SOUTH→WEST TASMANIA EL.13/65

GEOCHEMICAL METHODS USED DURING 1966 - 1968

by

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GEOCHEMICAL METHODS USED
IN SOUTH-WEST TASMANIA
1966 - 1968

M.H. McINTYRE AND E.D. BUMSTEAD

INTRODUCTION

During the two years 1966-68 reconnaissance stream
sediment sampling, follow up stream and bank sampling and
soil sampling have been carried out. The methods by which
these surveys were conducted are described together with
the methods of result evaluation.

Up to the end of the 1967-68 season over 5750 samples
were collected. The method of attack prior to analysis
was a hot ($180^{\circ}C$) perchloric acid leach. The samples were
then analysed for copper, zinc and nickel.

GEOCHEMICAL METHODS AND SAMPLING

The aim of geochemical reconnaissance is to measure
element distributions and concentrations in a particular
region in an effort to draw attention to areas with values
which are anomalous when compared with the local tenor.
These anomalous values may indicate mineralization. Both
soil and stream sediment surveys have proved successful in
other parts of the world for this work and these methods
have been used in South-west Tasmania during the years 1965
to 1968.

a) Stream Reconnaissance

Sample collection for stream sediments was carried out
in the following manner. After a work area was selected,
aerial photographs were studied and stream sample positions
and the most efficient traverse selected. Sample sites were
initially spaced at ¼ mile intervals but later ½ mile in-
tervals were used, the dispersion train of the elements
under investigation having been found to be sufficiently
long. Sites immediately above the confluence of two streams
were also sampled. Samples were taken from the active

stream bed. Each sample was to be from a similar position in the stream and of similar composition. These two criteria were not easy to meet. The fraction of sediment required in this survey was the less than 80 BSS mesh fraction, which contains silt-and clay-sized material.

Streams of S.W. Tasmania were immature and their sediments were consequently coarse grained. This meant that large samples, up to 1,000 gms., were collected to provide 25 gms. of less than 80 BSS mesh material for analysis. Samples were kept and dried in prenumbered water resistant paper bags. Sample site and number were recorded on aerial photographs; and pH, estimates of grain size, organic content, stream flow and type were noted in the field book. These field features were of use in interpretation.

b) Soil

Soil sampling was employed in E.L. 13/65 for the first time during 1967, and it has so far been confined to the Noddy Creek area. Two major soil types are present in S.W. Tasmania. One is 'peat', which is characteristic over 'button grass' plains and at Noddy Creek over ultrabasic rock. The other soil type is a well developed five horizon soil in areas underlain by Paleozoic sediments. The horizons developed in this soil are:

A_o Black to dark brown leaf litter
A_1 Dark brown clay soil often developing into a root mat in areas with certain vegetation

A_2 Chestnut brown stiff clay usually friable or plastic when wet

B Yellow brown sticky tenaceous clay

C Yellow brown sticky tenaceous clay with rock fragments.

The peat has been sampled at its base and such samples usually contain some rock fragments. The clay soil was sampled at the B horizon.

Sampling was carried out along cut lines or on compass

and pace/tape traverses. The horizon sampled, its texture, composition, consistency and amount of root material were all recorded.

c) Stream and Bank

Less accessible anomalous areas delineated by stream sampling were investigated by stream sediment and bank sampling over these stretches. The sample spacings used were between 50 feet and 100 feet. No particular horizon of the bank soils was sampled, as in the majority of cases horizons were not formed, and the soil represents col-luvial material. The purpose of this sampling was to isolate the side of the stream from which metals were entering and the length of bank from which they entered. This method was on the whole successful, but due to general difficulties of positioning oneself further sampling in the higher reaches of the streams could be advisable in future.

On return to base camp both soil and sediment samples were dried and lightly crushed prior to sieving to <80 BSS. The purpose of crushing is to disaggregate the soil peds which cake due to drying. Two size fractions were retained during sieving; the -30 to +80 BSS mesh fraction and the <80 BSS mesh.

INTERPRETATION

Stream sediment samples represent a drainage area and as such give mean values of elements in that area. The information from the aerial photographs is transferred to a base map and the results of analysis are plotted on these. A decision at this time is required to delineate anomalous lengths of stream. Two methods have been used in S.W. Tasmania. The first has relied on the subjective feeling of the geologist for the results and has been used lately (1967-68). The geologist has by inspection of the results, decided that a value is the top limit of background; values above this are threshold, i.e. probably background; but possibly anomalous. The values above threshold are divided into first, second and third class anomalies. These categories are entirely the result of the geologist's inspection.

