, well-sorted sandstone.	Leucoxenic semi-opaques, minor traces detrital schorl.	Typical fine-grained protoquartzite. Reflects weak (oxidised) sideritic carbonation analogous to 760/98 etc.

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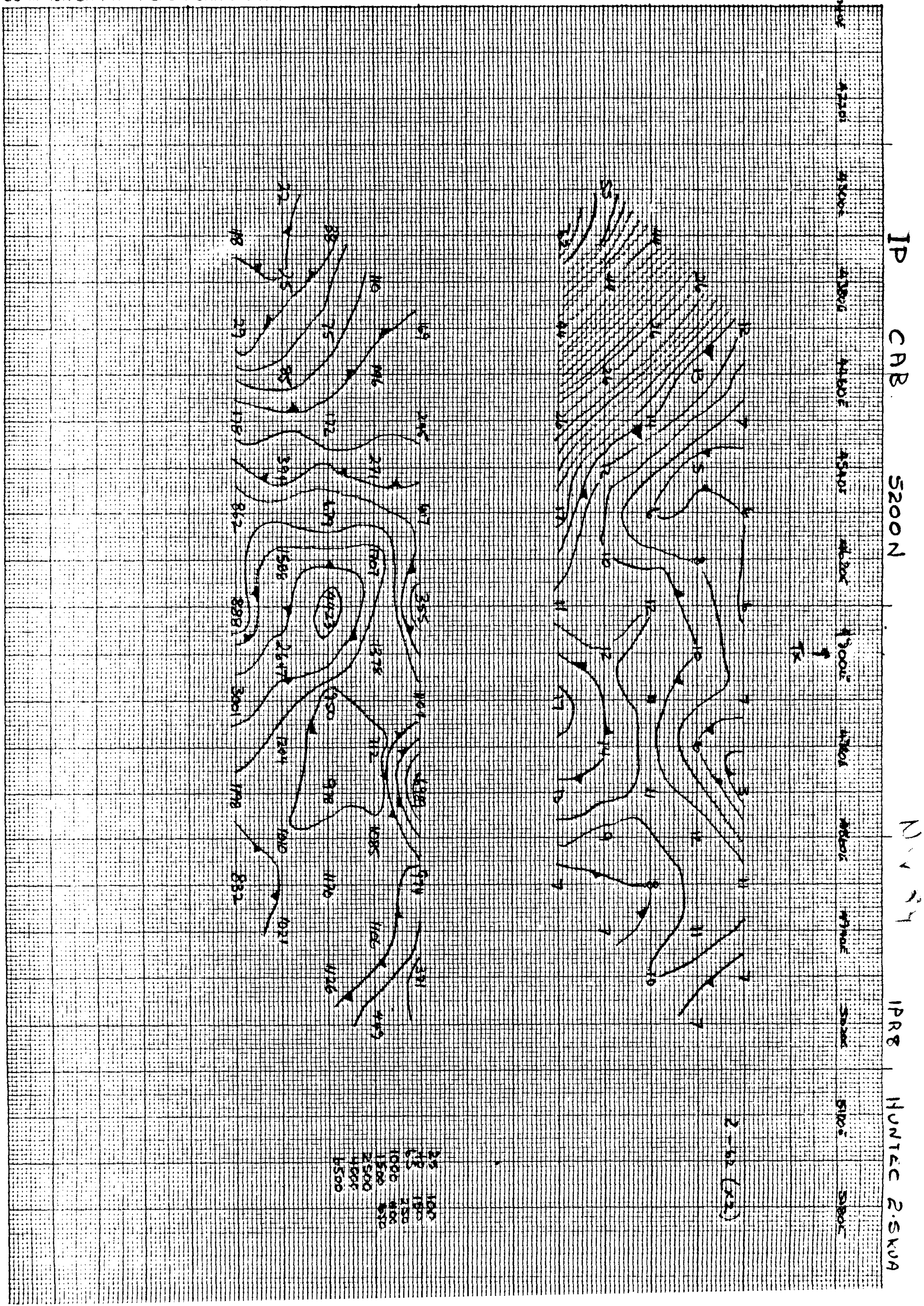
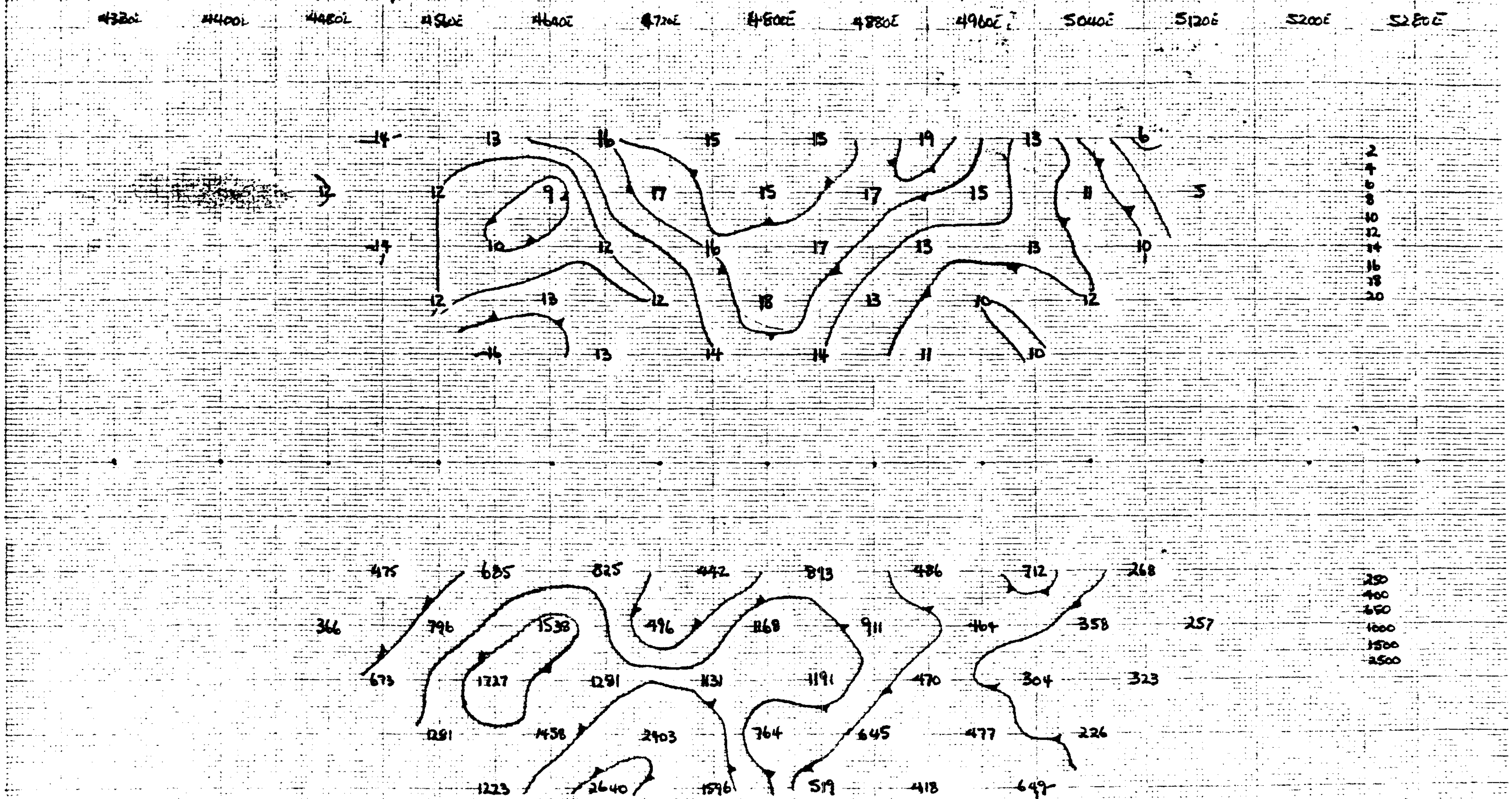


