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MICROFILMED

SHEFFIELD TASMANIA EL 15/65

STREAM SEDIMENT SURVEY

1969

E. D. Bumstead

1969

Melbourne

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1. INTRODUCTION

A stream sediment survey was considered as the most economical method of exploration in the Dial Range, Northern Tasmania. The Dial Range is an area of medium relief with well incised streams and covered with a reasonably dense euclyptus forest. The undergrowth is thick and in many areas difficult to penetrate. This type of bush is common and covers up to 90% of the land, in the southern part of the Exploration licence. To the north out of the Dial Range proper, much land has been cleared for farming.

Access to the area is easy with four wheeled vehicles using either public roads or forestry tracks. Numerous other bush tracks into more remote areas exist but these are passable only on foot.

The sampling plan was designed so that the roads could be used to best advantage.

2. GEOCHEMICAL SURVEY

a. Analysis

Analysis throughout the programme was carried out by Geochemical and Mineralogical Laboratories Pty. Ltd. (Geomin). Determination for manganese, cobalt, nickel, copper, zinc, arsenic, molybdenum, silver, cadmium and lead were made on samples originating from the orientation survey. Atomic absorption spectroscopy was used to determine all elements except molybdenum and arsenic, which were determined colourimetrically.

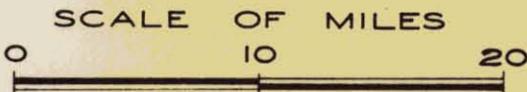
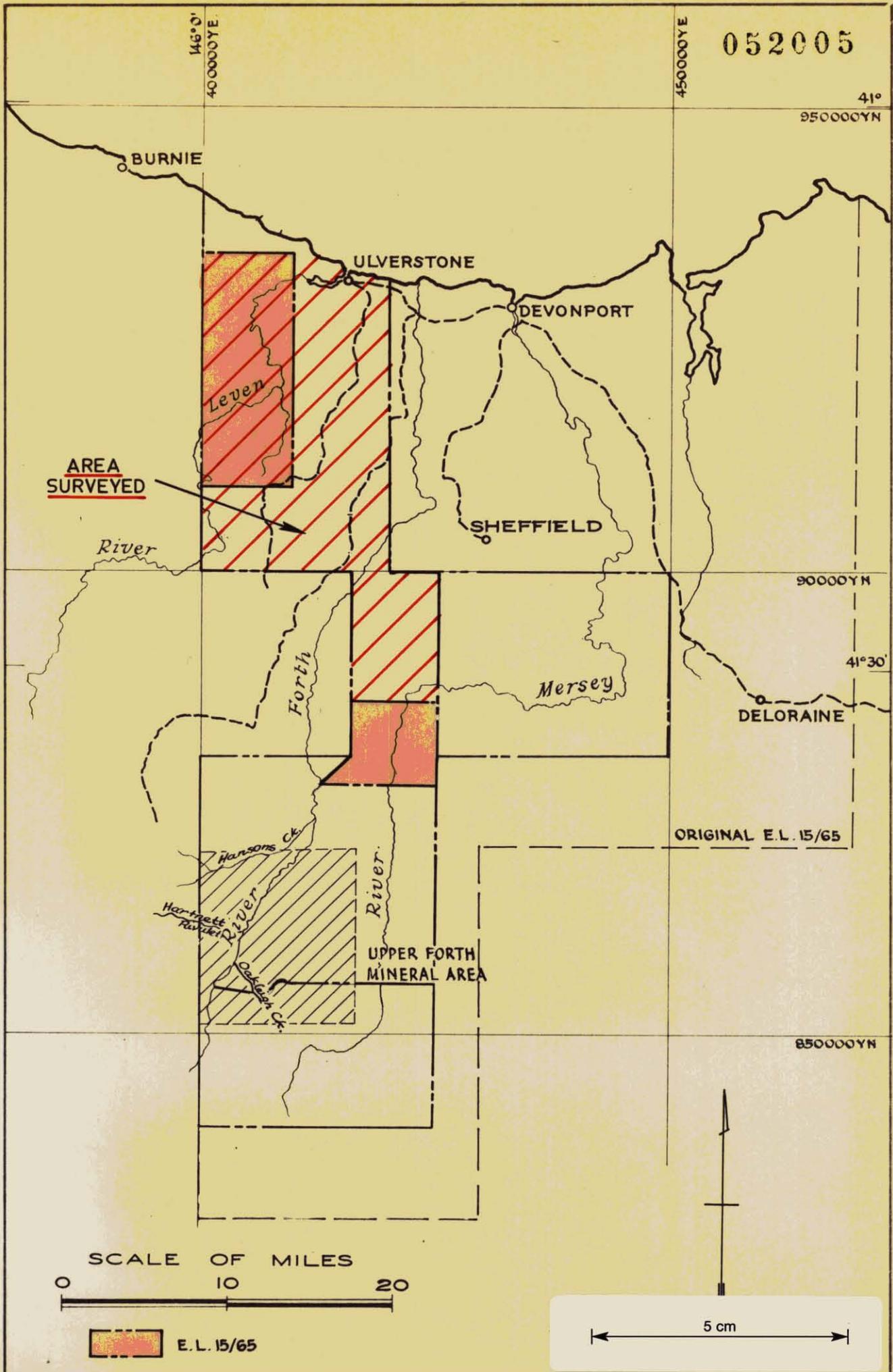
The precision of the analytical method was determined from duplicate results for certain samples using the following formula:

$$\frac{A}{S} = \sqrt{\frac{(\frac{1}{2}(x_1 - x_2))^2}{n - 1}}$$

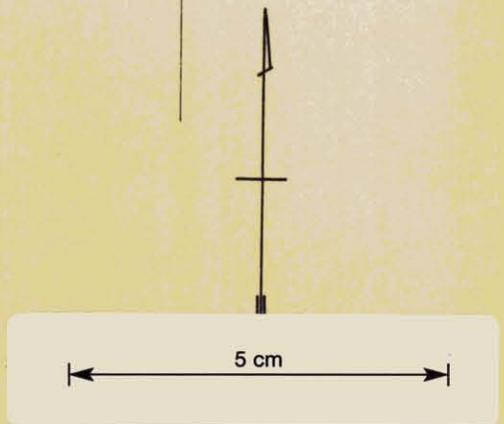
where x_1 and x_2 are the duplicate values of each duplicate

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25 July 1968

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LOCALITY MAP

Project No.
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A4-1077

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pair and n is the total number of duplicates.

The following results were obtained -

Copper	S	-	2.71 ppm
Arsenic	S	-	18.06 ppm
Lead	S	-	5.47 ppm

During the main survey copper, lead, cadmium, silver and arsenic were determined on all samples.

b. Orientation Survey

Samples were taken from every 100 feet from four creeks, Stanton, Revell and Dial, draining into the Leven River. These samples were dried, lightly crushed to disaggregate peds prior to sieving. Three size fractions were separated and analysed. These were the minus 30, minus 80 and minus 150 mesh size fractions. Each fraction was attacked by two separate acid mixtures, the first a perchloric, nitric, hydrochloric acid mixture at 180° and second a five normal hydrochloric acid solution under reflux.

Manganese, cobalt, nickel, copper, zinc, arsenic, cadmium and lead were all found to be anomalous in one creek (Stanton). Molybdenum was not detected in sufficient samples to be considered. The elemental dispersion train in Stanton Creek was disturbed by changes of pH of the stream water, which caused a distinct rise in the copper, arsenic, manganese, cobalt and zinc values with a rise in pH from 3 to 5 units. This change is seen in the above elements in all size fractions by all methods of attack and this must be due to absorption of these elements on clays or their precipitation as hydroxides.

The dispersion train was no longer than 1,000 feet for an anomaly of twice the background using perchloric acid mixture attack on the minus 30 mesh fraction. The train was longer with hot 5M Hydrochloric acid and the same fraction. The background was 25 ppm copper compared to a minimum anomaly

of 100 ppm. The arsenic anomaly also had a train of 1,000 feet in this fraction but other element trains were shorter.

In the minus 80 mesh fraction, the contrast was better and the train longer for copper and it was considered that 2,000 feet sample spacing would be the most economic for the survey. The background anomaly contrasts for copper are tabulated below with reference to attack and mesh size.

Perchloric Acid	Hydrochloric Acid	Mesh
Mixture at 180°	5M Hot	
4. 1	4. 6	150
6. 2	7. 6	80
3. 5	5. 0	30

It is apparent that a higher contrast was obtained with a 5M hydrochloric acid attack on the minus 80 mesh material.

The trains for other elements were more erratic; the use of other extraction methods did not effect the erratic nature of the results.

A statistical analysis of the analytical data in terms of mean, standard deviation, maximum and minimum and standardized data was made on all fractions. Standardized data is obtained by putting the mean value equal to zero and the standard deviation equal to unity and recording the original data in terms of standard deviation. Thus for a sample the standardized value for copper maybe plus 1.15 standard deviations from the mean of 32.7 ppm. If we define an anomaly as being the mean plus two standard deviations the above value is not anomalous.

The distribution of the values about the mean can be obtained by considering the values and the proportion of positive and negative values. For a good normal fit low values should be the major component of the list and the proportion of positive

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and negative values should be equal. For minus 80 mesh data the distribution of all elements determined approaches a lognormal distribution.

Knowing that Stanton Creek was anomalous, in so far as it has an old mine within its drainage basin, the standardized values indicate that an anomaly as defined above would not indicate this stream on any other in the orientation survey. However, considering samples from Stanton Creek further and referring to the standardized values and the table below, we find that the anomalous stretch of stream is almost uniquely described by copper values above +1:0 standard deviations. The elements arsenic, cadmium, silver and lead are also significant.

