REPT.BK.NO.74/230

TRINITY MINE - KING DAM GEOCHEMICAL SURVEY

M.H. STADTER

Department of Mines
South Australia

DEPARTMENT OF MINES
SOUTH AUSTRALIA

GEOLOGICAL SURVEY

TRINITY MINE - KING DAM GEOCHEMICAL SURVEY

by

M.H. STADTER
GEOCHEMICAL EXPLORATION SECTION

Rept.Bk.No.74/230
G.S. No. 5541
E.L. 141

18th March, 1975

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DEPARTMENT OF MINES
SOUTH AUSTRALIA

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ABSTRACT

Systematic soil sampling with ground magnetics and some I.P. was carried out in the Trinity Mine - King Dam area. Rock exposure is poor but the rocks are high grade metamorphics of the Willyama Complex.

About 3 680 soil samples were collected and analysed for Cu using A.A.S. Some samples were analysed for Pb, Zn, Ni, Co and Au.

A copper anomaly with a length of at least 6 km and average width of 300 metres occurs in the area. It is probably antiformal in structure with the Trinity Mine workings occurring near the nose of the fold.

A drilling programme of 3 diamond drill-holes and 5 rotary/percussion holes is recommended.

INTRODUCTION

Following the detection of several anomalous copper results by Mines Exploration Pty. Ltd. (1968), using shallow drilling to depths of about 20 feet, a programme of systematic soil sampling was planned for the Trinity Mine - King Dam area within E.L. 141.

Numerous old copper workings occur in the area with the most extensive being in the Trinity Mine area. The Mutooroo Mine, which is approximately 5 km north of the Trinity Mine, was the largest copper producer in the Olary Province until its closure in 1914.

LOCATION AND PHYSIOGRAPHY

E.L. 141 is situated approximately 20 km south of Cockburn, which is about 450 kms from Adelaide on the main Adelaide to Broken Hill highway, see Fig. 1. Access to the area is via a mail track which is passable to all vehicles except after heavy, prolonged rainfall.

The area is generally arid with little vegetation except for saltbush and occasional stunted trees. Unusual heavy rainfall in the last few years however, has resulted in a thicker than normal cover of vegetation.

Topographically the region is flat lying with gentle undulations cut by ephemeral streams.

GEOLOGY

Preliminary mapping and inspection of old mine dumps in the area has shown that the rocks are high grade metamorphics - amphibolites, schists, gneisses and pegmatites, with minor quartzite and aplite, of the Willyama Complex.

Poor rock exposure in the area has limited the understanding of the geology, and only major geologic trends can be interpreted from the outcrop distribution. No clear indication of dip direction could be obtained from the outcrop. All angular directions quoted in this report refer to true north.

The outcrop geology plan (Fig. 5) shows that the major geologic trend is approximately due east, and this is confirmed by the magnetic results of a geophysical survey (Pilkington, 1974). The location of outcrop is inaccurate in certain areas due to missing grid pegs, and this has been shown on the reliability diagram accompanying the outcrop geology plan.

Worthy of note are the numerous occurrences of amphibolite in the area. The amphibolite occurs mainly as float material, with occasional exposure which is usually jointed in several directions. The origin of the amphibolite is uncertain. Campana (in Campana and King, 1958) believes they are para-amphibolites, that is, they are metamorphosed sediments. Brooke (1966) however favours an igneous origin and calls them ortho-amphibolites.

GEOCHEMISTRY

Sampling

The area of investigation was previously part of two Special Mining Leases held by Broken Hill South Ltd. and Mines Exploration Pty. Ltd., and both of these companies gridded the area. The Mines Exploration Pty. Ltd. grid, which was based on a 500 foot line spacing, was better defined in the area of interest because it had a greater number of reference pegs. This grid was subsequently used for the sampling survey.

Geochemical sampling consisted mainly of surface soil sampling, with the depth of sampling being approximately 15 cms. Shallow drilling and stream sediment sampling was also attempted. The sampling was carried out in various stages, as shown in Table 1, and these are discussed below. For the location of sampling see Fig.2.

Reconnaissance Sampling: An initial soil sampling survey was undertaken at the end of May, 1974. The samples were taken at 100 ft intervals along 4 randomly spaced north-south grid lines.

