DEPARTMENT OF MINES
SOUTH AUSTRALIA

GEOLOGICAL SURVEY

METALLIC RESOURCES DIVISION

EXPLORATION LICENCE 16

PROGRESS REPORT FOR THE SIX MONTHLY PERIOD ENDING 25th OCTOBER, 1974 - Final Report

(OLARY 1:250 000)

by

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(OLARY 1: 250 000)

ABSTRACT

Detailed mapping, soil and rock chip sampling has located a promising copper anomaly at the Cronje Prospect, which is recommended to be tested by drilling. Arsenic has been shown to be a suitable pathfinder element for gold in the Wadnaminga Gold Field, and one anomaly not associated with known workings has been located. Underground sampling of the Thunder Queen Mine has shown some gold reserves still remain. An experimental biogeochemical sampling programme has shown that Kochia pyramidata (black bluebush) is a better sampling medium than Kochia sedifolia (bluebush) and is a promising exploration sampling medium particularly in the search for copper and molybdenum. Three diamond drill holes have been pegged to test Induced Polarization targets at Anabama Hill. Ministerial approval has been granted for the drilling of these holes. It has been recommended that the area of Exploration Licence 16, with the exception of the Wadnaminga Gold Field area be renewed.

INTRODUCTION

This report covers the period from 26th April 1974 to 25th October, 1974 and is the final progress report for Exploration Licence 16, which expired on the 25th October 1974, after being held for two years. A new Exploration Licence excluding the Wadnaminga Gold Field has been applied for.

The regional geology of Exploration Licence 16 is described in an earlier three monthly report (Morris 1973) and shown on figure 2.

During this report period a field party was in the area for about six weeks, in which detailed mapping, soil and rock chip sampling have been completed and the results assessed for the Cronje Prospect and the Wadnaminga Gold Field area. All samples both soil and rock chip were pulverized and analysed by atomic absorption.

The results of the experimental biogeochemical sampling in the Anabama Copper Mine Area carried out during the previous report period (Morris, 1974) have come to hand and been appraised.

Geophysical surveys, mainly induced polarization and magnetometer methods have been carried out over a part of the Wadnaminga Gold Field, the Cronje Prospect and the Anabama Copper Mine Areas (Fig. 2).

Three proposed diamond drill holes have been pegged at Anabama Hill.

CRONJE PROSPECT

Geology

A geological plan of the area is shown on figure 3. The area is generally undulating and mainly covered by Quaternary alluvium containing a strong calcrete horizon. Steep rocky outcrops surrounded by scree slopes jut out of the plains to produce the only relief in the area.

There is a strong foliation and schistosity developed in the rocks which appears to parallel bedding and strikes about 080° and dips steeply northwards. The schistosity in turn has been folded on a micro scale forming crenulations with the subsequent developments of a vertical crenulation cleavage, in some areas, striking 005°. At some localities shear zones have developed along this cleavage direction. Near vertical jointing is common with a strike varying from north-northeasterly to north-northwesterly.

The dominant outcrops in the area are composed of a pink and white, strongly foliated and crenulated quartz-muscovite schist with goethite/limonite pseudomorphs after pyrite. The pink colour is due to iron oxides/hydroxides partially replacing muscovite. This rock is considered to have originally been immature sediment containing pyrite, that has suffered low grade regional metamorphism (Appendix A, TS 32896). Numerous quartz blows occur in these outcrops and the rock tends to be silicified near these to resemble a micaceous quartzite in hand specimens.

A grey-green muscovite-quartz schist with cubic iron oxide pseudomorphs after pyrite occurs as subdued outcrops, containing malachite dispersed along schistosity planes in some areas (Appendix A, TS 32898). A small vertical prospecting shaft has been dug to a depth of about 10 m on this rock at one locality (Fig. 3).

The above two rock types make up most of the mapped area and possibly belong to the Yudnamutana Sub-Group (Sturtian) as shown on the South Australian Department of Mines, Olary, 1:250 000 preliminary geological sheet.

About 150 metres west east of the prospecting shaft is a low rounded rocky hill composed of a fine grained partially recrystallized rhyolite that has been pyritized and tourmalinized (Appendix A TS 32897). A band of metasomatised porphyritic rhyolite (Appendix A TS 32891) also occurs within this recrystallized rhyolite.

These rhyolites may be off-shoots or extrusives from the Ordovician Anabama Granite rather than part of the Yudnamutana Sub-Group. Massive outcrops of acid volcanics, some 12km northeast of this area, of unknown age, have been referred to as Lower Cambrian or Ordovician volcanics by Gerdes (1973) and the rhyolites at the Cronje Prospects are probably equivalent to these.

The petrological and structural evidence shows that the rocks in the area have suffered low grade regional metamorphism (greenschist facies), some metasomatism and several phases of deformation.

Geochemistry

During this report period 358 soil and 77 rock chip samples were collected (Fig. 4) and analysed for copper (Cu) lead (Pb) and zinc (Zn) and the results are shown on figures 5 and 6. The samples were collected to determine the extent of the copper anomalies found during a reconnaissance sampling of the area (MORRIS 1974). In all, 14 soil sampling traverses, orientated in a north-south direction, approximately perpendicular to the strike of the country rock, upto 1600 m long and about 100 m apart were completed. Soil samples were collected every 25 m in the anomalous areas and every 50 m elsewhere. Continuous rock chip samples were taken between soil sampling points provided there was sufficient outcrop.

Frequency distribution histograms, cumulative frequency, and log-probability curves were drawn for Cu, Pb and Zn from the soil sample results (figs. 7, 8, 9, 10 and 11).

Frequency distribution histograms show log normal populations for Cu, Pb and Zn with serveral peaks on the copper curve, indicating more than one significant pópulation of copper.

From the cumulative frequency curves the median (Me) and the lower limit of an anomaly (A) were calculated for Cu, Pb and Zn, by the method of Yufa and Gurvich (1964) and the results are shown on Table 1.

TABLE 1

Median (Me) and lower limit of anomaly (A) values.

	Cu (ppm)	Pb (ppm)	Zn (ppm)
Me	94	11.5	47
"A"	269	22	92

The log-probability curves for Cu show several distinct breaks in slope indicating that there are several Cu populations and one is probably due to secondary mineralization.
The curve for Pb shows one weak but distinct break in the curve due to a secondary population of Pb, which may be either mineralization or a lithological variation. The curve for Zn also shows a weak but distinct break in the curve due to a

second population of Zn which may be either mineralization or a lithological variation.

The contours of the soil and rock chip copper values correspond very well and are shown on figures 5 and 6. There are two strongly anomalous zones in the area sampled. The northerly zone (up to 1100 ppm Cu) is in an area of out-cropping to sub-outcropping grey-green muscovite-quartz schists (Appendix A. TS 32898) with small (0.5 mm) cubic iron oxide pseudomorphs after pyrite, and some visible malachite. The southerly anomaly (up to 450 ppm Cu) is in an east-west trending gentle valley where grey-green muscovite-quartz schists with small (0.5 mm) cubic iron oxide pseudomorphs after pyrite and a pink-grey schist which may be an altered lava tuff or sediment (Appendix A TS 32890) form subdued outcrops. The gentle valley lies between two steep rocky ridges composed of pink-white altered quartz-muscovite schist with abundant iron oxide pseudomorphs after pyrite. This rock appears to have been considerably leached suggesting that its copper content would be higher at depth than the 100 ppm Cu found at the surface.

The northerly anomaly with an area of 40 m x 200 m containing copper values above "A", has the strongest induced polarization anomaly of the area associated with it (Gerdes, 1974) and is also surrounded by the only anomalous Pb and Zn values found in the area. For these reasons the northerly anomaly is considered to have the most potential in the area investigated.

WADNAMINGA GOLD FIELD

History

The goldfield was first discovered and worked about 1888 and work continued often intermittently, until about 1936. Records show that approximately 20 000 tonnes of ore with an average grade of about 27 gms of gold per tonne have been mined; a small amount of galena has also been mined from the Thunder Queen Mine. The New Milo, Virginia and Thunder Queen Mines have been the most productive (Table 2).

TABLE 2

Production figures of the larger mines

Mine	Quantity of Ore (Tonnes)	Gold Content (gms)	Average Grade gms/tonne
New Milo	9938	341385	29
Virginia	8827	140354	16
Thunder Queen	1795	42825	24

Geology

The Wadnaminga Goldfield has a strike length of about 12 km in a northeasterly direction and the geological plan shown on figure 12 covers the northeastern part of the goldfield only. This section of the goldfield produced the most gold and it differs from the rest of the field in that the "lodes" were productive over a considerable extent and were stoped and treated in a large and systematic fashion (Winton 1929). On the other hand, in the section of the field not covered by the geological plan (fig. 12), the gold was found in rich pods, usually where narrow northerly striking "indicator" quartz veins intersected the main northeasterly trending quartz veins.

The mapped area is situated on the northern limb of the Wadnaminga Anticlinorium and contains interbedded dolomites, sandy dolomites, phyllites, siltstone, calcareous phyllites and calcareous siltstones of the Burra Group striking 065° and dipping about 70° to the north. As can be seen from the geological plan the auriferous quartz veins are not confined to one lithological unit, although they do generally occur in a dark grey siltstone usually containing iron oxide cubic pseudomorphs after pyrite. The mineralized quartz veins cut across the lithology at a low angle, striking about 080° and dipping 30° south. They are up to 2 m wide, parallel to the fold axis of the Wadnaminga Anticlinorium (Fig.2) and appear to be filling tension gashes often arranged in an en echelon pattern. The North and South Mine is an exception in that the mineralized vein is striking 160° and dipping 30° west.

For the purpose of mapping the rocks have been divided into several lithological groups. The youngest group consists of massive dolomites containing mica flakes (1-2 mm in size) and grey calcareous siltstones. Near the base of this unit are some interbedded phyllites with a massive dolomite bed, about one metre thick, at the base.

The underlying unit consists of a series of interbedded phyllites and dark grey sandy siltstones.

Below this is a series of interbedded sandy dolomites, calcareous siltstones, dark grey siltstones with iron oxide pseudomorphs after pyrite, calcareous phyllites and, at the base, a good marker horizon of sandy dolomite that weathers to a distinctive "honeycomb" structure.

Underlying this unit is a series of grey sandy siltstones and phyllites becoming calcareous at the base.

The above units are considered to be part of the Belair Sub-Group, which is underlain by the Saddleworth Formation Equivalent.

The top mappable unit of the Saddleworth Formation is marked by a band of silicified dark grey siltstone riddled with quartz veins and containing iron oxide pseudomorphs after pyrite. The rest of the unit consists of siltstones and phyllites.

The underlying unit consists of interbedded dark calcareous siltstones, coarse grained micaceous phyllites and sandy siltstones.

The mineralized veins consist chiefly of quartz and pyrite with usually small amounts of galena, chalcopyrite, arsenopyrite, malachite, cerrussite, calcite, siderite and gold. Pyrite in the more oxidised area has been converted to iron oxide pseudomorphs, some of which retain isolated residual particles of unaltered pyrite. Oxidised compounds have also developed along some cleavage planes of galena (Gartrell, 1934). Gartrell (1934) also found that the gold occurs partly free, partly locked up in the pyrite and partly locked up in the quartz, and that when locked up in the pyrite the gold is extremely fine grained. A gold particle 0.009 mm in width was observed microscopically embedded in a crystal of pyrite. Due to the fineness of the gold some was missed during treatment consequently the tailings dump, comprising approximately 1500 tonnes, contains about 1 ppm gold. Several tonnes of ore containing up to 85 gms of gold per tonne are lying on the surface near the old workings and the battery foundations.

Geochemistry

Ten sampling traverses, orientated approximately perpendicular to the regional strike, up to 2500 metre long and 500 metres apart, have been completed (Fig. 12). Soil samples were collected every 50 metres and continuous rock chip samples were taken between soil sampling points. Seven fill in lines, 300 metres long, 150 metres apart with soil samples collected every 20 metres, have been completed around the Thunder Queen Mine (Fig. 13). In all 573 soil and 235 rock chip samples have been taken and analysed for arsenic (As), copper (Cu) lead (Pb) zinc (Zn) and gold (Au). The results are shown on figure 14.

The soil sample results only were treated statistically, as the rock chip samples are sparsely distributed and generally give lower results than the soil samples, particularly for arsenic.

The arithmetic mean (A.M.) standard deviation (S.D.) and threshold (A.M. + 2 S.D.) values have been calculated for

As, Cu, Pb and zinc from the soil sample results and shown on Table 3.

TABLE 3

Statistical Results of Soil Samples

	As (p.p.m)	Cu (p.p.m)	Pb (p.p.m.)	Zn (p.p.m.)
A.M.	7.8	24.0	22.8	47.8
S.D.	8.2	11.2	94.3	17.1
Threshold	23.9	46.4	211.3	82.1

Thus values of As, Cu, Pb and Zn above 24 p.p.m., 46 p.p.m., 211 p.p.m., and 82 p.p.m., respectively can be considered to be anomalous of which there are seven As, four Cu, four Pb, and six Zn samples.

No statistical calculations were done for Au as insufficient samples contained detectable Au, but any Au value of 0.05 p.p.m. or greater (detection limit 0.05 p.p.m.) can be considered to be anomalous.

From a sampling of ore material from the Thunder Queen Mine, New Milo Mine and some ferruginous quartz veins in the area it was found that there is a strong correlation between As and Au suggesting that As would be useful pathfinder element for Au in this area (Table 4).

ADDENDUM

Eight samples in the area of the strong arsenic (As) anomaly at the end of line 8 were submitted for reassay (12th September, 1975). The reassayed results showed considerably lower As values than originally with only one weakly anomalous sample.

Sample No.	Initial Assay As(ppm)	Reassay As(ppm)
M869/74	105	24
M870/74	32	8
M871/74	26	8
M872/74	12	9
M873/74	20	7
M874/74	10	6
M875/74	12	9
M876/74	10	6

TABLE 4

Mkneralized Quartz Vein Sampling Results

	Au (p.p.m.)	As (p.p.m.)
Mineralized quartz (Thunder Queen Mine)	11.9	8700
Mineralized quartz (New Milo Mine)	12.8	1400
Pyritic slate (Nww Milo Mine)	0.2	65
Ferruginous quartz vein	0.15	18
Ferruginous quartz vein	0.25	155

The As values from the soil samples have been contoured and shown on figure 15. It can be seen that all mines and prospecting pits, with the exception of a group of workings (with no recorded production) to the north west of the Thunder Queen Mine, lie within high As areas. It should be pointed out that as As is being used as a pathfinder it need not have to be above its threshold value but only above its arithmetic mean to indicate the possible presence of Au, but naturally the higher the As value the greater is the potential for the presence of Au.

Apart from the high As values around old workings there is a strong anomaly near the end of line 8, with As values up to 105 p.p.m., and Pb values up to 255 p.p.m., making this a highly promising anomaly. Follow up soil sampling is recommended in this area to determine the extent of the anomaly.

Au was detected in only a few samples, usually associated with old workings, but two samples near the end of line 6 contained up to 0.25 p.p.m. gold. Some follow up sampling is also recommended in this area.

Thunder Queen Mine

The underground workings of the Thunder Queen Mine have also been sampled (Fig. 16). Rock chip samples were taken at about 10 metre intervals along all accessible shafts and drives. A rock chip sample of the mineralized vein and a rock sample of the country rock within a metre of the vein was taken at each point. Samples were assayed for Au, As, Cu, Pb and Zn. The assay results are shown on figure 17. Au was detected in nearly all samples with up to 26.1 ppm. in the quartz veins and up to 10 ppm. in the country rock. As can be seen in figure 17 a large area of the mine has been stoped down to the water table, except for an area between No. 3 and No. 5 shaft where, assuming an average grade of 5 ppm. Au in a zone 1 metre wide extending from the surface to the water table, an estimated 19000 gms (600 oz) of gold remains and there is no apparent evidence to say that the mineralized zone does not extend deeper or further to the west. The mineralized veins are up to 60 cms wide and dip about 30° to the south and often divide into several thin veins. Near the surface the vein consists mainly of quartz and iron oxides containing microscopic gold particles. This strongly oxidised zone extends down about 20 metres, on the incline, and then gives way to partially oxidised sulphides consisting mainly of pyrite and galena. A similar effect is observed in the pyritic siltstones of the country rock.

Within the mine the quartz veins do not appear to pinch out laterally or with depth and it would appear that mining at depth was hampered by the water table. Records show that at about 70 metres down No. 3 shaft the vein was 40 cms wide, contained 12 p.p.m. and had steepened in dip to become nearly vertical.,(Pearson, 1934).

This mine differed from most in the field in that the vein was practically gold bearing throughout (Winton 1924), and that veins of galena about 10 cms wide were fairly common. In fact a parcel of about 1 tonne of hand picked galena from shaft No. 4, containing 72.7% Pb and 935 gms. of silver, was sold (Winton 1929).

Geophysics

An experimental test resistivity profiling method (Gerdes and Wightman, 1974) was used to determine the resistivity characteristics of the mineralized veins, with the view of using this as an exploration tool. Traverses were done along strike from the Thunder Queen Mine and also along strike from the New Milo Mine. The results were disappointing apart from a questionable broad conductive zone associated with the mineralized veins. This conductive zone could represent the pyritic siltstone horizon in which the mineralized veins generally occur, or a pyritic halo surrounding the vein. Further testing would be necessary to make any positive predictions.

Ore Genesis

The origin of the gold is unknown but in all the mines with any significant production the mineralized veins occur in dark grey non calcareous pyritic siltstones that show traces of gold near the veins. The presence of gold in the country rock could represent a halo affect around the hydrothermal quartz veins that have intruded the country rock along tension gashes. The gold could be derived from depth, possibly from an igneous source associated with the nearby Anabama Granite. Alternatively the quartz veins may have sweated out of the nearby country rock into the tensional gashes, which are areas of low pressure, carrying fine grained gold that may be disseminated through the pyritic shales in trace amounts. The thermal activity associated with the intrusion of the Anabama Granite would be an ideal energy source for such a process. However no real evidence has been found that the pyritic shales away from the mineralized veins contain trace amounts of gold, but this could be due to the limitations of the sampling and analytical techniques.

Potential of Goldfield

There is no doubt that some gold still remains in the area, but in the past the richest portions have been worked by the miners producing a relatively small total amount of gold, thus the possibility of a large scale mining operation of the mineralized quartz veins seems remote.

However results indicate that small scale mining operations, reworking some of the old mines and some of the dumps, could be successful. Within the area of soil sampling some arsenic anomalies not associated with known workings have been found, suggesting that undiscovered mineralization still remains in the area. In the past the gold was found in outcropping quartz reefs, but large areas of alluvium exist within the field and careful prospecting beneath them could uncover some unexposed mineralization.

The possibility of a large low grade gold deposit within the pyritic country rock surrounding the quartz veins cannot be overlooked as insufficient detailed sampling has been done.

It should be pointed out that the high arsenic content of most of the mineralized veins could lead to treatment problems.

ANABAMA COPPER MINE AREA

Anabama Copper Mine

The mine was worked in about 1909 and it presently consists of three vertical shafts (upto 20 metres deep) and some shallow trenches excavated on three parallel mineralized quartz veins (about 40 cms wide) striking northeasterly and dipping 60° to the southeast. The country rock is a grey micaceous schist striking northeasterly and dipping steeply to the northwest. A total of about 85 tonnes of ore were mined, about seven tonnes were treated, and about 1 tonne of copper was recovered. The "lodes" consisted of ferruginous quartz with much copper carbonate and "grey copper ore" (Jones, 1909).

Biogeochemistry

A biogeochemical survey to determine if bluebush could be used as an indicator of copper mineralization below a thickness of alluvium was completed during the previous report period (Morris 1974).

The two plant types collected were identified as Kochia sedifolia and Kochia pyramidata by the Keeper of the State Herbarium of South Australia. The common name for the plants is bluebush and black-bluebush respectively (Specht 1972) (see Appendix B for photographs).

Four northwesterly trending sampling lines 100 metres long and 50 metres apart with a sample spacing of 5 metres were pegged out over the Anabama Copper Mine (fig. 18). The lines were orientated at right angles to the strike of the country rock and three known, partly mineralized, parallel quartz veins each about 40 cm. wide. Apart from the mineralized quartz veins and the country rock exposed in pits, trenches and shafts the area is covered by up to 1.5 metres of calcareous soil. At each sample point a soil, bluebush and black-bluebush sample was collected where possible. The plant samples, consisting of older branches and fleshy leaves of mature plants, were washed in the field with distilled water and then submitted for analysis for copper (Cu), nickel (Ni), Cobalt (Co), lead (Pb) zinc (Zn) and molybdenum (Mo). The results are shown on figures 19 and 20. A sample of the mineralized quartz vein assayed at greater than 10 000 ppm Cu, 10 ppm Ni, 5ppm Pb, 100 ppm Zn and 10 ppm Mo. From these values Cu and Mo are the only metals that could be expected to give any significant response in the soil and plant samples.

Figure 21 shows there is a good correspondence between the soil results and both plant results for copper, particularly the black bluebush. However, the copper content of the plants (A.M. 11ppm. for black bluebush) is much lower than that for soils (A.M. 140 ppm. Cu) making the plant results more susceptible to analytical errors. The copper content of the bluebush (A.M. 8.0. ppm. Cu) is consistently 2 or 3 ppm lower than that for black bluebush (A.M. 11 ppm. Cu) (Table 5).

Figure 26 shows that both the soil and plants contain similar amounts of molybdenum, with the plants giving a better response. The molybdenum content of black-bluebush is consistently 0.5 - 1 ppm greater than in bluebush.