IP CAB 26/27 · 11 · 84 LINE 5700N

NOV 84

OB: TC, BS IPR8 HUNTEC 2.5 kVA



APPENDIX 3

DATA MATRIX

FILENAME B:JITGRD.AUG

	Cu	Pb	Zn	Ba	CLASS
4760N	5	6	16	40	
	11	17	20	35	
4600	0	0	5	20	
	1	1	4	20	
	1	2	8	30	
	0	0	4	20	
	0	0	3	20	
	0	1	5	25	
	1	13	9	45	
	1	8	7	50	
	3	8	14	50	
	107	65	530	260	
	42	23	29	85	
	2	2	8	25	
	1	0	4	65	
	11	9	26	45	
	9	9	17	45	
	1	5	6	30	
	1	0	5	20	
	2	1	6	20	
	1	2	6	15	
	2	21	15	50	
5000	1	3	8	50	
	1	7	5	60	
	52	50	22	75	
	8	20	18	60	
	51	28	39	55	
	30	40	52	90	
	35	35	57	85	
	57	32	127	110	
	6	25	18	45	
	1	6	9	40	
	1	2	8	25	
	8	19	21	45	
	1	0	4	15	
	1	1	4	15	
	1	5	8	15	
	13	23	21	35	
	1	4	5	25	
	1	12	5	65	
	4	12	8	85	
	2	5	4	45	
	4	19	12	75	
	3	5	5	45	
	6	24	9	80	
	6	10	15	70	
	3	4	6	60	
	33	15	8	75	
5500	2	4	6	55	
	67	68	20	65	
Line 4840					
	3	5	13	25	
	2	3	6	30	
	1	0	5	20	
4680	1	0	4	15	
	1	0	5	20	
	3	8	20	35	

	2	12	6	30
	2	10	8	35
	18	18	39	80
	2	3	5	25
	2	0	5	20
	4	6	8	30
	3	17	13	40
	2	9	8	20
	1	0	3	25
	2	3	5	60
	7	18	22	110
	7	16	27	85
5000	17	27	22	45
	29	27	33	35
	6	58	13	50
	10	73	18	70
	26	95	21	95
	2	1	15	20
	3	22	9	45
	5	23	17	45
	5	9	12	110
	7	184	38	55
	18	26	16	30
	42	39	43	45
	2	1	5	45
	4	4	14	40
	2	2	6	45
	6	5	13	80
	3	25	8	100
	9	14	10	110
	14	15	11	100
	17	16	12	95
	14	11	13	80
	3	2	8	75
	17	15	16	85
	7	9	20	85
	2	2	10	40
	2	2	6	45
5500	2	2	9	45
	5	9	9	85
	7	14	10	40
	9	11	22	90
	13	21	13	60
L4920	2	3	4	35
4575	1	0	0	15
	2	0	1	15
	1	0	1	15
	1	0	1	15
	8	3	6	30
	13	3	7	20
	0	0	2	15
	0	0	1	15
	0	0	1	15
	1	1	2	25
	1	7	3	35
	1	3	4	105
	2	3	3	30
	2	6	5	40
	3	14	6	70
	6	9	9	1710
	9	23	10	237
	6	12	8	357
	18	7	16	105
	14	8	19	110
	33	7	63	50
	17	84	17	75

025

5015	5	165	10	45
	3	39	7	45
	7	16	24	70
	35	21	81	80
	3	3	16	20
	2	7	17	20
	2	2	21	20
	7	7	20	30
	8	14	20	30
	8	14	20	30
	4	9	13	35
	17	17	16	50
	27	20	23	50
	40	15	44	55
	3	4	4	60
	3	6	4	65
	3	5	5	65
	3	8	7	70
	2	7	3	50
	1	7	3	40
	2	8	3	45
	2	7	3	50
	3	8	3	50
	5	11	5	70
Line 4960				
	6	11	10	35
	26	29	41	55
	24	28	35	40
	20	24	42	45
	11	18	40	85
	22	29	112	120
	22	22	103	100
	23	22	114	115
	23	25	112	100
4735	20	20	94	110
	18	25	93	145
	18	23	104	140
	7	14	19	150
	13	19	49	175
	11	14	39	170
	11	19	32	135
	8	16	27	90
	11	20	28	105
	31	40	35	95
4935	21	9	22	0
	49	37	24	0
	43	58	27	0
	28	37	21	0
	9	75	16	0
	15	59	163	160
	12	13	8	60
	8	6	8	60
	7	5	10	35
	20	20	23	30
5135	6	4	12	15
	30	40	19	75
	7	3	20	40
	103	7	13	50
	8	2	4	40
	7	2	5	35
	5	0	3	25
	6	4	6	40
	15	8	24	25
	30	17	34	40
5335	25	13	30	25
	24	31	45	30

