DEPARTMENT OF MINES
SOUTH AUSTRALIA

GEOLOGICAL SURVEY
METALLIC RESOURCES DIVISION

GEOCHEMICAL EXPLORATION OF THE RIVERTON AND EUDUNDA 1:63 360 SHEETS COMPLETION REPORT

by

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21st October, 1976.

Rept.Bk.No. 76/134
G.S. No. 5804
D.M. No. 1308/57
1192/62

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DEPARTMENT OF MINES
SOUTH AUSTRALIA

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ABSTRACT

About 1,500 samples were collected during a stream sediment sampling survey on the Riverton and Eudunda 1:63 360 geological sheets and analysed for Cu, Pb, Zn, Au, W, Mo, Nb, Co and Mn. Rolling means, residual values, correlation coefficients and mean values for Groups were computed for Cu, Pb, Zn and Mn to help define anomalous areas. The distribution of anomalous values indicates higher metal content in the Appila and Pepuarta Tillites and siltstones of the Saddleworth, Tapley Hill and Woolshed Flat Formations. Areas of anomalous Cu-Zn, Pb-Zn, W and Au values require more detailed geochemical work.

INTRODUCTION

About 1,500 stream sediment samples were taken on the Riverton and Eudunda 1:63 360 geological sheets from March to June 1975. This sampling programme was undertaken as part of the geochemical exploration of the Adelaide 1:250 000 sheet, for which a preliminary report by Sibenaler & Rogers (1974) gives information on orientation studies. Figure 1 shows the position of the 1:63 360 sheets in this area, and the division of each 1:63 360 sheet into four parts for this project.

The Riverton 1:63 360 sheet comprises the Halbury and Riverton 1:50 000 sheets, and the Eudunda 1:63 360 sheet comprises the Eudunda and Mt. Mary 1:50 000 sheets.

The sampling method differs from previous projects on the Adelaide 1:250 000 sheet in that a one kilometre grid was used as a guide to the positioning of sample points, resulting in one sample being taken for every square kilometre. This was done in order to attain a more equal distribution of sample points for contour maps and to reduce the number of samples. M. Stadter (pers. comm. 1975) has shown that contour maps produced by this density of sampling on the Adelaide 1:63 360 sheet still retained the precision to delineate the same anomalous areas and regional trends as the original sampling density. The position of each sample point is a compromise between:-

(a) sampling near a grid point

(b) sampling equal catchment areas

(c) sampling all catchment areas.

Information on analytical results and sample localities are contained in the Mines Department computer file MIANALYSIS. Geometric rolling mean maps and residuals were used to help outline anomalous areas suitable for follow up work. Much of the western portion of the Riverton and the eastern portion of the Eudunda 1 mile sheets, which are under a thick cover of Cainozoic sediments, were not sampled.

TOPOGRAPHY AND CLIMATE

The Mount Lofty Ranges with the North Adelaide Plains to the west and the Murray Plains to the east form the main topographic divisions in the survey area. Between Eudunda and Riverton are three prominent NS trending ridges, separating wide valleys in which flow the Julia

and Tothill Creeks. The maximum elevation is 636 metres at Smith Hill within the Tothill Ranges just west of Ngapala. West of Riverton and east of Eudunda the topography falls below 366 metres and low hills separate broad valleys. The Rivers Gilbert and Wakefield flow from this terrain toward the Gulf of St. Vincent. Hoyleton and Sutherlands mark the western and eastern edges of the North Adelaide Plains and Murray Plains respectively.

Climatic conditions in the survey area are typically Mediterranean with average annual rainfall ranging from 425 mm at Hoyleton to 525 mm at Riverton and 275 mm at Sutherlands. Major streams in the area are perennial and show a parallel drainage pattern between Eudunda and Riverton. West of Riverton, the north south trend of the major drainage channels becomes less pronounced until streams conform to a dendritic pattern flowing westward onto the North Adelaide Plains. All streams east of Eudunda flow in an easterly direction, are ephemeral and have a dendritic drainage pattern.

Geology

The geology of the Riverton and Eudunda 1:63 360 sheets is shown on Figures 2 and 3. Pre-Tertiary sequences in the survey area trend in a north south direction and consist of rocks of the Adelaidean System and the Kanmantoo Group. In the west of the Mt. Lofty Ranges, phyllites, quartzites and dolomites of the Willouran Series (River Wakefield Group) crop out, succeeded to the east by sandstones, siltstones, dolomites, quartzites and shales of the Burra Group. East of the Gilbert Ranges,

tillites, shales, siltstones and limestones of the Umberatana Group crop out, along with members of the Burra Group, in the cores of anticlines, and minor outcrops of Ulupa Sandstone (Wilpena Group) in the synclines. The Tarnma Diapir situated 4 kilometres west of Tarnma crops out within the Burra Group in the core of one of the anticlines. East of the Mt. Lofty ranges, metasiltstones and greywackes of the Kanmantoo Trough crop out between Eudunda and Sutherlands. Minor outcrops of Ordovician dolerites and albitised granitic intrusives also occur within the Umberatana and Kanmantoo Groups in this area.

MINERALIZATION

Known mineralization within the survey area is restricted to the Peter's Hill Mine and several other minor occurrences. Small copper shows occur within the Blyth and Auburn Dolomites and the Appila Tillite. Gold is found within the Appila Tillite near Hamilton and barite has been found in the Auburn Dolomite.

The Peter's Hill Mine in the Mintaro Shale 8 km east of Riverton has been described by Nixon (1964). Sediments in the mine area are phyllitic and arenaceous dolomites, magnesites and quartzites. Small lenses of quartz parallel to the bedding and carrying silver, lead and copper minerals, predominantly of a secondary nature, have been mined. Small quantities of copper sulphide and possibly lead sulphide were identified in the country rock. There is a marked difference in the relative abundances of the minor elements (Co, Ni, Ag, Cr, Va, Mn, Ba, Ti) between the sediments and the lode rock. Similar occurrences are found in approximately this stratigraphic position elsewhere in the area. Nixon suggests that the quartz veins in the

mine area are of metamorphic origin due to migration of Si, and Cu, Ag and Pb along pressure and temperature gradients.

GEOCHEMISTRY

In this survey, a one kilometre grid was used as a guide to the positioning of sample points giving a density of sampling of one sample/sq. kilometre (see Introduction). Approximately 1,000 samples were taken on the Riverton sheet and 500 on the Eudunda sheet; sampling depth was 20 cm. The <-180 micron size fraction of each sample was analysed by AMDEL for Cu (5), Pb (5), Zn (1) and Au (0.05) using atomic absorption analysis (± 5%) and W (50), Nb (20), Mn (10), Mo (3) and Co (5) using semi-quantitative emission spectroscopy (± 10%). Detection limits (in ppm) for elements and accuracies for each method are given in brackets.

Copper, Lead, Zinc and Manganese

STATISTICAL INFORMATION

Copper Pb, Zn and Mn contents in stream sediments are shown on Figure 5. Table 1 shows statistical data for these elements. The values more than 1 km downstream from the topographically higher Group boundaries were used in the computation of means for each Group to ensure that the values are representative.

TABLE 1

STATISTICAL RESULTS FOR RIVERTON AND EUDUNDA

GEOLOGICAL GROUPS

	River Wakefield	Burra	Umberatana	Kanmantoo	Recent and Tertiary
No. Samples	103	535	429	26	163
Cu mean	12	14	17	22	20
S.D.	5	7	7	5	8
mean + 2 S.D.	24	28	31	32	37
Pb mean	14	17	17	20	17
S.D.	7	11	8	6	8
mean + 2 S.D.	28	38	33	32	33
Zn mean	25	33	40	48	43
S.D.	12	20	24	14	20
mean + 2 S.D.	50	73	87	76	84
Mn mean	114	104	94	100	119
S.D.	65	70	50	27	97
mean + 2 S.D.	243	243	204	153	312

SHEET AREAS

	Riverton	Eudunda	Riv.-Eud.
No. Samples	1042	538	1580
Cu mean	14	22	17
S.D.	13	6	11
mean + 2 S.D.	40	34	39
Top 2.5% value	24	29	28
Threshold	30	35	
Pb mean	17	18	17
S.D.	19	8	18
mean + 2 S.D.	55	34	53
Top 2.5% value	37	34	35
Threshold	30	30	
Zn mean	31	53	39
S.D.	22	57	39
mean + 2 S.D.	73	167	116
Top 2.5% value	84	90	85
Threshold	55	70	
Mn mean	119	112	118
S.D.	61	48	70
mean + 2 S.D.	241	208	257
Top 2.5% value	195	198	195
Threshold	170	170	

The main points of interest are the general increase in the means of Cu, Pb, Zn toward younger groups of formations, and the narrow range in values for Cu. There is only 11 ppm difference between the Cu mean and the top 2.5% value for Cu on Riverton-Eudunda.

THRESHOLD VALUES

Threshold values for anomalous populations of Cu, Pb, Zn and Mn were chosen using two methods. The first method was to plot cumulative frequency values on log probability paper (Figure 9). These plots result in good approximations to straight lines and show that the overall distributions may be resolved into two or more log normal populations. The second and higher order populations for Cu, Pb and Zn are small and regarded as anomalous but for Mn the third order population is considered to be anomalous. In general the thresholds to anomalous values are higher on the Eudunda sheet than the Riverton sheet.

Govett et al. (1975) believe that many positively skewed distributions of trace elements are actually composed of a number of normal populations. If this is so, the application of log transformations to these data may result in the masking of an anomalous population, or at least the enhancement of the background population and suppression of the anomalous population. Govett et al. show that plotting the distribution of means of values within spatial blocks of geochemical data makes it possible to resolve the overall smooth distribution into component normal populations with the background populations separated from the mineralised population.

For this project 4 kilometre square blocks were chosen and frequency curves of the means of values within these blocks were plotted (Figure 10). In most cases this method seems to separate a small population with a higher mean from the bulk of values. Two exceptions are:-

(1) Pb on Eudunda where the highest order population contains over 10 per cent of the values, and

(2) Zn on Riverton where the highest order population would belong to the background on Eudunda.

In general, threshold values are lower using this method. Threshold values obtained from log probability plots are used in this report as lower thresholds in Govett et al.'s method did not delineate any new areas.

Anomalous Values

Anomalous values on Riverton and Eudunda are plotted on Figures 11 and 12. On the Riverton Sheet anomalous Cu, Pb and Zn values are associated with the Saddleworth and Tapley Hill Formations and anomalous Pb-Zn values are associated with the Tarcowie Siltstone. On the Eudunda sheet anomalous Cu, Pb, Zn values are concentrated in the Appila Tillite and anomalous Pb, Zn values are concentrated within the Pepuarta Tillite and Tapley Hill Formations.