Element	Copper	Arsenic	Silver	Cadmium	Lead
Mean	45	68	0.68	0.29	22
Mean + 1 SD	166	365	1.12	0.80	45
2 SD	612	1965	1.83	2.23	92
n*	109	88	108	108	109
Threshold	+1.3	+1.2	+1.3	+1.3	+1.0

* where n is the number of values considered.

As a result of this work the survey was carried out on the basis of 1/2 mile sample spacing on first and second order stream with density not exceeding five samples per square mile drainage area. The selection of sample sites was controlled by the distribution of roads and is presented in Figure 1.

The following elements, copper, arsenic, silver, cadmium and lead were determined on the minus 80 mesh fraction after hot five normal hydrochloric acid leach.

c. Results

The results returned by samples collected in during the survey are presented in Figures 2, 3 and 4. The statistics are shown in the table below, in parts per million.

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Variable	pH	Cu	As	Ag	Pb
Maximum	6.7	176	130	6	200
Minimum	3.9	-	-	-	-
Mean	5.1	28	.28	.3	22
Mean + 1 SD	5.6	64	8.2	2.5	48
Mean + 2 SD	6.3	147	236	21.5	104
Observation	463	463	463	463	463

Inspection of the data listing shows that there are 30 anomalous copper values, that is values outside +1.3 standard deviations. However, twelve of these are close spaced samples from four creeks in the same area which were already indicated. There is some correlation between copper and silver in that area.

There are twenty-eight anomalous lead values of which several are from close spaced samples, there is reasonable correlation here between lead and arsenic. These values are also associated with a pH below the mean.

pH does not appear to be affecting the element levels but there is a definite partition. It appears that pH in the north west of the area is about 4.5 units, where as to the south the pH lies slightly above the mean at about 5.5 units. The effect of this change in pH should be minimal and would be in the direction of higher metal values with higher pH. This cannot be demonstrated however. There is only one case of correlation between pH and element values. This is with sample SHF 697 where pH is 6.0 and silver, cadmium, arsenic and lead values are all high. Other values of cadmium are insignificant and these have not been considered further.

The areal distribution of the results is seen in Figure 2, 3 and 4. Associated arsenic, lead anomalies stretch in a belt from, (403 932) to (409 915). All these points lie over Cambrian Dundas group volcanics and shales. The Dundas group is known to be mineralized and it is possible that the high values are background for this rock group. Copper values based on these statistical anomalies lie in stream draining the east bank of the Leven River about 407 923. This area is

009
underlain by Molton Spilite and may be background values for this member, as spilite commonly have low associated copper mineralization. The copper data was subjected to trend surface analysis. Trend surface analysis consists of fitting mathematical surfaces (models) to the data by least square techniques in an effort to obtain a regression equation that can be used to interpolate or predict between map points or to separate components of map variance. The trend surface is considered an estimate of the regional component of variance or trend. Deviations of the observed data from the trend described the local components on the map into areas of positive or negative values they are thought to reflect mostly local variations. Where deviations are not clustered they appear to represent very local variations, at a scale less than the sample spacing, together with noise due to sampling and analysis.

First (linear), second (quadratic) and third (cubic) order surfaces were constructed for the Sheffield copper data. The first order plane is almost horizontal and is not considered further. The second order surface (Figure 5) is dome shaped and the highest part lies at (410 915) and the long axis trends nor'nor'west. This surface appears to be related to the outcrop of tertiary rocks and to the structure in the underlying cambrian.

The third order trend (Figure 6) has the same general trend as the second order but is open to the south and west. Again this surface appears to be related to the structure but a greater part is due to stratigraphy. The low areas appear to be related to the Gog Range greywacke in the east and the tertiary basalts to the south, both of which would be expected to carry low copper tenors.

The second order surface explains 11% of the total variation and the third order surface explains 18%.

Both these surfaces indicate that an area to the north or centre of the exploration licence is of interest. The residual plots are presented in Figures 5 & 6. These are the contoured deviations of the raw data from the trend surfaces. They indicate the local variations due to topography, mineralization, human contamination and other minor factors.

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The second order residual show seven areas, there the deviation from the surface is greater than 40 ppm. (This is not the true value but the difference). Four of these areas are close to the boundary of the map area and will be affected by 'edge effects' which tend to distort or lay unwarranted emphasis on isolated high values. This can be particularly seen in the south east corner of the map.

The three second order residue peaks remaining are considered significant. They indicate two areas at (408 923) and (408 920) on the east bank of the Leven River and one on the west side. At the + 40 ppm level these anomalies cover 3.6 square miles, 1.5 square miles, 0.25 square miles and the first reaches a peak over the + 100 ppm level.

The third order anomalies are essentially the same but a slight decrease in size is also found. The association of copper and silver can be taken as encouraging possibly indicating vein mineralization by association with occurrences in the Dundas group to the south. The anomaly at (4085 9225) require on the ground geological inspection and some preliminary ridge and spur sampling with a sample spacing of 100 feet. Grid sampling on some lines in a grid based on 200 feet centres would be alternative. This grid would need 50 lines approximately 150,000 feet long being cut. The two programmes are illustrated in Figure 7. In addition lines over the minor anomalies would be required to test these.

Lines are preferred as geophysical methods could be used to back up soil sampling. Self potential measurement would probably be adequate in the first instance. The lines suggested for the initial follow up are indicated in Figure 7.

A total of 721 samples were collected, of these 212 were collected to provide orientation data. The cost of this survey is indicated in the following table and that of the full survey below.

011

Orientation Survey:

Man days at \$39.00 per day	\$ 234
Analysis cost (212) effective samples for 30 elements at \$11.00	\$2,332
Transport	\$ 25
Data Handling	\$ 25
Cost per sample	\$ 12.22
Total cost	\$2,616.22

Stream Survey:

Man days at \$ per day	\$3,030
Analysis cost 509 samples for 5 elements at \$2.15	\$1,095
Transport	\$ 355
Data Handling	\$ 350
Accommodation	\$1,075
Cost per sample	\$ 11.60
Total cost	\$5,905.60

A number of weeks taken to conclude this survey was excessive and the number of samples collected per man per ~~week~~ ^{day} (2.3) was abysmally low. In future much closer control of this facet of stream surveying will be required. This is probably a fault of in-field planning of Economic traverses and an absence periodic or weekly sample collection targets.

3. CONCLUSIONS AND RECOMMENDATIONS

Three areas are delineated which require some follow up work. The element association of copper and silver suggests that the mineralization if present is of vein type similar to some found in south west Tasmania. If this is so the area lacks sustaining interest.

Soil sampling on several lines over the target anomaly is recommended to test both the possibility of the anomaly being due to high background copper in the Molten Spilite or economic mineralization.

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A1 Sheffield Report Appendix 1.

Soil and stream follow-up sampling.

Soil sampling at 100 ft. spacing along roads and tracks in the area about 40859225 was undertaken as a first step in assessing the stream values previously reported. Sampling of the B horizon was carried out after the characteristics of the profile were studied from a pit three feet deep on Leven Hill. These results are summarized in Fig. 19. The soil over the Molton spilite was characteristically red while that over the Barrington Chert encountered near the base of the hill was grey.

The sampling plan is outlined in Fig.7 of the main report. A total of 100 soil samples were collected together with 6 rock samples. These samples were dried, lightly crushed and sieved to give the minus 80 BSS mesh. size fraction. They were despatched to Geochemical and Mineralogical Laboratories Pty. Ltd., for the determination of copper, zinc, silver and lead by atomic absorption after a perchloric acid leach. The results of this survey are discussed below.

A number of streams showing lead arsenic anomalies were resampled by bank and sediment samples at 200 ft. interval. These were McKennas Creek (40639240), McBrides Creek (40309326) and a small creek (41699052) draining into the Wilmont River. The pH of all the streams lay between 4.2 and 5.0 units. The sample treatment and analysis was similar to that used on the soils.

The copper, zinc, arsenic and lead results Fig. 8 and 9 from soils along roads shown in Fig.7 indicate that the values found in the streams draining this area are in fact background values for the Molton Spilite. At the base of Leven Hill a distinct change

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is seen in the analytical results. It is postulated that the boundary between the Barrington Chert and Molton Spilite is in fact higher up the hill than shown on the maps. Some outcrop of chert has been seen in this area. The possibility of a lower volcanic bed of different chemistry can not be discounted.

The analytical values rise over a ferruginous chert which appears to cross cut the spilite. The trend of this chert band is N.W. which is the major structural trend in the Cambrian. The chert band is represented poorly in outcrop and on chemical data varies between 300' and 500' wide and an outcrop length (between lines) of 2000'. No satisfactory chert samples were available for analysis. It is not believed that this represents significant mineralization, however, if geophysical work is to be carried out in the area it is recommended that this zone be tested. Alternatively, a shallow percussion hole would be adequate to test the zone.

The analytical values in McBrides, and McKennas Creeks and part of the Wilmot River, Figs.9,10,11, cannot be compared directly with the main survey due to the change of analytical method. The results are expected to be higher. Inspection shows this to be true for copper, but the reverse for lead. The arsenic values are in tolerable agreement bearing in mind the method.

McAennas Creek (4063/9240). The copper values from this creek are more variable on the finer spacing but none can be considered as anomalous. Zinc, lead and arsenic values are likewise erratic. Only lead values show anomalies in the present samples. The sample position showing these values are all associated with black chert or red clay. The arsenic values remain near the mean. Bank samples between sample position SHF 820 and SHF 810 all have values of 200 ppm lead and are associated with grey chert. Rock samples show no mineralization.