026

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	0	10	20	30
	2	8	8	150
	2	16	8	90
	1	0	3	20
	3	7	7	85
	2	3	6	60
	2	2	4	35
	2	4	5	40
L5000N	25	39	74	55
4575	12	49	70	75
	28	32	133	120
	26	32	139	115
	32	32	140	110
	24	35	109	70
	32	40	131	70
	23	36	101	65
	29	32	140	115
	28	28	133	100
4755	27	27	124	100
	28	30	135	105
	28	27	122	110
	26	34	108	105
	17	29	60	100
	16	31	77	110
	19	32	87	105
	26	35	133	390
	16	38	81	125
	22	38	115	110
	21	126	171	658
	18	145	290	583
4995	29	300	187	6530
	15	41	18	85
	4	118	9	175
	7	11	8	75
	6	9	5	75
5075	7	14	7	70
	2	3	3	30
	29	25	28	125
	13	52	15	85
	5	9	7	70
	14	13	6	55
	2	2	2	30
	2	0	2	25
	5	7	4	55
	2	1	2	35
	2	0	1	20
	2	0	2	15
	3	9	4	40
	5	10	8	40
	3	8	6	55
	17	13	15	70
	11	15	8	85
	4	6	10	85
	6	9	8	90
	6	15	8	70
	3	4	8	65
	40	56	54	70
	2	6	4	40

A P P E N D I X   4

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SIROTOPE

CSIRO
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CONFIDENTIAL

REPORT TO COMSTAFF PROPRIETARY LIMITED ON THE SIGNIFICANCE OF LEAD ISOTOPIC COMPOSITIONS OF SAMPLES FROM THE WOW/CAB AREA, WESTERN TASMANIA

GRAHAM R. CARR

13/3/85

1. AIM OF STUDY

This study was undertaken to determine the origin and possible association of low grade vein and stratiform Pb-Zn mineralization in Upper Precambrian Oonah Formation rocks, western Tasmania. In particular the following questions were asked:

1. Could the disseminated sulfide mineralization with values of up to 5000 ppm Pb represent the distal part of a significant shale or carbonate hosted deposit?

2. Is the vein mineralization a result of metamorphic remobilization of stratiform sulfides or are they primary veins related to much younger tectonism (e.g. similar to the Devonian age veins found commonly in the region)?

3. Can the lead isotopic information give any indication of the age of the various mineralizing events?

2. SAMPLES

The samples analysed can be divided into three groups: 1) four galenas from vein style mineralization, 2) four shales, mudstones and dolomites with moderate to high lead (500 to 850ppm) and 3) four samples related to the shales above but with low lead contents (25 - 75 ppm, Table 1).

3. REFERENCE SIGNATURES

The only available signatures of massive sulfide concentrations in the area are for the Cambrian Hellyer and Que River deposits. A large amount of isotopic information is available on various styles of veins (including those associated with barite) distributed between Elliot Bay and the Que River area. The WOW/CAB data are plotted in relation to the Cambrian signature and reference is made in the text to their distribution in relation to the wide spread in the vein signatures. Brian Gulson has calculated that an Upper Proterozoic signature (about 750 my) in this area should have a 206Pb/204Pb of between 18.06 and 18.16.

4. RESULTS

The data have been plotted on two XY diagrams which have as their axes 208Pb/206Pb vs 207Pb/206Pb and 207Pb/204Pb vs 206Pb/204Pb. Error bars in the left hand corner of the diagrams indicate the analytical precision. The dashed line on the figures is the average growth curve for massive sulfide deposits outside Tasmania. For high lead samples it is commonly possible to calculate a model age (based on their position on the growth curve) which is within about 100 - 150 my of the true age . Although this does not hold true in Tasmania, with the palaeontological control on the age of the massive sulfide orebodies of the Mt Reid Volcanics, a Cambrian isotopic signature can be confidently defined.

The vein samples plot in two distinct groups displaced considerably on either side of the Cambrian reference fields (Figures 1 and 2). The Group 2 samples (Table 2) are more radiogenic than the reference signature and have values typical of the Devonian Queen Hill/Tullah- style mineralization. The barite associated samples (Group 1, Table 2) are considerably less radiogenic than the Cambrian signature and are similar to other barite associated, uneconomic veins found in the northern end of the Dundas Trough.

The samples containing disseminated sulfides also show a wide distribution of lead isotopic ratios and fall into two distinct groups (Table 2). Group 3 consists of the two high lead and two low lead samples from costeans D and E (COSD AND COSE) which are less radiogenic than the Cambrian signatures and range down to the ratios of the barite associated veins. Of the remaining samples (Group 4), CR2 (124 - 130ft) and CR3 (130 - 136ft) with 4850ppm and 50ppm Pb respectively have indistinguishable ratios and fall within the Hellyer reference field. Another sample (CR3 83 - 107ft) with 2100ppm lead lies close to the previous two samples but outside the reference field, and sample CR2 (376 - 381ft) with very low lead (25ppm) has highly radiogenic ratios.

5. DISCUSSION

The more radiogenic vein galenas (Group 2) can be readily ascribed to the Devonian mineralizing event responsible for a host of uneconomic sulfide occurrences in the region. The barite associated galenas (Group 1) have 206Pb/204Pb ratios of about 18.15, compatible with an Upper Proterozoic model age but they could also have formed during a Phanerozoic orogeny as a result of the remobilization of Upper Proterozoic sulfide lead (i.e galena or rocks with lead contents greater than about 1000ppm) or mixing of leads from lower in the Proterozoic with younger leads. Similar isotopic ratios have been found in unmineralized shales of the Oonah Formation at Queen Hill and in uneconomic vein mineralization at Elliot Bay and possible Precambrian rocks in the East McIntosh E.L.

The two groups of samples containing disseminated sulfides in shales and dolomites represent distinctly different mineralizing events . The simplest explanation for Group 4 samples is that they are part of a population with a similar isotopic signature to Hellyer and the lead was deposited from the a closely related mineralizing event as Hellyer. Sample CR2 (376 - 381ft) with only 25ppm Pb has almost certainly had its original (Cambrian) lead isotopic ratios changed due to the decay since the time of deposition of U and Th to the daughter products 206Pb, 207Pb and 208Pb. As 204Pb neither decays nor is the product of decay, the ratios 206Pb/204Pb, 207Pb/204Pb and 208Pb/204Pb increase with time.