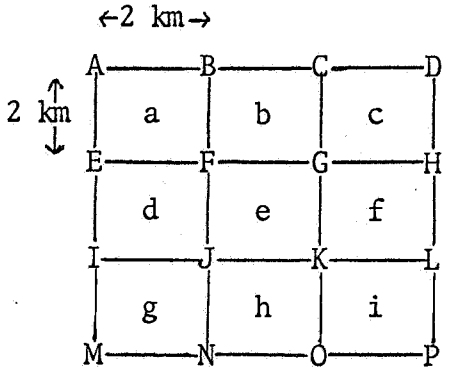
The Peter's Hill Mine located within the Mintaro Shale is delineated by a single point multi-element anomaly. A small lead-zinc working within the Appila Tillite 3 km SE of Manoora is also delineated by a single point Pb-Zn anomaly. Two copper workings on the Eudunda sheet within the Appila Tillite and Saddleworth Formation were not delineated by anomalous values.

ROLLING MEANS

Rolling mean maps for Cu, Pb, Zn and Mn on Riverton and Eudunda are shown on figures 16-23. The method used in calculating the rolling means is demonstrated in Figure 15.

FIGURE 15

CALCULATION OF GEOMETRIC ROLLING MEAN



Rolling mean values A,B,C, etc. are plotted on the corners of a two kilometre grid. In figure 24 the values a, b, c, etc., are the geometric mean of values within that square. Rolling mean values A, B, C, etc. are derived from a, b, c, etc. in the following manner, e.g. $F = \sqrt{4\ a \times b \times c \times d}$. It can be seen that areas represented by the rolling means overlap, and that each raw value is used in computing four rolling mean values. Where possible, rolling mean values for the edges of the map used geochemical values from adjoining one mile sheets.

The Cu rolling mean maps show that background values in general increase from west (5-10 ppm) to the east (>25 ppm) with a roughly north south trend of contours.

Locally, many highs and lows in the overall trend can be related directly to geology e.g. highs corresponding to the Saddleworth Formation and lows related to the Rhynie Sandstone Member on the Riverton Sheet. Background values for Pb show no simple generalised trend, nor are they obviously related to surface geology. The trend of contours varies from north south to east west and background values vary from 5-25 ppm. The Zn rolling mean map has many similarities in detail to the Pb rolling mean map but has a similar generalised trend as the Cu contours. Background values vary from 20 ppm to 75 ppm.

AREAS OF INTEREST

Significant deviations of actual values from the regional trends are plotted on the rolling mean map. These show a similar pattern of distribution to the anomalous values, modifying the importance of areas of interest only slightly. Main areas of interest are:-

on Riverton A (1) An area of Pb, Zn anomalies east and southeast of Undalya within the Skillogalee Dolomite and Woolshed Flat Shale Formations.

(2) An area of anomalous Pb values west and southwest of Auburn within the Saddleworth Formation and Auburn Dolomite.

(3) A single point Cu, Zn anomaly showing very high contrast with background values 2 km northeast of Hoyleton, within the Pooraka Formation.

on Riverton B (1) Cu-Zn residuals near an old mine working 3 km south-east of Manoora within the Tapley Hill Formation.

(2) An area of Cu, Pb residuals southwest of Manoora within the Woolshed Flat Shale.

(3) Pb, Zn anomalous values 5 kilometres northeast of Saddleworth in the Appila Tillite.

(4) Anomalous Cu-Zn values within the Saddleworth Formation 2 km southeast of Saddleworth are situated within a regional high and do not have a significantly high contrast with the background. Anomalous Zn values within the Saddleworth Formation in the east of Riverton B also do not have a high contrast with the background.

(5) Four isolated anomalous Cu values; two coincide with the Tindelpina Shale Member of the Tapley Hill Formation, one with the Bethel Shale Member of the Saddleworth Formation and the fourth is situated above the boundary of the Saddleworth Formation and the Tarnma Diapir.

on Riverton C (1) A number of anomalous Pb values just west of Marrabel within the Tapley Hill Formation.

(2) An anomalous Cu value on the boundary of the Saddleworth Formation and Tarnma Breccia and an anomalous Cu value within the Tindelpina Shale Member of the Tapley Hill Formation.

(3) Five anomalous Cu values south of Hamilton within the Tapley Hill Formation and Appila Tillite.

on Eudunda (1) A single point Cu, Pb, Zn anomaly surrounded by anomalous Pb values within the Appila Tillite north of Point Pass.

(2) A single point multi element anomaly showing high contrast with background within the Appila Tillite just west of Sutherland.

(3) An area of anomalous Pb, Zn values just south of Julia which has a low contrast with the local high background.

(4) A single point multi-element anomaly 3 km east of Sutherlands within the Bakara Soil of the Murray Plains.

CORRELATION COEFFICIENTS

Correlation coefficients between Cu, Pb, Zn and Mn are shown on Table 2. Most correlations are significant at the 95% level.

TABLE 2

CORRELATION COEFFICIENTS FOR RIVERTON AND EUDUNDA

No. Samples	Cu-Mn	Cu-Pb	Cu-Zn	Mn-Pb	Mn-Zn	Pb-Z
River Wakefield Group	-.005	.456	.480	.152	-.020	.318
Burra Group	-.892	.316	.333	-.572	-.596	.464
Umberatana Group	-. 30	.198	.588	-.074	-.166	.161
Kanmantoo Group	.042	.301	.107	.390	.760	.441
Recent & Tertiary	-.089	.168	.367	-.064	-.161	.511
Riverton	-.234	.142	.263	-.188	-.301	.319
Eudunda	.138	.288	.204	.068	.361	.207
Riverton-Eudunda	-.144	.147	.241	-.109	0.14	.184

Correlations between Cu, Pb and Zn are all positive and are in general low, but correlations of Mn with each of these elements are in general negative and low. However high positive correlations occur between Cu-Pb and Cu-Zn in the River Wakefield Group. Very high negative correlations occur with Mn within the Burra Group. A good Cu-Zn correlation occurs within the Umberatana Group and a very high positive correlation for Mn-Zn within the Kanmantoo Group. There is a striking trend of increasingly positive correlations between Mn and Cu, Pb and Zn from the Burra Group to the Kanmantoo Group. No explanation is known for these changes in the nature of the association between manganese and these elements between the Groups.

Manganese, Gold, Cobalt, Tungsten, Niobium, Bismuth, Molybdenum

Manganese

The geometric rolling mean for Mn with residuals is shown on Figures 22 and 23. Within the ranges the background values for Mn have a north-south trend and local variations sometimes are obviously associated with geological units in a similar manner to the Cu rolling mean. On the plains to each side of the ranges the contours begin to develop an east west grain, congruent with the general direction of the drainage. A very general regional trend is the preponderance of low values on the Riverton B and D sheets with higher values to the east and west. This could be due to the effects of topography. The high positive and negative associations of Mn with Cu, Pb and Zn within certain Groups are not obvious from a comparison of the regional trends.

Gold

Ten values of Au above detection limit (0.05 ppm) were found on the Riverton and Eudunda sheets. The highest value was .2 ppm in the east central part of the Riverton B sheet. Three detections of .05 ppm occur within a small area around Halbury; the remaining six values are scattered. Gold was not detected near an old gold digging 2 km east of Hamilton.

Cobalt

Cobalt detections are common especially on the Eudunda sheet. Most detections are between 5 and 20 ppm and none are greater than 30 ppm. On the Riverton sheet, a greater concentration of Co values are contained within the Saddleworth Formation east of Riverton.

Tungsten, Molybdenum, Niobium, Bismuth

A value of 300 ppm W was found 3 km southeast of Hamilton. Several other W detections and some Mo values also occur in the same general area. Scattered Bi detections were found in the northeast of the sampled area on the Eudunda sheet in the same wide area as four low Au detections. There are a small number of Nb detections located mainly on the Riverton A sheet.

SUMMARY AND RECOMMENDATIONS

Stream sediment sampling on the Riverton and Eudunda sheets successfully delineated the Peters Hill Mine and an old lead-zinc working near Manoora, and pinpointed new areas (see Geochemistry) which require follow up work to further assess their potential. Most of these areas are defined by anomalous Cu, Pb and Zn values. Of the other trace elements, only one area of Au and one of W

are worthy of follow up. Statistical analysis of the data shows there is a general increase in the means for Cu, Pb and Zn from older to younger Groups. Rolling mean maps show that the regional trends of Cu, Zn and Mn values are in general north-south and are essentially related to the surface geology. The Pb regional trend is not obviously related to the geology. The distribution of anomalous values and significant positive deviations from the regional trend indicate increased metal content in the Appila and Pepuarta Tillites and siltstones of the Saddleworth Tapley Hill and Woolshed Flat Shale Formations. Anomalous Cu values also emphasise the Tindelpina and Bethel Shale Members at the base of the Tapley Hill and Saddleworth Formations as well as the boundary of the Tarnma Diapir and the Saddleworth Formation. There are some strikingly strong associations of Mn with Cu, Pb and Zn and these vary from strongly positive to strongly negative in different Groups.

B.A. Eberhard.

B.A. EBERHARD

21st October, 1976. GEOLOGIST

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ADELAIDE 1:250,000

WAKEFIELD	A RIVERTON C	B D
	A EUDUNDA C	B D
DUBLIN	A KAPUNDA C	B D
	A TRURO C	B D
VINCENT	A GAWLER C	B D
	A CAMBRAI C	B D
SEMAPHORE	A ADELAIDE C	B D
	A MANNUM C	B D

FIG. I

DEPARTMENT OF MINES — SOUTH AUSTRALIA

Compiled. R.S.R.

Drn. A.F. Ckd.

ADELAIDE STREAM SAMPLING EUDUNDA AND RIVERTON LOCALITY PLAN

Date: November 1974

Drg. No. S11786d

P.F. No. S5850 994.2

CAINOZOIC

QUATERNARY — RECENT

Qrl — Undifferentiated lake deposits

Qra — Grey fluviatile silts, sands and gravels of the modern drainage channels.

Qrs — Dune-sands

Qpp — POORAKA FORMATION: Pale red-brown sandy clay containing carbonate of the LOVEDAY SOIL.

Qca — Calcrete in BAKARA SOIL with RIPON CALCRETE at base.

TERTIARY — PLEISTOCENE TO LOWER ORDOVICIAN

T: Tfe — Laterite; ferruginous residual of old weathering profile.

