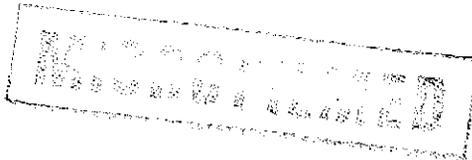


CRA EXPLORATION PTY. LIMITED

EXPLORATION LICENCE 34/88 HENTY, TASMANIA

STATUTORY PROGRESS REPORT FOR THE PERIOD

ENDING 9TH NOVEMBER, 1991.



AUTHOR: M. Kratochvil

DATE: September, 1991

SUBMITTED TO: T. W. Dickson

ACCEPTED BY:

COPIES TO: Department of Resources and Energy

CRAE Canberra

CRAE Preston

Major Mining Ltd

91-3312.

TCR 91-3312

LINES	
EL 34/88	
10 NOV 1991	
Author	Initials
REFER TO	
COVER SHEET	
30.9.91	
(FOLIO 107A)	
Date	

CRAE Report No. 17635

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1. SUMMARY

A data review of previous exploration for Carbonate Lead-Zinc deposits in the Zeehan area was undertaken to determine priorities for future exploration within EL 34/88. At the same time all previous stream sediment samples of CRAE and competitors were reviewed to determine regional pattern within the Zeehan district.

2. INTRODUCTION

EL 34/88 was parted to His Grace, The Most Noble, The Duke of Avram on the 9th December, 1988 and transferred to Major Mining Ltd. on the 23rd November, 1989. CRA Exploration Pty. Ltd. have entered into a joint venture agreement with Major Mining Ltd. with the commencement date given on 23rd April, 1991.

Since April 1991 CRA Exploration Pty. Limited has been engaged in a series of data reviews with the aim of commencing active field investigations during the coming summer season.

3. CONCLUSIONS AND RECOMMENDATIONS

1. The *Badger River grids* appear to have been adequately explored although a detailed review of the geophysical target is still warranted.
2. The McCleans and Fen Creek Limestone areas have received little attention. The McCleans Creek block in particular has little Quaternary cover and for this reason is considered the most attractive of the unexplored carbonate blocks. Both these blocks fall with its adjacent EL 28/88.
3. Isotope work by the CSIRO for Cyprus-EZ suggests a Devonian Granite source for the Lead in the *Oceana Mine* is unlikely. The most likely source is a time equivalent horizon to the Mt. Read Volcanics or perhaps rocks of the Oonah Formation. This makes the large area of Cambrian rocks east of Professor Plateau and down to the Queensberry Mine of major interest.
4. Lead-Zinc geochemical anomalism is wide spread with major concentrations occurring to the south east of Zeehan and in the Dundas area. The Cambrian east of Professor Range has been hardly sampled to date.

It is recommended that further exploration work within EL 34/88 should consist of:-

1. A detailed review of the UTEM data from the Badger River Grids to determine if all the anomalies have been identified and tested.
2. Determine depth to potential source rocks within the Cambrian or Pre Cambrian rocks underlying the Gordon Limestone.
3. Examine major fault traces to determine if there is any geochemical leakage and carry out stream sediment sampling of Cambrian outcrop area especially around the old Queensberry Mine.
4. Conduct geological surveys to target areas for later diamond drilling.

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4. GEOLOGY

Geology of EL 34/88 in complex well be shown on the existing Zeehan 1: 63,360 and Strahan 1: 50,000 Geology Sheets. Basically folded Ordovician rocks including the Gordon Limestone occur along the northern boundary of the licence with a large wedge of Cambrian Sediments in the Central and eastern area east of Professor Plateau. A large area of Devonian fine grained sandstones occur south of the Queensberry Mine.

More specific geology in relation to the Carbonate hosted Lead-Zinc mineralisation is detailed in the memorandum of F. Funnell in Appendix 1.

5. GEOCHEMISTRY

The review of previous stream sediment data shows a general lack of sampling with EL 34/88 and especially within the area of Cambrian aged potential source rocks. The only area within the licence with anything like adequate coverage is along the Limestone outcrop of the Badger River Valley.

KEYWORDS

Lead-Zinc, Cambrian, Ordovician, Devonian, Geochem, Drainage.

LOCATION

Queenstown

1:250,000 sheet

SK 5505

LIST OF PLANS

<u>Plan No.</u>	<u>Title</u>	<u>Scale</u>
TV 443	Zeehan area Grid and Prospect plan	1: 50,000
TV 438	Zeehan Joint Venture EL's Stream Sediment data <u>Zinc</u> .	1: 50,000
TV 441	Zeehan Joint Venture EL's Stream Sediment data <u>Lead</u> .	1: 50,000
TV 442	Zeehan Joint Venture EL's Stream Sediment data <u>Tin</u> .	1: 50,000
TV 439	Zeehan Joint Venture EL's Stream Sediment data <u>Arsenic</u> .	1: 50,000
TV 440	Zeehan Joint Venture EL's Stream Sediment data <u>Copper</u> .	1: 50,000

LIST OF APPENDICES

Appendix 1. A summary of exploration for Carbonate Hosted Pb-Zn conducted in the Zeehan area (1978-1989) Memorandum, F. R. Funnell to M. Kratochvil dated 19th July, 1991.

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APPENDIX 1.

DATE: 19th July 1991

MEMORANDUM TO: M Kratochvil

COPY: T W Dickson

FROM: F R Funnell

SUBJECT: A Summary of Exploration for Carbonate Hosted Pb-Zn conducted in the Zeehan Area (1978-1989)

SUMMARY

The Badger River Grids appear have been adequately explored. The McCleans and Fen Creek areas drain fault bounded blocks of Ordovician Limestone which have received little attention. The limestone block centred on McCleans Creek has little mapped Quaternary cover. This lack of cover makes it the most attractive of the unexplored carbonate blocks.

Lead isotope studies carried out by the CSIRO on galena samples from the Oceana Mine¹ showed the samples had a closer isotopic affinity with the lead from the Mount Reads rather than Devonian Granite related lead. This Cambrian-Ordovician age raises the possibility the metals were sourced from the Mount Reads and emplaced into the carbonates rather than the accepted (by Cyprus/EZ) theory that the metals are syndepositional/diagenetic in origin.