A second method employs statistics to obtain a more objective approach. Unfortunately the statistical distribution of geochemical values is often not normal and can not be described readily by any distributional form. However, the results are closest to a log normal distribution. It would be possible to obtain values in this system but the work involved is manually excessive.

The method used here has applied normal distribution statistics to the problem. The median, the middle value of values arranged in ascending order, has been taken in calculation of the standard deviation.

$$\sigma = \sqrt{\left(\sum (x-m)^2 \right) / (n-1)}$$

where m is the median
x is the value
n is the total number of values
σ is the standard deviation

Background is then considered as being: zero to median (m) plus one standard deviation (σ).

Threshold   between $m+1\sigma$ to $m+2\sigma$
Anomalous   above $m+2\sigma$

A further separation has been made in some cases in the 1st, 2nd and 3rd order anomalies. The basis of this division is given below.

3rd Order anomaly $m + 2\sigma$ to $m + 4\sigma$
2nd Order anomaly $m + 4\sigma$ to $m + 8\sigma$
1st Order anomaly   greater than $m + 8\sigma$

Both methods lead to the same type of categories but they have different values. The choice of which method to use is dependent on one's belief in statistics as against inspection. It is probable that statistics give a more consistent picture.

The results obtained by both methods indicate similar areas in S.W. Tasmania to be anomalous. The distribution of the various values is shown by colour or line
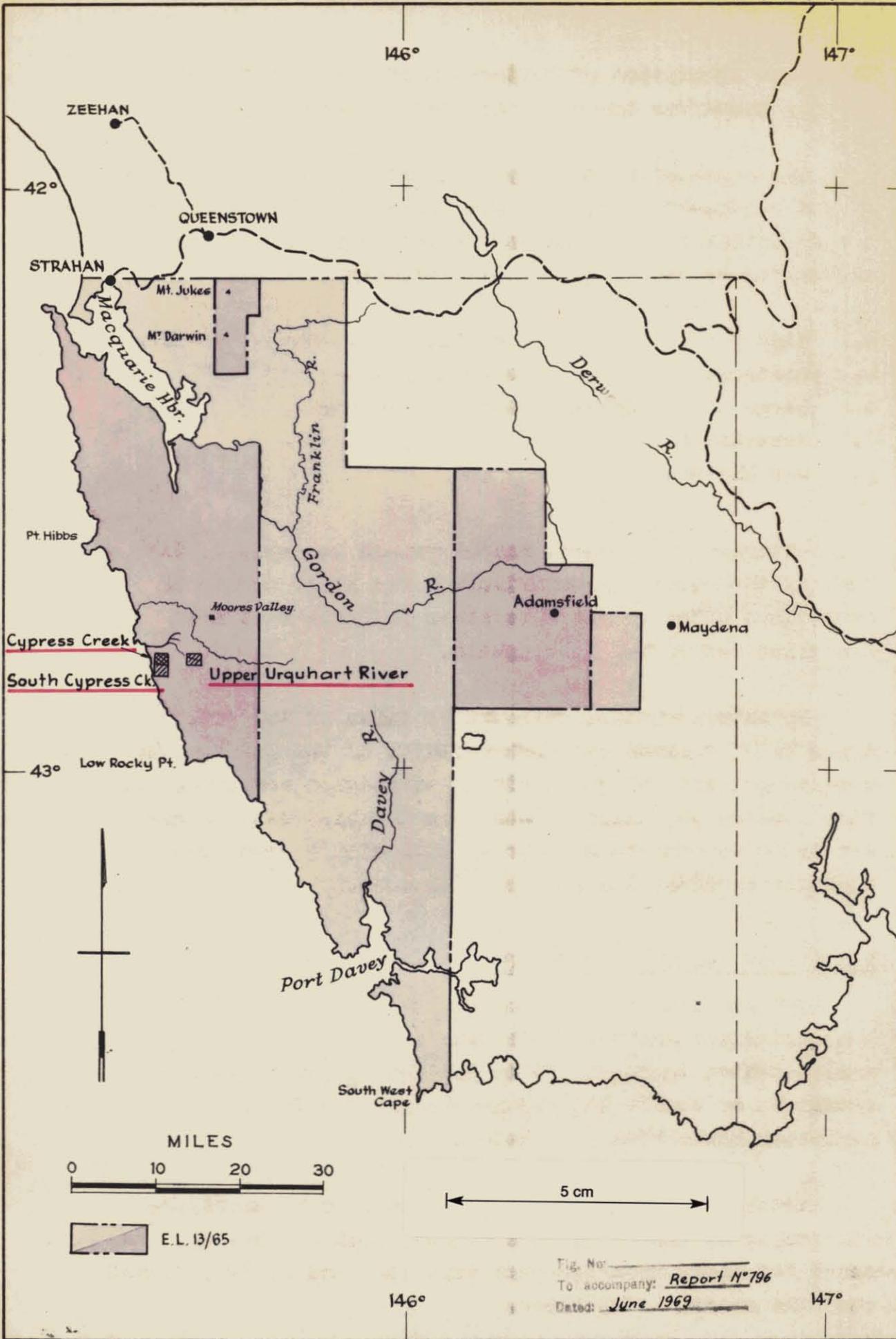
146°   147°