T: Tsi — Silcrete; residual of Tertiary weathering profile.

Undifferentiated white quartz sand and pebbly conglomerate, sandy clays in places with ferruginous matrix. Unconformity.

PALAEOZOIC

CAMBRIAN ORDOVICIAN — UPPER CAMBRIAN TO LOWER ORDOVICIAN

Qtz — Quartz veins.

D — Dolerite, microdiorite and porphyrite; fine-grained basic to intermediate dykes.

Qdg — Albitized granitic intrusives, generally medium to coarse grained granodiorite, aplite and adamellite.

METAMORPHIC AND IGNEOUS ROCKS OF DELAMERIAN OROGENY

LOWER CAMBRIAN — LOWER TO MIDDLE CAMBRIAN — KANMANTOO GROUP

Ekb — BRUKUNGA FORMATION: Metasiltstone and greywacke.

Ekk — KARINYA SHALE MEMBER

Eki — INMAN HILL FORMATION: Grey metamorphosed greywacke, arkose and turbidite.

Eks — STRANGWAY HILL FORMATION: Grey-green metamorphosed siltstone-greywacke, arkosic siltstone.

Eht — MT. TERRIBLE FORMATION: Quartzite

HAWKER GROUP EQUIVALENT

Unconformity.

ADELAIDE SYSTEM

STURTIAN — MARINOAN — UMBERATANA GROUP — WILPENA GROUP

Ewu — ULUPA SILTSTONE: Green laminated siltstone, minor unnamed quartzite and sandstone.

Ee — NUCCALEENA FORMATION: White and buff dolomite. Unnamed siltstone and quartzite.

Eep — PEPUARTA TILLITE: Massive boulder tillite, gritty quartzites, feldspathic sandstone, arkose and siltstones.

Efr — TARCOWIE SILTSTONE: Banded grey-green siltstones with minor sandstones.

Eft — TAPLEY HILL FORMATION: Laminated grey and green siltstone.

Efx — EUDUNDA ARKOSE MEMBER: Fine grained grey silty arkose.

TINDELPINA SHALE MEMBER: Blue finely-laminated carbonaceous and pyritic shale.

Eya — APPILA TILLITE: Massive grey boulder tillite interbedded with sandstone, arkose and siltstone and includes HANSBOROUGH TILLITE MEMBER.

TORRENSIAN — BURRA GROUP

Elg — Grey laminated sandy siltstone with sandstone dykes (MINTARO SHALE), ripple-marked feldspathic quartzite (GILBERT RANGE QUARTZITE) at top, gritty arkose (MITCHAM QUARTZITE) in type area at base.

Eli — SADDLEWORTH FORMATION: Green calcareous siltstone. Black carbonaceous BETHEL SHALE MEMBER at top. Minor unnamed quartzites and calc-silicate members

Elm — Dark AUBURN DOLOMITE, in places with cherty blebs, minor dark slate and siltstone.

Ebz — Lenticular feldspathic WATERVALE SANDSTONE MEMBER (Ebv) and upper quartzitic members.

Ebs — Flaggy feldspathic UNDALYA QUARTZITE, includes unnamed siltstone members.

Eba — WOOLSHED FLAT SHALE: Grey laminated siltstone, minor quartzite member.

Ebv — White and grey SKILLOGALEE DOLOMITE and unnamed quartzite and siltstone members.

Ebu — RHYNIE SANDSTONE: Feldspathic fine-to coarse-grained sandstone and arkose, minor conglomerate and dolomite members.

Ebh — STRADBROOKE FORMATION: Laminated grey-green phyllite and schist, minor quartzite and dolomite.

Ebk — INGOMAR QUARTZITE: Pale-brown fine-to coarse-grained feldspathic quartzite.

Ebr — BOCONNOC FORMATION: Grey sandy phyllite, quartzite and dolomite.

Ers — BLYTH DOLOMITE BEDS: Grey and black dolomite, some black chert, minor quartzite.

Eri — Unnamed sandstone, phyllite and dolomite.

WILLOURAN — RIVER WAKEFIELD GROUP

Erc — ? Diapiric breccia, including dolomite.

Ery

Er

?Er

PROTEROZOIC

GEOLOGICAL BOUNDARY

OBSERVED .....

INFERRED .....

FAULT

OBSERVED .....

INFERRED .....

MINE .....

Compiled by B.A. Eberhard from ADELAIDE 1:250000 sheet (B.P. Thomson, 1969)

RIVERTON AND EUDUNDA GEOLOGICAL REFERENCE

DEPARTMENT OF MINES - SOUTH AUSTRALIA

COMPILED: B.A. EBERHARD

DRN: Lee

CKD

SCALE

DATE: AUGUST 1976

PLAN NUMBER: 76-589

FIG.2

METRES 1000 0 1 2 3 4 5 KILOMETRES

Note For Legend see plan Nº 76-589 (Fig.2)

RIVERTON 1:63 360 SHEET AREA

FIG.3

DEPARTMENT OF MINES-SOUTH AUSTRALIA				
ADELAIDE STREAM SAMPLING RIVERTON				
GEOLOGICAL MAP				
GEOCHEMICAL EXPLORATION SECT.	COMPILED B.E.	DRN L.C.	SCALE 1:50000	PLAN NUMBER
DIRECTOR OF MINES		CKD	DATE AUGUST '76	76-619

11177

Compiled by B.Eberhard from
ADELAIDE 1:250,000 sheet (B.P.Thomson 1969)

For geological reference see FIG.2 - Drg.No.76-589

EUDUNDA 1:63 360 SHEET AREA

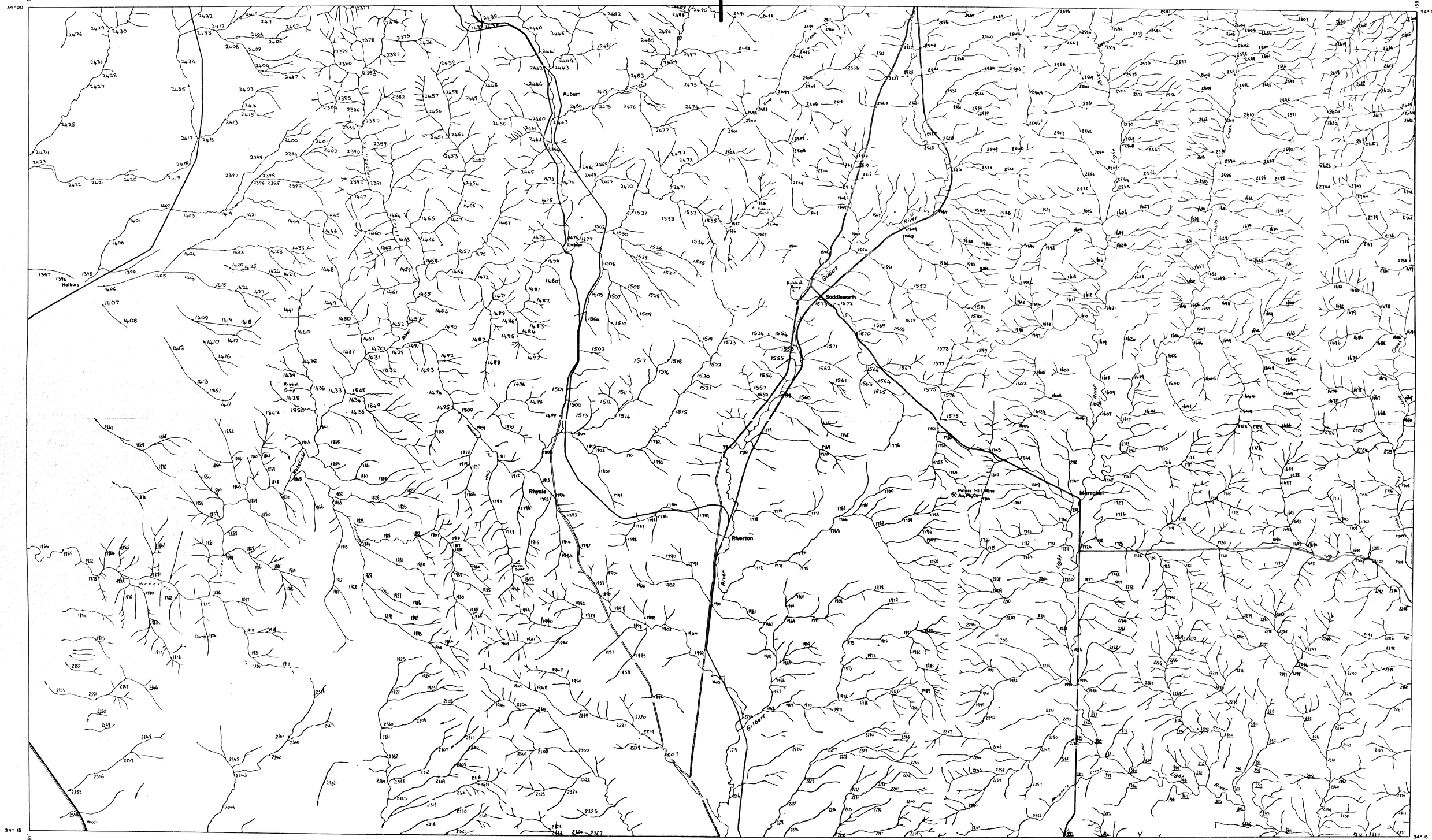
FIG.4

DEPARTMENT OF MINES-SOUTH AUSTRALIA

ADELAIDE STREAM SAMPLING
EUDUNDA
GEOLOGICAL MAP

GEOPHYSICAL EXPLORATION	COMPILED B.E.	DRN	SCALE 1:50,000	PLAN NUMBER
DIRECTOR OF MINES	B.Eberhard	CKD	DATE 6th AUG 76	76-701

1777



RIVERTON 1:63 360 SHEET AREA

FIG.5

DEPARTMENT OF MINES—SOUTH AUSTRALIA

ADELAIDE STREAM SAMPLING
RIVERTON

'G' NUMBERS FOR SAMPLE POINTS

GEOCHEMICAL EXPLORATION SECT	COMPILED B E	DRN	SCALE 1 : 50 000	PLAN NUMBER
DIRECTOR OF MINES		CKD	DATE AUGUST '76	76-620

Stream sediment sample point showing, "G" numbers eg G1319/75

METRES 1000 0 1 2 3 4 5 KILOMETRES

EUDUNDA 1:63 360 SHEET AREA

FIG. 6

DEPARTMENT OF MINES–SOUTH AUSTRALIA

ADELAIDE STREAM SAMPLING
EUDUNDA

"G" NUMBERS

GEOCHEMICAL EXPLORATION	COMPILED B.E.	DRN	SCALE 1:50,000	PLAN NUMBER
DIRECTOR OF MINES	B. Ebernard	CKD	DATE 3rd AUG '76	76-702

1177

138° 30'

139° 00'

34° 00'

34° 15'

Hoyleton

Auburn

Manoora

Hallett

Undalya

Saddleworth

Rhynie

Riverton

Peters Hill Mine
Au, Pb, Cu

Marrabel

Hamilton

Gilbert River

Light River

Wakefield River

Broughton River

Stream sediment sample point

Copper value ppm
Lead " "
Zinc " "

22
12
40

METRES 1000 0 1 2 3 4 5 KILOMETRES

RIVERTON 1:63360 SHEET AREA

FIG.7

DEPARTMENT OF MINES-SOUTH AUSTRALIA

ADELAIDE STREAM SAMPLING
RIVERTON

COPPER, LEAD & ZINC VALUES (p.p.m.)