INITIAL RECOMMENDATIONS

- 1) A one to two day mapping, sampling traverse along McCleans Creek should provide sufficient information to decide whether or not further work is warranted.
- 2) A geophysicist examines the UTEM data from Badger River grids to determine whether all anomalies have been identified.

INTRODUCTION

This memorandum details the progress to date of a review of exploration for carbonate hosted Pb-Zn mineralization in the Zeehan area, NW Tasmania. The study area covers some 900 sq. km and blankets EL's 28/88, 34/88, 33/89 and 39/89. (Figure 1). Given the limited time available (5 days) and the size and complexity of the database it was only possible to commence the review.

Exploration Licence 4/78 was applied for by Amoco in the late seventies and subsequently held and explored by Cyprus and EZ and covered most of the current study area. The EL was subject to a substantive exploration programme whose primary target was Irish type carbonate hosted Pb-Zn deposits within the Ordovician Gordon Limestone. Cambrian hosted tin and basemetal mineralization were secondary targets. The exploration data from EL 4/78 is the most reliable available for the study area and consequently this review has focused on this data.

¹By 1983 Amoco had outlined a resource of 4,000,000t @ 2% Pb and 8% Zn and 80g/t Ag on the basis of 13 drillholes.

EXPLORATION

Overview:

North Broken Hill and Broken Hill South explored the area around the Oceana Mine between 1946 and 1951. As a result of this work the mine was reopened in 1954 and operated until falling grades and rising dewatering costs (11 million litres/day) forced its closure in 1960. A limited heliborne Turair survey was flown by Tennenco around 1970. This was followed up by reconnaissance IP, SP and soil sampling.

Amoco commenced work on EL 4/78 in 1978. Most work concentrated on the limestone block covered by the Rose Valley, Baura, Grieves and Myrtle grids (collectively known as the Badger Valley grids) and the Austral-Oceana grids. These areas were ranked highly because of the known Zn-Pb-Ag mineralization (Oceana and Grieves Mines) and excellent access via the Henty road.

A semi-regional stream sediment sampling programme was completed over selected limestone blocks. Minus 80# stream sediment and Panned Concentrate samples were collected. All samples were assayed by AAS for Au, Cu, Pb, Zn, Ag (+Cr and Ni in Pan Cons) and for Sn by XRF. Anomalies were followed up by soil and bedrock geochemistry, magnetics, gravity, ground EM and diamond drilling.

A review of exploration can be found in EZ report T229 (May 1986-May 1987). The geophysical investigations were summarised in Amoco report 353 (January-July 1983). Table 1 lists the exploration completed on EL 4/78 and the relevant report reference. The licence was relinquished in 1989.

Analytical Considerations:

The check sampling for the regional programme was inadequate. The check sampling density was insufficient (one check per 20 samples). No mention was made of any check of sample preparation (carried out by Amoco prior to despatch to Comlabs). No orientation work or duplicate sampling was recorded. As no sample site ledgers are available it is difficult to assess the quality of the sampling.

Sampling Problems:

The sampling problem occurs on the macro and meso scale.

On the macro scale the intensity of exploration is directly related to the ease of access. It is no coincidence that the most intensively explored block of limestone has the Henty road running down the middle of it. The Fen and McCleans Creek blocks (boat or helicopter access only) were not been sampled.

The meso scale problem arises from the fact the limestone has been weathered under wet, acid conditions. The Ordovician limestones tend to form flat bottomed valleys bounded by ridges of Moina Sandstone and Crotty Quartzite. The limestone is often mantled by a layer of puggy decarbonized limestone which is in turn overlain by Tertiary to Recent mud, peat, coal, sand and gravel. Cyprus and EZ used Bombardier mounted Jackro rigs, wacker sampling and excavators to collect soil samples. These techniques were necessary to penetrate the overburden (often thicker than 3m). Mathison (EZ report T192) noted that there was "poor agreement" between assay results obtained from wacker, Jackro and excavator samples. Assay values only agreed when the samples were collected from the soft, partially weathered limestone close to bedrock. Secondary dispersion of Pb and Zn in the clays appears widespread.

Geophysical Constraints:

In common with many Tasmanian programmes the geophysical exploration of EL 4/78 could have benefited from greater planning. Some test work was done on core from Oceana. The rocks were observed to be variably conductive and to possess low magnetic susceptibility.

The gravity surveys over the Badger River Grids (100m line spacing and 50m stations) were useful but the presence of a clay rich, conductive overburden and faults unrelated to mineralization significantly reduced the effectiveness of the EM systems. Over the years Turair, Genie EM, PEM, SIROTEM and UTEM systems were used over selected portions of the EL. A complication in the Badger Creek grid area is that Pb constitutes only a minor portion of the sulphide lode (zinc dominates as sphalerite or smithsonite/zincian siderite) and copper sulphides are very rare.

The presence of fine grained disseminated sulphides in the Gordon Limestone resulted in the early IP surveys being of little use.

Cyprus-EZ Model:

The mineralization at the Oceana Mine will be used to demonstrate the Cyprus-EZ model.

South of the Mine Fault lie stratabound bodies of semimassive weakly banded sphalerite, galena and siderite which occupy the top and bottom portions of a 30m thick limestone breccia body. It has been considered to result from syndiagenetic replacement.

North of the Mine Fault coarse grained galena, sphalerite and siderite with minor quartz, calcite and trace pyrite and chalcopyrite either as discordant irregular massive lenses or as open space fillings and interclastic areas in breccias. This mineralisation is different from that found to the south in that it has higher copper content and is accompanied by pervasive dolimitization and silicification.

Mathison and Taylor (EZ report T229) argue the breccias south of the Mine Fault are the result of submarine gravity debris flows triggered by movement on the Oceana Fault during the deposition of the limestone. They also suggest that the structurally controlled base metal veins (presumably the mineralization from the N of the Mine Fault) is related to the Devonian Heemskirk granite and associated hydrothermal systems. This ignores the isotopic data (samples were collected from both styles of mineralization) which indicates that all the lead had a common character/source and was Cambrian-Ordovician in age (see attached).