ZEEHAN

42°

QUEENSTOWN

STRAHAN
Mt. Jukes
Mt Darwin

Derw

R.

Franklin R.

Pt. Hibbs

Gordon

Moores Valley

R.

Cypress Creek

Adamsfield

South Cypress Ck   Upper Urquhart River

Maydena

Low Rocky Pt.
43°

Davey R.

Port Davey

South West
Cape

MILES

0   10   20   30

5 cm

E.L. 13/65

146°   147°

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Melbourne	E.L. 13/65 SOUTH WEST TASMANIA	
Date.	GEOCHEMICAL SURVEY 1966 – 68	Drawing No.
27-6-69	LOCALITY MAP	

thickness annotation of drainage maps: blue for back-
ground, green for threshold and red for anomalous.

The cause of an anomaly is decided after examination
of the geochemical patterns and their correlation with
the distribution of metal in the bedrocks. Anomalous
values can be due to any of the following causes:

a. High grade mineralized bodies of non-economic size.
b. Contamination from mine workings.
c. Large areas of weakly mineralized rocks.
d. Fertilizer.
e. Ore bodies.

Although the largest anomaly would be expected to
lead to the richest mineralization the large number of
exceptions cited in the literature indicate that all
anomalies should be investigated.

In interpretation, account is taken of the rock
types being drained and such features of the sediment as
organic content and grain size distribution and type.
Stream water pH indicates the form in which cations are
likely to be present and the pH will also control pre-
cipitation and/or absorption of cations.

RESULTS OF FOLLOW UP SAMPLING

The results of follow up sampling in the Upper
Urquhart River and the South Cypress and Cypress Creeks
are presented in figures 1 to 3. The streams remain
anomalous on resampling and new sample population
parameters have been calculated.

South Cypress Creek has been found to be anomalous
for copper in the south bank of the northerly branch. No
cause for these anomalies has been seen and it is presumed
that the source is up slope.

Nickel and zinc values are generally coincident and
of low tenor. Some coincidence of copper and nickel stream

sediment values is noted suggesting a possible co-origin of the anomalies. This may indicate that the anomalies are due to changes in rock type. However the values so obtained are rather higher than the average for the rock type.

Cypress Creek values show a similar pattern of results. The tenor of copper values is higher, reaching 1875 ppm c.f. 630 in the South Cypress Creek, but the major results are on the north bank. Nickel and zinc values indicate a similar behaviour in both Cypress Creeks.

Copper values in the upper Urquhart River east tributary show bank values of a low anomalous tenor. However the stream sediment results remain at background level. In the west tributary, the stream sediments return anomalous values and the bank samples are in the threshold zone.

Nickel and zinc values indicate similar behaviour to that previously described.

In no creek is there any indication of mineralization. This is partly due to effective soil and vegetation cover. The sporadic nature of the anomalies suggests that they are caused by -

a. A bias due to method of sampling.
b. Thin mineralized zones within the country rock.
c. Interbedding of two different rock types with different copper tenor.

It is not believed that biased sampling is the cause of the anomalies, leaving either case b or c as the possible cause. The second case - c - is ruled out because the soil values are considered too high to be due to rock type changes. Thus thin zones of mineralization are considered to be the probable cause of these stream anomalies. These zones may be related to significant mineralization in the area.