Wilmot River (41699051). One bank sample alone shows anomalous values. This is SHF 880 with a copper value

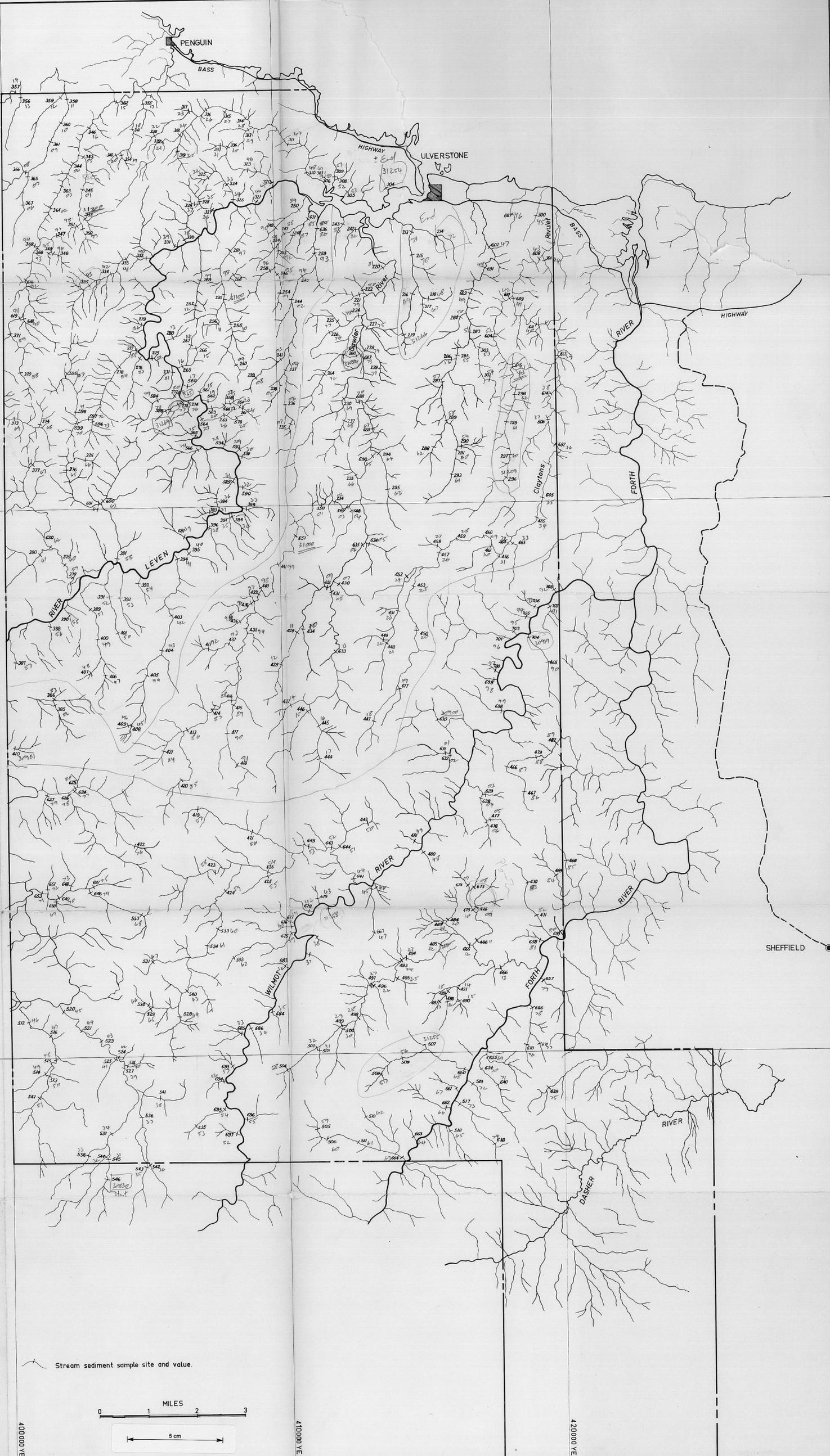
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of 470 ppm in bank material over iron stained shale. Similar values have been encountered in S.W. Tasmania and indicated small veins of pyritiferous shale. Thus this stream is not considered to be significant.

McBrides Creek (40309326). Results from this creek are more interesting. Stream values below sample SHF 900 show high zinc and lead values. The train is seen in these samples for 3000 ft. with values running between 160 and 1700 ppm, lead and 100 ppm and 900 ppm zinc compared with a background of 22 ppm and threshold of 45 ppm for lead. Isolated low lead values (78 ppm) also occur but these appear to be erratic. The lead values show a relatively faster drop off in value when compared to the zinc values.

Bank samples show that mineralization, if it is present, is of limited and sporadic occurrence. Of five bank sample positions with significantly high lead values ($x =$ twice threshold) only two are adjacent (SHF 896, SHF 902) two are separated by one sample and the other by five samples. A trend joining samples SHF 896, SHF 902 and SHF 920 can be drawn, and a vein at this position would explain all analytical values downstream, except that in the sediment at SHF 900.

This area requires detailed geological inspection, but it is felt from the values that the potential of the area as a mineral prospect is low.



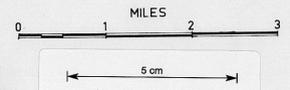
920000 YN

900000 YN

400000 YE

420000 YE

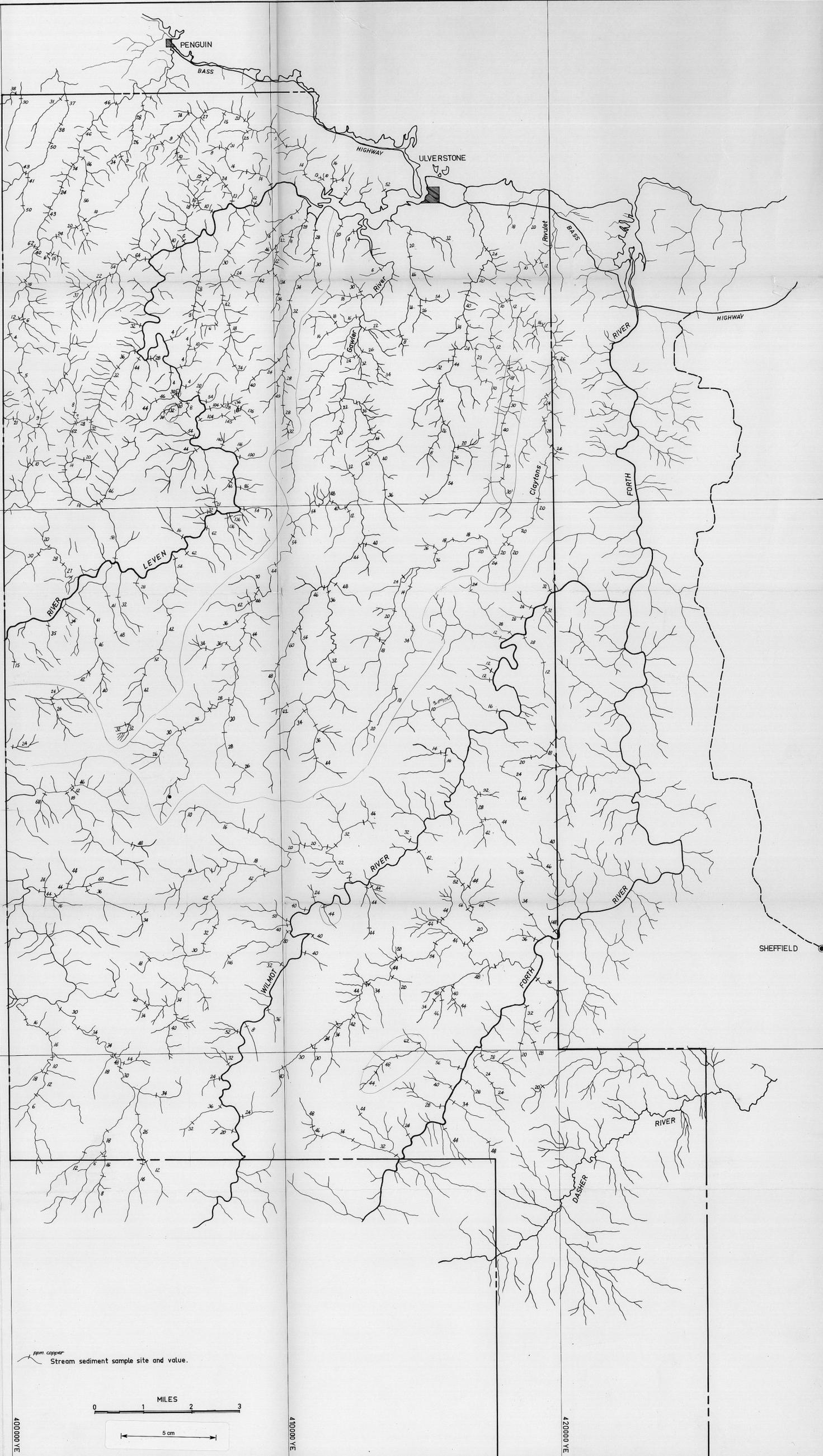
Stream sediment sample site and value.



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THE BROKEN HILL PROPRIETARY CO. LTD.			
EXPLORATION DEPARTMENT			
ELI/65 SHEFFIELD - TASMANIA			
GEOCHEMICAL SAMPLE SITES			
Drawn: C. I. I. W. W.	Date: 19. 5. 70	Centre: Melbourne	
Traced: C. I. I. W. W.	Drawing No:	Project No:	
Checked: A1-1357		TSH 54	
O.I.C.			

3326

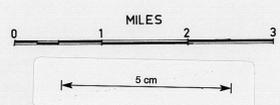
FIG.