The presence of "submarine debris flow" breccias in the Gordon limestone is atypical as they suggest a deep water environment. The limestone was deposited in a very shallow marine setting. The conventional model invokes substantial movement along the existing faults. While it is evident that some faults were active during deposition it is considered unlikely the movement across these faults was sufficient to accommodate the Cyprus-EZ Model.

Alternate Model:

The limestone breccias observed South of the Main Fault at Oceana and in drillcore from the Badger River Grids was hydrothermal/diagenetic in origin and directly related to the mineralizing event.

The metals were thought to have been sourced from the underlying Cambrian sequence rather than from syn-depositional precipitation.

If this interpretation is correct it shows that it is possible to remobilize substantial amounts of metals from the Cambrian into overlying sequences.

OUTPUT GENERATED

Assay and location data for stream sediment samples collected by Amoco/Cyprus/EZ from EL 4/78 have been entered onto the Mac. The data will be added to the CIS database within the next few days.

The CIS database was interrogated and all CRAE and competitor stream sediment assay data was downloaded. A copy of this database was supplied to Milos as "MilosTassieData Info" Plots of sample locations at 1:25 000 scale were prepared, see below.

Several reports and numerous assorted working plans were copied from microfiche.

The Badger River Grids are being copied from microfiche at 1:5 000 scale and digitized to enable an accurate grid location plan to be produced.

The following plans have been or are in the process of being drafted.

- 1) 1:25 000 scale Base Plans (5 sheets) [coast, AMG ticks, roads, EL boundaries]
- 2) 1:25 000 scale Stream Sediment Sample Location Plans (2 sheets) [CRAE and Competitors]
- 3) 1:50 000 scale Summary Base Plan
- 4) 1:50 000 scale Geology
- 5) 1:50 000 scale Grid and Prospect Location Plan

Regards,

F.R. Funnell.

F R FUNNELL

TABLE 1: EL 4/78 WORK SUMMARY (Reference by grid)

WORK	MYRTLE GRID	GRIEVES GRID	BAURA GRID	ROSE VALLEY GRID	BADGER RIVER GRID*	PYRAMID GRID	SASSAFRASS GRID	PROFESSOR GRID	REGIONAL
GEOLOGICAL MAPPING	6	6			4, 6				
GEOCHEMISTRY									
SOILS (HAND AUGER)	1, 2	1							SS = 12
SOIL (WACKER)	6	5, 6	5, 6		5, 6, 7	7			
BEDROCK (JACKRO)	3, 12				13, 4	4			
BEDROCK (COSTEAN)		5	5	5	5	5			
GEOPHYSICS									
MAGNETICS					13, 4, 6		?	6	13
GRAVITY	3, 6				3, 6	3	3		
EM (GENIE)		5			5				
EM (SCROTEM)									
EM (PEM)									
EM (UTEM)		6	6		5, 7				
DRILLING									
WINKIE		6			7	7			
DEEP DIAMOND		5, 9, 11			5, 7, 8				

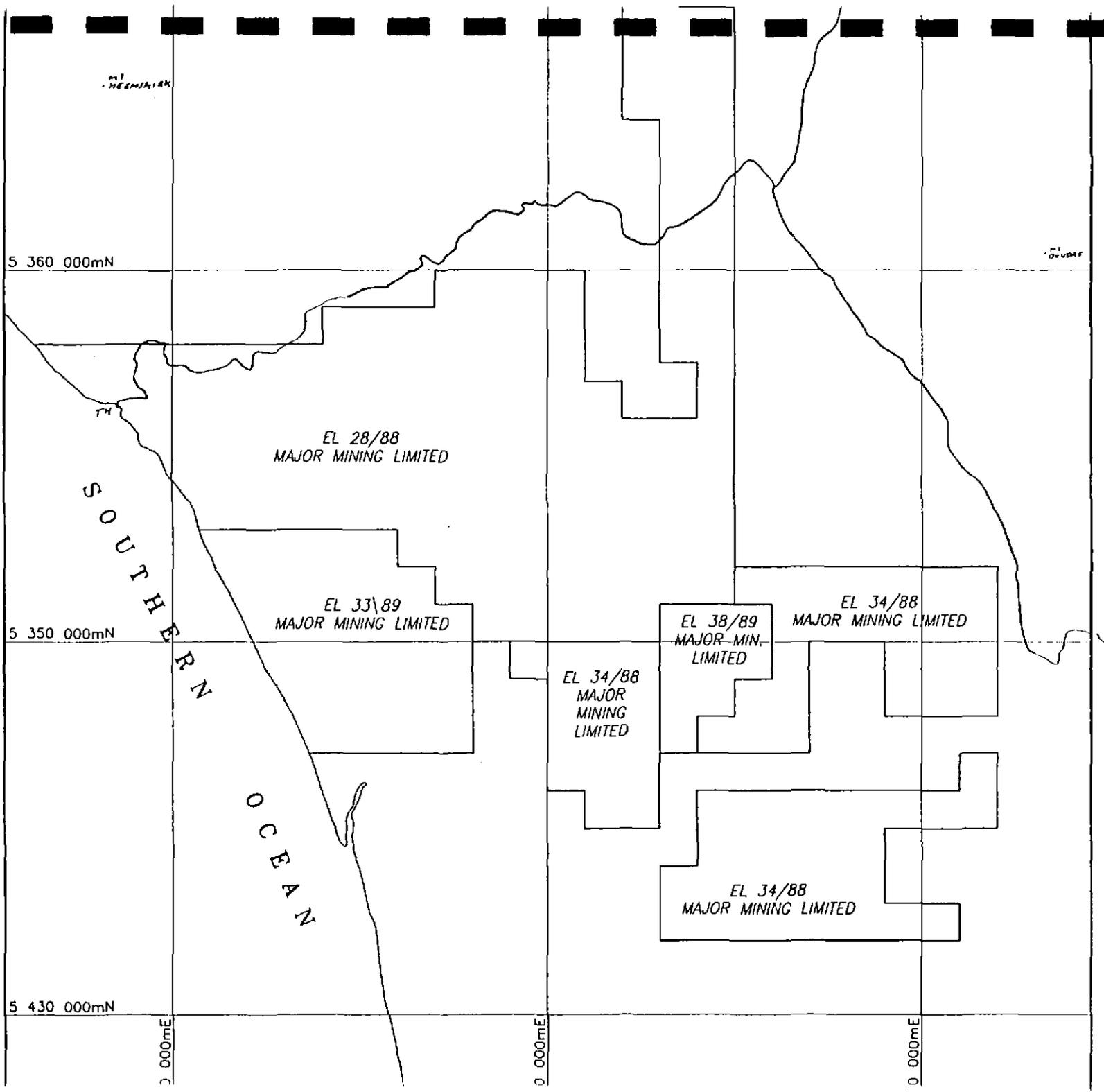
1. June 1978 - June 1979, Amoco Report
2. June 1979 - June 1980, Amoco Report
3. July 1981 - January 1982, Report No. 279
4. June 1983 - January 1984, EZ Report T177
5. January 1984 - June 1984, EZ Report T192
6. June 1984 - April 1985, EZ Report T205
7. May 1985 - May 1986, EZ Report T215
8. April 1986 - April 1987, EZ Report T299
9. April 1987 - April 1988, EZ Report T232
10. May 1988 - July 1988, EZ Report T234
11. January 1989 - June 1989, EZ Report T241
12. January 1983 - July 1983, Report No. 353
13. July 1982 - December 1982, Report 347