CONCLUSION AND RECOMMENDATION

Several streams from the same general area show reconnaissance anomalies of a similar nature to those that led to the Cypress Creeks and the Urquhart River anomalies and enclose an area overlain by a known aeromagnetic anomaly. Thus it may be that more significant mineralization is the ultimate cause of all the anomalies.

It is recommended that a soil sampling program be carried out in the area between the Urquhart and Mainwaring Rivers.

COPPER

NICKEL   FIG.1

350000 E

350000 E

8351

8401

211

801

408

730000 N

730000 N

204

8441

350
275

ZINC

8399

5 cm
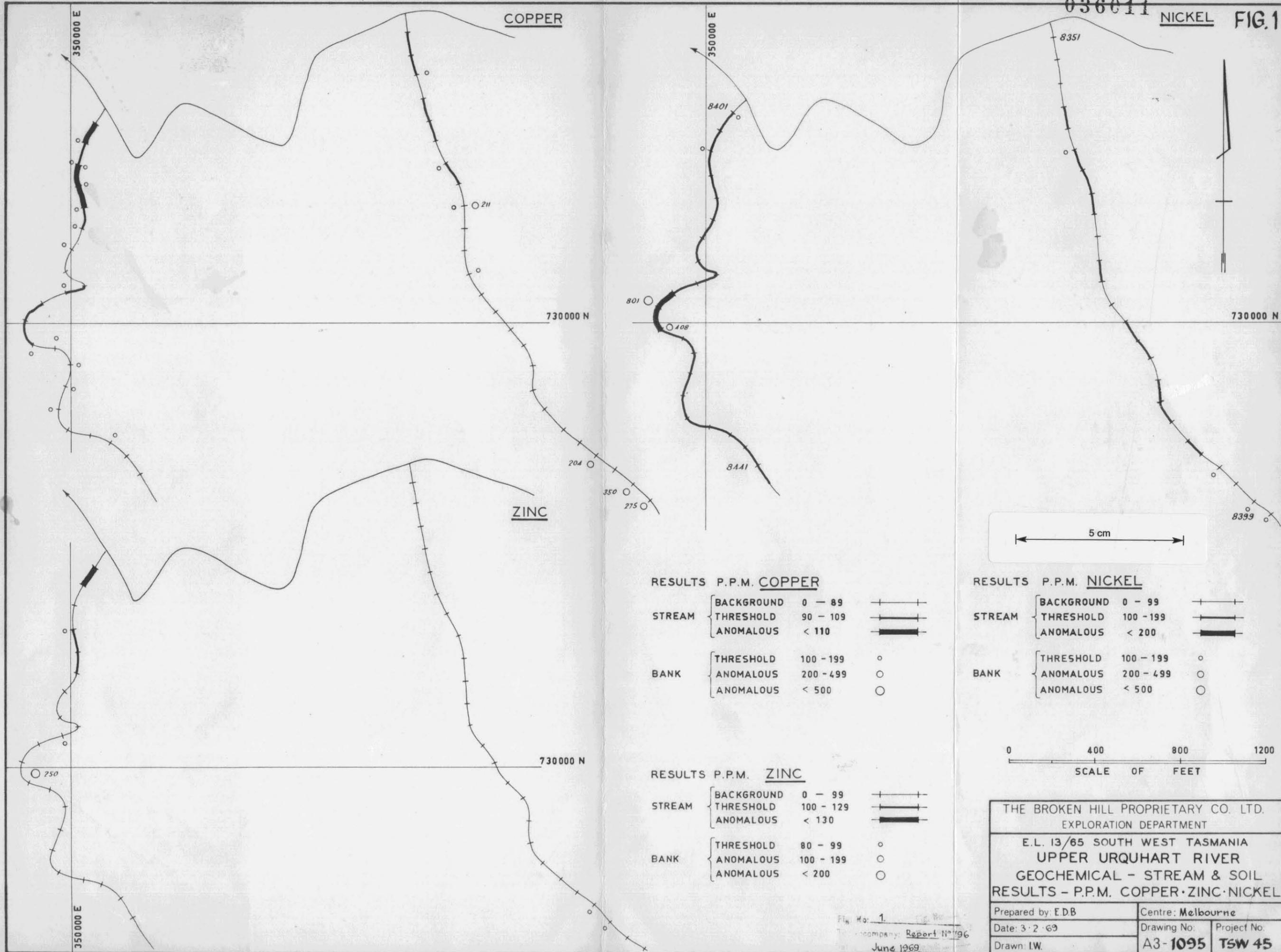
RESULTS P.P.M. COPPER

STREAM	BACKGROUND	0 — 89	
	THRESHOLD	90 — 109	
	ANOMALOUS	< 110	

BANK	THRESHOLD	100 - 199	o
	ANOMALOUS	200 - 499	O
	ANOMALOUS	< 500	O