Figure 24 shows that the soil and both plant samples display a similar trend for Ni, with both having a fairly flat response. However, one "kick" does occur in the soil samples which is not reflected in the plant samples.

The results for Zn are similar to those for Ni with the soil and both plant samples giving a fairly flat response (Fig. 23).

In figure 22 it can be seen that the Pb content of the soil samples is irregular. The Pb results for the plants do not correspond to the soil but the plant results do appear to be more regular and could represent a halo effect about the main hydrothermal quartz vein.

In figure 25 it can be seen that the Co content of the soil and plants is fairly irregular with no apparent systematic variation. Both sets of plant results have a poor correlation with the soil results and with each other.

Statistical Results

TABLE 5

(AM - arithmetic mean, S.D. - Standard deviation, Threshold = AM + 2 SD)

	Kochia pyramidata (Black-bluebush)	Kochia sedifolia (Bluebush)	Soil Samples
Copper (Cu)			
A.M.(p.p.m.)	11.0	8.0	140
S.D.(p.p.m.)	3.2	2.1	70
Threshold "	17.4	12.2	280
Molybdenum (Mo)			
A.M.(pp.m.)	1.5	1.1	-
S.D. "	0.8	0.8	-
Threshold "	3.1	2.7	-
Nickel (Ni)			
A.M.(p.p.m.)	1.7	1.5	26.2
S.D. "	0.4	0.5	5.1
Threshold "	2.5	2.5	36.4
Lead (Pb)			
A.M.(p.p.m.)	1.2	1.2	8.0
S.D. "	0.7	0.4	2.5
Threshold "	2.6	2.0	13.0
Zinc (Zn)			
A.M.(p.p.m.)	7.0	6.0	46.6
S.D. "	1.4	0.9	8.9
Threshold "	9.8	7.8	64.4
Cobalt (Co)			
A.M.(p.p.m.)	0.4	0.5	13.6
S.D. "	0.2	0.2	2.5
Threshold "	0.8	0.9	18.6

From this experimental biogeochemical sampling it is clear that of the two plants sampled the black bluebush (Kochia pyramidata) is the better sampling medium, giving a consistently higher metal content than the bluebush (Kochia sedifolia). Both species of plant gave best results for Cu, and Mo, however, the Cu content is low giving a poor contrast for any anomalies. The plants may be a useful sampling medium in search for Mo as their Mo content was about the same as that for soils. As these plants are widespread this type of sampling has potential in areas of alluvial cover particularly in arid areas and with a root system that descends to a depth of more than 2 metres (Carrodus and Specht 1965), can absorb metals from rising groundwaters.

Geophysics

An induced polarization survey of two traverses was carried out over this area (Gerdes 1974). A strong induced polarization anomaly was detected on both lines about 60 metres to the north of the area sampled. Gerdes (1974) considers it may represent a lithological change, possibly due to graphitic shales.

It is proposed to extend the four soil sampling traverses to the northwest to cover this anomalous area.

ANABAMA HILL

Anabama Hill is a greisened granite complex within the Anabama Granite (Fig. 2). The hill has been investigated in detail and reported on by Blissett and Reed (1973). They found a concentration of copper and molybdenum centred around the greisened portion of the granite preserved on Anabama Hill, and reconnaissance induced polarization and geochemical soil sampling indicated two broad anomalous zones, one on the eastern part of Anabama Hill (Area T.1 figure 27), and the other on the western slopes (Area T.2 figure 27). Detailed induced polarization surveys over these zones located a number of targets to be tested, and drilling was recommended. However, mainly due to a lack of water in the area the drilling was not undertaken, but with the water position being much more favourable at present three diamond drill holes designed to intersect the source of the most intense induced polarization anomalies, have been proposed.

Figure 27 is a plan of Anabama Hill showing the contours of copper values in soils, the induced polarization anomalies and the proposed diamond drill holes. The induced polarization targets are at a depth of 122 metres and the drill holes have been inclined at 50° to 55° to intersect the targets at depth. Details of diamond drill holes are given in Table 6.

TABLE 6

Details of Proposed Diamond Drill Holes

Hole No.	Coordinates		Dip/ Azimuth	Depth	Remarks
D.D.H. 1	20000N	17625E	55/090	215m	area T.1
D.D.H. 2	18800N	12400E	50/090	230m	area T.2
D.D.H. 3	20800N	14800E	55/090	215m	area T.2

CONCLUSIONS AND RECOMMENDATIONS

Cronje Prospect

1. There is a good correlation between soil and rock chip samples and it is considered that soil sampling alone is sufficient to delineate anomalous areas.
2. Two anomalous copper zones have been found.
3. The northerly anomaly is considered to have the most potential and rotary drilling is recommended to test the source of the anomaly.

Wadnaminga Goldfield

1. Gold bearing quartz veins generally occur within dark grey non calcareous pyritic siltstones but not necessarily at the same stratigraphic position.
2. The gold is fine grained and occurs partly free, partly locked up in pyrite and partly locked up in quartz.
3. The pyritic country rock within a metre of the mineralized veins invariably contains traces of gold.
4. Some gold remains in the old workings and considering the present price of gold one or two prospectors could work some of the mines profitably.
5. Arsenic has been shown to be a reliable pathfinder element for gold in this area.
6. One significant arsenic anomaly not associated with any known workings has been found and follow up work is recommended to determine the extent of this anomaly.
7. The reconnaissance appraisal of the goldfield is considered to be completed.

8. It is recommended that detailed exploration of the goldfield be considered in the future.
9. It is recommended that the goldfield area not be renewed and the results of this survey made available to encourage company exploration or private mining in the area.

Biogeochemical Sampling, Anabama Copper Mine Area

1. Black bluebush (Kochia pyramidata) is a better sampling medium than bluebush (Kochia sedifolia) because it gives generally higher and better results, particularly for copper, molybdenum and zinc.

2. The plants give lower values than soils for all metals analysed except molybedum, hence the interpretation of the plant results has to be more subtle than for the soil results.

3. There is a definite potential for black bluebush to be used as a biogeochemical sampling medium in areas of alluvial cover, particularly in the search for copper and molybdenum.

4. Further experimental sampling of black bluebush, bluebush and associated species is recommended to gauge the full potential of this form of sampling.

5. Follow up soil sampling over the induced polarization anomalies to the north of the Anabama Copper Mine is recommended.

Anabama Hill

1. Diamond drilling is recommended to test the induced polarization anomalies.

<u>General</u>

It is recommended that the area of Exploration Licence 16, with the exception of the Wadnaminga Goldfield area, be renewed to allow time for the drilling at Anabama Hill and the conclusion of the investigations at The Cronje and Anabama Copper Mine prospects.

B.J. MORRIS

GEOLOGIST
Metallic Minerals Section.

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APPENDIX A.

Amdel Petrographic Report MP 1330/75

Thin Sections Dexcriptions TS 32890, TS 32891, TS 32892,

TS 32894, TS 32895, TS 32896, TS 32897, TS 32898

amdel

Australian Mineral Development Laboratories

Flemington Street, Frewville, South Australia 5063
Phone Adelaide 79 1662, telex AA82520

Please address all correspondence to Frewville.
In reply quote: MP 1/15/04

25th October, 1974.

S.A. Department of Mines,
Box 38, Rundle Street P.O.,
ADELAIDE. S.A. 5000.

Attention: B.J. Morris - Metallic Minerals Section.

REPORT MP 1330/75

YOUR REFERENCE:	Application dated 27th September, 1974.
MATERIAL:	Eight hand specimens
LOCALITY:	Cronje Dam Area, Anabama 1 mile sheet
IDENTIFICATION:	S1 M1465/74 to S8 M1472/74 P1539/74 → P1546/74
DATE RECEIVED:	30th September, 1974
WORK REQUIRED:	Petrographic Description

Investigation and Report by: R. Cooper

Officer in Charge,
Mineralogy/Petrology Section: Dr. K.J. Henley,

K.J. Henley

for F.R. Hartley,
Director.

maa.

1. INTRODUCTION

Eight samples were submitted by the South Australian Department of Mines (Mr. B.J. Morris, Metallic Minerals Section) for petrographic description. The samples were collected from a small area near Cronje Dam which is a locality within the Anabama 1 mile sheet area. The area of outcrop is close to the Anabama-Redan Fault and has been variously mapped by previous workers as part of the Willyama complex, the Yudnamutana Sub-Group, and as altered acid volcanics that are not assignable to any existing rock formation.

2. SUMMARY AND COMMENTS

Details of the samples examined are as follows:-

Sample	Thin Section No.	Rock Name	Genesis
S1,M1465/74	32890	Altered quartz-mica schist.	? igneous or sedimentary
S2,M1466/74	32891	Metamorphosed/metasomatised porphyritic rhyolite.	Recrystallizati and sulphide mineralization of rhyolite.
S3,M1467/74	32892	Crenulated quartz-tourmaline schist.	Metasomatic alteration of a pre-existing quartzose sedim or lava accompanied by tecton deformation.
S4,M1468/74	32894	Quartz-muscovite schist containing goethite/limonite pseudomorphs of pyrite.	Low grade regior metamorphism of an immature sediment.
S5,M1469/74	32895	Altered quartz-muscovite schist.	Low grade regional metamorphism of an immature sedimen

Sample	Thin Section No.	Rock Name	Genesis
S6,M1470/74	32896	Altered quartz-muscovite schist.	Low grade reg ional metamor of an immatur sediment.
S7,M1471/74	32897	Partially re-crystallized rhyolite.	
S8,M1472/74	32898	Altered quartz-muscovite schist with evidence of sulphide mineral-ization.	Probably an immature sedim which has unde gone low-grade metamorphism a sulphide miner ization.

The alteration and mineralization of this suite of rocks is comparabl to that found in the nearby Anabama granite (MP reports 1426/71, 1574/72, 1714/72). In fact the rhyolites are probably off-shoots or extrusives from the Anabama Granite. The variously altered quartz muscovite schists are probably part of the Yudnamutana Sub-Group, of the Umberatana bearing in mind the closeness of the outcrop to the Anabama-Redan Fault and the evidence of sulphide mineralisation and other alteration. The greenschist facies rocks around the nearby Anabama Granite have been assigned to the Anabama Group.

Although not specifically stated in the petrographic descriptions the potassic nature of the groundmass in the rhyolites was confirmed by a microchemical test employing sodium cobaltinitrite and hydro-fluoric acid.

PETROGRAPHIC DESCRIPTION OF EIGHT ROCKS FROM THE CRONJE DAM AREA, ABABAMA 1 MILE SHEET.

Sample: S1,M1465/74; TS 32890

Location:
Anabama 1 mile sheet, Cronje Dam Area.

Rock Name:
Altered lava tuff or sediment.

Hand Specimen:
This sample is brown, of weathered appearance, weakly bedded, and consists of grains of quartz up to 2 mm across dispersed through a fine grained matrix of quartz, iron oxides, and ? clay. On external surfaces the sample has a white calcerous coating which is up to 1 mm thick in places.

Thin Section:
An optical estimate of the constituents gives the following:

	%
Quartz	50-60
Clay	20-30
Chlorite	3-6
Muscovite	1-3
Iron Oxides/hydroxides	5-10

This sample is extensively weathered and has an indeterminate ? schistose/clastic texture. It is composed principally of quartz, with minor amounts of clay, iron oxides/ hydroxides, and chlorite, and trace amounts of muscovite. The quartz occurs as equant, xenoblastic to subidioblastic grains, which are typically about 0.1 mm across with the largest being up to 0.3 mm across. The quartz grains are aggregated into patches or foliae, the largest of which extends for several mm. Dispersed through the quartz are equant to slightly elongate patches of clay, the largest of which are up to 1 mm across. The clay has low interference colours and in places has a fibrous/flaky habit. Iron oxides/ hydroxides are dispersed throughout the rock occurring in patches up to 1 mm across, and along grain boundaries, fractures, and ? cleavage planes. In many areas of clay and iron oxides/hydroxides there are associated flakes of chlorite and muscovite. These flakes are randomly oriented and up to 0.2 mm long.

The origins of this rock are uncertain but there is a faint suggestio in places that the clay has replaced feldspar. If this is so then it is possible that this rock was formally an acid igneous lava or tuff. Certainly the rock contained relatively large mica flakes (now altered to clay) and hence the rock was a quartz-mica schist.

Sample: S2, M1466/74; TS 32891

Location:

Anabama 1 mile sheet, Cronje Dam Area.

Rock Name:

Metamorphosed/metasomatized porphyritic rhyolite.

Hand Specimen:

This sample is grey green, weakly foliated, and fine grained. Joint surfaces are stained with iron oxides/hydroxides.

Thin Section:

An optical estimate of the constituents gives the following:

	%
Quartz	5-10
Plagioclase	2-4
Orthoclase	8-12
Biotite	5-10
Matrix (potassic)	70-80
Opaques (including pyrite)	1-3

This sample has an igneous texture and consists of phenocrysts of feldspar, and grains of quartz, and flakes of biotite in a fine graine potassic matrix. The feldspar phenocrysts are aligned, and occur as euhedral to subhedral laths, up to 1 mm long. The feldspar has low interference colours, low relief, extinguishes unevenly, is simply twinned, and in many sections displays faint cross-hatch twinning. The composition of most of the feldspar phenocrysts is thought to be potassic (microcline), but in some instances it is evident that the uneven extinction is due to small patches of exsolved plagioclase (albite). Biotite occurs as subhedral flakes up to 0.3 mm long. These flakes, although crudely aligned, cut across the pre-existing igneous texture, in some instances occurring as inclusions in the feldspar phenocrysts, and in other places following foliation planes which are at a slight angle to the general alignment of the feldspar phenocrysts. The biotite is brown, pleochroic, and relatively fresh. Quartz occurs as equant anhedral grains up to 0.2 mm across. In places these are aggregated, with biotite and plagioclase phenocrysts, into patches up to several mm across, and these patches may represent either xenoliths or patches of more intense alteration in the igneous rock. The matrix is fine grained, with a grain size of less than 0.01 mm, is of relatively low relief and has low interference colours, and is thought to consist mainly of potash feldspar. Opaques occur as minute granules, typically less than 0.02 mm across, and as larger grains, up to 0.3 mm across, which have euhedral (cubic) outlines. The latter grains are thought to have once consisted of pyrite although they now consist of iron oxides/hydroxides.

This is a potassic acid igneous rock, a rhyolite, which has been metamorphosed/metasomatized with the development of brown biotite and the formation of ? pyrite.

Sample: S3, M1467/74; TS 32892

Location:
Anabama 1 mile sheet, Cronje Dam Area

Rock Name:
Crenulated quartz-tourmaline schist

Hand Specimen:
This sample is compact, fine grained, weakly foliated, and consists of light coloured patches or schlieren up to 2 cm long arranged in en echelon fashion in a grey matrix.

Thin Section:
An optical estimate of the constituents gives the following:

	%
Quartz	50-60
Tourmaline	35-45
Rutile	2-4

This sample has a schistose texture and is composed principally of quartz and tourmaline. The quartz occurs as equant, interlocked, subidioblastic crystals whichare typically in the size range 0.05 mm to 0.3 mm. There are foliae consisting almost entirely of quartz and foliae consisting principally of tourmaline with minor quartz. The tourmaline is generally a neutral to very pale yellow/brown colour with an irregularly developed green colouration in places, the latter usually being about small inclusions. The tourmaline forms subidioblastic prismatic crystals up to 1 mm long, although most crystals are less than 0.3 mm. The tourmaline crystals are aggregated into foliae or patches where they occur interlocked together in some places to the almost complete exclusion of quartz. Associated with the tourmaline are granular aggregates and rods of rutile up to 0.2 mm across. There are also a few patches of goethite/limonite in this sample.

This sample is a quartz-tourmaline schist, the quantity of tourmaline indicating metasomatic alteration. The abundance of rutile suggests that the tourmaline may have replaced a pre-existing titanium phase, possibly biotite, but there is no real textural evidence as to the nature of the pre-existing rock.

Sample: S4, M1468/74; TS 32894

Location:
Anabama 1 mile sheet, Cronje Dam Area

Rock Name:
Quartz-muscovite schist containing goethite/limonite pseudomorphs of pyrite.

Hand Specimen:
This sample is pale yellow green, strongly foliated, fine grained, and appears to be composed principally of quartz and muscovite. Dispersed through this matrix are pseudomorphs of goethite/limonite after pyrite. These pseudomorphs are quite regular in form and up to 3 mm across. There are numerous small iron-stained voids in the sample, and iron staining also occurs on external and joint surfaces.

Thin Section:
An optical estimate of the constituents gives the following:

	%
Quartz	55-65
Muscovite	30-40
Goethite/limonite (principally pseudomorphs after pyrite).	3-6

This sample has a schistose texture and is composed principally of quartz and muscovite. The quartz occurs as equant, interlocked, xenoblastic to subidioblastic crystals which are typically in the size range 0.05 to 0.3 mm. There is some segregation of quartz and muscovite, the latter mineral tending to be concentrated along the more prominent cleavage planes. The muscovite occurs as aggregates of subidioblastic flakes with individual flakes rarely exceeding 0.2 mm in length. Opaques occur as small irregularly shaped grains/patches, which are rarely more than 0.2 mm across, and as larger idioblastic (cubic) grains up to 3 mm across. The latter are goethite/limonite pseudomorphs of pyrite. Goethite/limonite also occurs along grain boundaries and cleavage planes.

This sample is a quartz-muscovite schist probably derived through the regional metamorphism of a sediment such as a silty sandstone. At some stage in the rocks history it has been pyritized.

Sample: S5,M1469/74; TS 32895

Location:
Anabama 1 mile sheet, Cronje Dam Area

Rock Name:
Altered quartz-muscovite schist.

Hand Specimen:
This sample is strongly foliated, light coloured, fine grained and composed principally of quartz. The quartz contains a vein-like network of very thin foliae composed of muscovite and iron oxides/hydroxides.

Thin Section:
An optical estimate of the constituents gives the following:

	%
Quartz	65-75
Muscovite	20-30
Iron oxides/hydroxides	3-6

This rock has a schistose texture and is composed principally of quartz and muscovite. The quartz occurs as equant, interlocked, xenoblastic to subidioblastic crystalsin the size range 0.03 to 0.3 mm. Muscovite occurs dispersed throughout the rock but is particularly concentrated, and coarsest, along the more prominent foliation planes in the rock. In these foliae aligned, subidioblastic flakes, up to 0.5 mm long are not uncommon, although the muscovite flakes in the body of the rock are rarely more than 0.1 mm long. Associated with the muscovite-rich foliae are irregular grains, veinlets, and patches of iron oxides/hydroxides. Many of the latter have regular (cubic) outlines and presumably have replaced a mineral such as pyrite.

This sample is an altered quartz muscovite schist, which once contained pyrite, and was probably derived from the low grade regional metamorphism of an immature sediment.

Sample: S6,M1470/74; TS 32896

Location:
Anabama 1 mile sheet, Cronje Dam Area.

Rock Name:

Altered quartz muscovite-schist

Hand Specimen:

This sample is fine grained, strongly foliated, and appears to be composed principally of quartz and muscovite with minor iron oxides/hydroxides. The iron oxides have penetrated along foliation planes and from the crenulated nature of these it is evident that the rock has suffered more than one phase of folding/crumpling. On external surfaces the rock has a smooth, talcose feel, due to the fine grained nature of the muscovite and the fact that it is concentra along the more prominent foliation planes.

Thin Section:

An optical estimate of the constituents gives the following:

	%
Quartz	70-80
Muscovite	15-25
Iron oxide/hydroxides	4-8

This sample strongly resembles the previous one, M1459/74, TS 32895 It has a schistose texture and is composed principally of quartz with minor muscovite and iron oxides/hydroxides. The quartz occurs as equant, interlocked, xenoblastic crystals the largest of which are 0.2 mm across. As with the previous sample no feldspar could be detected. Muscovite is present throughout the rock, but is principally concentrated in narrow foliae along the more prominent foliation planes in the rock. The muscovite forms aligned flakes, the largest of which are up to 0.5 mm long. The crumpled nature of the muscovite foliae suggests that the rock has been subjected to more than one phase of folding. Associated with the muscovite, and apparently partially replacing it, are iron oxides/ hydroxides. There are also a few grains of opaques with regular (cubic) outlines which are thought to be goethite/limonite pseudomorphs after pyrite. Many of the voids in the rock also have regular (cubic) outlines and may have once contained pyrite.

This sample is an altered quartz/muscovite schist, with evidence that it once contained pyrite. It was probably derived originally from the low grade regional metamorphism of an immature sediment.

Sample: S7, M1471/74; TS 32897

Location:

Anabama 1 mile sheet, Cronje Dam Area

Rock Name:

Partially recrystallized rhyolite.

Hand Specimen:

This sample is fine grained, highly siliceous, very faintly banded, and mostly grey in colour. Marginly, and along fractures it is altered to an off-white/pale pink colour.

Thin Section:

An optical estimate of the constituents gives the following:

	%
Quartz	3-6
Plagioclase	trace-4
Orthoclase	10-20
Tourmaline	2-4
Opaques	2-4
Matrix (potassic)	65-75

This sample is very similar to M1466/74, TS 32891. It has an acid igneous, flow banded texture and consists essentially of phenocrysts of orthoclase in a fine grained potassic matrix. The feldspar phenocrysts form aligned, subhedral laths, which are up to 0.5 mm long. The mineral was identified as orthoclase on the basis of its low relief, low interference colours and the presence in a few crystals of very faint, poorly developed cross-hatch twinning. In places the rock is quite porphyritic where the crystals of orthoclase occur aggregated into clots up to 1 mm across. Crystals of quartz, up to 0.1 mm across, are present dispersed throughout the rock, with most occurring along narrow indistinct veinlets. Opaque grains occur dispersed throughout the rock, and many of these have euhedral (cubic) outlines and are though to be pyrite grains pseudomorphedby iron oxides/hydroxides. There are also trace amounts of rutile and ? jarosite in this sample. Green-brown tourmaline occurs as subidioblastic prismatic crystals up to 0.1 mm across. These tourmaline crystals occur in patches aligned parallel to the flow banding and in a few instances along fractures. The matrix of this rock is crystalline, but extremely fine grained, and as it reacts strongly to a microchemical test for potassium, it is thought to consists principally of potash feldspar.