* The Myrtle, Grieves, Baura and Rose Valley grids are collectively known as the "Badger Valley Grids"

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Figure 1



REVIEW
AREA

0011

127012

207 Pb / 204 Pb

15.8
15.7
15.6
15.5

18.2 18.3 18.4 18.5 18.6 18.7
206 Pb / 204 Pb

Common range of
Cambrian Volcanogenic
mineralization

Devonian Granite
related mineralization

14-6-84

84-2208

ROSEBERRY

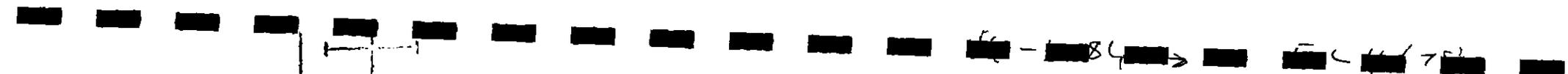
Mt FARRELL

OCEANA SAMPLES

0012

127013

1x



HOBART 7001

Dear Ros,,

Enclosed is a $7/4 - 6/4$ plot for the six analyses from the Oceana area compared with the average isotopic signature for Rosebery and De onian vein-style mineralization. As you can see from the plot, the data are very homogeneous (as little variation as Rosebery) and as far as approximate ages are concerned, have closer affinities with the Cambrian or Ordovician - it is not possible to distinguish between these periods using lead isotopes in galenas.

An alternative interpretation would be that the metals were derived from the Mount Read Volcanics and emplaced into the Ordovician carbonates. This type of signature for Oceana is consistent with the Irish deposits and the model Matti Vaasjoki and I have for a continuum of lead isotopic compositions from true Mississippi Valley through Irish type to shale-hosted deposits (one of the papers in process). Oceana reminds me a little of the Midway deposit, Yukon - B.C. border.

Do you wish me to speak with the companies concerned? I think they are rather exciting results. All the best

Kind regards,



Brian Gulson
Division of Mineralogy

127014

0013

DATE: November 21, 1980

0014

TO: B. Roxburgh
P. Jones

EL 4/78

Amoco

Report to June 1981

127015

Appendix 5

FROM: S. Collins

SUBJECT: ZEEHAN DRILLCORE PHYSICAL PROPERTIES TEST

Eight samples of drillcore from the Oceana Prospect were sent to Geotrex for physical property tests.

The samples showed a wide variation in their electrical properties and density. None of the samples showed any measurable magnetic susceptibility.

Details of the test follow.

Hole 2 (ZT-79-2)

- Sample 1 Claystone (from 98.1m) 10.6% Pb
Found from 98.1 - 100.3 and 117 - 121.2m surrounding sample 2.
Density = No measurement
Resistivity = 500 Ohm-m approx.
Chargeability = 10 millisecs approx.
- Sample 2 Massive lead/zinc sulfide.
Not tested as sample had disintegrated during shipping.
- Sample 3 Ankeritic dolomite (from 146m)
Found from 134 - 173.5, 176 - 199 and 229 - 236m
Density = 3.0 gm/cc
Resistivity = 480 ohm-m
Chargeability = 26 millisecs

Hole 4 (ZT-80-4)

- Sample 4 Limestone breccia (from 56.6m)
Found from 42 - 58m
Density = 2.6 gm/cc
Resistivity = 800 ohm-m
Chargeability = 47 millisecs
- Sample 5 Silty Dolomite (from 69.3m)
Found from 62.2 - 76.2m
Density = 2.7 gm/cc
Resistivity = 1200 ohm-m
Chargeability = 34 millisecs
- Sample 6 Interbedded calcareous shale/sandstone (from 157.8m)
Found extensively through hole
Density = 2.5 gm/cc
Resistivity = 3500 ohm-m
Chargeability = 0
- Sample 7 Semi massive siderite/galena/sphalerite (from 255.3)
Pb = 11.9% Zn = 3.74%
Found from 247 - 258m
Density = 3.3 gm/cc

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Resistivity = 2 ohm - m
Chargeability = 10 milliseconds
Sample 8 Mineralized breccia (from 306.5) Pb = 36.4% Zn = 5.3%
Found from 298.8 - 308m
Density = 5 gm/cc
Resistivity = 0.2 ohm-m
Chargeability = 0 - 10 millisecs

Density and resistivity are the properties which best define the mineralized zones. Densities of unmineralized zone range from 2.5 to 3.0 gm/cc while mineralized core ranges in density from 3.3 to 5.5 gm/cc. The density of the massive lead/zinc sulfide (sample 2) is estimated to be greater than 6 gm/cc. The bulk density of the unmineralized rock is estimated to be about 2.6 gm/cc. Resistivities of the unmineralized rock are greater than 500 ohm-meters with probable bulk resistivities in excess of 1000 ohm-m. Resistivities of the mineralized rock are all less than 10 ohm-m with the lowest measurement at 0.2 ohm-m.