RESULTS P.P.M. NICKEL

STREAM	BACKGROUND	0 — 99	
	THRESHOLD	100 - 199	
	ANOMALOUS	< 200	

BANK	THRESHOLD	100 - 199	o
	ANOMALOUS	200 - 499	O
	ANOMALOUS	< 500	O

| 0 | 400 | 800 | 1200 |
| SCALE | OF | FEET | |

RESULTS P.P.M. ZINC

STREAM	BACKGROUND	0 — 99	
	THRESHOLD	100 - 129	
	ANOMALOUS	< 130	

BANK	THRESHOLD	80 - 99	o
	ANOMALOUS	100 - 199	O
	ANOMALOUS	< 200	O

250

730000 N

350000 E

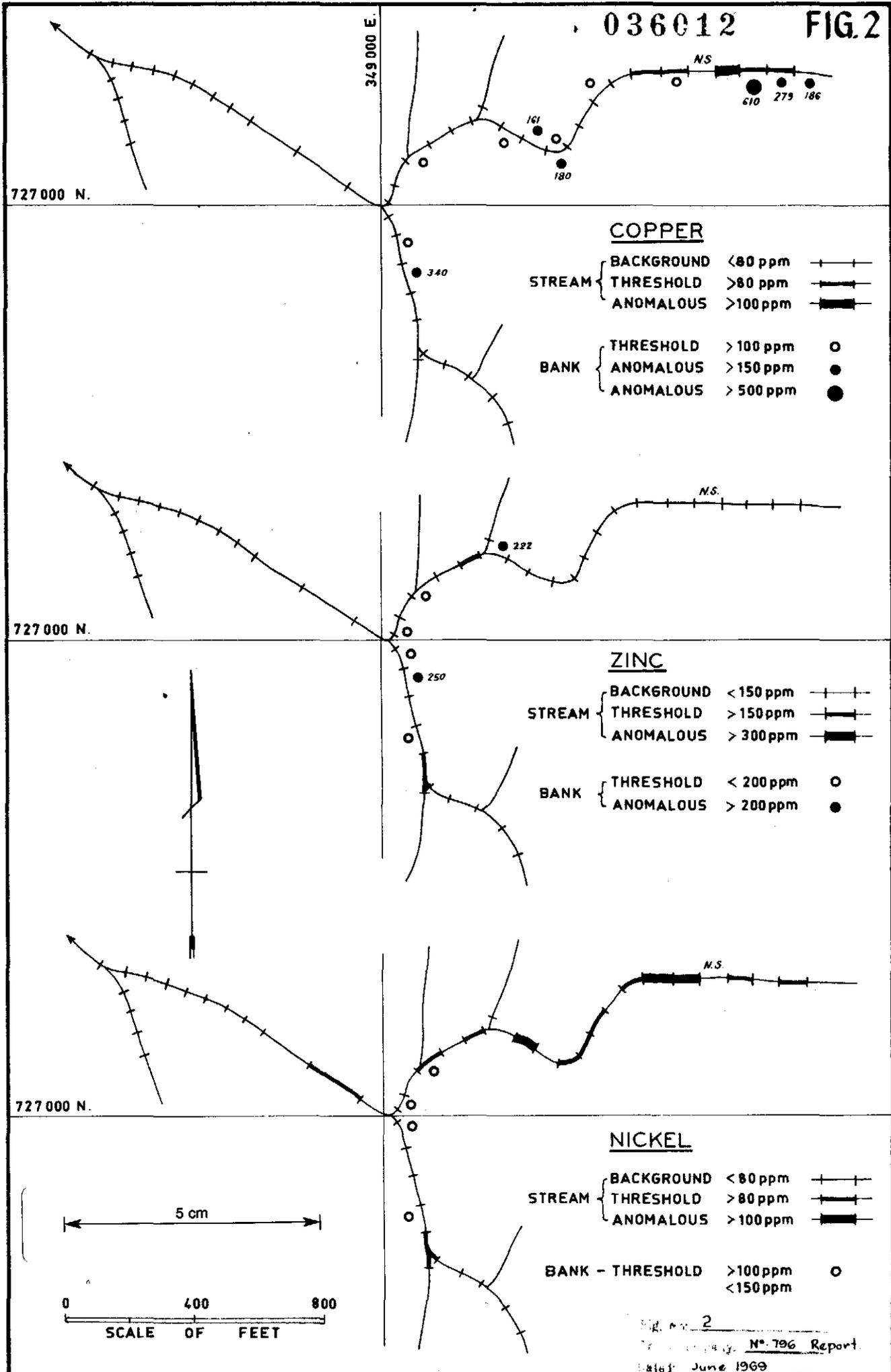THE BROKEN HILL PROPRIETARY CO. LTD.
EXPLORATION DEPARTMENT

E.L. 13/65 SOUTH WEST TASMANIA
UPPER URQUHART RIVER
GEOCHEMICAL - STREAM & SOIL
RESULTS - P.P.M. COPPER·ZINC·NICKEL

Prepared by: E.D.B	Centre: Melbourne	
Date: 3·2·69	Drawing No:	Project No:
Drawn: I.W.	A3-1095	TSW 45

Fig. No: 1.
Tc accompany: Report No. 96
June 1969

036012   FIG.2

