

**THE SHELL COMPANY OF AUSTRALIA LIMITED**

**FINAL REPORT FOR  
EXPLORATION ON**

**EL 6895 EMERALD SPRINGS**

**AUTHOR: D GILES**  
**DATE: July 1994**

**REPORT NO: 08.7037**  
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CR 94/516

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## SUMMARY

Exploration Licence (EL) 6895 (Emerald Springs) consisting of 4 blocks was granted to The Shell Company Of Australia Limited on 22 June 1990 for a period of four years. Two blocks in the western portion of the licence were relinquished on 1 June 1992. A further block was relinquished on 13 May 1993. The licence expired on the 21 June 1994. This report details all work completed by The Shell Company of Australia Limited within the area covered by EL 6895 in the period 22/06/90 to 21/06/94.

Work completed within EL 6895 has included the purchase and interpretation of aeromagnetic data, a stream sediment sampling programme and follow up reconnaissance and rock chip sampling. No significant near surface mineralisation was identified.

## **1.0 INTRODUCTION**

Exploration Licence (EL) 6895 (Emerald Springs) consisting of 4 blocks was granted to The Shell Company Of Australia Limited on 22 June 1990 for a period of four years. Two blocks in the western portion of the licence were relinquished on 1 June 1992. A further block was relinquished on 13 May 1993. The licence expired on the 21 June 1994.

This report details all work completed by The Shell Company of Australia Limited within the area covered by EL 6895 in the period 22/06/90 to 21/06/94.

## **2.0 LOCATION AND ACCESS**

The licence area is located approximately 28 kms north-northwest of the township of Pine Creek. Access is best taken from the Stuart Highway on the well formed, culverted, gravel Spring Hill Road, figure 1. The Spring Hill Road is followed for 9.5 kms and then on the left hand side of the road a track is selected which when followed passes just to the south of the tenement area.

## **3.0 REGIONAL SETTING**

Exploration Licence 6895 is located in the Pine Creek area in the central portion of the Pine Creek Geosyncline, figure 2. The geosyncline contains Early Proterozoic metasedimentary rocks resting on a gneissic and granitic Archean basement. The metasediments represent a preserved basinal sequence up to 14 kms thick (Needham et al., 1980). These rocks were tightly folded and metamorphosed to greenschist facies (in some places amphibolite) at about 1890 - 1870 Ma (Ferguson, 1980).

The geosynclinal sequence is intruded by transitional igneous rocks; including pre-tectonic dolerite lopoliths and dykes and post deformational granites. Largely undeformed platform cover of Middle and Late Proterozoic, Cambro-Ordovician and Mesozoic strata rest on these with marked unconformity.

#### **4.0 TENEMENT GEOLOGY**

Exploration Licence 6895 is dominated by rocks of the Lower Proterozoic South Alligator Group including the Mt Bonnie Formation, Gerowie Tuff and Koolpin Formation, figure 2. The Koolpin Formation is the oldest unit exposed in the licence area, covering most of the north-west portion. The unit consists dominantly of ferruginous and carbonaceous phyllite with rare chert bands. The Gerowie Tuff conformably overlies the Koolpin Formation and consists of a sequence of interbedded siltstone, phyllite, argillite, tuff and minor chert. This, in turn, is conformably overlain by the interbedded shale, siltstone, greywacke and minor chert of the Mt Bonnie Formation (the upper-most member of the South Alligator Group). The Mt Bonnie Formation is exposed only in the far north-east and south-west corners of the tenement area.

The metasedimentary sequence is intruded by the predeformational Zamu Dolerite in the form of elongate, stratigraphically controlled dykes and sills. Dolerite occurs throughout the licence area and intrudes all rock types but is most abundant within the Gerowie Tuff in the central part of the licence area.

The entire sequence has been folded to produce a series of tight, south plunging folds with north-northwest trending axial traces. Peak greenschist facies metamorphism was broadly coincident with this folding event.

#### **5.0 WORK COMPLETED**

##### **5.1 Year 1 (22 June 1990 to 21 June 1991)**

###### **Detailed Aeromagnetic Interpretation**

Data from a multi-client detailed aeromagnetic survey by Aerodata was purchased by Billiton Australia during late 1989. A total of approximately 6,000 flight line kilometres were surveyed, the coverage of which includes the Emerald Springs licence area.

The survey was flown for the purpose of identifying regional structures and more specifically significant magnetic anomalies that may represent bulk tonnage gold mineralisation (e.g. pyrrhotite bearing veining at Mt Todd).

Detailed processing of the aeromagnetic data was conducted by GeoImage of Brisbane.

Interpretation of both the raw and filtered magnetic data over EL 6895 highlighted several magnetic features in the area, including:

- a major SW-NE fault crossing the top NW corner of the EL.
- A number of small dislocations of magnetic units throughout the tenement area.
- A series of folded magnetic units which are interpreted to be caused by BIF's in the Koolpin Formation.
- No discrete aeromagnetic anomalies that could be interpreted to represent bulk tonnage gold mineralisation as at Mt Todd (figure 3).