Chargeabilities are opposite to what would normally be expected. Mineralized rock has low chargeability and, with the exception of the shale/sandstone, unmineralized rock has a high chargeability. It is likely that previous IP work has in effect mapped the limestone/dolomite rocks which have chargeabilities in excess of 30 milliseconds.

Core test of physical properties suggest that a rational geophysical approach to exploration in this area should be based on electromagnetics with gravity follow up.

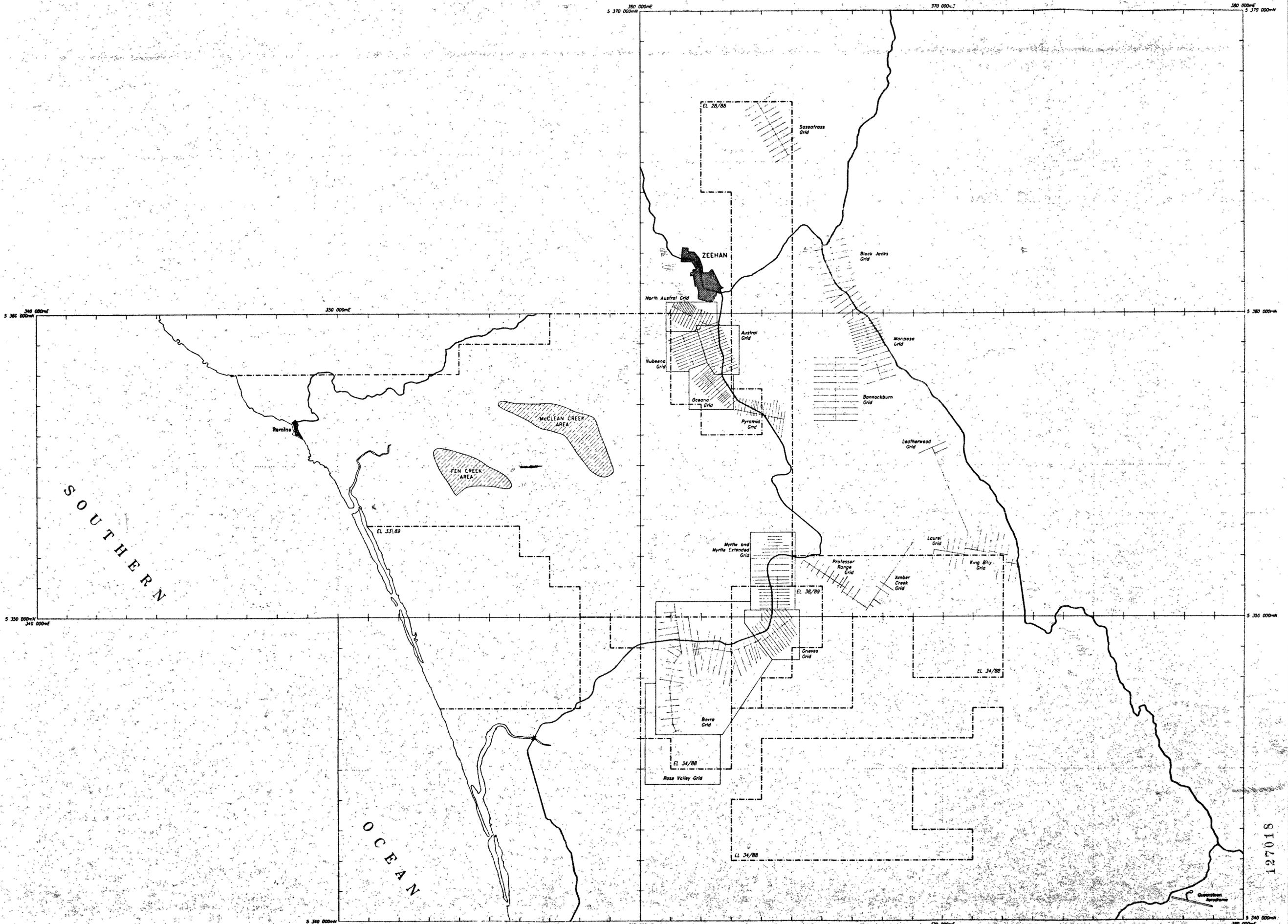
STEVE COLLINS
SC:jm

resistivity parameter is that anomalies caused by altitude changes are virtually eliminated, so the resistivity data reflect those anomalies caused by conductivity changes. This helps the interpreter to differentiate between conductive trends in the bedrock and those patterns typical of conductive overburden. Discrete conductors will generally appear as narrow lows on the contour map and broad conductors will appear as wide lows.

Conductive overburden diminishes the ability of any EM system to effectively explore the bedrock. For example, the lower the resistivity of the cover, the more active the EM channels, and the less the likelihood of recognizing that a particular anomaly might be caused by a bedrock conductor. As a general rule of thumb, the effectiveness of most EM systems for base metal exploration is given in Table II.

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2 TOP LEFT

5 cm

5 kilometres

North

NOTE
 Contiguous grids are internally consistent, however the relative position of groups of grids may vary.