Programme I: A sampling programme along 7 lines each 10 000 ft long and 2 000 ft apart, was completed at the beginning of July, 1974. Approximately 700 soil samples were collected at 100 ft intervals along the lines.

Prior to the above sampling, an attempt was made to use a power post-hole digger to obtain samples from a depth of 1 metre or greater. Unfortunately this proved to be an unsuccessful and expensive exploration method. Sample recovery was poor, penetration rate very slow, and there was little variation in metal content between samples collected at the surface with those collected at the bottom of the drill-holes. The poor recovery and difficult drilling conditions were due to dampness of the soil and the common occurrence of a calcrete layer approximately 20 cm below the surface. The average depth of the drill-holes was 40-70 cm and the maximum depth was 1.4 metres. The little variation in metal content between surface and drill-hole samples is shown in Fig. 3.

Consequently surface soil sampling was considered the most effective exploration method in the area.

TABLE I

DESCRIPTION OF SAMPLING

SAMPLING	NUMBER OF SAMPLES	ELEMENTS ANALYSED FOR	METHOD OF ANALYSIS	ANALYSIS DONE BY
Reconnaissance				
Soil Sampling	95	Cu, Pb, Zn, Au	AAS on -80#	AMDEL (Report No. AN4587/74)
Programme I				
Drilling	30	Cu, Zn,	AAS on -80#	DEPT. OF MINES
Soil Sampling	Approx. 700	Cu, Zn (Approx. 440)	AAS on -80#	" " "
Programme II				
Soil Sampling	Approx. 1 300	Cu	AAS on -80#	DEPT. OF MINES
Programme III				
Stage 1. Soil Sampling	732	Cu	AAS on -80#	AMDEL (Report No. AN1404/75)
Stream	12	Cu, Pb, Zn, Au	AAS on -80#	AMDEL (Report No. AN1428/75)
Stage 2. Soil Sampling	853	Cu, Co, Ni	AAS on -80#	AMDEL (Report No. AN1937/75)
Hand Auger	5	Cu, Pb, Zn, Co, Ni, Au	AAS on -80#	AMDEL (Report No. AN1834/75)

Programme II: In order to delineate an east-west trending anomalous zone south-west of King Dam, which was established by earlier sampling, detailed soil sampling was carried out in early August, 1974. About 1 300 samples were collected, 800 of which were collected at 50 ft intervals and the remainder at 100 ft intervals.

Programme III: Detailed soil sampling in the Trinity Mine area and to the south-west of the Mine was planned for the end of September, 1974. Heavy rainfall in the area resulted in the sampling being done in two stages.

During the first stage, 732 soil samples were collected at 50 ft intervals along 12 lines. As well as this, 12 stream sediment samples were collected and their locations and results are shown in Fig. 4.

A total of 862 soil samples were collected along 18 lines at 50 ft intervals during the second stage of sampling. Also, two previously established geochemical anomalies, at 160S 73E and 172.5S 67.5E, were hand-augered to depths of 1 metre and 0.7 metres respectively.

Results

Copper:

The geochemical soil sampling defined several anomalous copper areas, shown as areas A, B, C and D in Fig. 6, and most of these have associated magnetic anomalies (Pilkington, 1974). An attempt was made to determine whether there was any correlation between areas of low copper content and areas covered by transported soil. Transported soil representing either wind-blown or stream carried material. No clear correlation could be made, except for some areas of relatively lower copper values which were covered by red, wind-blown sand.

Area A is the largest anomalous zone, with a length of at least 2.2 km and a width of approximately 400 metres. The mean copper value for this zone is about 150 ppm with values as high as 0.21%, compared with an estimated regional background of 25 ppm. The zone is flanked on either side by east-west trending magnetic highs. The limited I.P. work done in this area showed little response. Old workings occur in the area, with pyrite and malachite being present in the dump material. The zone has an obvious east-west trend, which if extended to the east would include the Trinity Mine workings. Further sampling is required to determine the western extent of the zone, particularly since the magnetic anomaly extends in this direction.

Area B is a lower order anomalous zone with a mean copper value of about 65 ppm. No obvious trend of the zone is visible and there is no associated magnetic or I.P. anomaly.

Area C is similar to area A, in that the zone has old workings and is associated with a magnetic anomaly. The mean copper value is approximately 85 ppm with a maximum value of 330 ppm. The zone, which is about 300 metres wide, trends north-east and if it is projected in this direction would also include the Trinity Mine workings. Its south-western extent is uncertain but it is likely that it extends further in this direction,and close-spaced sampling is required to determine this extent.