## **5.2 Year 2 (22 June 1991 to 21 June 1992)**

### **Stream Sediment Sampling**

Active stream sediment samples were collected from 22 locations in EL 6895 in August 1991 (figure 4). From each site a 5kg sample of material sieved to -10 mesh and a 200gm sample sieved to -80 mesh were collected. Samples were submitted to Australian Assay Laboratories (now known as Assaycorp) in Pine Creek. The coarse samples were assayed for gold using the bottle roll bulk cyanide leach (BCL) method to an accuracy of 0.1ppb. The fine samples were assayed for Ag, Cu, Pb, Zn (AAS) and As and Sn (XRF).

Assay results are shown on figure 5 and appendix 1. All Cu, Pb, Zn, Ag, As and Sn results were very low or below detection. Several gold results were regarded as anomalous including samples at 7.6, 6.3 and 4.6 ppb Au. These three samples were located in the eastern portion of the licence and all three drained the same north-northwest trending ridge.

## **Reduction**

The western two blocks of the tenement were relinquished on 1 June 1992.

### **5.3 Year 3 (22 June 1992 to 22 June 1993)**

#### **Reconnaissance mapping and rock chip sampling**

Anomalous stream sediment samples were followed up by reconnaissance and rock chip sampling. A total of 26 samples were taken concentrated in the eastern block of the licence area and particularly on the north-northwest trending ridge identified as a target by the stream sediment sampling programme.

The area covered was dominated by rocks of the Gerowie Tuff and Zamu Dolerite. Only limited mineralisation was located in the licence area. At the contact of the Gerowie Tuff and the Zamu Dolerite approximately 30cm wide stockworks of smokey quartz were found at several locations. This veining displayed minor brecciation and contained iron oxide filled vughs, possibly after sulphide. Massive milky "buck" quartz veins with poorly developed alteration haloes were also encountered within the Gerowie Tuff.

Rock chip samples were submitted to Amdel in Darwin and analysed for Au (fire assay, detection limit 1ppb), Cu, Pb, Zn, Ag (AAS, detection limit 1ppm), As (AAS, detection limit 50ppm), Bi (AAS, detection limit 10ppm) and Sn (XRF, detection limit 4ppm).

Rock chip sample locations and results are shown in figure 5 and appendix 2. All results were very low or below detection.

## **Reduction**

The easternmost block of the tenement was relinquished on the 13 May 1993.

#### 5.4 Year 4 (22 June 1993 to 21 July 1994)

##### Reconnaissance mapping and rock chip sampling

Further reconnaissance and rock chip sampling was undertaken in August 1993. The focus was again the north-northwest trending ridge from which the anomalous stream sediment samples drained. A total of 3 samples were taken within the area of EL 6985. Samples were assayed for Au, Ag, Cu, Pb, Zn and As at Amdel in Darwin.

Rock chip sample results are shown in figure 5 and appendix 3. The best result was a single sample at 0.21ppm taken over a narrow quartz vein at the contact between siltstone and greywacke units within the Gerowie Tuff. All other samples were either very low or below detection.

No further exploration was completed on the tenement.

#### 6.0 EXPENDITURE

Expenditure by The Shell Company of Australia for the period 22 June 1990 to 21 June 1994 was as follows:

	Year 1	Year 2	Year 3	Year 4	Total
Staffing	4,864	4,106	5,272	2,521	16,763
Field & office support	4,795	3,567		1,906	10,268
Vehicle costs			159	450	609
Airborne magnetics	4,200				4,200
Analyses		711	577	80	1,368
Overheads	1,385	847	342	496	3,070
<b>Total</b>	<b>15,244</b>	<b>9,321</b>	<b>6,430</b>	<b>5,453</b>	<b>36,278</b>



## 7.0 REFERENCES

FERGUSON J, 1980. Metamorphism in the Pine Creek Geosyncline and its bearing on stratigraphic correlations. In FERGUSON J, & GOLBY AB, (Editors) - URANIUM IN THE PINE CREEK GEOSYNCLINE.

International Atomic Energy Agency, Vienna, 91-100.

NEEDHAM RS, CRICK IH, & STUART-SMITH PG, 1989. Regional geology of the Pine Creek Geosyncline. In FERGUSON J, & GOLBY AB, (Editors) - URANIUM IN THE PINE CREEK GEOSYNCLINE.

International Atomic Energy Agency, Vienna, 1-22.