This sample is an altered acid igneous rock, a rhyolite, which at some stage in its history has been pyritized and tourmalinised.

Sample: S8,M1472/74; TS C32898

Location:
Anabama 1 mile sheet, Cronje Dam Area

Rock Name:
Altered quartz-muscovite schist with evidence of former sulphide mineralisation.

Hand Specimen:
This sample is grey, strongly foliated, and fine grained. The foliation planes are strongly crumpled and there is evidence of cross shearing/jointing. Dispersed through the rock are patches of iron oxides/hydroxides which appear to be pseudomorphs after pyrite, and also several patches, up to 1 mm across, of green secondary copper minerals.

Thin Section:
An optical estimate of the constituents gives the following:

	%
Quartz	60-70
Muscovite	55-35
Opaques (including pseudomorphed pyrite crystals).	3-6
Secondary copper minerals	trace-2

This sample is a quartz-muscovite schist, not dissimilar to samples M1468/74-M1470/74, but with more prominent signs of former sulphide mineralisation. The quartz occurs as equant to slightly elongate, interlocked, xenoblastic crystals in the size range 0.03 to 0.3 mm. The quartz is concentrated/segregated into foliae which are up to several mm across with the intervening foliae being muscovite-rich. The muscovite is heavily altered and occurs as aligned flakes, up to 0.5 mm long. It is stained/altered/replaced by iron oxides/hydroxides The latter also form patches, up to 0.5 mm across, which have regular (cubic) outlines and are evidently pseudomorphs after pyrite. In a few places in the rock, usually in quartz-rich foliae, there are patches of iron oxides/hydroxides, up to 0.6 mm across, which have secondary, green, copper minerals associated with them. A few patches of secondary coppper minerals are also present without iron oxides/hydroxides.

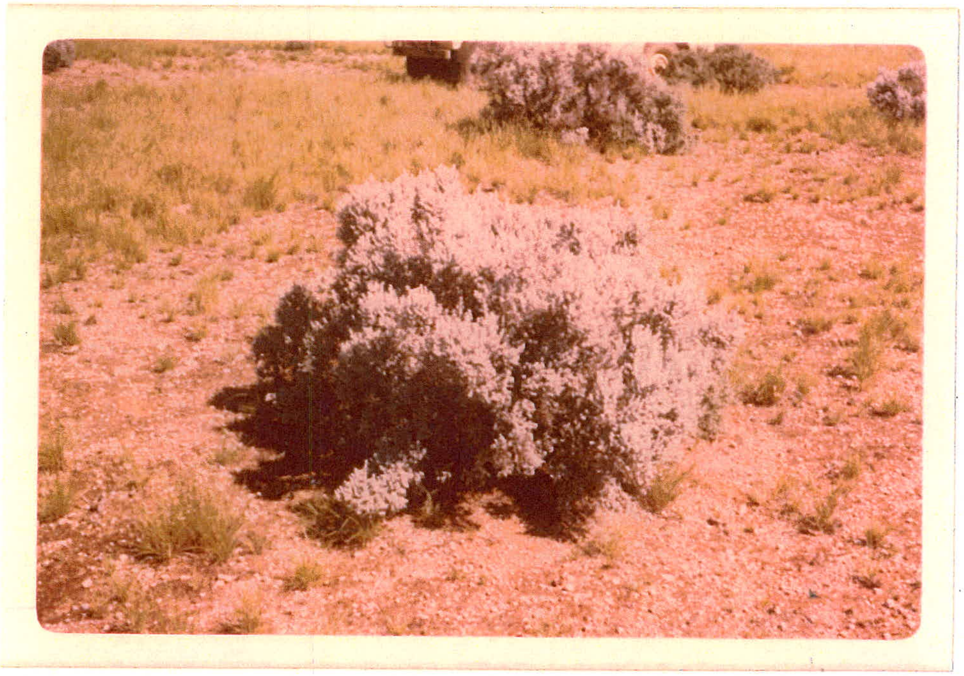
This rock is a quartz-muscovite schist which contains plentiful evidence of former sulphide mineralisation.

APPENDIX B

Photographs 1. Kochia pyramidata (black bluebush)

2. Kochia sedifolia (bluebush).

(1.)



(2.)

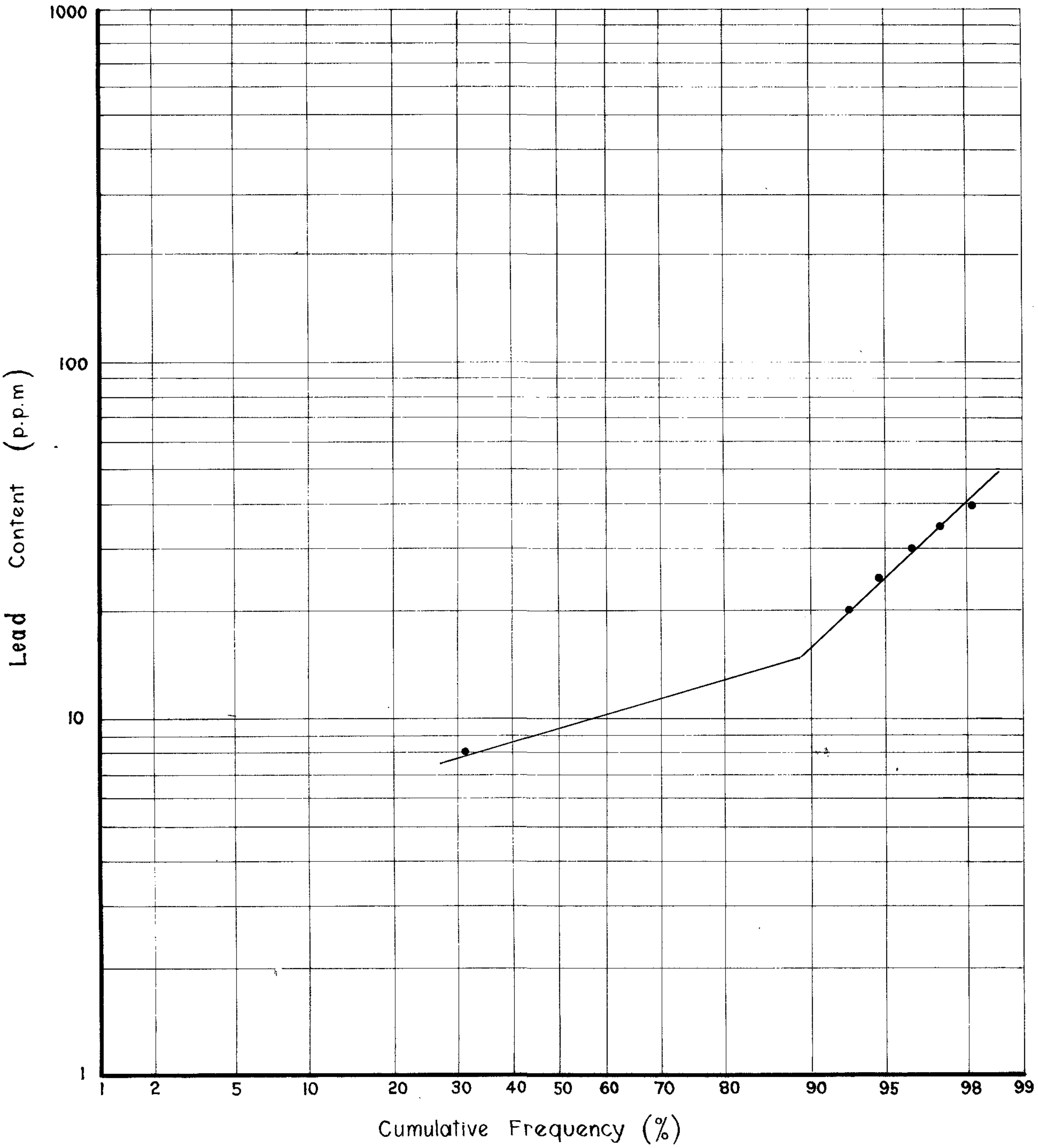


FIG.

METALLIC MINERALS SECTION	**DEPARTMENT OF MINES – SOUTH AUSTRALIA**	Scale:
Compiled: B.M.	EXPLORATION LICENCE 16 CRONJE PROSPECT LOG PROBABILITY CURVE LEAD	Date: 12 DEC. 1974
Drn. B.W. Ckd. A.F.		Drg. No. S11246

1M–2,70 A1810

6932

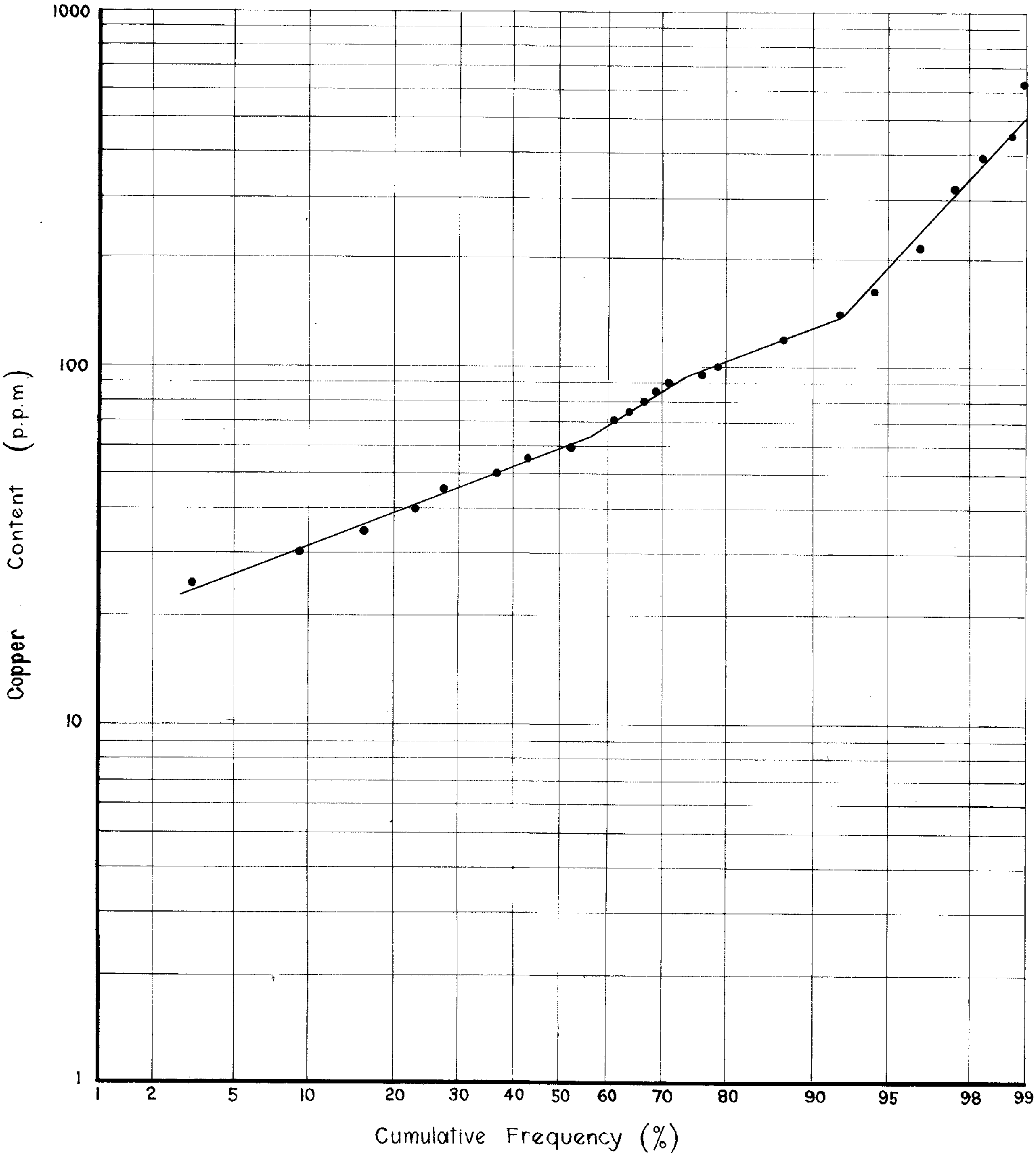


FIG.

METALLIC MINERALS SECTION	DEPARTMENT OF MINES – SOUTH AUSTRALIA	Scale:
Compiled: B.M.	EXPLORATION LICENCE 16	Date: 12 DEC. 1974
Drn. B.W. Ckd. A.F.	CRONJE PROSPECT	Drg. No.
	LOG PROBABILITY CURVE	S 11245
	COPPER	

1M–2.70 A1810

6932

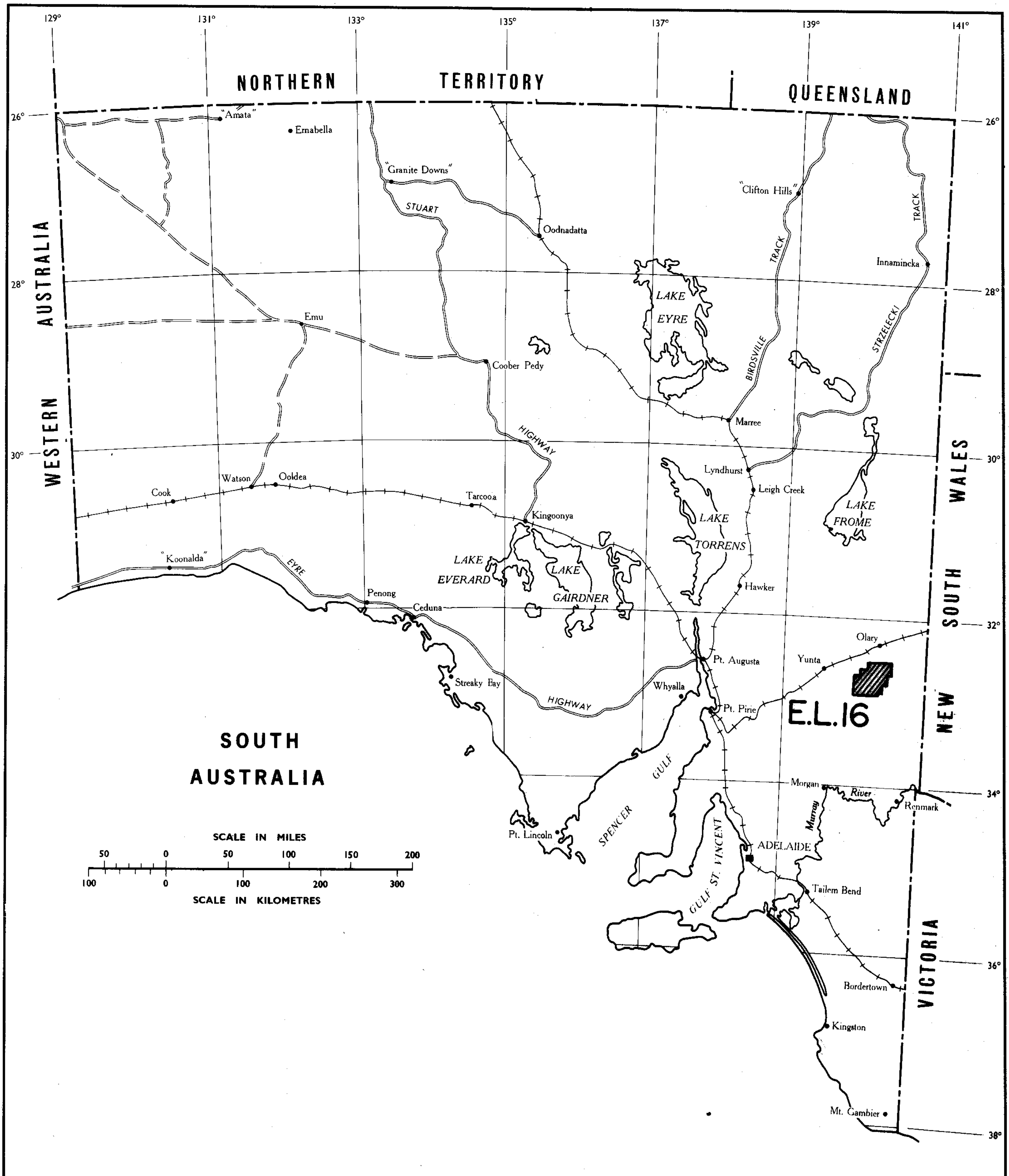
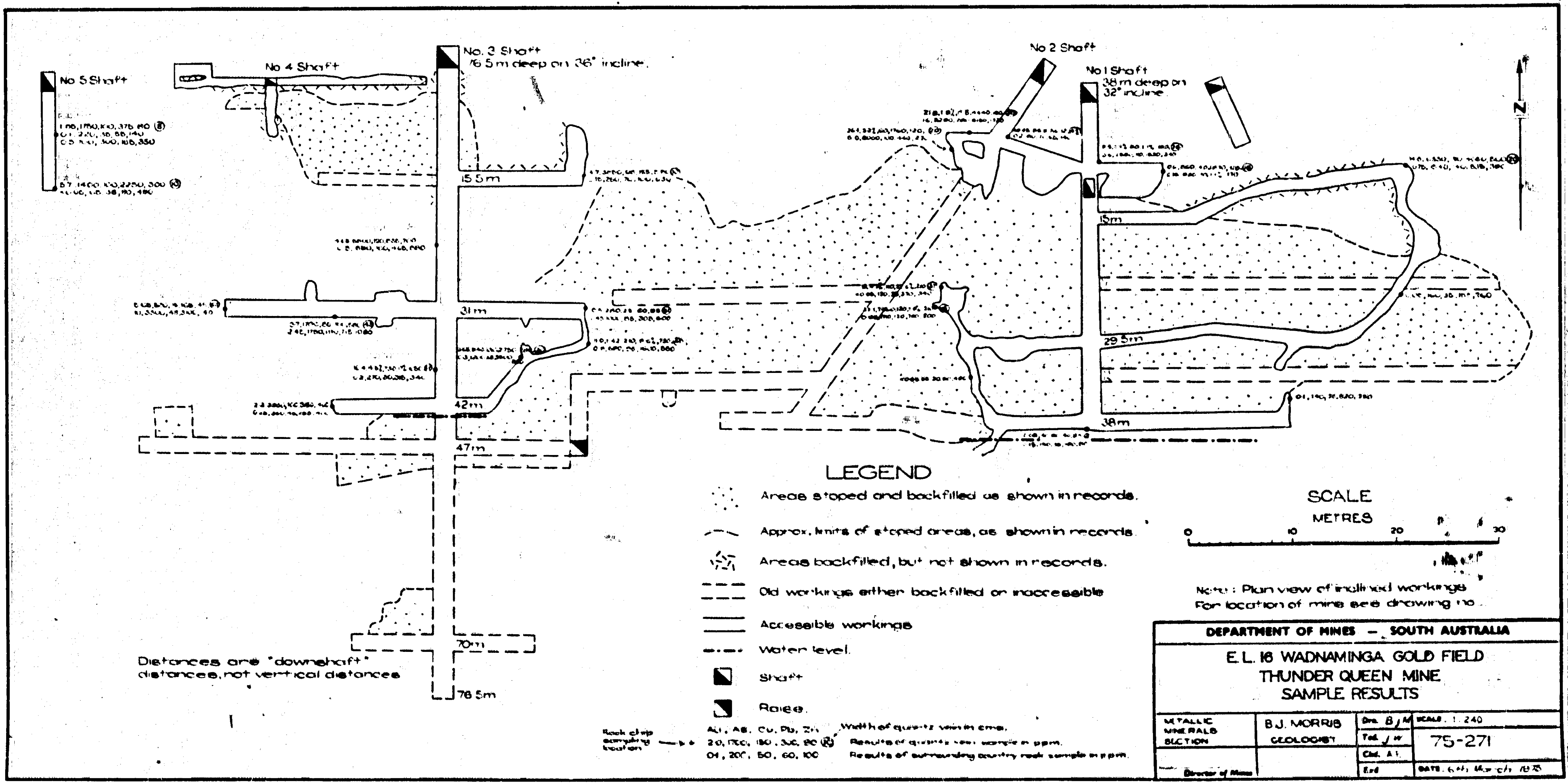