Area D is an anomalous zone which includes the Trinity Mine workings and has a maximum copper value of 0.355%. This value, as well as other high copper values, was obtained close to the large dump sites from the workings. Although contamination is suspected, the zone is considered anomalous because of the presence of the old workings, and the association of a magnetic anomaly with the geochemical anomalous zone (as in areas A and C). I.P. work in the area also produced several anomalies, particularly over the Trinity Mine workings.

From an inspection of geochemical anomalies in area D, there appeared to be an association of high copper values with pegmatite and amphibolite outcrop. The two geochemical highs that were hand-augered (the results for which are shown in Table 2 below) were both associated with amphibolite and pegmatite outcrop.

TABLE 2

RESULTS FOR HAND-AUGER HOLES

SAMPLE		RESULTS (in ppm)					
		Cu	Pb	Zn	Co	Ni	Au
<u>160S - 73E</u> :	0 m	140	-	-	-	-	-
	0.45 m	70	5	22	12	5	<0.05
	0.75 m	130	<5	85	30	5	<0.05
	1.0 m	150	<5	110	30	20	<0.05
<u>172.5S - 67.5E</u> :	0 m	130	-	-	-	-	-
	0.45 m	220	8	55	32	5	<0.05
	0.7 m	170	<5	95	22	5	<0.05

<u>Other Elements</u>: Although exploration was based mainly on the determination of the extent of the anomalous copper zones, analysis for Zn, Pb, Ni, Co and Au was also done. Table I shows which samples were analysed for particular elements, and gives reference to results which are not included in this report.

The value for these elements were considered non-anomalous.

<u>Interpretation</u>

Interpretation of the anomalous copper areas is difficult, due mainly to the lack of adequate rock exposure in the area. As an anomalous region it is very promising due to the following reasons:

(1) The most striking feature is the size of the anomalous zone, particularly since area A is thought to extend eastwards at depth to include the Trinity Mine workings. It is also possible that area C extends north-eastwards at depth to include the same workings. If this is true, the anomalous zone would take the shape of either a large antiform plunging north-eastwards or a large synform plunging south-westwards, with the Trinity Mine workings occurring near the nose of the fold. Observations made by Brown (1908) on the lode formation at Trinity

Mine favour the antiform structure, with the lode formation dipping towards the north-east.

The overall length of the anomalous zone would be at least 6 kms, with a width of approximately 300 metres.

(2) Another feature of the zone is its association with anomalous magnetic values, with the copper zone lying between two magnetic highs. This could be due to some type of differentiation in the mineralized zone. The magnetics also suggest the fold structure.

The I.P. results were significant over the Trinity Mine workings and suggest vein-type mineralization.

(3) Exploration carried out by Mines Exploration Pty. Ltd. shows that metal content increases with depth. Their results also suggest continuity of the anomalous zone at depth across areas where surface sampling has produced low metal values.

(4) If the assumption of the antiformal mineralized zone is true, then the existence of a stratigraphically controlled orebody on a limb of the antiform is possible. This can only be determined by drilling.

RECOMMENDATIONS

Further work both inside and outside the area of interest is strongly recommended.

A detailed drilling programme consisting of 3 diamond drill-holes and 5 rotary/percussion holes is proposed (see Fig. 5 for proposed drill-hole locations). This will enable determination of the nature and extent of the mineralization, and also the nature and relationship of the rock types. The diamond drill-holes should be drilled to a depth of at least 200 metres and they should be inclined at 60^o to the horizontal. The direction of drilling, indicated in Fig. 5, should be opposite to the dip directions suggested by the magnetic results (Pilkington, 1974). The rotary/percussion holes should be drilled vertically to a depth of about 100 metres.

The location of the proposed drill-holes is based on the Mines Exploration Pty. Ltd. data, the surface geochemistry and geophysics. The basis of choice for the location of the drill-holes is described below.