## APPENDIX 1

### Stream sediment sampling results

## ANALYSIS REPORT

Amberley Pty. Ltd. A.C.N. 009 443 887  
as Trustee for the AALG Unit Trust t/a**Australian  
Assay  
Laboratories  
Group**

- DK

- Anal labs file

Emerald Springs

PINE CREEK: Lot 174 Ward St, Pine Creek 0847  
PO Box 41, Pine Creek 0847  
Ph (089) 761 262 Fax 761 310

SHELL COMPANY OF AUSTRALIA

REPORT : PC 028870 1 Page(s) Date : 11/08/91

Client reference : 10812 HE13

HE13/.31

Cost code :

Copies to : SHELL - DARWIN

Samples : Type

Preparation code

Received : 24/07/91

Analysis	Code	Quality Parameter	Detection	Units
AUCN	BLEG	Prec. $\pm 10$ %	0.2	ppb
AUCNR	BLEG	Prec. $\pm 10$ %	0.2	ppb

# ANALYSIS REPORT



**Australian  
Assay  
Laboratories  
Group**

REPORT : FC 028871

Page 1 of 1

Sample	Ag	Pb	Zn	Cu	Sn	As
241183	<1	42	51	25	<5	28
241184	<1	67	59	44	<5	39
241185	<1	35	44	39	<5	22
241186	<1	41	71	56	<5	24
241187	<1	35	34	42	<5	53
241188	<1	30	23	35	6	40
241189	<1	15	19	21	<5	27
241190	<1	64	72	41	<5	34
241191	<1	46	53	20	<5	33
241192	<1	28	34	20	<5	19
241193	<1	30	20	19	<5	62
241194	<1	20	34	19	<5	18
241195	<1	26	28	20	<5	26
241196	<1	26	22	19	<5	24
241197	<1	27	21	19	<5	30
241198	<1	36	36	20	<5	63
241199	<1	19	26	20	<5	49
241200	<1	42	120	56	7	66
241694	<1	24	32	20	7	50
241695	<1	14	17	14	<5	19
241696	<1	19	35	19	6	65
241697	<1	33	27	19	14	198
241698	<1	24	26	19	<5	25

Data in ppm unless otherwise stated.

## APPENDIX 2

### Year 3 rock chip sampling results



File UROG/.3.2

21 Marjorie Street, Berrimah, Northern Territory  
Postal Address : P.O. Box 58, Berrimah, N.T. 0828  
Telephone: (089) 322 637 Facsimile: (089) 323 531

Mr. K. Hellsten  
UNION REEFS PROJECT  
G.P.O. Box 1826  
DARWIN

N.T. 0801

ANALYSIS REPORT :

Your Reference : 10703/HE13

Our Reference : 2DN1318

Samples Received : 30/11/92

Results Reported : 07/12/92

Number of Samples : 31

Report Pages : 1 to 2

This report relates specifically to the samples tested in so far as the samples supplied are truly representative of the sample source.

If you have any enquiries please contact the undersigned quoting our reference as above.

Report Codes:

N.A. -Not Analysed

L.N.R. -Listed But Not Received

I.S. -Insufficient Sample

Approved Signature:

for

ALAN CIPLYS  
Manager - Darwin  
CLASSIC LABORATORIES

Date Recd <b>11 DEC 1992</b>	Copy for
Pass to <i>Craig</i>	File
Action	

*are these Emerald Springs if so please file*



Job: 2DN1318  
O/N: 10703/HE13

Final

ANALYTICAL REPORT

SAMPLE	Cu	Pb	Zn	Ag	As	Bi	Sn
242233	19	480	620	1	<50	<10	6
242234	13	33	46	<1	<50	<10	6
242235	37	11	20	<1	<50	<10	6
242236	6	<4	4	<1	<50	<10	<4
242237	16	23	42	<1	<50	<10	<4
242238	7	5	20	<1	<50	<10	<4
242239	5	12	8	<1	<50	<10	<4
242240	20	54	52	<1	<50	<10	<4
242241	10	4	6	<1	<50	<10	<4
242242	11	4	8	<1	<50	<10	<4
242243	19	46	170	<1	<50	<10	4
242244	5	8	25	<1	<50	<10	8
242245	6	<4	3	<1	<50	<10	<4
242246	105	10	5	<1	140	20	<4
242247	13	<4	4	<1	<50	<10	<4
242248	9	<4	2	<1	<50	<10	<4
242249	21	19	27	<1	<50	<10	<4
242250	4	<4	4	<1	<50	<10	<4
242251	4	5	7	<1	<50	<10	<4
242252	2	19	13	<1	<50	<10	<4
242253	5	<4	7	<1	<50	<10	<4
242254	65	<4	35	<1	<50	<10	<4
242255	4	<4	7	<1	<50	<10	<4
242256	25	25	24	<1	<50	<10	6
242257	50	91	20	<1	<50	<10	8
242258	13	<4	2	<1	<50	<10	<4
242259	17	1190	32	<1	520	<10	<4
242260	72	450	97	1	520	<10	<4
242261	22	57	50	<1	60	<10	<4
242262	20	14	41	<1	<50	<10	<4
242263	10	6	7	<1	<50	<10	<4

UNITS	ppm	ppm	ppm	ppm	ppm	ppm	ppm
DET.LIM	2	4	2	1	50	10	4
SCHEME	AAS2	AAS2	AAS2	AAS2	AAS2	AAS2	XRF1