The proposal of a Cambrian age is in disagreement with the currently accepted Precambrian age for these rocks. If the rocks are Precambrian, the only possible explanations for this discrepancy are that 1) the sulfides are epigenetic and formed either due to the remobilization of Cambrian leads or the mixing of older and younger leads and their deposition into Precambrian rocks, or 2) the sulfides are syngenetic and Precambrian but have had their isotopic ratios changed due to radioactive decay. The first possibility is unlikely as I understand the sulfides occur as fine disseminations in shaley sediments rather than as veins. The second possibility is also highly unlikely. For samples containing high lead (e.g. galenas or samples with greater than about 1000ppm Pb) the decay products from the generally low levels of U and Th present are insignificant relative to the original lead content and the isotopic ratios do not change with time. It can be calculated that for samples such as CR3 (83 - 107ft) and CR2 (124 - 130ft) with 2000 and 5000ppm Pb respectively, about 100 to 240ppm U would be required in the sample to change the isotopic ratio from a Precambrian (206Pb/204Pb = 18.1) to a Cambrian (206Pb/204Pb = 18.4) signature. The most common U values in rocks of the Dundas Trough are between 3 to 12ppm (except for the granites which range up to about 30ppm). As has been noted, the effects of radioactive decay are best seen in low lead samples such as CR2 (376 - 381ft) and

COSE (11 - 13m).

The Group 3 shale and dolomite samples have a distinctly different origin to the Group 4 samples. If the host rocks are the same age for the two Groups then the mineralization in Group 3 rocks must be epigenetic and may be related to the barite containing veins described previously.

6. CONCLUSIONS

1. Two generations of veins can be defined, neither of which is known to be associated with economic mineralization.

2. The low grade, disseminated sediment hosted mineralization intersected in drill holes CR2 and CR3 is most probably Cambrian in age and was deposited in the same or similar mineralizing event to the Hellyer/Que River deposits.

3. The mineralization intersected in costeans COSD and COSE is distinctly different to the sediment hosted mineralization described above and may be related to the barite associated vein mineralization.

7. FOLLOW UP

It would be worthwhile to analyse about 2 additional high lead samples from CR 2 and CR3 and/or any other nearby holes in order to confirm the proposed Cambrian signature and to determine its extent.

Table 1 Samples used in this study.

SIROTOPE No	COMPANY No	DESCRIPTION	Pb(ppm)
S25	Z5105 JIT	Vein galena with barite	
S26	Z5106 CR4.	Vein galena	
S27	Z5107 CR4.	Vein galena (Drill site)	
S28	Z5108 JIT.	Vein galena assoc with Z5105	
S38	CR3 (83-107ft)	Dolomite	2100
S39	CR2 (124-130ft)	Black shale	4850
S40	COSE (21-23m)	Mudstone	500
S41	COSD (28-30m)	Black shale	3775
S42	CR2 (376-381ft)	Dolomite	25
S43	CR3 (130-136ft)	Black shale breccia	45
S44	COSE (11-13m)	Mudstone/siltstone	75
S45	COSD (37-39m)	Black shale	75

Table 2

LEAD ISOTOPE RESULTS FOR WOW/CAB AREA

Sample	208 Pb / 206 Pb	207 Pb / 206 Pb	206 Pb / 204 Pb	207 Pb / 204 Pb	208 Pb / 204 Pb	Pb(ppm)
VEINS WITH BARITE (GROUP 1)						
S25 JIT	2.0938	0.8596	18.150	15.602	38.002	
S28 JIT	2.0920	0.8591	18.135	15.581	37.939	
VEINS WITHOUT BARITE (GROUP 2)						
S26 CR4	2.0763	0.8452	18.481	15.620	38.372	
S27 CR4	2.0731	0.8432	18.508	15.606	38.368	
SHALE/DOL-COSTEANS (GROUP 3)						
S40 COSE	2.0939	0.8585	18.204	15.629	38.118	500
S41 COSD	2.0938	0.8599	18.137	15.596	37.975	3,775
S44 COSE	2.0894	0.8555	18.248	15.612	38.127	75
S45 RaED COSD	2.0934	0.8572	18.194	15.595	38.088	75
SHALE/DOL-DRILL HOLES (GROUP 4)						
S38 CR3	2.0799	0.8482	18.414	15.619	38.299	2,100
S39 CR2	2.0814	0.8500	18.375	15.618	38.245	4,850
S42 CR2	2.0650	0.8429	18.532	15.621	38.269	25
S43 CR3	2.0809	0.8497	18.375	15.613	38.237	45