1. D.D.H. 1, is designed to test the anomalous zone in area A. This is the widest surface anomalous zone and the highest shallow drilling result from the Mines Exploration Pty. Ltd. data occurs in this zone.
2. D.D.H. 2, is designed to drill the nose of the antiform close to the Trinity Mine workings. The hole would be sited on an anomalous I.P. area and close to one of the highest magnetic anomalies.
3. D.D.H. 3, is to be sited on the largest I.P. anomaly, which has associated high surface geochemical values and also high shallow drilling results (Mines Exploration Pty. Ltd.).
4. P.H. 1, 2, 3 and 5 are designed to test the extent and continuity of the mineralised zone. Their locations are based mainly on the surface geochemistry and magnetics.
5. P.H. 4 is designed to test area B which is different to the other anomalous areas. Although the surface geochemical values are lower and there is little magnetic or I.P. response, the shallow drilling suggests high metal values at depth.

Further work should be done outside the area of interest to determine the western extent of area A and the south-western extent of area C. Surface soil sampling is recommended.

MHS:FdeA
18/3/75

M.H. STADTER

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Brown, H.Y.L., 1908. Record of the Mines of South Australia.

Campana, B. and King, D., 1958. Regional Geology and Mineral Resources of the Olary Province. Bull. Geol. Surv. S. Aust., 34.

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Pilkington, G., 1974. E.L. 141 Trinity Mine - King Dam Geophysical Survey, August, 1974. S. Aust. Dept. Mines unpublished report 74/221.