FIG. 1

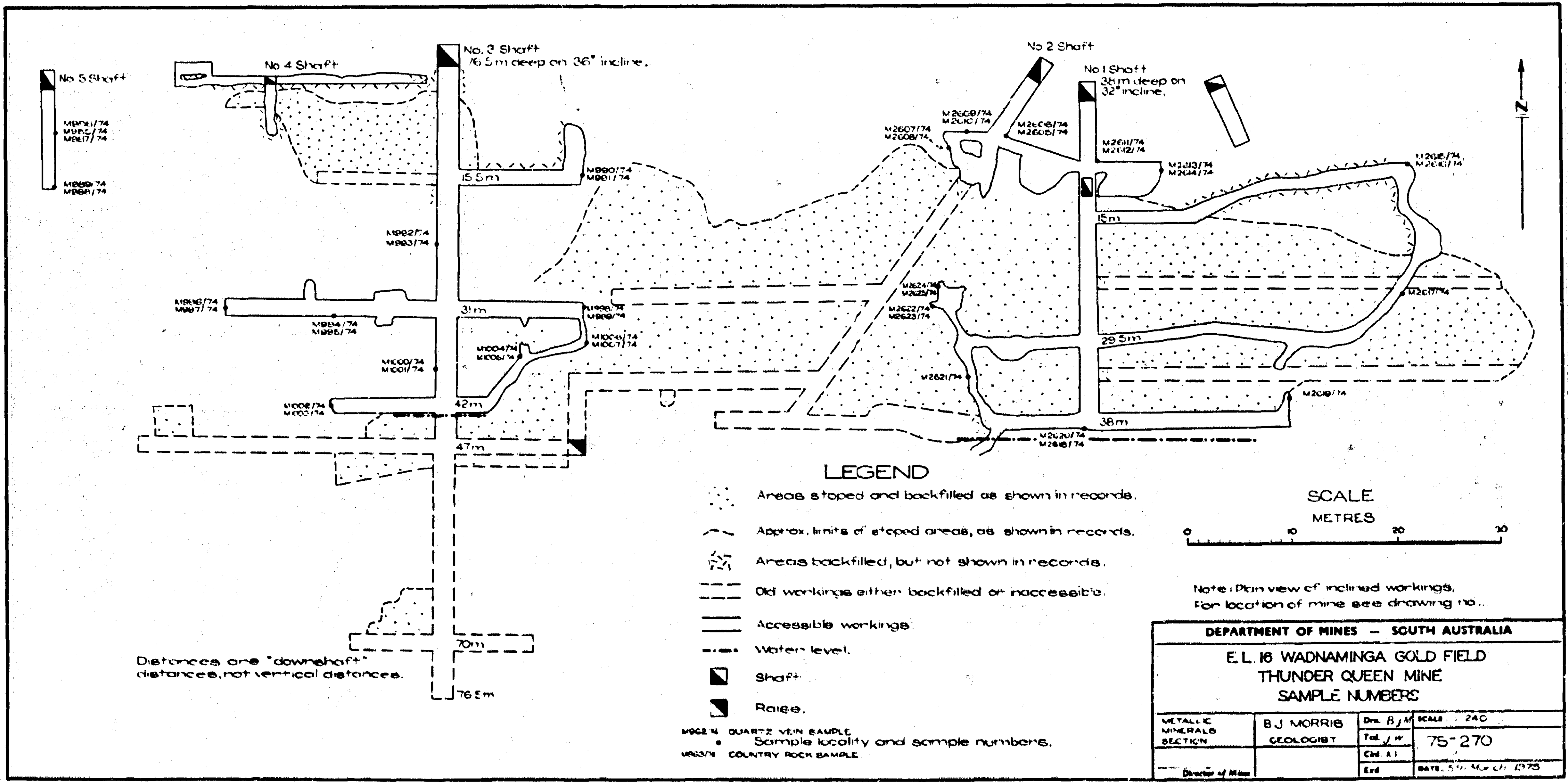
DEPARTMENT OF MINES —— SOUTH AUSTRALIA

Compiled. A.S.F.	EXPLORATION LICENCE 16 ANABAMA PROJECT LOCALITY PLAN	Date: 30 JAN. 1973
Drn. D.J.M. Ckd.		Drg. No. S10115 Fl

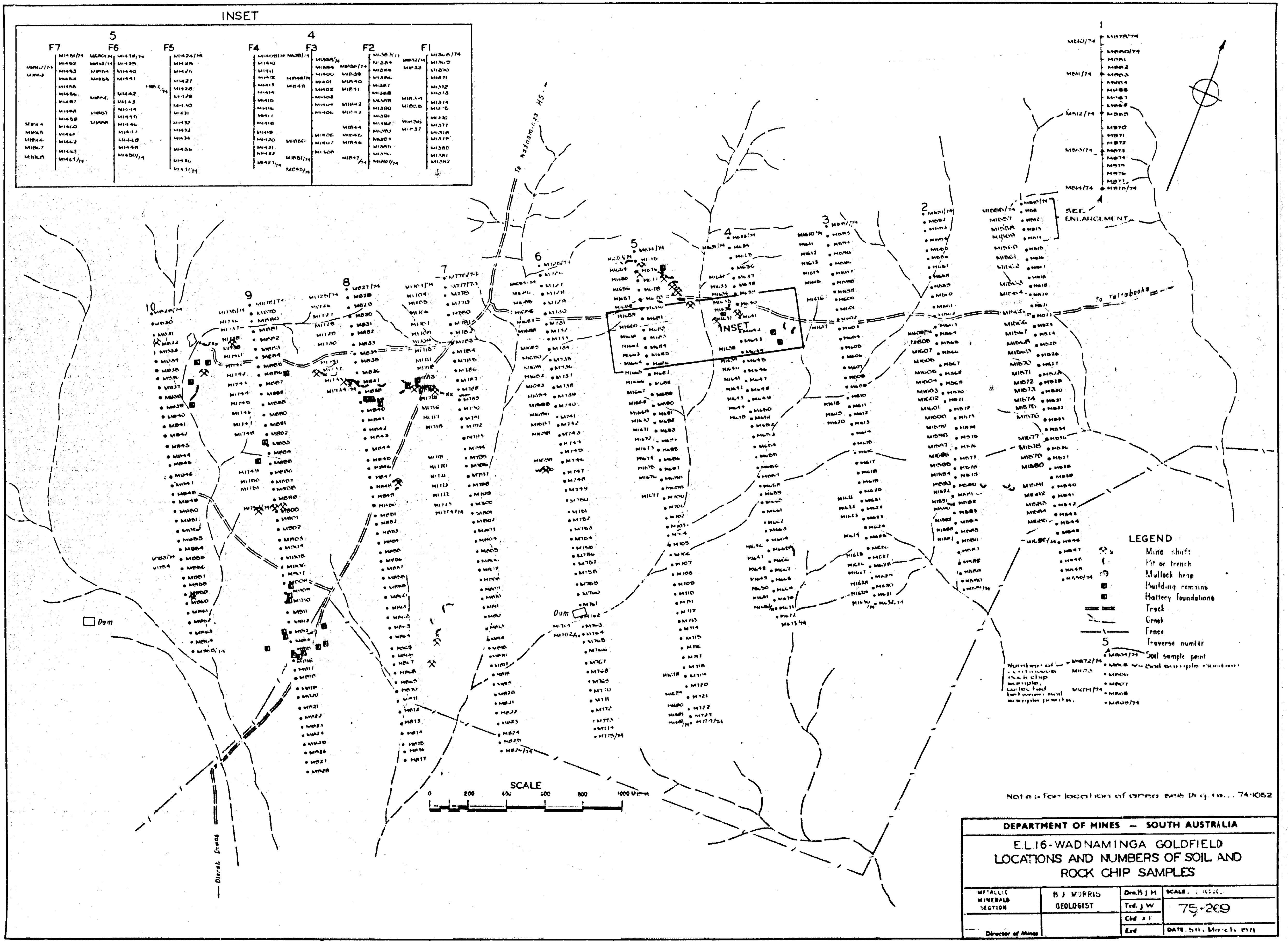
P.F. No. 55850 994.2

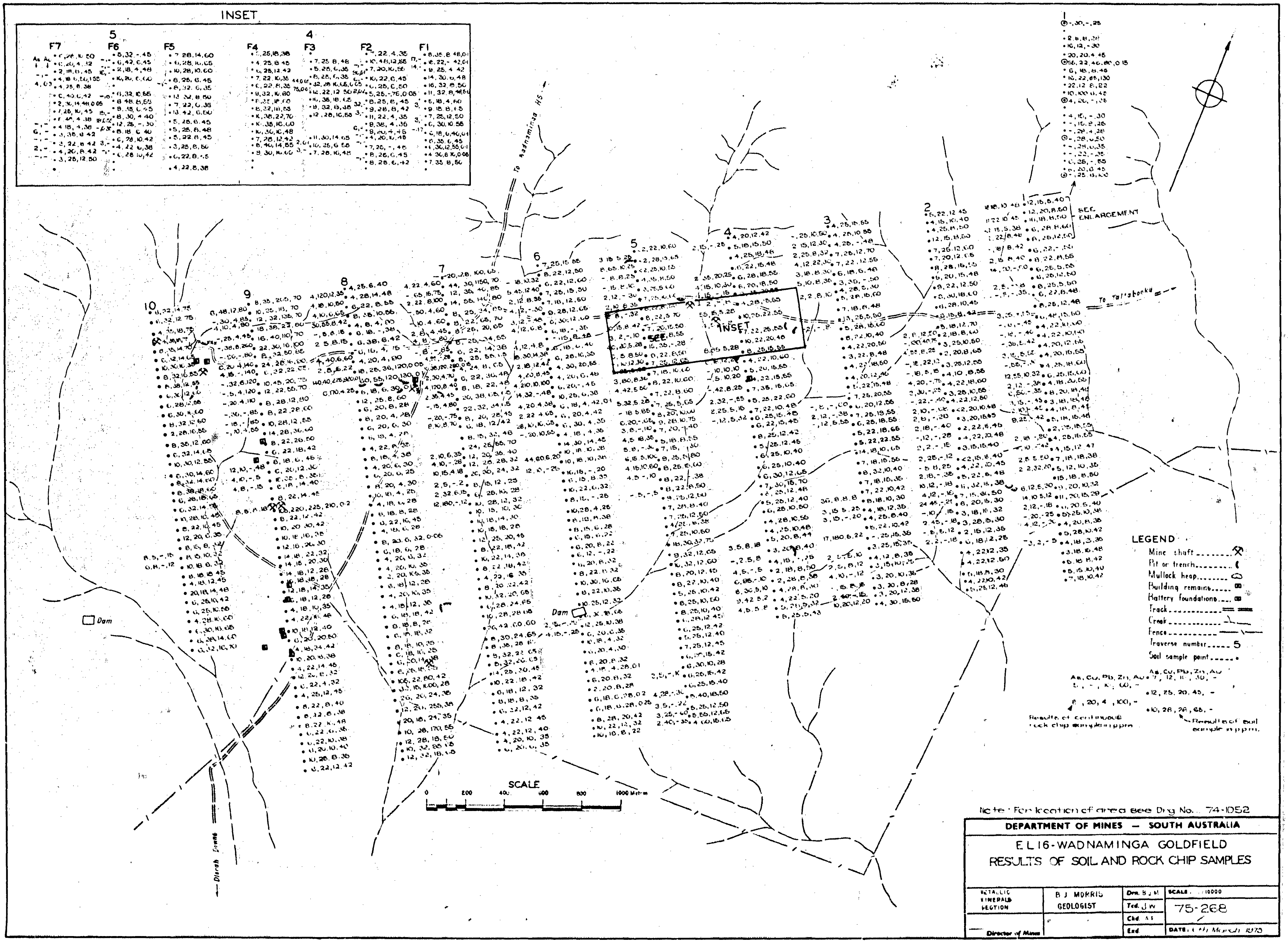


No 5 Shaft
No 4 Shaft
No. 3 Shaft
76.5 m deep on 36° incline.
No 2 Shaft
No 1 Shaft
38 m deep on
32° incline
N
15.5 m
31 m
42 m
47 m
70 m
78.5 m
15 m
29.5 m
38 m
Distances are "downshaft"
distances, not vertical distances
LEGEND
Areas stoped and backfilled as shown in records.
Approx. limits of stoped areas, as shown in records.
Areas backfilled, but not shown in records.
Old workings either backfilled or inaccessible
Accessible workings
Water level.
Shaft
Raise.
Rock chip sampling location
Au, As, Cu, Pb, Zn
20, 1700, 150, 300, 90
01, 200, 50, 60, 100
Width of quartz vein in cms.
Results of quartz vein sample in ppm.
Results of surrounding country rock sample in ppm.
SCALE
METRES
0
10
20
30
Note: Plan view of inclined workings
For location of mine see drawing no.
DEPARTMENT OF MINES — SOUTH AUSTRALIA
E.L. 16 WADNAMINGA GOLD FIELD
THUNDER QUEEN MINE
SAMPLE RESULTS
METALLIC MINERALS SECTION
B.J. MORRIS
GEOLOGIST
SCALE 1:240
75-271
Director of Mines

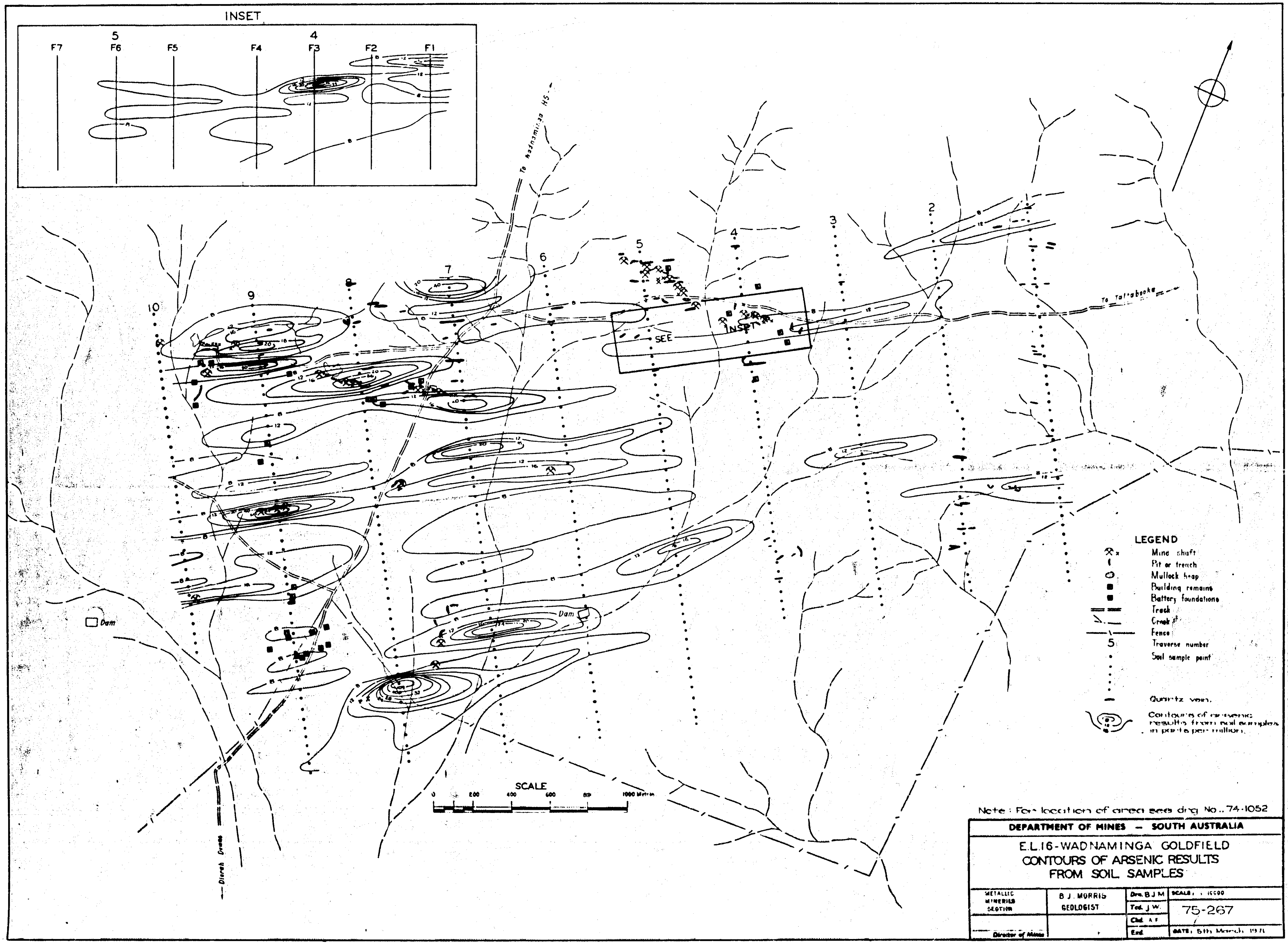


No. 3 Shaft
76.5 m deep on 36° incline.
No 4 Shaft
No 5 Shaft
No 2 Shaft
No 1 Shaft
38 m deep on
32° incline.
N
15.5m
31m
42m
47m
70m
76.5m
15m
29.5m
38m
M2607/74
M2608/74
M2611/74
M2612/74
M2621/74
M2620/74
M2618/74
M2619/74
M2617/74
M982/74
M983/74
M984/74
M985/74
M1000/74
M1001/74
M1002/74
M1004/74
Distances are "downshaft"
distances, not vertical distances.
LEGEND
Areas stoped and backfilled as shown in records.
Approx. limits of stoped areas, as shown in records.
Areas backfilled, but not shown in records.
Old workings either backfilled or inaccessible.
Accessible workings.
Water level.
Shaft
Raise.
QUARTZ VEIN SAMPLE
Sample locality and sample numbers.
COUNTRY ROCK SAMPLE
SCALE
METRES
0
10
20
30
Note: Plan view of inclined workings.
For location of mine see drawing no....
DEPARTMENT OF MINES — SOUTH AUSTRALIA
E.L. 18 WADNAMINGA GOLD FIELD
THUNDER QUEEN MINE
SAMPLE NUMBERS
METALLIC
MINERALS
SECTION
B.J. MORRIS
GEOLOGIST
Director of Mines
75-270

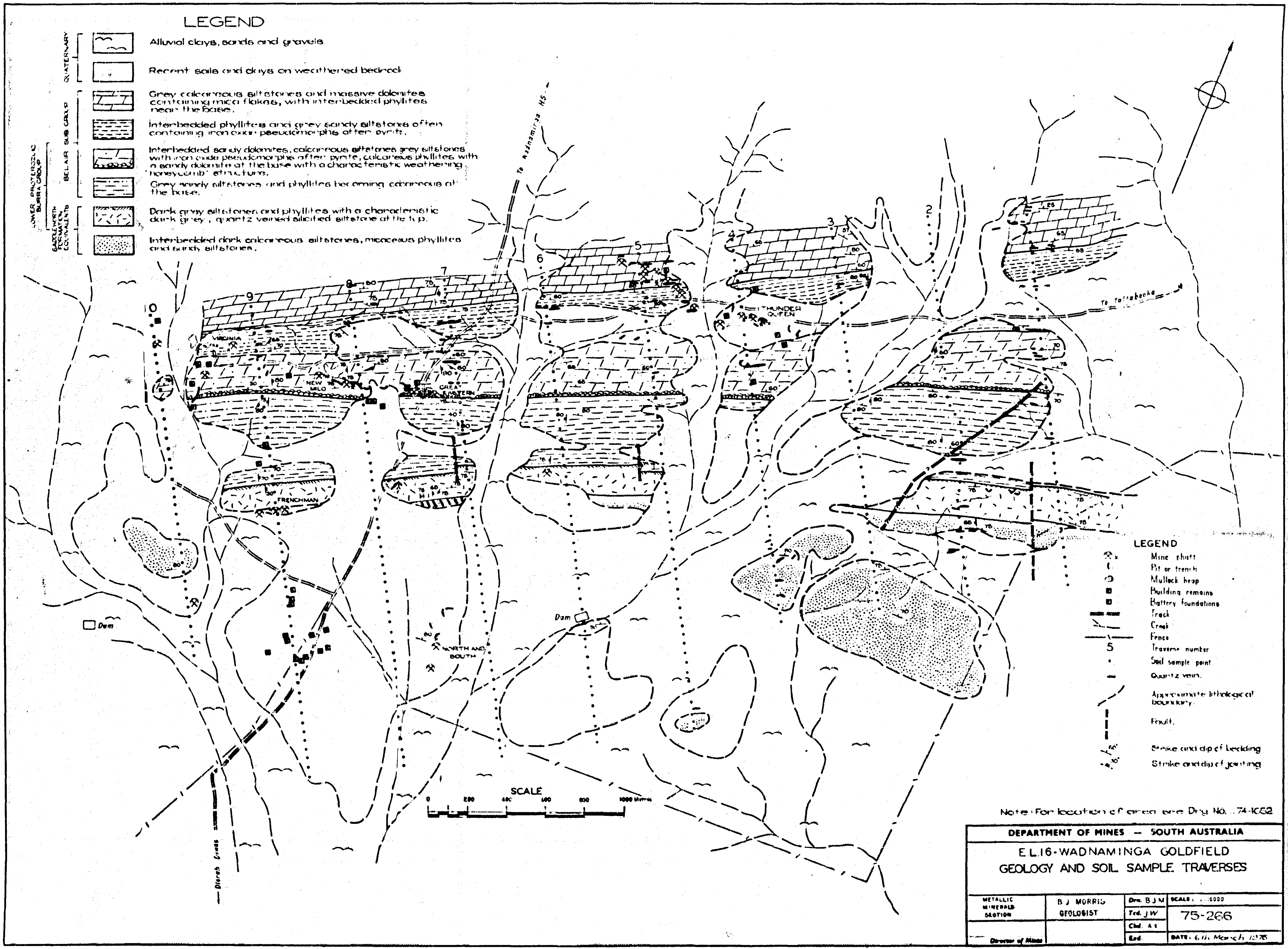

INSET
SEE ENLARGEMENT
To Wadnaminga HS
To Tallabooka
Dam
Dam
Dieroh Downs
SCALE
0 200 400 600 800 1000 Metres
LEGEND
Mine shaft
Pit or trench
Mullock heap
Building remains
Battery foundations
Track
Creek
Fence
Traverse number
Soil sample point
Soil sample number
Number of continuous rock chip samples collected between soil sample points
DEPARTMENT OF MINES — SOUTH AUSTRALIA
E.L.16-WADNAMINGA GOLDFIELD
LOCATIONS AND NUMBERS OF SOIL AND ROCK CHIP SAMPLES
METALLIC MINERALS SECTION
B J MORRIS
GEOLOGIST
Director of Mines
Drn. B J M
Trd. J W
75-269