Job: 2DN1318  
O/N: 10703/HE13

Final

ANALYTICAL REPORT

SAMPLE	Au	AuDp1
242233	<0.001	--
242234	<0.001	--
242235	0.003	--
242236	<0.001	--
242237	<0.001	--
242238	<0.001	--
242239	<0.001	--
242240	0.011	0.013
242241	0.002	--
242242	<0.001	--
242243	0.035	--
242244	0.002	--
242245	<0.001	--
242246	0.001	--
242247	<0.001	--
242248	0.023	0.018
242249	0.005	--
242250	<0.001	--
242251	<0.001	--
242252	<0.001	--
242253	0.001	--
242254	0.002	--
242255	0.001	--
242256	0.002	0.002
242257	0.009	--
242258	<0.001	--
242259	<0.001	<0.001
242260	0.007	--
242261	0.004	--
242262	0.001	--
242263	0.001	--

UNITS	ppm	ppm
DET.LIM	0.001	0.001
SCHEME	FA3	FA3



## APPENDIX 3

### Year 4 rock chip sampling results

18 AUG 1993

21 Marjorie Street, Berrimah, Northern Territory  
Postal Address : P.O. Box 58, Berrimah, N.T. 0828  
Telephone: (089) 322 637 Facsimile: (089) 323 531

Mr. K. Hellsten  
UNION REEFS PROJECT  
G.P.O. Box 1826  
DARWIN

N.T. 0801

ANALYSIS REPORT :

Your Reference : 23553/UR06

Our Reference : 3DN0691

Samples Received : 12/08/93

Results Reported : 16/08/93

Number of Samples : 15

Report Pages : 1 to 1

This report relates specifically to the samples tested in so far as the samples supplied are truly representative of the sample source.

If you have any enquiries please contact the undersigned quoting our reference as above.

Emerald Springs  
Rockchip Samples  
UR06 3.2.3

Report Codes:

N.A. -Not Analysed  
L.N.R. -Listed But Not Received  
I.S. -Insufficient Sample

A handwritten signature in dark ink, appearing to read 'A Ciplys', written over the 'Approved Signature:' text.

Approved Signature:

for

ALAN CIPLYS  
Manager - Darwin  
AMDEL LABORATORIES LIMITED  
A.C.N. 009 076 555



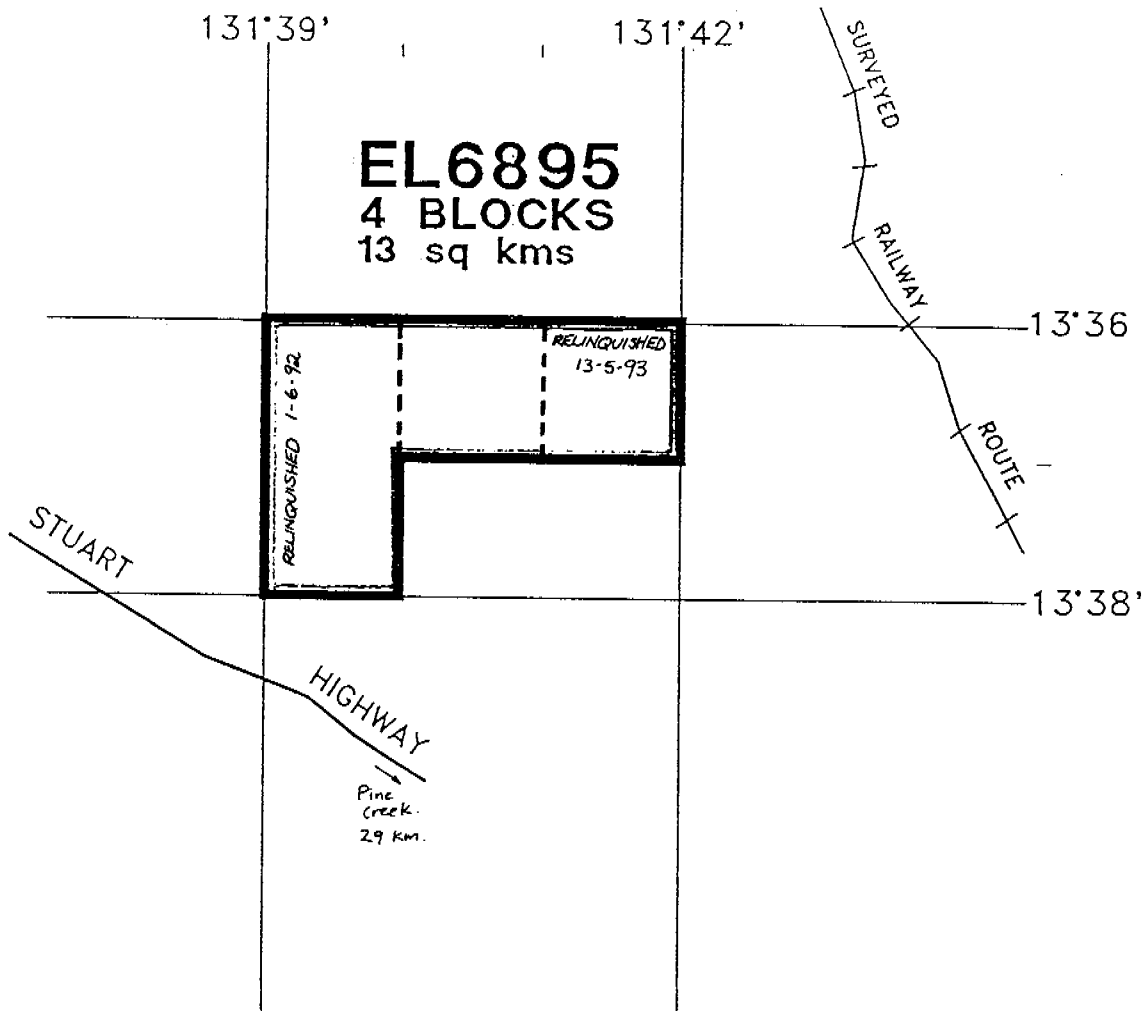
Job: 3DN0691  
O/N: 23553/UR06


Final

ANALYTICAL REPORT

SAMPLE	Au	AuDp1	Ag	Pb	Zn	Cu	As
257408	<0.01	<0.01	<1	7	15	6	<50
257409	0.21	0.20	<1	47	27	7	460
257410	<0.01	<0.01	<1	10	16	6	<50

UNITS	ppm	ppm	ppm	ppm	ppm	ppm	ppm
DET.LIM	0.01	0.01	1	4	2	2	50
SCHEME	FA1	FA1	AAS2	AAS2	AAS2	AAS2	AAS2



 <b>Billiton Australia</b> <small>The Metals Division of the Steel Company of Australia Limited</small>			
Project <b>EMERALD SPRINGS - EL 6895</b>			
Title  <b>LOCATION .</b>			
Author <b>CRM.</b>	Date	Scale <b>1:100 000</b>	
Drawn	Office	Revised	Date



EL 6895

# EMERALD SPRINGS

ROCK CHIP SAMPLING LOCATIONS

- Year 3 sampling  
all numbers prefixed by 2422
- ▲ Year 4 sampling  
all numbers prefixed by 257