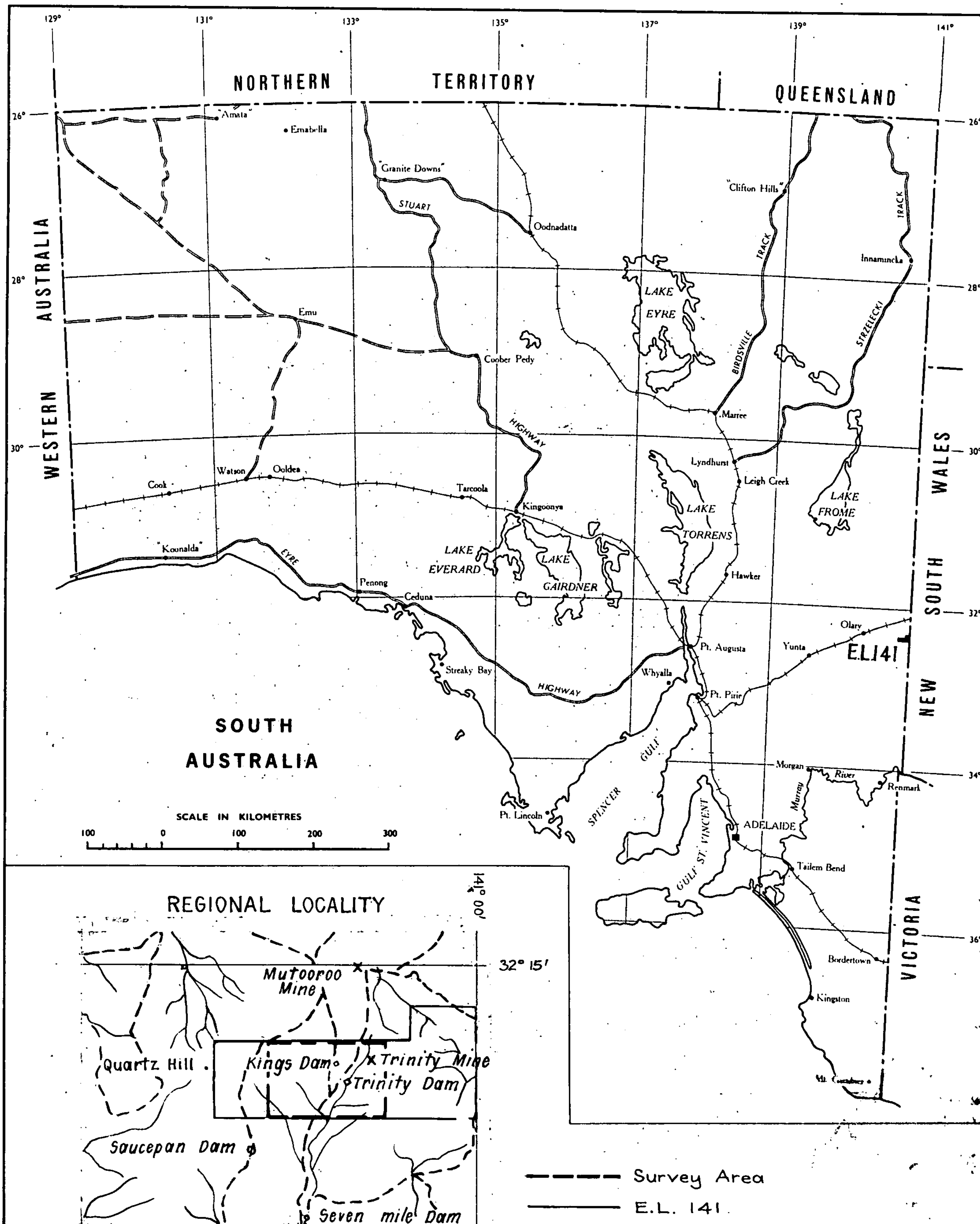


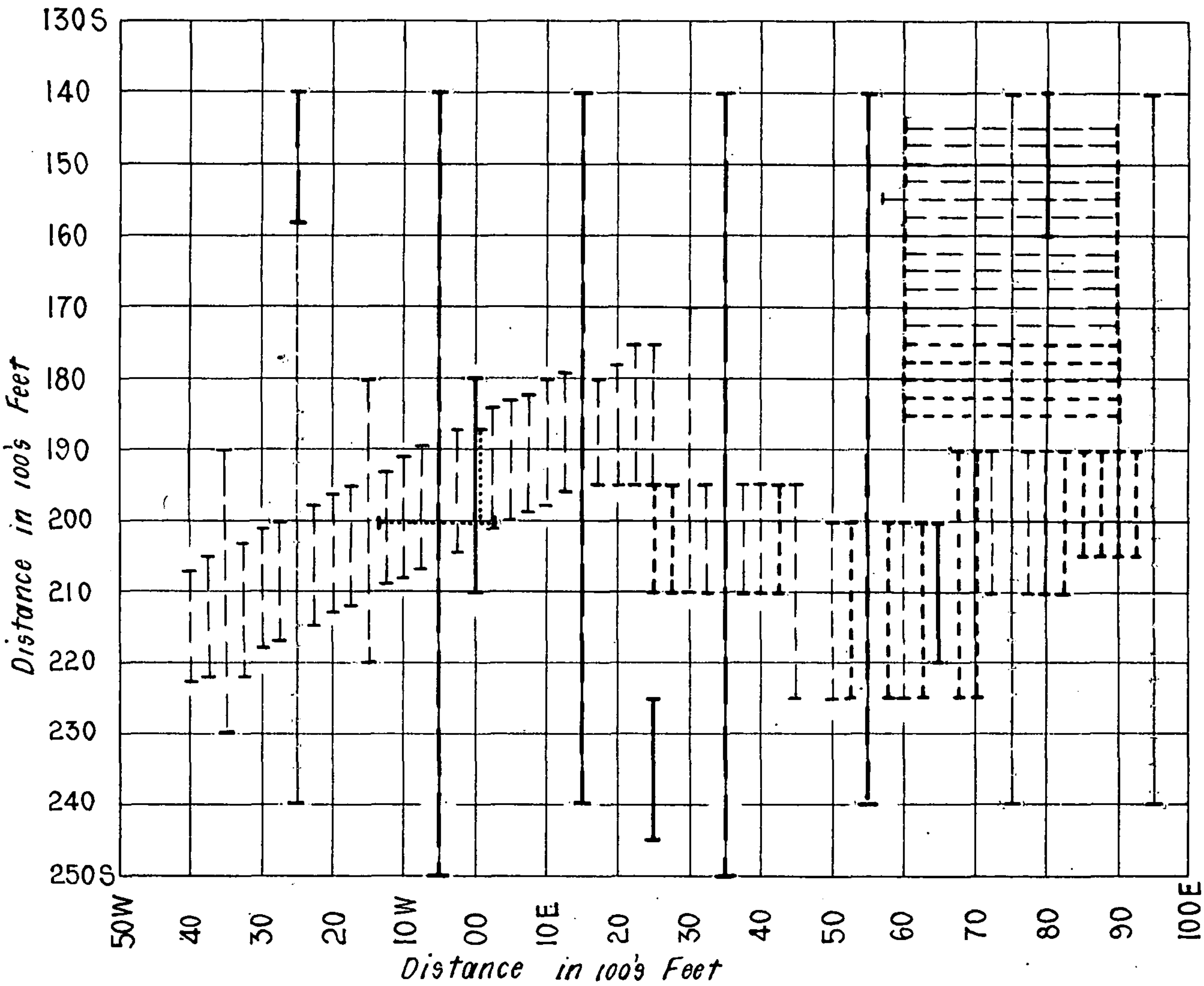
FIG I.