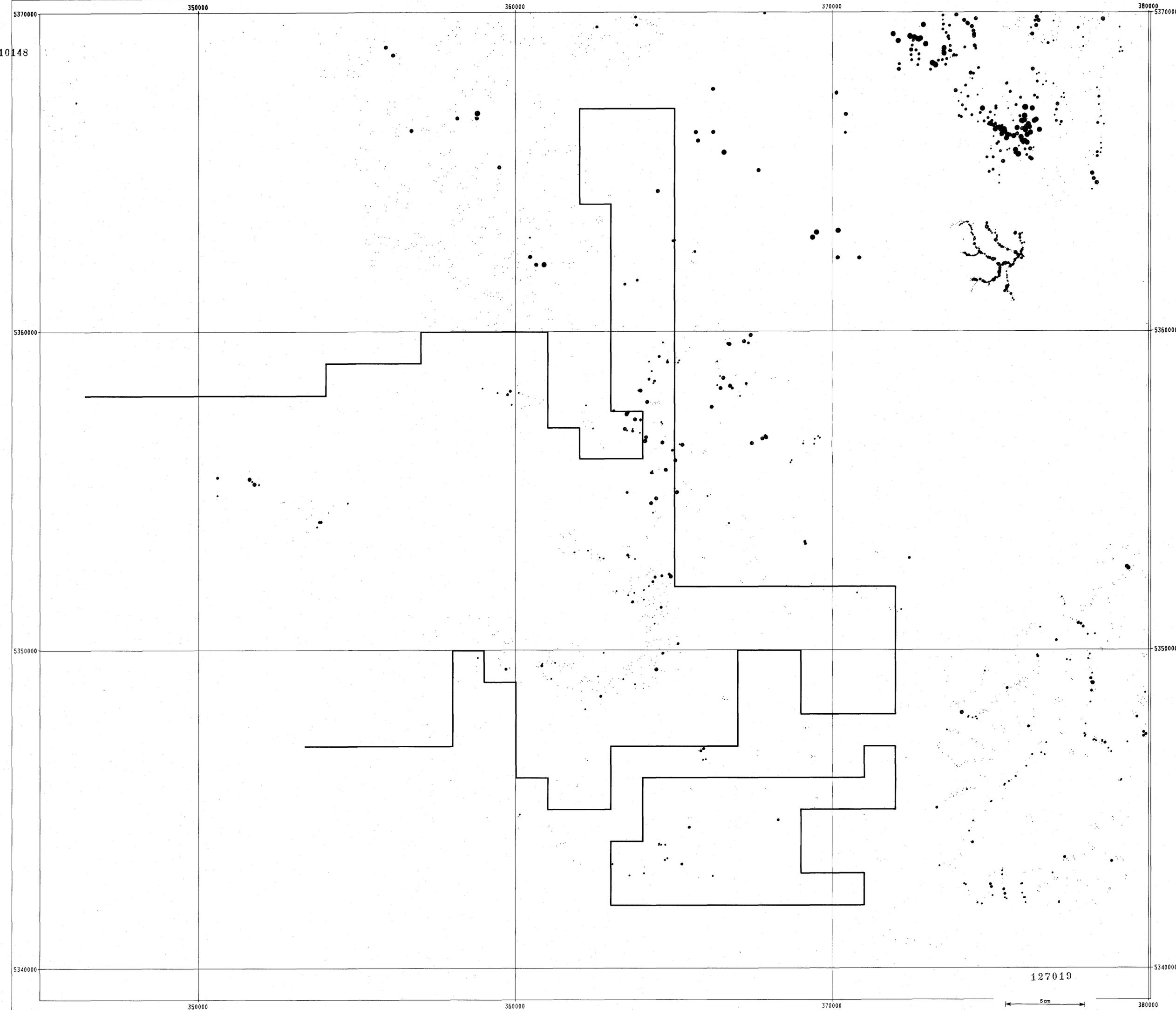
91-3312

CRA EXPLORATION PTY. LIMITED

ZEEHAN AREA
 Western Tasmania
 Grid & Prospect Location Plan

Ref.: SK55 - 5	File: ZEEHAN/50000
Scale: 1:50000	Date: November 1991
Author: T.W. Dickson	Report No.: 17635
Drawn: R. Trevelyan	Plan No.: Tr 443

127018



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360000

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370000

370000

370000

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380000

380000

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127019

5 cm

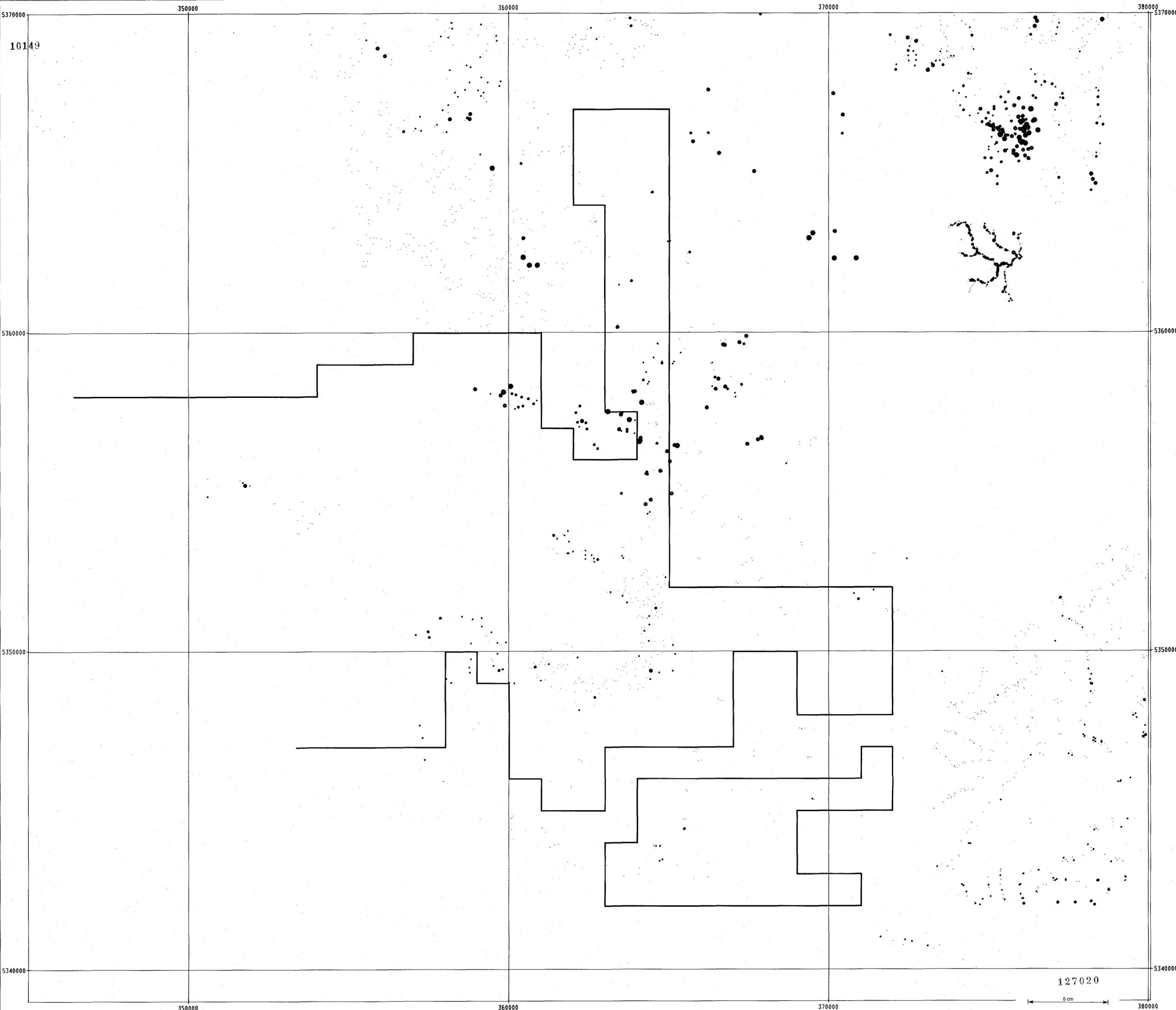
- 0
- 0-50
- 50-100
- 100-300
- 300-500
- 500-1000
- 1000-3000
- 3000-5000
- +5000