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COMSTAFF CAB LINE 4500N IP IPR8 HUNTEC 2.5KVA OB: BS DEC 1984

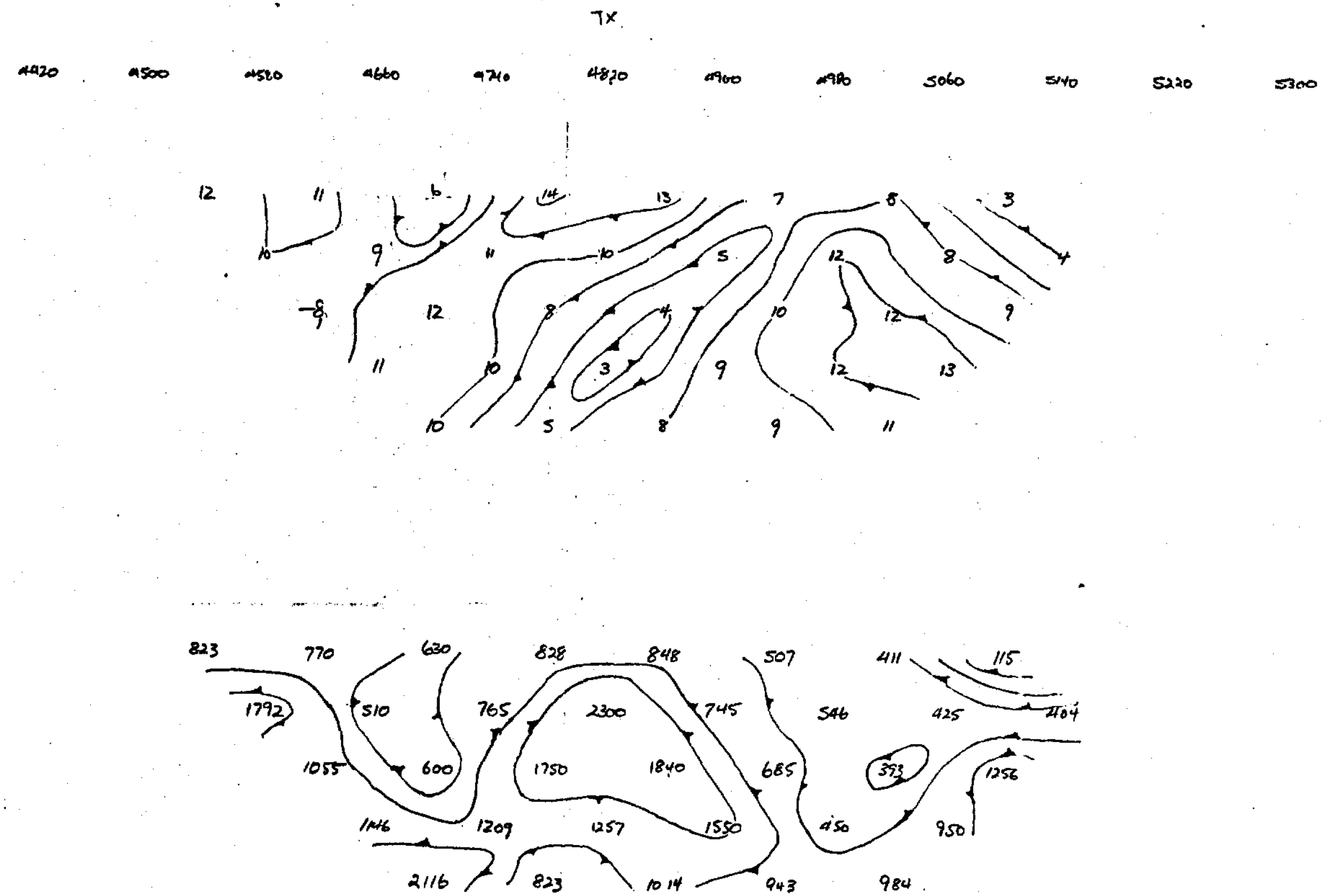

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Figure 1