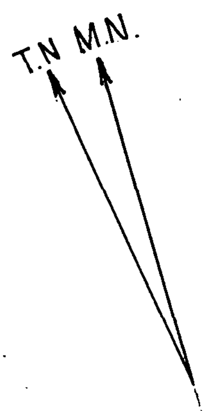
DEPARTMENT OF MINES — SOUTH AUSTRALIA

Compiled. F. STADTER	TRINITY MINE-KING DAM AREA GEOCHEMICAL SURVEY LOCALITY PLAN	Date: 23 DEC. 1974
Drn. B.D.W. Ckd.		Drg. No. S11157

P.F No 55850 994 2

7033





LEGEND

Type of Sampling	Elements Analysed
Soil (solid line)	Cu, Pb, Zn, Au.
Soil (long dash)	Cu, Zn.
Soil and drilling (dotted)	Cu, Zn.
Soil (dash)	Cu.
Soil (short dash)	Cu, Co, Ni.

SCALE

0 — 5000 FEET

0 — 1500 METRES

FIG. 2

DEPARTMENT OF MINES — SOUTH AUSTRALIA

GEOCHEMICAL SECTION	Drn.	TRINITY MINE - KING DAM GEOCHEMICAL SURVEY LOCATION OF SAMPLING	SCALE: 1 : 3048
	Tcd.		S11151
M.H.STADTER GEOLOGIST	Ckd.		
	Exd.		DATE: 29 NOV. 1974