GEOCHEMICAL EXPLORATION SECT	COMPILED B E	DRN	SCALE 1:50000	PLAN NUMBER
DIRECTOR OF MINES		CKD	DATE AUGUST '76	76-630

W177

6629 IV

METRES 1000 0 1 2 3 4 5 KILOMETRES

Stream sediment sample point

20 Copper value p.p.m.
10 Lead " "
42 Zinc " "

1177

EUDUNDA 1:63 360 SHEET AREA

FIG. 8

DEPARTMENT OF MINES–SOUTH AUSTRALIA				
ADELAIDE STREAM SAMPLING EUDUNDA COPPER, LEAD & ZINC VALUES (p.p.m.)				
	COMPILED B.E.	DRN	SCALE 1:50000	PLAN NUMBER
DIRECTOR OF MINES		CKD	DATE	76-703

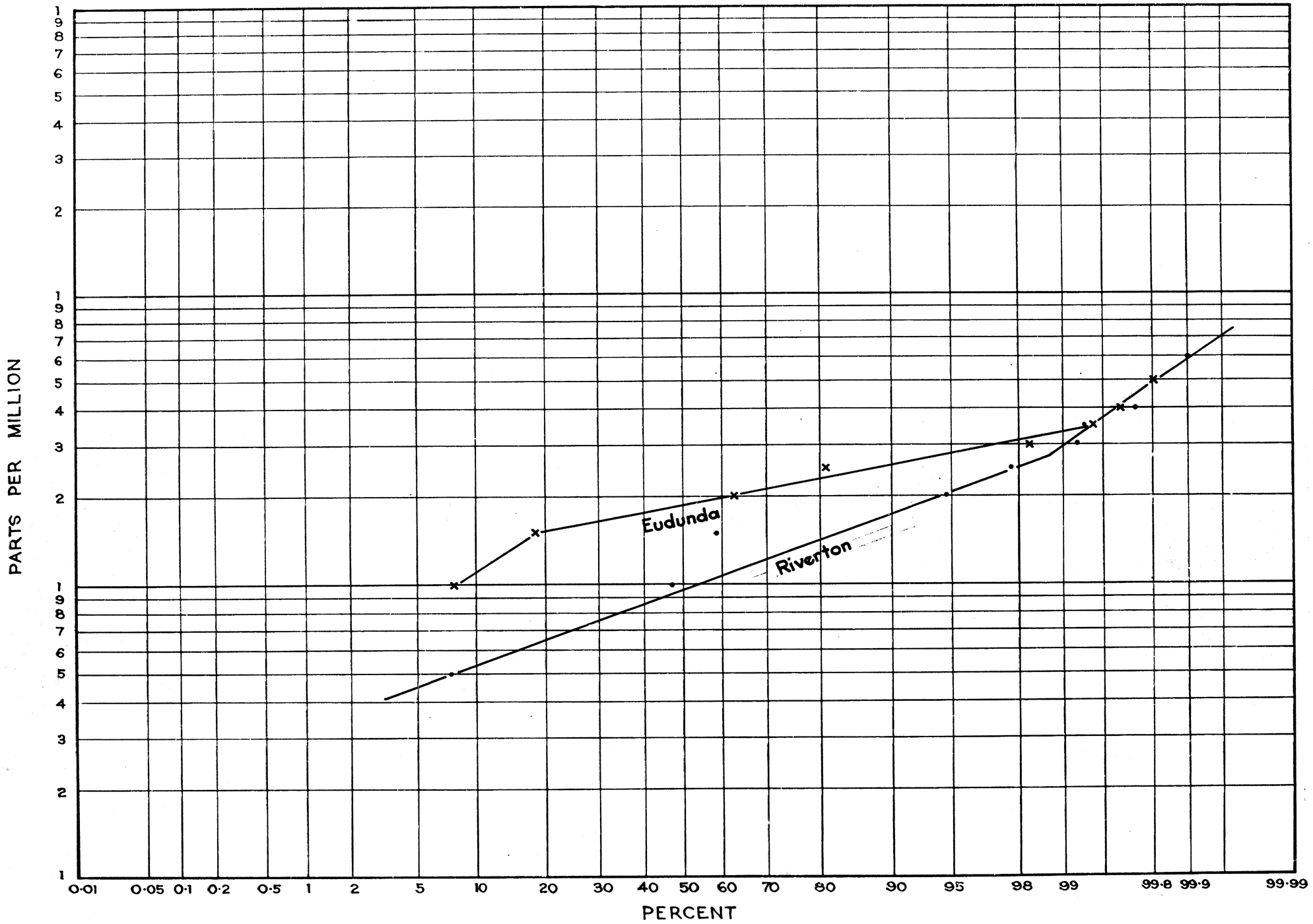


FIG.9a

DEPARTMENT OF MINES — SOUTH AUSTRALIA

EUDUNDA, RIVERTON
CUMULATIVE FREQUENCY PLOT
Cu

GEOCHEMICAL EXPLORATION SECTION	B. A. EBERHARD GEOLOGIST	*Drn.* B.E.	SCALE :
		Tcd. L.C.	76-626
		Ckd.	
Director of Mines		*Exd.*	DATE : AUGUST '76

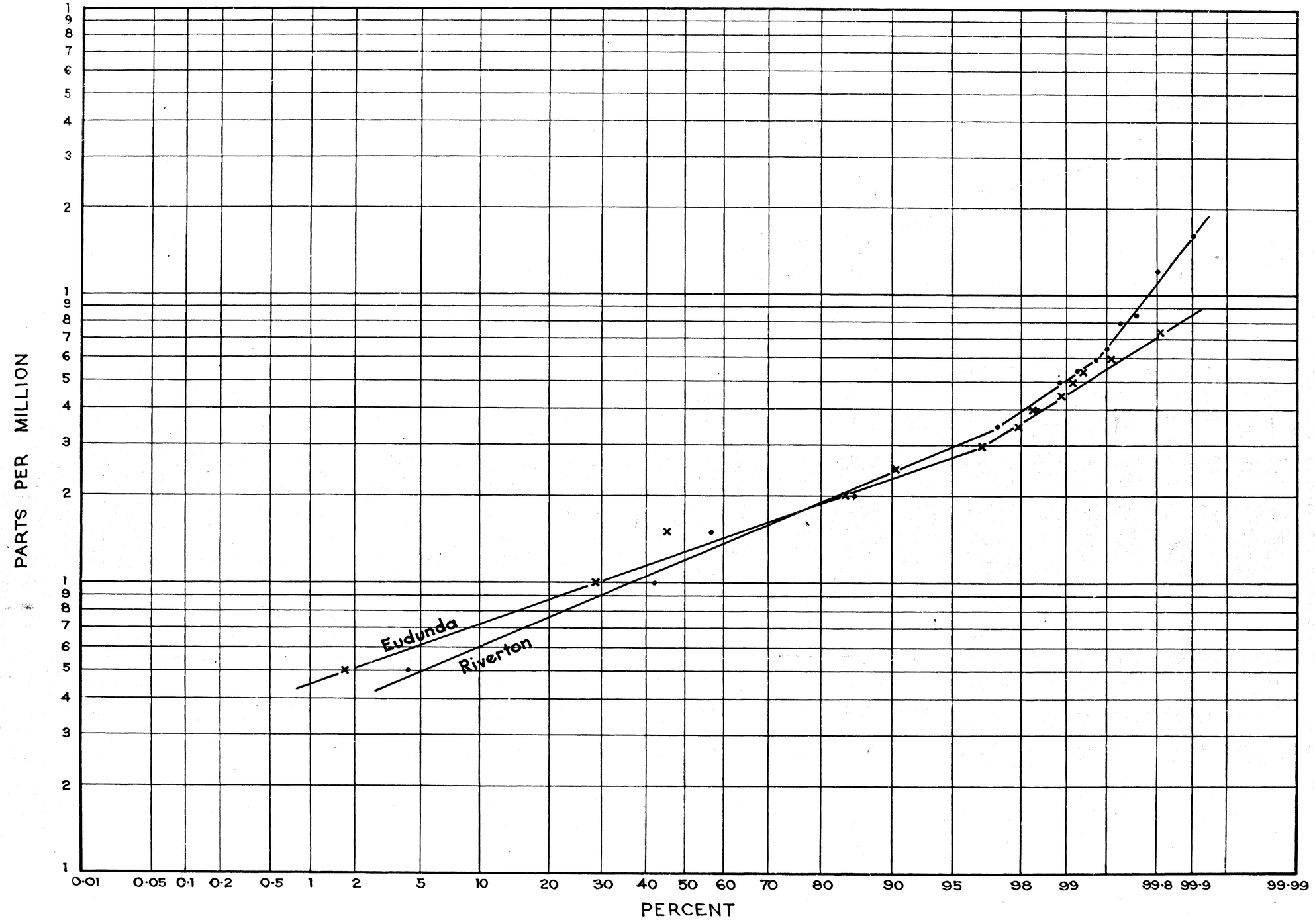


FIG.9b

DEPARTMENT OF MINES — SOUTH AUSTRALIA

EUDUNDA, RIVERTON
CUMULATIVE FREQUENCY PLOT
Pb

GEOCHEMICAL EXPLORATION SECTION	B.A. EBERHARD GEOLOGIST	*Drn.* B.E	SCALE :
		Tcd. L.C.	76-627
Director of Mines		*Ckd.*	
		Exd.	DATE : AUGUST '76