920000 YN

900000 YN

ppm copper
Stream sediment sample site and value.



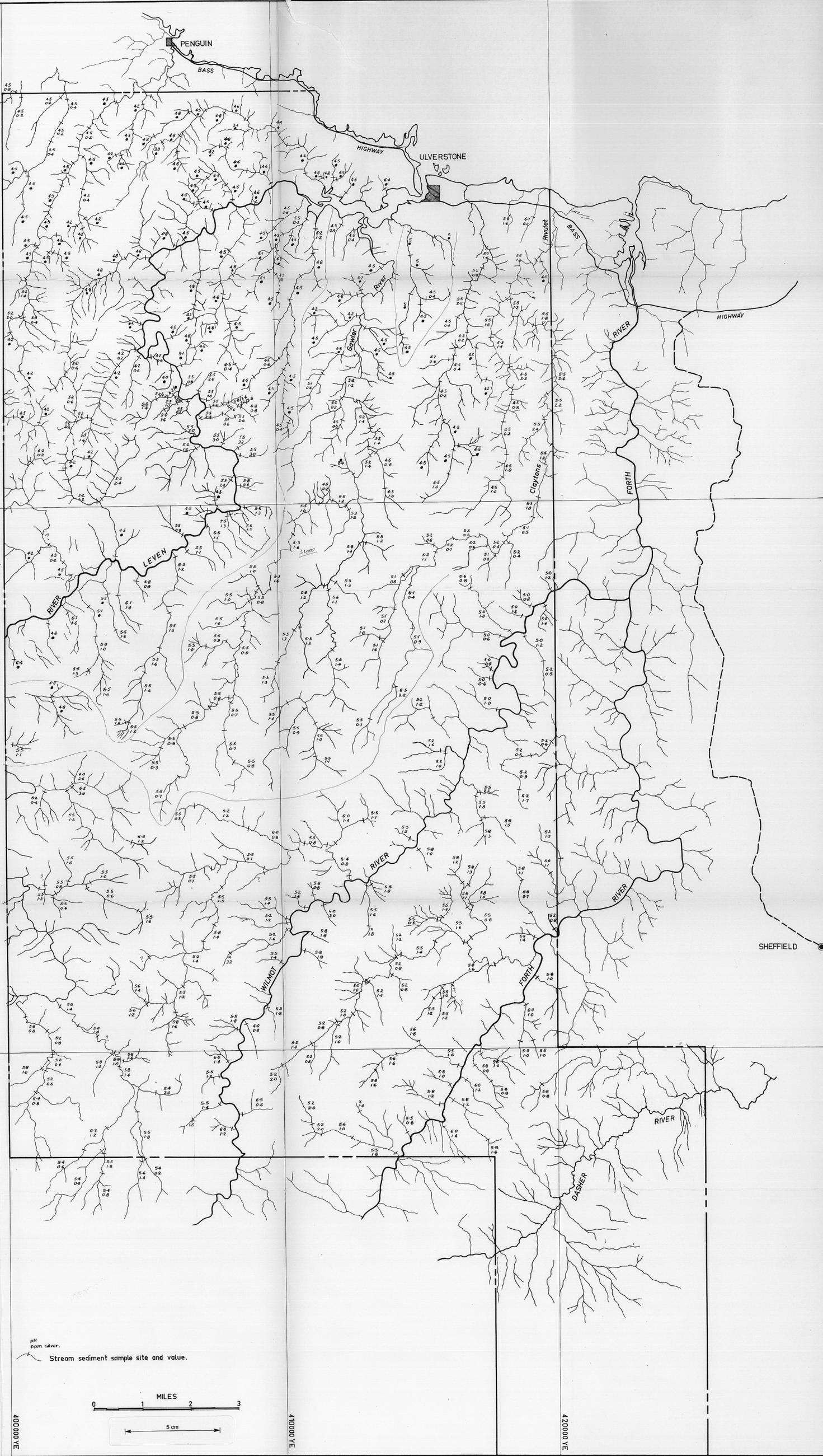
400000 YE

410000 YE

420000 YE

052018 69-538
 THE BROKEN HILL PROPRIETARY CO. LTD.
 EXPLORATION DEPARTMENT
 EL.15/65 SHEFFIELD - TASMANIA
 STREAM SEDIMENT SURVEY PPM COPPER
 Drawn: C. Linn Date: 17.4.70 Centre: Melbourne
 Traced: C. Linn Drawing No: A1-1344 Project No: TSh 57
 Checked: O.C. 3327

FIG. 2



920000 YN

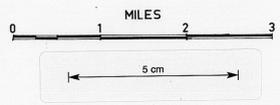
900000 YN

400000 YE

420000 YE

420000 YE

pH
ppm silver.
Stream sediment sample site and value.



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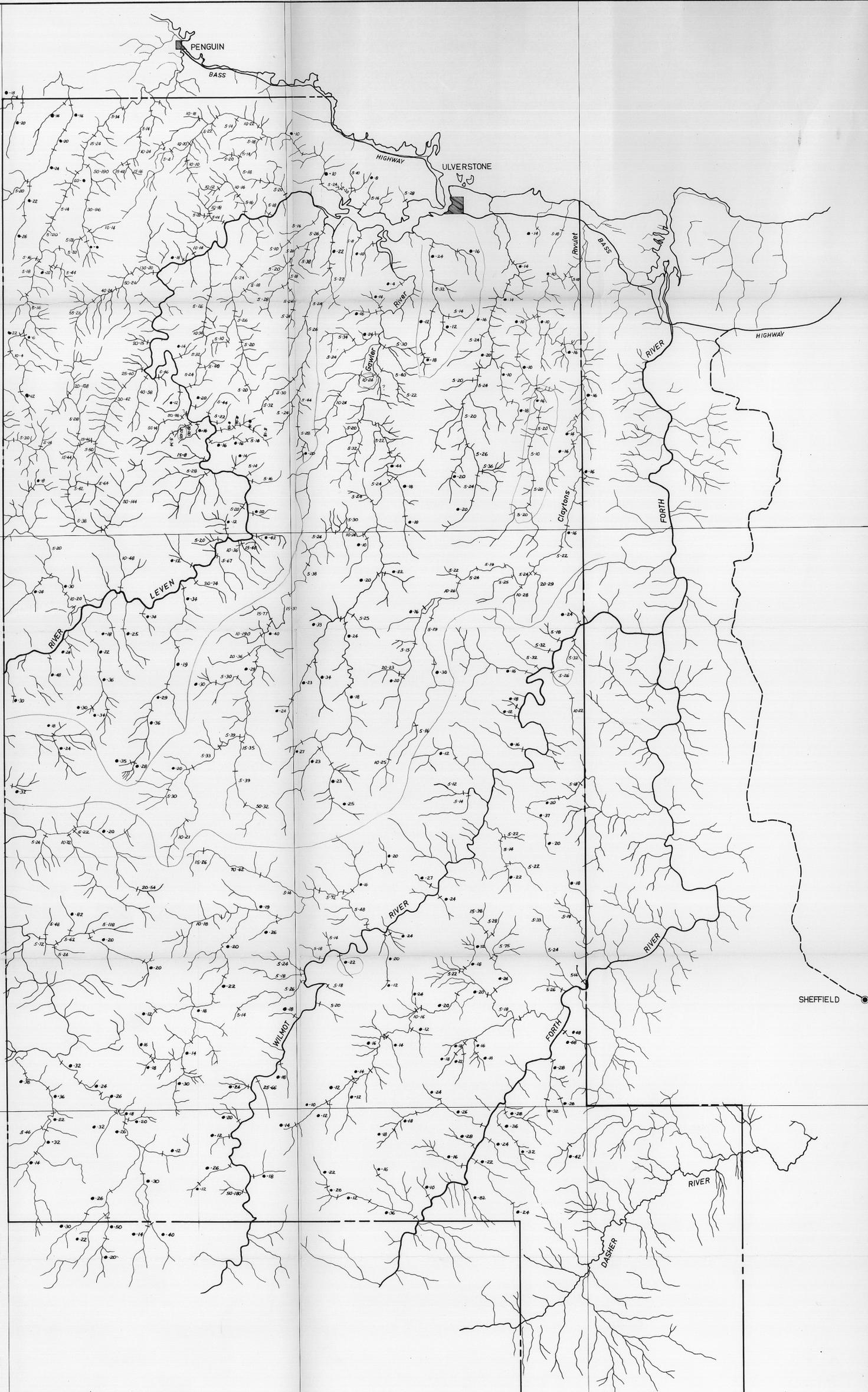
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EXPLORATION DEPARTMENT

ELI/65 SHEFFIELD - TASMANIA
STREAM SEDIMENT SURVEY
PH - PPM SILVER

Drawn: C. Irwin Date: 17.4.70 Centre: Melbourne
Traced: C. Irwin Drawing No: Project No:
Checked: A1-1346 TSH 56
O.I.C.

3328

FIG.3

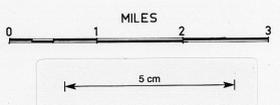


920000 YN

900000 YN

052020 69-588
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 EXPLORATION DEPARTMENT
 EL15/65 SHEFFIELD - TASMANIA
 STREAM SEDIMENT SURVEY
 PPM ARSENIC - PPM LEAD
 Drawn: C. Irwin Date: 17-4-70 Centre: Melbourne
 Traced: C. Irwin Drawing No: AI-1345 Project No: Tsh 55
 Checked: O.I.C. 3329

890 000 YN = 5 405 626 N
 ppm arsenic - ppm lead
 Stream sediment sample site and value.