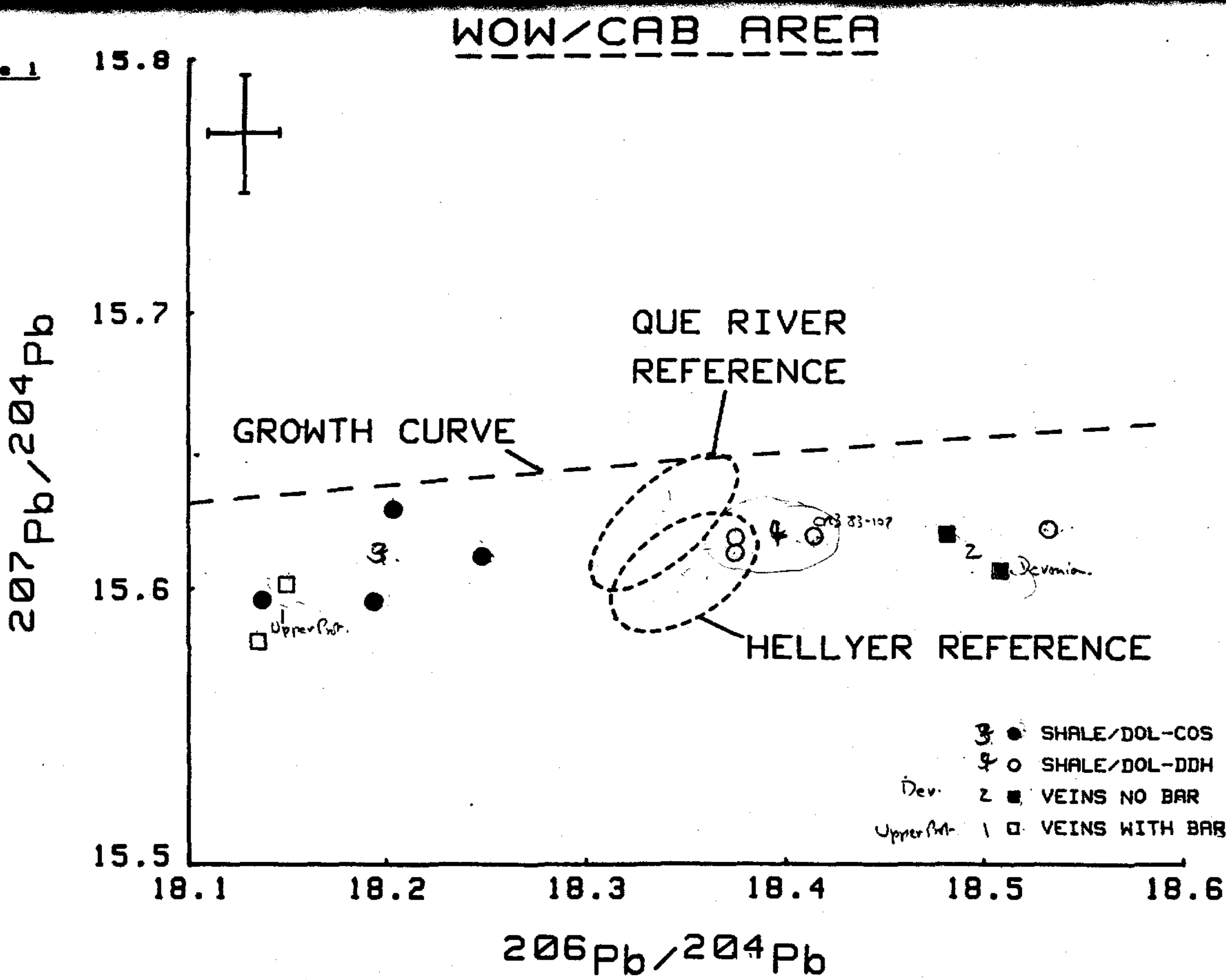

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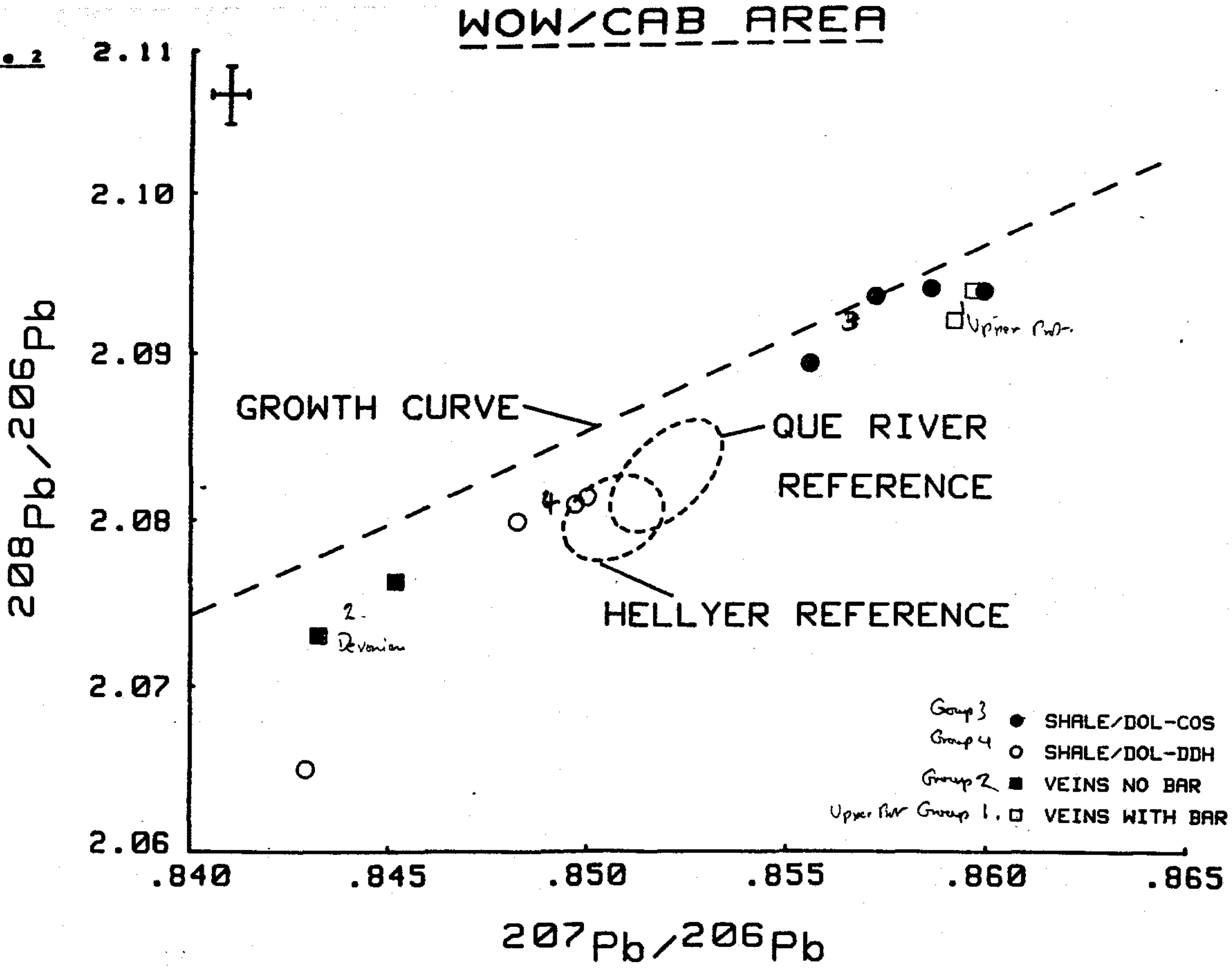
Figure 2



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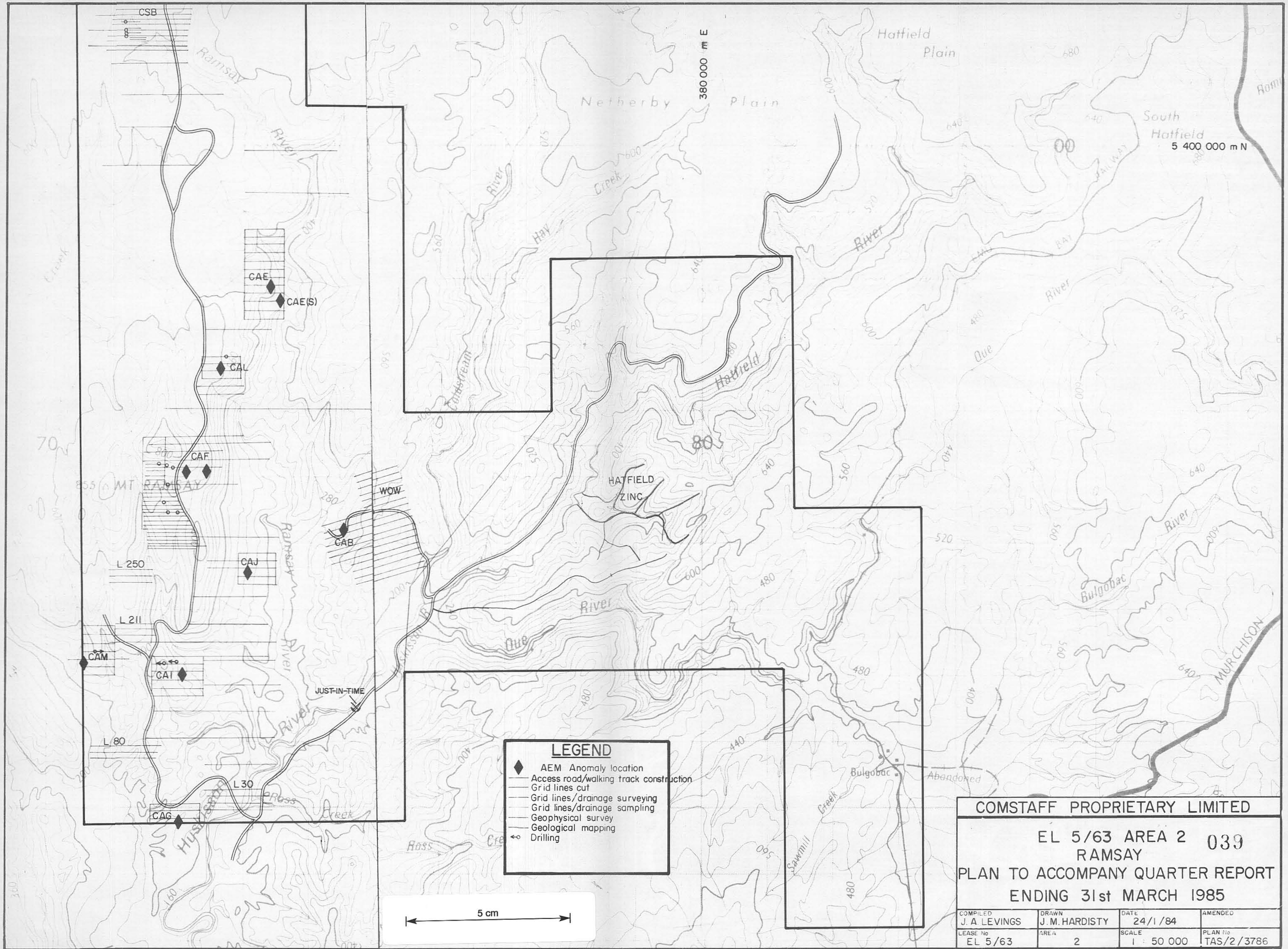