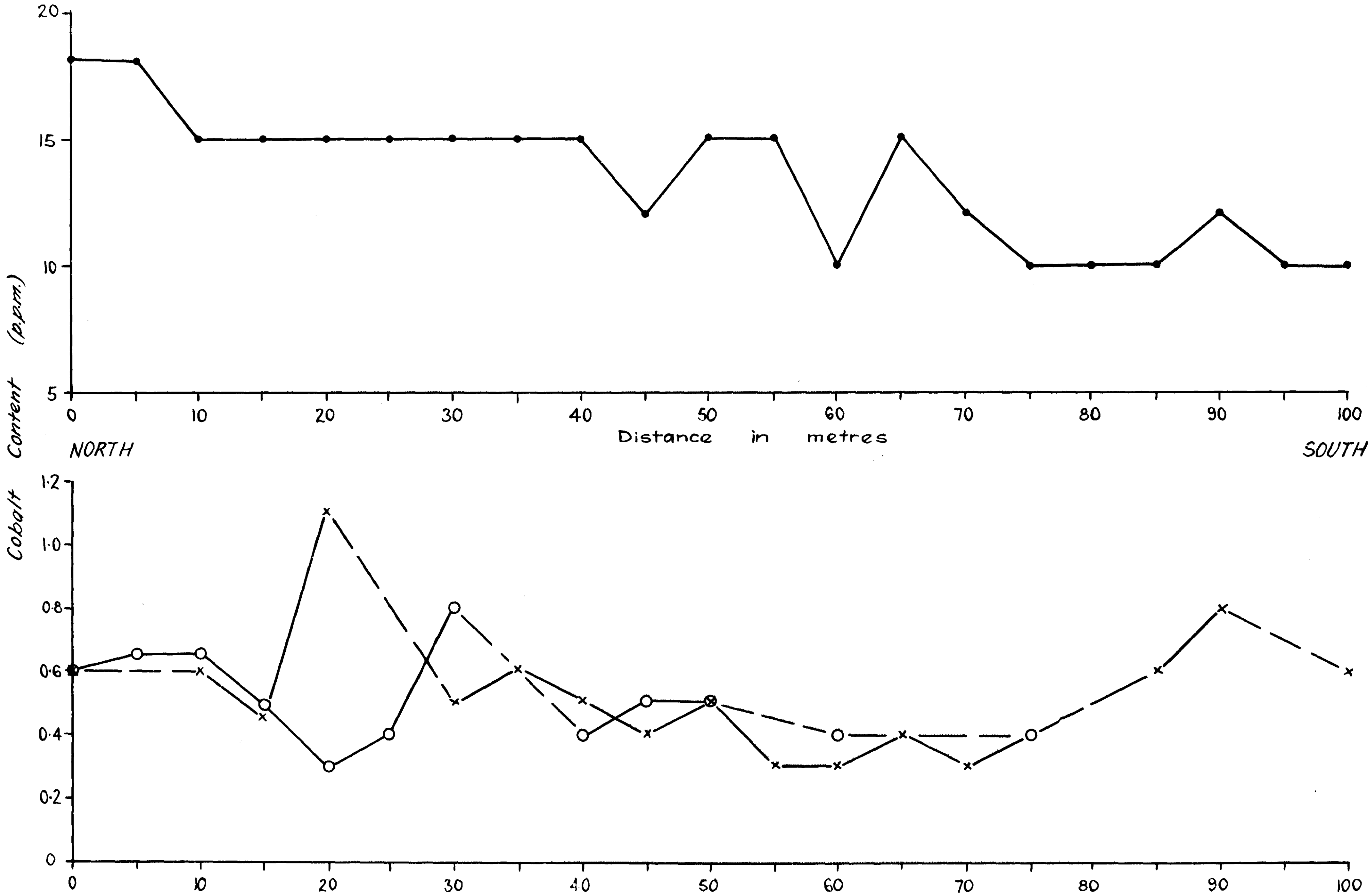


INSET
F7
F6
F5
F4
F3
F2
F1
To Wadnaminga H.S.
To Tattabooka
SEE ENLARGEMENT
SEE INSET
Dam
Dam
Olarah Dam
LEGEND
Mine shaft
Pit or trench
Mullock heap
Building remains
Battery foundations
Track
Creek
Fence
Traverse number 5
Soil sample point
As, Cu, Pb, Zn, Au
Results of continuous rock chip samples in ppm
Results of soil sample in p.p.m.
SCALE
0 200 400 600 800 1000 Metres
Note: For location of area see Drg. No. 74-1052
DEPARTMENT OF MINES — SOUTH AUSTRALIA
EL16-WADNAMINGA GOLDFIELD
RESULTS OF SOIL AND ROCK CHIP SAMPLES
METALLIC MINERALS SECTION
B J MORRIS GEOLOGIST
Director of Mines
SCALE 1:10000
75-268



INSET
F7
F6
F5
F4
F3
F2
F1
To Wadnaminga HS
To Tallabooka
SEE INSET
Dam
SCALE
0
200
400
600
800
1000 Metres
LEGEND
Mine shaft
Pit or trench
Mullock heap
Building remains
Battery foundations
Track
Creek
Fence
Traverse number
Soil sample point
Quartz vein.
Contours of arsenic results from soil samples in parts per million.
Note: For location of area see drg No.. 74-1052
DEPARTMENT OF MINES — SOUTH AUSTRALIA
E.L.16-WADNAMINGA GOLDFIELD
CONTOURS OF ARSENIC RESULTS
FROM SOIL SAMPLES
METALLIC MINERALS SECTION
B. J. MORRIS
GEOLOGIST
Director of Mines
Drn. B J M
Tcd. J W.
Chd. A F
Exd.
75-267
DATE: 5th March 1975


LEGEND
QUATERNARY
Alluvial clays, sands and gravels
Recent soils and clays on weathered bedrock
LOWER PROTEROZOIC BURRA GROUP
BELAIR SUB GROUP
Grey calcareous siltstones and massive dolomites containing mica flakes, with interbedded phyllites near the base.
Interbedded phyllites and grey sandy siltstones often containing iron oxide pseudomorphs after pyrite.
Interbedded sandy dolomites, calcareous siltstones grey siltstones with iron oxide pseudomorphs after pyrite, calcareous phyllites with a sandy dolomite at the base with a characteristic weathering 'honeycomb' structure.
Grey sandy siltstones and phyllites becoming calcareous at the base.
SADDLEWORTH FORMATION EQUIVALENTS
Dark grey siltstones and phyllites with a characteristic dark grey, quartz veined silicified siltstone at the top.
Interbedded dark calcareous siltstones, micaceous phyllites and sandy siltstones.
To Wadnaminga HS.
To Yatratunka
VIRGINIA
NEW MILO
GREAT EASTERN
THUNDER QUEEN
FRENCHMAN
NORTH AND SOUTH
Dam
Dlorah Creek
SCALE
0 200 400 600 800 1000 Metres
LEGEND
Mine shaft
Pit or trench
Mullock heap
Building remains
Battery foundations
Track
Creek
Fence
Traverse number
Soil sample point
Quartz vein
Approximate lithological boundary
Fault
Strike and dip of bedding
Strike and dip of jointing
Note: For location of area see Drg No. 74-1062
DEPARTMENT OF MINES — SOUTH AUSTRALIA
E.L.16-WADNAMINGA GOLDFIELD
GEOLOGY AND SOIL SAMPLE TRAVERSES
METALLIC MINERALS SECTION
B J MORRIS
GEOLOGIST
Director of Mines
Drn. B J M
Trd. J W
Chd. A S
Scale: 1:10000
75-266
DATE: 6th March 1976



Soil Samples

Kochia Pyramidata (black bluebush)

Kochia Sedifolia (blue bush)

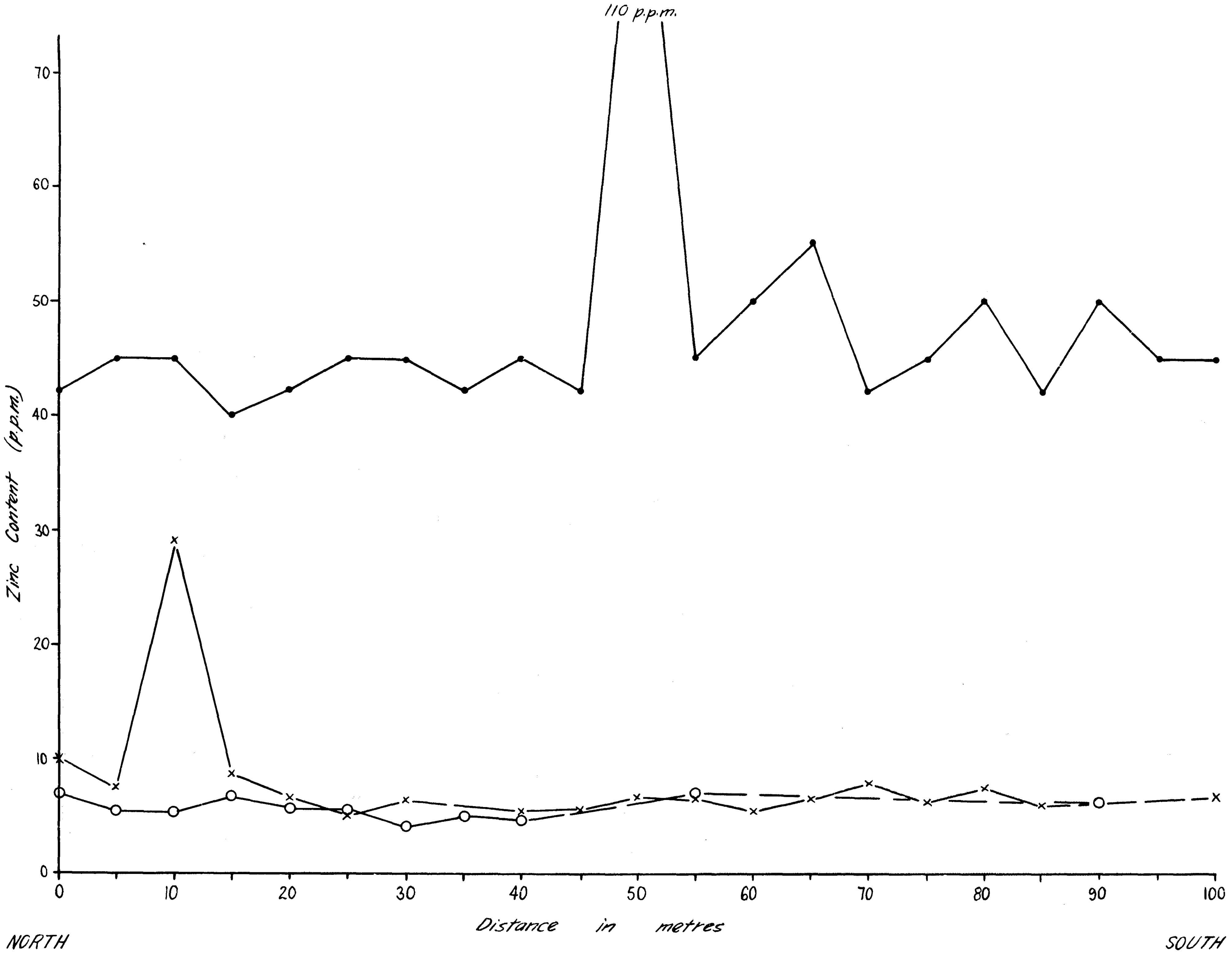
N.B. For location of line 4, see drawing no. 75-130

DEPARTMENT OF MINES — SOUTH AUSTRALIA

EXPLORATION LICENCE 16
ANABAMA COPPER MINE AREA
GRAPHS OF COBALT RESULTS FOR SOILS & PLANTS – LINE 4

METALLIC RESOURCES DIVISION		Drn. B.J.M.	SCALE :
		Tcd. B.J.M.	75-137
		Ckd. A.F.	
Director of Mines		Exd.	DATE : 12 Feb. 1975

6932



Soil Samples

Kochia Pyramidata (black bluebush)

Kochia Sedifolia (bluebush)

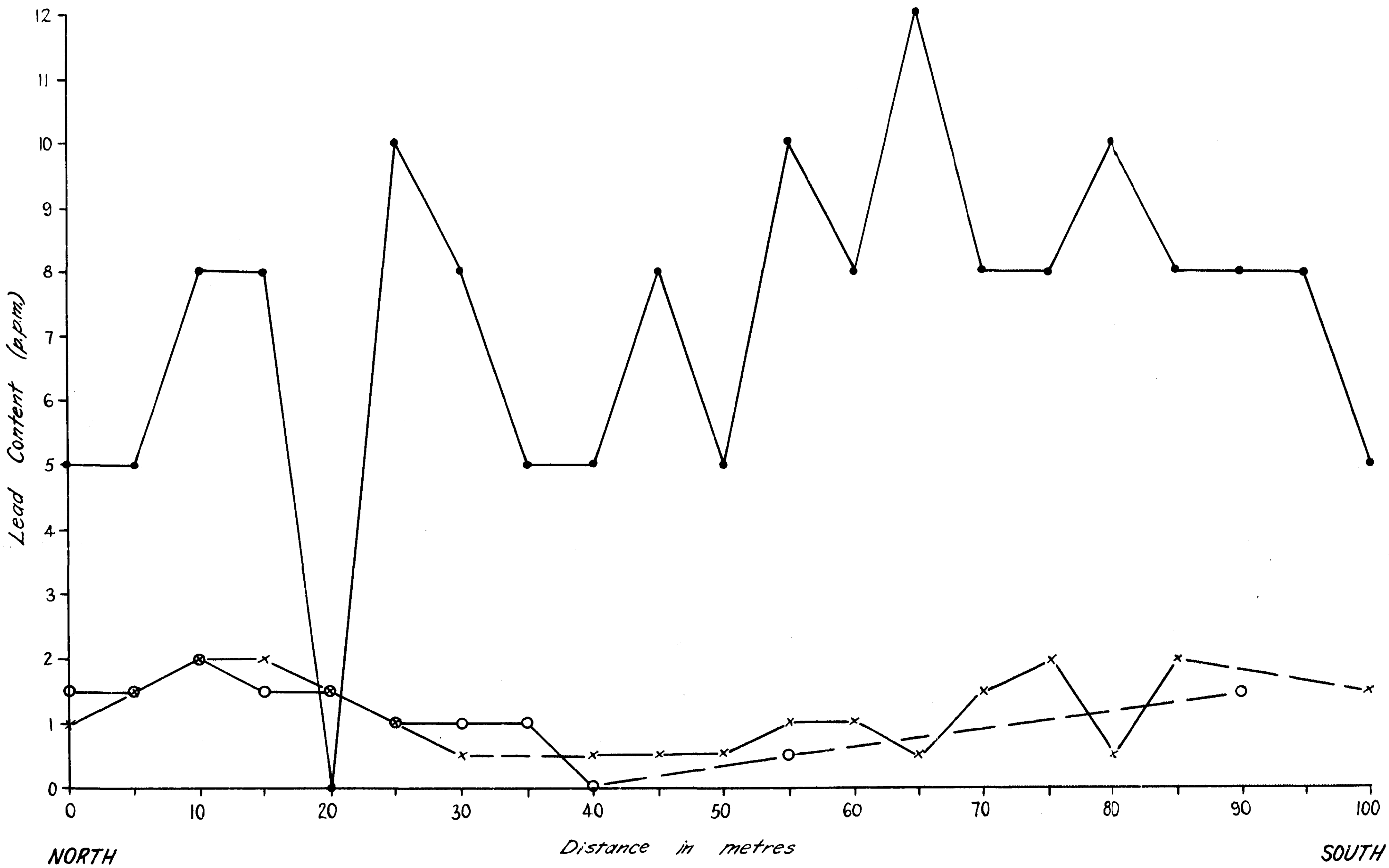
NB. For location of line 2, see drawing no. 75-130

DEPARTMENT OF MINES — SOUTH AUSTRALIA

EXPLORATION LICENCE 16
ANABAMA COPPER MINE AREA
GRAPHS OF ZINC RESULTS FOR SOIL & PLANTS — LINE 2

METALLIC RESOURCES DIVISION		**Drn.** B.J.M.	**SCALE :**
		Tcd. D.J.M.	75-136
		Ckd. A.F.	
.... **Director of Mines**		**Exd.**	**DATE :** 12 Feb. 1975

6932



Soil Samples

Kochia Pyramidata (black bluebush)

Kochia Sedifolia (bluebush)

N.B. For location of line 2, see drawing no. 75-130

DEPARTMENT OF MINES — SOUTH AUSTRALIA

EXPLORATION LICENCE 16
ANABAMA COPPER MINE AREA
GRAPHS OF LEAD RESULTS FOR SOIL & PLANTS — LINE 2

METALLIC RESOURCES DIVISION		**Drn.** B.J.M.	**SCALE:** /
		Tcd. D.J.M.	75-135
		Ckd. A.F	
Director of Mines		**Exd.**	**DATE:** 12 FEB. 1975

6932

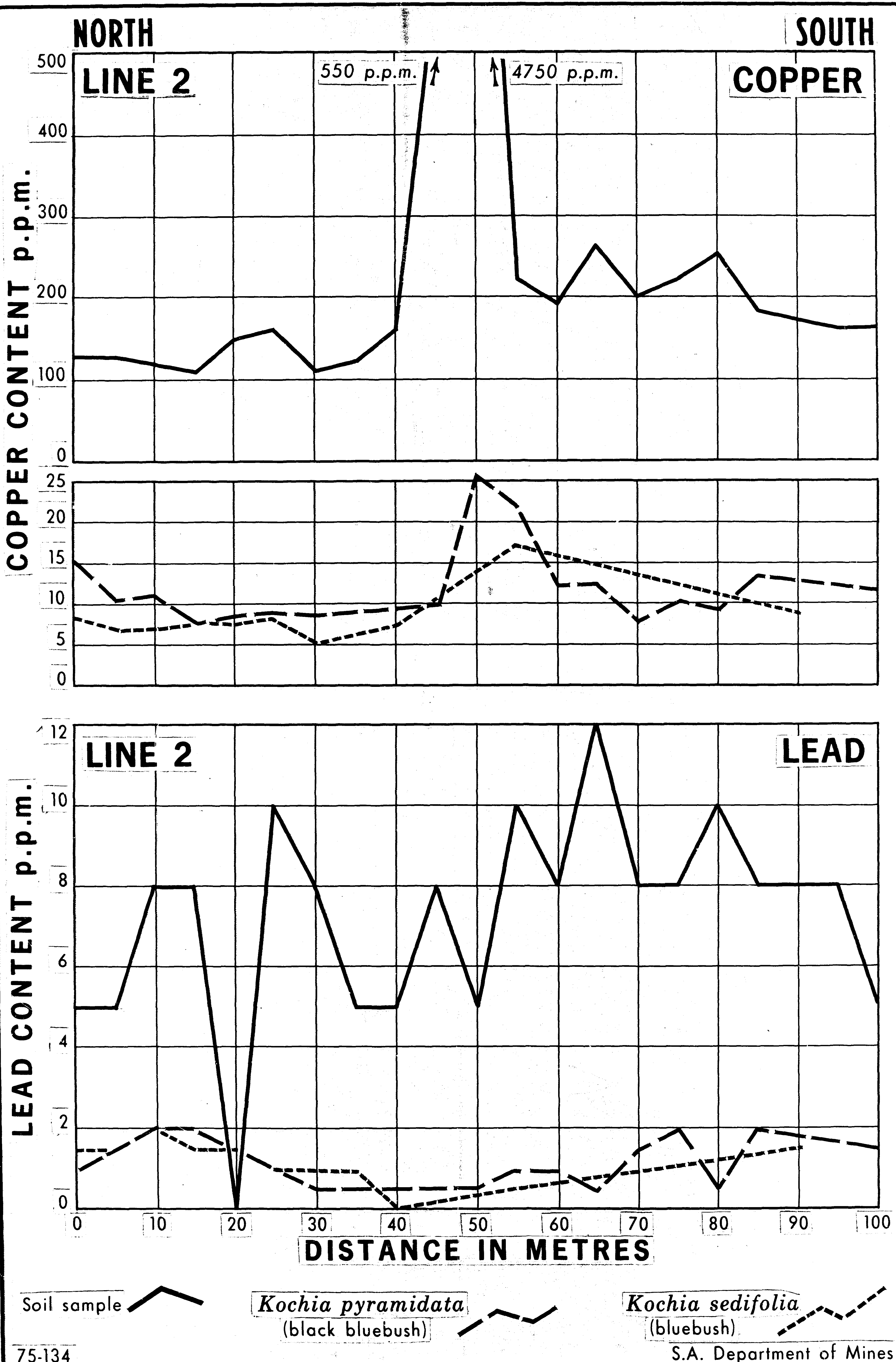
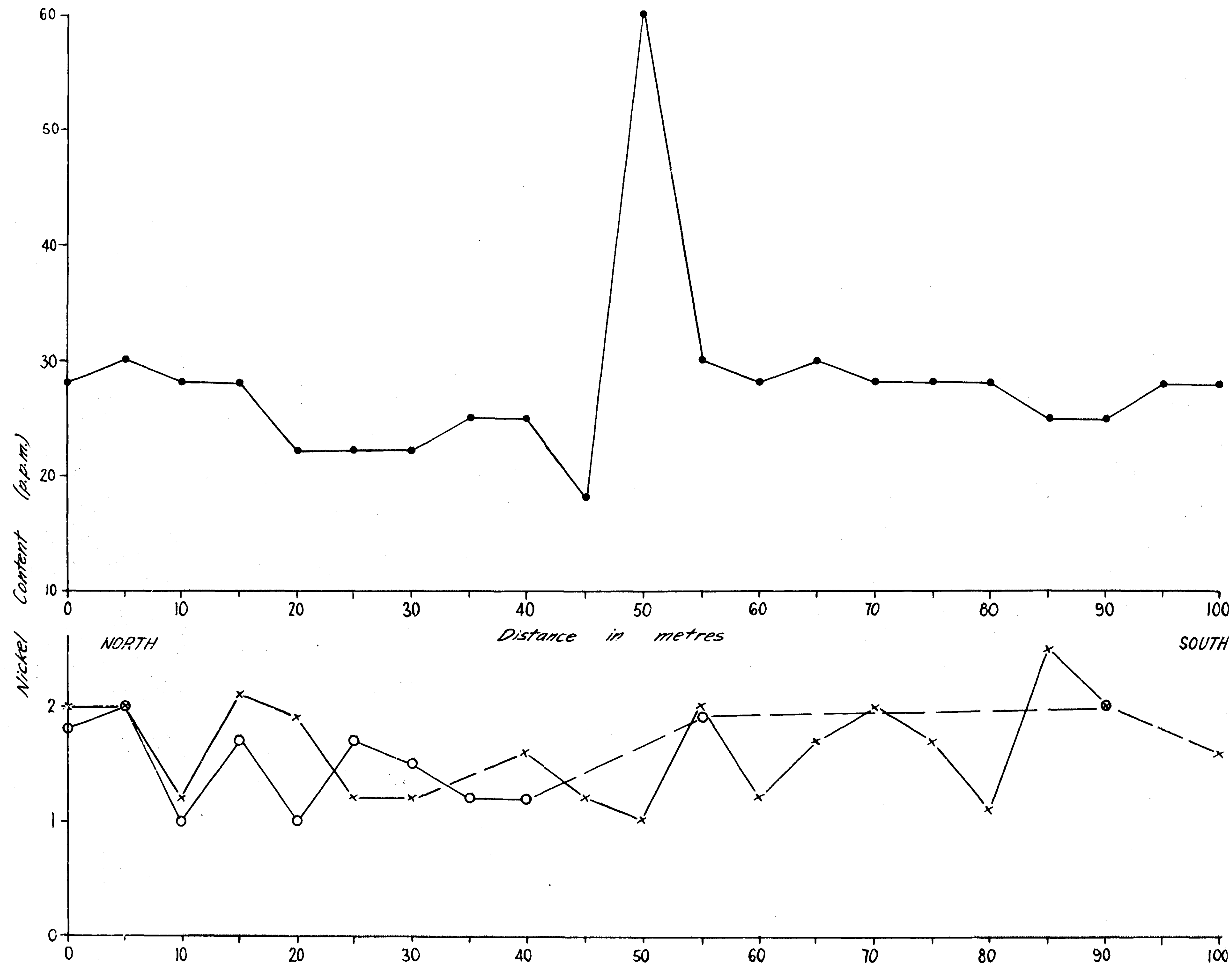