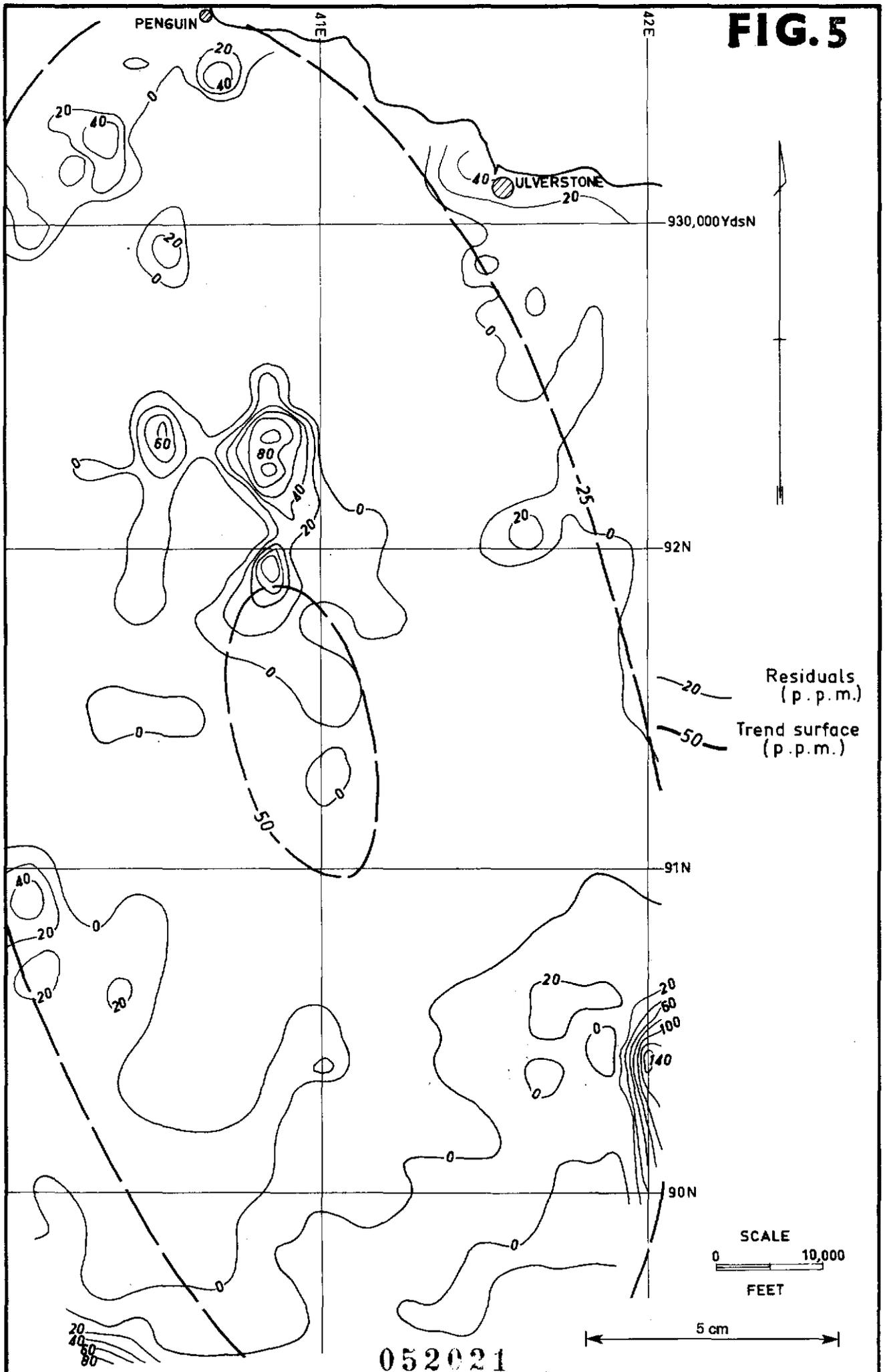
400000 VE

410000 VE

420000 VE

FIG. 5

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Date
April 1970

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SHEFFIELD TASMANIA E.L.15/65
STREAM SEDIMENT SURVEY

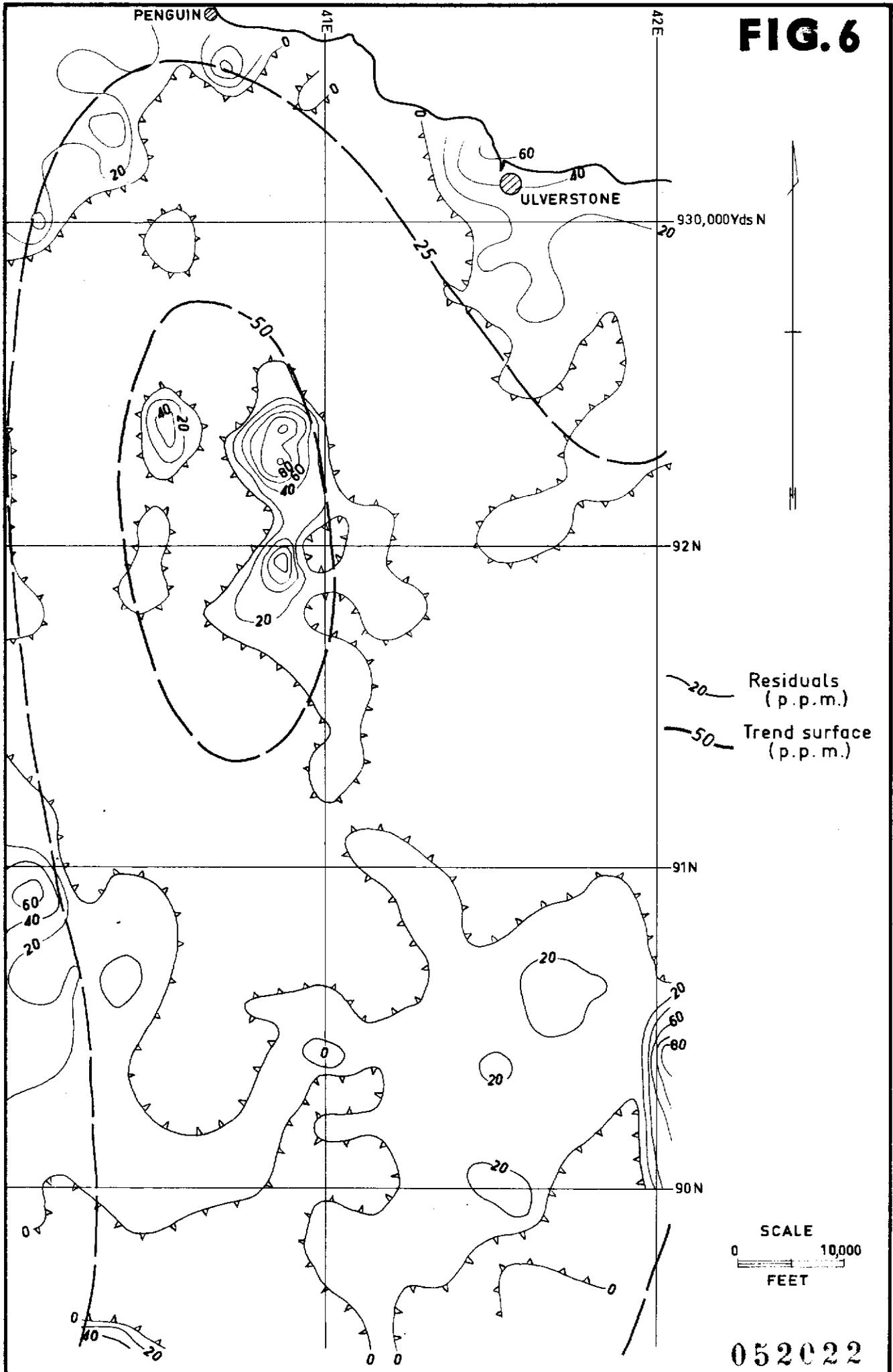
2ND ORDER TREND SURFACE & RESIDUALS FOR COPPER VALUES

Project No.
TSh 49

Drawing No.
A4/1283

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FIG. 6



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Date
April 1970

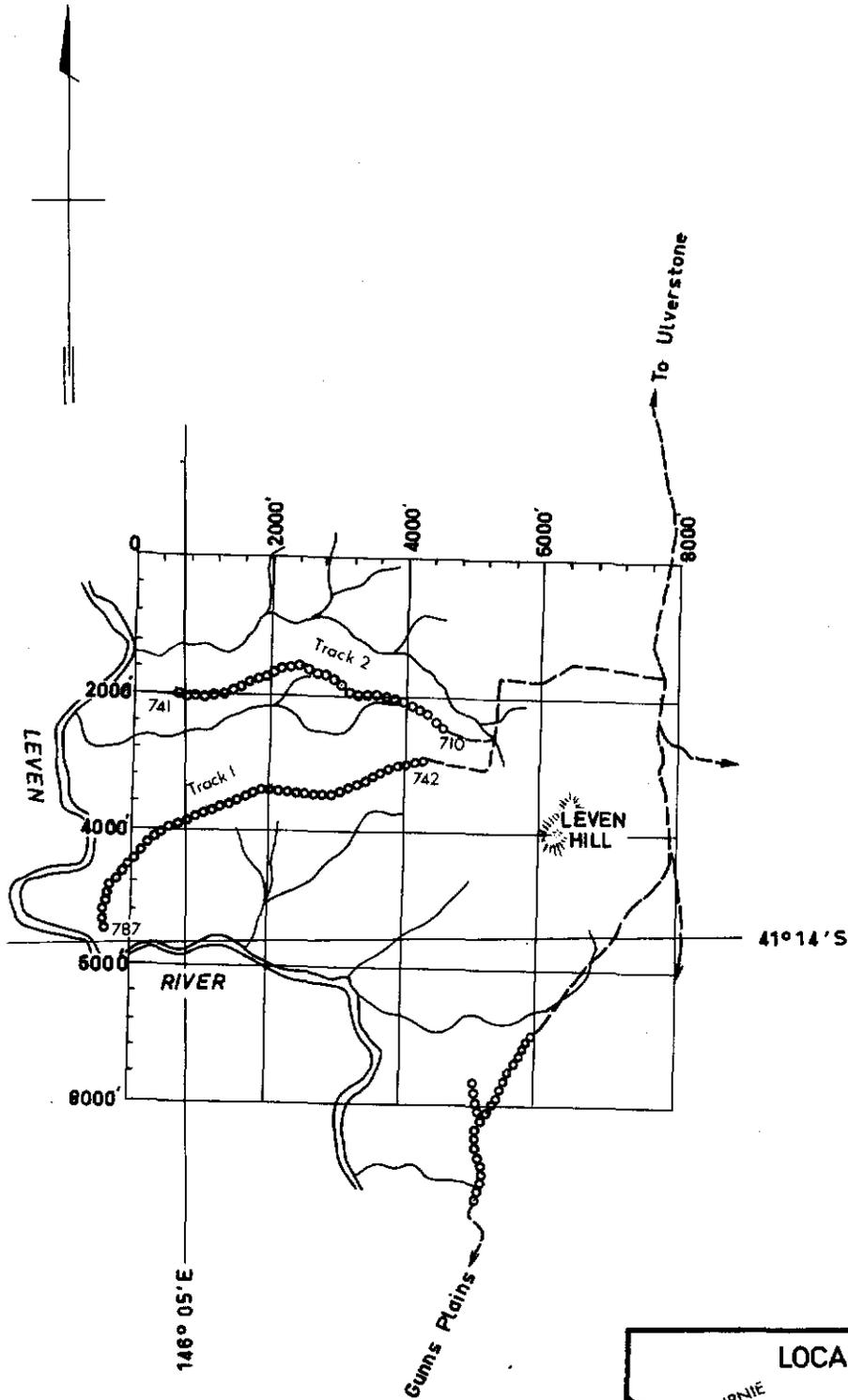
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SHEFFIELD TASMANIA E.L.15/65
STREAM SEDIMENT SURVEY
3RD ORDER TREND SURFACE & RESIDUALS FOR COPPER VALUES

Project No.
Tsh 48