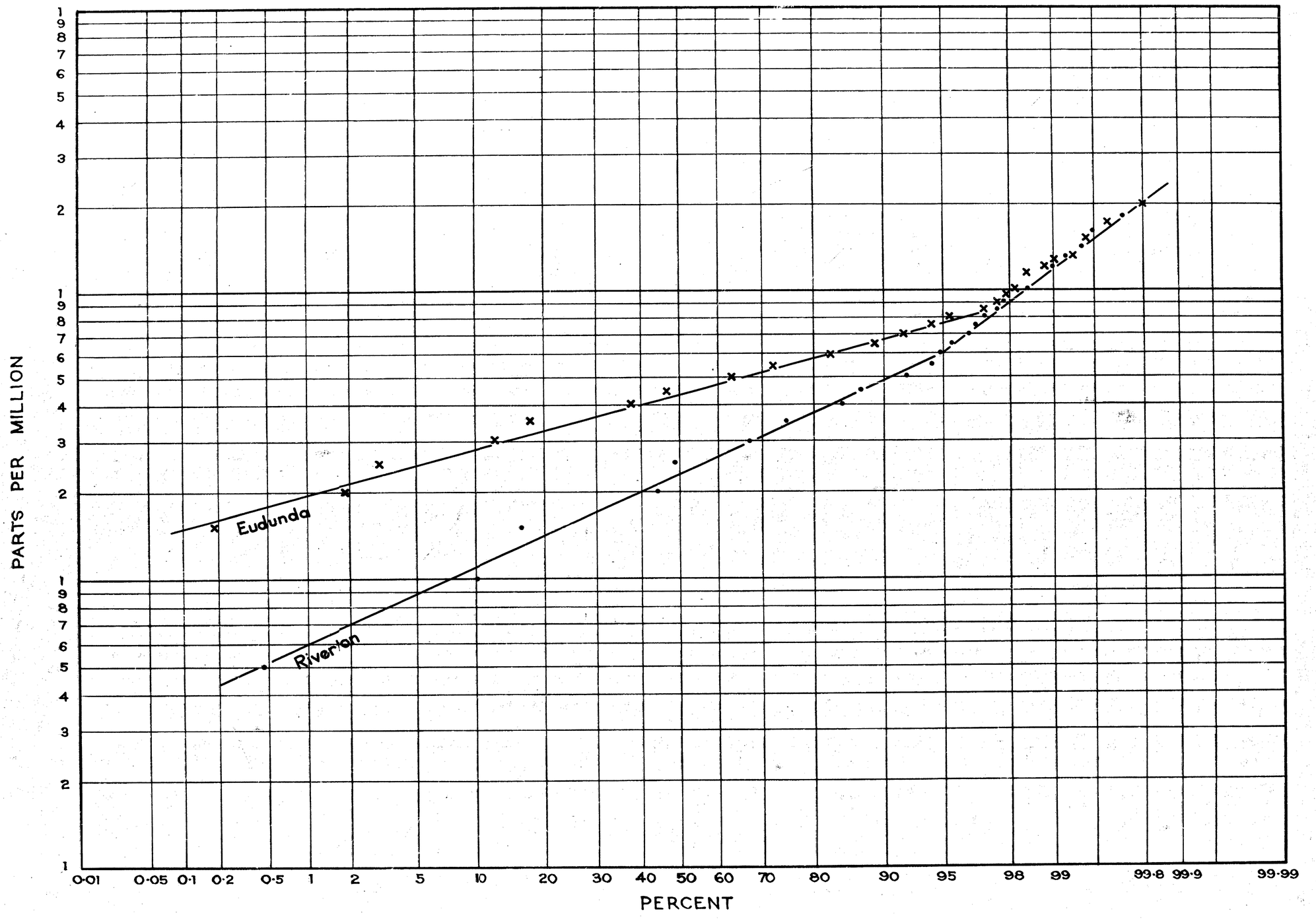


FIG.9c

DEPARTMENT OF MINES — SOUTH AUSTRALIA

EUDUNDA, RIVERTON
CUMULATIVE FREQUENCY PLOT
Zn

GEOCHEMICAL EXPLORATION SECTION	B.A. EBERHARD GEOLOGIST	*Drn.* B.E	SCALE :
		Tcd. L.C.	76-628
		Ckd.	
Director of Mines		*Exd.*	DATE : AUGUST '76

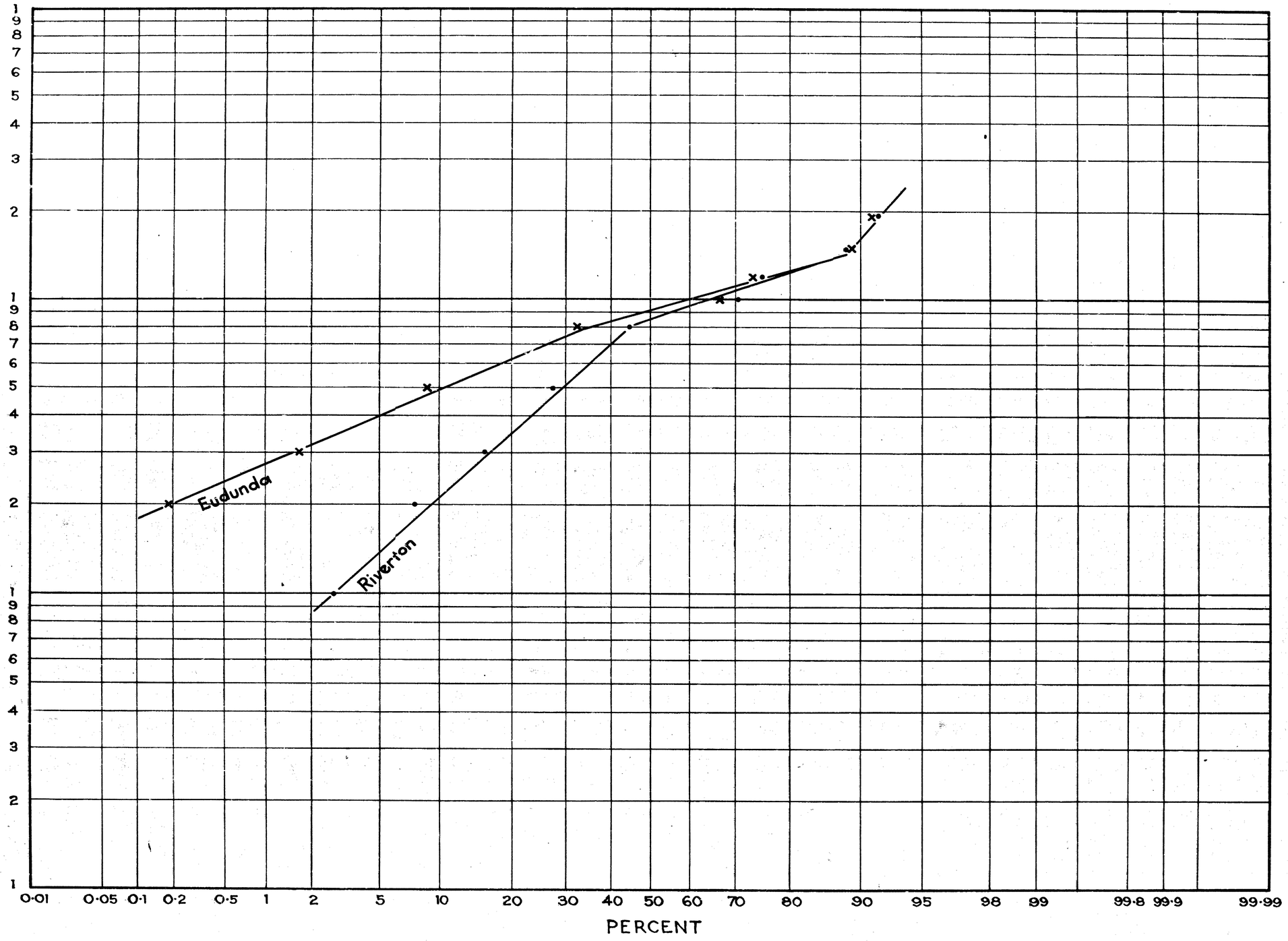


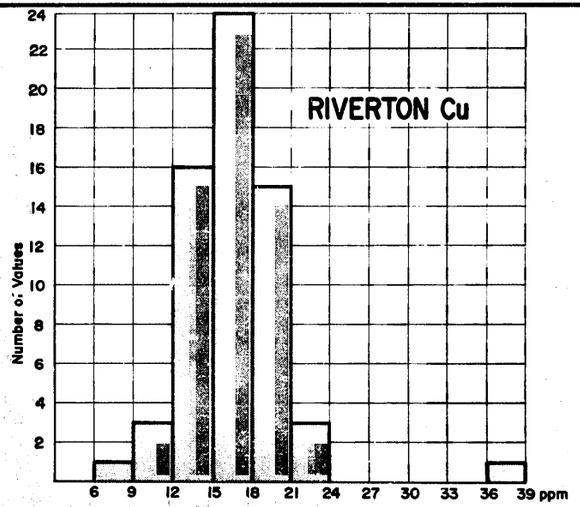
FIG. 9d

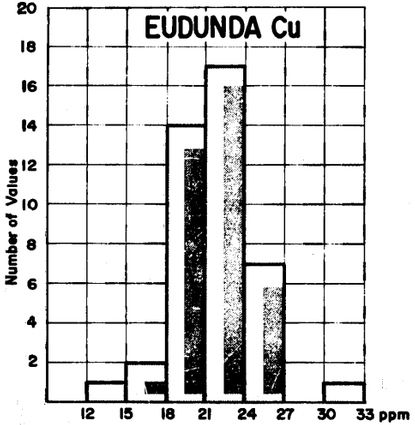
DEPARTMENT OF MINES — SOUTH AUSTRALIA

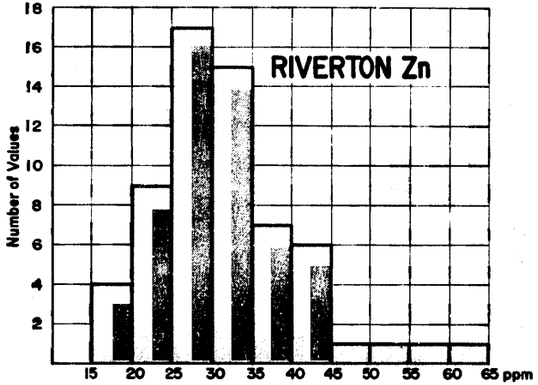
EUDUNDA, RIVERTON
CUMULATIVE FREQUENCY PLOT
Mn