FIG. 4

Graphs for Lead & Copper sampling of soil and plants, Line 2, Anabama Copper Mine QGN 56



N.B. For location of line 2, see drawing no. 75-130

DEPARTMENT OF MINES — SOUTH AUSTRALIA

EXPLORATION LICENCE 16
ANABAMA COPPER MINE AREA
GRAPHS OF NICKEL RESULTS FOR SOIL & PLANTS - LINE 2

METALLIC RESOURCES DIVISION

Director of Mines

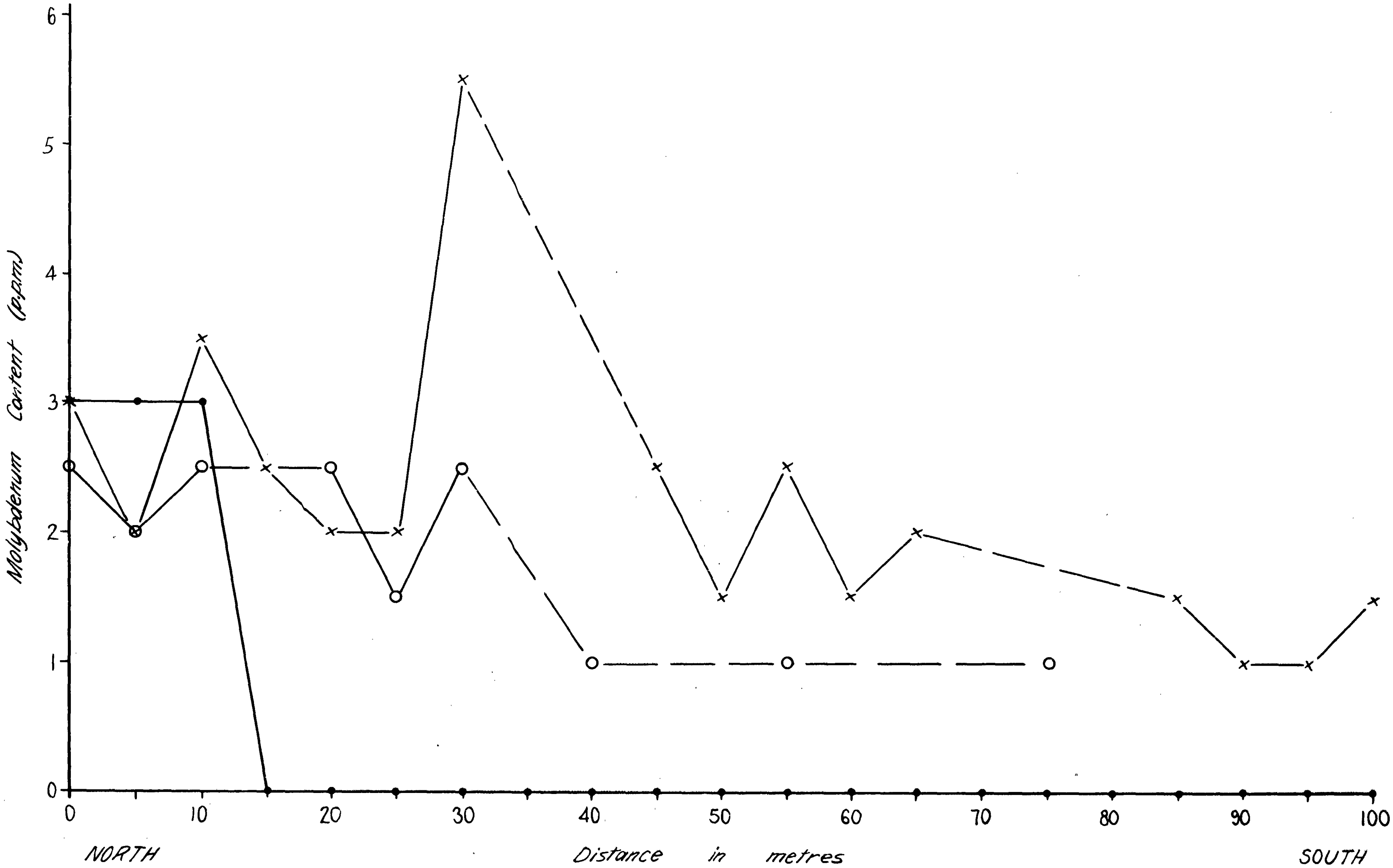
Drn. B.J.M.
Tcd. D.J.M.
Ckd. A.F.
Exd.

SCALE: /

75-133

DATE: 12 Feb 1975

6932



Soil Samples

Kochia Pyramidata (black bluebush)

Kochia Sedifolia (bluebush)

NB. For location of line 1, see drawing no. 75-130

DEPARTMENT OF MINES — SOUTH AUSTRALIA

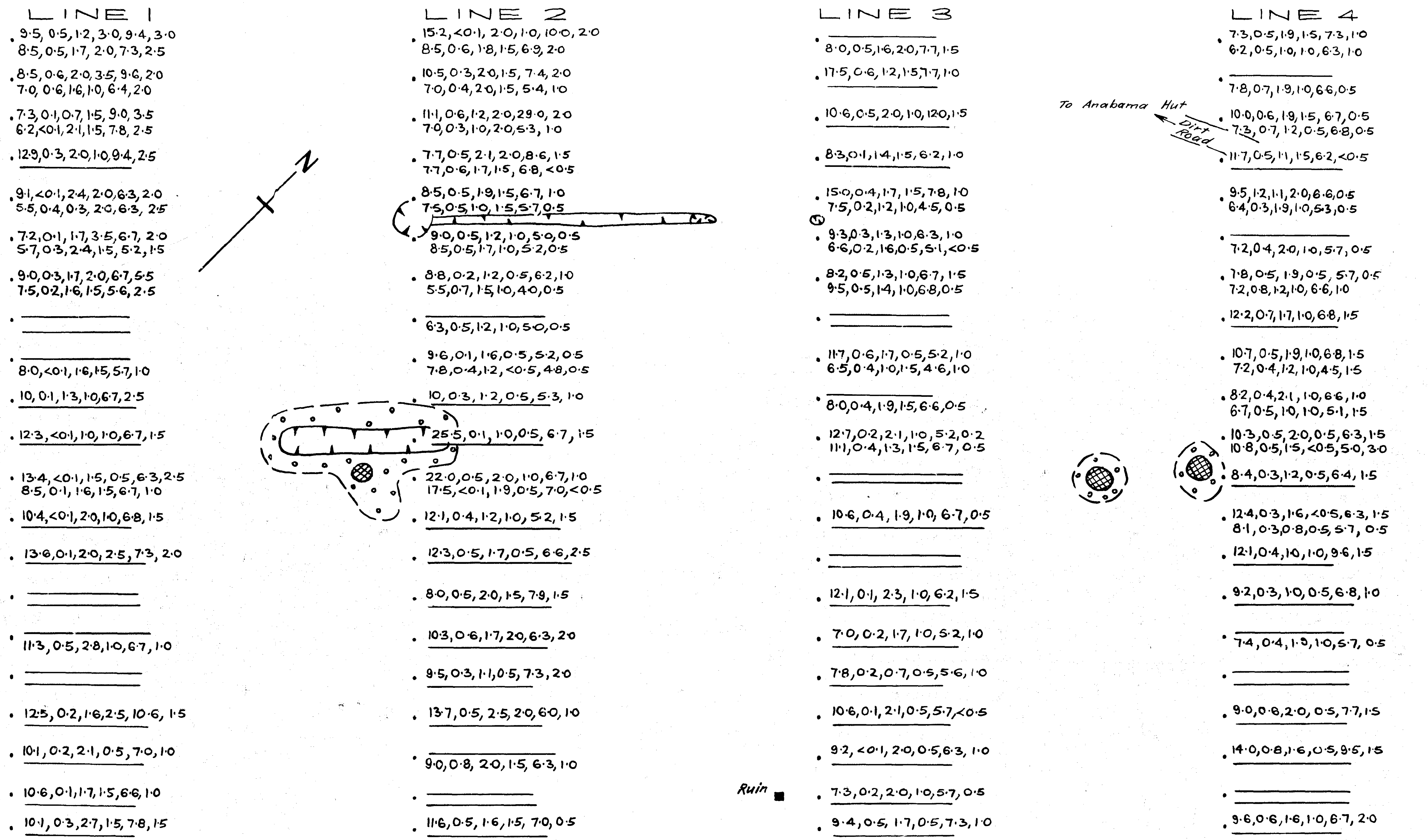
EXPLORATION LICENCE 16

ANABAMA COPPER MINE AREA

GRAPHS OF MOLYBDENUM RESULTS - SOIL & PLANTS - LINE 1

METALLIC RESOURCES DIVISION		**Drn.** B.J.M.	**SCALE:** /
		Tcd. D.J.M.	75-132
		Ckd. A.F.	
Director of Mines		**Exd.**	**DATE:** 12 Feb. 1975

6932



LEGEND

Cu Co Ni Pb Zn Mo

Sampling Point • 9·5, 0·5, 1·2, 3·0, 9·4, 3·0 ← Metal content of black bluebush in parts per million
8·5, 0·5, 1·7, 2·0, 7·3, 2·5 ← " " " bluebush " " " "

Trench

Mullock heap

Mine Shaft

N.B. For location of area see Drawing No. 74-1052

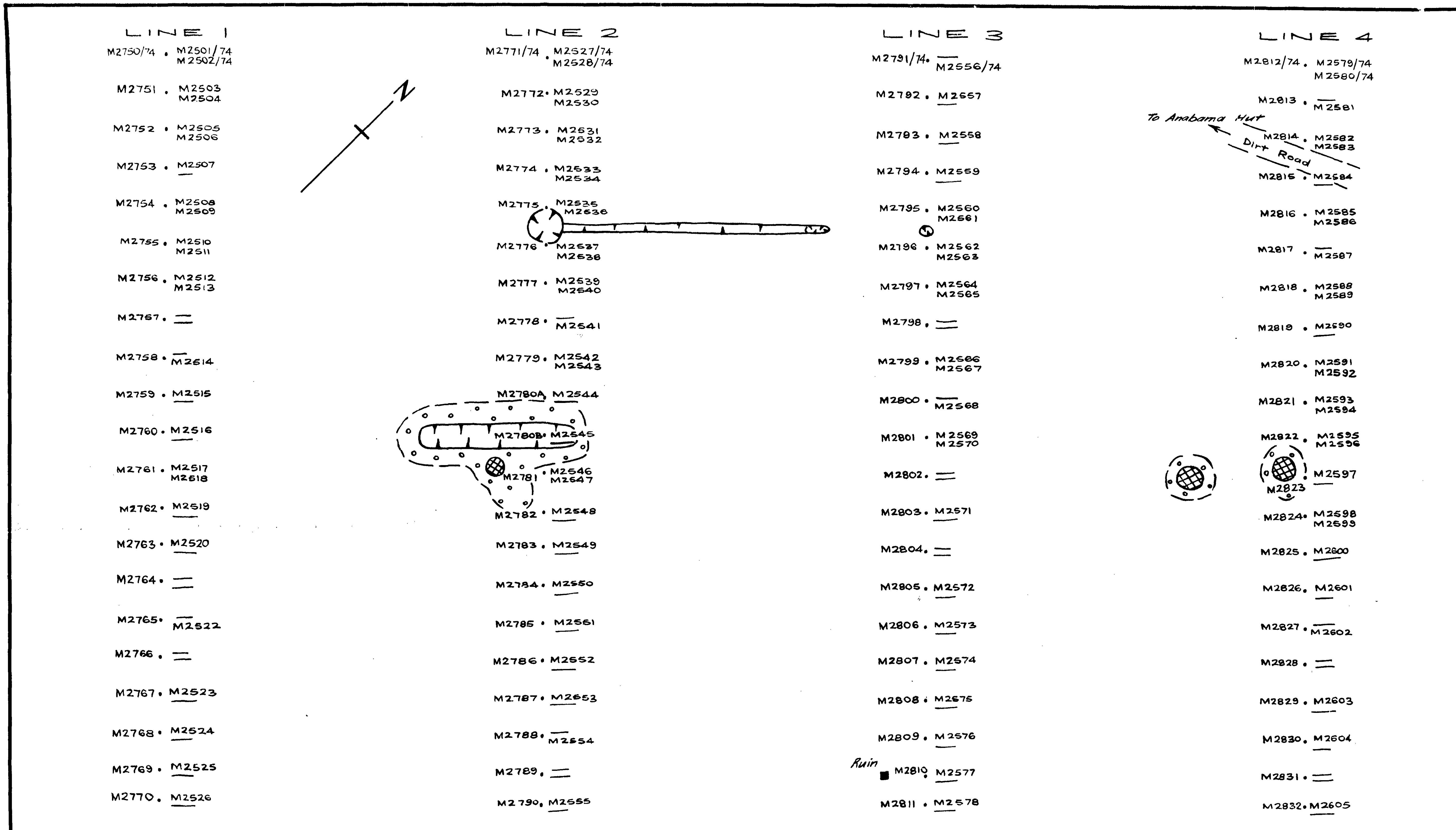
SCALE IN METRES
0 10 20 30 40

DEPARTMENT OF MINES — SOUTH AUSTRALIA

EXPLORATION LICENCE 16
ANABAMA COPPER MINE AREA
PLANT SAMPLE RESULTS

METALLIC RESOURCES DIVISION		Drn. B.J.M.	SCALE: 1:500 (ORIGINAL)
		Tcd. D.J.M.	75-131
		Ckd. A.F.	
Director of Mines		Exd.	DATE: 10 Feb. 1975

6932



LEGEND

Sampling Point

M2771/74 — Sample No. of soil sample

M2527/74 — Sample No. of black bluebush sample

M2528/74 — Sample No. of bluebush sample

Trench

Mullock heap

Mine shaft

SCALE IN METRES

0 10 20 30 40

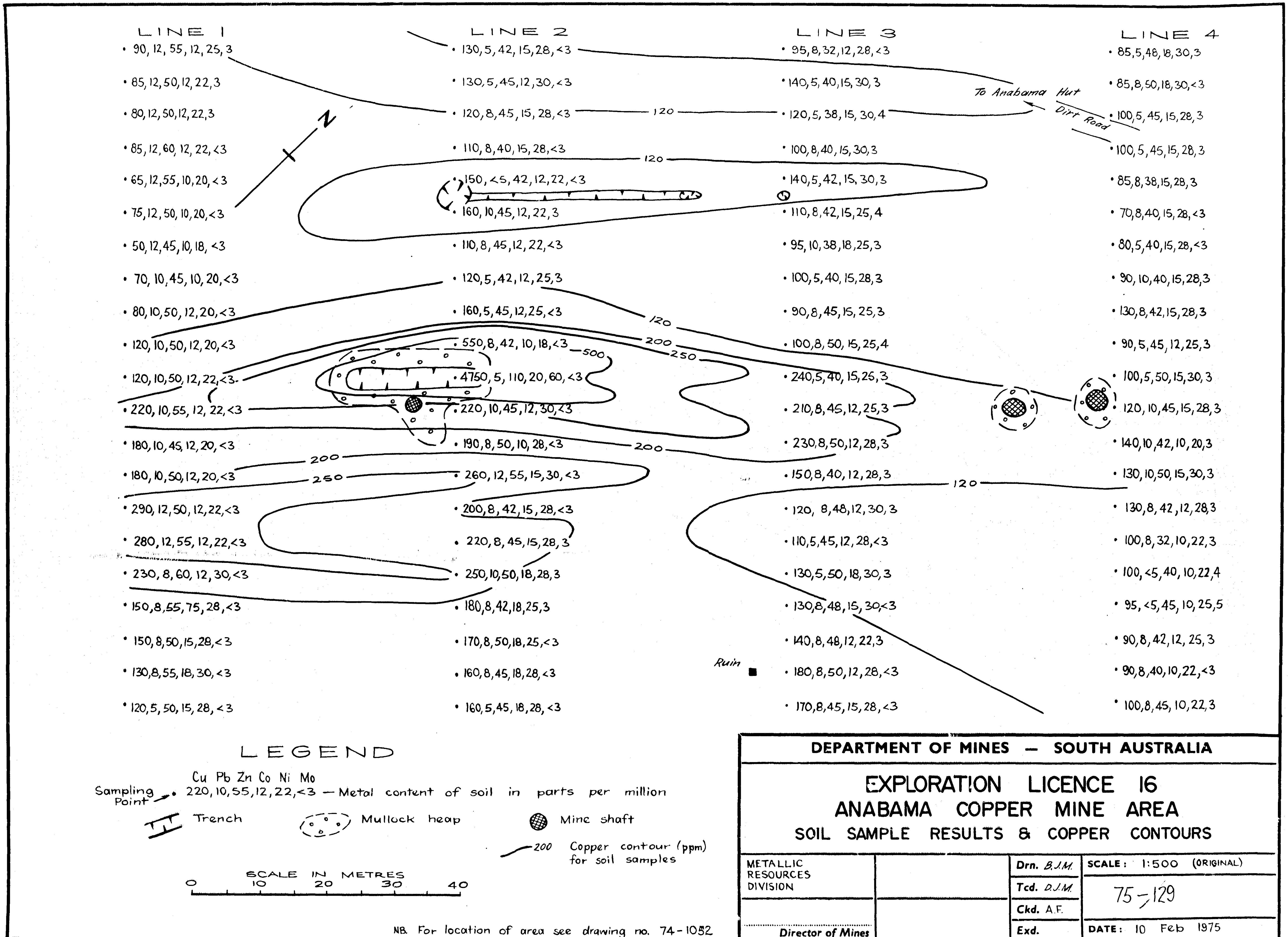
NB. For location of area, see drawing no. 74-1052

DEPARTMENT OF MINES — SOUTH AUSTRALIA

EXPLORATION LICENCE 16
ANABAMA COPPER MINE AREA
SOIL & PLANT SAMPLE NUMBERS

METALLIC RESOURCES DIVISION		Drn. B.J.M.	SCALE: 1:500 (ORIGINAL)
		Tcd. D.J.M.	75-130
		Ckd. A.F.	
Director of Mines		Exd.	DATE: 7 Feb. 1975