Drawing No.
A4/1284

1021

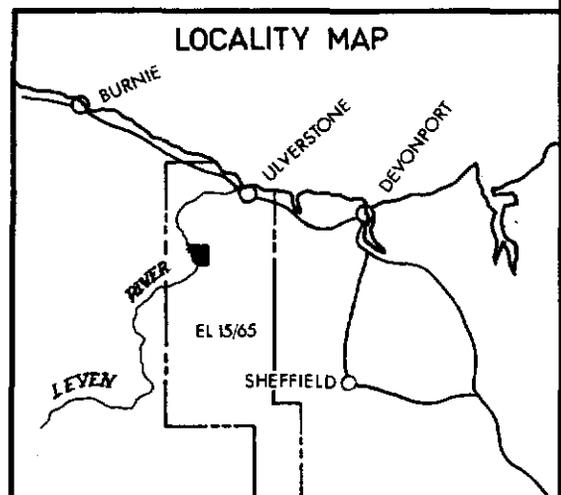
FIG. 7



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∞ Soil sample. (taken every 100')



C.I.

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Melbourne

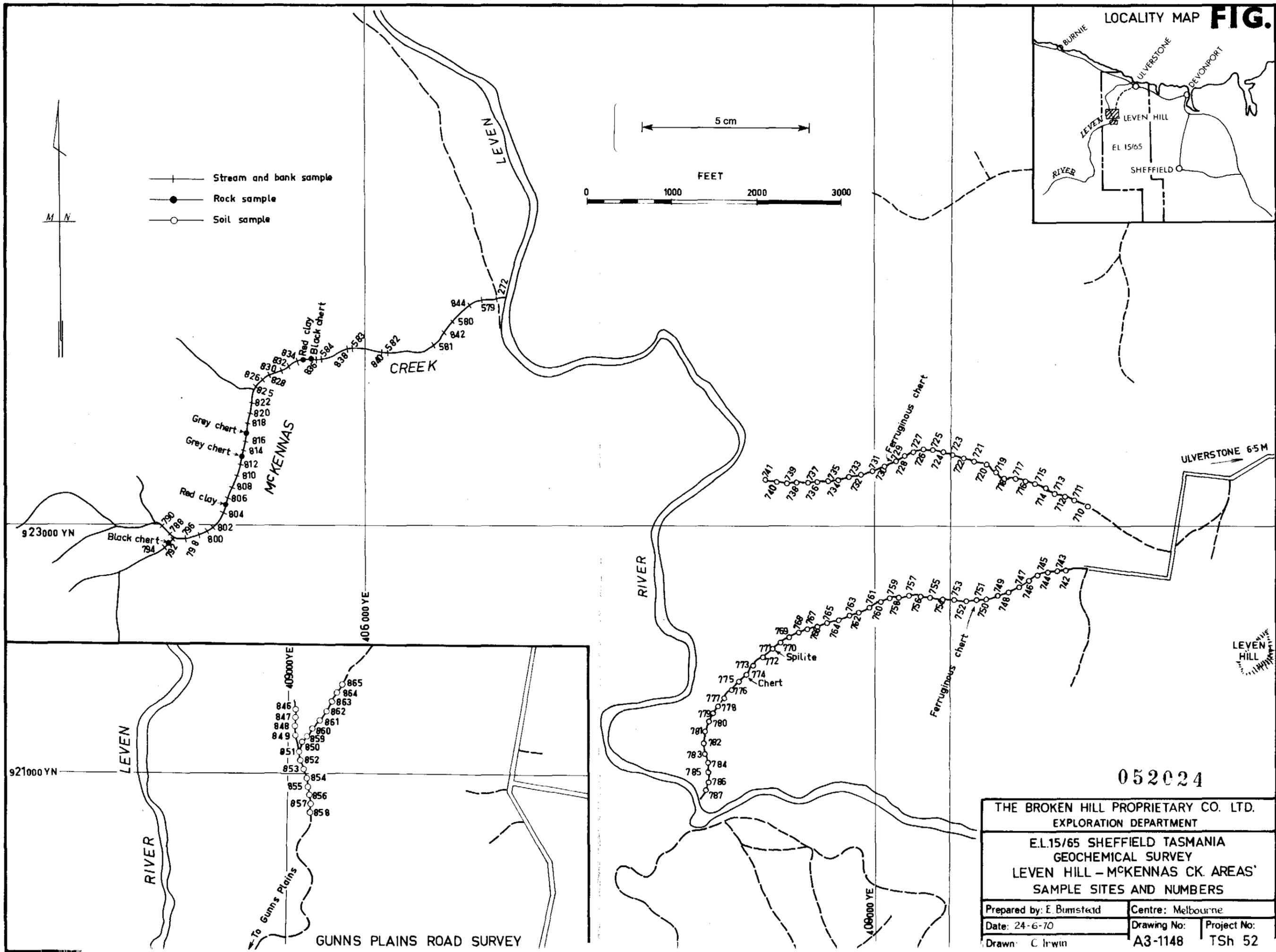
Date
18-5-70

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E.L.15/65 SHEFFIELD TASMANIA
SOIL SAMPLES - LEVEN HILL AREA.

Project No.
Drawing No.
A4/

022

LOCALITY MAP FIG. 8



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E.L.15/65 SHEFFIELD TASMANIA GEOCHEMICAL SURVEY LEVEN HILL - MCKENNAS CK. AREAS' SAMPLE SITES AND NUMBERS		
Prepared by: E. Bumstead	Centre: Melbourne	
Date: 24-6-70	Drawing No: A3-1148	Project No: TSh 52
Drawn: C. Irwin		