500-2.69 665

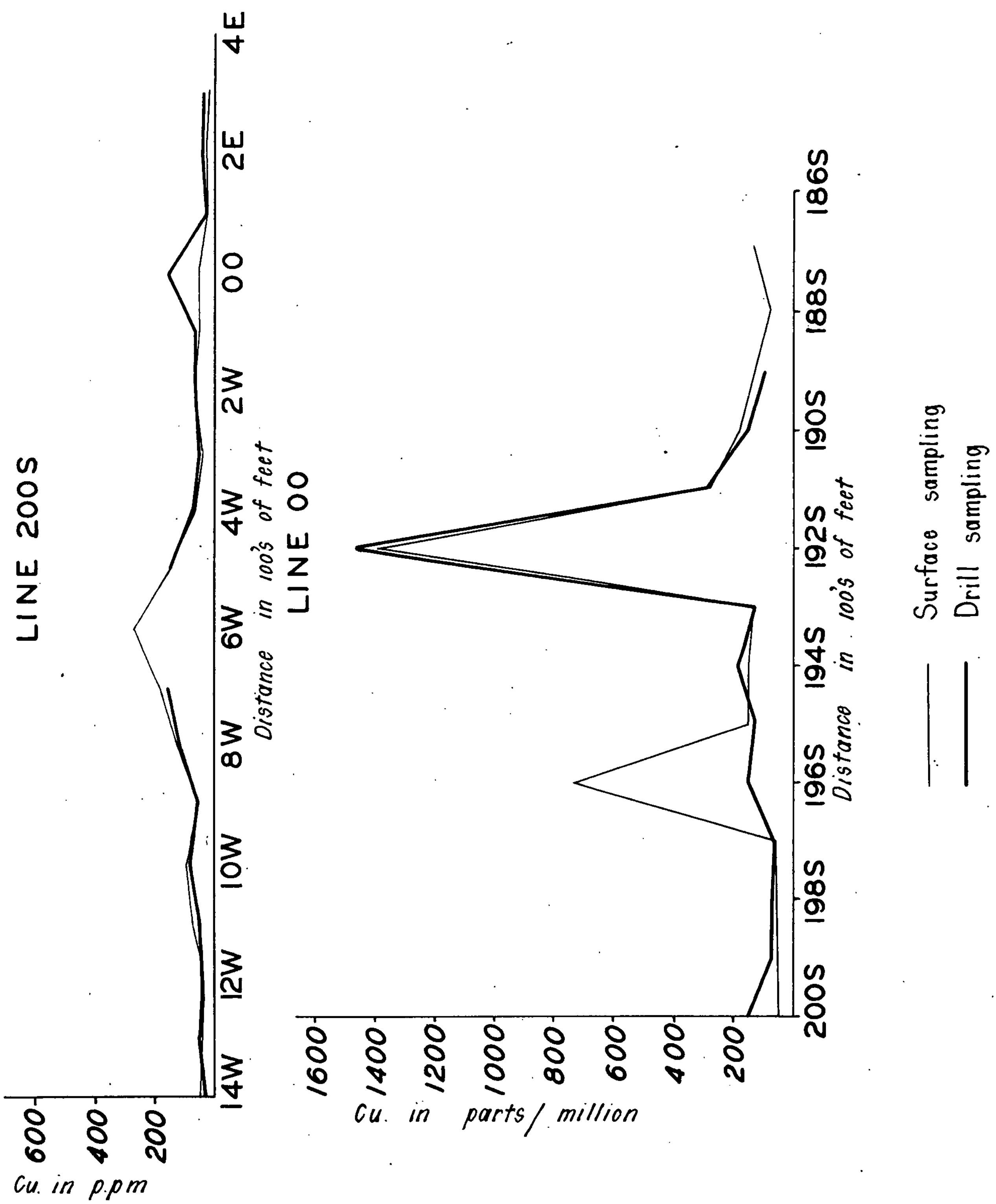
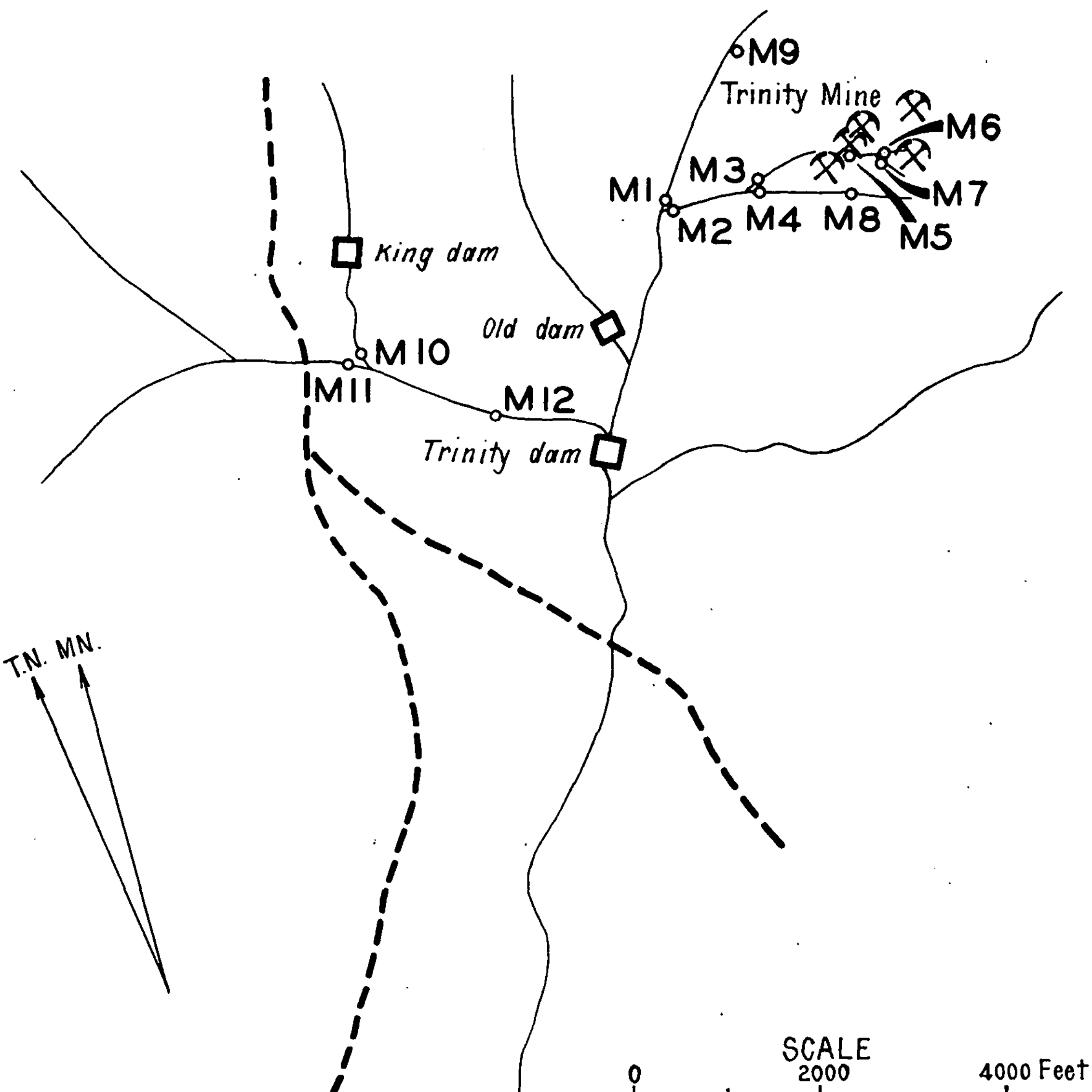