91-3312.

All Samples

1000m

CRA EXPLORATION PTY. LIMITED		
ZEEHAN JOINT VENTURE EL'S		
SS DATA - Zn (ppm)		
Geol: M.K.	Scale: 1:50,000	Report: 17635
Drawn: M.K.	Date: 11/9/91	Plan: Tv 438



10149

127020

- 0
- 0-50
- 50-100
- 100-300
- 300-500
- 500-1000
- 1000-3000
- 3000-5000
- >5000

91-3312.

"CRA EXPLORATION PTY. LIMITED"		
ZEEHAN JOINT VENTURE EL'S		
SS DATA - Pb (ppm)		
Geol: M.K.	Scale: 1:50,000	Report: 17635
Drawn: M.K.	Date: 11/9/91	Plan: Tv 441

10150

5360000

5360000

5350000

5350000

5340000

5340000

350000

360000

370000

380000

127021

5 cm

- 0
- 0-50
- 50-100
- 100-300
- 300-500
- 500-1000
- 1000-3000
- 3000-5000
- +5000

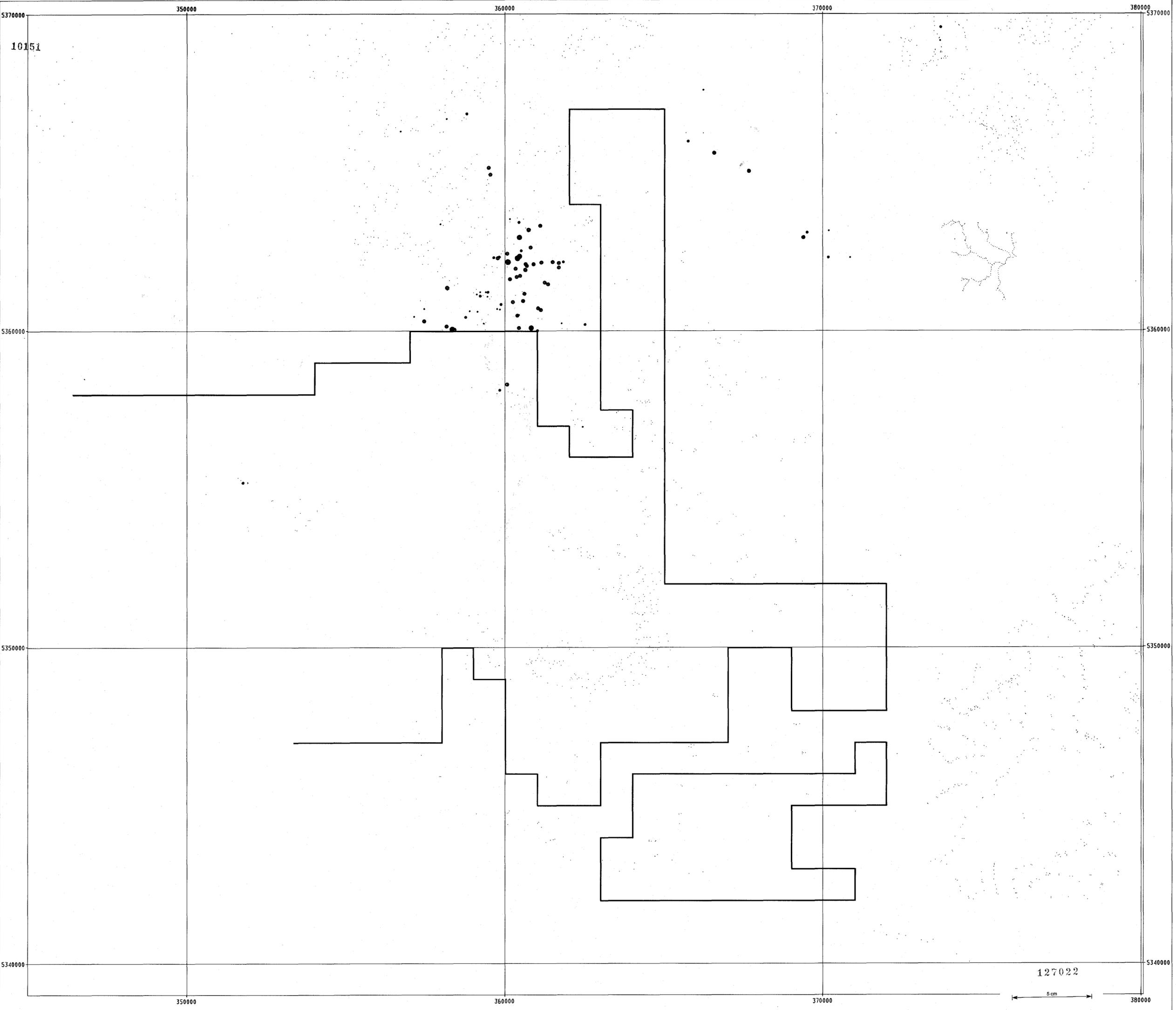
91-3312.