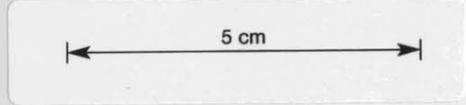
GUNNS PLAINS ROAD SURVEY

ULVERSTONE 6.5 M

LEVEN HILL

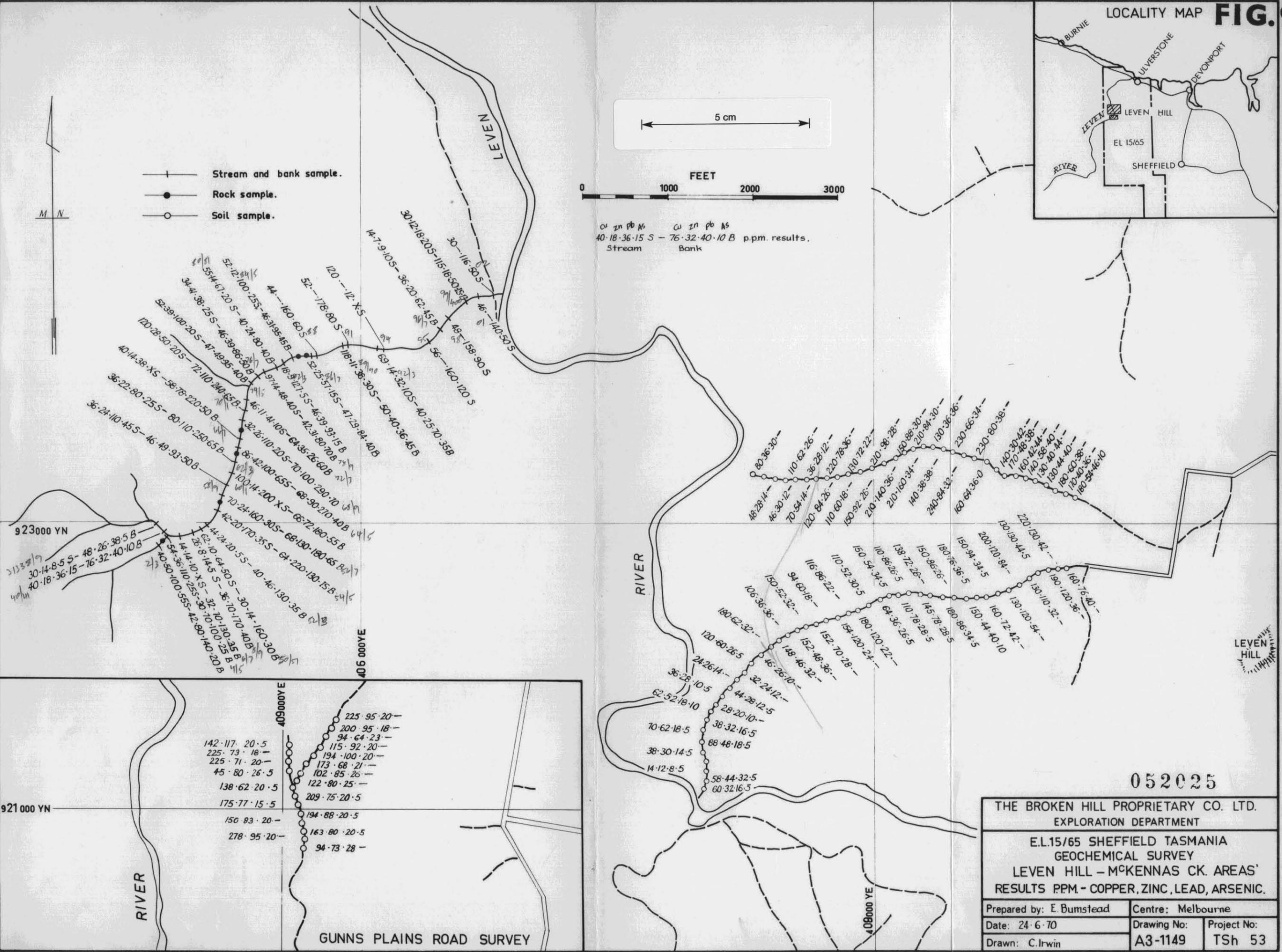
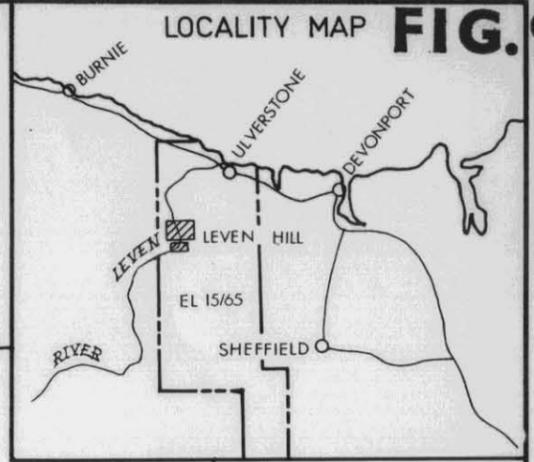


- +— Stream and bank sample.
- Rock sample.
- Soil sample.



0 1000 2000 3000
FEET

Cu Zn Pb As Cu Zn Pb As
40-18-36-15 S - 76-32-40-10 B ppm. results.
Stream Bank



923000 YN

921000 YN

4090000E

4060000E

408000 YE

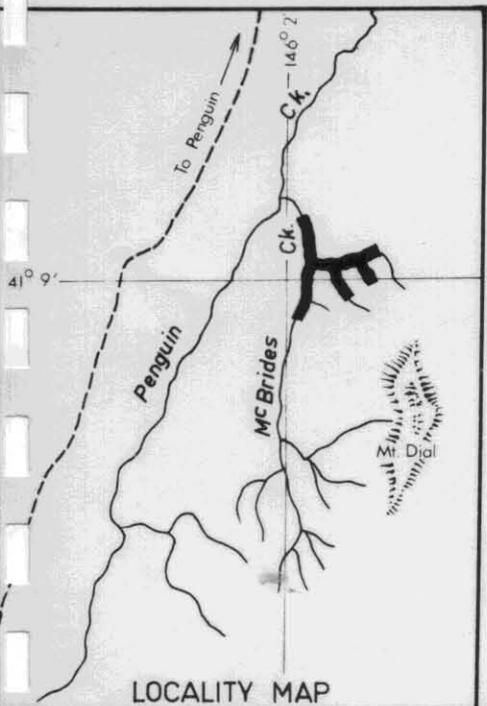
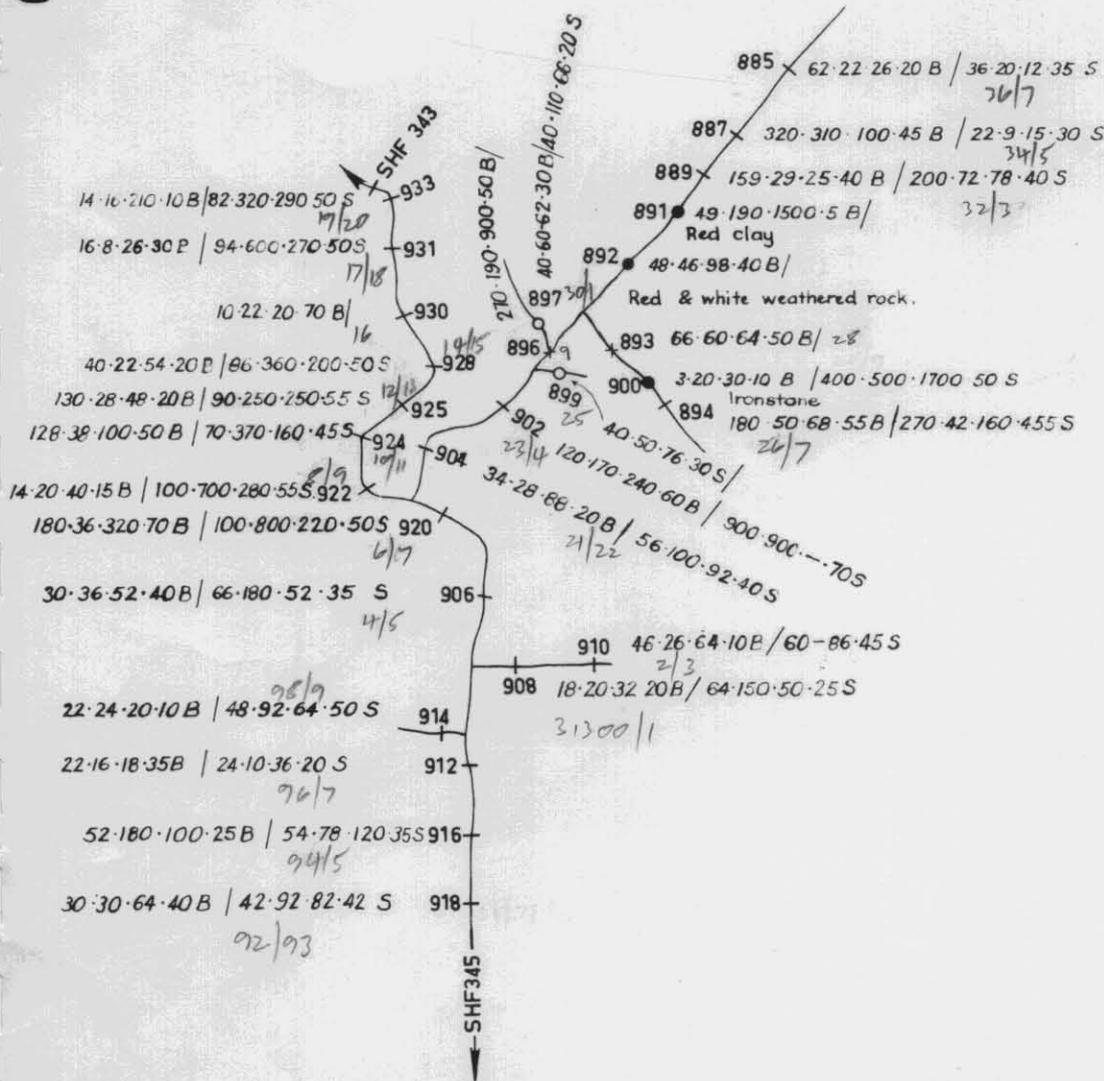
GUNNS PLAINS ROAD SURVEY

052025

THE BROKEN HILL PROPRIETARY CO. LTD. EXPLORATION DEPARTMENT		
E.L.15/65 SHEFFIELD TASMANIA GEOCHEMICAL SURVEY LEVEN HILL - MCKENNAS CK. AREAS' RESULTS PPM - COPPER, ZINC, LEAD, ARSENIC.		
Prepared by: E. Bumstead	Centre: Melbourne	
Date: 24.6.70	Drawing No: A3-1149	Project No: TSh 53
Drawn: C. Irwin		

FIG. 10

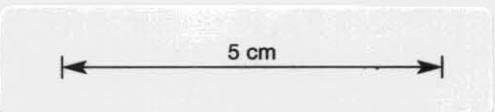
016



- x — Bank sample only.
- + — Stream & bank sample.
- o — Adit sample
- • — Rock sample