6932

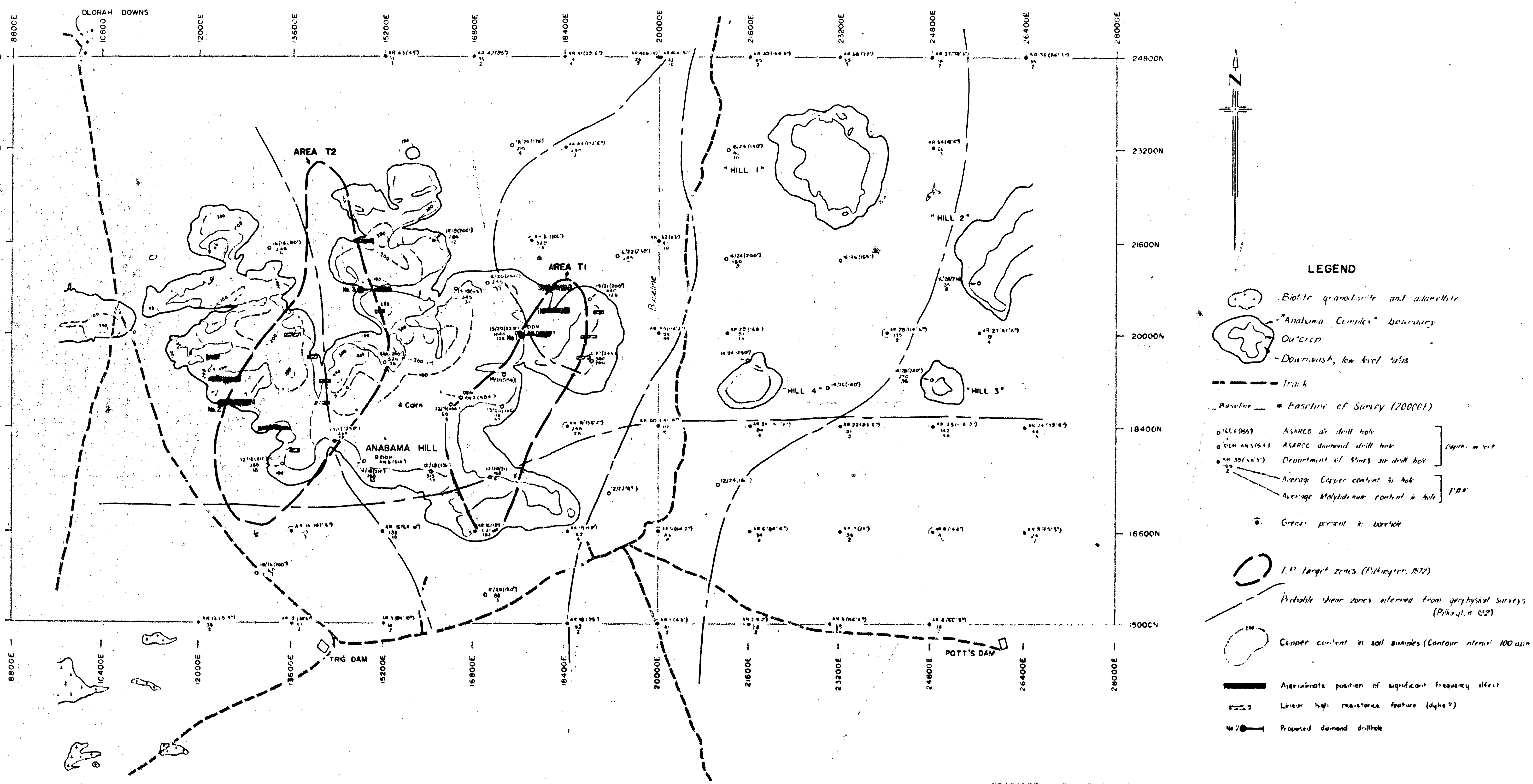


DEPARTMENT OF MINES — SOUTH AUSTRALIA

EXPLORATION LICENCE 16
ANABAMA COPPER MINE AREA
SOIL SAMPLE RESULTS & COPPER CONTOURS

METALLIC RESOURCES DIVISION		Drn. B.J.M.	SCALE: 1:500 (ORIGINAL)
		Tcd. D.J.M.	75-129
		Ckd. A.F.	
Director of Mines		Exd.	DATE: 10 Feb 1975

6932



Scale in Metres

500 0 500 1000 1500

1000 0 1000 2000 3000 4000 5000

Scale in Feet

PROPOSED DIAMOND DRILLING

Hole No.	Co-ordinates		Dip/Azimuth	Depth (metres)	Remarks
1	20000N	17625E	55/090	230	Area T1
2	18800N	17600E	60/050	230	Area T2
3	20800N	14980E	65/090	215	Area T2

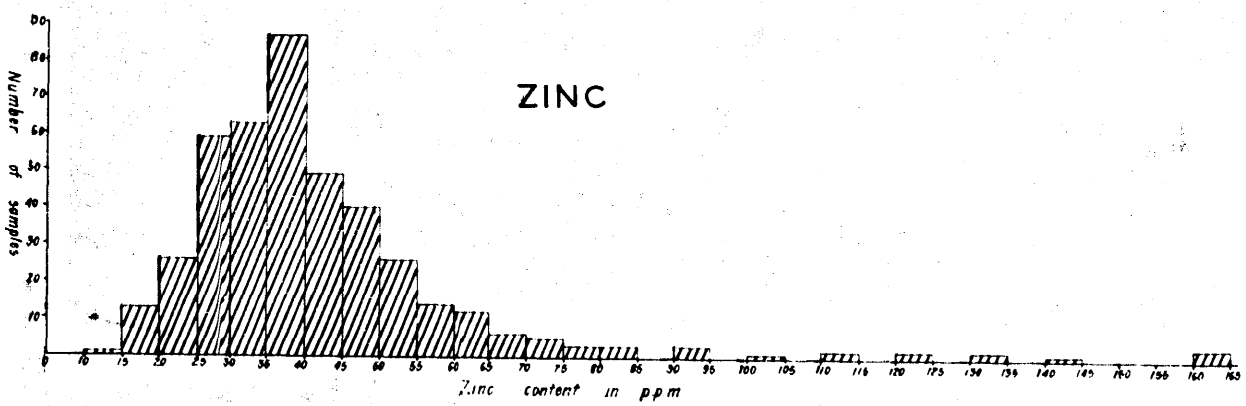
FIG.

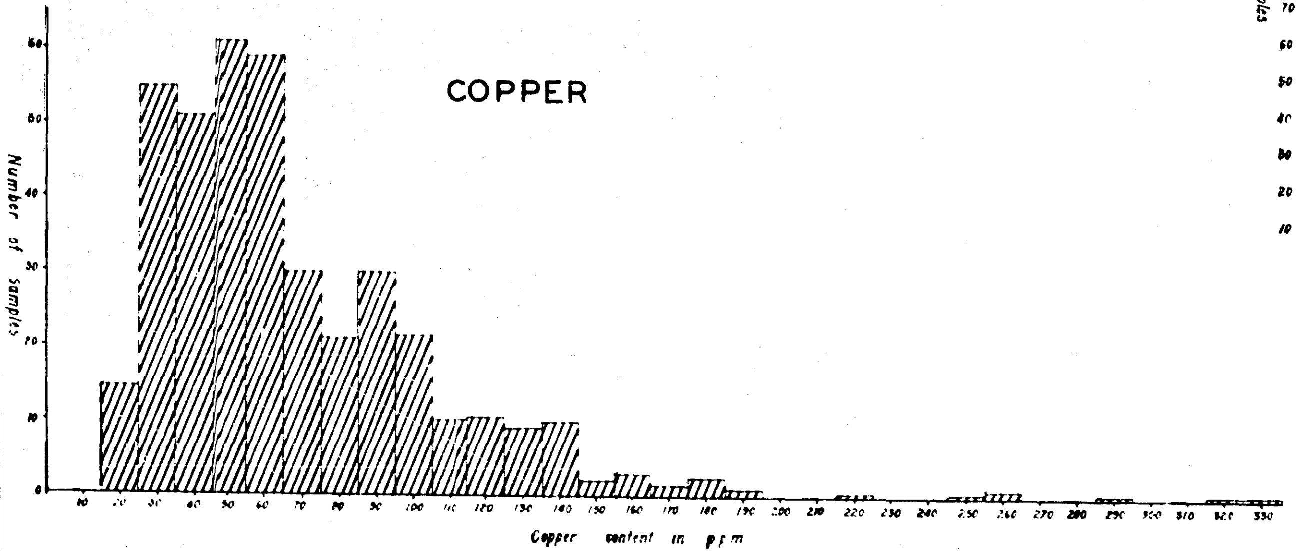
DEPARTMENT OF MINES — SOUTH AUSTRALIA

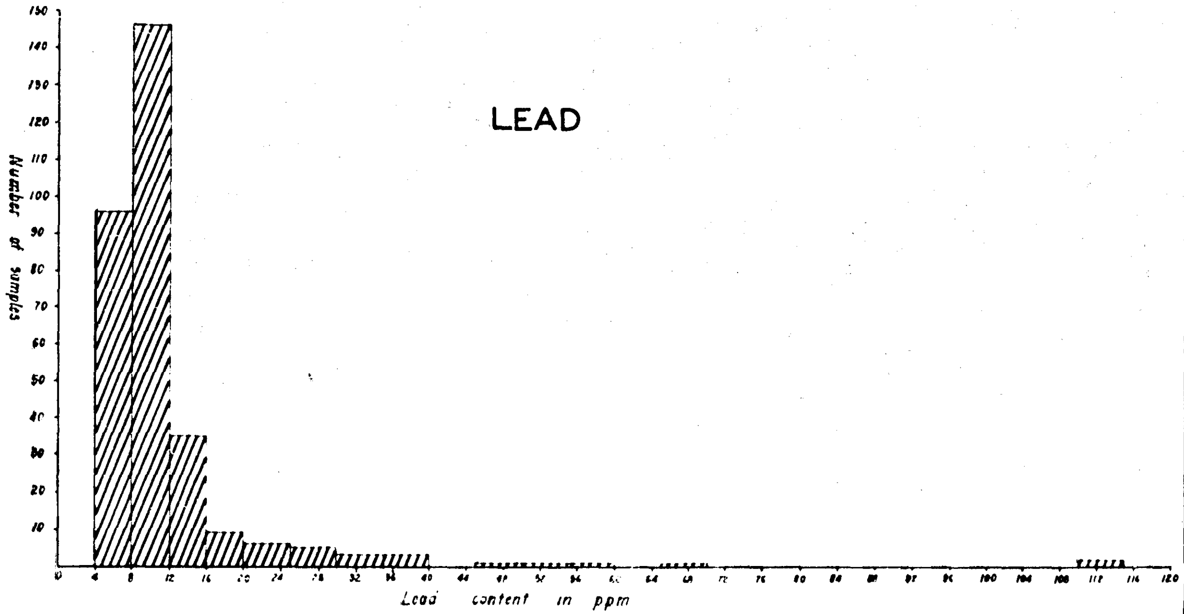
"ANABAMA COMPLEX"
CONTOURS OF COPPER VALUES IN SOILS
I.P. TARGETS AND PROPOSED DIAMOND DRILL HOLES

MINERAL RESOURCES DIVISION	SEN GEOLOGIST	Drn A.R.	SCALE 1in = 800 feet (orig)
		Tcd. D.M	75-128
		Chd. A.K.	
Director of Mines	SUP GEOLOGIST	End.	DATE 14 Feb 1975

6932

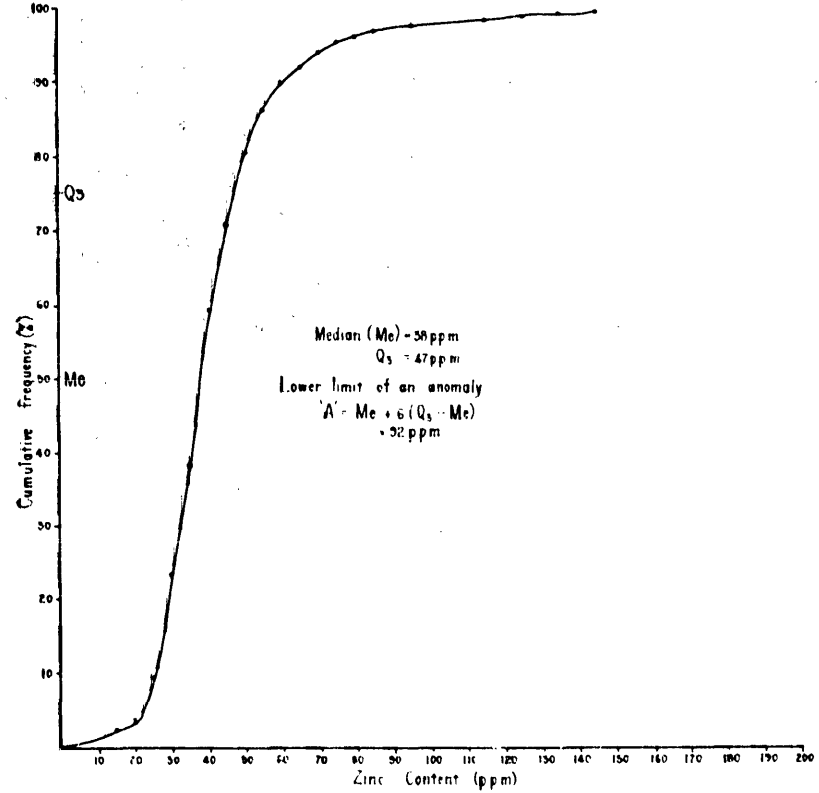




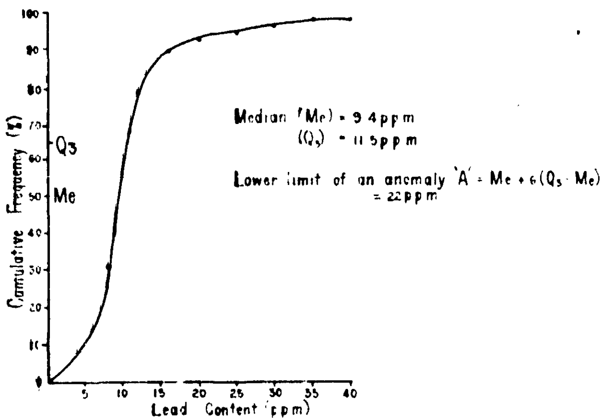


DEPARTMENT OF MINES — SOUTH AUSTRALIA			
EXPLORATION LICENCE 16 FREQUENCY DISTRIBUTION HISTOGRAMS CRONJE PROSPECT			
METALLIC MINERALS SECTION	B. MORRIS GEOLOGIST	Drn. R.M.	SCALE
		Tcd. B.W.	75-35
		Chd.	
Director of Mines		Exd.	DATE 12 DEC 1974

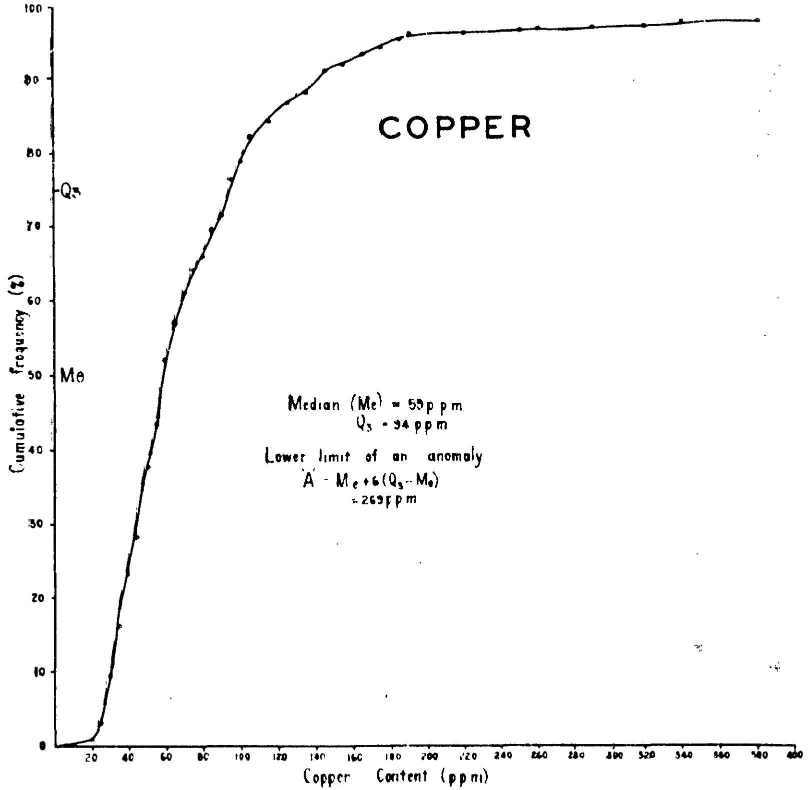
ZINC



LEAD



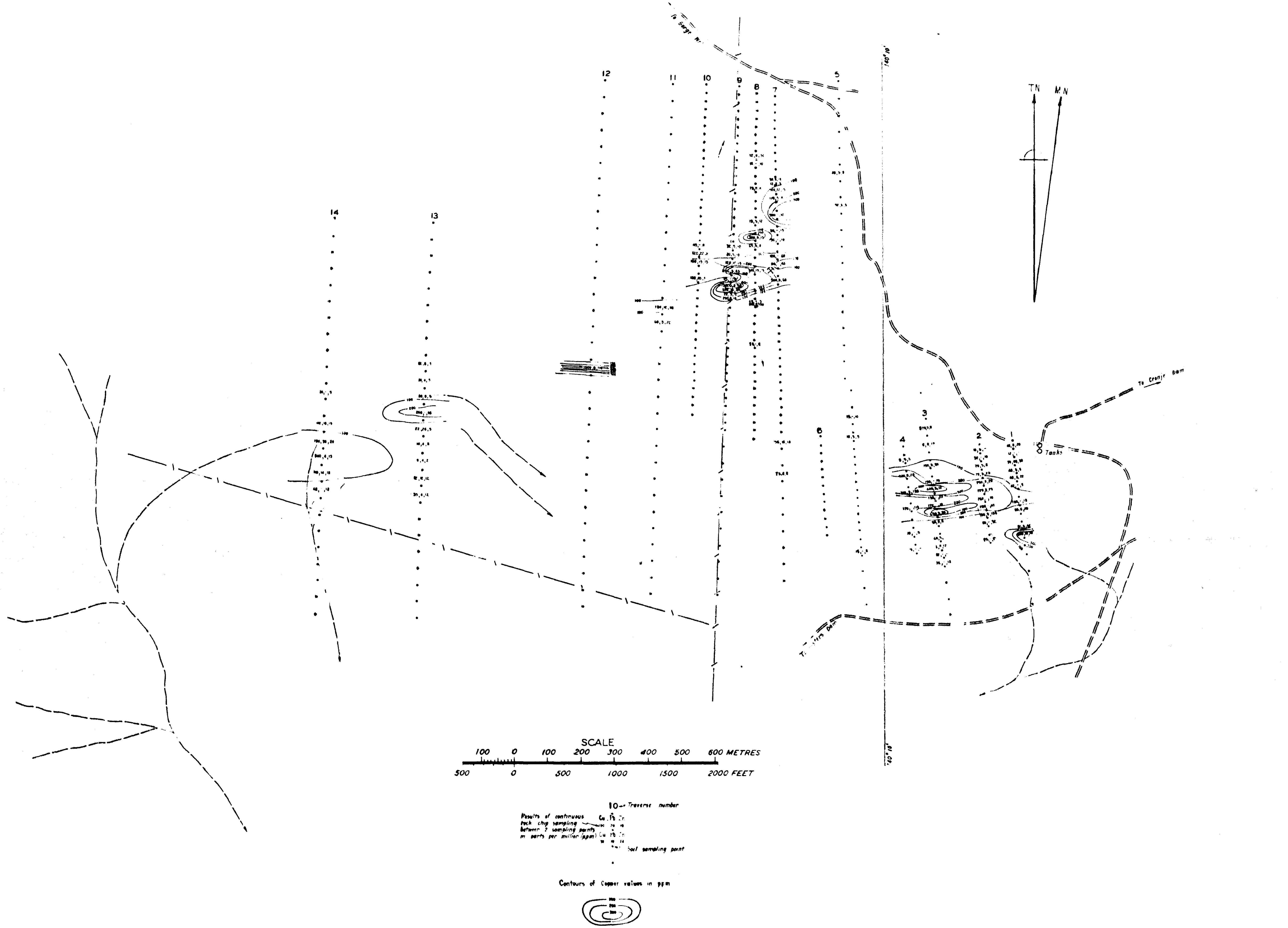
COPPER



DEPARTMENT OF MINES — SOUTH AUSTRALIA

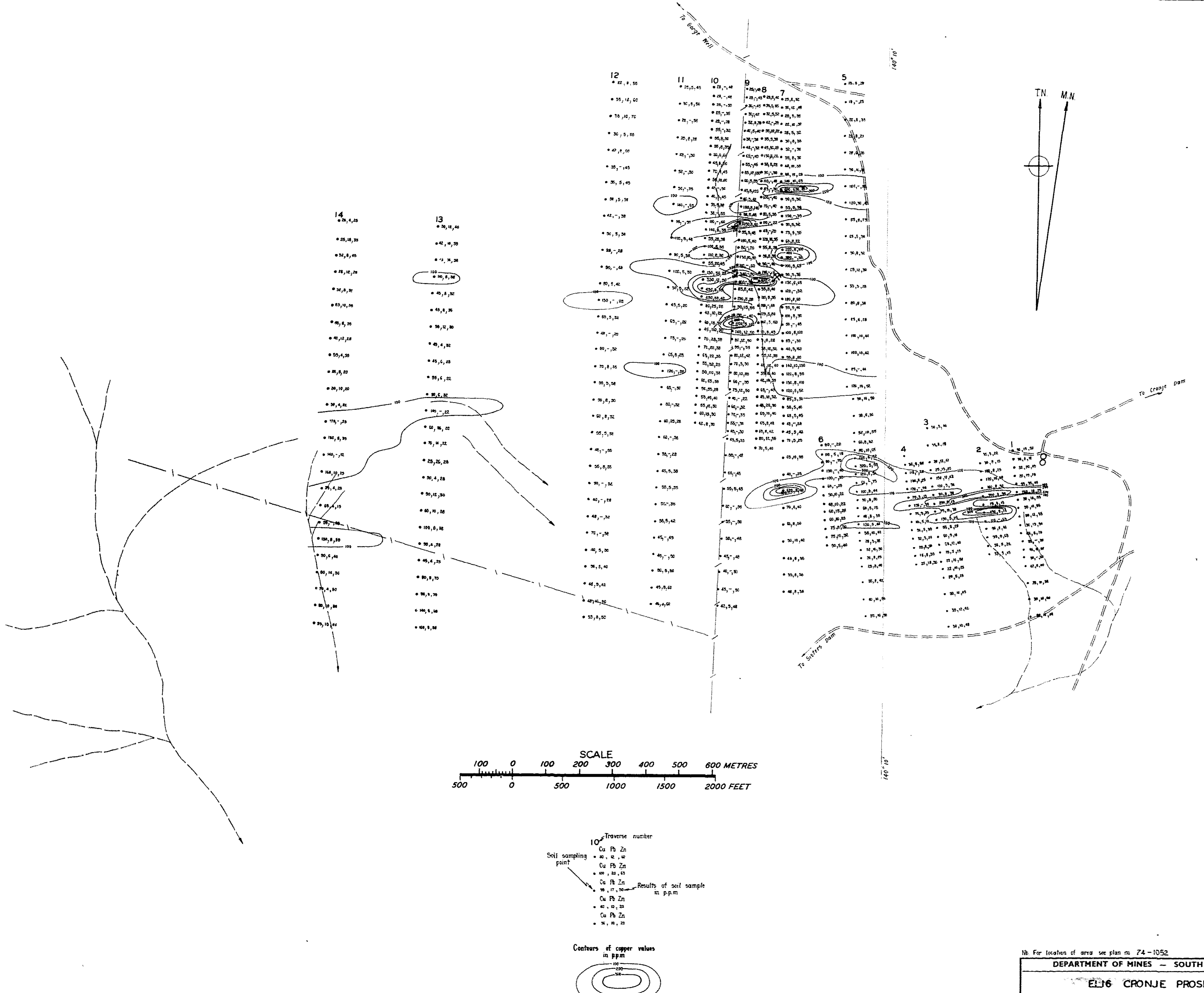
EXPLORATION LICENCE NO 16
CUMULATIVE FREQUENCY CURVE
CRONJE PROSPECT

METALLIC MINERALS SECTION	B. MORRIS GEOLOGIST	Drn. R.M.	SCALE
		Tcd. B.W.	75-34
		Ckd. A.F.	
Director of Mines		Exd.	DATE 12 DEC 1974