All Samples



1000m

"CRA EXPLORATION PTY. LIMITED"		
ZEEHAN JOINT VENTURE EL'S		
SS DATA - Sn (ppm)		
Geol: M.K.	Scale: 1:50,000	Report: 17635
Drawn: M.K.	Date: 11/9/91	Plan: Tv.442



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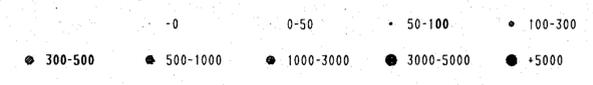
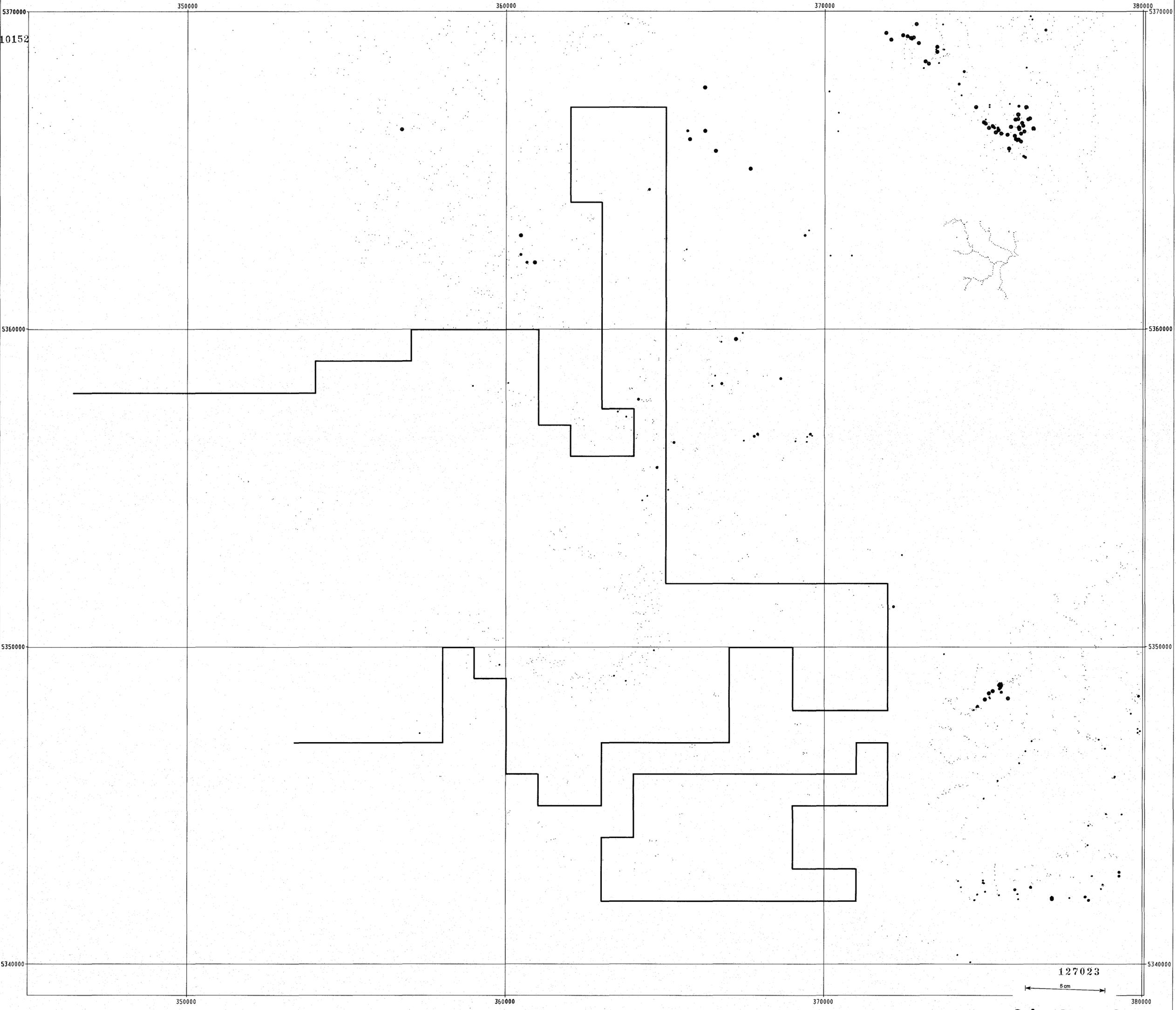
- 0
- 0-50
- 50-100
- 100-300
- 300-500
- 500-1000
- 1000-3000
- 3000-5000
- +5000

91-3312.

5 cm

1000m

"CRA EXPLORATION PTY. LIMITED"		
ZEEHAN JOINT VENTURE EL'S		
SS DATA - As (ppm)		
Geol: M.K.	Scale: 1:50,000	Report: 17635
Drawn: M.K.	Date: 11/9/91	Plan: Tv 439



127023
5 cm
91-3312.

All Samples
jmap
1000m

"CRA EXPLORATION PTY. LIMITED"		
ZEEHAN JOINT VENTURE EL'S		
SS DATA - Cu (ppm)		
Geol: M.K.	Scale: 1:50,000	Report: 17635
Drawn: M.K.	Date: 11/9/91	Plan: Tv.440