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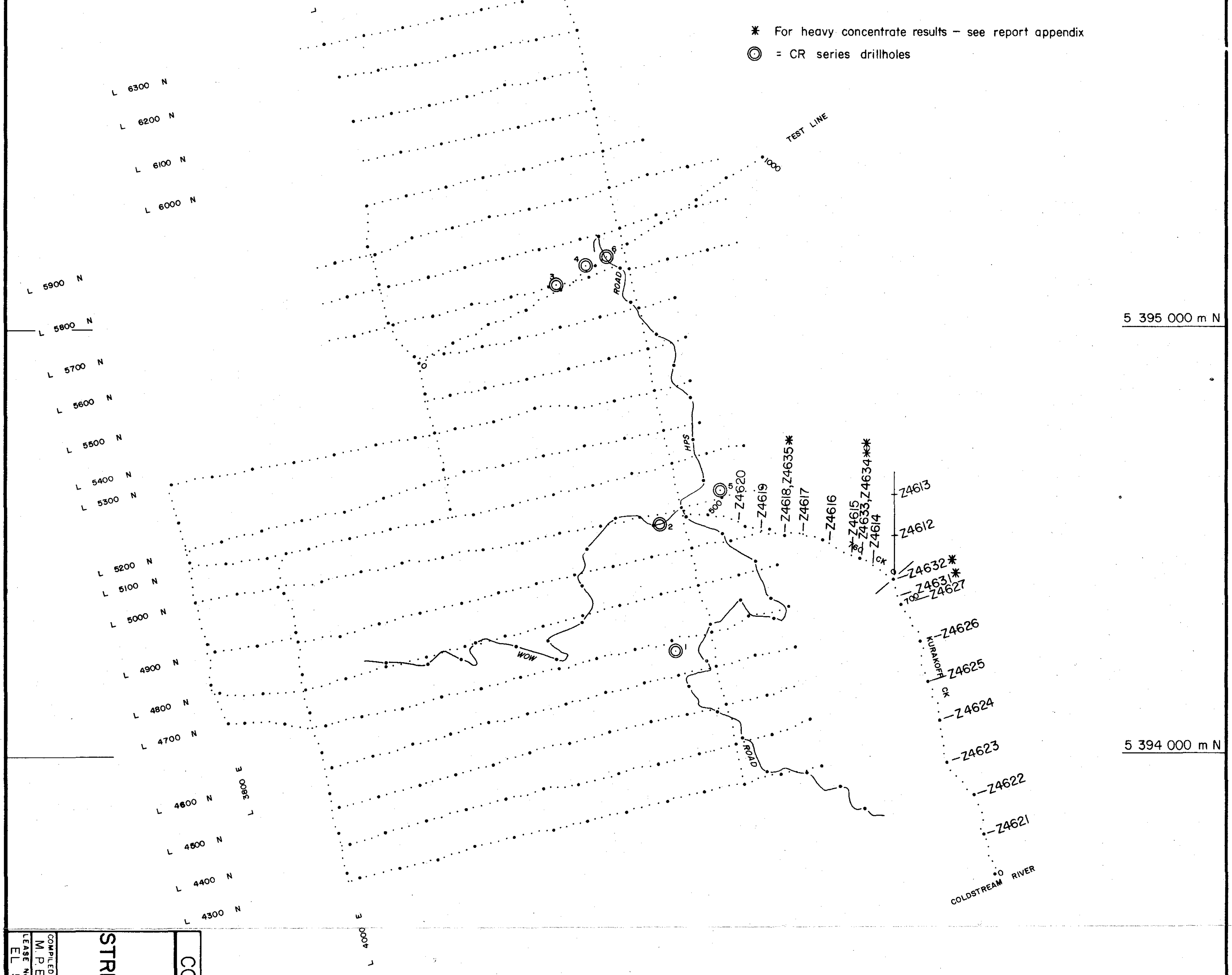
STREAM SEDIMENT & CONCENTRATE RESULTS

		Cu	Pb	Zn	Ag	Au	Ba	Sn
KURAKOFF CREEK	Z4612	10	25	55	X	X	183	X
	Z4613	10	40	100	X	X	203	3
	Z4621	10	45	55	X	X	190	3
	Z4622	10	55	80	X	X	214	X
	Z4623	10	60	65	X	X	186	X
	Z4624	15	70	95	X	X	208	X
	Z4625	10	70	165	X	X	191	X
	Z4626	15	75	170	X	X	177	X
	Z4627	15	115	135	0·5	X	223	X
760 CREEK	Z4614	25	120	185	0·5	X	339	X
	Z4615	15	110	120	0·5	X	441	X
	Z4616	10	105	120	0·5	X	404	X
	Z4617	20	125	140	0·5	X	450	X
	Z4618	10	110	100	0·5	X	575	X
	Z4619	30	125	150	0·5	X	1320	X
	Z4620	15	120	75	0·5	X	438	X

* For heavy concentrate results – see report appendix

◎ = CR series drillholes



COMSTAFF PROPRIETARY LIMITED

RAMSAY GRID - CAB 040
STREAM SEDIMENT SAMPLE LOCATIONS AND RESULTS

COMPILED	DRAWN	DATE	AMENDED
M.P. EVERETT	J. HARDISTY	8/5/85	
LEASE No EL 5/63	AREA 2	SCALE 1:10000	PLAN No TAS/2/4232

85-2381

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CHANNEL SAMPLING RESULTS

	m	Cu	Pb	Zn	Ag	Ba	Au	
COSTEAN A	0 – 1	225	525	200	4	1·10%	0·032	
	1 – 2	150	275	175	X	2050	0·025	
	2 – 3	125	150	50	X	3·47%	0·017	
	3 – 4	150	200	125	X	1·52%	0·008	
	4 – 5	125	3450	75	X	4·28%	0·017	*
COSTEAN B		not sampled						
COSTEAN C	0 – 1·5	75	500	25	X	5·07%	X	
	1·5 – 4	X	300	X	X	8·59%	X	*
	4 – 5	X	625	X	X	9·30%	0·008	
	5 – 6	X	875	X	X	9·11%	X	
	6 – 7·5	X	550	X	X	8·74%	0·008	
	7·5 – 10	not sampled						
COSTEAN D	0 – 23	not sampled						
	23 – 26	25	450	425	X	620	0·017	
	26 – 28	not sampled						
	28 – 30	175	3775	825	2	3050	X	
	30 – 32	75	650	475	2	1600	X	
	32 – 35·5	not sampled						
	35·5 – 37	125	1025	350	5	670	0·008	
	37 – 39	X	75	25	X	270	X	
	39 – 42	X	25	25	X	270	0·008	
	42 – 49	not sampled						