Cu Zn Pb As Bank Stream
17.36.28.52 B - S

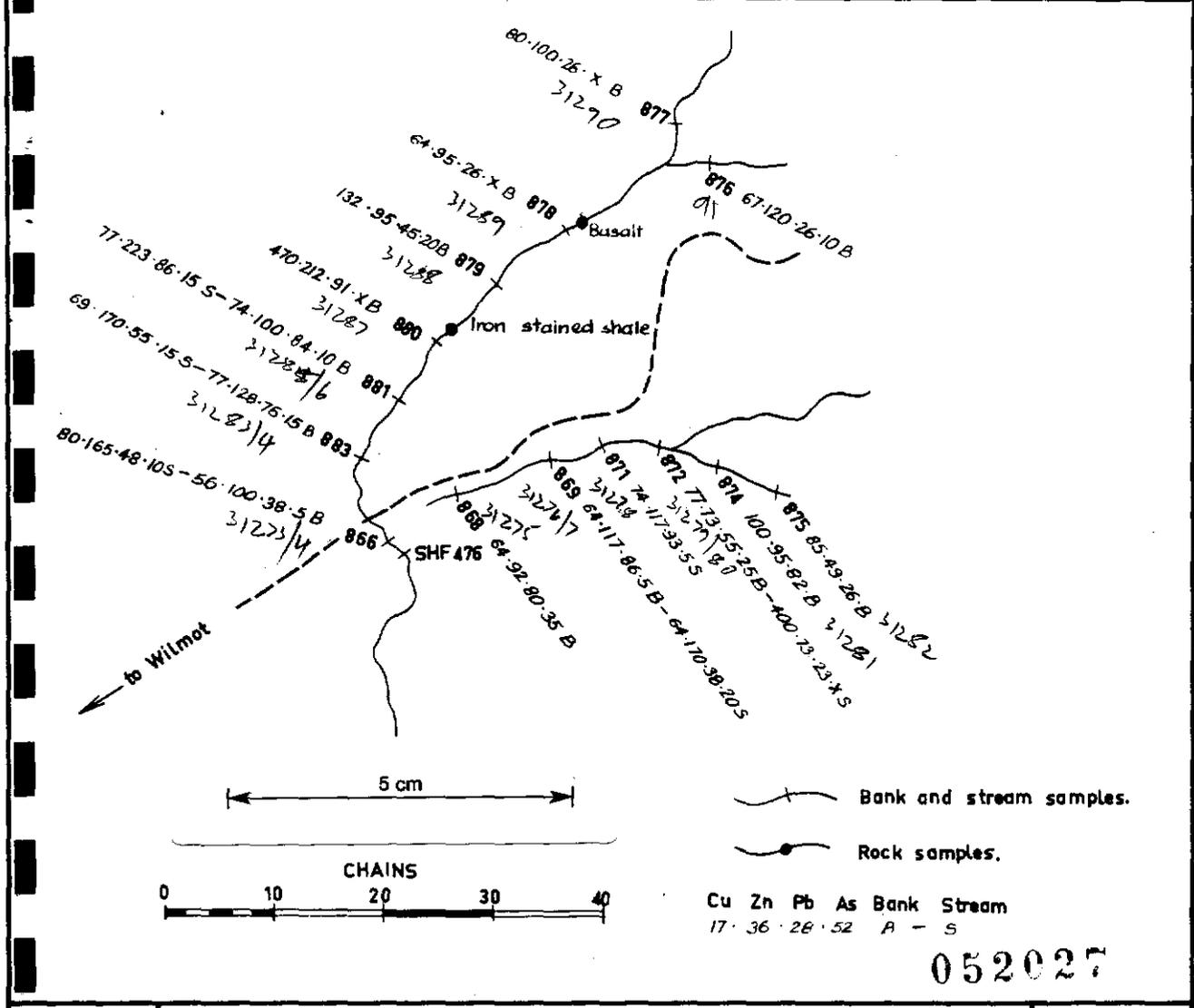
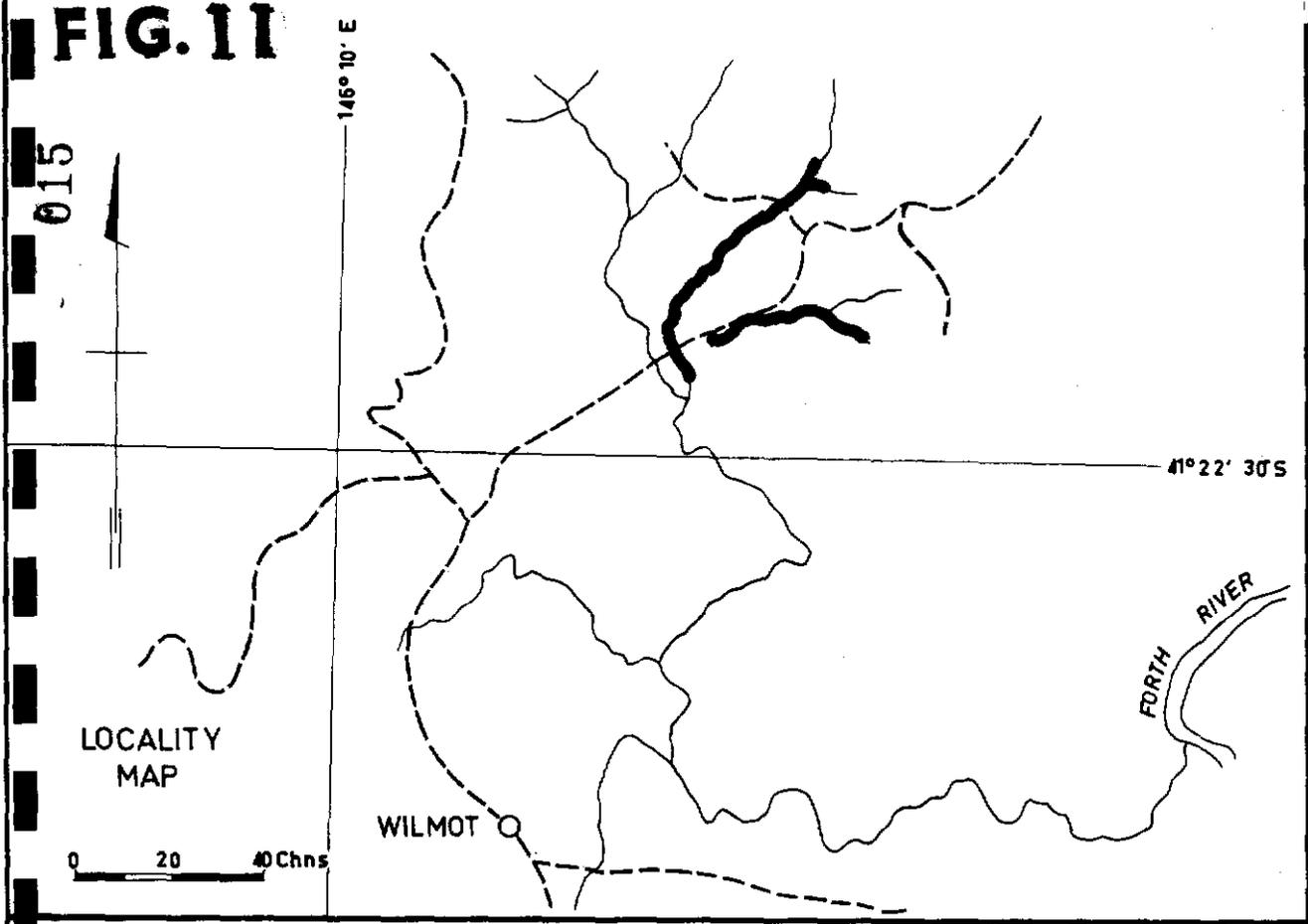
418 885
5444 125



052026

Centre Melbourne	THE BROKEN HILL PROPRIETARY CO. LTD.	Project No. TSh 50
Date 10.7.70	MCBRIDES CREEK AREA - E.L.15/65 SHEFFIELD TASMANIA	Drawing No. A4/1245
	GEOCHEMICAL SAMPLE SITES & VALUES - PPM. Cu, Zn, Pb, As.	

FIG. 11



Centre
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THE BROKEN HILL PROPRIETARY CO. LTD.

WILMOT AREA - E.L.15/65 SHEFFIELD TASMANIA

GEOCHEMICAL SAMPLE SITES & VALUES-PPM. Cu, Zn, Pb, As.

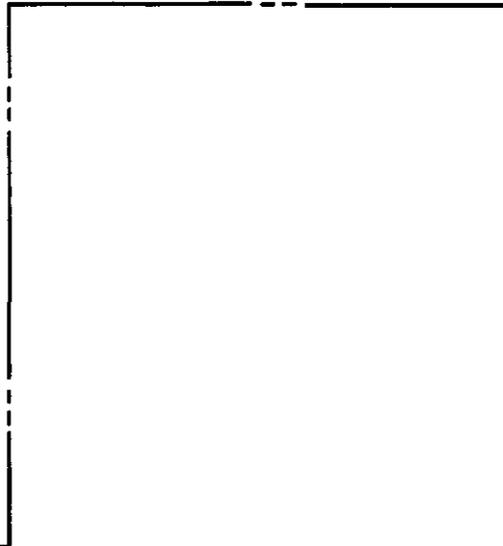
Project No.
TSh 47

Drawing No.
A4/1281

023

PENGUIN

FIG. 12



930

LEVEN

RIVER

920

5 cm

MILES

0 1 2 3

400

Topography from Devonport 1:63360 Geological sheet.

052028

410

Centre
Melbourne

Date
10.7.70

THE BROKEN HILL PROPRIETARY CO. LTD
E.L.15 65 SHEFFIELD TAS.
PART A
AREA NOT TO BE RELINQUISHED

Project No.
TSh 51
Drawing No.
A4/1282