NB For location of area see plan no. 74-1052

DEPARTMENT OF MINES — SOUTH AUSTRALIA			
EL16 CRONJE PROSPECT **RESULTS OF ROCK CHIP SAMPLES**			
METALLIC MINERALS SECTION	B MORRIS GEOLOGIST	Compiled B M	Scale 1 : 5000 Date 10 JAN 1974
Director of Mines		Drn. B D W Chd. A F	Drg. No 75-21



Nb For location of area see plan no 74-1052

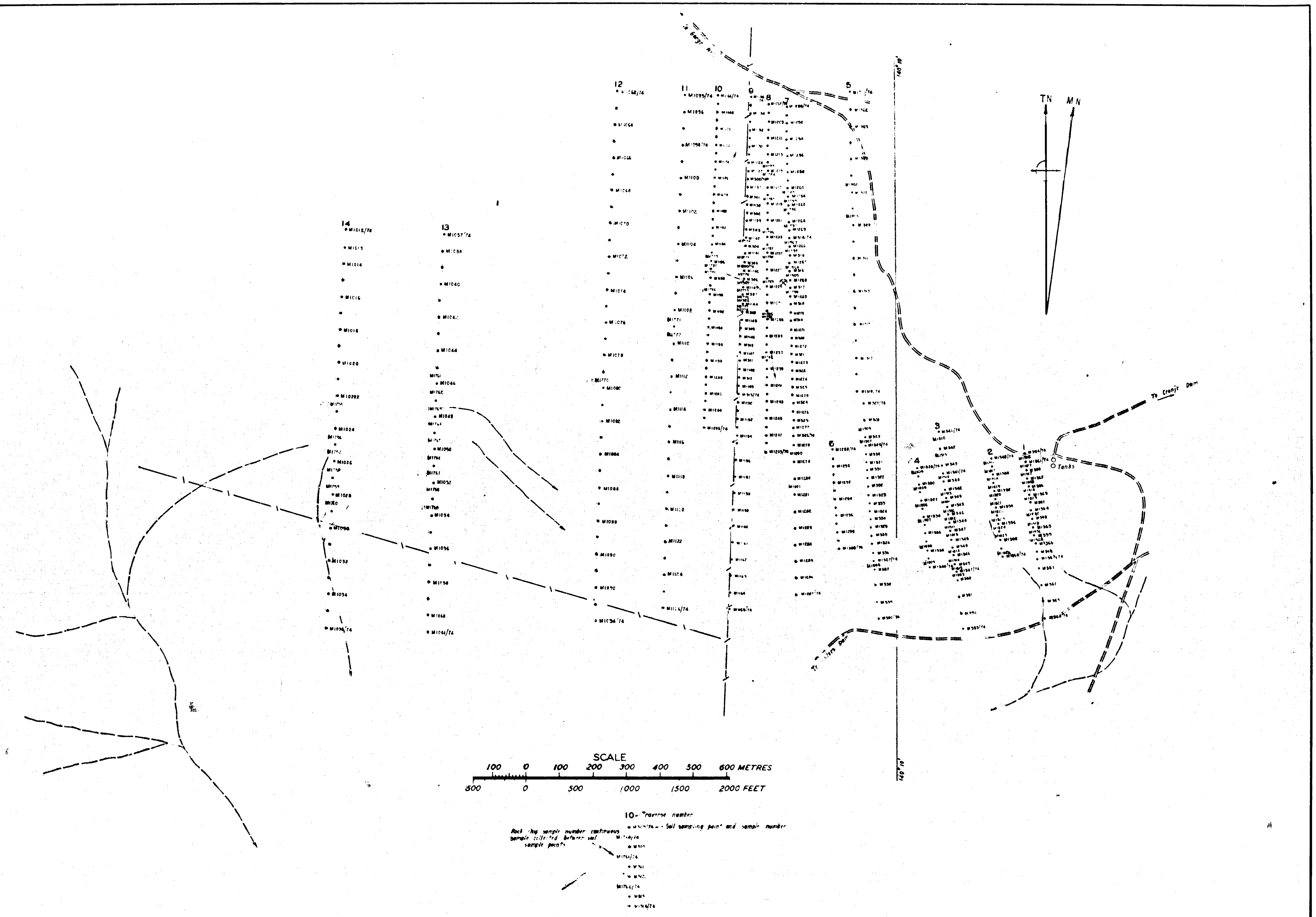
DEPARTMENT OF MINES — SOUTH AUSTRALIA

EL 16 CRONJE PROSPECT

RESULTS OF SOIL SAMPLES

METALLIC MINERALS SECTION	S MORRIS - GEOLOGIST	Compiled B.M.	Scale: 1:5000
			Date: 10 JAN 1974
Director of Mines		Drn. B.D.N Ckd. A.F	Drg. No. 75-20

6932

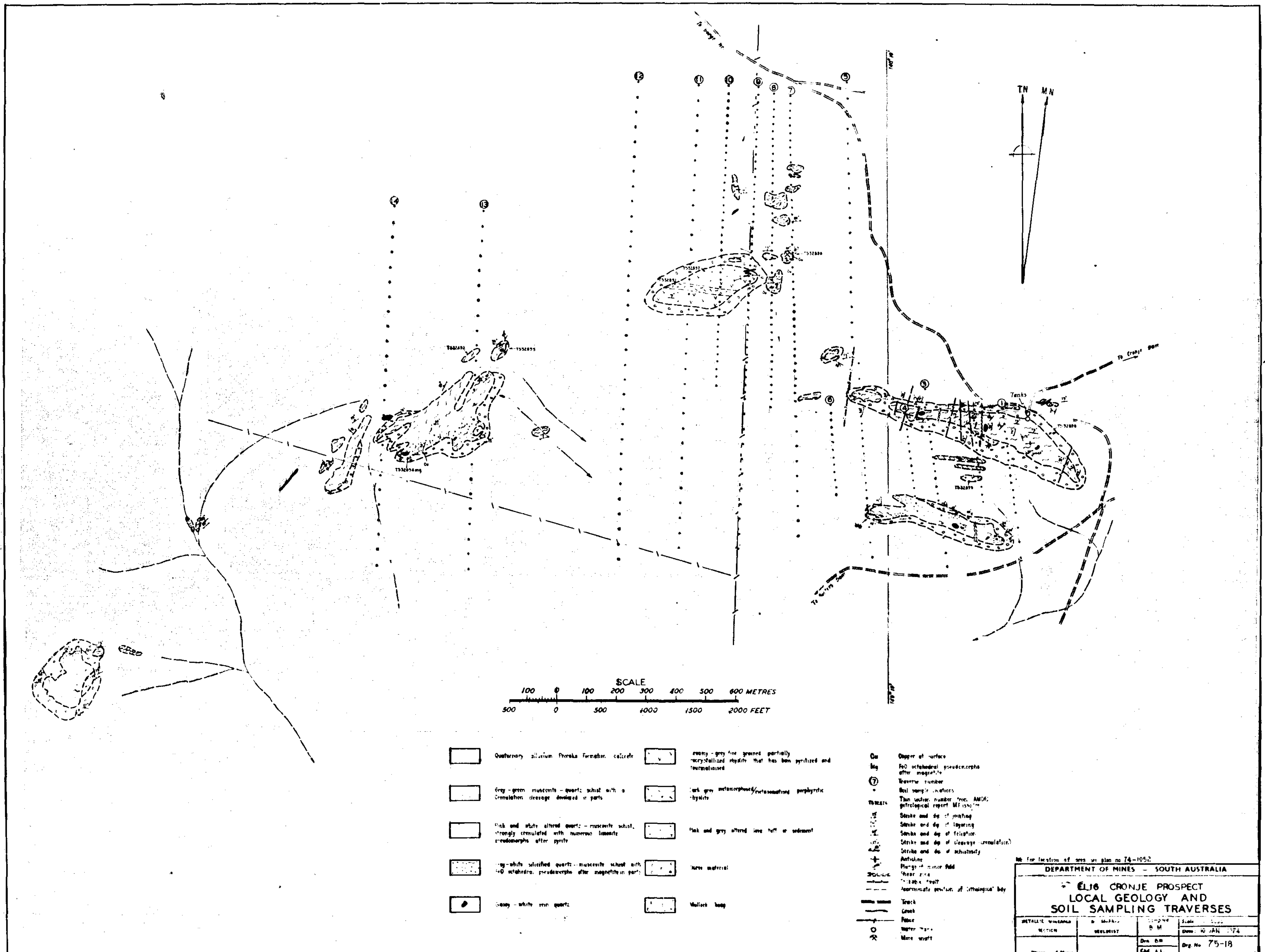


Nb For location of area see plan no 74-1052

DEPARTMENT OF MINES — SOUTH AUSTRALIA

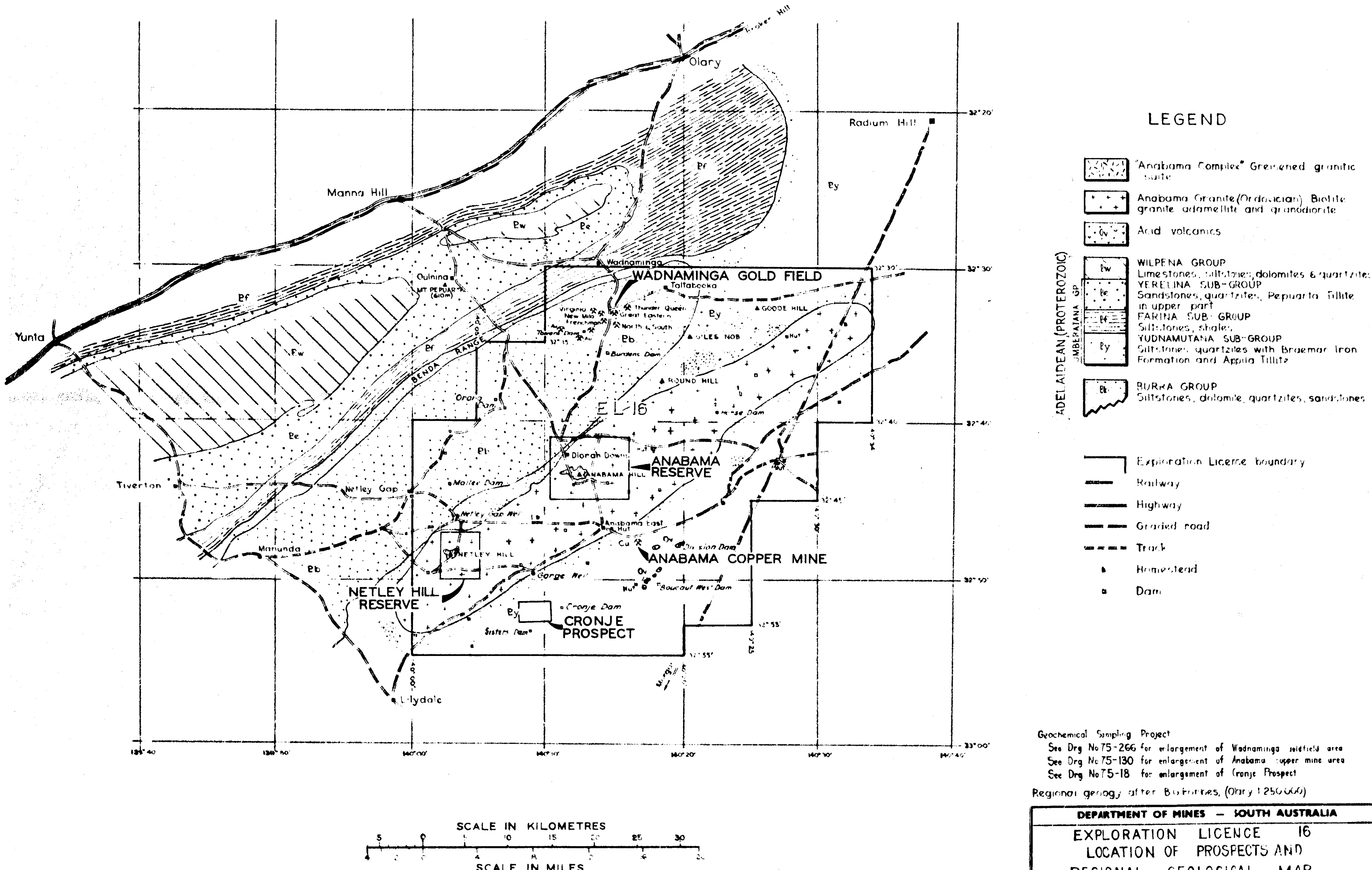
ELI6 CRONJE PROSPECT
SOIL AND ROCK CHIP SAMPLE NUMBERS

METALLIC MINERALS SECTION	B MORRIS MCLOUGHLIN	Compiled B M	Scale 1 5000
			Date 10 JAN 1974
Director of Mines		Drn B W	Drg. No 75-19
		Chd AF	



TN
MN
To Cronje Dam
Tanks
SCALE
100 0 100 200 300 400 500 600 METRES
500 0 500 1000 1500 2000 FEET
Cu Copper at surface
Mg FeO octahedral pseudomorphs after magnetite
Traverse number
Soil sample locations
Strike and dip of jointing
Strike and dip of layering
Strike and dip of foliation
Strike and dip of schistosity
Anticline
Shear zone
Track
Creek
Fence
Mine shaft
Quaternary alluvium Pooraka Formation, calcrete
Grey-green muscovite-quartz schist with a crenulation cleavage developed in parts
Pink and white altered quartz-muscovite schist, strongly crenulated with numerous limonite pseudomorphs after pyrite
Pink and grey altered lava, tuff or sediment
Milky-white vein quartz
NB For location of area see plan no 74-1952
DEPARTMENT OF MINES – SOUTH AUSTRALIA
EL16 CRONJE PROSPECT
LOCAL GEOLOGY AND
SOIL SAMPLING TRAVERSES
METALLIC MINERALS SECTION
GEOLOGIST
Date: 10 JAN 1974
Drn. BM
Ckd. A1
Drg. No. 75-18
Director of Mines

6932



Geochemical Sampling Project
See Drg No 75-266 for enlargement of Wadnaminga goldfield area
See Drg No 75-130 for enlargement of Anabama copper mine area
See Drg No 75-18 for enlargement of Cronje Prospect

Regional geology after B. Forbes, (Olary 1:250 000)

DEPARTMENT OF MINES — SOUTH AUSTRALIA

EXPLORATION LICENCE 16
LOCATION OF PROSPECTS AND
REGIONAL GEOLOGICAL MAP

METALLIC MINERALS SECTION	B. J. Morris GEOLOGIST	Drn. B.J.M.	SCALE 1:250 000
		Tcd. A.F.	74-1052
Director of Mines		Ckd. A.I.	
		Exd.	DATE 15 January 197

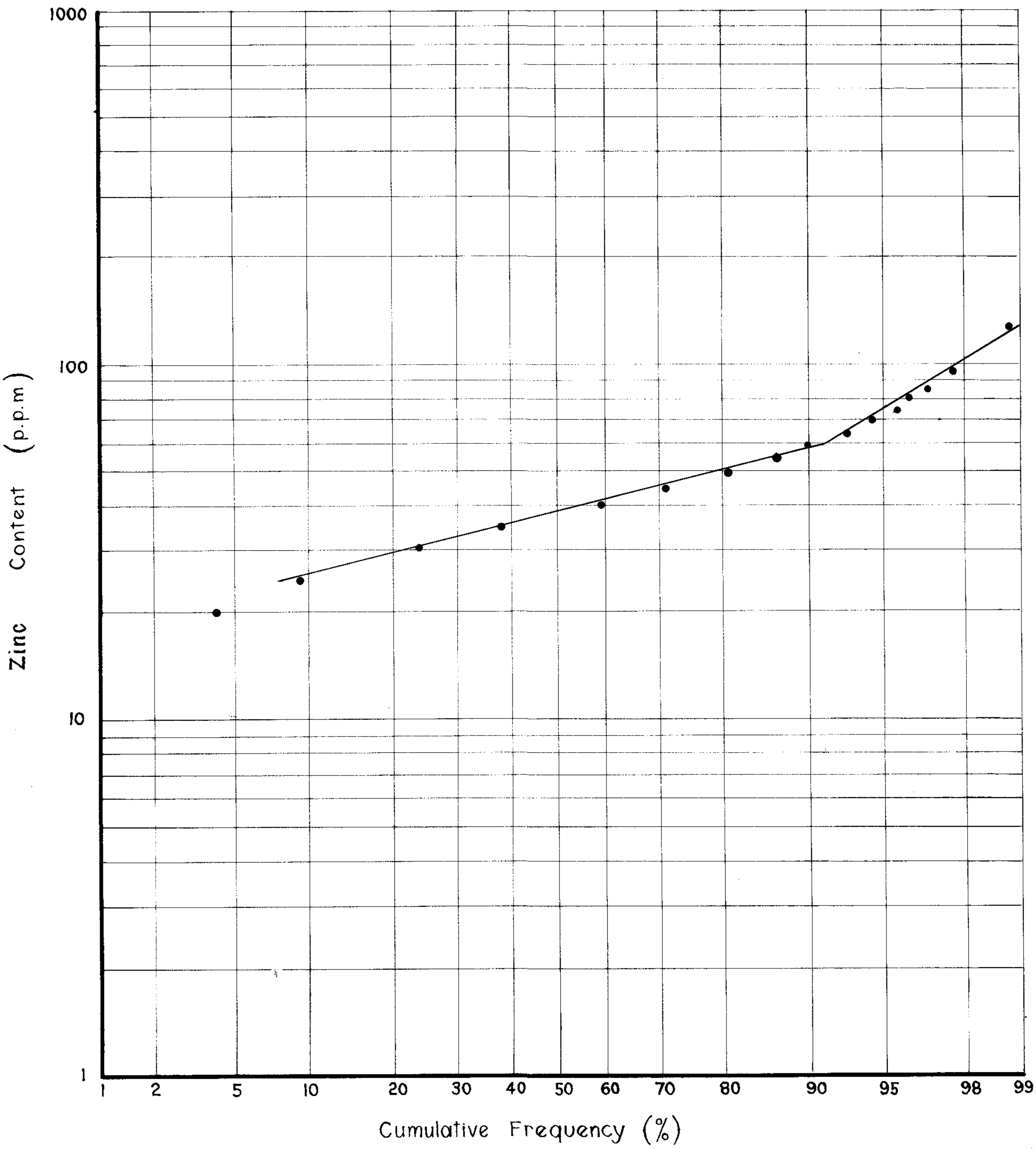


FIG.

METALLIC MINERALS SECTION	DEPARTMENT OF MINES – SOUTH AUSTRALIA	Scale:
Compiled: BM	EXPLORATION LICENCE 16 CRONJE PROSPECT	Date: 12 DEC. 1974
Drn. B.W.	Ckd. AF	LOG PROBABILITY CURVE ZINC	Drg. No. S11247

1M–2.70 A1810

6932