Note:- lode not visible in sidewall of costean

	m	Cu	Pb	Zn	Ag	Ba	Au	As	
COSTEAN E	0 – 3	X	X	X	X	190	X		
	3 – 6	X	25	X	X	200	X		
	6 – 9	X	X	X	X	170	0·008		
	9 – 11	25	50	X	X	270	X		
	11 – 13	50	75	50	X	240	0·017		
	13 – 15	25	125	25	X	270	X		
	15 – 17	25	150	X	X	250	X		
	17 – 18·5	25	350	25	X	300	X		
	18·5 – 19·5	25	1125	25	X	15·20%	X		
	19·5 – 21	25	650	250	X	430	X		
	21 – 23	X	500	25	X	260	X		
	23 – 25	X	50	X	X	160	0·008		
	25 – 27	X	25	25	X	130	0·008		
	27 – 29	X	25	25	X	150	0·008		
	29 – 30	not sampled							
COSTEAN F	0 – 3	X	1100	25	X	5050	0·017		
	3 – 4	50	1400	25	2	6350	X		*
	4 – 5	75	1100	25	2	4000	0·017		
	5 – 8	X	550	25	X	860	0·017		
'LODE' A GRAB SAMPLE	25101	1525	0·59%	100	X	15·7%	0·001	120	
	25102	300	4·11%	50	6	23·2%	X	27	

* lode sample

Pb
• Zn
Ba

COMSTAFF PROPRIETARY LIMITED		
LEASE No EL 5/63	JUST-IN-TIME GRID – CJT 041	COMPILED M. P. EVERETT
AREA 2		DRAWN J. HARDISTY
AMENDMENTS	SUMMARY OF GEOLOGY & GEOCHEMISTRY	DATE 8/5/85
		SCALE 1 : 1000
		REF No TAS/2/4233

85-2381

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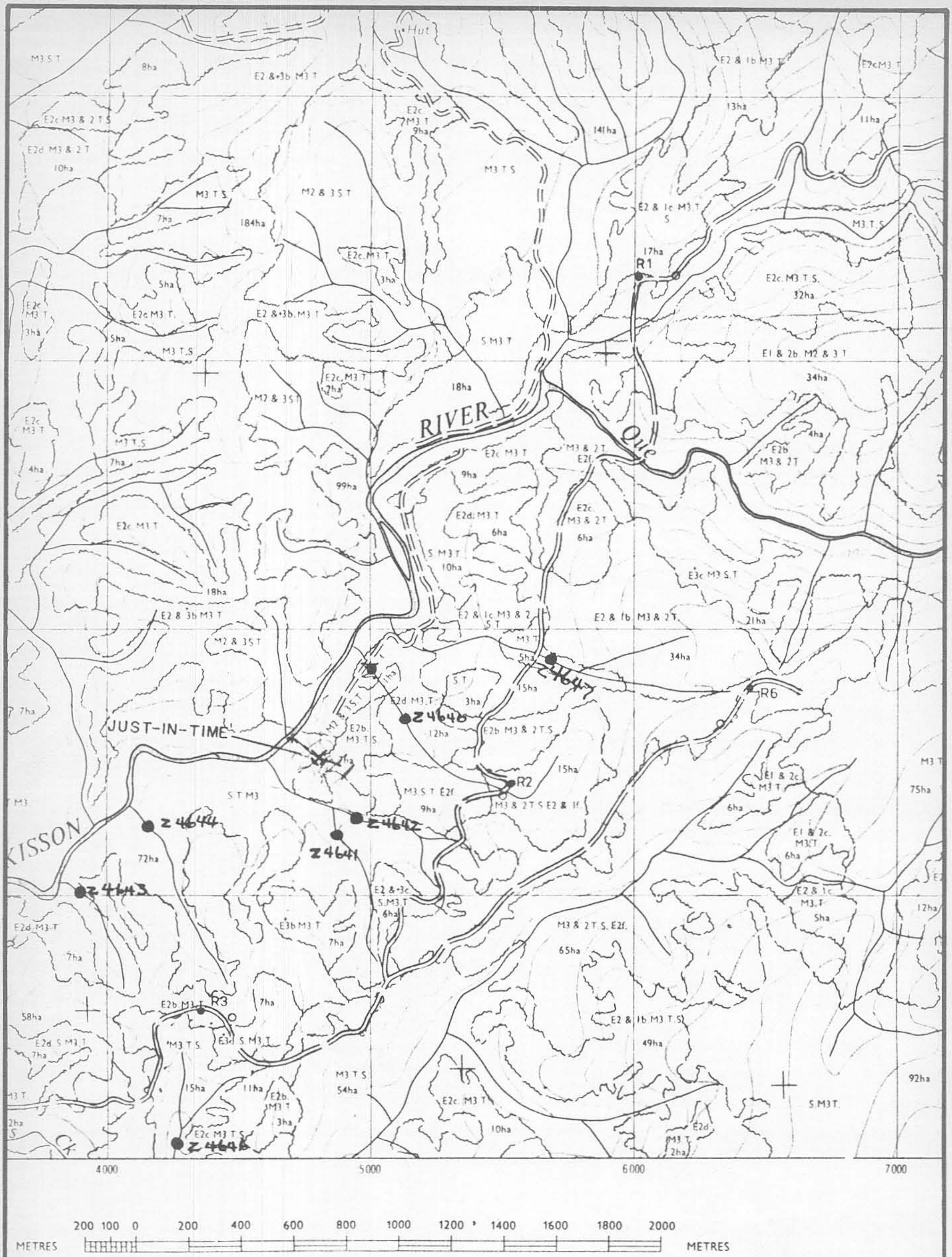

• 24645

COMSTAFF PROPRIETARY LIMITED

JUST-IN-TIME GRID - CJT
PLAN SHOWING LOCATION OF HEAVY CONCENTRATE SAMPLES

COMPILED	DRAWN	DATE	AMENDED
M.P. EVERETT	J. HARDISTY	8/5/85	
LEASE No	AREA	SCALE	PLAN No
EL 5/63	2	1 : 20 000	TAS/2/4234

5 cm

85-2381