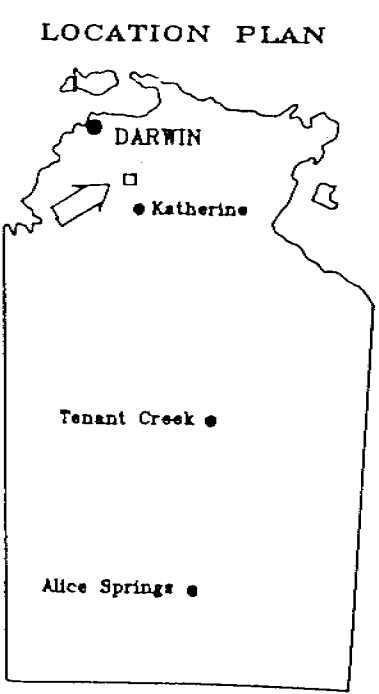
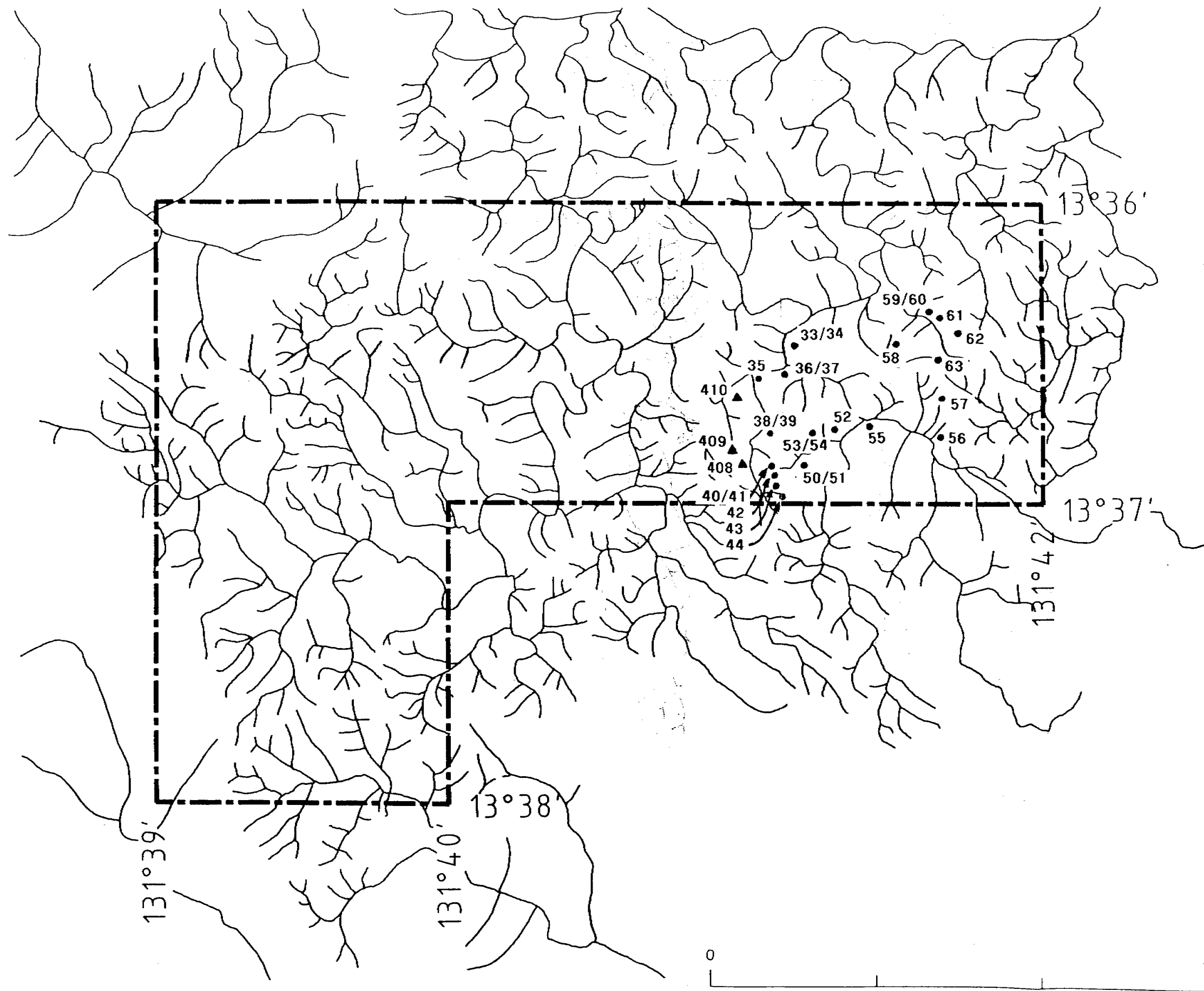
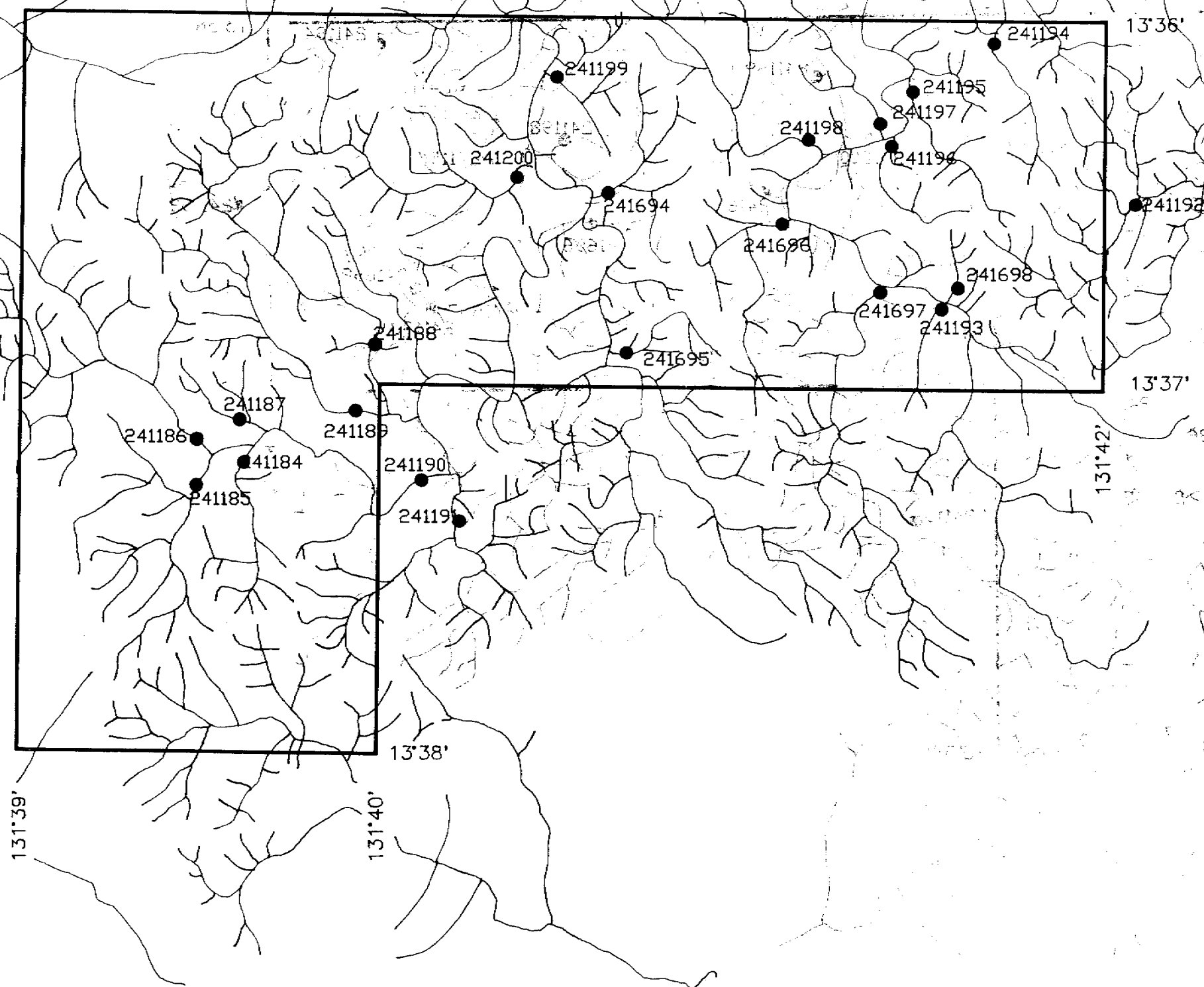