349 000 E.

727 000 N.

COPPER

STREAM	BACKGROUND	<80 ppm	—+—+—
	THRESHOLD	>80 ppm	
	ANOMALOUS	>100 ppm	

BANK	THRESHOLD	>100 ppm	○
	ANOMALOUS	>150 ppm	●
	ANOMALOUS	>500 ppm	⬤

161 *180* *610* *279* *186* *340* NS

727 000 N.

ZINC

STREAM	BACKGROUND	<150 ppm	—+—+—
	THRESHOLD	>150 ppm	
	ANOMALOUS	>300 ppm	

BANK	THRESHOLD	<200 ppm	○
	ANOMALOUS	>200 ppm	●

222 *250* N.S.

727 000 N.

NICKEL

STREAM	BACKGROUND	<80 ppm	—+—+—
	THRESHOLD	>80 ppm	
	ANOMALOUS	>100 ppm	

BANK - THRESHOLD	>100 ppm <150 ppm	○

N.S.

Fig. No. 2
N°. 796 Report
dated June 1969

5 cm

0   400   800
SCALE   OF   FEET

Centre		Project No.
Melbourne	THE BROKEN HILL PROPRIETARY CO. LTD.	TSW 43
	E.L. 13/65 SOUTH WEST TASMANIA	
Date	SOUTH CYPRESS CREEK	Drawing No.
3·2·69	GEOCHEMICAL RESULTS - PPM COPPER ZINC NICKEL	A4/1142