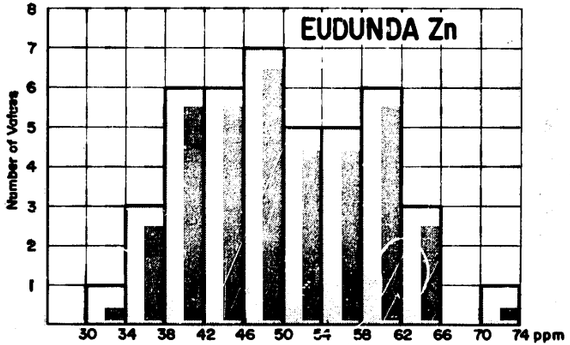
GEOCHEMICAL EXPLORATION SECTION	B.A. EBERHARD GEOLOGIST	Drn. B.E	SCALE:
		Tcd. L.C.	76-629
Director of Mines		Ckd.	
		Exd.	DATE: AUGUST '76

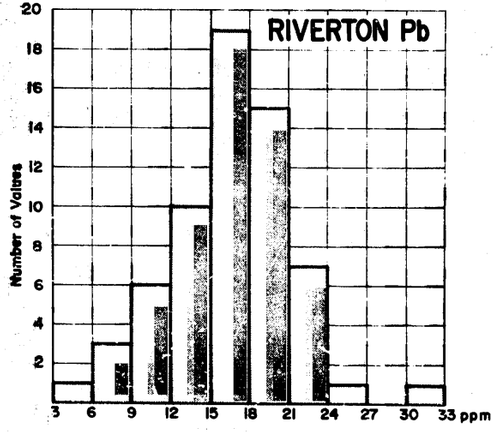
6629 & 6729

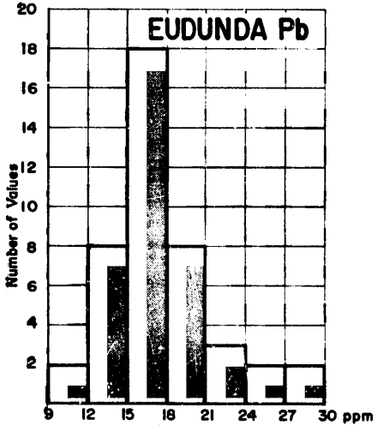


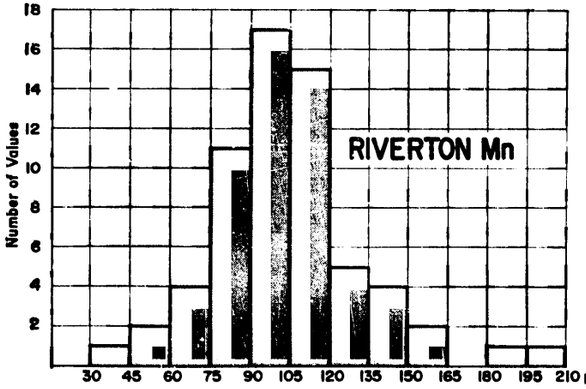












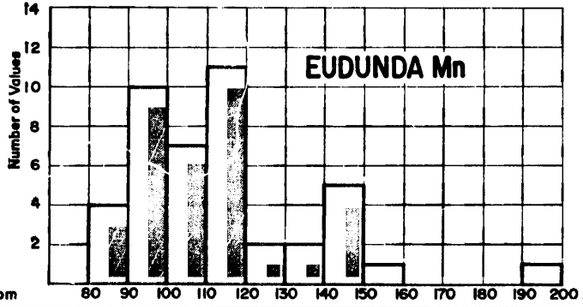


FIG.10

COMPILED B.SBERHARD JOHN Lee CKD GEOCHEMICAL EXPLORATION	DEPARTMENT OF MINES – SOUTH AUSTRALIA **RIVERTON & EUDUNDA** FREQUENCY PLOTS OF MEANS OF VALUES CONTAINED WITHIN 4km GRID SQUARE AREA	SCALE DATE SEPTEMBER 1976 PLAN NUMBER **76-726**

138° 30'

139° 00'

34° 00'

34° 15'

Hoyleton

Auburn

Manoora

Saddleworth

Rhynie

Riverton

Marrabel

Hamilton

Halbury

Peters Hill Mine
Au, Pb, Cu

Creek

River

Gilbert

Light

Stream sediment sample point

Copper value ppm
Lead " "
Zinc " "

METRES 1000 0 1 2 3 4 5 KILOMETRES

RIVERTON 1:63360 SHEET AREA

FIG.11

DEPARTMENT OF MINES-SOUTH AUSTRALIA

ADELAIDE STREAM SAMPLING
RIVERTON

ANOMALOUS Cu, Pb and Zn VALUES (p.p.m)

GEOCHEMICAL EXPLORATION SECT.	COMPILED B.E.	DRN	SCALE 1:50000	PLAN NUMBER
DIRECTOR OF MINES		CKD	DATE AUGUST '76	76-631

1177

G623-16-V

METRES 1000 0 1 2 3 4 5 KILOMETRES

Stream sediment sample point, showing anomalous values in p.p.m.

EUDUNDA 1:63360 SHEET AREA

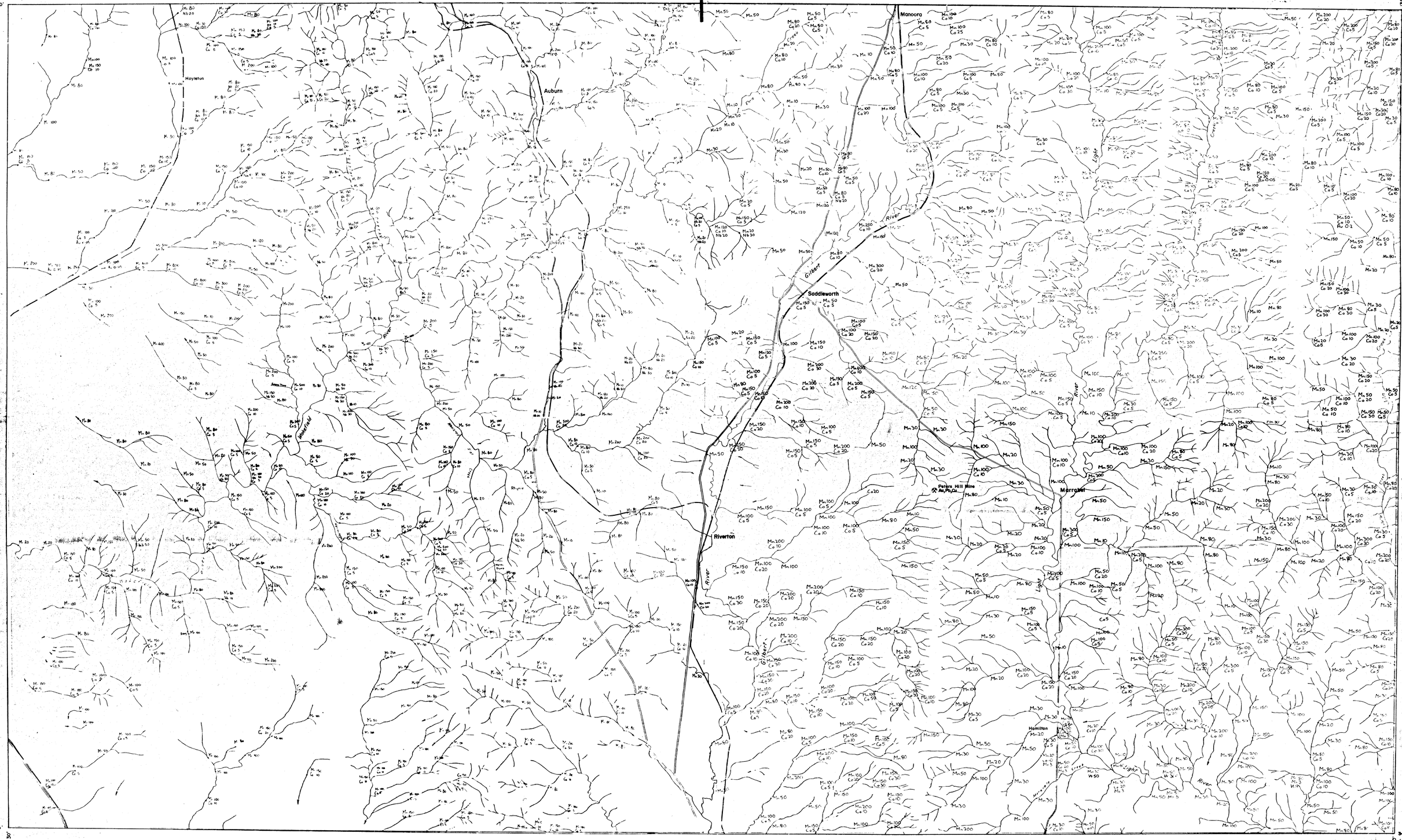
FIG.12

DEPARTMENT OF MINES-SOUTH AUSTRALIA

ADELAIDE STREAM SAMPLING
EUDUNDA

ANOMALOUS COPPER, LEAD & ZINC VALUES

GEOCHEMICAL EXPLORATION	COMPILED B.E.	DRN	SCALE 1:50,000	PLAN NUMBER
DIRECTOR OF MINES	B Eberhard	CKD	DATE 3RD AUG '76	76-704



METRES 1000 0 1 2 3 4 5 KILOMETRES

Stream sediment sample point

Manganese value p.p.m

Gold "
Molybdenum "
Bismuth "
Niobium "
Tungsten "
Cobalt "