Figure 5.



Sample	Au	Cu	Pb	Zn	Ag	As	Sn
241183	1.60	25	42	51	<1	28	<5
241184	2.40	44	67	59	<1	39	<5
241185	0.9	39	35	44	<1	22	<5
241186	1.20	56	41	71	<1	24	<5
241187	0.8	42	35	34	<1	53	<5
241188	1.20	35	30	23	<1	40	6
241189	1.00	21	15	19	<1	27	<5
241190	1.00	41	64	72	<1	34	<5
241191	1.00	20	46	53	<1	33	<5
241192	2.50	20	28	34	<1	19	<5
241193	4.60	19	30	20	<1	62	<5
241194	0.5	19	20	34	<1	18	<5
241195	0.6	20	26	28	<1	26	<5
241196	0.9	19	26	22	<1	24	<5
241197	0.6	19	27	21	<1	30	<5
241198	2.10	20	36	36	<1	63	<5
241199	1.70	20	19	26	<1	49	<5
241200	1.30	56	42	120	<1	66	7
241694	2.80	20	24	32	<1	50	7
241695	0.4	14	14	17	<1	19	<5
241696	6.30	19	19	35	<1	65	6
241697	7.60	19	33	27	<1	198	14
241698	0.8	19	24	26	<1	25	<5

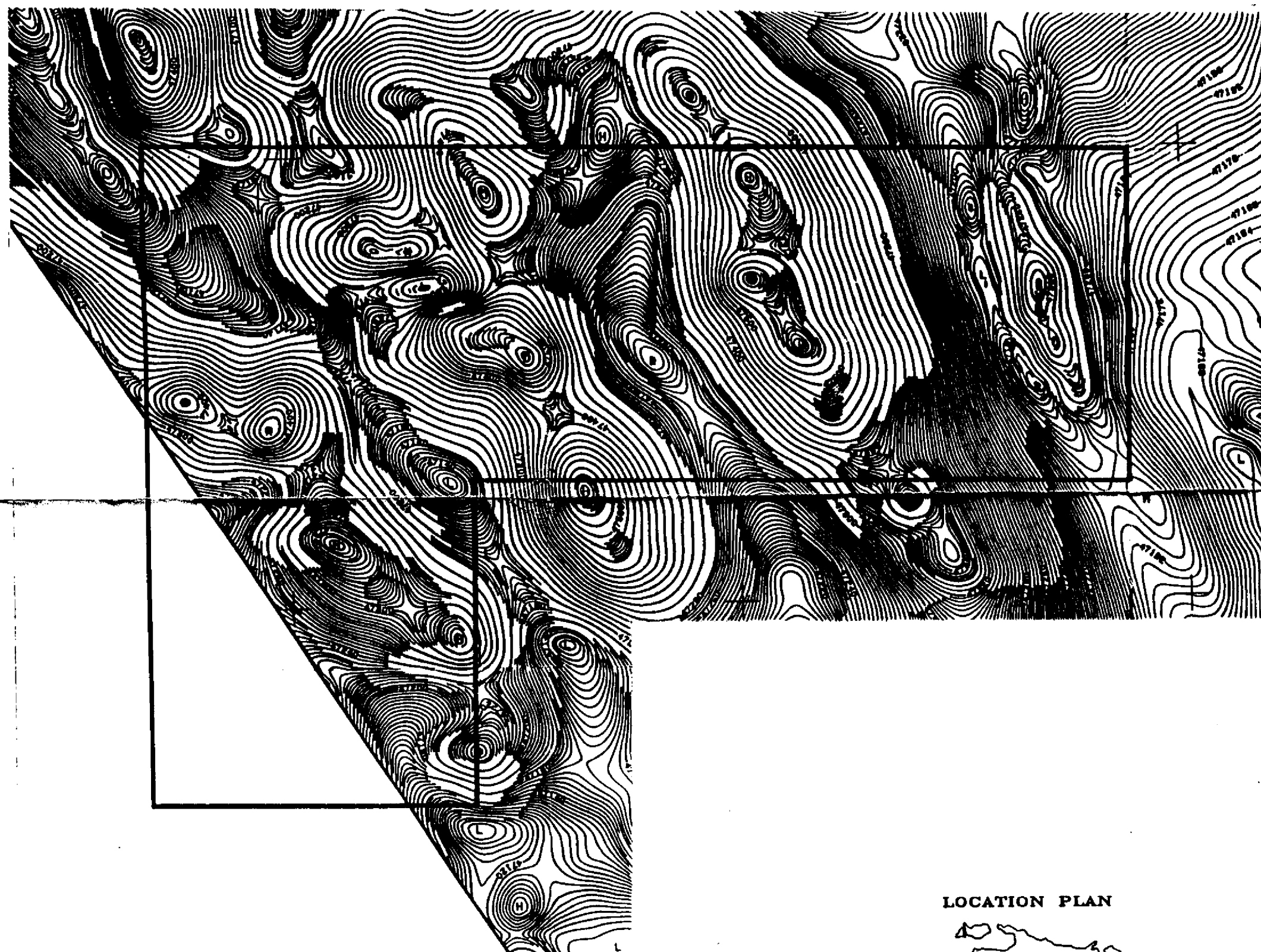
Note: Data in ppm unless otherwise stated