009

350000 E

RESULTS P.P.M. COPPER

STREAM	BACKGROUND	0 - 99	
	THRESHOLD	100 - 149	
	ANOMALOUS	150 - 199	
	ANOMALOUS	> 200	

BANK	THRESHOLD	100 - 199	o
	ANOMALOUS	200 - 499	o
	ANOMALOUS	500 - 999	O
	ANOMALOUS	> 1000	O

8120 Stream sample number
Two consecutively numbered samples at each site.

731000 N

8120
8130
8140
8150
8160
8170
8180
8190
8200
8210
8220

1875 960 1440

RESULTS P.P.M. ZINC

STREAM	BACKGROUND	0 - 149	
	THRESHOLD	150 - 174	
	ANOMALOUS	> 175	

BANK	THRESHOLD	100 - 149	o
	ANOMALOUS	> 150	o

S121 Soil sample North bank

731000 N

S121
S131
S141
S151
S161
S171
S181
S191
S201
S211
S221

RESULTS P.P.M. NICKEL

STREAM	BACKGROUND	0 - 99	
	THRESHOLD	100 - 129	
	ANOMALOUS	130 - 149	
	ANOMALOUS	> 150	

BANK	THRESHOLD	100 - 199	o
	ANOMALOUS	200 - 499	o
	ANOMALOUS	> 500	O

S130 Soil sample South bank

731000 N

S130
S140
S150
S160
S170
S180
S190
S200
S210
S220

Fig. b 3
To accompany Report N° 796
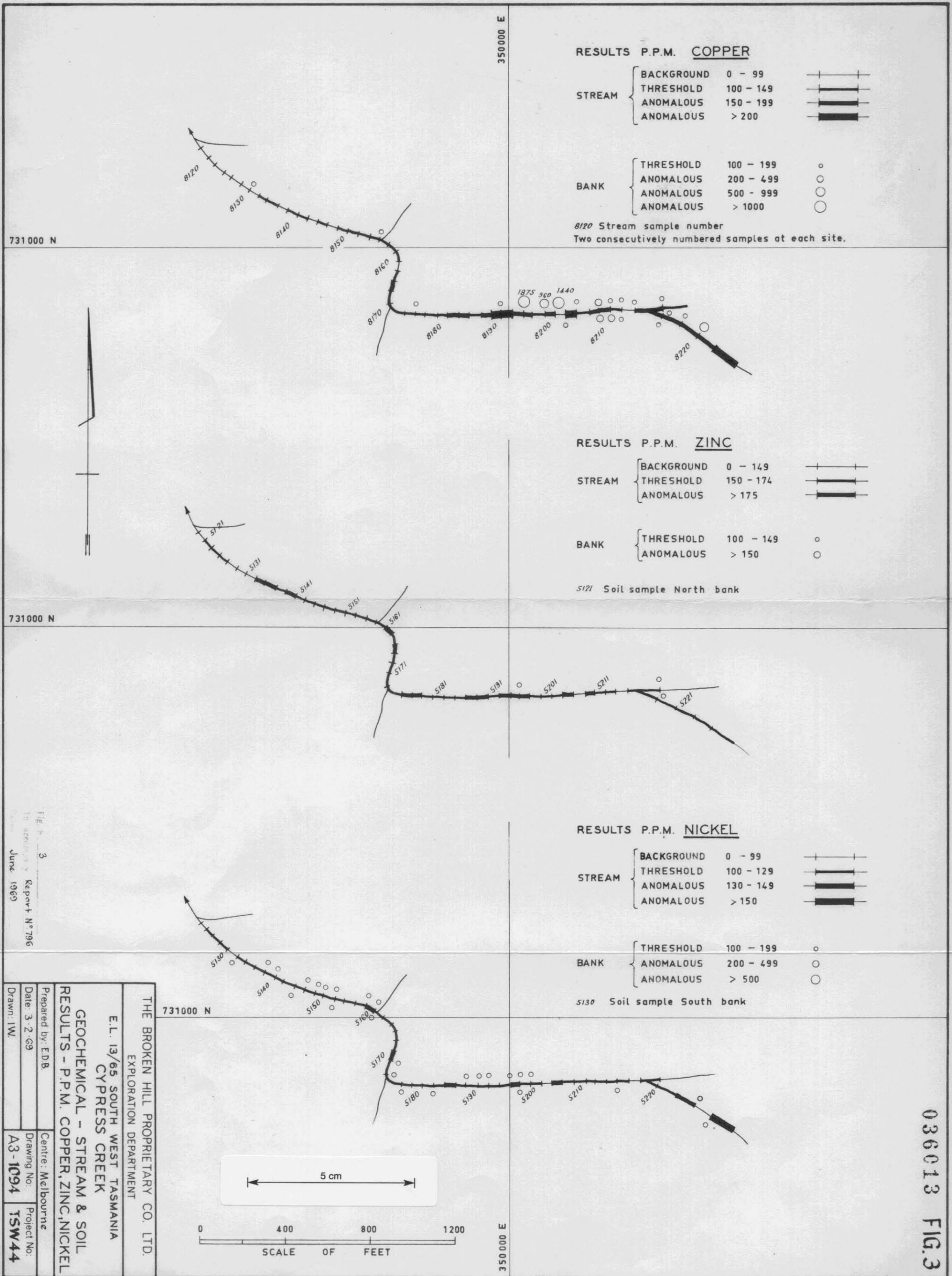June 1969

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EXPLORATION DEPARTMENT
E.L. 13/65 SOUTH WEST TASMANIA
CYPRESS CREEK
GEOCHEMICAL - STREAM & SOIL
RESULTS - P.P.M. COPPER, ZINC, NICKEL

Prepared by: E.D.B.
Date: 3 · 2 · 69
Drawn: I.W.
Centre: Melbourne
Drawing No: A3-1094
Project No: TSW44

5 cm

0	400	800	1200

SCALE OF FEET

350000 E