RIVERTON 1:63360 SHEET AREA

FIG.13

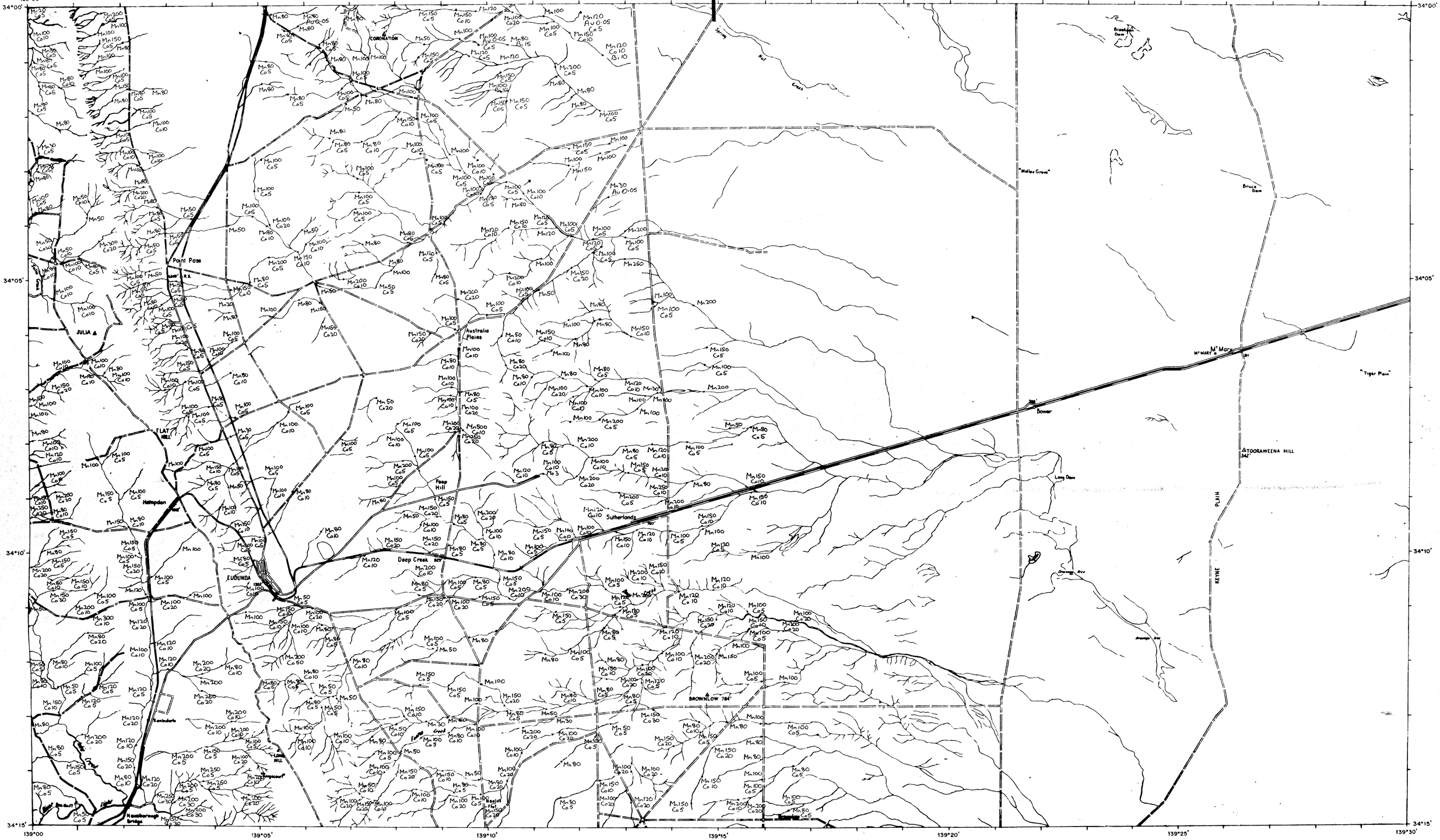
DEPARTMENT OF MINES - SOUTH AUSTRALIA

ADELAIDE STREAM SAMPLING
RIVERTON

Mn, Au, Mo, Bi, Nb, W and Co VALUES (p.p.m)

GEOCHEMICAL EXPLORATION SECT.	COMPILED B E	DRN	SCALE 1:50 000	PLAN NUMBER
DIRECTOR OF MINES		CKD	DATE AUGUST '76	76-621

6626-14 IV



METRES 1000 0 1 2 3 4 5 KILOMETRES

Mn 150
Co 10
Bi 10
Au 0.05

Stream sediment sample point showing analaysis values in ppm.

FIG. 14

EUDUNDA 1:63360 SHEET AREA

DEPARTMENT OF MINES - SOUTH AUSTRALIA

ADELAIDE STREAM SAMPLING
EUDUNDA
Mn, Au, Mo, Bi, Nb, W & Co values

GEOCHEMICAL EXPLORATION	COMPILED B.E.	DRN	SCALE 1:50,000	PLAN NUMBER
DIRECTOR OF MINES	B Eberhard	CKD	DATE 3rd AUG '76	76-705

138° 30'

139° 00'

34° 00'

34° 15'

Hoyleton

Auburn

Manoora

Halbury

Saddleworth

Rhynie

Riverton

Peters Hill Mine
Au, Pb, Cu

Marrabel

Hamilton

Gilbert River

Light River

Wakefield River

METRES 1000 0 1 2 3 4 5 KILOMETRES

15 Geometric rolling mean contour value (p.p.m)

15 Residual value (≥10 p.p.m & ≤-10 p.p.m)

RIVERTON 1:63 360 SHEET AREA

FIG.16

DEPARTMENT OF MINES—SOUTH AUSTRALIA

ADELAIDE STREAM SAMPLING

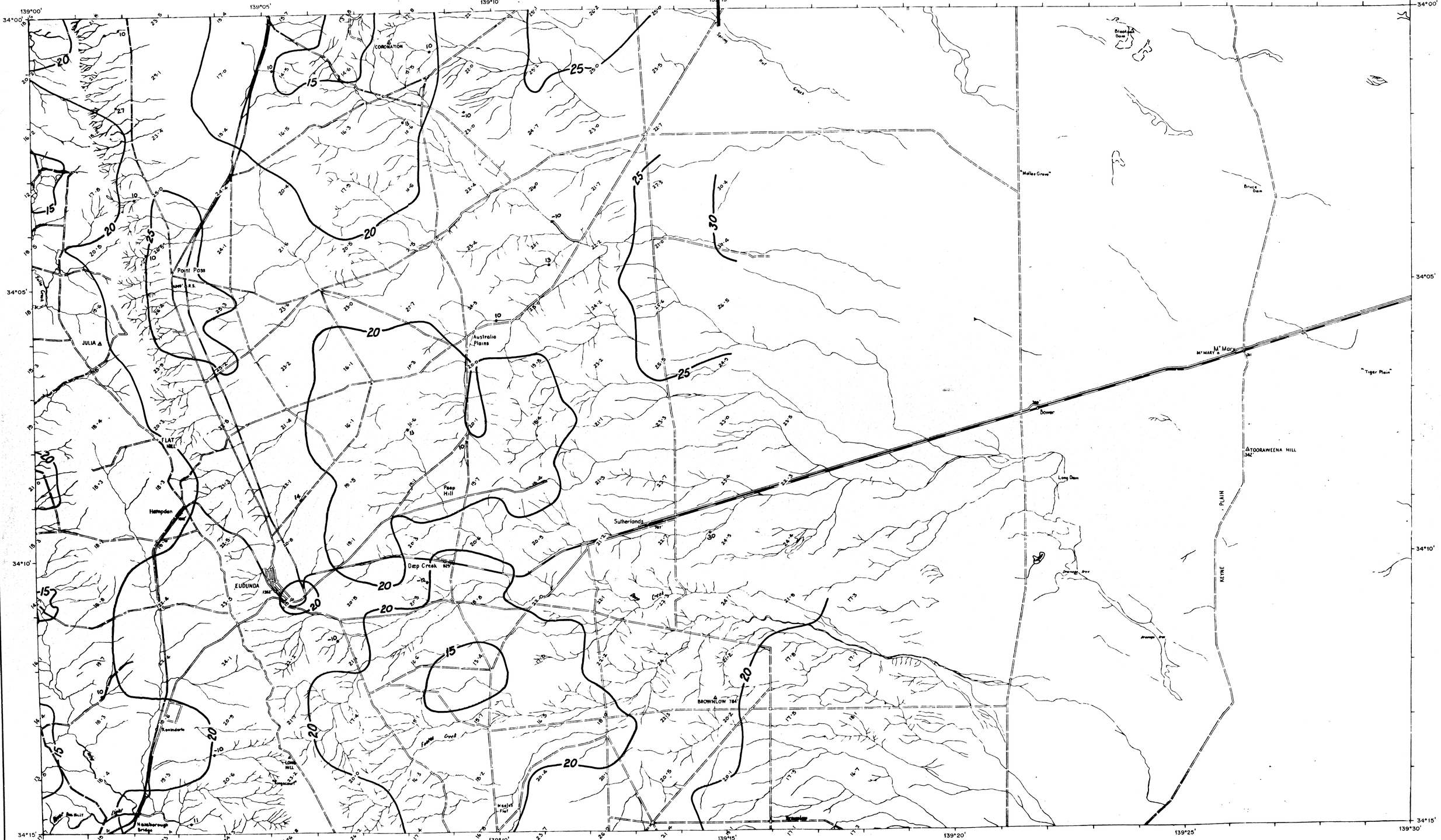
RIVERTON

GEOMETRIC ROLLING MEAN OF COPPER

GEOCHEMICAL EXPLORATION SECT.	COMPILED B.E.	DRN	SCALE 1:50000	PLAN NUMBER
DIRECTOR OF MINES		CKD	DATE AUGUST '76	76-622

11177

6625-1 & IV



EUDUNDA 1:63 360 SHEET AREA

FIG.17

DEPARTMENT OF MINES - SOUTH AUSTRALIA

ADELAIDE STREAM SAMPLING
EUDUNDA
GEOMETRIC ROLLING MEAN OF COPPER

GEOPHYSICAL EXPLORATION	COMPILED B.E.	DRN	SCALE 1:50,000	PLAN NUMBER 76-706
DIRECTOR OF MINES	B. Eberhard	CKD	DATE 4TH AUG. '76	

METRES 1000 0 1 2 3 4 5 KILOMETRES

15 Geometric rolling mean contour value (p.p.m)

15 Residual value (≥ 10 p.p.m & ≤ -10 p.p.m)

RIVERTON 1:63 360 SHEET AREA

FIG.18

DEPARTMENT OF MINES–SOUTH AUSTRALIA				
ADELAIDE STREAM SAMPLING RIVERTON **GEOMETRIC ROLLING MEAN OF LEAD**				
GEOCHEMICAL EXPLORATION SECT.	COMPILED B.E.	DRN	SCALE 1:50 000	PLAN NUMBER
DIRECTOR OF MINES		CKD	DATE AUGUST '76	76-623

11177

0020-16 IV

METRES 1000 0 1 2 3 4 5 KILOMETRES

—15— Rolling mean contour of Lead

•10 Residuals ≥ 10ppm ; ≤ -10 ppm

EUDUNDA 1: 63 360 SHEET AREA

FIG.19

DEPARTMENT OF MINES-SOUTH AUSTRALIA

ADELAIDE STREAM SAMPLING
EUDUNDA
GEOMETRIC ROLLING MEAN OF LEAD

GEOCHEMICAL EXPLORATION	COMPILED B. E.	DRN	SCALE 1:80,000	PLAN NUMBER	
DIRECTOR OF MINES	B. Eberhard	CKD	DATE 4TH AUG. '76	76-707	

1177

METRES 1000 0 1 2 3 4 5 KILOMETRES

15 Geometric rolling mean contour value (ppm)

15 Residual value (≤-20ppm & ≥ 20ppm)

RIVERTON 1:63360 SHEET AREA

FIG.20

DEPARTMENT OF MINES-SOUTH AUSTRALIA

ADELAIDE STREAM SAMPLING
RIVERTON
GEOMETRIC ROLLING MEAN OF ZINC

GEOCHEMICAL EXPLORATION SECT	COMPILED B.E.	DRN	SCALE 1:50000	PLAN NUMBER
DIRECTOR OF MINES		CKD	DATE AUGUST '76	76-624

11177

EUDUNDA 1:63360 SHEET AREA

FIG.21

—30— Rolling mean contour of Zinc

•40 Residuals > 10 p.p.m. & ≤ −20 p.p.m.