● 241192 STREAM SEDIMENT SAMPLE LOCATION & NUMBER

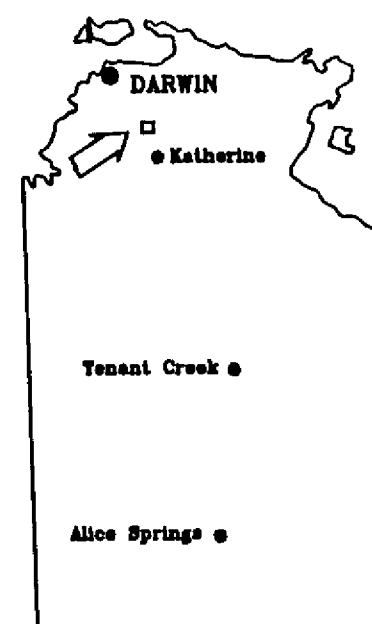


<b>Project</b> EMERALD SPRINGS EL6895 NORTHERN TERRITORY	
<b>Title</b> -80# & -10# STREAM SEDIMENT SAMPLE LOCATIONS & RESULTS	
<b>Author</b> C.R.M. Office CNS	<b>Scale</b> 1:25000
<b>Drawn</b> K.S.J. Date 9/90	<b>Revised</b> B.J.F. Date 9/91
<b>Plotted</b> date 5/9/91	<b>Report</b> No.
<b>Drawing</b> No. C/HE13/3	<b>Fig.</b> No.

Figure 4.



LOCATION PLAN



## AIRBORNE SURVEY SPECIFICATIONS

AIRCRAFT	ROCKWELL SHARK COMMANDER 500B.
MAGNETOMETER	BENTON V801 SPLIT BEAM CERMUM VAPOR.
	RESOLUTION: 0.04 nanoTesla.
	CYCLE RATE: 0.2 second.
	SAMPLE INTERVAL: 14 metres.
SPECTROMETER	256 CHANNEL GEOMETRICS SPECTROMETER 6800B.
	Processed channels:
	Total Count 0.40 - 8.01 MeV
	K <sub>α</sub> 1.87 - 1.88 MeV
	Bi <sub>α</sub> 1.87 - 1.88 MeV
	Ti <sub>α</sub> 2.41 - 2.80 MeV
	Cosmo 8.02 - 8.00 MeV
	VOLUME: 88.68 litres.
	CYCLE RATE: 1.0 second.
	SAMPLE INTERVAL: 70 metres.
DATA ACQUISITION	HEWLETT PACKARD 8000 SERIES COMPUTER.
	RECORDING DIGITAL ACQUISITION SYSTEM.
FLIGHT LINE SPACING	Traverse line: 800 metres.
	Tie line: 8000 metres.
FLIGHT LINE DIRECTION	Traverse line: 080-070 degrees.
	Tie line: 180-080 degrees.
SURVEY HEIGHT	70 metres - mean terrain clearance.
NAVIGATION	SYLONB LHF positioning system.

## REFERENCE

CONTOUR INTERVAL: 100 counts per second

The radiometric data has been stripped, corrected for altitude variation and levelled.

Data has been corrected for system parallel

CLIENT: BILLITON AUSTRALIA

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CR 94 / 516

**Billiton Australia**

Project NORTHERN TERRITORY  
EMERALD SPRINGS EL6895

Title  
**TOTAL MAGNETIC  
CONTOUR MAP**

Author C.R.M. Office CNS Scale 1 25 000

Drawn K.B.J. Date 9/90 Revised Date

Report No.

Drawing No. Fig. No. 3