FIG. 3

DEPARTMENT OF MINES — SOUTH AUSTRALIA

GEOCHEMICAL SECTION	Drn. M.S.	TRINITY MINE – KING DAM GEOCHEMICAL SURVEY COMPARISON OF DRILL AND SURFACE COPPER VALUES	SCALE: 1 : 6096 HORIZ.
	Tcd. B.W		S11149
M. H. STADTER GEOLOGIST	Ckd.		
	Exd.		DATE: 29 NOV. 1974

500–2.69 665



STREAM SEDIMENT SAMPLE	METAL VALUES (p.p.m) Cu	Pb	Zn	Au
M1	38	8	25	<0·05
M2	18	10	32	<0·05
M3	90	10	32	<0·05
M4	30	8	40	0·05
M5	50	12	38	<0·05
M6	32	10	35	0·05
M7	30	<5	45	<0·05
M8	25	<5	30	<0·05
M9	22	10	40	<0·05
M10	30	<5	48	<0·05
M11	65	<5	70	<0·05
M12	35	5	42	<0·05

FIG.4

DEPARTMENT OF MINES — SOUTH AUSTRALIA

GEOCHEMICAL SECTION	Drn. M.S.	TRINITY MINE – KING DAM GEOCHEMICAL SURVEY STREAM SEDIMENT SAMPLING	SCALE: 1 : 24000
	Tcd. B.W		S11150
M.H. STADTER GEOLOGIST	Ckd.		
	Exd.		DATE: 28 NOV. 1974

500–2.69 685

FIG. 5

DEPARTMENT OF MINES — SOUTH AUSTRALIA

TRINITY MINE – KING DAM AREA GEOCHEMICAL SURVEY

OUTCROP GEOLOGY

GEOCHEMICAL SECTION	M.H. STADTER GEOLOGIST	Compiled M.H.S	Scale: 1:6000
Director of Mines		Drn. B.D.W.	Date: 14 JAN. 1976
		Ckd.	Drg. No. 75-30

7033

FIG. 6

DEPARTMENT OF MINES — SOUTH AUSTRALIA

TRINITY MINE – KING DAM AREA GEOCHEMICAL SURVEY

COPPER VALUE PROFILES AND PROPOSED DRILLING PROGRAMME

GEOCHEMICAL SECTION	M.H. STADTER GEOLOGIST	Compiled M.H.S	Scale: 1:6000
			Date: 14 JAN. 1975
Director of Mines		Drn. B.D.W.	Drg. No. 75-31
		Ckd.	

7033

500-6.72 C5553

FIG. 7

DEPARTMENT OF MINES — SOUTH AUSTRALIA

TRINITY MINE – KING DAM AREA GEOCHEMICAL SURVEY

COPPER VALUES

GEOCHEMICAL SECTION	M.H. STADTER GEOLOGIST	Compiled M.H.S	Scale: 1:6000
Director of Mines		Drn. B.D.W.	Date: 14 JAN 1976
		Ckd.	Drg. No. 75-32

7033

FIG. 8

DEPARTMENT OF MINES — SOUTH AUSTRALIA			
TRINITY MINE – KING DAM AREA GEOCHEMICAL SURVEY			
ZINC VALUES			
GEOCHEMICAL SECTION	M.H. STADTER GEOLOGIST	Compiled M.H.S.	Scale: 1:6000
			Date: 14 JAN. 1976
		Drn. B.D.W.	Drg. No. 75-33
Director of Mines		Ckd.	

7033