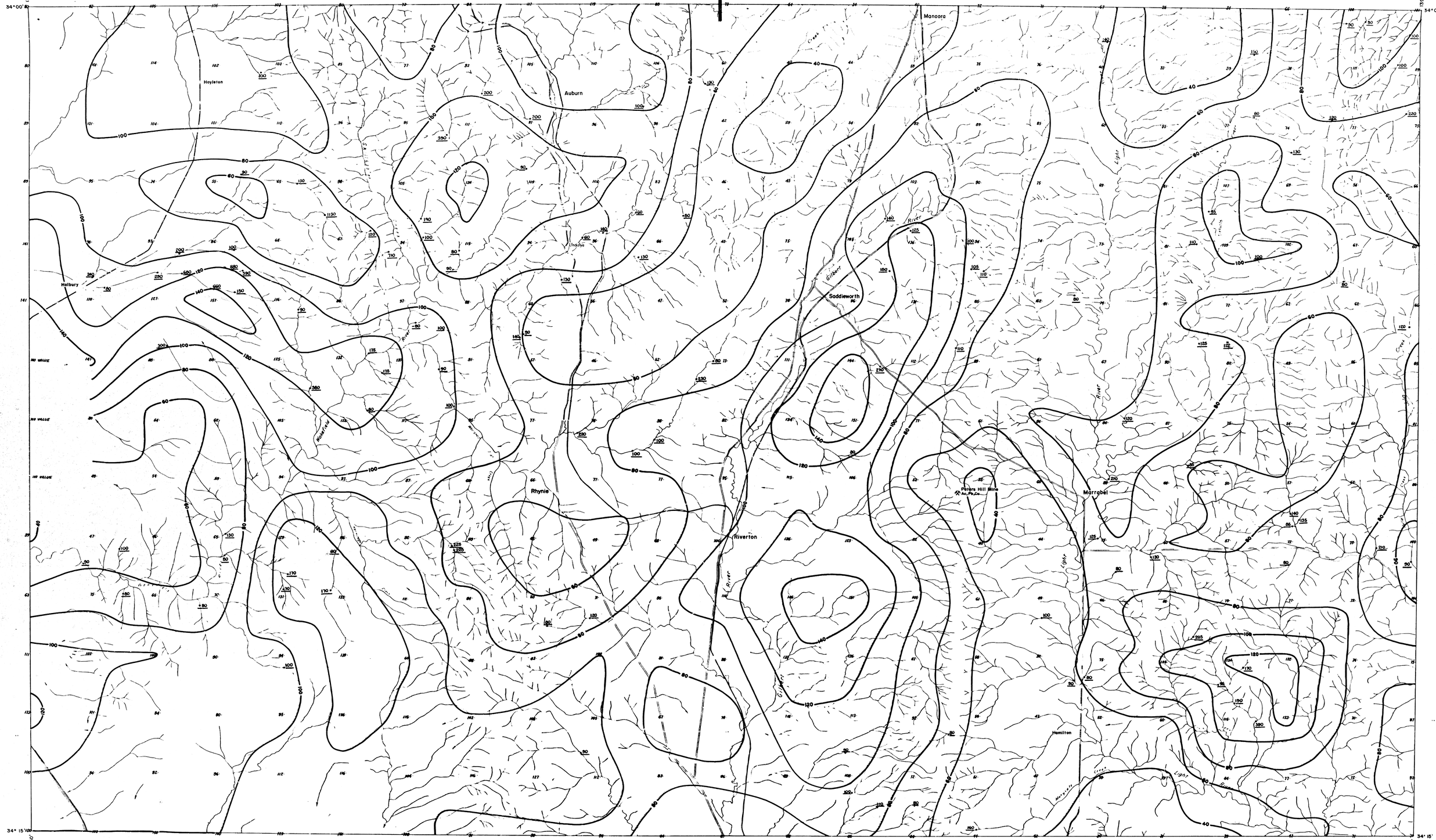
METRES 1000 0 1 2 3 4 5 KILOMETRES

DEPARTMENT OF MINES–SOUTH AUSTRALIA

ADELAIDE STREAM SAMPLING
EUDUNDA

GEOMETRIC ROLLING MEAN OF ZINC

GEOCHEMICAL EXPLORATION	COMPILED B.E.	DRN	SCALE 1:150,000	PLAN NUMBER
DIRECTOR OF MINES	B. Eberhardt	CKD	DATE 5th AUG '76	76-708



METRES 1000 0 1 2 3 4 5 KILOMETRES

140 Geometric rolling mean contour value (p.p.m)

100 Residual value (≥ 80ppm & ≤ -80ppm)

RIVERTON 1:63 360 SHEET AREA FIG.22

DEPARTMENT OF MINES - SOUTH AUSTRALIA

ADELAIDE STREAM SAMPLING

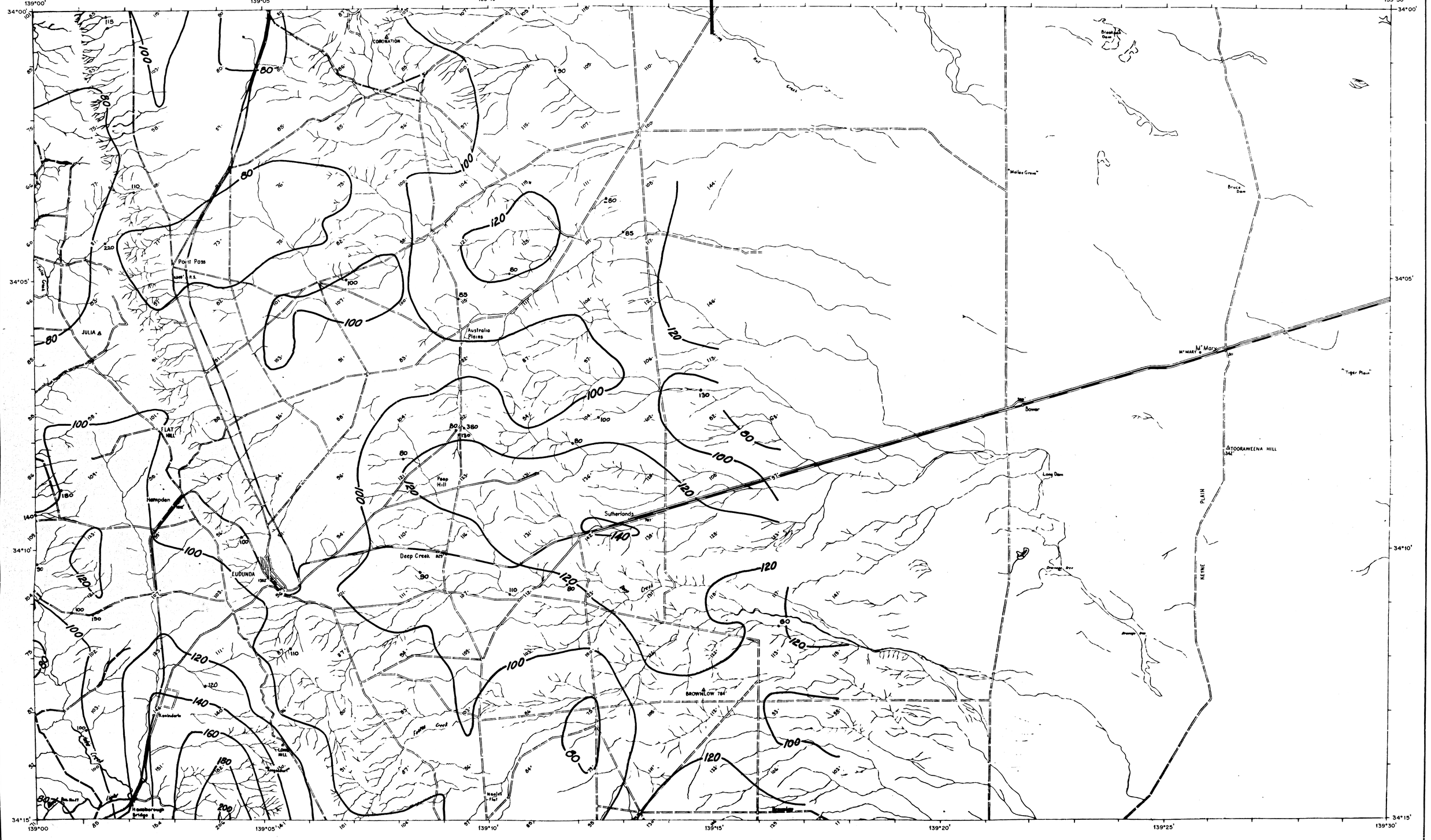
RIVERTON

GEOMETRIC ROLLING MEAN OF MANGANESE

GEOCHEMICAL EXPLORATION SECT.	COMPILED B.E.	DRN	SCALE 1:50000	PLAN NUMBER
DIRECTOR OF MINES		CKD	DATE AUGUST '76	76-625

177

GG29-141V



-80- Rolling mean contour of Manganese

•110 Residuals > 65ppm. & < -85ppm.

EUDUNDA 1:63360 SHEET AREA

FIG.23

DEPARTMENT OF MINES-SOUTH AUSTRALIA

ADELAIDE STREAM SAMPLING
EUDUNDA
GEOMETRIC ROLLING MEAN OF MANGANESE

GEOCHEMICAL EXPLORATION	COMPILED B.E.	DRN	SCALE 1:50,000	PLAN NUMBER
DIRECTOR OF MINES	B. Eberhard	CKD	DATE AUG '76	76-709